

Low Cost 2½ Digit DPM For Analog Meter Replacement

FEATURES

Small Size: 1.8"H x 3"W x 1.5"D

High Reliability

0.5% ±1 Digit Maximum Error

Bright, Sharp Display **Fast Conversion Time Optional BCD Data Outputs**

APPLICATIONS

Analog Meter Replacement

Display in Physical and Engineering Units

Analytical, Medical, and Scientific Instrumentation



Analog Devices' AD2002 is a 21/2 digit Digital Panel offering high performance at a low price. It is a 5V powered DPM designed as a minimum-cost replacement analog meters used in OEM equipment requiring accuracy to 0.5%. Economy and reliability of the AD2002 are achieved through the use of a "staircase" conversion technique and the resulting lower component count.

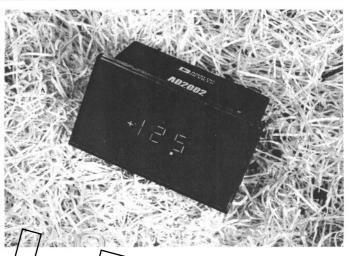
Other features of the AD2002 include: 0.5% ±1 digit maximum error; data processing system interface capability (optional); 7 segment filament test; and a ruggedly designed 1.8"H x 3"W x 1.5"D aluminum case. The unit provides highly accurate and stable readings of unipolar, single-ended input signals over a full scale range of 0 to +1.99V with automatic overload indication. Readings can be held indefinitely upon command. The temperature coefficient is 1/20 digit/°C. Prior to shipment, all AD2002 units are burned in for a seven day period to assure high reliability.

Typical applications for the AD2002 include: scientific, industrial, and medical instrument designs; measurement, control, and data acquisition systems.

BRIGHT, SHARP DISPLAY

The AD2002 utilizes green filtered RCA Numitron tubes. The green filter provides optimum matching with the optical response of the human eye. The result is a bright, sharp and highly readable display over a wide range of ambient light without operator fatigue. This precise digital display offers the added advantage over analog meters of totally unambiguous readings.

Standard features of the display are: programmable decimal points; 7 segment filament test; automatic zero; 4 readings/sec



trigger and hold feature for up to readings/sec

ALL BUT R AD2002 is the smallest 21/2 digit DPM availa pact size allows it to be easily substituted for conventional analog meters, in many cases requiring even less space than the analog meter. It is housed in an aluminum case providing light weight, structural strength, optimum heat dissipation, and shielding against external noise. The case, which easily snaps into the panel from the front, offers a clean modern look. The ease of installation is illustrated in Figure 7. Its light weight is ideal for installation in hinged panel equipment.

EASY TO USE IN NEW DESIGNS

The AD2002 was designed with this equipment of the 70's in mind. Its logic levels are compatible with DTL and TTL integrated circuits. The AD2002 can operate from the same 5V dc that supplies other integrated circuits in the user's system eliminating the shielding, decoupling, etc., normally needed when the ac line must be routed near signal leads. Separate dc inputs to the converter and the display allow the OEM designer to minimize effects of display transients on conversion accuracy and blank the display independently of the converter.

MODES OF OPERATION

To use the panel meter for visual readout as a conventional measuring component, only 5 connections, as shown in Figure 5, are required. For use in data processing equipment, connections for BCD outputs, "status" signal, overrange, overload signals, and external read and hold features are available as a low cost option. Interconnection layout is shown in Figure 4.

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STANDARD

DISPLAY OUTPUT

- Display consists of three RCA Numitrons (7 segment incandescent readout tubes) for data digits plus 100% overrange.
- Overload two data digits display dashes when reading exceeds the input range.
- Decimal Points selectable at input (rear of the case -Figure 5). The AD2002 is supplied with both decimal points connected. The undesired decimal point may be eliminated by drilling out the appropriate plated through hole on the P.C. Board.

