ROCHESTER INSTITUTE OF TECHNOLOGY
MICROELECTRONIC ENGINEERING

RIT Gas Flow Sensor

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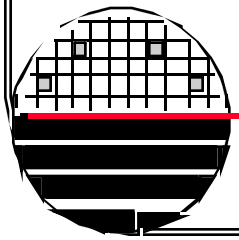
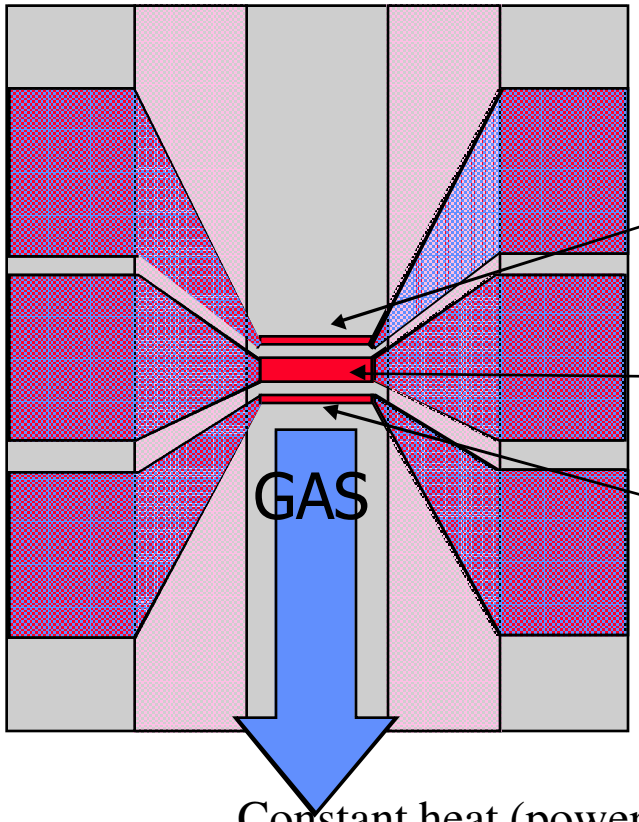


