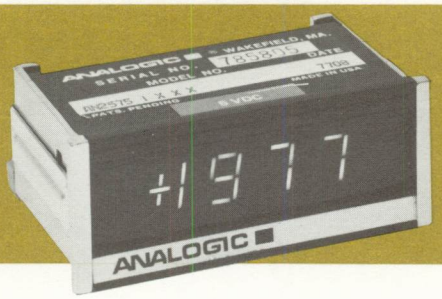

AN2575

Miniature 3½-Digit (±1999-count) Full-Performance, Low-Cost DIGITAL PANEL INSTRUMENT

GENERAL DESCRIPTION

The Analogic AN2575 is a bipolar, 3½-digit (±1999 counts), full performance, digital panel instrument in a miniature metal case, ideally suited for 5-volt, battery-powered, portable instrumentation. With the optional micro-powered BCD option card, installed within the miniature-sized case, the AN2575 is computer-I/O compatible for laboratory and process control instrumentation.

APPLICATIONS

The AN2575 provides true cost-performance benefits when used in a wide variety of display/control instrumentation. Designers of field use instruments will appreciate the rugged construction, long battery life, and miniature size features. Biomedical instrumentation will profit from the battery-operated, differential input, and EMI/RFI shielded case features. Process control designers will find the latched, buffered, parallel BCD outputs easy to incorporate into their system requirements, no matter how difficult they may appear. Automotive, marine, and aircraft instrument designers may simply step down their power source to a 5-volt supply, and thereby obtain performance benefits of this low-power, miniature DPI in a host of remote measurement, display and control applications.

Installation of the BCD card provides latched, buffered, parallel BCD output signals, updated after every conversion; these are TTL, DTL or CMOS compatible for almost universal application in digital control systems or computer-Input/Output applications where long-lead data transmissions are required for remote display. The BCD card also provides latched and buffered status signals of PRINT and POLARITY for each conversion, and permits the user to program AN2575 conversions to synchronize the data outputs with any printing or process controlling timing requirements.

The packaged AN2575 is designed for simple installation; it is easily contained within assemblies fitting into ¼-DIN controller openings. An OEM version of the AN2575 is also available without metal case for custom installations. In either standard or OEM format, each AN2575 is conformance tested with exhaustive Quality Control procedures including vibration and burn-in before shipment, and the documented results are forwarded with each instrument.

