COX INSTRUMENTS
FLOW MEASUREMENT

Proven Performance for Over 50 Years

Precision Turbine Flow Meters - Gas Series

ADVANTAGES

- High accuracy
- Wide flow range
- Fast response to rate changes
- Simplicity of construction with few parts
- Cost effective
- Calibration traceable to NIST

DESCRIPTION

A series of flowmeters designed for precise flowrate measurement of all compressible fluids with a minimum pressure loss. Most operating characteristics are similar to the AN series, except that guaranteed standard accuracy is ±1.0% of reading. Accuracies of ±0.5% are available depending on fluid conditions, consult factory for data.

The series comprises three basic designs. For low, medium, and high density gases (See Table 1 below). This variety of design permits accurate flow measurement under operating densities from 0.01 to 15 lbs/cu. ft. (at flow ranges from 0.4 to 400 acfm).

Virtually any type of clean gas can be measured—argon, air, helium, oxygen, ammonia, methane, nitrogen, etc. Repeatability is ±0.25% of reading. Response, despite the low densities, is a reasonable 10 to 20 milliseconds.

TABLE 1 - DENSITY RANGES

	Low Density	Medium Density	High Density
Density (lb/cu ft)	0.01 to 0.75	0.38 to 3.0	1.5 to 15
Atmosphere of air	0.125 to 10	5 to 40	20 to 200

Performance Specifications	
Turbine Meter Accuracy (% of reading)	±1.0%
Repeatability (% of reading)	±0.25%
Frequency Output (maximum)	1500 to 1800 Hz
Pressure Rating (at 75°F)	6000 psi
Output Signal (minimum)	10 millivolts
Response Time (milliseconds)	20-30 or better

SIZING GAS FLOWMETERS

It is important to remember that turbine flowmeters measure the actual volume of fluid passing through the meter and therefore it is necessary to convert all flow units to actual cubic feet/minute to determine proper meter size. To determine actual cubic feet/minute (ACFM), it is necessary to know the gas density at the operating pressure and temperature condition.

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TABLE 2 - UNIVERSAL GAS CONSTANTS

Gas	Symbol	Universal Gas Constant (R)	Standard Density Condition* (lb/cu ft)
Acetylene	C_2H_2	59.4	0.06724
Air		53.3	0.07493
Ammonia	NH_2	90.8	0.04399
Argon	A	38.7	0.10320
Carbon Dioxide	CO_2	35.1	0.11380
Carbon Monoxide	CO	55.2	0.07236
Ethylene	C_2H_4	55.1	0.07249
Helium	HE	386.0	0.01035
Hydrogen	H_2	767.0	0.00521
Methane	CH_4	96.4	0.04143
Methyl Chloride	CH_3Cl	30.6	0.13052
Nitrogen	N_2	55.2	0.07236
Nitric Oxide	NO	51.5	0.07755
Nitrous Oxide	N_2O	35.1	0.11379
Oxygen	O_2	48.3	0.08269
Sulphur Dioxide	SO_2	24.1	0.16573

TABLE 3 - MAXIMUM PRESSURE LOSS

Density	Low	Medium	High
For gases (psi)	8.0 X ρ	2.75 X ρ	1.0 X ρ
Atmosphere of air	0.6 X atm of air	0.2 X atm of air	0.08 X atm of air

For applications with Constant operating temperature and pressure.

1. Determine density of gas in pounds per cubic feet (lbs/cu ft). If operating at standard conditions (14.7 psia at 70°F), obtain density value directly from Table 2. If operating at other than standard conditions, calculate density using:

$$\text{Density } (\rho) = \frac{144P}{RT}$$

2. Determine maximum flow rate in actual cubic feet/minute (ACFM) using:

$$\text{acfm} = \left(\text{scfm } \frac{14.7}{P} \text{ X } \frac{T}{530}\right) \text{ or}$$

$$\text{acfm} = \left(\text{scfm } \frac{\text{pph}}{\rho \text{ X } 60}\right)$$

Where P = operating pressure in psia (psia = psig + 14.7)
T = operating temperature in Degrees Rankin (T = °F + 460)
R = Universal Gas Constant (see Table 2)
ρ = Density in lb/cu ft
scfm = standard cubic feet per minute
pph = pounds/hour

3. Repeat Step 2 to determine minimum flow rate in acfm.
4. Using density value and minimum and maximum flow rates, select proper size GAS flowmeter using Flow Range Table 4. Specify flowmeter as GL, GM, or GH plus appropriate size number.

TABLE 4 - FLOW RANGES

COX Model		L	M	H
AN Series	FLANGE Series	Low Density Range (acfm)	Med. Density Range (acfm)	High Density Range (acfm)
G(*)(8-4)	FG(*) -½"(8-4)-(†)	0.75-3.0	NA	NA
G(*)(8-6)	FG(*) -½"(8-6)-(†)	1.5-7.0	0.5-3.0	NA
G(*)(8)	FG(*) -½"(8)-(†)	2.0-10.0	1.2-7.0	0.4-3.0
G(*)(10)	FG(*) -¾"(10)-(†)	2.5-15.0	1.5-10.0	1.0-7.0
G(*)(12)	FG(*) -¾"(12)-(†)	3.5-25.0	2.0-15.0	1.2-10.0
G(*)(16)	FG(*) -1"(†)	5.0-50.0	2.5-25.0	1.5-15.0
G(*)(20)	FG(*) -1 ¼"(†)	8.5-85.0	4.0-50.0	2.0-25.0
G(*)(24)	FG(*) -1 ½"(†)	12.5-125	7.0-85.0	3.5-50.0
G(*)(32)	FG(*) -2"(†)	20.0-250	10.0-125	6.5-85.0
NA	FG(*) -2 ½"(†)	35.0-400	18.0-250	8.0-125

Frequency at Max Flow: 1200 Hz
* When specifying Model numbers use L,M, or H as second letter of model designation, depending on density range used.
† Specify flange rating 150 lb, 300 lb, or 600 lb

For more information, contact COX Instruments or your local COX Instruments representative.

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