FLOPAC Flow Measurement System

FLOPAC

Meriam Instrument

a Scott Fetzer Company

Precision Measurement Since 1911

PRODUCT OVERVIEW: The LFS-3 FLOPAC Flow Measurement System is designed to allow users to accurately measure gas flow rate using state-of-the-art electronic instruments, electronics and software. Real-time data measured by the instrumentation is transmitted via RS-485 to a personal computer. The SOFTFLOW software enables the PC to automatically calculate flow rate and compensate for changes in line pressure, temperature, and relative humidity. The user can select the units for flow rate, temperature, and pressure using the system software. Configurations for multiple flow elements can be saved and recalled for later use. Results of flow tests can be saved for post processing or archiving purposes.

The LFS-3 FLOPAC Flow Measurement System will allow the user to:

- Interface with a Laminar Flow Element (LFE) for data acquisition
- Measure flow rates with a system accuracy of $\pm$ 1.0 % at FS (based on system with a Laminar Flow Element)
- Display Actual or Standard volume flow or mass flow in user selected units
- Install the portable NEMA 4X instrument enclosure in convenient location
- Service internal electronics easily
- Collect and store data for archiving purposes or data analysis

SYSTEM COMPONENTS & FUNCTIONS

The FLOPAC system components are housed in a NEMA 4X steel enclosure. Power to enclosure is 110 or 240 VAC through a 15 ft. power cord (supplied). An internally mounted power supply provides 24 VDC power. Two Meriam model 1500 Smart Transmitters with RS-485 output are used to measure the differential and inlet pressure. A dual temperature / humidity sensor provides analog signals for temperature and relative humidity. A/D converters in the enclosure convert this data to RS-485 signals as well. All measured parameters are transmitted to the PC on a single cable. Since most PCs are equipped to handle RS-232, the FLOPAC system includes an RS-485 to RS-232 converter and power supply to allow the PC to receive the DP, P, T and RH measurements. The PC will calculate actual or standard volume or mass flow rate using the SOFTFLOW software.

The 1500 Smart Transmitters are available to meet customer needs:

20" wc DP at $\pm$0.1% F.S.
200" wc DP at $\pm$0.025% FS
900 mm Hg Abs at $\pm$0.020% F.S.
2000 mm Hg Abs at $\pm$0.025% F.S.
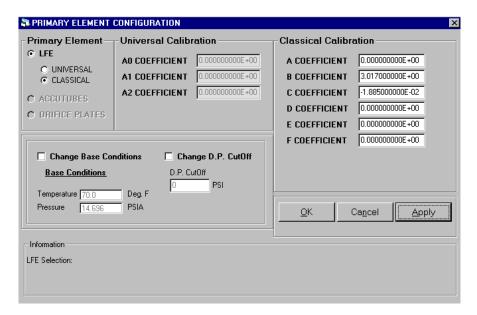200 PSIG at $\pm$0.025% F.S.

The dual T / RH sensor provides 0 - 100% RH and 0-140° F measurement.

"SOFTFLOW" SOFTWARE INFORMATION

SOFTFLOW is a Windows based set-up software that facilitates configuration of a flow program and selection of the primary element to be used. The menu driven instructions guide the user through initialization of computer communication settings and selection of the calculation method and desired engineering units.
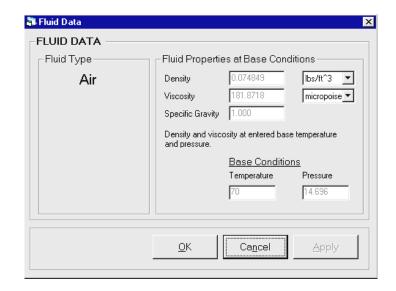
Computer Requirements

- 90 MHz or better Pentium PC system
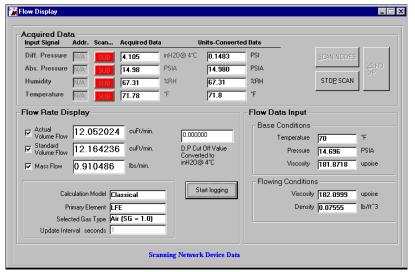- Windows '95 or '98
- 1 available COM port
- 3.5" disk drive

The initial release of the SOFTFLOW software (included with the LFS-3 FLOPAC Measurement System) supports Laminar Flow Elements (LFEs). The program allows the user to choose between Classical or Universal calculation methods to suit user needs. The classical method is familiar to most LFE users and is excellent for gas flow conditions less than 30 PSIG or less than 120° F. Universal calculation is recommended when flowing conditions are above 120° F or greater than 30 PSIG.

