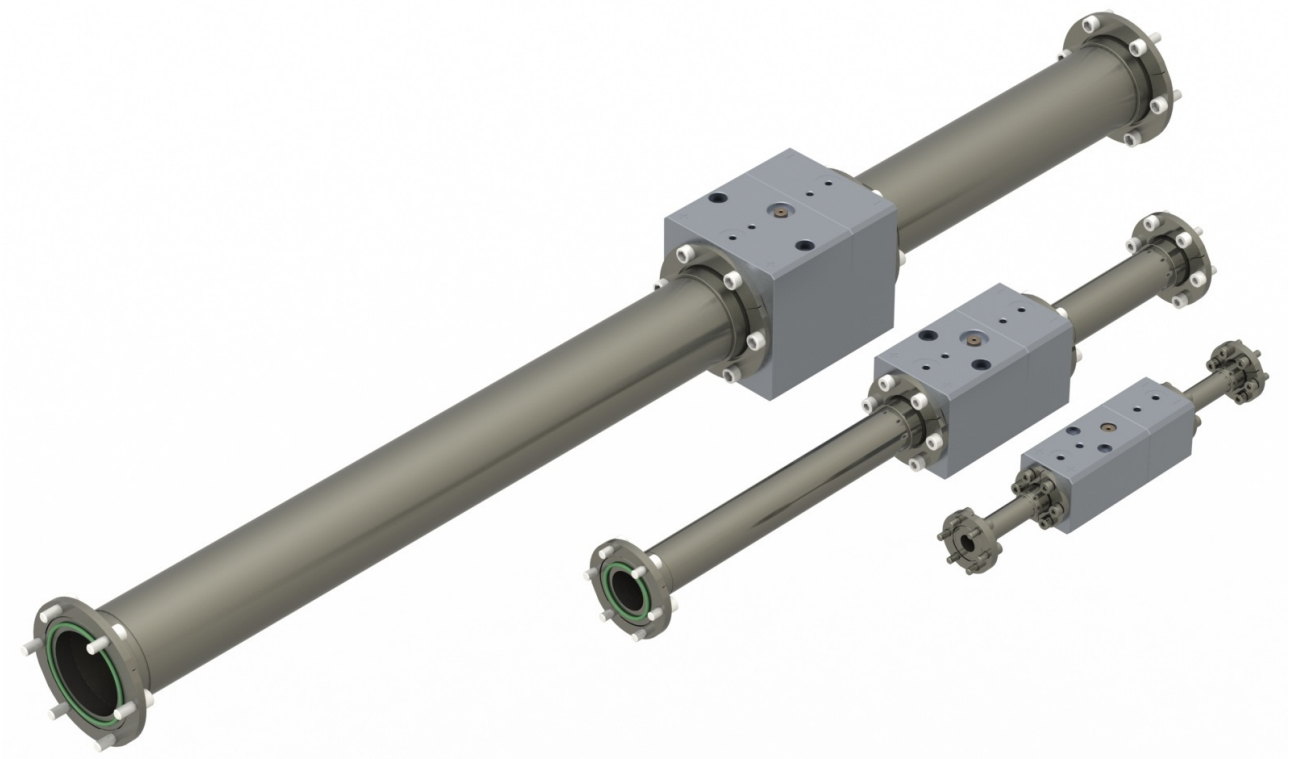
TetraTec® Instruments



LAMINAR FLOW ELEMENT

LFE S-Serie

Differential pressure element with a linear characteristic

TETRATEC INSTRUMENTS GMBH · STEINENBRONN · GERMANY

01 — THE COMPONENT

Linear characteristic, threefold span.

Orifices and Venturi tubes produce a differential pressure that grows with the square of the volumetric flow. At the lower end of the range they therefore reach the point at which the sensor can no longer resolve the differential pressure earlier than a laminar flow element does; with its linear characteristic, the laminar flow element thus achieves a larger span.

1:50
TURNDOWN
S010 glass capillary – else up to 1:20

0.2 %
ACCURACY
S010, of reading*

0.40 %
MEASUREMENT UNCERTAINTY (K=2)
smallest stated, after calibration

THE ESSENTIALS

Linear characteristic

The differential pressure follows the law of Hagen-Poiseuille and is proportional to the volumetric flow. Residual deviations at inlet and outlet are corrected by the calibrated curve.

Turndown up to 1:50

Glass capillary version (S010) up to 10 L/min, stainless steel matrices up to 1:20. Compared with an orifice the usable span is about three times as large.

Six sizes

From 0.001 to 990 L/min, each of modular block design and with ring pressure taps.

Materials for reactive gases

Housing aluminium 3.2315, connection adapter stainless steel 1.4404, seals PTFE and FPM. Oxygen, hydrogen and CO (up to S030) on request, subject to the Pressure Equipment Directive.

Low intrinsic leakage

Below 1×10^{-6} mbar L/s as helium leak rate, O-ring sealed.

Any mounting position

The position has no influence on the characteristic. Operating temperature 5 to 70 °C in the non-condensing range.

* Accuracy: residual deviation after calibration against a reference standard assumed to be error-free.

WHY NOT AN ORIFICE OR VENTURI TUBE

With orifice and Venturi tube the differential pressure enters the volumetric flow quadratically. Halve the flow and the signal drops to a quarter – at the lower end of the measuring range it is lost in the noise. With a laminar flow element the relationship is linear, which is why the usable span is about three times as large for the same sensor.