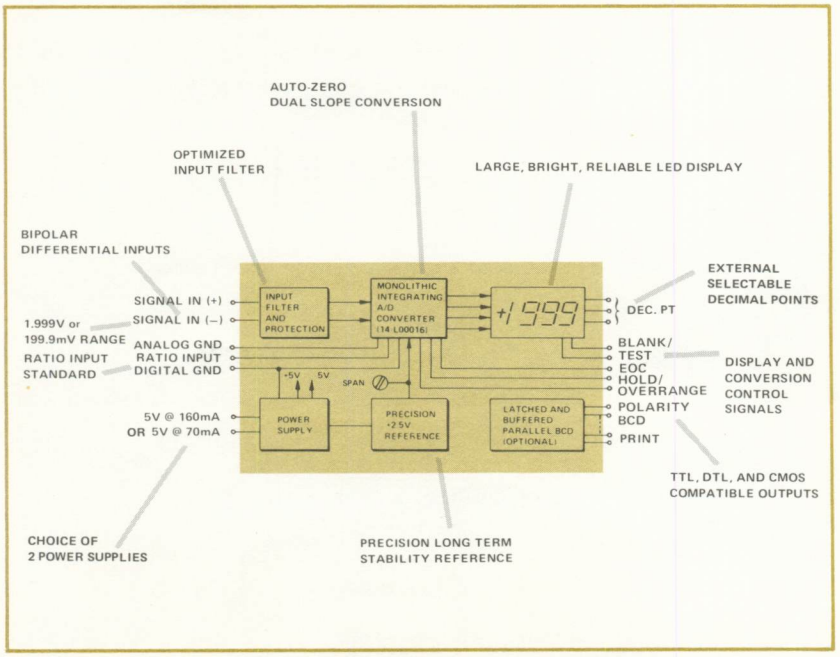

Figure 1. AN2575 Simplified block diagram

FEATURES

Full 3½-digit performance quality at lowest cost

- ±1999 count; 0.05% resolution.
- Accuracy: ±0.05% of reading ±1 count.
- Bipolar differential input.
- 50 picoamps bias current.
- Optimized input filter.
- Signal input protected to 300 volts.
- Automatic zeroing.
- Automatic polarity indication.
- Automatic overrange indication.
- Externally selectable decimal point.
- Dual-slope fourth generation LSI circuit.
- 100 msec signal integration -- highest NMRR at 50 and 60 Hz.

Wide range of system compatibility

- Operating temperature range from 0°C to 65°C.
- EMI and RFI shielded metal case.
- Small enough for ¼-DIN controller applications.
- Supercool operation: minimal parts count; over 100,000 hrs MTBF.
- Large 0.43" LED display for maximum viewing ease.
- Low power: +5-volt (160mA).

Performance enhancing options

- Latched and buffered parallel BCD outputs.
- OEM version available, without case.
- 3-wire Ratiometric option; external reference input.
- Extra-low power version (+5V @ 70mA) for critical power applications.

APPLICATIONS

- Portable battery-powered instruments.
- Process control equipment.
- Automotive, Marine, Railroad, and Aircraft instrumentation.
- Computer controlled systems.
- Ratiometric indicators.
- Biomedical instrumentation.

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AN2575 SPECIFICATIONS

ANALOG INPUT

Configuration	Bipolar, differential input.
Full Scale Range	±1.999VDC or ±199.9mVDC (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. (See Figure 5).

COMMON MODE

Signal Return to Analog Ground Voltage (CMV)	±0.25VDC or AC peak.
DC Rejection Ratio (CMRR) DC	110dB typical, 90dB minimum.
AC Rejection Ratio (CMRR) AC	90dB typical, 70dB minimum @ 50 to 60Hz.

PERFORMANCE

Accuracy	±0.05% of reading ±1 count.
Resolution	±0.05% for ±1999 counts.
Range Tempco	±35ppm of reading/°C typical, ±50ppm of reading/°C maximum.
Zero Stability	Auto zero in each conversion, ±1μV/°C maximum zero drift.
Code Centers	Less than 20μV RMS uncertainty, resulting in very stable readings.
Step Response	Less than 400msec for ±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.
Overload 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.
HOLD	Logic "0" (open collector or equivalent) blanks 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 6).
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

