

# INSTALLATION & OPERATION MANUAL

## AN25 Totalizer/ Rate Indicator

DOC#: MN-AN25.doc



***LIQUID CONTROLS SPONSLE, INC.***

**FLOW MEASURING DEVICES AND CONTROLS**

**A Unit of the IDEX Corporation**

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## SPECIFICATIONS

<b>Temperature:</b>	Operating 0 to 70°C Storage -20 to 85°C
<b>Input Voltage:</b>	110VAC or 12-16.5VDC 100mA MAX Observe Polarity
<b>Signal Input:</b>	Frequency 0-10KHz Amplitude 50mV – 35V sine or square wave Sensitivity field adjustable Impedance 10K
<b>Display:</b>	LCD, 8 Digit .3" characters Totalizer – 8 Digit Rate Indicator – 5 Digit Leading zero blanking on rate function Totalizer has battery backup Totalizer reset externally initiated Engineering units – Input factoring .00000001 – 1.9999
<b>Accuracy:</b>	Totalizer $\pm 1$ Count Rate Indicator $\pm 1\%$ Analog Outputs .3% F/S
<b>Analog Output:</b>	4mA @ 0Hz, 20mA @ desired full scale frequency 0V @ 0Hz, 5V or 10V @ desired full scale frequency Full scale range 100Hz-10KHz Response time 95% of change in 1 second Linearity .3% F/S Tempco < 2% of reading over entire temperature range 4-20mA Maximum load resistance 500 Ohms Voltage Output minimum load resistance 250 Ohms
<b>AN25-L:</b>	Loop powered by a 4-20mA loop input Minimum voltage 6.5V + (.02 x RL) Maximum Voltage 28V + (.004 x RL) (Same temperature, Display and accuracy specifications apply)
<b>Enclosure:</b>	Panel mount, ¼ DIN molded plastic

## **INTRODUCTION**

### **General**

The Model AN25 Totalizer and Rate Indicator is comprised of compact, convenient and precision electronics designed to interface with any frequency generating device such as a turbine flowmeter. The Model AN25 provides flow totalization and rate in any engineering unit. Total and rate are displayed simultaneously via two 8 digit liquid crystal displays. A backup battery is incorporated in the Totalizer display circuitry to retain the total until Reset. Reset is accomplished externally by a magnetic field.

Negatives previously associated with LCD's – poor cold temperature performances, condensation which is a by product of heaters and display ghosting – have all been eradicated by incorporating a low temperature coefficient LCD (-35° C).

In addition to totalization and rate indication, the Model AN25 (Analog) provides an interface 4-20mA output and an interface voltage output of 0-5V or 0-10V, selectable. The AN25 (Analog) linearly converts a frequency to equivalent analog outputs of 4-20mA and 0-5V or 0-10V. When incorporated with a turbine flowmeter, interface outputs of 4-20mA and 0-5V or 0-10V proportional to flow are obtainable.

An input supply voltage of 110VAC or 12VDC is standard.

The Model AN25-L is a Loop Powered Totalizer & Rate Indicator which accepts a 4-20mA Loop Powered Input. Model AN25-L provides the same totalization and rate indication as the Model AN25.

### **Theory of Operation**

Model AN25 amplifies and shapes the incoming pulses generated by the turbine's response to flow. The amplified pulse train is factored by a phase locked loop (PLL). The factored pulse train is then scaled & divided to produce a totalized display in the desired engineering unit. For rate, the divided pulse train is combined with a crystal timebase for absolute accuracy. This configuration permits the calibration factor to be universal for both total and rate indication.

Model AN25-L Loop Powered Totalizer & Rate Indicator accepts a 4-20mA loop input. An analog to frequency converter is incorporated in the circuitry to establish a calibrated 10KHz full scale frequency pulse. This pulse is then scaled and divided by the same circuitry as the standard AN25 to provide totalization and rate indication in engineering units.

### **Calibration**

Field calibration for Totalization and Rate is accomplished by incorporating a calibration factor based on the turbine K-Factor. Divider switches provide divisional increments of .00000001 – 1.9999. The calibration factor is entered via 4 BCD switches, a divider switch, and a '0-1' switch.

Calibration of the analog control outputs is established by installation of a F/S frequency jumper in conjunction with the zero and span adjustments. 0-5 or 0-10VDC output is selected by installation of a jumper. 4-20mA and 0-5/0-10V calibrations are independent of each other and independent of the calibration factor entered for total and rate indication.

