



The **Laminar Master Flow System**, in brief **LMF**, is designed for high-precision and dynamic measurement and control of volume and mass flow of air and gases.

- Very fast and precise flow calculation
- Measurement with different flow elements
- Gas property calculation for air and pure gases
- Electronic pressure control (optional)
- Controller S320 as measuring and control system
- Various interfaces (digital, serial and Ethernet)
- Networking with up to 32 devices via RS485

Technical Description

The measuring system runs testing schedules autonomously and can transfer the measurement results digitally. The controller S320 manages the complete testing schedule as well as the data acquisition and evaluation. Modularity is preserved by both mechanical set-up and sensors of the measuring system and also by the multi-purpose parameterisable software of the device. Modular set-up and parameterisability allow an optimal customisation for various testing tasks.

The 10 available programs make it possible to switch quickly and easily between the saved configurations to satisfy different measuring tasks.

Effective usage and precise results are achieved by different operating modes and functions like:

- Continuous measurement and control
- Programmable control (PLC mode)
- Automatic range switching
- Averaging for analogue and frequency signals with start/stop or time control
- Gate time measurement for impulse signals
- Zeroing of differential and gauge pressures
- Test of tightness and signal test menu

During standard operation the display of the LMF shows for up to 2 measuring sections:

- the actual volume flow value
- the standard volume flow value
- the mass flow value

Additionally it's possible to linearise all sensor signals the measuring system is fed with (e.g. differential pressure, absolute pressure, temperature etc.) and to display them in different physical units. If needed, internally calculated values for density, viscosity or Reynolds number etc. of the gas can be output.

Furthermore for all popular types of flow elements like Laminar Flow Elements, gas counters, critical nozzles, accutubes, orifice plates, Venturi tubes, nozzles, thermal mass flow sensors etc. high-precision and standard calculation as well as correction procedures are available to be used with the measuring system.

The calibration data of the flow element and the configuration data, like gas type, display units and testing parameters can be set by interfaces via PC or manually via front keypad. Being saved in Flash-ROM the entered data are preserved in powerless state.

The measuring system has a modular set-up. As separate components likewise measuring sensors or flow elements can be connected.

Optional pressure sensors and electronic pressure controllers allow it to run the programs fully automated with different test pressures.

The LMF can be controlled by an external computer via different interfaces: digitally (PLC compatible, galvanically isolated), serial (RS232 or RS485) or Ethernet. Quite the same is valid for data acquisition. It can be done by the serial or Ethernet interfaces or by the optional analogue outputs. The two implemented RS485 interfaces allow it furthermore to link and address up to 32 devices by a RS485 bus structure.

The measurement with flow elements follows the effective differential pressure method. The flow through the measuring section causes a pressure drop that allows flow measurements in milli-second range. Propagating with sonic velocity, pressure changes can be measured with pressure sensors much faster as e.g. with the temperature sensors of methods measuring the temperature changes.

For flow measurement usual flow elements or Laminar Flow Elements (LFE) can be used. Because of the combination of fast response and big turn down (span) the LFE is outperforming against all other flow elements.

When gas or air is flowing through the fine capillaries of a LFE a linear pressure drop proportional to flow arises (Hagen-Poiseuille's law). This can be measured with a differential pressure sensor and is directly proportional to volume flow and viscosity of the medium. Increasing static pressure LFEs provide much bigger turndowns referred to mass flow in comparison to other flow elements.

Specifications

Flow Measuring Range

Max. volume flow: 5 ml/min to 64 m³/min
The measurable maximum volume flow can be varied widely by selection and design of the flow elements (e.g. Laminar Flow Elements).

Accuracy

Standard: ≤ 1 % of Rdg. Span 1:10
Optimised: ≤ 0,5 % of Rdg. Span 1:25

The used sensors and flow elements as well as their calibration determine the measuring accuracy referred to the actual volume flow.