Software developments for primary elements such as Accutube averaging pitot tubes and Orifice plates are pending.

SOFTFLOW allows selection from a wide range of common gases with pre-programmed properties for ease of use. The program also allows the user to input exotic gas properties through interactive menus. SOFTFLOW automatically calculates gas properties for most common gases. Viscosity is determined using AICHE methods. Density is determined from the Modified Benedict Webb Rueben (MBWR) equation. Natural gas density is calculated using AGA Report No. 8 methods. Other gas densities are calculated using the Real Gas Law and a modified "Z" factor. Properties of gas mixtures can be input directly or calculated from user input of mole fractions for the component gases. Wet air calculations are handled using the wet air compensation method defined in our F/N 501:440.

Flow Display

Acquired Data

Input Signal	Addr.	Scan...	Acquired Data		Units-Converted Data	
Diff. Pressure	N/A	SUB	4.105	inH2O@ 4°C	0.1483	PSI
Abs. Pressure	N/A	SUB	14.98	PSIA	14.980	PSIA
Humidity	N/A	SUB	67.31	%RH	67.31	%RH
Temperature	N/A	SUB	71.78	°F	71.8	°F

SCAN NODES   ZERO DP   STOP SCAN

Flow Rate Display

☑ Actual Volume Flow   12.052024   cuFt/min.
☑ Standard Volume Flow   12.164236   cuFt/min.
☑ Mass Flow   0.910486   lbs/min.

0.000000   D.P Cut Off Value Converted to inH2O@ 4°C

Calculation Model Classical
Primary Element LFE
Selected Gas Type Air (SG = 1.0)
Update Interval seconds 1

Start logging

Flow Data Input

Base Conditions
Temperature 70 °F
Pressure 14.696 PSIA
Viscosity 181.8718 upoise

Flowing Conditions
Viscosity 182.0999 upoise
Density 0.07555 lb/ft^3

Scanning Network Device Data

During flow measurement operations, FLOPAC transmits the measured variables to a personal computer. The PC displays DP, P, T and RH plus the calculated flow rate in the engineering units previously selected by the user. Base conditions are included on this screen to allow at-a-glance verification of these important values. The results of the flow calculation are displayed as well. The user can activate one desired flow value (i.e. Actual volumetric, Standard volumetric or Mass flow) or all three for simultaneous display.

For post-test data processing or archiving purposes, all measured or calculated data can be saved as a comma delimited file (.CSV extension). Excel can be used to open these files for viewing purposes, data processing or graphical presentation.

SPECIFICATIONS

- **ACCURACY:** FLOPAC measurement accuracy (w/o primary element): ± 0.49% at F.S. (RSS method) FLOPAC with ±0.86% Reading LFE: ± 1.00% of Reading at F.S., ± 1.3% of Reading at 5:1 flow turndown, ± 2.0% of reading at 10:1 flow turndown.

- **POWER REQUIREMENTS:** 110 or 240 VAC. A 15 foot grounded power cord is included.

- **ENCLOSURE:** NEMA 4X rated steel enclosure (16" x 12" x 6"). Mounting tabs located on rear of enclosure.

- **DATA OUTPUT:** Digital output via RS-485. DIN connectors provided on enclosure and all cabling is included. RS-485 to RS-232 converter (DB 9 connections) and power supply included with system.

- **ENGINEERING UNITS:** Actual and standard volume flows measured in liters, cubic meters, cubic feet, or cubic centimeters. Mass flows in pounds, kilograms, or grams. Pressure options include mm Hg, cm Hg, inches of Hg, inches of water, cm of water, mm of water, PSI, mbar, and kPa. Time units are /second, /minute and /hour

- **TEMPERATURE RANGE of FLOPAC:** Operating: 55° F to 100° F (12.8° C to 37.8° C) Storage: -40° F to 140° F (-40° C to 60° C)

- **OVER-PRESSURE LIMITS:** Twice the range on the Differential (DN) transmitter when pressurized on the high side only and 150 PSI (10.5 kg/cm^2) static when applied to both sides of the sensor simultaneously. Twice the range on the Absolute (AI) or Gauge (GI) units. 15 PSIG on standard dual T / RH sensor.

- **PROCESS CONNECTIONS:** 1/4" tube fittings for high and low pressure

- **COMPUTER REQUIREMENTS:** 90MHz Pentium PC or greater, Windows '95 or '98, one COM port, 3.5" Disk Drive