

AN2570

±1999 count

Full Performance, Low Cost

DIGITAL PANEL INSTRUMENT

DESCRIPTION

The Analogic AN2570 is a bipolar 3½-digit (±1999 counts) full performance digital panel instrument. Low cost, without loss of desirable instrumentation features, is made possible through state-of-the-art LSI technology and Analogic's years of leadership in digital panel instrumentation design.

A full scale input range of ±1.999 volts or ±199.9mV, coupled with four available power configurations, (two DC and two AC) make the AN2570 universally applicable. Instrumentation features such as a bipolar differential input, 50 picoAmps of bias current, automatic zero correction and a virtually "blow-up-proof" signal input front end make it easy to use. A host of interface and control signals, including parallel BCD data output, provides maximum versatility for today's instrumentation design.

The displays are designed for maximum readability. Up close, several feet away, or off at an angle, the four large, red LED digits are bright, clear, crisp and free from glare and interpretation problems even under high ambient light conditions. If an input overload condition occurs, all four digits are automatically blanked to prevent an erroneous reading; however, the polarity sign and decimal point remain on to show that the instrument is working properly.

Among the outstanding features that assure high reliability and accuracy are: Comprehensive Quality Control and reliability procedures (e.g., minimum 100 hour temperature-cycled burn-in with power on/off cycle), instantaneous warmup and display (no waiting for readings to settle), isolation that "floats" the measuring circuits up to 1400 volts from the power-line ground (maintains electrical separation between signal and power lines), maximum rejection of ripple and noise due to input signal filtering, and true dual-slope integration.

Packaged in a standard DIN/NEMA high impact plastic case, with front panel accessible span control, every AN2570 is conformance tested before shipment. Rated performance is guaranteed by a Quality control certificate and calibration report enclosed with every instrument.

FEATURES

- Full Performance at Low Cost .
- Accuracy: ±0.05% of Reading ±1 Count .
- Bipolar Differential Input .
- Optimized Signal Input Filter .
- 50 Picoamps Bias Current .
- Input Protected to 300 Volts .
- Automatic Zero .
- Automatic Overrange Indication .
- Automatic Polarity .
- Fourth Generation LSI Design .
- Large 0.43" LED Display .
- Supercool Design for more than 100,000 hours MTBF .
- Wide Operating Temp. Range: -10°C to +65°C .
- 1400 Volts Power Transformer Isolation .
- Universal Powering:
 - +5VDC ±5% @ 170mA
 - +8VDC to +28VDC @ 90mA
 - 110 VAC ±20% @ 1.6 Watts
 - 220VAC ±20% @ 1.6 Watts
- Ratiometric Operation .
- DISPLAY TEST, HOLD, BLANK, EOC, and OVERRANGE Control Signals .
- Externally Programmable Decimal Points .
- 100msec Integration for Highest NMRR and CMRR .
- Standard DIN/NEMA High Impact Plastic Case (UL 94V-0 Rated).
- Metal Case Available .
- Latched and Buffered Parallel BCD Output Available .
- Rear Screw Terminal Connector Available .

APPLICATIONS

- Portable Battery Powered Instruments .
- Process Control Equipment .
- Automotive, Marine, Railroad, and Aircraft Instrumentation .
- Ratiometric Indicators .
- Computer Controlled Systems .
- Biomedical Instrumentation .

