DINSMORE SENSING SYSTEMS
GENERAL INFORMATION

The **DIGITAL SENSOR No. 1490** magnetically indicates the four Cardinal (N. E, S. W) directions, and, by overlapping the four Cardinal directions, shows the four intermediate (NE, NW, SE, SW) directions.

No. 1490 Sensor (Protected by patents and patents applied for) is a combination of a subminiature rotor jewel suspended in combination with solid state Hall-effect IC's.

The Sensor was designed to indicate the direction of the horizontal flux pattern (Compass component) of the earth's field thus becoming a compass.

The Sensor is damped to give the same speed indication as a liquid filled compass, that is, 0.5 second response from 90° displacement without overswing. It has built-in hysterisis to prevent indication "flutter" when near a switching direction.

Sensor No. 1490 will accept input power between 6.0 and 18.0 volts, but should be polarity and “spike" protected from a vehicular power supply. The output is an "open collector NPN which will sink up to 25 mils per direction.

ANALOG SENSOR No. 1525 outputs a sine-cosine curve pair which may be interpreted by microprocessor, graphs, or other simple system into directional information.

No. 1525 Sensor (Protected by patents applied for) requires a regulated 5 volt input and gives a ratiometric output. The rail to rail voltage swing is close to 0.75 volts for both curves.

ANALOG SENSOR No. R1655 is the same as No. 1525 except that it outputs a voltage swing of close to 1.3 volts rail to rail for both curves.

All three sensors are low cost and reliable. Each serves a slightly different purpose. All three sensors are based on Hall-effect technology and can be mounted remotely. Also, all three sensors outputs can be used in stand-alone applications.

Dinsmore Instrument Company was the world's first maker of Auto compasses and has had seventy-two years of experience, and many patents, for the correction of vehicle caused anomalies in compass readings. Dinsmore has designed and manufactured compasses for special uses as well as aircraft, mariners and vehicular compasses, and can aid designers in the use of the above sensors.

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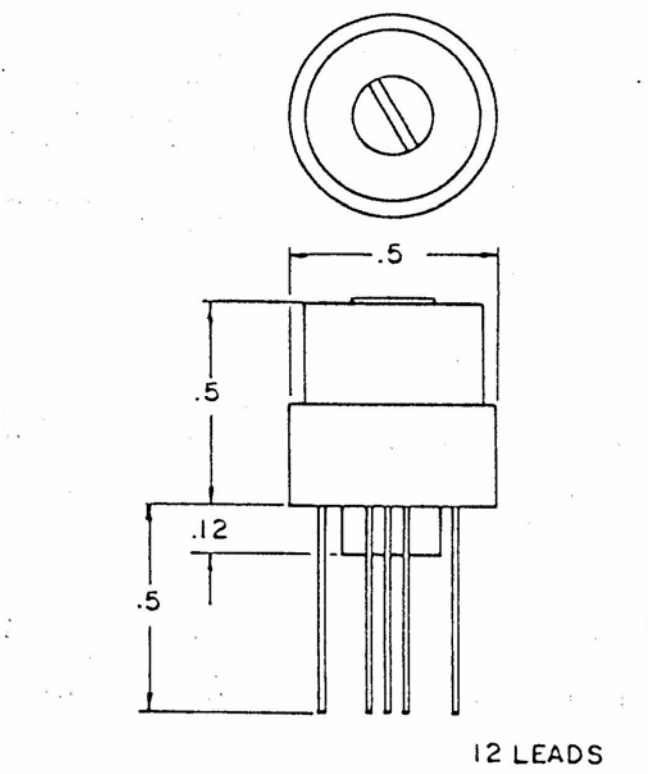
Revised: 14 October 2003

No. **1490 DIGITAL SENSOR**



No. **1490 Sensor** may be operated from input voltage of 5 to 20 volts DC with 8 to 13 recommended. Input should be both “spike” and polarity protected. Power requirement is 1 approximately 30 mils (0.030 amps).

Output will sink up to 25 mils (0.025 amps) per output channel. The sensor will switch so that no more than two adjacent output channels are gong at any one time.

Output is **open collector NPN** sinking the output to ground, thus does not add to the input requirement.

No. 1490 Sensor is internally designed to respond to directional change similar to a liquid filled compass. It will return to the indicated direction from a 90° displacement in approximately 0.5 to 1.0 seconds with no overswing.

Sensor No. 1490 should be operated in a vertical position. The sensor Indicates the horizontal component or compass component of the earth’s field. If off vertical, some of the vertical component of the earth’s field is introduced which may create some directional error. Generally, tilt up to 12° is acceptable with little error.

The sensor is manufactured for pins down operation but may be furnished for pins up operation on request at no extra cost. The sensor operates equally well pins up or down.

