

“Sensing the pulse of industry”

## tekFab Multivariable DP02 + tekProbe World’s First All-Digital Nano Technology DP Cell and True Static Averaging Pitot Flow Sensor

The **tekflo tekFab DP02** Series brings the most advanced all-digital differential pressure (dp) sensing to **tekflo’s** insertion **tekProbe PR3** multivariable averaging Pitot flow sensors. This ideal Multivariable system is used for liquids, mass flow or density corrected volumetric flow measurement of gases, saturated or superheated steam, in pipes and ducts 50 to 3000mm (2” – 120”).

The flow computation is entirely digitally and accomplished within the **tekFab DP02** DP Cell. It is based on classical Bernoulli Theory, which defines a **true static pressure** input. Only the **tekflo PR3** averaging Pitot produces such a noise free **true static pressure**. Other industrial Pitot types measure either a suction pressure, or an attempt at static pressure measured on the side of a costly profiled tube in the pipe line. Both these types result in a noisy, erroneous static pressure, resulting in erroneous flow measurement.

Besides all digital square root extraction and mass flow computation, the **tekflo tekFab DP02** series uniquely accomplishes all-digital sensing. It embodies two nano-molecular crystal silicon resonators, protected behind silicon oil filled diaphragms. The resonators are caused to vibrate at their natural frequencies. These are shown as 2 elongated H shapes in the diagram below. The **tekProbe** produces a noise free dp across the H resonators. One vibrates in a +ve compression mode, while the other vibrates in a -ve tensional mode. The resultant dp signal,  $(f_c - f_t)$  in the diagram, together with TekProbe’s noise free **true static pressure** input to the dp transmitter’s computer,  $(f_c + f_t)$  in the diagram, provides unmatched total system mass flow accuracy, repeatability, and resolution, with virtually zero hysteresis.

Being entirely digital, the **tekFab DP02** reduces the combined errors of temperature, overpressure, hysteresis, square root extraction, computation, static span and zero span to insignificance.