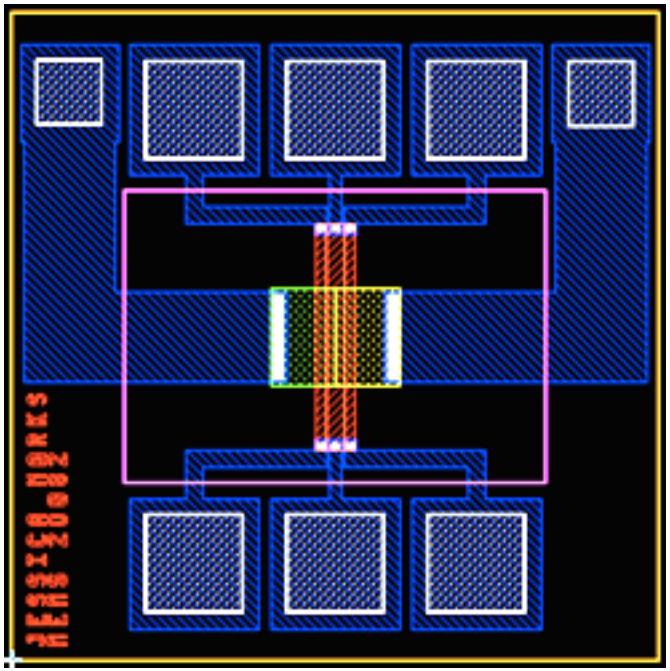
GAS FLOW SENSOR

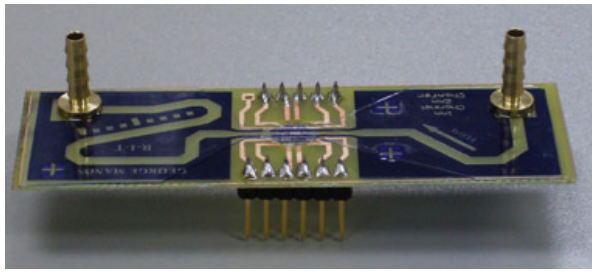


Upstream Polysilicon Resistor

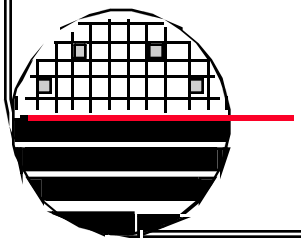
Polysilicon heater

Downstream Polysilicon Resistor

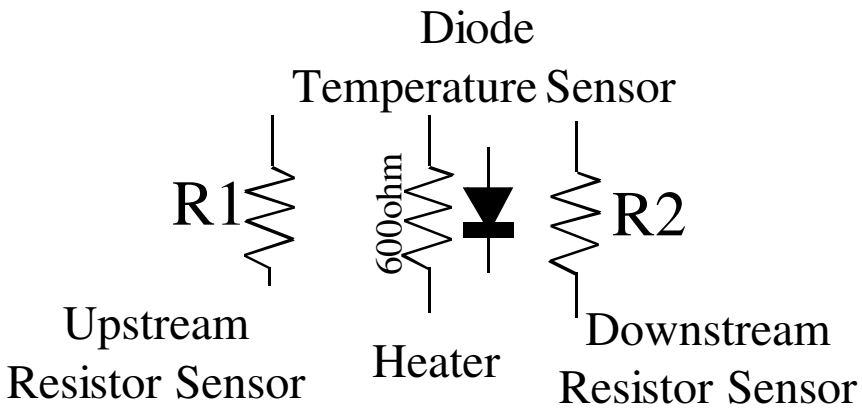


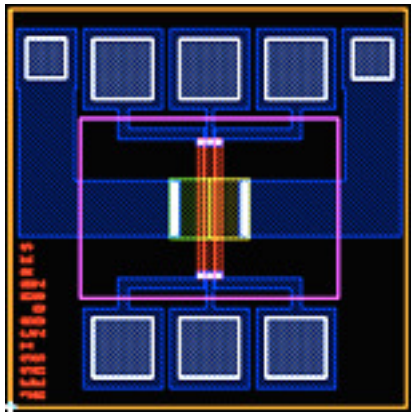


Constant heat (power in watts) input and two temperature measurement resistors, one upstream, one downstream. At zero flow both sensors will be at the same temperature. Flow will cause the upstream sensor to be at a lower temperature than the down stream sensor.