No. 1490 sensor weighs approximately 2.25 grams. The dimensions are shown on the drawing upper left Operating temperature is -20° C to +85° C. The sensor may be stored without damage in wider temperature limits and may be subjected to high flux levels (up to 1000 gauss) without permanent damage.

No. 1490 sensor and sensing systems are covered by issued patents and patents pending.

The pins are on 0.050 centers but may be distorted for 0.100 spacing without damage to the sensor or its measurements. The four V_{cc} and four grounds may be common connected.

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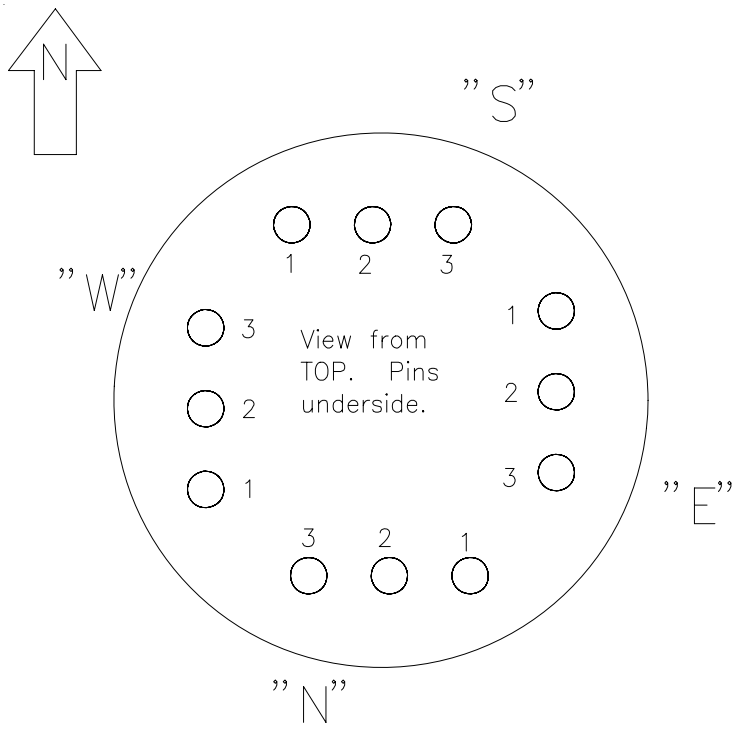
No. **1490 DIGITAL SENSOR**

PIN-OUT FOR DIGITAL COMPASS SENSOR (No. 1490)



1= V_{cc}
2= Ground
3 = Signal

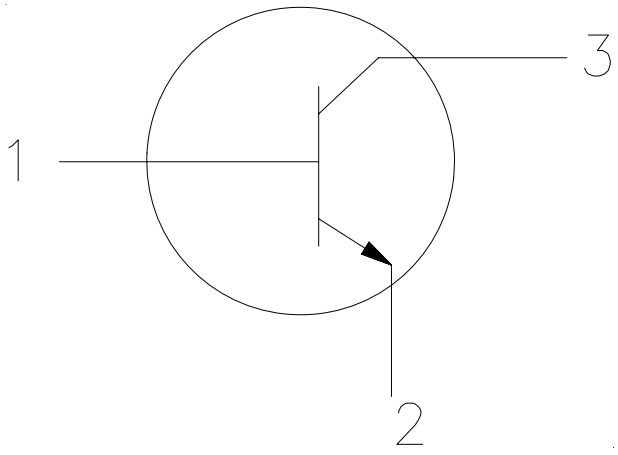
Vcc = 5 to 20 Volts; 8 to 13 recommended

Output is Open Collector

Output will sink 25 mils @ 12 Volts

Temperature Range: -20° C to +85° C.

Reverse polarity will damage IC.



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ANALOG HALL-EFFECT SENSOR; PART NO. R1525

No. R1525, ANALOG SENSOR: The sensor requires closely regulated 5.00 volts DC input and furnishes a ratiometric DC output. The input should be “spike" and polarity protected if operated from a vehicle power supply. Power consumed is approximately 18 to 19 mils (0.018 to 0.019 amps) when using 5.00 volt supply.

The output closely resembles a sine-cosine set of curves which cross at approximately 2.5 volts and peak at approximately 2.9 volts and floor at about 2.1 volts. Each output will drive up to 4 mA.