## **INSTALLATION**

### **Inspection**

All units are completely assembled, inspected and tested at the factory prior to shipment. Upon receipt of the unit, a visual inspection should be conducted to detect any damage that may have occurred during shipment. Report any discrepancy to the factory immediately.

### **Physical**

All Model AN25 units are enclosed in a ¼ DIN, molded plastic housing. The housing has a snap on the front Bezel, removable mounting clips, and a plug-in wiring terminal on the back.

Refer to dimensional requirements for dimensions, bezel size, and depth needed for mounting the instrument in a user panel. Be sure to provide additional space for cabling and connections behind the instrument. Additionally, all wiring to the back of the instrument should have sufficient service loops to allow for the easy removal of the instrument from the panel.

### **Electrical**

An input supply voltage of 110VAC or 12VDC is standard for the Model AN25. Be sure to observe correct polarity when making field terminations.

Model AN25-L requires a minimum loop voltage of  $6.5V + (.02 \times RL)$ . Maximum voltage is  $28V + (.004 \times RL)$ .

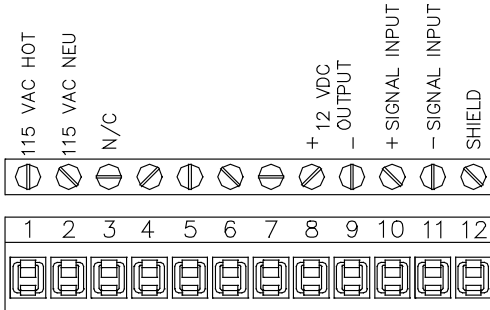
### **Signal**

The standard signal cable is a 2 wire shielded cable with a MS3102 connector termination which is the industry standard interface for 2 pole pickup coils. The shielding is singly ended and should not be altered.

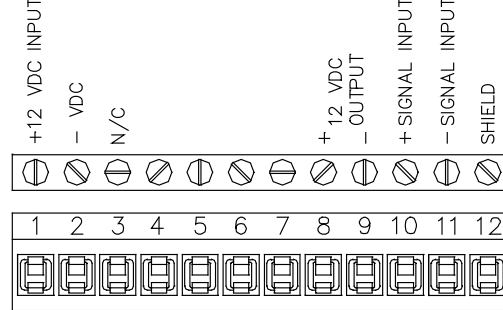
**Field Terminations**

**MODEL AN25**

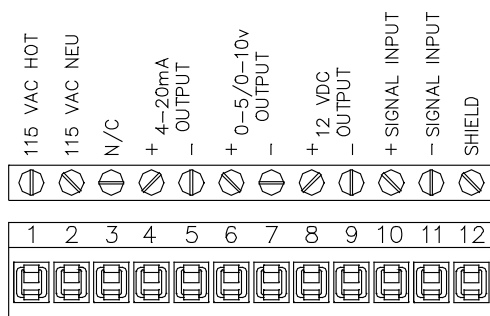
**For 115VAC**



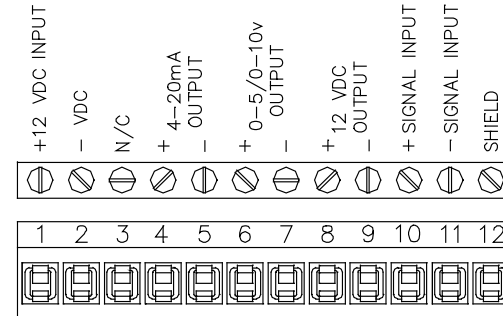
**For +12VDC**



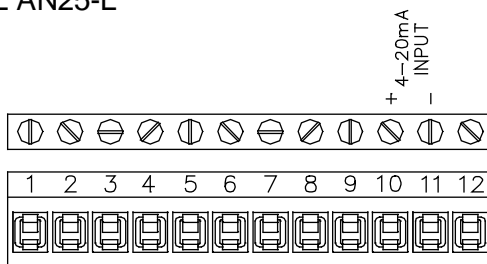
**For 115VAC with Analog Output**



**For +12VDC with Analog Output**



**MODEL AN25-L**



## CALIBRATION

### Sensitivity

The sensitivity adjust R6 is located on the Power Supply and Input Amplifier P.C.B. The amplitude of the signal generated by the turbine is proportional to the rate of flow, therefore, sensitivity should be adjusted at the lowest usable flow rate. Rotate R6 completely counter-clockwise, then slowly rotate R6 clockwise until the display correctly responds, then increase R6 slightly clockwise.