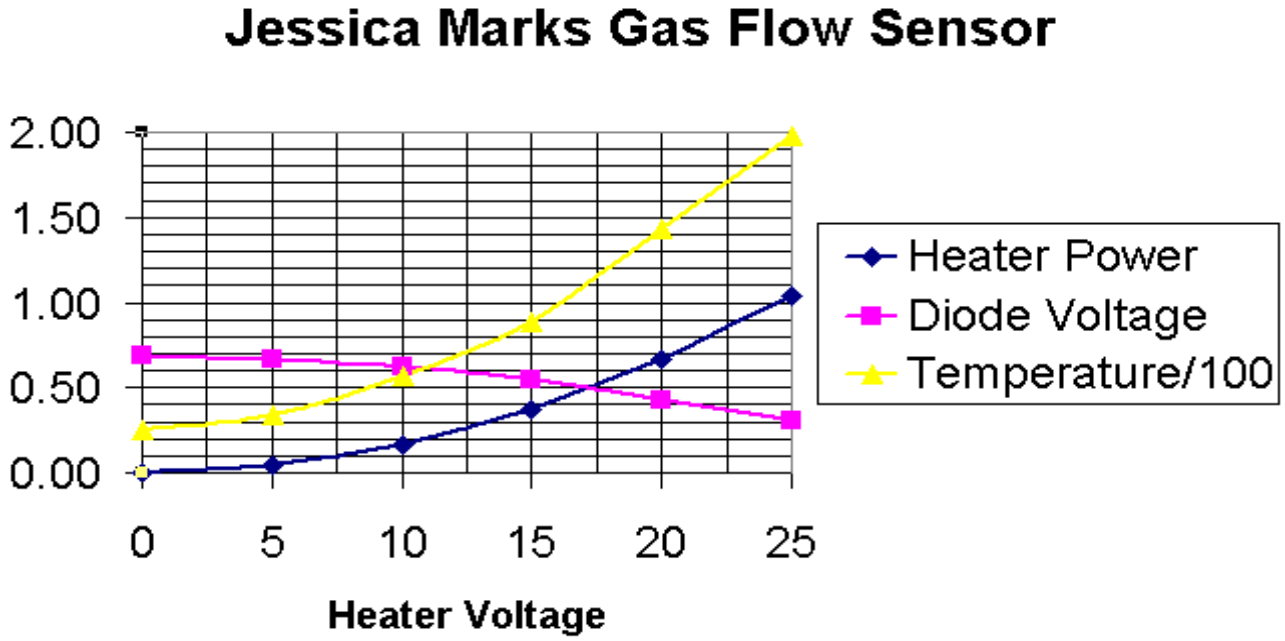
GAS FLOW SENSOR

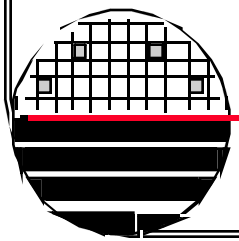




Winter 2008

Gas Flow Sensor - Jessica Marks, 2009			
	600 ohms		-2.2mV/°C
Heater Voltage	Heater Power	Diode Voltage	Temperature/100
0	0.00	0.69	0.25
