



**Intronics  
Power®**

# Low Cost 3½ Digit Logic Powered DPM With LED Displays

## AD2021

### FEATURES

- “Second Generation” MOS-LSI Design
- Large 0.5” (13mm) LED Displays
- +5VDC Logic Powered
- ±1.999V or ±199.9mV Full Scale Ranges
- Limited Differential Input
- Low Power Consumption: 1.45 Watts
- Small Size

### APPLICATIONS

- General Purpose Logic Powered DPM Applications
- Portable Applications Requiring Low Power Consumption



### GENERAL DESCRIPTION

The AD2021 is a low cost, 3½ digit, +5VDC logic powered digital panel meter with large LED displays. While designed for general purpose DPM applications, the small size, light weight and low power consumption of the AD2021 make it an ideal digital readout for modern, compact instrument designs.

### THE BENEFITS OF “SECOND GENERATION” DESIGN

The AD2021 is designed around MOS-LSI (Metal-oxide semiconductor, large scale integration) integrated circuits, which greatly reduce the number of components, and thereby the size, and reduce power consumption to 1.45 watts. Both the lower power consumption and fewer interconnections between components promise greatly increased reliability, and the circuit design maintains the performance and features of earlier DPMs. Large 0.5 inch (13mm) LED displays offer the visual appeal of gas discharge displays with the ruggedness and lifetime of all solid state devices.

### EXCELLENT PERFORMANCE AND EASY APPLICATION

The AD2021 measures input voltage over a full scale range of ±1.999VDC or ±199.9mVDC (“S” option) with an accuracy of ±0.05% reading ±0.025% full scale ±1 digit. Using the “limited differential” input first used on Analog Devices’ AD2010, the AD2021 prevents ground loop problems and provides 35 to 50dB of common mode rejection at common mode voltages up to ±200mV. Normal mode rejection is 40dB at 50 to 60Hz.

BCD data outputs are provided in a bit parallel, character serial format compatible to CMOS logic systems. For those applications requiring parallel BCD data, schemes for making the serial to parallel conversion are available. Controls to hold readings, select decimal points and blank the display are provided.

### INDUSTRY STANDARD PACKAGING

The AD2021 is packaged in Analog Devices’ logic powered DPM case size, only 1.25 inches (32mm) deep. The small size of this DPM makes it easy to accommodate in any instrument design, and since several other manufacturers now use the same panel cutout for logic powered DPMs, this industry standardization allows mechanical second sourcing. In addition, the AD2021 uses the same pin connections as the AD2010 (except in BCD outputs, of course) as a convenience to allow updating designs to take advantage of the second generation design and larger display of the AD2021.

### DESIGNED AND BUILT FOR RELIABILITY

Even beyond the reliability advantages of the LSI-IC design and LED displays, the AD2021 has had extreme care taken in its design and manufacture to insure reliability. Manufacturing processes are monitored by continuous quality assurance inspections to insure proper workmanship and testing. Automatic test equipment is used to test each DPM thoroughly and without error. And each AD2021 receives a full one week failure free burn-in before shipment.

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# SPECIFICATIONS

(typical at +25°C and nominal power supply voltage)

## DISPLAY OUTPUT

- Light emitting diode, planar seven segment display read-outs, 0.5" (13mm) high for three data digits, 100% over-range and negative polarity indication. Overload indicated by flashing display, polarity remains valid.
- Decimal points selectable at input connector.
- Display blanking on three data digits (does not affect overrange digit, polarity sign of decimal points).

