Fuji Electric

Innovating Energy Technology

Averaging PITOT Tube
5RD series

for flow measurement

- **Pipe** : Inner pipe diameter Ø50 to Ø1500mm
- **Drift** : Zero drift for better long-term stability
- **Type of fluid** : Liquid, gas or steam
- **Process pressure** : Up to 50bar
- **Process temperature** : Up to 500°C
- **High accuracy** : ±1% of actual flow
- **Measurement repeatability** : ±0.1%

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ECNO613c

SPECIFICATIONS

■ Pitot tube operation principle

Flow measurement is based on a measuring method by exploration of the velocity field (this method is described in AFNOR X10:112 norm : velocity measurement of key points of the output pipe to calculate average velocity considering area of each measurement point).
Pitot tube enables the measurement of this average flow by generating a differential pressure proportional to the dynamic pressure of the fluid, when the pitot tube is placed in the flowing fluid.
The differential pressure generated is functions of the average axial velocity, fluid density and the characteristics of the probe (K0 factor of the probe).
This differential pressure is measured with FCX series pressure transmitter connected the HP and LP side.

Pitot tubes 5RD series are available for all kind of circular pipe from Ø 50 to Ø 1500 mm and for rectangular duct.
They are averaging Pitot tube allowing flow measurement by differential pressure.

Perfect for difficult application (until 500°C).

Pitot tubes are speed / flow sensors that deliver an averaging differential pressure proportional to the square root of the speed.

Suitable for liquids, gas and steam measurement and generating low pressure loss.
Robust construction, long service life, easy and economical set up.

■ Advantages and strengths

Appropriate use

The accuracy of the k factor of 5RD pitot Tube is less than ±1% over a range greater than 10:1 (results coming from test in a laboratory).
Flow measurement possible in rectangular duct and large diameter pipe.
They are suitable for regulation system, even under difficult conditions thanks to high repeatability.

Designed for difficult erection

5RD pitot tubes have been designed to fit real world problems, such as growth or shrinkage resulting from site welding, pipe ovalisation and standard pipeline tolerances.

Construction

Manufacture of 5RD pitot tube series in stainless steel 316L with material traceability available.
The total average pressure upstream of the probe is obtained by 5 orifices (or 3 holes for the 8mm diameter) on the upstream portion of the probe 5RD.
A proportional pressure value to the static pressure in the flow is obtained by one orifice located on the downstream portion of the probe 5RD.
Connection to HP and BP of the differential pressure transmitter FCX series can measure the differential pressure which is proportional to the dynamique pressure of the fluide (and so proportional of the square of the volumetric flowrate).
The fixation on the pipe or duct can be made with:

- Gland or weld boss

Or

- Flange, adaptater etc…

Available process connections:

- -1/2" NPT or 1/4"NPT screw connection
- 3 valves manifold integrated to the pitot tube's head

2 isolating valves 1/4" G (PN 16 or PN40) are available at optional and too a automatic blowing system for the high loaded gas.

Economical

It provides a low cost solution for measurement in large diameter pipes or ducts :

- Low permanent pressure loss - energy lost use is minimal
- Robust construction - long service life
- Negligible wear - long term stability with zero drift or degradation.

■ Technical specifications

Accuracy	± 1% of real flow (tested by independent laboratories)
Repeatability	± 0.1%
Drift	Zero drift for better long-term stability
Reynolds number	Re mini : 1.2 x 10.4
Rangeability	10:1
Fluid	Liquid, gas or steam
Pipe	Pipe diameter from Ø50 to Ø1500mm or rectangular duct
Pressure application	Up to 50 bar
Process temperature	Up to 500°C
Viscosity	Up to 500 centipoises max
Long term accuracy	Independante of wear
Plate	Stainless steel (standard)
Material	316L stainless steel
Fixation	Gland or flange

CALCULATION FORMULAE

General Formula :

$$DP = \rho \times (V^2/20) \times 2.18 \times Ko \times Kt$$

$$Q = 3600 \times S \times \sqrt{\frac{20 \times DP}{\rho \times 2{,}18 \times K0 \times Kt}}$$