INPUT

- Unipolar, single ended
- . Input Range - 0 to +1.99 Volts
- Bias Current 250nA max. 70nA typ.
- Impedance 100 Megohms (10k ohms in overload)
- Overvoltage Protection ±50 Volts sustained without damage

ACCURACY

- Maximum Error 0.5% of reading ±1 digit
- 10 millivolts Resolution
- 0 to +60°C operating Temperature Range

Temperature cient 1/20 digit/°C PFF ER1 dc ±59 egulated Unregulated ± 109 500mA

WARM UP TIME - Ess ntially none requir ed acc ADJUSTMENTS - Range potentionieter for fu ment. Recalibration recommended after 6 mc

(display

· An external manual switch or power transistor switched to ground will turn on all segments, polarity sign, and decimal points. The switch or transistor must sink 160mA of current.

OPTIONAL - The DP option includes the following:

DATA PROCESSING SIGNALS In • DTL/TTL Compatible Logic "0" <0.8V <0.4V Logic "1" >2.0V >2.4V

Inputs

External Trigger - Operation in the External Trigger mode requires that the External Hold input be grounded. A >10 µs external trigger pulse (Logic "1" to Logic "0") is required to start each conversion.

External Hold - When this input is grounded or held at 0.8V max, the last conversion is held and displayed. For a new conversion under internal control, this input must be open or at 5V.

Decimal Points - Grounding the appropriate pin or applying Logic "0" illuminates either decimal point. The switch or power transistor used must sink 24mA.

Outputs

2BCD Digits (8421 Positive True) - unlatched - 9TTL loads Overrange - Logic "1" indicates an overrange - unlatched - 7TTL loads

Overload - Logic "1" indicates the input has exceeded the input range - unlatched - 8TTL loads Status Signal - Logic "0" indicates converison is complete -8TTL loads

SPEED

- External Trigger up to 200 conversions/second
- · Hold & Read on command

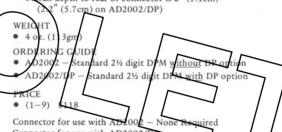
POLARITY INDICATION

"+" or "-" polarity indication is programmable externally. A switch or power transistor to ground must sink 24mA for "-" or 48mA for "+".

SIZE

• 3"W x 1.8"H x 1.5"D (7.6 x 4.6 x 3.8cm)

erall depth to rear of connector is 2" (5.1cm)



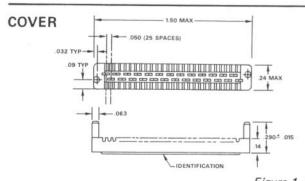
Connector for use with AD2002/DI

3M mating connector part No. Price \$4.50 each.

AC5003 6 feet of decade color coded wire mated with the above 3M connector part No. 3399-1000 Price \$12.00 each.

Specifications subject to change without notice.

1 To assure the specified life span of the RCA Numitron displays (100,000 hours) when using an unregulated power supply, it is essential that no more than 5.25V dc max be supplied to the displays. Normal voltage range is 4.5 to 5.0V dc



W "U" CONTACTS 26 PLS --- .050 TYP

Figure 1. AD2002/DP Connector Options

TYPICAL PROPERTIES OF AC5002

Self Stripping

Simultaneous Terminations Positive Pressure Type Connections

PHYSICAL

No. Contacts: 26

Body Material: Glass Filled Nylon Contact Metal: Beryllium Copper

Contact Plating: Gold Over Nickel

Contact Spacing: Fits Wire on 0.050" Centers

BODY

Color: Grav ELECTRICAL

> Temperature Rating: +105°C Contact Rating: 1 Amp

Withstand Voltage: 500V dc (Sea Level)

WIRE RECOMMENDATIONS

#28 AWG Solid

#28 AWG Stranded (7 Strand)