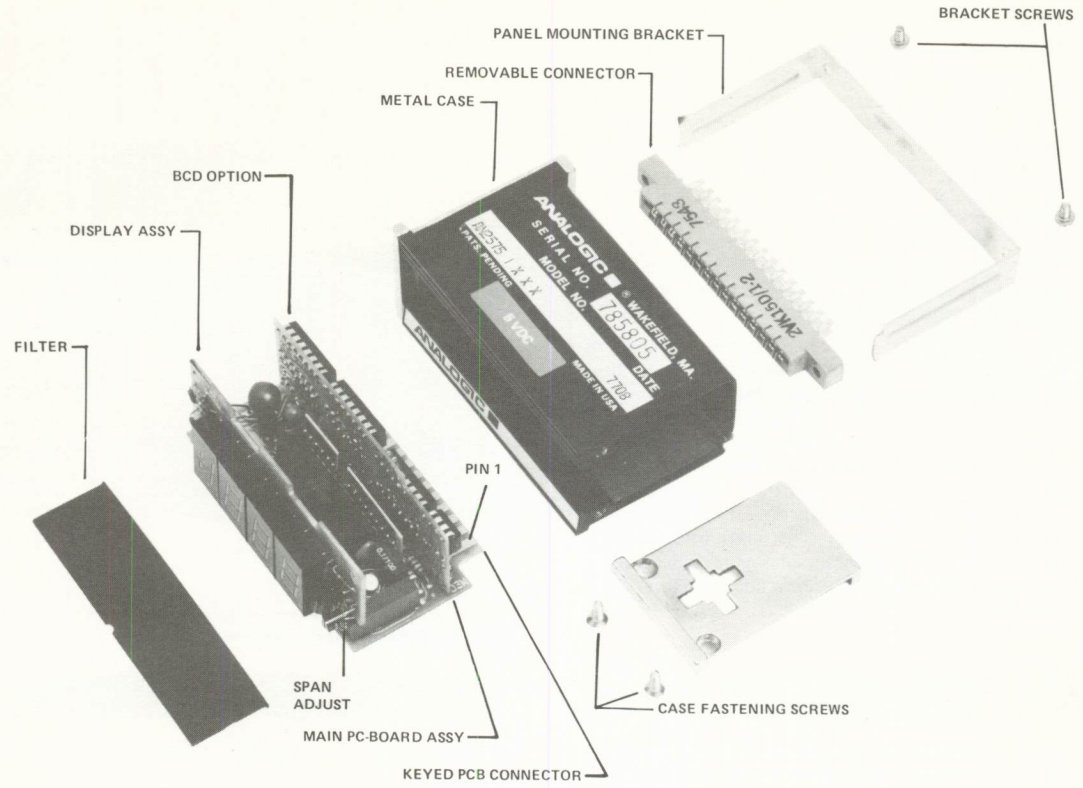
Choice of 2 power inputs	+5VDC ±5% @ 160mA nominal, standard +5VDC ±5% @ 70mA nominal, optional } (30mA nominal with display blanked).

ENVIRONMENTAL & PHYSICAL

Operating Temperature Range	0°C to +65°C.
Storage Temperature Range	−40°C to +85°C.
Relative Humidity	0 to 90%, noncondensing.
Case	Metal case standard. OEM version without case. (See Ordering Code)
Mounting	Metal U-bracket, supplied.
Dimensions	3.182" W x 1.375" H x 1.800" D (See Figure 9).
Weight	5oz (150 grams) nominal.
EMI/RFI	Shielding on 5 sides with metal case.
OSHA/UL/CSA/DIN/NEMA/NFPA	Consult factory.

RELIABILITY

MTBF	>100,000 hours, calculated.
Burn-In	⩾100 hours with 0°C to +55°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.



To disassemble:

(1) Remove bracket fastening screws from rear panel of instrument.
(2) Remove mating connector.
(3) Remove two fastening screws from right-hand side panel (facing front of DPI).
(4) Remove right side panel.
(5) Slide assembly from metal case.
(6) Remove front panel filter.

To assemble:

Reverse above sequence. Snap filter into place.

Front Panel Span Adjust:

(1) Move filter straight up until notch at bottom becomes accessible.
(2) With thin tool engaged in notch, rotate filter away from display making SPAN ADJUST potentiometer accessible.
(3) Adjust Span and push filter back in and slide down.

Figure 10. AN2575 assembly, exploded view showing span control adjustment potentiometer, BCD option card, and indicating low parts count for super-cool operation

AN2575 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)*
SPARE	P	13	POLARITY*
SPARE	R	14	SPARE
DIGITAL GND, POWER RETURN	S	15	+5V POWER IN

*Active with BCD options only.
**See Figure 5.
#See Figure 3 for connections.

ORDERING CODE

AN2575

For	Enter
±1.999 Volts Input Range	1
±199.9m Volts Input Range	01
For	**Enter**
No BCD Output	X
Parallel Buffered BCD Output	1
For	**Enter**
+5VDC @160mA	X
+5VDC @70mA Low Power Version	1
For	**Enter**
Standard Metal Case	X
OEM Assembly without case	1

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Principles of Operation

The AN2575 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 in the digital translation of the converted signal. The output data is the digitized ratio of the input signal to the precision reference within the panel instrument. Optionally, the user may introduce his own reference (scaled for +2 volts dc), and the output maximum count of 1999 represents an input equal to the full value of the reference. A front panel-accessible span control permits the user to calibrate the precision reference (standard internal, or user-supplied external) to system standards; while Analogic's precision reference is calibrated traceable to NBS standards.