Sensor Type and Measuring Ranges

Differential pressure: 0 .. 20 / 60 mbar
Gauge pressure: 0 .. 0,1 / 1 / 2,5 / 4 / 6 bar
Absolute pressure: 0 .. 0,1 / 1 / 2,5 / 4 / 6 bar

The specified pressure sensors with their corresponding measuring and control ranges for electronic control within the flow measuring range are only **optionally** available.

Operating Conditions

Inlet pressure: 0 .. 7 bar abs
Inlet temperature: 0 .. +45 °C
Inlet humidity: 0 .. 100 %, non-condensing

Ambient Conditions

Pressure: Atmospheric
Temperature: -10 .. +50 °C
Humidity: 0 .. 100 %, non-condensing

Media Compatibility

Clean, dry, non-condensing, non-corrosive gases and air. The measuring medium has to correspond with the requirements of ISO 8573-1. Additionally to a 5 µ filter, an oil/water separator in the compressed air supply is strongly recommended.

Overrange Limits

The overrange limits primarily depend on the pressure sensors but also on the pressure resistance of the used pipes. Usually twice the upper range limit of the pressure limits is permissible, but max. the piping's pressure stage.

Display

Alphanumeric LED (red).
3 displays with 6 characters. Character height: 10 mm.
3 text-displays with 4 characters. Character height: 6 mm.

Enclosure

Type: DIN IEC 61554 or
19" rack with 3 HU / 84 HP or
19" rack with 6 HU / 84 HP

Dimensions 3 HU: 450 x 150 x 316 mm (WxHxD)
6 HU: 450 x 280 x 316 mm (WxHxD)

Weight 3 HU: ≈ 5 kg
6 HU: ≈ 10 kg

Ingress Protection IP 20 to IP 54
Ingress protection according to set-up, higher levels on request.

Process Connections

Standard DIN threads and flanges, other designs according to agreement.

Electrical Connections

Power supply: VAC power connector
Analogue inputs/outputs: Round connector (Lumberg)

Interfaces

1 x Ethernet, 1 x RS232 und 2 x RS485

Power Supply

90 .. 260 VAC (power supply unit), 50/60 Hz, max. 80 W.

Approvals

The device corresponds to European standard EN 61010-1 (safety regulations for electrical measuring, control and laboratory devices) and the regulations of the EC-Machinery Directive - 89/392.

Delivery Content

- Measuring/control device incl. power cable
- Sensor incl. connection cable
- Operation manual with electrical connection circuit

Special Features

Mounting Options

Measuring/control device: the controller S320 is mounted in a stable 19" rack housing with 3 HU or 6 HU, ready for connection. Sensors and measuring section are (also) available as separate units.

Measuring Sections

Up to 2 measuring sections can be connected to the measuring/control device. They are operated/evaluated continuously or controlled by program. The calibration data for the determination of the sensor values and the flows is saved in the measuring/control device.

Measuring Medium

Usable media: the media property database supports the usage of air and more than 12 gases.

Operation

F1/F2/F3 key: 5 foil keys at the controller for program selection, setting of display and parameterisation.
Zero key: zeroing of diff. and gauge pressure sensors.
START/STOP key: begin/end of averaging measurement.
LEAK TEST key: start of leak test.

Parameter Settings

10 programs: configuration of measuring sections, controller settings, display units, decimal places.
Testing parameters: e.g. pressure limits, wait / fill / stabilisation / measuring / venting time, O.K./N.O.K counter.
System parameters: superior settings and calibration data.
Password: protection of the configuration against unauthorised and unintended changes.

Status Displays (Optional)

Coloured lamps: green (O.K.), red (N.O.K.).

Ordering Information

The LMF is fully customised for the specific requirements. Please supply us for design and quotation with the following information:

- Flow range(s)
- Gas(es)
- Testing volume
- Operating conditions (pressure and temperature)
- Control requirements
- Measuring and control accuracy
- Ambient conditions
- Enclosure requirements
- Electrical supply
- Requirements concerning data acquisition
- Other special requirements