#30 AWG Solid

Maximum O.D. of Ins. Wire: 0.038" Insulation: (Most Acceptable) - PVC,

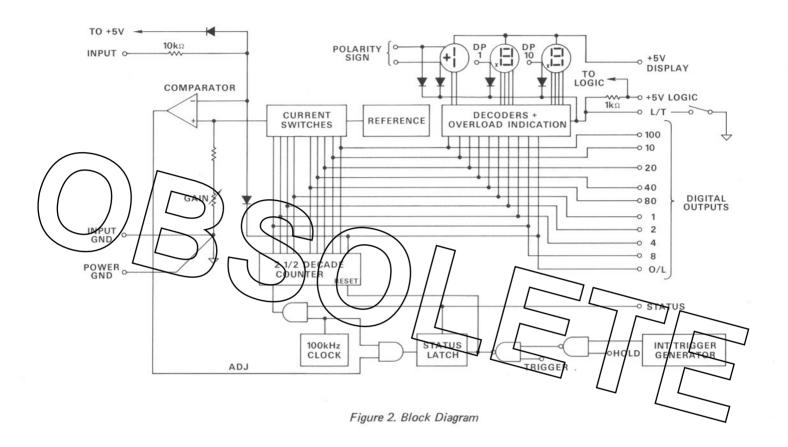
Non-Irradiated

AC5003: consists of AC5002 attached to 6 ft. (1.83m) of decade color coded, 26 way #28 AWG, 7 strand, flat woven cable.

THEORY OF OPERATION

The timing and block diagrams for the AD2002 are shown in Figures 2 and 3. The leading edge of the trigger pulse resets the AD2002 to the zero state. The trailing edge starts the $2\frac{1}{2}$ digit

decade counter which increases until it is equal to the analog input. At this time, the comparator's output changes state, inhibiting the counter and holding and displaying the final digital result.



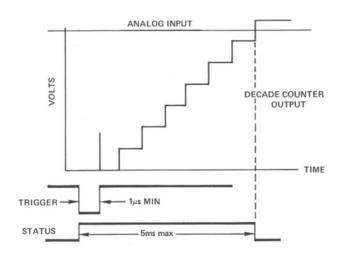


Figure 3. Timing Diagram

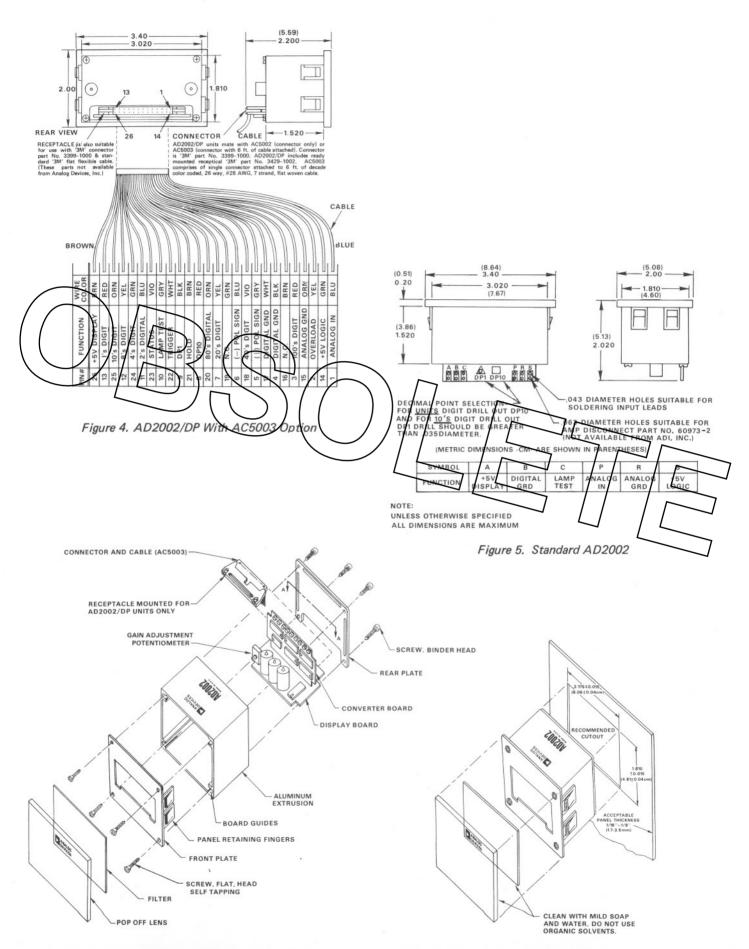


Figure 6. Easy to Maintain

Figure 7. Installation (3 Parts) Into Panel