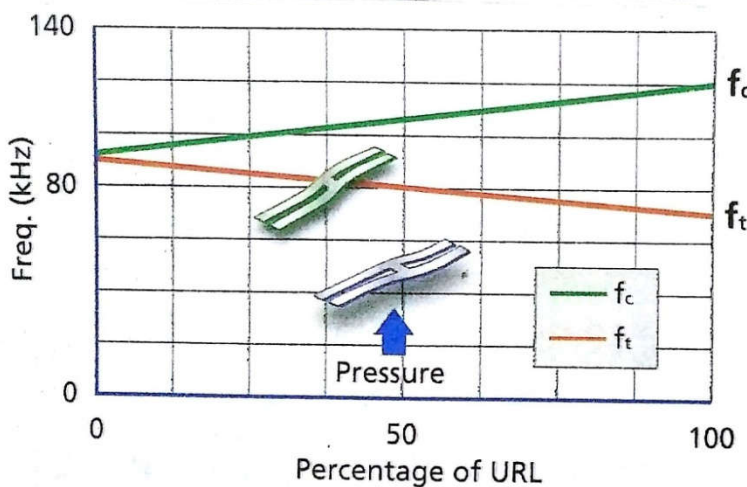


**tekFab All Digital Sensing  
Nano-Technology DP Cell  
Quality Assurance to ISO 9001**

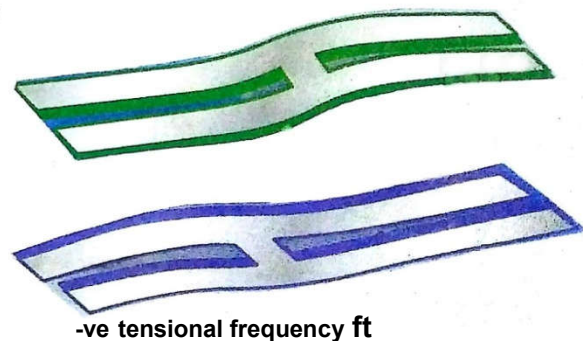


**tekFab DP Cell  
With Radio Link**

+ve compressional frequency  $f_c$



**tekProbe differential pressure =  $f_c - f_t$**   
**tekProbe true static pressure =  $f_c + f_t$**



### tekFab Nano-Technology Crystal Silicone Resonators

### Specification:

Differential pressure accuracy:	±0.04% of span
Static pressure accuracy:	±0.1% of span
Static pressure effects:	±0.075% per 69 bar g (1000 psig) on span ±0.028% of upper range limit (URL) on zero
Stability:	±0.1% of URL over 10 years
Ambient temperature effects:	±0.055% of dp span + 0.09% of dp URL per 28° C (50° F)
Overpressure effects:	±0.03% over a span 11 – 160 bar g (145 – 2300 psig)
Mass flow computation error:	±1.0% of mass flow rate over 10 : 1 mass flow range (100 : 1 dp range) for totalized mass and rate of mass flow
Differential pressure range:	0 - 10–1000 mm wc, 0 - 0.4”–40” wc, 0 - 1–100 mbar, 0 - 0.1–10 kPa May be adjusted for same negative pressures
Maximum static pressure:	169 bar g (2300 psig)
External temperature range:	- 200° to + 850° C (-328° to + 1582° F)
Vibration effects:	±0.1% on dp URL with vibration frequencies 10 – 60 Hz at 0.21mm double amplitude, or 60 – 2000 Hz up to 3g
DP response time:	230ms with HART and Modbus protocols, 300ms with Fieldbus
Signal damping:	0 – 100 seconds adjustable
Protocols:	HART or Modbus or FOUNDATION Fieldbus.
Non-isolated signal functions:	4 x 4 – 20mA 2-wire for flow rate, dp, static pressure, temperature 0 – 10kHz scaleable output for flow rate, scaled pulse for total flow High/Low alarms for flow rate, dp, static pressure, temperature Pt 100 RTD conforming to IEC 751
Temperature sensor input:	
Pulse outputs:	Transistor sink type outputs max 30Vdc, 120mA dc max.
Self diagnostics:	CPU failure, hardware failure, configuration error, process alarms for dp, static pressure, and external temperature
SIL Certification:	The <b>tekFab DP02</b> are TUV certified to IEC 61508 : 2000, parts 1 – 7, Except when using FOUNDATION Fieldbus or Modbus protocols. The SIL 2 capability is for single DP Cell use.
Digital display:	5-digit numerical display for volumetric or mass flow rate, dp, static pressure (not suction pressures) and temperature. 6-digit numerical display for total flow. A bar graph is also configurable to display up to 4 variables periodically. For FOUNDATION Fieldbus, indication is configurable to display up to 10 function block outputs. For Modbus, indication is configurable to display up to 16 output values, including RTU output.
Computation:	Mass flow, absolute referenced temperature and pressure volumetric flow computation is in accordance with classical Bernoulli Theorem, and assumes <b>true static pressure sensing</b> , as provided by a TekProbe PR3 averaging Pitot. For further details consult <b>tekflo sensors</b>
HART supply:	10.5 – 42 Vdc for general and flameproof applications 10.5 – 43 Vdc for lightening protection 10.5 – 30 Vdc for intrinsically safe, type n or non-incendive
FOUNDATION Fieldbus supply:	9 – 32 Vdc, steady state 15mA draw, 24 mV software download
Modbus supply:	9 – 30V dc, 250 mW for general or flameproof, quiescent draw 10mA

### Optional Manifold:

Optional **TekFab** 3-way valve manifold is available in AISI 304 or 316 stainless steel (see Ordering Code)

### Wetted Parts Materials:

Resonator capsule housing:	Hastelloy C-276 dp diaphragm, AISI 316
Capsule gasket:	Teflon coated AISI 316 stainless steel
Vent/Drain plug:	AISI 316 stainless steel
Cover flange and process ports:	AISI316 stainless steel

**Note:** 1) All wetted parts conform to NACE MRO103 and recommendation MR0175 / ISO 15156  
2) Other materials see Ordering Code  
3) further options and technical details consult **tekflo sensors**