5	0.04	0.67	0.34
10	0.17	0.62	0.57
15	0.38	0.55	0.89
20	0.67	0.43	1.43
25	1.04	0.31	1.98





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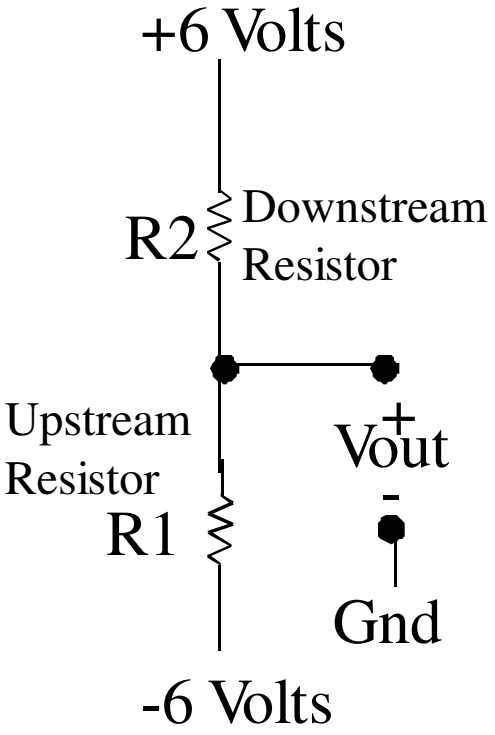
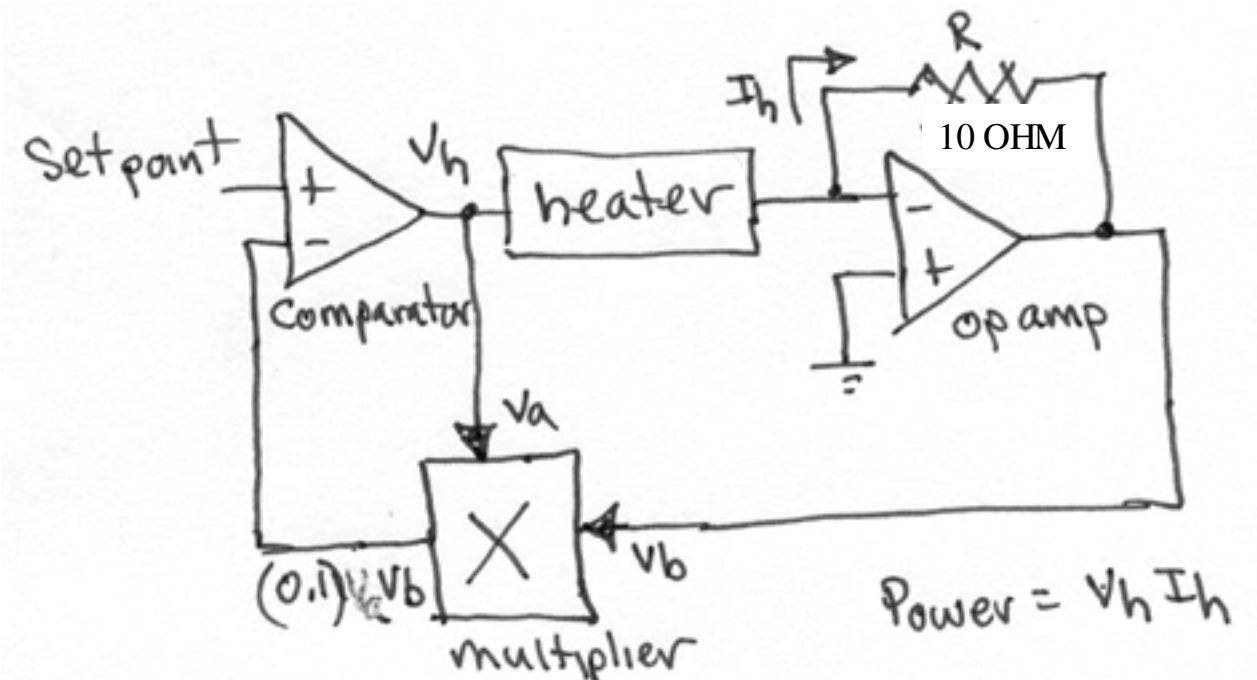
FLOW SENSOR ELECTRONICS