The AN2575 provides a number of status and control signals: an OVERRANGE 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. The relationships among these signals are shown in the Timing Diagram of Figure 2. Note that the status/control functions are shared on common lines: HOLD/EOC, and BLANK/OVERRANGE.

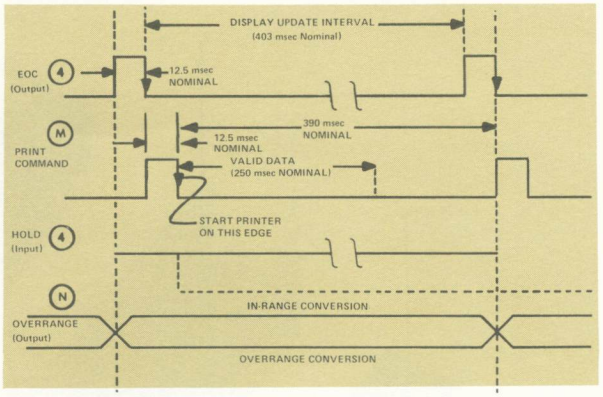
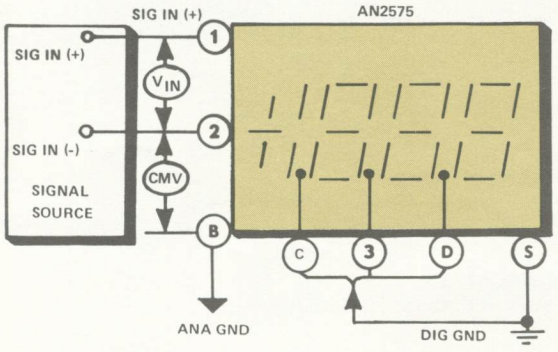


Figure 2. System timing waveform diagram

DESIGN FEATURES

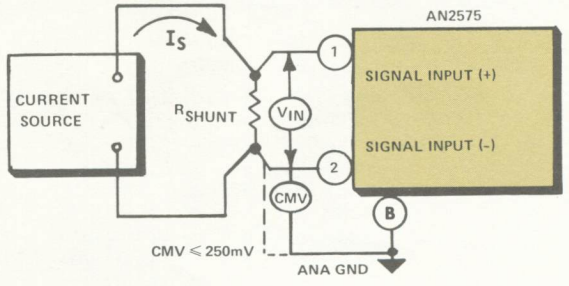
The AN2575 is a design innovation in low-powered digital panel instrumentation. Compare the AN2575 full scale input range of ±1.999V or ±199.9 mV, 50 picoAmps of input bias current, auto-zeroing dual-slope conversion, automatic polarity indication, terminal-selected decimal point, automatic overrange indication, 100 dB common mode rejection ratio, rugged, EMI- and RFI-proof metal case only 1.800" deep behind the front panel, and more than 100,000 calculated MTBF hours of trouble-free operation. Optionally, a very low power (only 350 milliwatts) unit is available for long battery life requirements.

True dual slope integration provides almost infinite rejection of normal-mode noise at (or near) 50 Hz or 60 Hz frequencies, while a built-in input filter provides optimal single-pole filtering of other normal-mode interferences. In addition, the input circuit, with more than 1000 megohms input impedance, is protected against damage from ±300 VDC or ACV RMS continuously applied inputs.



For Single-Ended Inputs, connect Terminal 2 to Terminal B.
For Floating Differential Inputs, CMV should be less than ±250mV.
For 199.9 mV FSR, V_{IN} should be less than ±199.9 mV for in-range readings.
For 1.999 V FSR, V_{IN} should be less than ±1.999 V for in-scale readings.
V_{IN} may be up to ±300 VDC without damage to the DPI.
Connect digital ground, Terminal S, to Terminal C, 3 or D for appropriate decimal point selection.