### Radio Linked **tekFab**

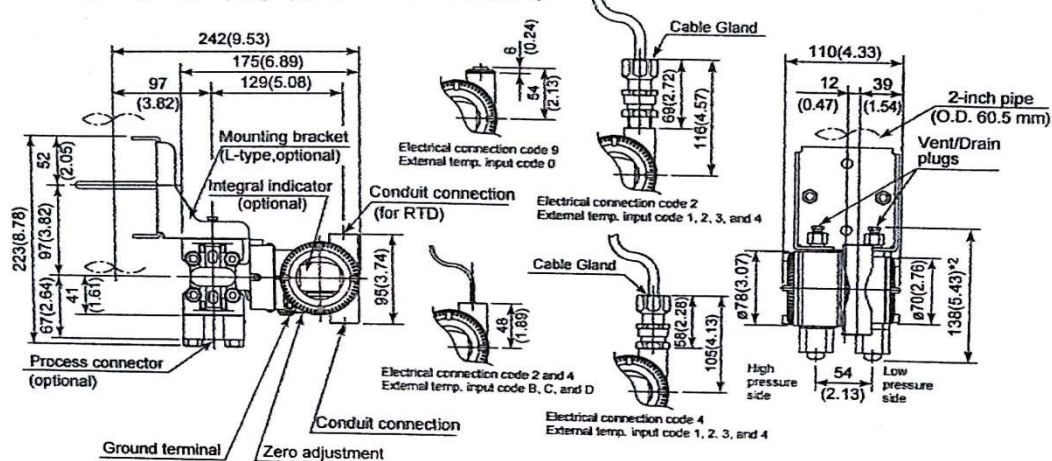
Consult **tekflo sensors** or your **tekflo** Authorised Dealer for radio linked **tekFab** DP Cells to ISO 100, fully supporting HART, FOUNDATION, Fieldbus, Modbus, Profibus, FDT/DTM and EDDL

## Certifications:

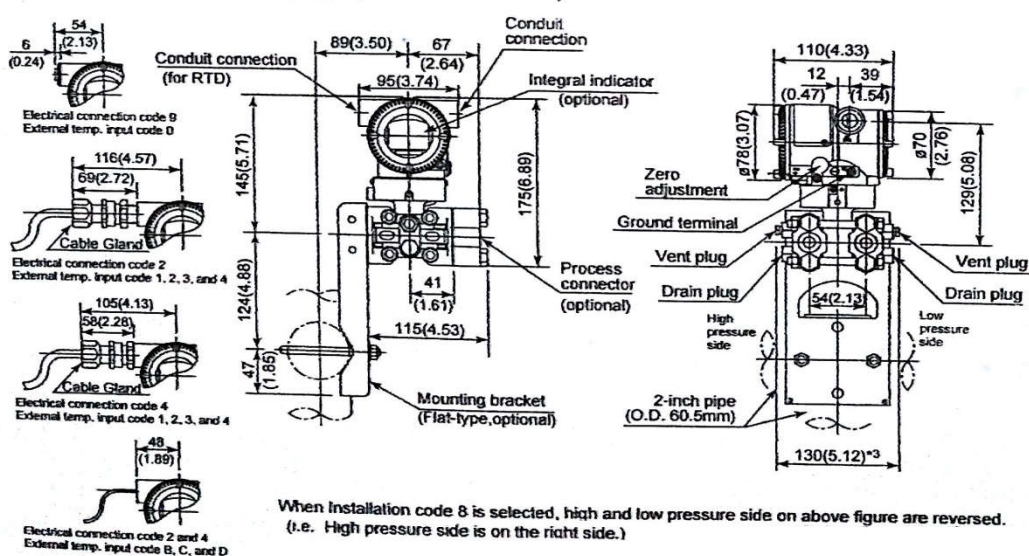
Electro-magnetic conformity:	EMC conformity EN61326-1 Cl 1, Table 2 industrial locations, EN61326-2-3
European Pressure Equipment Directive:	Conforms to Sound Engineering Practice, Category III, Pressure Accessory Vessel, Fluid Groups 1 and 2
Safety Requirement Standards:	Meets EN61010-1, max. 2000 m (6560 feet) altitude, pollution degree 2
Factory Mutual (FM) Ex Proof:	Explosion proof Class 1, Division 1, Groups B, C, D. Dust ignition proof Class II/III, Div 1, Groups E, F, G. Conforms to NEMA 4X. Conduit seal not necessary. Temp Class T6, ambient -40° C/F to +60° C (+140° F)
Factory Mutual (FM) IS:	Intrinsically Safe to Class I, II, III, Div 1, Groups A, B, C, D, f, G. Conforms to NEMA 4X, ambient temp -40° C/F to +60° C (+140° F)
ATEX Flameproof:	Flameproof to ATEX and IECEx to Ex d IIC, T4 – T6 Gb, Ex ib IIIC T85°C Db IP6X.
CENELEX and IECEx:	Protection to IP 66 and IP 67 Max temps: process gas 120° C, max dust surface 85° C, ambient -50° to 80° C
ATEX Intrinsically Safe:	Intrinsically Safe to EEx ia IIC T4
CENELEX:	Protection to IP 66 and IP 67 Max process temp 120° C, max dust proof temp 85° C
Canadian Standards Assoc:	CSA Explosion Proof Approved to Class 1, Groups B, C, D Dust Ignition Proof to Class II / III, Groups E, F, G When installed in Div 2 area, seal is not required, NEMA 4X applies Flameproof to Ex d IIC, T4 – T6, IP66 and IP 67 applies Max process temp 120° C (248° F) Max ambient temp – 50° to + 80° C (- 58° to + 176° F) CSA Intrinsically Safe Approved with HART/4-20m outputs. Note: CSA IS is not approved for Modbus nor FOUNDATION Fieldbus