Vout near Zero so that it can be amplified

Constant Power Circuit for the Heater



AD534

MULTIPLIER

ANALOG DEVICES

Internally Trimmed Precision IC Multiplier

AD534

FEATURES

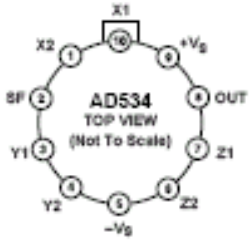
Pretrimmed to ±0.25% max 4-Quadrant Error (AD534L)
All Inputs (X, Y and Z) Differential, High Impedance for $[(X_1 - X_2)(Y_1 - Y_2)/10\ V] + Z_2$ Transfer Function
Scale-Factor Adjustable to Provide up to X100 Gain
Low Noise Design: 90 μV rms, 10 Hz–10 kHz
Low Cost, Monolithic Construction
Excellent Long Term Stability

APPLICATIONS

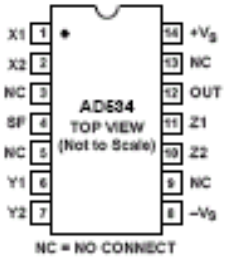
High Quality Analog Signal Processing
Differential Ratio and Percentage Computations
Algebraic and Trigonometric Function Synthesis
Wideband, High-Crest rms-to-dc Conversion
Accurate Voltage Controlled Oscillators and Filters
Available in Chip Form

PIN CONFIGURATIONS

TO-100 (H-10A) Package

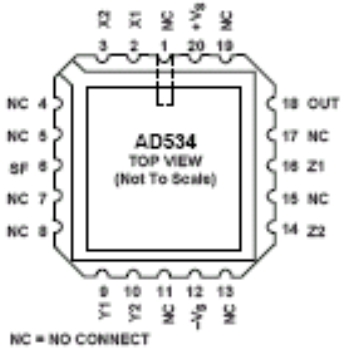


TO-116 (D-14) Package



NC = NO CONNECT

LCC (E-20A) Package



NC = NO CONNECT

PRODUCT DESCRIPTION

The AD534 is a monolithic laser trimmed four-quadrant multiplier divider having accuracy specifications previously found only in expensive hybrid or modular products. A maximum multiplication error of ±0.25% is guaranteed for the AD534L without any external trimming. Excellent supply rejection, low temperature coefficients and long term stability of the on-chip thin film resistors and buried Zener reference preserve accuracy even under adverse conditions of use. It is the first multiplier to offer fully differential, high impedance operation on all inputs, including the Z-input, a feature which greatly increases its flexibility and ease of use. The scale factor is pretrimmed to the standard value of 10.00 V; by means of an external resistor, this