Figure 3. Input configurations and decimal point selection

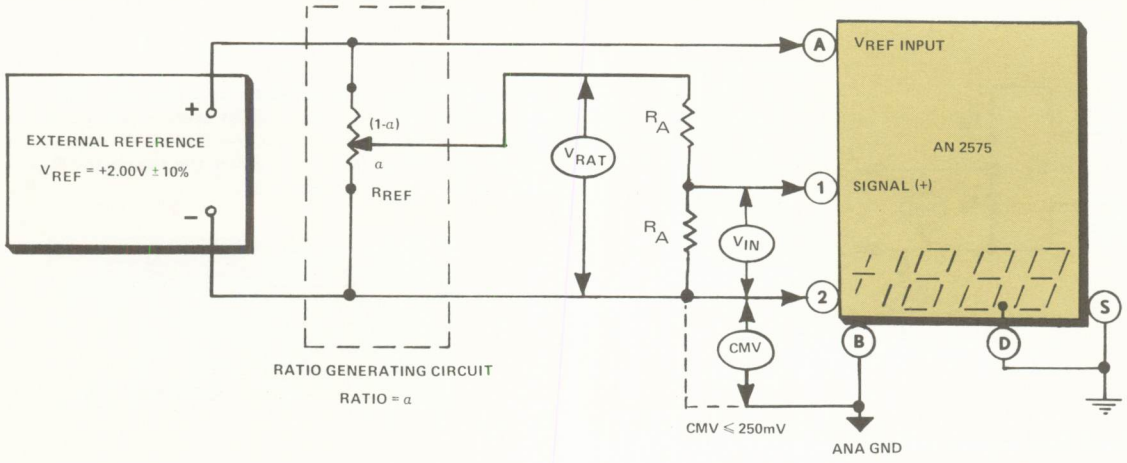


Select shunt resistance R_s according to following:

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

where, K = 0.001 for 1.999 V_{IN}
K = 0.0001 for 199.9m V_{IN}

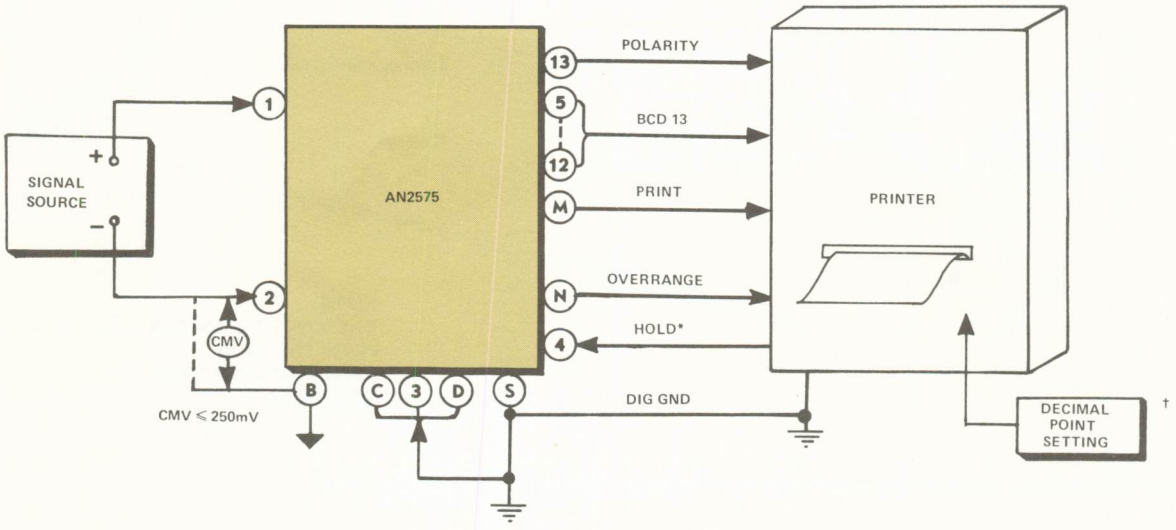
Figure 4. Using AN2575 to measure input currents