## Dimensional Drawings:

### • Vertical Impulse Piping Type (Installation code 7)

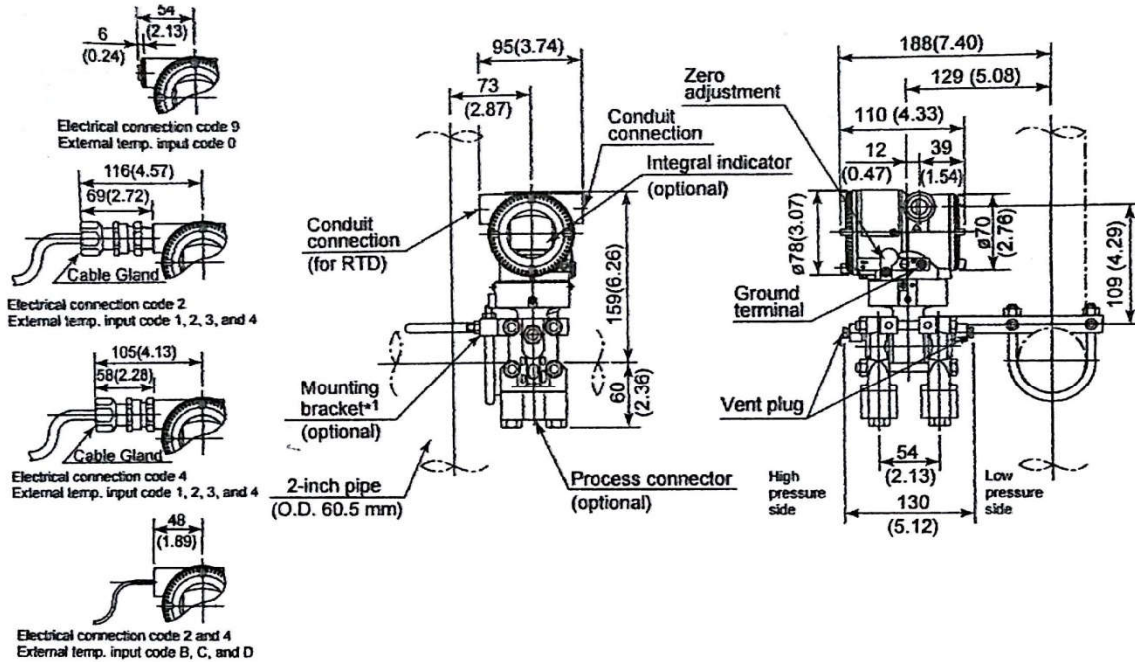


### • Horizontal Impulse Piping Type (Installation code 9)



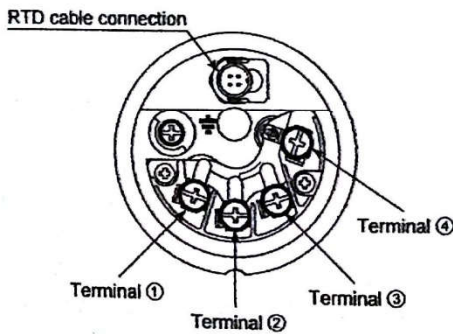
Unit: mm (approx.inch)

• **Bottom Process Connection Type (Installation code B)**



\*1: A transmitter with SST housing is not applicable for mounting to horizontal 2-inch pipe.

• **Terminal Configuration**



• **Terminal Wiring (HART and FOUNDATION Fieldbus protocol types)**

SUPPLY	+	①	] Power supply and output terminals
	-	②	
CHECK	+	③	] External indicator (ammeter) terminals *1*2
	-	②	
PULSE	+	④	] Pulse or status contact output terminals *2
	-	②	
			⏏ Ground terminal

\*1: When using an external indicator or check meter, the internal resistance must be 10Ω or less.

\*2: Not available for FOUNDATION Fieldbus communication types.