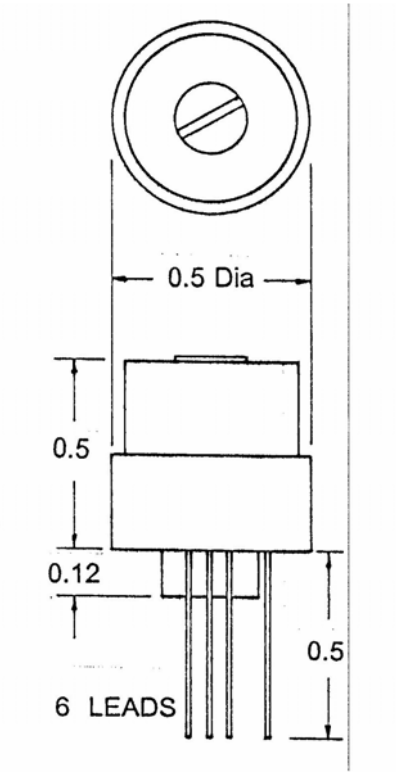
The sensor is constructed to operate in a vertical position with the leads down. The sensor is designed to measure the direction of the horizontal component of the earth's flux field (Compass l component). If it is tilted off of vertical, it begins to sense some of the vertical component of the earth's field introducing some error. For practical purposes, up to about 12° tilt is considered acceptable.

The sensor is damped slightly so that the indications are similar to those from a standard liquid filled compass. That is, if displaced 90°, it will return to proper indication in about 0.5 to 1.0 seconds with no overswing. Sensors can be furnished with zero damping if so ordered. Undamped sensors can "flutter" caused by stray magnetic anomalies in the vicinity of the sensor or by vibration of the sensor.

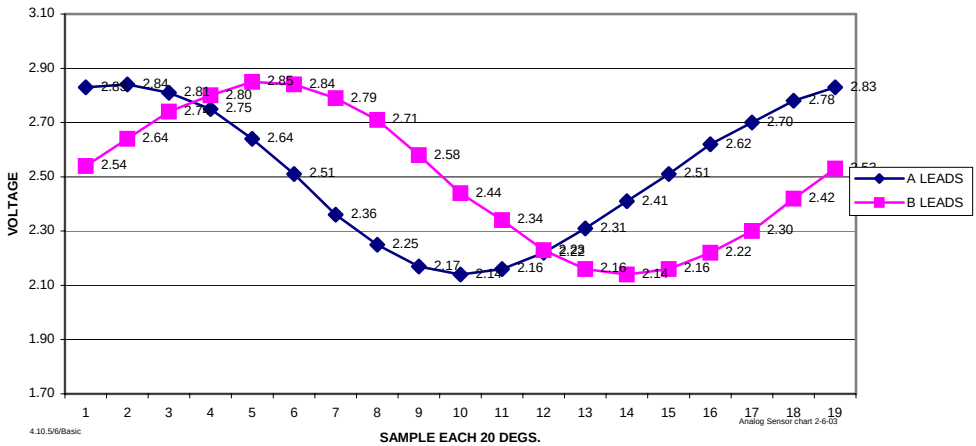
The sensor is not affected by exposure to large flux fields; outside flux (to 1,000 Gauss) is unlimited.

The operating temperature is -40° C to +85°.

No. 1525 sensor weighs approximately 2.25 grams. It is 0.5 inches (12.7 mm) diameter and its height (exclusive of leads) is 0.63 inches (16mm).



SENSOR 1525



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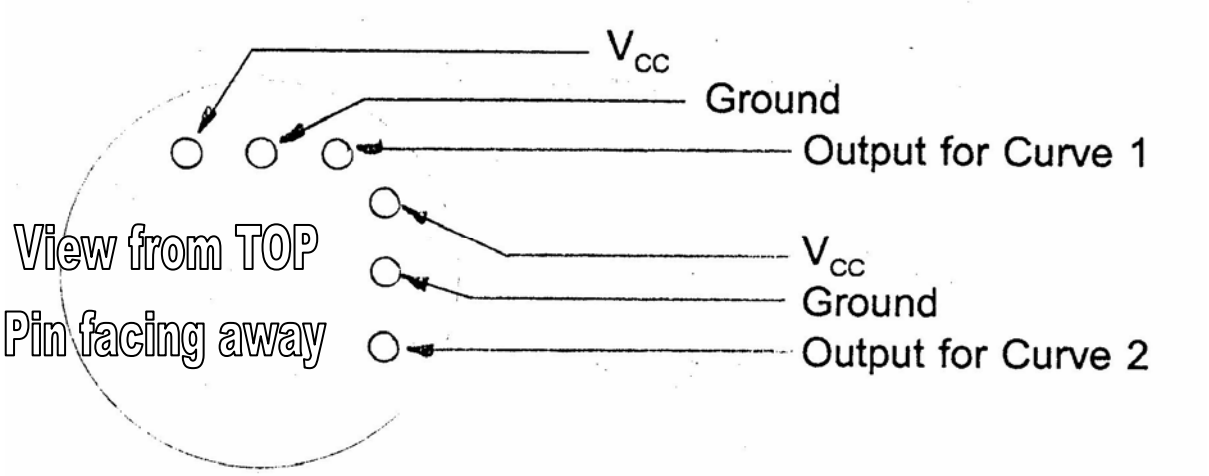
ANALOG SENSOR, Part No. 1525

PIN OUT AND GENERAL DATA

View of pin out looking down through sensor. Pins are **underside.** Sensor is vertical



V_{cc} should be controlled 5.00 volts. Output is ratiometric and depends on controlled input voltage. Input to sensor should be “spike” protected.