MULTIPLIER AND DIVIDER CONFIGURATION

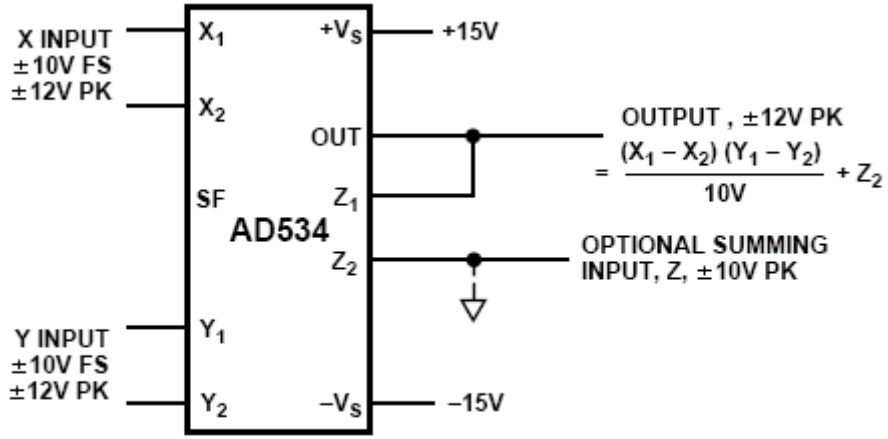


Figure 3. Basic Multiplier Connection

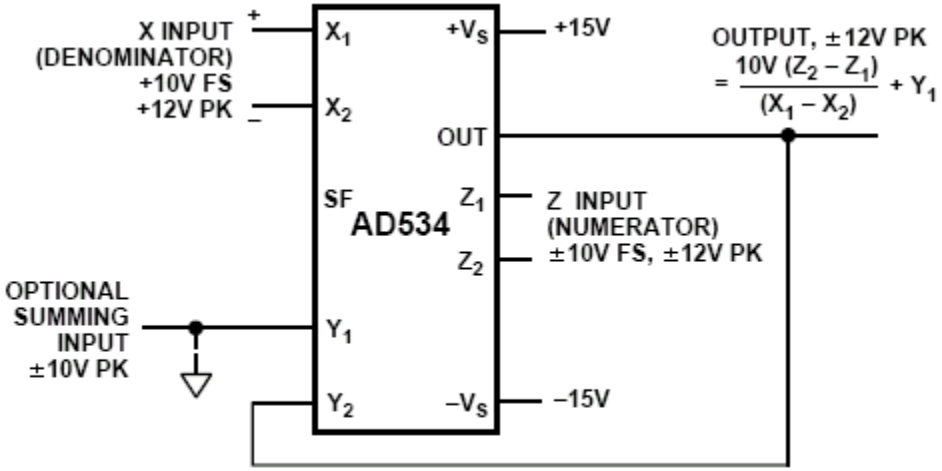
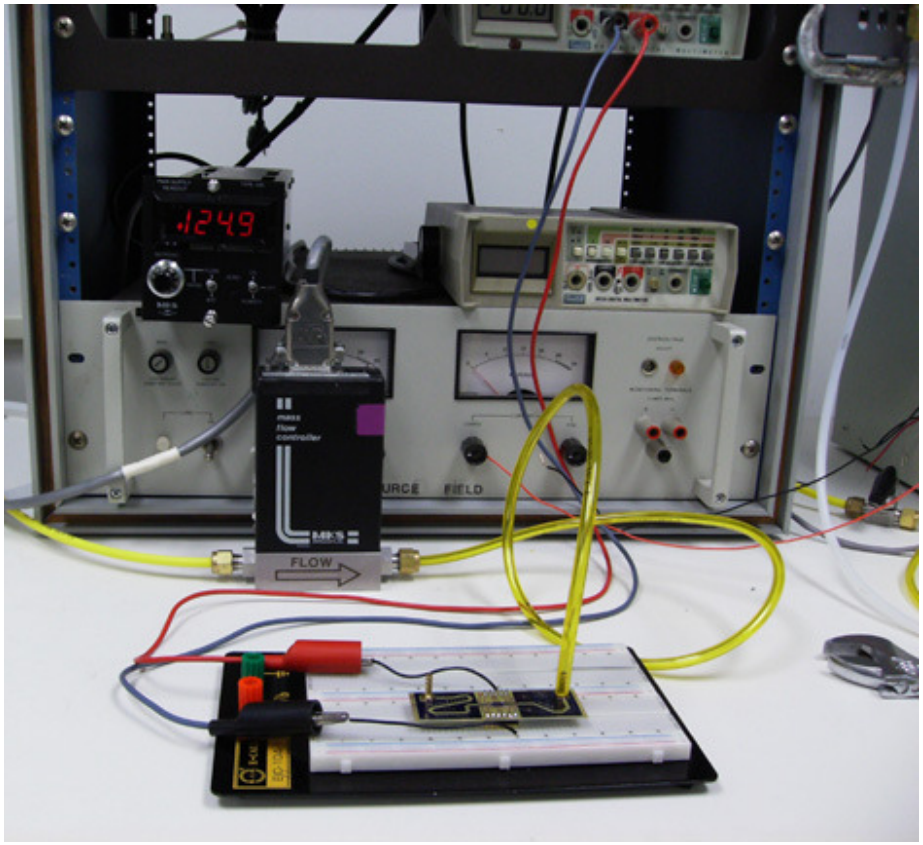
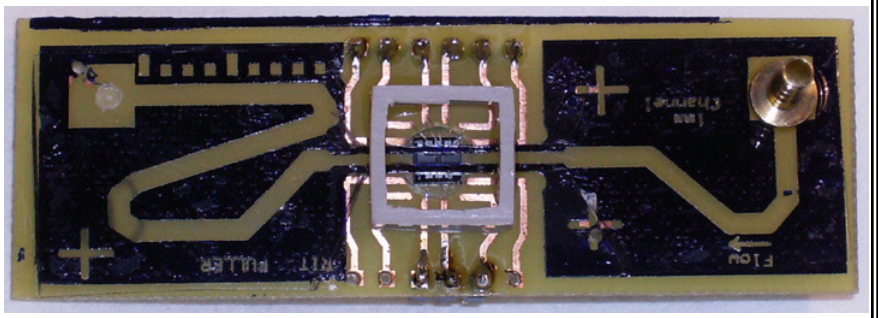