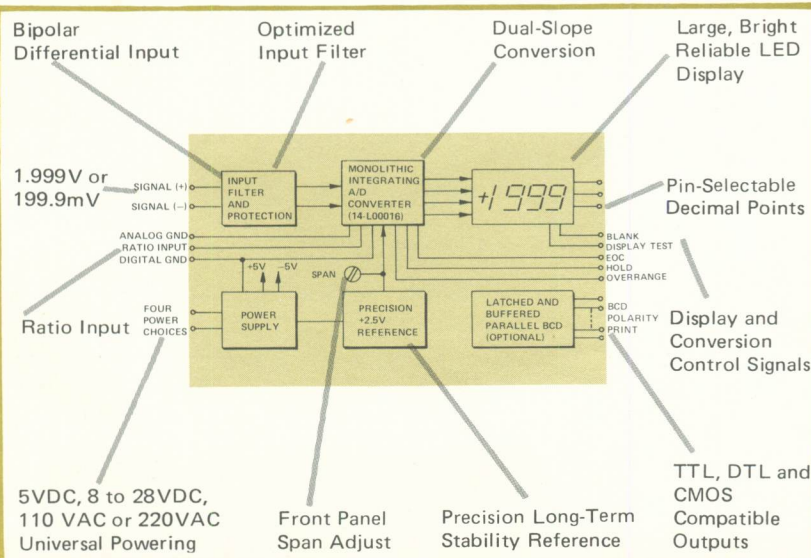


Figure 1. AN2570 Functional Block Diagram

ANALOGIC
 ... The Digitizers

AN2570 SPECIFICATIONS

ANALOG INPUT

Configuration	Bipolar, differential input
Full Scale Range	$\pm 1.999\text{VDC}$ or $\pm 199.9\text{mVDC}$ (See Ordering Code)
Input Resistance	> 1000 megohms
Bias Current	50pA typical, 100pA maximum
Input Protection	± 300 volts DC or AC RMS continuous without damage
Input Filter	Single pole, optimized signal enhancement filter
Normal Mode Rejection Ratio	65dB typical, @ 50 or 60Hz.
Ratiometric Operation	Ratio input for use with external reference. (Consult factory)

COMMON MODE

Signal Return to Analog Ground Voltage (CMV)	$\pm 0.25\text{VDC}$ or AC peak
DC Rejection Ratio (CMRR) DC	110dB typical, 90dB minimum
AC Rejection Ratio (CMRR) AC	90dB typical, 70dB minimum @ 50 to 60Hz
Analog Ground to AC Power Line Voltage (CMV)	1400 Volts DC or AC peak
AC Rejection Ratio (CMRR) AC	140dB typical, 120dB minimum at 50 to 60Hz

PERFORMANCE

Accuracy	$\pm 0.05\%$ of reading ± 1 count
Resolution	$\pm 0.05\%$ for ± 1999 counts
Range Tempo	$\pm 35\text{ppm}$ of reading/ $^{\circ}\text{C}$ typical, $\pm 50\text{ppm}$ of reading/ $^{\circ}\text{C}$ maximum
Zero Stability	Auto zero, $\pm 1\mu\text{V}/^{\circ}\text{C}$ maximum zero drift
Code Centers	Less than 20 μV RMS uncertainty, resulting in very stable readings.
Step Response	Less than 400msec for $\pm 0.05\%$ of reading accuracy for a "+" or "-" full scale step input

DISPLAY

Type	Seven segment planar LED, red, 0.43" (11mm) high
Polarity Indication	Automatic, plus "+" or minus "-" sign displayed
OVERRANGE Indication	All digits blanked to prevent erroneous readout, "+" or "-" sign and decimal point remain on.
Decimal Points	3 positions, externally programmable with jumper, TTL/DTL, open collector or relay logic. (See Figure 9.)
HOLD	Logic "0" (open collector or equivalent) holds last reading in display.
BLANK	Logic "0" (open collector or Equivalent) blanks display.
DISPLAY TEST	Logic "0" (sink 0.2mA to digital ground) tests all 23 segments of display by displaying "1888".

ANALOG TO DIGITAL CONVERSION

Technique	Dual slope, six phase conversion with automatic zero correction, complete conversion each cycle.
Rate	2.5 conversions per second nominal, internally triggered. See "HOLD" command for display control.
Input Integration Period	100 milliseconds nominal for optimum 50 and 60Hz noise rejection.

DIGITAL OUTPUTS

Parallel BCD (Optional)	15 parallel lines provide latched and buffered BCD output, POLARITY, and PRINT command. All are TTL/DTL and CMOS compatible, 2TTL loads each. (See Figure 3.)
OVERRANGE	Logic "0" indicates that input exceeds ± 1999 counts, CMOS compatible, 0 to +5VDC.
EOC	Falling edge of "End of Conversion" signal indicates conversion complete, CMOS compatible, 0 to +5VDC.