• **Terminal Wiring (Modbus protocol type)**

SUPPLY	+	①	] Power supply terminals
	-	②	
MODBUS	A	③	] Modbus communication (RS-485) terminals
	B	④	
			⏏ Ground terminal

## Ordering Code **tekFab** DP02 Multivariable DP Cell:

Basic Type Example:

**tekFab** DP02 - J - L - S - 4 - G - 8 - 2 - 2 - D - B - 4 - B - 1

Output: \_\_\_\_\_

J = 4-20mA + HART 5/HART 7

F = FOUNDATION Fieldbus

M = RS485 Modbus

DP Span: \_\_\_\_\_

L = 0 – 10 to 1000 mm wg

(0 – 0.4” to 40” wg)

Larger ranges on request

Wetted Parts: \_\_\_\_\_

S = Standard wetted parts

X = Non-standard wetted parts

Process Connections: \_\_\_\_\_

3 = 1/4” NPT female (non-standard)

4 = 1/2” NPT female standard

Bolts and Nuts Material: \_\_\_\_\_

J = B7 carbon steel

G = AISI 316L stainless steel

Installation: \_\_\_\_\_

7 = Vertical pipe, left hand +ve pressure, process downside

8 = Horizontal pipe, right hand +ve pressure

9 = Horizontal pipe, left hand +ve pressure

B = Bottom process connection, left hand + pressure

Note: **TekProbe PR3** +ve pressure is **downstream** of flow direction

Electronics enclosure: \_\_\_\_\_

1 = Aluminium casting

2 = ASTM CF-8M stainless steel casting

Electrical connection: \_\_\_\_\_

F = 2 x 1/2” BSPF (1 for RTD)

2 = 2 x 1/2” NPTF (1 for RTD)

4 = 2 x M20 female (1 for RTD)

A = 2 x 1/2” BSPF (1 for fixed temp AISI 316 st st blind plug)

C = 2 x 1/2” NPTF (1 for fixed temp AISI 316 st st blind plug)

D = 2 x M20 female (1 for fixed temp AISI 316 st st blind plug)

Integral indicator: \_\_\_\_\_

D = Integral digital indicator

N = No indicator

Mounting Bracket: \_\_\_\_\_

B = AISI 304 st st 2” (60mm) OD pipe mount, horizontal process piping

D = AISI 304 st st 2” (60mm) OD pipe mount, vertical process piping

J = AISI 316 st st 2” (60mm) OD pipe mount, horizontal process piping

K = AISI 316 st st 2” (60mm) OD pipe mount, vertical process piping

M = AISI 316 st st 2” (60mm) OD pipe mount for bottom process connections

N = No mounting bracket

Temperature Sensor Input: \_\_\_\_\_

O = No temperature input (mean temperature is set)

2 = RTD input with 4m (13 feet) shielded cable and 2 cable glands

4 = RTD input with 25m (81 feet) shielded cable and 2 cable glands

Measurement Function: \_\_\_\_\_

A = Multi-Sensing, dp, static pressure, temperature

B = Mass or corrected volumetric flow measurement

(display shows flow, dp, static pressure, temperature)

3-Way Manifold: \_\_\_\_\_

1 = 3-way valve manifold in AISI 304 stainless steel

2 = 3-way valve manifold in AISI 316 stainless steel

N = no 3-way manifold



## Technical Data Sheet & General Specifications

### tekFab Multivariable DM02 DP Cell and PR3 tekprobe Enquiry Form

Customer's Name, Project Name, & Location:						
<b>Detail</b>	<b>Sensor 1</b>	<b>Sensor 2</b>	<b>Sensor 3</b>	<b>Sensor 4</b>	<b>Sensor 5</b>	<b>Sensor 6</b>
Quantity						
<b>Media Type</b> ADD any special notes, such as dirty, clean, deionised water, solutions of eg. ethylene glycol, propylene glycol, glycol substitutes, brine, or special flow. Please provide % solution by weight.....						
Typical flow rate with units required						
Min & max flow rate with units						
Shielded temperature cable length (4m / 13 ft or 25m / 81 ft standard)						
Bi-directional (B)/ uni-directional (U) Flow						
Pressure range and units						
Temperature range and units						
Liquid viscosity and units						
Explosive atmosphere and type required						
Nominal pipe size (N) or ID ( I ) Specify mm or inches						
OR Pipe schedule or wall thickness Specify mm or inches						
Straight pipe runs available						
Pipe material						
Is the flow sensor to be used in an area of magnetic fields ? Yes or No						
Is communication network required? If yes, specify which						
Mass flow (M) or corrected volumetric Flow (CV)						
tekProbe style required: A = fixed flange, B = locking gland version, C = locking gland and under pressure version (see tekProbe specification)						
Are you interested in tekFab DP Cells with radio Link to ISO 100.						
What communication protocol do you require?						



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Specifications are subject to change without notice