Circular Pipes :

Liquids : $DP = \rho \times (Qv / 8564.0488)^2 (Ko \times Kt / D^4)$

Gas : $DP = \rho_0 \times (T / Ps) \times (QN / 4445.8595)^2 (Ko \times Kt / D^4)$

All Fluids : $DP = (1 / \rho) \times (Qm / 8564.0488)^2 (Ko \times Kt / D^4)$

Rectangular Ducts :

Liquids : $DP = \rho \times (Qv / 10904.0856)^2 (Ko \times Kt) / (L \times H)^2$

Gas : $DP = \rho o \times (T / Ps) \times (QN / 5660.6441)^2 \times (Ko \times Kt) / (L \times H)^2$

All Fluids : $DP = (1 / \rho) \times (Qm / 10904.0856)^2 \times (Ko \times Kt) / (L \times H)^2$

Units :

DP :	Differential pressure (daPa)	QN:	Gas flow rate (Nm^3/h)
ρ :	Density under terms of service (kg/m^3)	Qm:	Mass flow (kg/h)
ρo :	Density under regular conditions (0°C, 1013 mbar abs) kg/Nm^3	Qv:	Flow rate (m^3/h)
V :	Flow rate (m/s)	Ps :	Statique pressure (mbar)
D :	Duct diameter (m)	L, H:	Duct size (m)
T :	Temperature (°K)	Ko :	Mounting coefficient
		Kt :	Thermique coefficient