POWER

Choice of 4 power inputs	$+5\text{VDC} \pm 5\%$ @ 170mA nominal $+8$ to $+28\text{VDC}$ @ 90mA nominal (Specifically designed for Automotive, Marine, Railroad, and Aircraft applications; protected against supply reversals.) $110\text{VAC RMS} \pm 20\%$, 47 to 500Hz @ 1.6 Watts nominal (88 to 132VAC input range) $220\text{VAC RMS} \pm 20\%$, 47 to 500Hz @ 1.6 Watts nominal (176 to 264VAC input range)
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ENVIRONMENTAL & PHYSICAL

Operating Temperature Range	-10°C to $+65^{\circ}\text{C}$
Storage Temperature Range	-40°C to $+85^{\circ}\text{C}$
Relative Humidity	0 to 90%, noncondensing
Case	DIN/NEMA standard, high impact molded plastic case UL94V-0 Rated. Metal case available. (See Ordering Code)
Dimensions	DIN/NEMA (See Figure 6.)
Weight	5oz (150 grams) nominal, DC Powered; 8oz (230 grams) nominal, AC powered.
EMI/RFI	Shielding on 5 sides with metal case option.
Special Line Noise Suppression	Provision made for surge suppressors, varistors and line input passive Pi filtering for industrial applications. Consult factory.

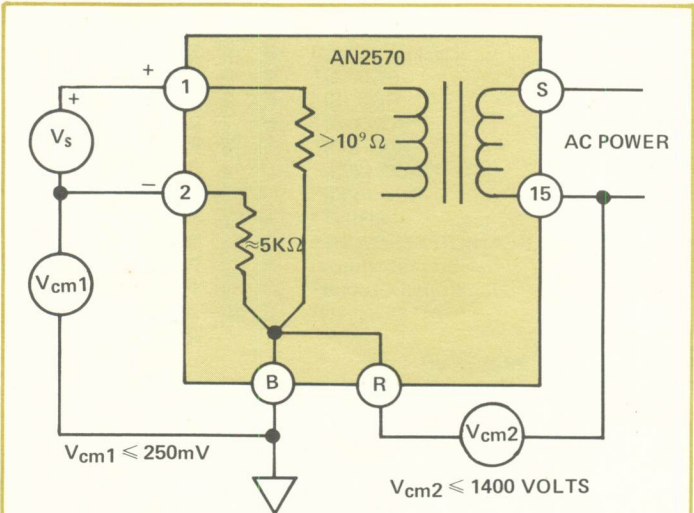
RELIABILITY

MTBF	$> 100,000$ hours, calculated
Burn-In	≥ 100 hours with 0°C to $+55^{\circ}\text{C}$ temperature cycles and power on/off cycles.
Vibration	Each unit vibrated at 5gs for 30 seconds
Calibration	NBS traceable. Detailed certificate of calibration shipped with each unit.
Recalibration	Recommended 15-month intervals
Warranty	24 months

PRINCIPLES OF OPERATION

The AN2570 utilizes a true dual-slope form of analog-to-digital conversion, instrumented in a fourth-generation monolithic integrated circuit. In each conversion cycle, the internal offset voltages are sensed and compensated for automatically. The displayed data is the digitized ratio of the input signal to the precision reference within the instrument. Optionally, the user may introduce his own reference (scaled for +2 volts DC), where the output maximum count of 1999 would then represent an input equal to the full value of the external reference. A front panel-accessible span control permits the user to calibrate the precision internal reference to system standards; Analogic's precision reference is calibrated traceable to NBS standards.

The AN2570 provides a number of status and control signals: an OVER-RANGE output line goes to a low level when the conversion exceeds 1999 counts; an EOC output pulse is negative going when the conversion cycle is completed; grounding the input of the DISPLAY TEST line checks the operation of the segments of each display digit; maintaining the HOLD input line at a low level retains and displays the results of the last conversion and also keeps that value latched in the buffered output registers of the BCD option, if installed; and grounding the BLANK line blanks the display. Relationships among these signals are shown in the Timing Diagram of Figure 3. Note that the status/control functions are shared on common lines: HOLD/EOC, and BLANK/OVERRANGE.