Current requirement: between 18 and 19 mils (0.018 to 0.019 amps) at 5.00 volts.

Reversing V_{cc} and Ground may destroy sensor.

Output of signals runs approximately 0.34 to 0.40 volts above and below the "middle" voltage which is between 2.4 to 2.6 volts. This may vary between sensors but should be uniform for both curves on any single sensor.

Maximum current draw on output should not exceed 0.004 amps (4 mils).

Operating temperature is: - 40° C to + 85° C.

Sensor weighs approximately 2.25 grams.

Sensors are fabricated to operate pins down or pins up.

Sensors are damped to show a return from a 90° displacement in approximately 0.5 -1.0 seconds.

Sensors can be supplied without damping on request at no additional cost.

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ANALOG HALL-EFFECT SENSOR; PART NO. R1655

No. R1655, ANALOG SENSOR: The sensor requires closely regulated 5.00 volts DC input and furnishes a ratiometric DC output. The input should be "spike" and polarity protected if operated from a vehicle power supply. Power consumed is approximately 18 to 19 mils (0.018 to 0.019 amps) when using 5.00 volt supply.

The output closely resembles a sine-cosine set of curves which cross at approximately 2.5 volts and peak at approximately 3.1 volts and floor at about 1.9 volts. Each output will drive up to 4 mA.

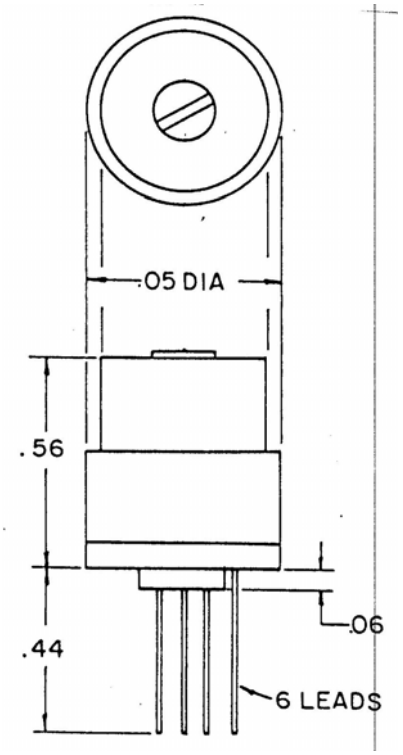
The sensor is constructed to operate in a vertical position with the leads down. The sensor is designed to measure the direction of the horizontal component of the earth's flux field (Compass component). if it is tilted off of vertical, it begins to sense some of the vertical component of the earth's field introducing some error. For practical purposes, up to about 12° tilt is considered acceptable.

The sensor is damped slightly so that the indications are similar to those from a standard liquid filled compass. That is, if displaced 90°, it will return to proper indication in about 0.5 – 1.0 seconds with no overswing. Sensors can be furnished with zero damping if so ordered. Undamped sensors can flutter" caused by stray magnetic anomalies in the vicinity of the sensor or by vibration of the sensor.

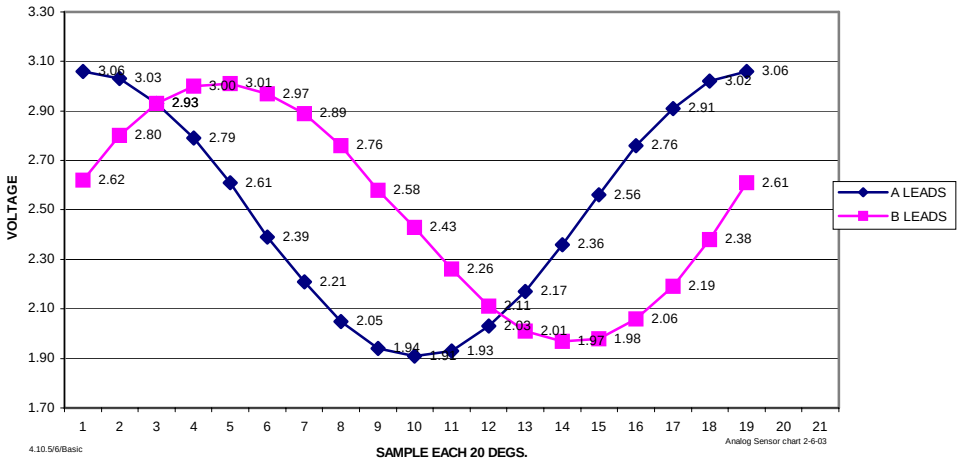
The sensor is not affected by exposure to large flux fields; outside flux (to 1,000 Gauss) is unlimited.