## ANALOG INPUT

- Configuration: bipolar, limited differential
- Full Scale Range:  $\pm 1.999\text{V}$  or  $\pm 199.9\text{mV}$  ("S" option)
- Automatic Polarity
- Auto Zero
- Input Impedance: 100M $\Omega$
- Bias Current: 50pA
- Overvoltage Protection:  $\pm 50\text{VDC}$ , sustained

## ACCURACY

- $\pm 0.05\%$  reading  $\pm 0.025\%$  full scale  $\pm 1$  digit<sup>1</sup>
- Resolution: 1mV or 100 $\mu\text{V}$  ("S" option)
- Temperature Range<sup>2</sup>: 0 to +50°C operating; -25°C to +85°C storage
- Temperature Coefficient: Gain: 50ppm/°C  
Zero: auto zero
- Warm-Up Time to Rated Accuracy: less than one minute
- Settling Time to Rated Accuracy: 0.4 second

## NORMAL MODE REJECTION

- 40dB at 50–60Hz

## COMMON MODE REJECTION

- AD2021: 35dB (DC -10kHz)
- AD2021/S: 50dB (DC -10kHz)

## COMMON MODE VOLTAGE

- $\pm 200\text{mV}$

## CONVERSION RATE

- 5 conversions per second
- Hold and read on command

## CONTROL INPUTS

- **Display Blanking:** (TTL, DTL compatible, 2 TTL loads). Logic "0" or grounding blanks the three data digits only, not the decimal points, overrange digit (if on) and polarity sign. Logic "1" or open circuit for normal operation. Display blanking has no effect on output data and the display reading is valid immediately upon removal of a blanking signal.
- **Hold:** (CMOS, DTL, TTL compatible, 1LP TTL load). Logic "0" or grounding causes the DPM to cease conversions and display the data from the last conversion. Logic "1" or open circuit for normal operation. After the "Hold" input is removed, one to two conversions are needed before the reading is valid.
- **Decimal Points:** Grounding or Logic "0" will illuminate the desired decimal point. External drive circuitry must sink 25mA peak at a 25% duty cycle when the decimal points are illuminated.

## DATA OUTPUTS (See Application Section for details on data outputs)

- BCD Data Outputs: (CMOS, LP TTL or LP Schottky compatible), bit parallel, character serial format.
- Digit Strobe Outputs: (CMOS, DTL, TTL compatible, one TTL load). Logic "1" on any of these lines indicates the output data is valid for that digit.
- Polarity Output: (CMOS, TTL, DTL compatible, one TTL load). Logic "1" indicates positive polarity input, logic "0" indicates negative polarity.
- Status: (CMOS or LP TTL compatible). When this signal is at Logic "1", the output data is valid.
- Clock: (CMOS, DTL, TTL compatible, one TTL load). The clock signal is brought out to facilitate conversion from character serial to parallel data.

## REFERENCE OUTPUT

- A 6.4V  $\pm 5\%$  analog reference output is made available. This reference should be buffered and filtered if use in external circuitry is desired.

## POWER INPUT

- +5VDC  $\pm 5\%$ , 1.45 watts

## CALIBRATION ADJUSTMENTS (See Application Section for calibration instructions)

- Gain
- Zero
- Recommended recalibration interval: six months

## SIZE

- 3"W x 1.8"H x 1.25"D (76 x 46 x 32mm)
- 1.90" (48mm) overall depth to rear of card edge connector.
- Panel cutout required: 3.175" x 1.810" (80.65 x 45.97mm)

## WEIGHT

- 4 ounces, (115 grams)

## OPTIONS – ORDERING GUIDE

- Input Voltage Range: AD2021 – 1.999VDC Full Scale  
AD2021/S – 199.9mVDC Full Scale  
(Consult the factory or representative for other input ranges)
- Display Lens Option<sup>3</sup>: Lens 5 – Red with ADI logo  
Lens 6 – Red without ADI logo

## CONNECTOR

- 30 pin, 0.156" spacing card edge connector. Viking 2VK15D/1-2 or equivalent.
- Optional: Order AC1501

<sup>1</sup> Guaranteed at 25°C and nominal supply voltage

<sup>2</sup> Guaranteed

<sup>3</sup> If no lens is specified, Lens 5 will be supplied.

Specifications subject to change without notice.