Definitions:

- V_s Voltage source to be measured.
- V_{cm1} Common mode voltage between pins ② and ①. Typically this would be due to ground loops or other system noise. Note that only a differential input such as on the AN2570 can reject this type of noise and interference.
- V_{cm2} Common mode voltage (isolation potential) between power line and digital ground.
- Pin ① Positive input for voltage to be measured.
- Pin ② Negative input (return) for voltage to be measured.
- Pin ③ Analog ground. For single-ended inputs, jumper pins ② and ③ together; for differential inputs, connect as shown.
- Pin ④ Digital ground. Internally connected to analog ground via Kelvin connection. All digital signals, such as Decimal Points, HOLD, BLANK, EOC, DISPLAY TEST, OVERRANGE, BCD etc. should be returned to this point.

Figure 2. Input Configurations and Common Mode Voltages

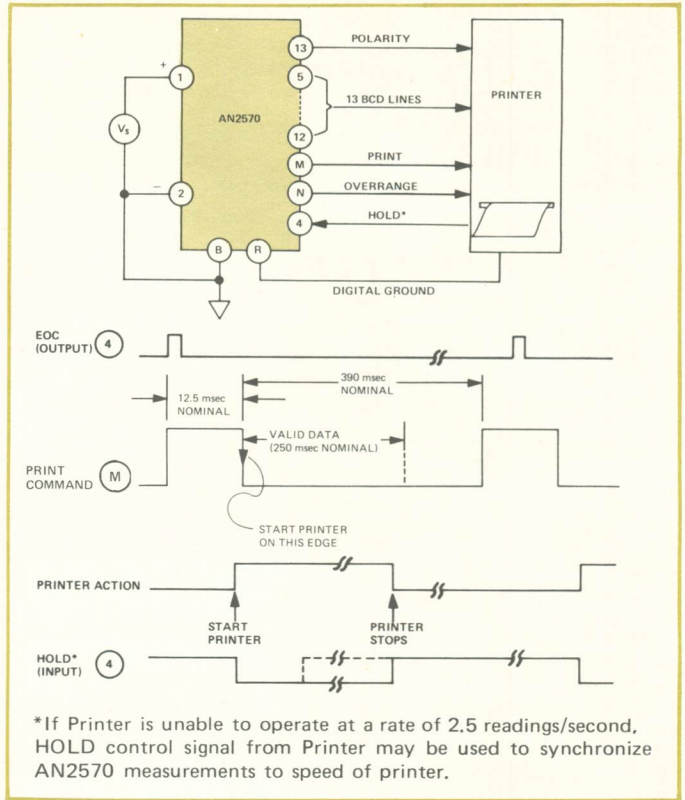
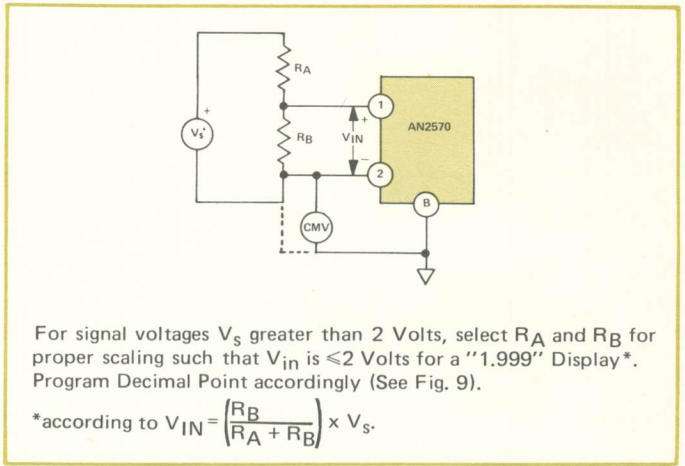