The operating temperature is -40° C to +85° .

No. 1655 sensor weighs approximately 2.25 grams. It is 0.5 inches (12.7 mm) diameter and its height (exclusive of leads) is 0.63 inches (16mm).



SENSOR R1655



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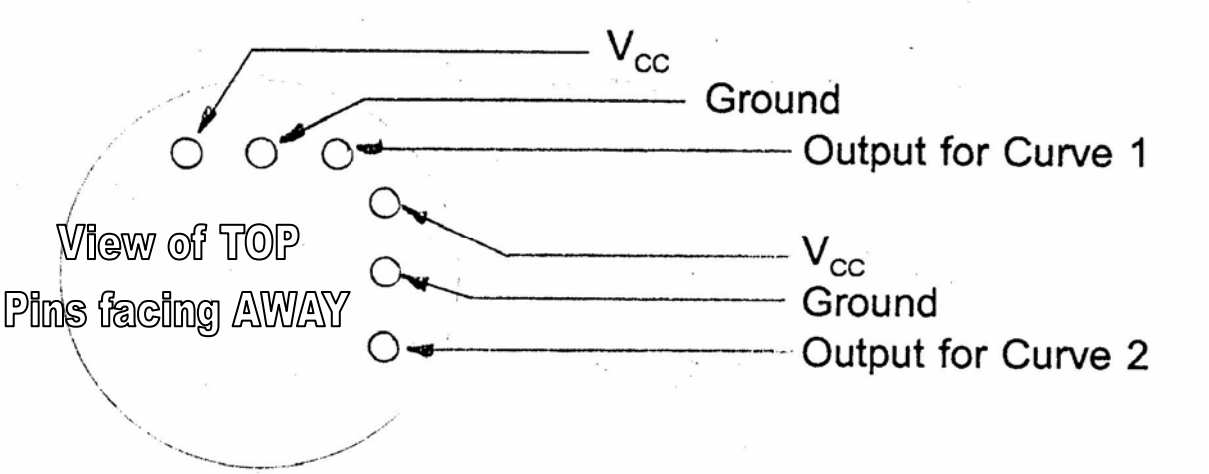
ANALOG SENSOR, Part No. R1655

PIN OUT AND GENERAL DATA

View of pin out looking down through sensor. Pins are **underside.** Sensor is vertical



V_{cc} should be controlled 5.00 volts. Output is ratiometric and depends on controlled input voltage. Input to sensor should be “spike” protected.

Current requirement: between 18 and 19 mils (0.018 to 0.019 amps) at 5.00 volts.

Reversing V_{cc} and Ground may destroy sensor.

Output of signals runs approximately 0.6 volts above and below the "middle" voltage which is between 2.4 to 2.6 volts. This may vary between sensors but should be uniform for both curves on any single sensor.

Maximum current draw on output should not exceed 0.004 amps (4 mils).

Operating temperature is: - 40° C to + 85° C.

Sensor weighs approximately 2.25 grams.

Sensors are fabricated to operate pins down or pins up.

Sensors are damped to show a return from a 90° displacement in approximately 0.5 – 1.0 seconds.

Sensors can be supplied special damping on request at no additional cost.