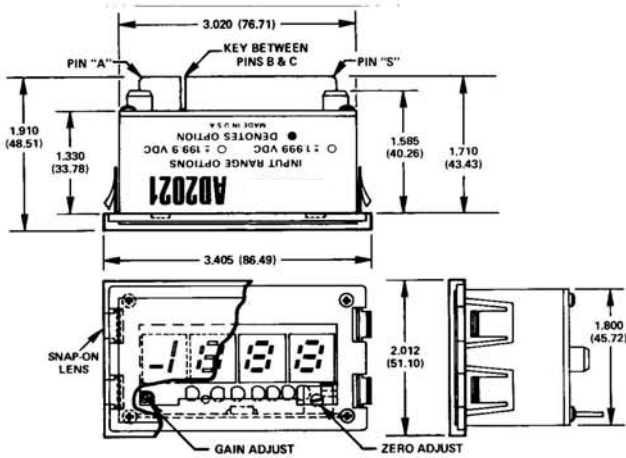


Figure 3. AD2021 Mechanical Outline  
(All Dimensions Are Given in Inches and (mm))

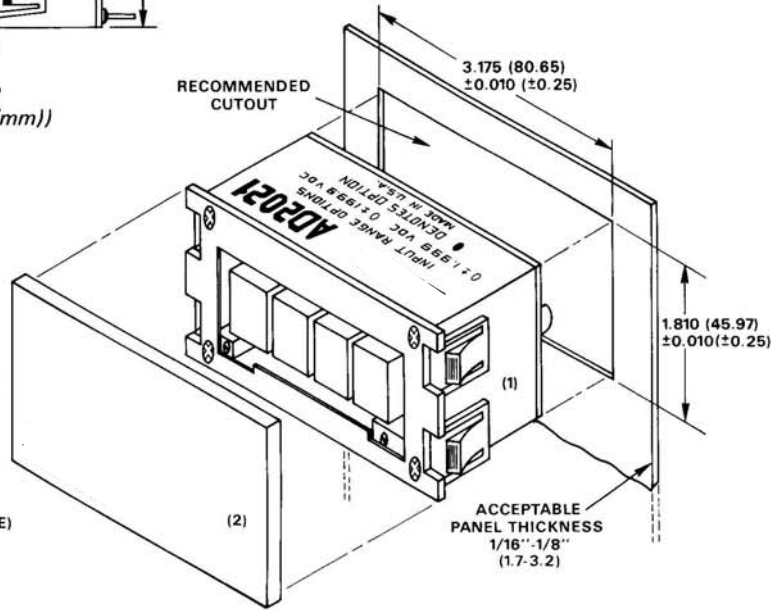


Figure 4. Snap In Case Assembly

- (1) DPM SNAPS INTO PANEL, IS HELD IN PLACE BY RETAINING FINGERS (DEPRESS TO REMOVE)
- (2) LENS ASSEMBLY SNAPS ONTO DPM

### AD2021 CONNECTOR PIN DESIGNATIONS

PIN REF	PIN FUNCTION
1	NC
2	KEY
3	
4	NC
5	DP1XX.X
6	BCD 1
7	BCD 2
8	DIGIT 3 (10 <sup>2</sup> )
9	DIGITAL GND <sup>2</sup>
10	ANALOG HIGH <sup>1</sup>
11	REF OUT
12	NC
13	DIGIT 2 (10 <sup>1</sup> )
14	ANALOG HIGH <sup>1</sup>
15	ANALOG GND
	DP2X.XX

PIN REF	PIN FUNCTION
A	NC
B	NC
C	NC
D	HOLD
E	POLARITY
F	BCD 4
H	BLANKING
J	DIGITAL GND <sup>2</sup>
K	STATUS
L	DIGIT 4 (10 <sup>3</sup> )
M	BCD 8
N	+5 SUPPLY
P	DIGIT 1 (10 <sup>0</sup> )
R	NC
S	DP1.XXX

NOTE 1. PIN 13 AND PIN 9 ARE BOTH ANALOG HIGH INPUTS.

NOTE 2. PIN 8 AND PIN J MAY BE USED INTERCHANGEABLY AS DIGITAL GROUND AND POWER SUPPLY RETURN.