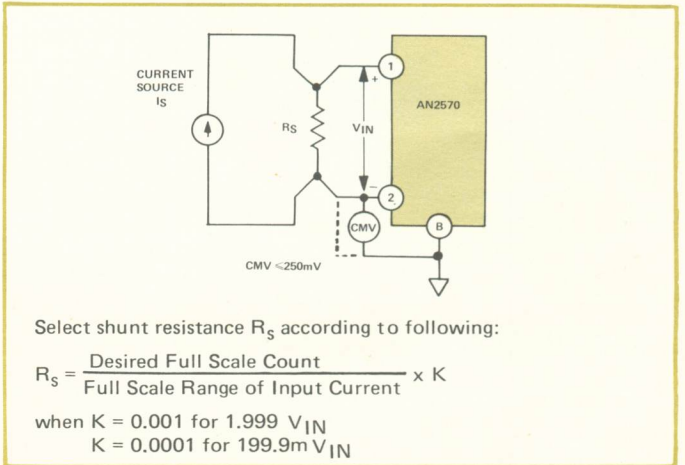
Figure 3. Using AN2570 with a printer.



For signal voltages V_s greater than 2 Volts, select R_A and R_B for proper scaling such that V_{IN} is ≤ 2 Volts for a "1.999" Display*. Program Decimal Point accordingly (See Fig. 9).

*according to $V_{IN} = \left(\frac{R_B}{R_A + R_B} \right) \times V_s$.

Figure 4. Input Voltage Scaling.



Select shunt resistance R_s according to following:

$$R_s = \frac{\text{Desired Full Scale Count}}{\text{Full Scale Range of Input Current}} \times K$$

when $K = 0.001$ for $1.999 V_{IN}$
 $K = 0.0001$ for $199.9m V_{IN}$

Figure 5. Current Measurement with AN2570.

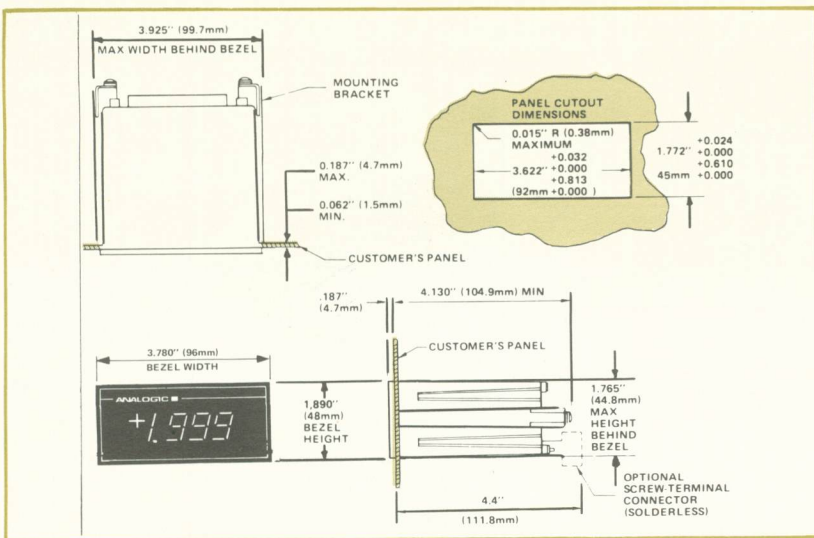


Figure 6. Panel Mounting and Outline Dimensions

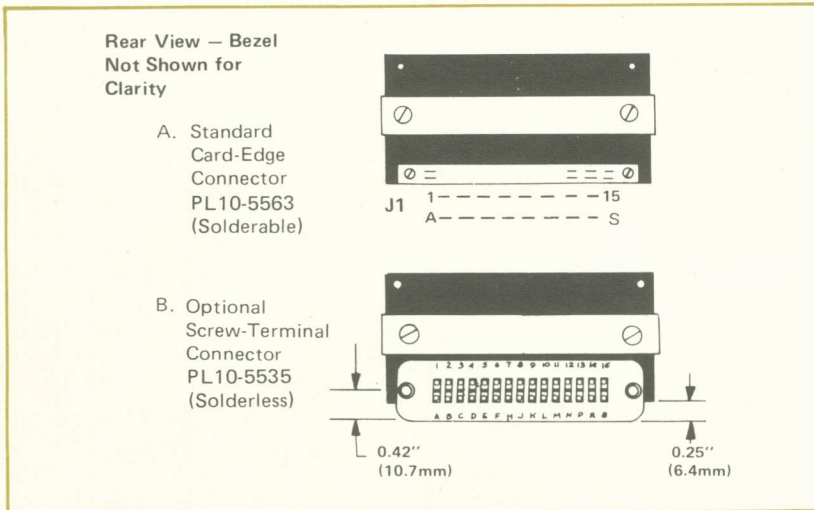


Figure 7. Rear Panel Connectors (Metal Case Option Shown)