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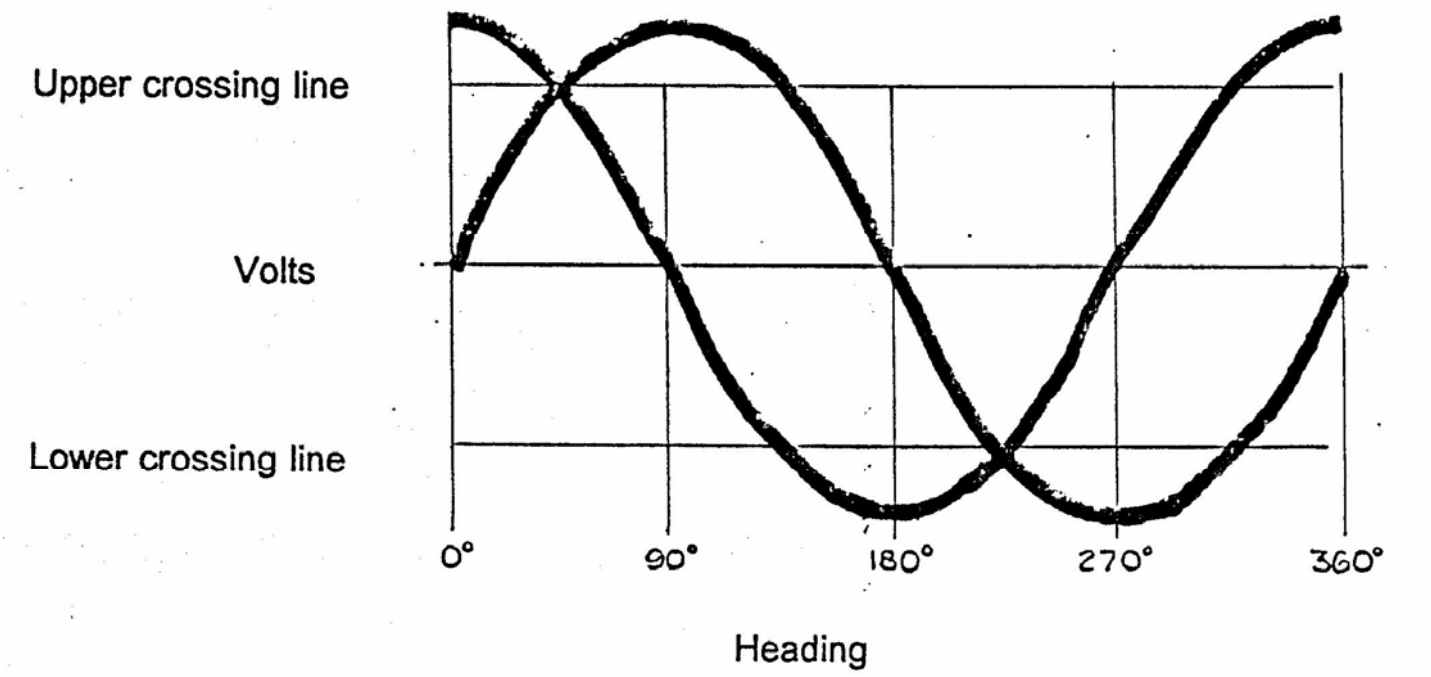
SUGGESTED SYSTEM FOR USING AN 8-BIT A-D CONVERTER FOR 1° ACCURACY

A sin-curve set is plotted on the chart below. If you compare the portions of the curves above and below their crossing voltages, note that above the upper crossing line, the curves are relatively small increments of voltage per degree while below the upper crossing finer the curves are relatively straight and steep. The "crossing line" is drawn at the point where the sin and cos is equal.

Use only the straight and steep portions of either curve for 255 counts on an 8-bit A-D converter, and use the highly curved portions as a sector designator only.



When the sin curve is above the upper crossing lines the cos Curve measures from 45° to 135° with a relatively straight line. At 135°, the cos curve (below the lower crossing line) now serves as the designator and to 225°, the sin curve is relatively straight. At 225°, the sin curve is below the lower crossing line and serves as designator so that you can measure a relatively straight portion of the cos curve to 315°. At 315°, the cos curve (above the crossing line) becomes the designator at the upper crossing lines and you have the relatively straight sin curve as the measuring voltage between 315° and 45°.

This system was devised at

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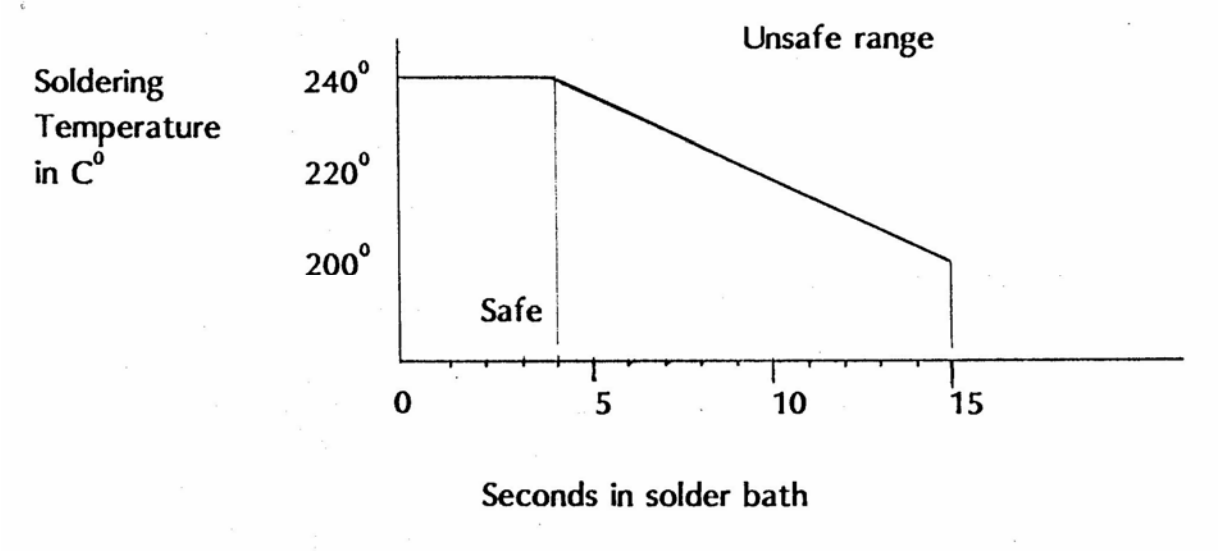
SOLDERING TEMPERATURE CAUTION

The junction temperature of the ICs in the sensors must be kept within the limits of the chart below. If the recommended temperatures are exceeded in the soldering operation, the ICs may exhibit erratic and unusual outputs. The changes are not reversible. The accuracy of the sensor is permanently destroyed.