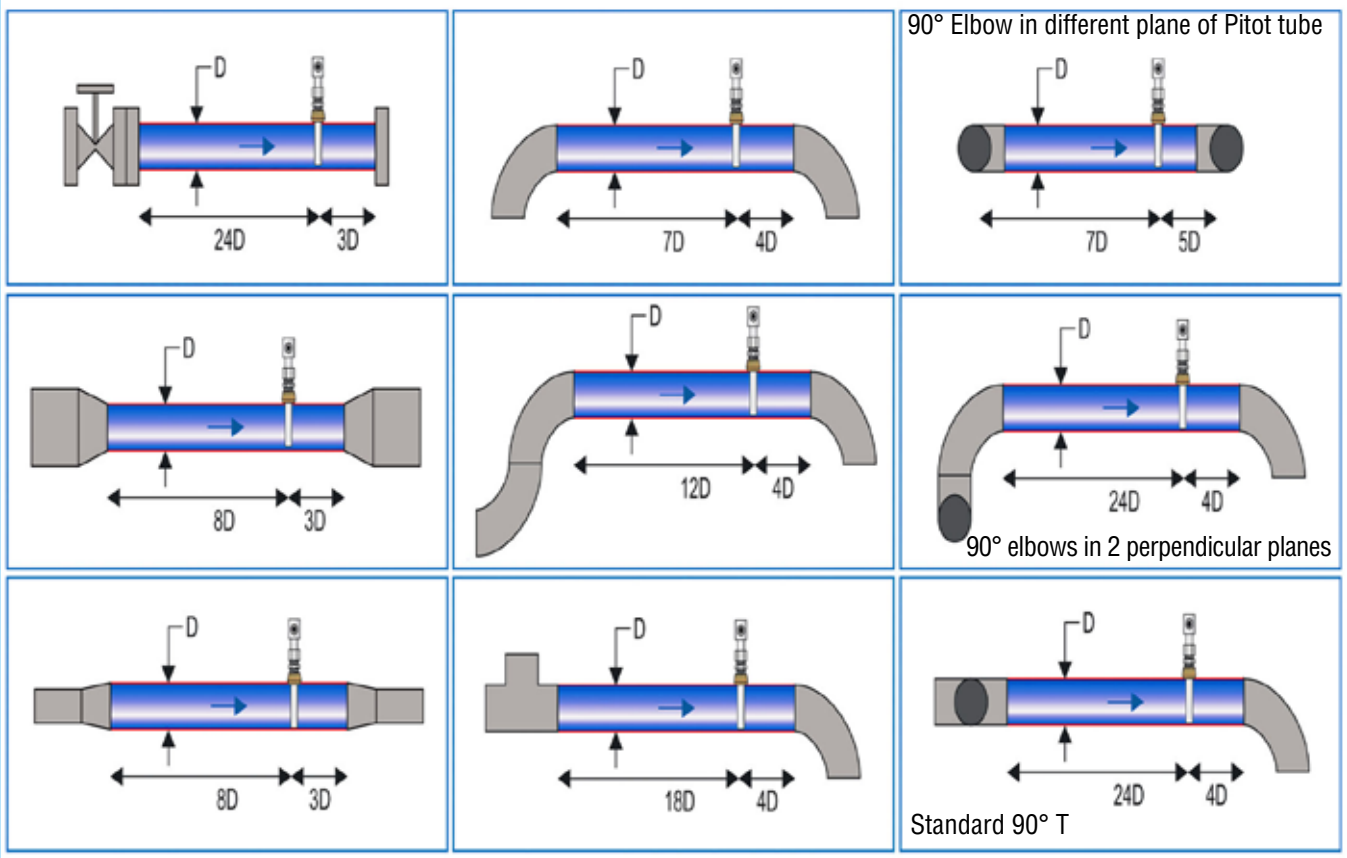
Mounting coefficient

Diameter (m)	0,19	0,2	0,25	0,3	0,4	0,5	0,6	0,9	1 et+
Ko	1	0,992	0,962	0,951	0,947	0,944	0,942	0,940	0,939

INSTALLATION & ORIENTATION

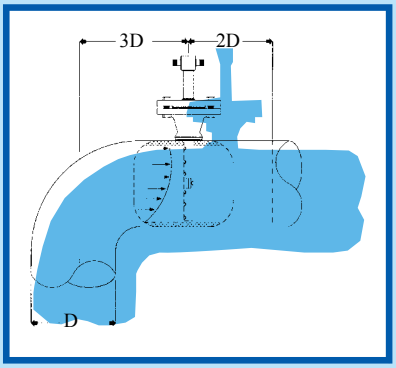
■ Recommended upstream and downstream straight length

This figure shows straight length in diameter numbers (D) to observe between 5RD Pitot tube series and disruptive components located upstream and downstream.



Chosen location for 5RD Pitot tube series set up in piping systems really matters because of the turbulence (secondary flow) in the flow created by the pipe configuration which can compromise the measurement accuracy. If the 5RD Pitot tube series is set up on shorter distance than advised, accuracy might be compromise but measurement repeatability will remain exact.

If mounted distances advised can't be observed and maximum accuracy is mandatory, it is advised to set up a flow stabilizer.



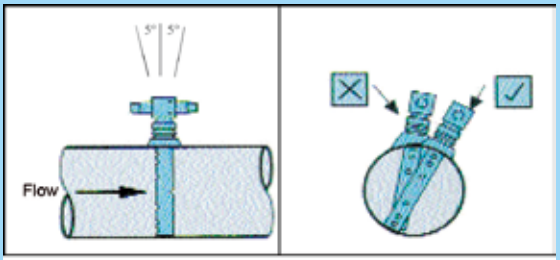
INSTALLATION & ORIENTATION

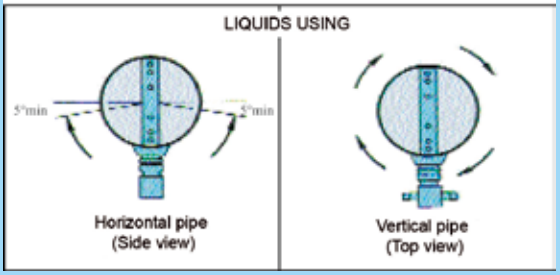
Orientation

Pitot tube must be installed perpendicular to the duct diameter according to allowance as shows in the figure and in conformity of the upstream and downstream length.