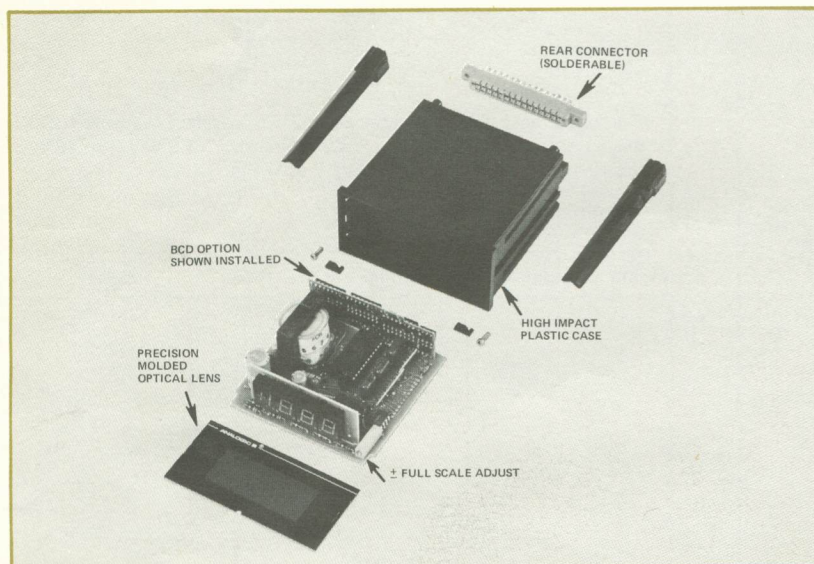


Figure 8. Disassembled View of the AC Powered AN2570.

ORDERING CODE

	AN2570	□	/	□	/	□	/	□
For	Enter							
±1.999 Volts Input Range				1				
±199.9 mVolts Input Range				01				
For	Enter							
No BCD Output				X				
Parallel Buffered BCD Output				1				
For	Enter							
+5VDC Power Input				X				
110VAC ±20%				1				
220VAC ±20%				2				
+8 to +28VDC				3				
For	Enter							
Plastic Case (UL 94V-0 Rated)				P				
Metal Case				M				
(Connectors optional)								

J1 PIN DESIGNATIONS

Ratio Input	A	1	Signal IN (+)#
Analog Ground#	B	2	Signal Return (-)#
Decimal Point 1	C	3	Decimal Point 2
Decimal Point 3	D	4	EOC/HOLD
BCD (2)*	E	5	BCD (1)*
BCD (8)*	F	6	BCD (4)*
BCD (20)*	H	7	BCD (10)*
BCD (80)*	J	8	BCD (40)*
BCD (200)*	K	9	BCD (100)*
BCD (800)*	L	10	BCD (400)*
PRINT*	M	11	DISPLAY TEST
BLANK/OVERRANGE	N	12	BCD (1000)*
-5.1VDC Output	P	13	POLARITY*
Digital Ground†	R	14	+5V†
AC Power IN†	S	15	AC Power or +8 to +28VDC IN†

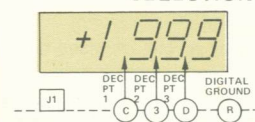
#See Figure 2.

*These signals are active with BCD option only.

†POWER CONNECTIONS

+5VDC	Pin 14 for +5VDC, Pin R for Power Return
+8 to +28VDC	Pin 15 for +8 to +28VDC, Pin R for Power Return
110VAC	Pins S and 15
220VAC	Pins S and 15

DECIMAL POINT SELECTION



To display the desired decimal point, simply connect the appropriate pin as shown to Digital Ground (Pin R, J1) using a jumper lead.

Figure 9. Decimal Point Position Terminals

**NEED APPLICATIONS HELP?
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