Since the junction temperatures are essentially the same as the lead (pin) temperatures, it is strongly recommended that a heat sink be used between the base of the sensor and the point of soldering the leads or pins.



Hand soldering requires particular care for most hand soldering equipment is not accurately temperature controlled.

THE SINE DIVIDED BY THE COSINE IS EQUAL TO THE TANGENT. TO USE THIS FORMULA FOR DIRECTION REQUIRES THAT THE SINE AND COSINE BE ABSOLUTE VOLTAGES, THAT IS, BASED ON THE CROSSING VOLTAGE BEING "ZERO". THE SINE AND COSINE ARE EITHER POSITIVE OR NEGATIVE VALUES DEPENDING ON THE PORTION OF THE CURVE BEING MEASURED. THIS SUGGESTED SYSTEM USES A-D CONVERTERS SEPARATED ALTHOUGH SOME OF THE NEWER MICROPROCESSORS HAVE A-D FRONT ENDS.

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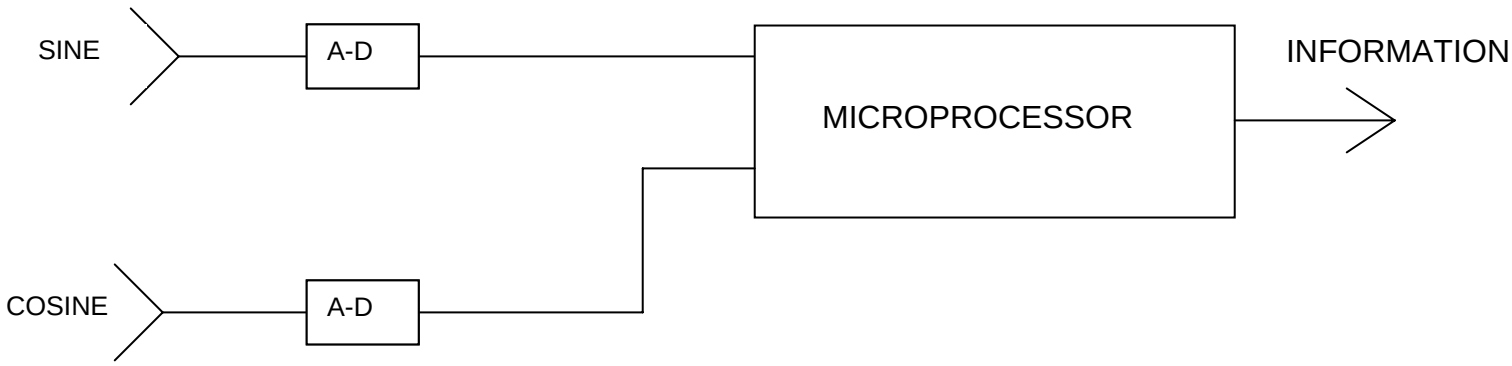
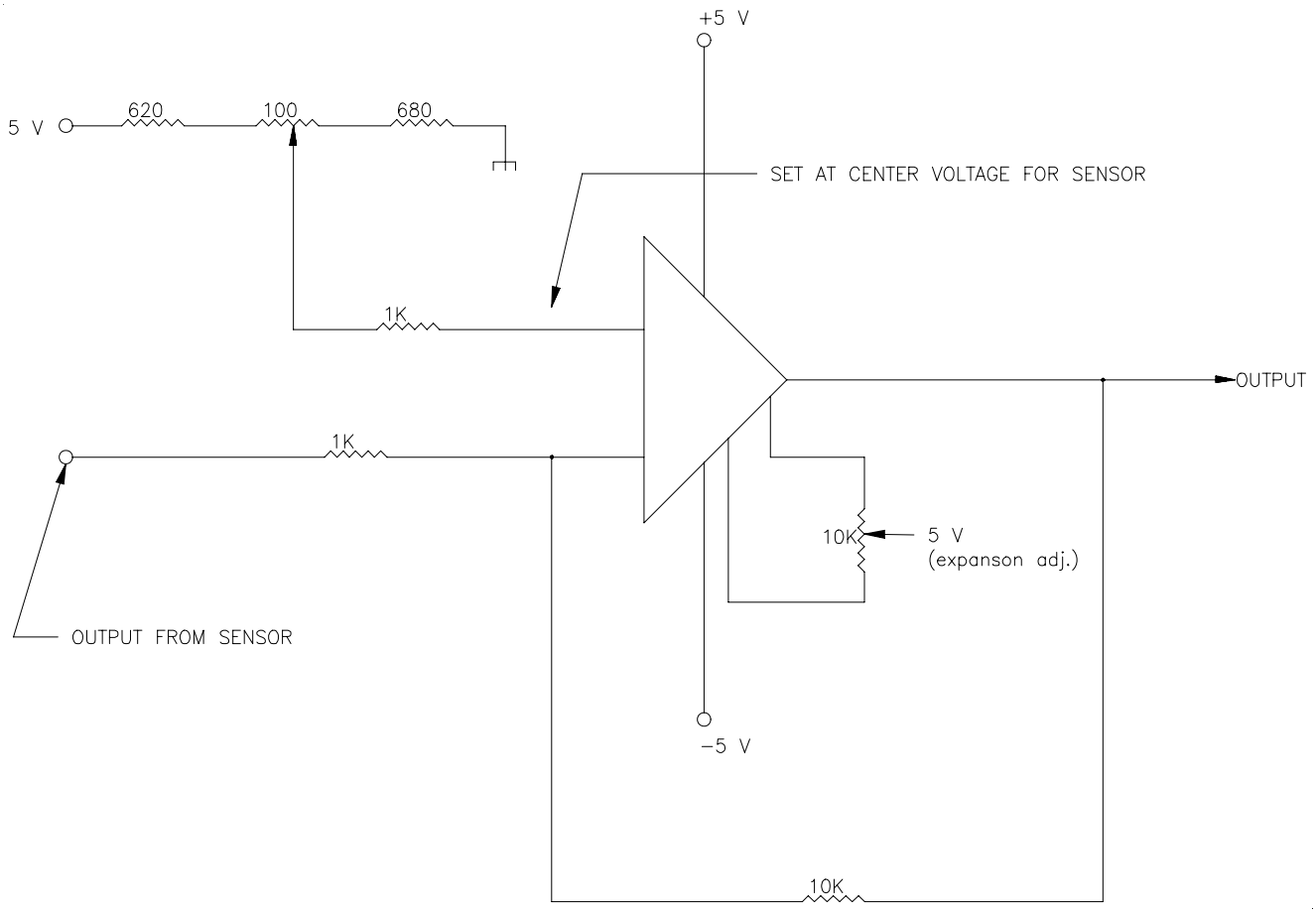
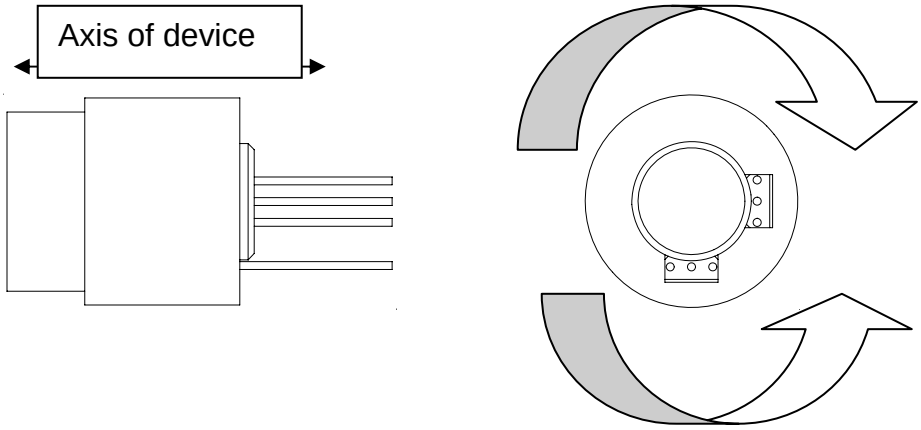


SUGGESTED CIRCUIT USING A COMPARATOR TO EXPAND THE SENSOR OUTPUT AND TO SUBTRACT THE CROSSING VOLTAGE SO THE OUTPUT IS ABSOLUTE VOLTAGE.



GENERAL INFORMATION FOR PENDULOUS SENSORS
Part No. P1655 Analog Pendulous Senor

For this type of Sensor(Part No.P1655), the rotor is controlled by gravity, not magnetism. Unlike our standard R1655 Analog Sensors, in this device, the rotor assembly has been specially modified to work in the horizontal plane. The device does work and is tested in the vertical plane, however it is specifically manufactured for horizontal use. The device can be used to measure azimuth or horizontal rotation by using the dual sine wave voltage data output from the device.



The leads can be bent to accomdidate the horizontal operation. Please note that the leads should not make contact with each other or failure of the device will occur, as with our standard devices.

Please note, rotation measurement can be made per the diagrams above in one axis plane. (To measure both pitch AND roll, two devices would be required)

Please refer to information specifications on the P/N R1655 Analog Sensor.