Important : upstream orifice must be face the flux.

Installation in a rectangular duct is also possible.
The place must offer flow conditions following flow defined and without gyration. All upstream control valves must be open. For configuration it is advised to use downstream manifolds.

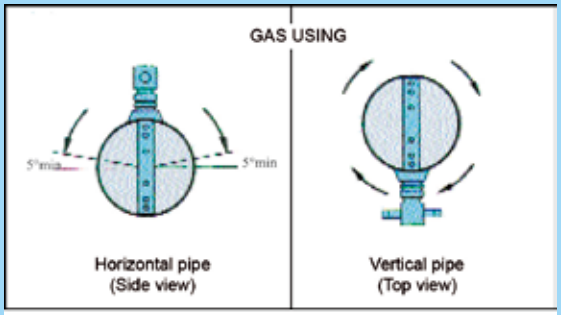




LIQUID :

Air trapped must be avoided during installation (as shows on figure) to allow correct filling of the connected pipe.

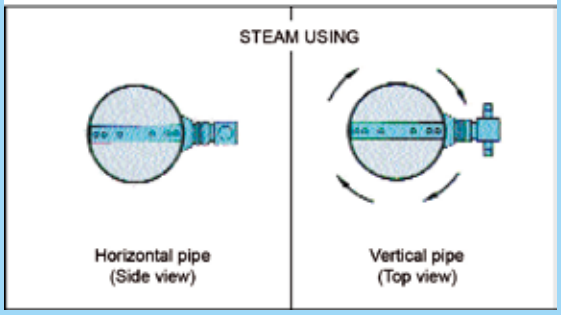
- Manifolds must be directed downward.
- Transmitter must be installed lowerposition than the pitot tube.



GAS :

Installation must not allow condensate accumulation in lower situated points, neither in connection pipe of FCX series differential pressure transmitter.

- Manifold must me directed upward
- Transmitter must be installed higher than the Pitot tube.



STEAM :

Manifolds must be place on a horizontal plane and directed downward.

- Transmitter must be placed below the pitot tubee.
- The two wet legs must be identical in both connection pipes.

Installation conditions

- Drill the pipe on the insertion point or two diametrically opposite points if there is an end bracket.
- Welding spud must to be assembled on the pipe. Mind the pitot tube orientation for the version without gland and flange.
- Weld the end bracket
- Pull the pitot tube until the end rest against the bracket (or the pipe). The sensor is then positioned in depth.
- Turn the pitot tube until the 5 orifices are directed upstream, **facing the flow**.
- Fixe the pitot tube using gland flange or flange.

CODIFICATION

Codification Averaging Pitot tube 5RD type

1	2	3	4	5	6	-	7	8	9	10	11	12		13	14	15	16
5	R	D											-			Y	1

Type

Averaging Pitot tube 5RD type

Connection

A	P.E. 3/4 NPT + 1/2 NPT block (for 5RD_08 & 10)
B	P.E. G 3/4 + 1/2 NPT block (for 5RD_08 & 10)
C	P.E. 1" NPT + 1/2 NPT block (for 5RD_22)
D	P.E. G 1" + 1/2 NPT block (for 5RD_22)
E	P.E. 3/4 NPT + 1/4 NPT block (for 5RD_08 & 10)
F	P.E. G 3/4 + 1/4 NPT block (for 5RD_08 & 10)
G	P.E. 1" NPT + 1/4 NPT block (for 5RD_22)
H	P.E. G 1" + 1/4 NPT block (for 5RD_22)
K	P.E. 3/4 NPT + plate (for 5RD_08 & 10)
L	P.E. G 3/4 + plate (for 5RD_08 & 10)
M	P.E. 1" NPT + plate (for 5RD_22)
N	P.E. G 1" + plate (for 5RD_22)
*	On demand

Diameter, length & material

	Inner Ø[*3]	Thick-ness[*3]	Probe diameter	Material	Gasket
0 8 -			8mm	SS 316L	KG
1 0 -			10mm	SS 316L	KG
2 2 -			22mm[*2]	SS 316L	KG