Figure 6. Basic Divider Connection

TEST SET UP FOR GAS FLOW SENSOR

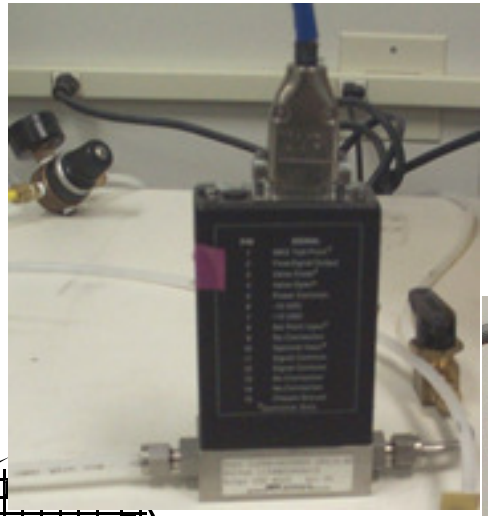


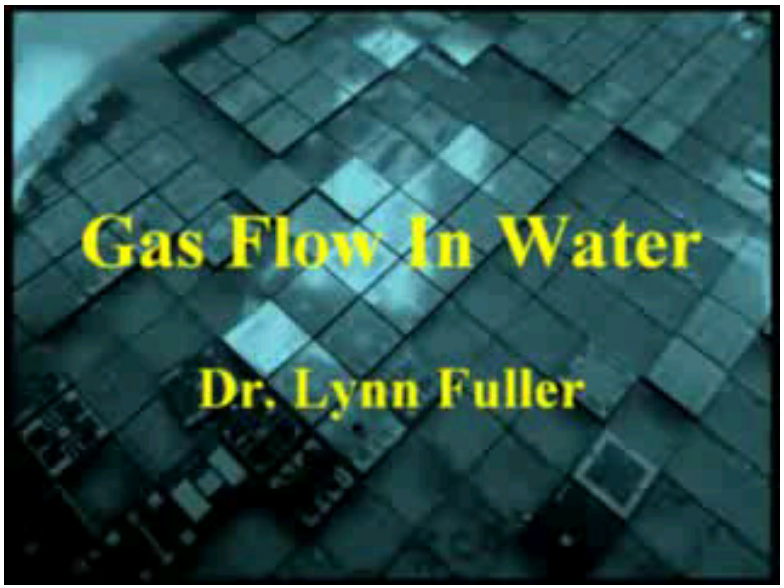


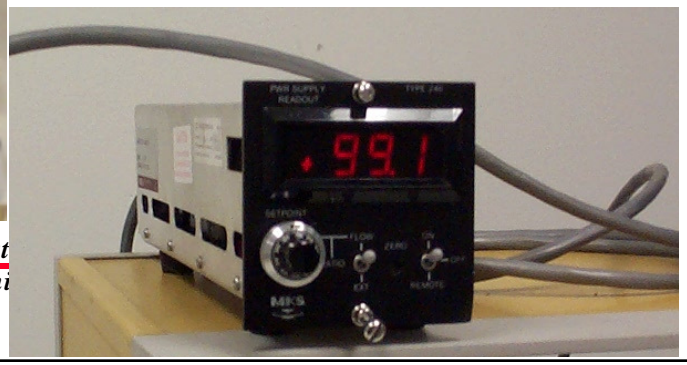
EXPERIMENTAL SETUP

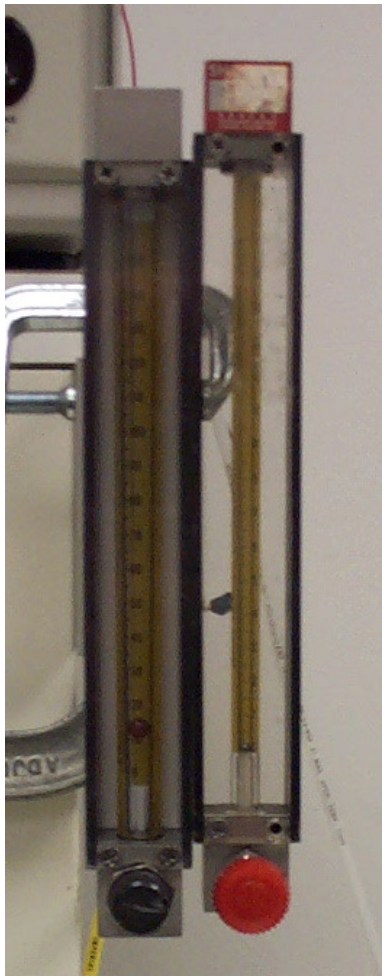
1. How can we control the flow? Pressure?
2. How can we calibrate the flow?

MFC



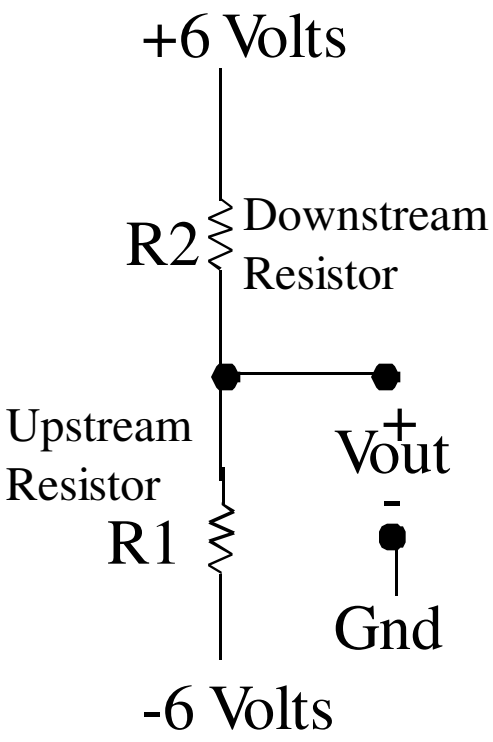






Rotometer

MEASUREMENTS



Vout near Zero so that it can be amplified

Constant voltage on the heater (15 volts)

Vout set to ~zero with no flow by adjusting the -6 Volt supply slightly.

Measure Vout with a Digital Multimeter For varous gas flows from 0 to 200 sccm.

Gas Flow (sccm)	R upstream	R downstream	Vout
0	10,000	10,000	0
50			
100			
150			
200			