Operating principle

A laminar flow element consists of a capillary matrix. In its narrow, parallel channels a laminar – that is, swirl-free – flow forms. For such a flow the law of Hagen-Poiseuille applies: the pressure drop across the matrix is directly proportional to the volumetric flow.

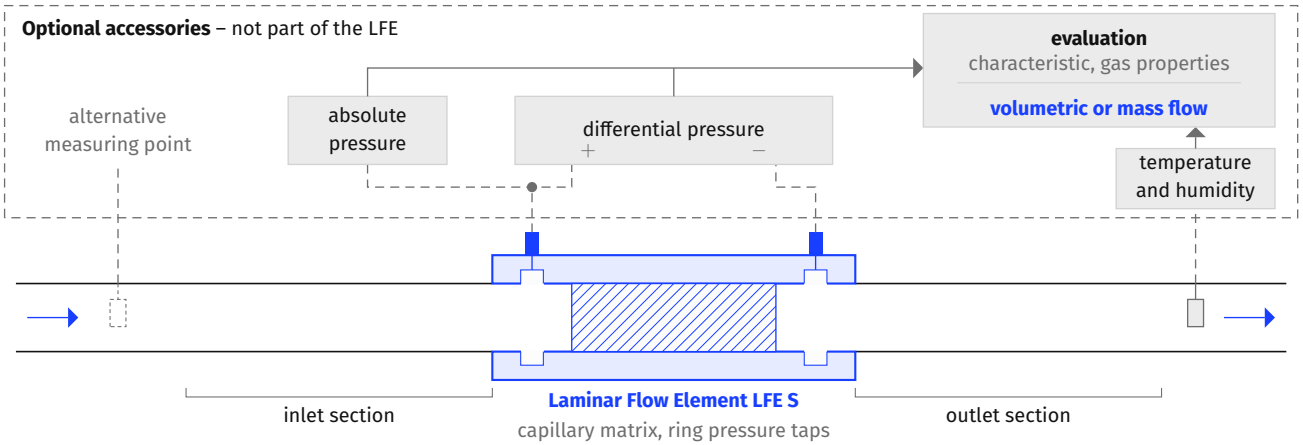
The ideal approach yields a linear characteristic. Orifice effects at the inlet and outlet of the matrix cannot be avoided; the real relationship between volumetric flow and differential pressure is therefore corrected by a calibrated curve. How fast and how accurately the measurement runs then depends mainly on the differential pressure sensor – with a fast sensor, measurements with high temporal resolution are possible.

THE SIX SIZES

SIZE	CALIBRATABLE RANGE	MATRIX MATERIAL	PRESSURE RATING
LFE S010	0.001–10 L/min	Borosilicate glass multi-capillary	2.5 bar Δp / 11 bar abs.
LFE S018	10–150 L/min	Stainless steel matrix	2.5 bar Δp / 11 bar abs.
LFE S024	16–260 L/min	Stainless steel matrix	1.5 bar Δp / 11 bar abs.
LFE S030	24–350 L/min	Stainless steel matrix	1 bar Δp / 9 bar abs.
LFE S038	38–500 L/min	Stainless steel matrix	0.75 bar Δp / 7 bar abs.
LFE S050	70–990 L/min	Stainless steel matrix	0.5 bar Δp / 5 bar abs.

The ranges apply to air, referred to 1000 mbar, 20 °C and 0 % RH. They are the window into which the ordered measuring range is placed: the LFE S010 spans up to 1:50 within it, the sizes with a stainless steel matrix up to 1:20 – beyond that on request.

MEASURING SECTION LAYOUT



TYPICAL APPLICATIONS

- Differential pressure element for flow measurement systems
- Calibration of flow meters
- Test benches for air and various pure gases
- Measurements with high temporal resolution
- Retrofitting of existing measuring sections

> *A linear characteristic keeps the differential pressure measurable even at the low end of the range.*

02 — SELECTION

One range equals one size.

VERSIONS

- Six sizes S010 to S050
- Matrix of borosilicate glass or stainless steel

ACCESSORIES

- CoM4.Flow-Eco/Pro evaluation unit
- Connection adapter stainless steel 1.4404
- HUMTMP temperature and humidity probe
- Factory or DAkkS calibration certificate

KEY SPECIFICATIONS

Calibratable range	**0.001–990 L/min**
max. turndown ratio	**1:50 (S010), otherwise 1:20**
Sizes	**six, S010 to S050**
Accuracy	**< 0.2 % of reading (S010)**
Repeatability	**< 0.1 % of reading**
Operating temperature	**5–70 °C**
Hysteresis	**± 0.1 % of reading (S010)**
Long-term stability	**< 0.5 % of reading in one year**
Housing material	**Aluminium 3.2315**
Seals	**PTFE and FPM**
Intrinsic leakage	**$< 1 \times 10^{-6}$ mbar L/s**

Complete data in the technical datasheet.

FROM ENQUIRY TO RECURRING CALIBRATION

1. **Record the measuring task**
   Measuring range, type of gas, test volume, cycle time and operating conditions – the design follows from these.
2. **Design and calibrate the instrument**
   Assembly, calibration in our own accredited laboratory, calibration certificate with stated uncertainty.
3. **Integrate and support**
   Integration into your production, training and the recurring calibration at the agreed interval.

We select the size for your range.

REQUEST A DESIGN

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