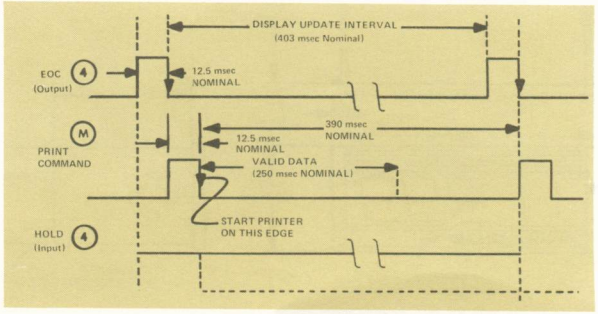


NOTE :

In normal internal reference operation, a reference voltage of +2.0 volts results in a counting rate of 1 millivolt/count. Thus, full scale inputs result in a count of 1999. Therefore, in order to scale the ratio in terms of 100% for full scale voltage, V_{IN}, and to make the display read directly in percentage, a divider network is inserted between the ratio voltage V_{RAT}, and the input. The value of resistance, R_A, should be selected so that $2R_A$ minimizes the loading on the reference resistance, R_{REF}. R_A should be selected for as large a value as possible (up to 1 megohm).

Figure 5. Using AN2575 for 3-Wire ratiometric measurements

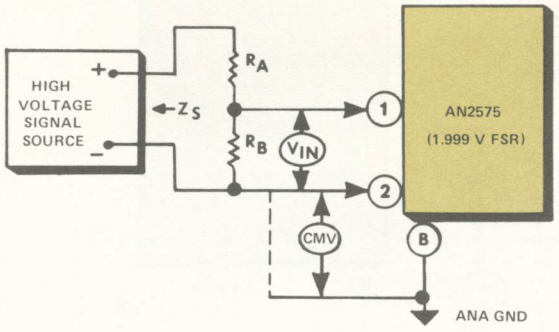




*If printer is unable to operate at a rate greater than 2.5 readings/second, HOLD control signal from PRINTER may be used to synchronize AN2575 measurements to speed of PRINTER.

†Decimal Point selection corresponds to DP connection AN2575.