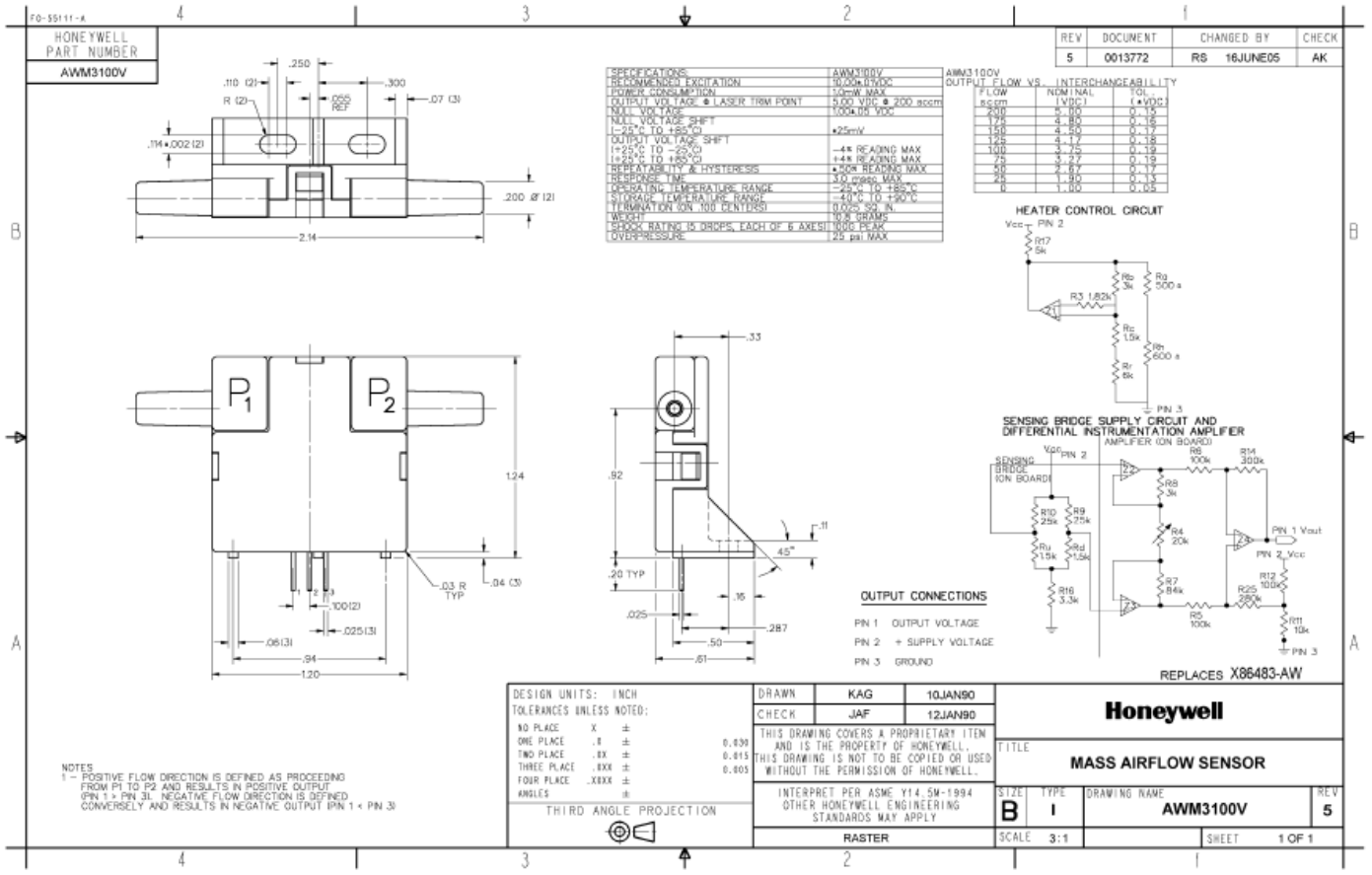
HONEYWELL GAS FLOW SENSOR

Digi-Key Part Number	480-2692-5-ND
Quantity Available	0 Enter Quantity Requested
Manufacturer	Honeywell Sensing and Control
Manufacturer Part Number	AWM3100V
Description	SENSOR AIRFLOW AMP 200 SCCM
Lead Free Status / RoHS Status	Lead free / RoHS compliant

Price Break	Unit Price	Extended Price
1	80.77000	80.77
25	64.61840	1,615.46
100	61.15670	6,115.67
500	57.69500	28,847.50

All prices are in US dollars.

HONEYWELL GAS FLOW SENSOR



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Microelectronic Engineering

POSIFA MICROSYSTEMS INC

Posifa Microsystems, Inc., a leader in Advanced MEMS Sensor Development, today unveiled its new line of Low-flow Mass Air Flow Sensors. The PMF2000 family, which incorporates the latest MEMS and microelectronics innovations, eliminates the field failures associated with pressure shock, humidity and contamination that have for years plagued other manufacturers. By replacing the common "membrane-cavity" structure with a proprietary "solid-state" thermal isolation structure on the sensor die, Posifa's sensors bring new levels of reliability to their customer's applications. Additionally, the sensor die incorporates a pair of thermopiles surrounding a central heating element to detect changes in temperature gradient caused by mass flow, delivering ultra-high signal-to-noise, and unsurpassed repeatability.

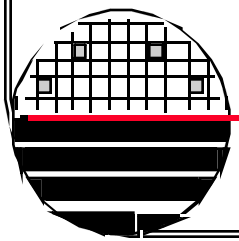
By using a high-caliber internal microcontroller, the PMF2000 family delivers 2% full scale (max.) accuracy, linear output for each of their respective ranges of 10, 30, 200, 1,000 and 2,000 sccm (standard cubic centimeter per minute). This expanded set of ranges gives customers an ability to choose a range best suited to their application for improved overall performance.

The sensors are fully calibrated and compensated over the temperature range of 0°C to +50 °C. Offering a 4 volt linear output range (1 to 5 Vdc), the sensors provide better than 2% F.S. accuracy over the entire output range. The new line of Sensors also offer extremely high repeatability of less than 0.5% F.S. per year null drift, making field replacements a calibration-less task.

Posifa Microsystems Inc.
http://www.posifamicrosystems.com/

REFERENCES

1. Digikey.com
2. Honeywell Sensing



HOMEWORK – RIT GAS FLOW SENSOR

1. Write a 150 word abstract for Jessica Marks gas flow sensor and results.
2. Make up some reasonable data for the table on page 9 that illustrates the operation of the gas flow sensor.