Stainless steel parts

	Tag plate with engraving		Screws
	Datas	Customer tag	
- A	with	without	M10-20 (without manifold)[*1]
- B	with	with	M10-20 (with manifold)[*1]
- C	with	without	M10-50 (without manifold)[*1]
D	with	with	M10-50 (with manifold)[*1]
E	with	without	without (block and tips)
F	with	with	without (block and tips)

Condensation chamber

Y	Without
C	With

Specific process connection

Y	Without
V	In the axis of the pipe (example: horizontal steam pipe)

Revision

1

Nota :
1- Order the manifold separately
2- From 500mm, pitot tubes have opposite support
3- The values in mm (inner Ø and thickness) must be ordered

Codification - Automatic unclogging cabinet system for Pitot probes

1	2	3	4	5	6	-	7	8	
D	E	V	2	0	0				

Description

Type

Automatic unclogging cabinet system for Pitot probes 5RB & 5RD

Thermocontrol

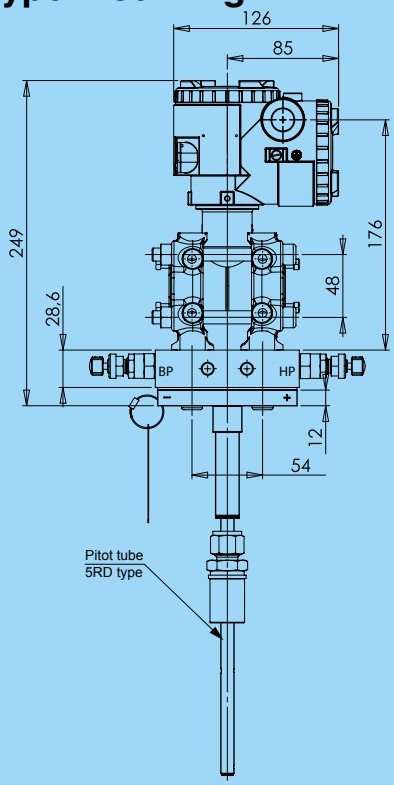
Y	Sans
A	Avec

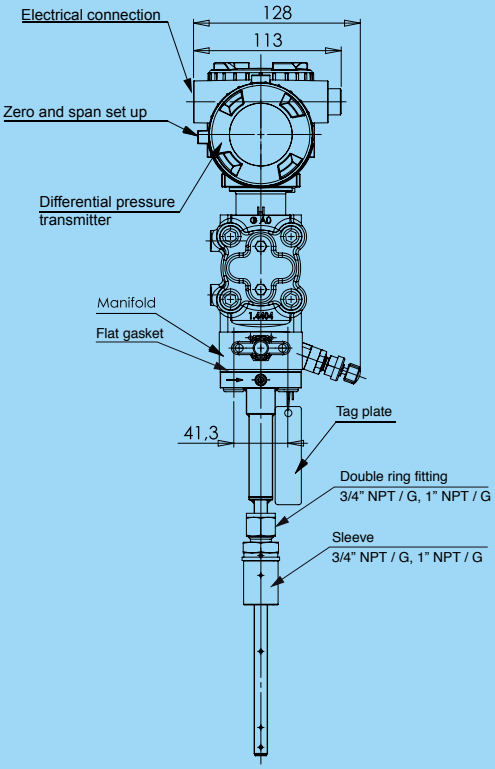
Supply voltage

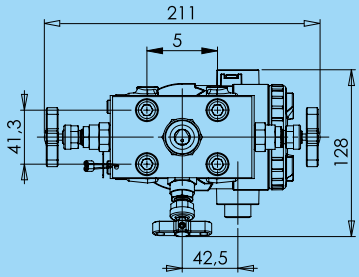
Y	230Vac - 50/60Hz
A	115Vac - 50/60Hz

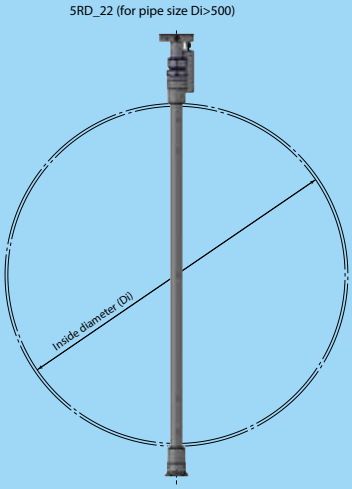
DIMENSIONS [MM]