Figure 6. Using the AN2575 with a typical printer system

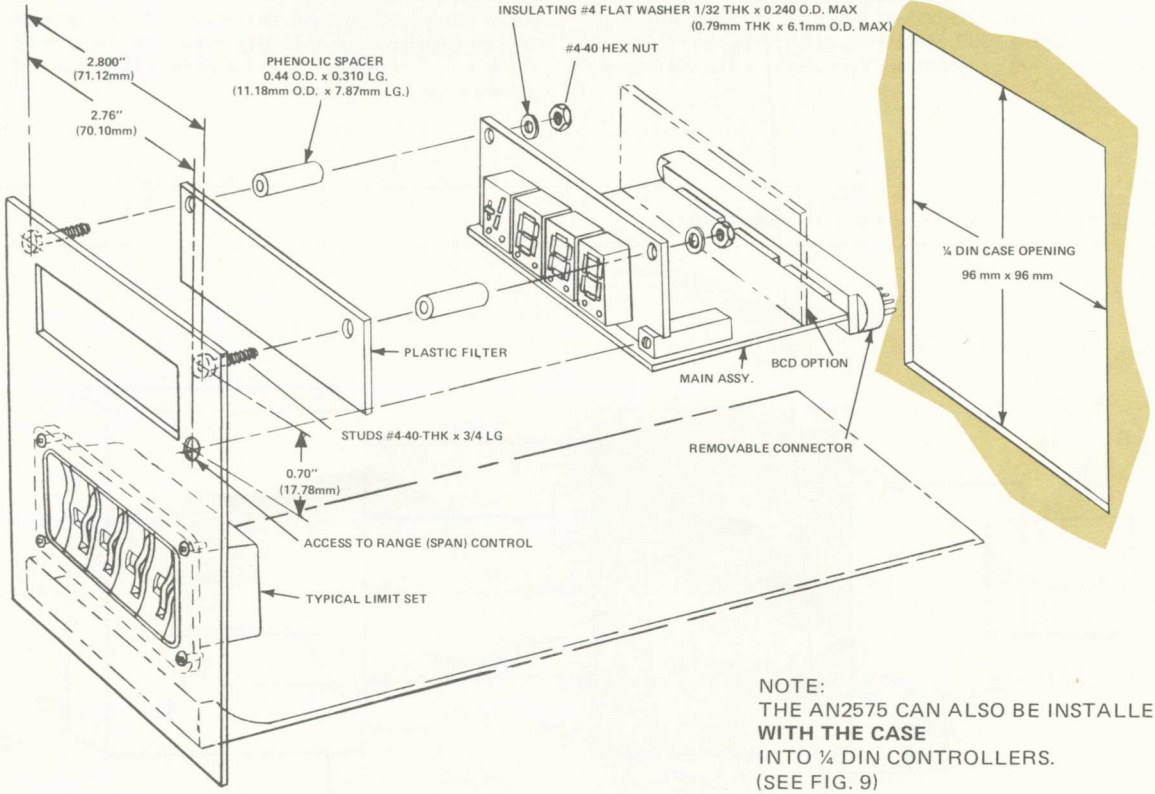


$$V_{IN} = \frac{R_B}{R_A + R_B} V_S$$

To make the display read directly in volts, the ratio should be an integral decade, and the decimal point should be selected accordingly. Other ratios can be used to scale the display in other units. R_A and R_B should also be selected to minimize the loading of $R_A + R_B$ on the source impedance, Z_S. For example:

V_S FSR	$\frac{R_B}{R_A + R_B}$	DECIMAL POINT CONNECT (S) TO
19.99 V	1:10	(3)
199.9 V	1:100	(D)
1999 V	1:1000	NOT CONNECTED

Figure 7. Using AN2575 to measure input voltages greater than 1.999 volts



NOTE:
THE AN2575 CAN ALSO BE INSTALLED **WITH THE CASE** INTO ¼ DIN CONTROLLERS.
(SEE FIG. 9)

Figure 8. Typical installation of the OEM configuration of AN2575 in ¼-DIN controller configuration

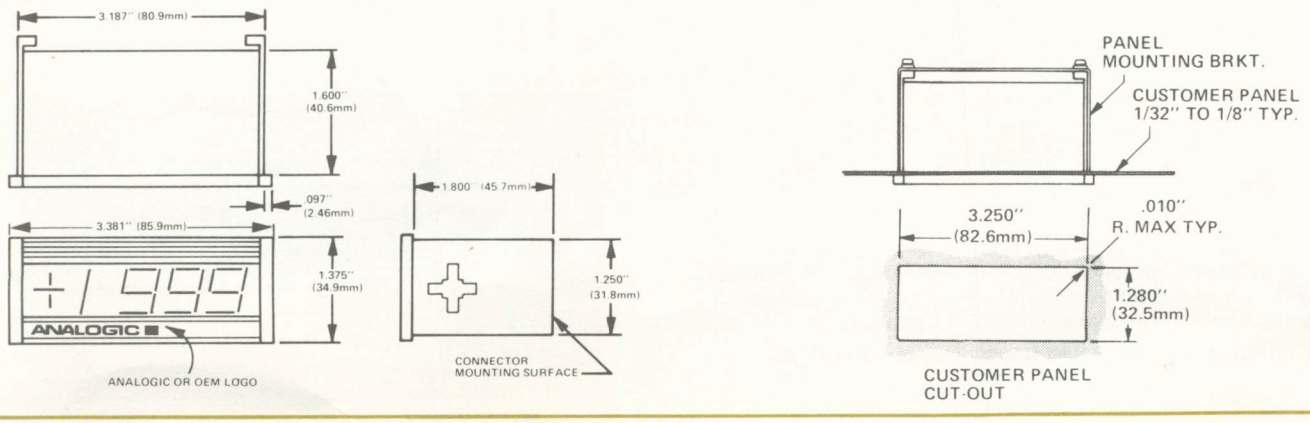


Figure 9. AN2575 case outline dimensions and panel installation