

## Drag Force Flow (DFF) Sensor

Lenterra's DFF sensor is an immersion probe that provides continuous real-time measurement of flow force and temperature in liquids and powders. This novel Process Analytical Technology (PAT) tool enables process monitoring and control in pharmaceutical, food, biotech and other industries.

### Probe features

- Stainless steel construction, sterilizable and chemically resistant
- Fiber optic sensing – no electromagnetic interference and no ignition hazard
- High measurement rate (500 per second)
- Simultaneous measurements of force and temperature
- Force measurement is self-calibrated for temperature variations
- Directional measurement
- Turn-key operation when coupled with Lenterra Optical Interrogator (LOI)
- Wide range of sensitivities (model dependent)

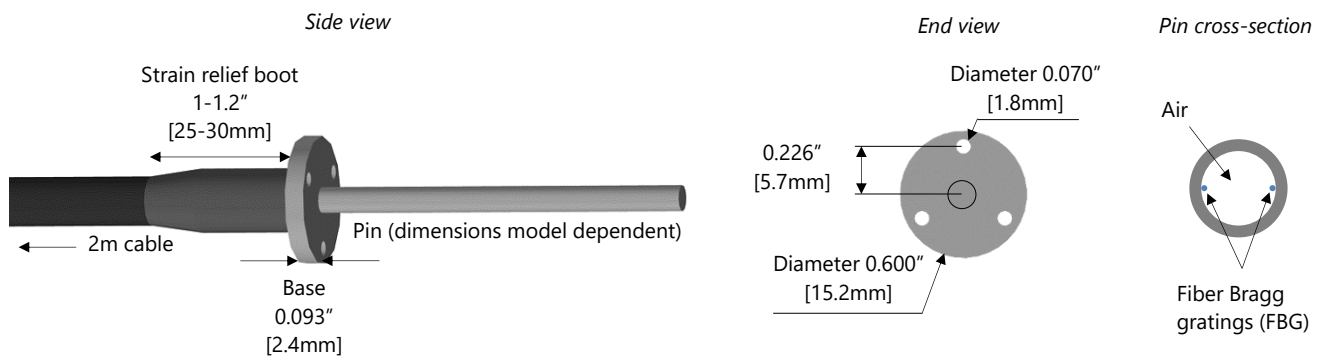
### Models

Model number	Measurement range <sup>1</sup> , mN	Resolution, <sup>2</sup> mN	Pin diameter, mm	Pin length, mm
P-15000-30	±15,000	2.3	3.2	30
P-11000-40	±11,000	1.7	4.19	40
P-8000-40	±8,000	1.2	3.2	40
P-5000-40	±5,000	0.75	3.0	40
P-4000-40	±4,000	0.6	2.8	40
P-2500-40	±2,500	0.37	2.77	40
P-1500-40	±1,500	0.23	2.41	40
P-1000-40	±1,000	0.15	2.11	40
P-500-40	±500	0.075	1.83	40
P-300-40	±300	0.045	1.27	40
P-170-80	±170	0.026	2.11	80
P-70-40	±70	0.01	1.07	40
P-45-80	±45	0.0068	1.65	80

<sup>1</sup> Custom measurement ranges available

<sup>2</sup> When used with a Lenterra LOI interrogator

### Probe construction



Optical wavelength

1556.5 nm

Operating temperature<sup>3,4</sup>

-10°C to 120°C (14°F to 248°F)

Storage temperature

-10°C to 60°C (-14°F to 140°F)

<sup>3</sup> Custom-made probes may operate down to -30 °C and up to 180 °C

<sup>4</sup> Operating temperature is for pin thermally insulated from cable

# Specifications

## Pin

Cylindrical hollow stainless steel tube sealed with a stainless steel cap, Fiber Bragg gratings adhered to inner surface  
Materials: SS 303, 316 or 316L, Silica glass, Epoxy (Cotronics 4525)  
Fastening: pin to base – welding, cap to pin and FBGs to pin – epoxy

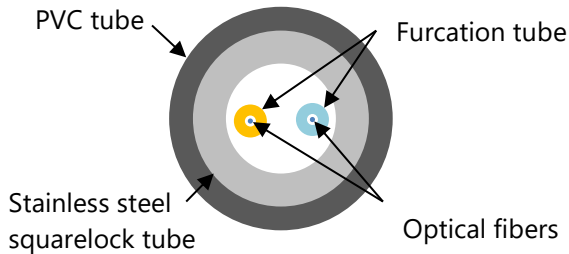
## Base

Material: SS 303, 316 or 316L

## Strain relief boot

Material: Polyolefin Plastic

## Instrument cable



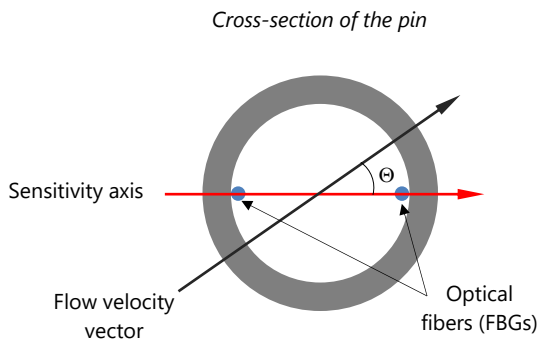
Material: SS squarelock tube covered with PVC tube  
Outside diameter: 0.24" (6.1mm)  
Length: 6.5 ft (2m)  
Operating temperature: -10°C to 60°C (14°F to 140°F)

## Fiber optic connector



Type: Duplex LC/PC fiber connector  
Ingress Protection: IP67 - Dust Tight, Waterproof  
Operating temperature: -40°C to 85°C (-40°F to 180°F)

## Directional response



Sensitivity vs. flow direction