Plate type mounting

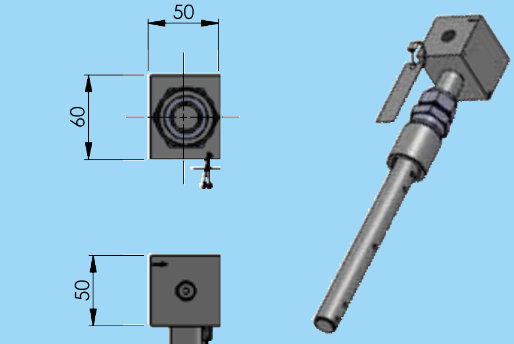


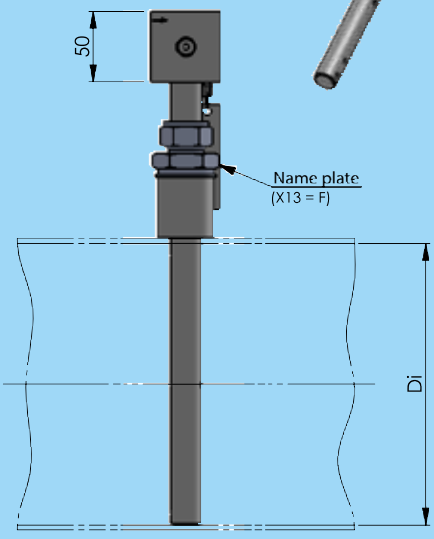


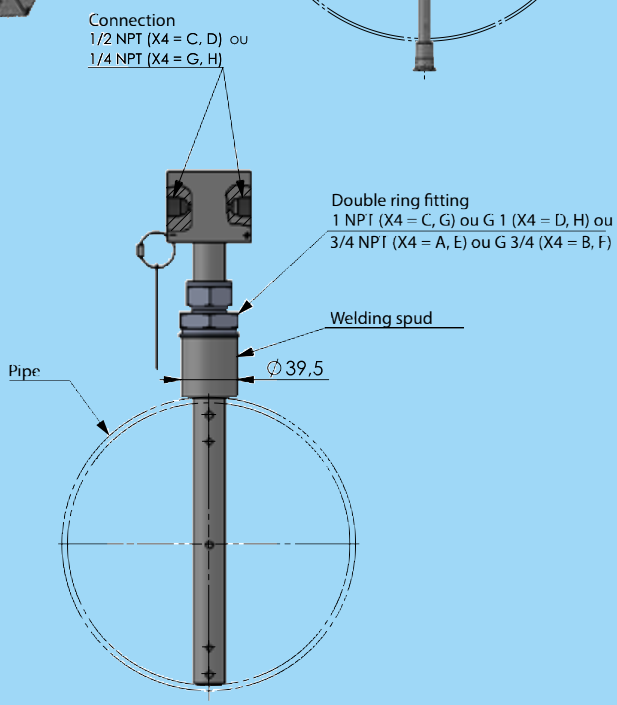




Block type mounting







APPLICATIONS :

- Flow gas or atmospheric emission flue gas measurement
- Can be installed on all kind of chimney (cement, sturdy brick, made of iron sheeting …) until DN 1600mm
- Biogas flow measurement
- Measurement of oxygenation of water treatment plant's aerations tanks
- Air and gas measurement on combustion burner
- Air Flow measurement of High-temperature combustion boiler
- Air flow measurement on compressor and HVAC

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