### Calibration Factor for Total & Rate

The calibration factor is derived from the turbines K-Factor (Pulses per gallon or other desired engineering unit). The K-Factor is listed on the calibration data sheet for the specific turbine being used.

$$C.F. = \frac{\text{Engineering Units}}{\text{K-Factor}}$$

Example # 1: K-Factor = 250 Pulses per gallon  
Desired Engineering Units = gallons  
C.F. =  $1/250 = .00400$

On the factoring P.C.B.

Set S6 #3 'ON' (↓ Position) for ÷ 100 (Moves decimal point right 2 places)

Set S2 @ 4, S3, S4, S5 @ 0 (Enters .4000)

Set S1 in '0' Position (0.4000)

The electronic accuracy can be verified by injecting a stable frequency @ TB1-10, 11 and incorporating the following formulas:

$$\text{Total} = \frac{F \times T \times C.F.}{D}$$

$$\text{Rate} = \frac{F \times C.F. \times 60}{D} \quad (\text{Rate is per minute})$$

Where F = Frequency in Hz

T = Time (Duration) of test in seconds

C.F. = Calibration Factor as entered in S1-S5

D = Divisor as entered in S6

Example #2: F = 500 Hz T = 2 min (120 sec) C.F. = .4000 D = 100

$$\text{Total} = \frac{500 \times 120 \times 4000}{100}$$

$$= \frac{60,000 \times 4000}{100}$$

$$= 24000/100 = 240 \text{ in 2 minutes}$$

$$\text{Rate} = \frac{500 \times .4000 \times 60}{100}$$

$$= 120 \text{ per minute}$$

**Calibration '0-1' Function**

The '0-1' function provides enhanced accuracy when totalization encompasses a large quantity for an extended period of time such as SCF produced in a 24 hour period.

The '0-1' function should be incorporated only when both conditions listed below are met:

- 1) C.F.'s 1<sup>st</sup> digit right of decimal is 1
- 2) C.F.'s 5<sup>th</sup> digit right of decimal is not 0

Example #3 Assume a turbine has a K-Factor of 79.58 pulses per SCF and the customer product demand is 520,000 SCF a day

$$\begin{aligned} \text{C.F.} &= 1/79.58 \\ &= .0125659 = .12566 \div 10 \quad \text{Note: Both conditions are met} \end{aligned}$$

Without the '0-1' function: S6 #2 'ON' ( $\div 10$ )  
 S2@1, S3@2, S4@5, S5@6  
 S1 in '0' Position

A usage of 520,000 SCF = 41,381,600 total pulses (520,000 x 79.58) and using the C.F. of S1-S6 the displayed quantity is 519,752 S (  $\frac{41,381,600 \times .1256}{10}$  ) rather than 520,000 for a difference of 248 SCF.

With the '0-1' function: Set S6 #2 'ON' ( $\downarrow$  Position) for  $\div 100$  (moves decimal right 2 places)  
 Set S2@2, S3@5, S4@6, S5@6 (.2566)  
 Set S1 in '1' Position (1.2566)

as stated above the 24 hr usage is 520,000 SCF. The displayed quantity is now 520,001 SCF (  $\frac{41,381,600 \times 1.2566}{100}$  ) for a difference of 1 SCF.

**Change of Calibration Engineering Units**

Assume that liters rather than gallons is the desired engineering unit.

Example # 4 K-Factor = 250 pulses per gallon  
 Liters = 3.785 per gallon

$$\text{C.F.} = \frac{\text{Units per Gallon}}{\text{Pulses per Gallon}}$$

$$\begin{aligned} \text{C.F.} &= 3.785 / 250 \\ \text{C.F.} &= .01514 \text{ for display of liters} \end{aligned}$$

On the Factoring P.C.B.:  
 Set S6 #2 'ON' ( $\downarrow$  Position) Moves decimal point right 1 place  
 Set S2@1, S3@5, S4@1, S5@4 (.1514)  
 Set S1 in '0' Position (0.1514)

Note: The '0-1' function was not incorporated because only 1 of the 2 conditions was met  
 C.F.'s 1<sup>st</sup> digit right of decimal is 1  
 C.F.'s 5<sup>th</sup> digit right of decimal is 0

Example #5: The Engineering Unit is pounds in 10<sup>th</sup>s CO<sub>2</sub>  
 K-Factor = 250 pulses per gallon  
 Pounds of CO<sub>2</sub> = 8.470 per gallon

In order to establish 10<sup>th</sup>s, increase lbs./gal. by a factor of 10  
 C.F. = 84.7/250  
 C.F. = .3388

On the Factoring P.C.B.:  
 Set S6 #1 'ON' (↓ Position) ÷ 1 does not move decimal point  
 Set S2@3, S3@3, S4@8, S5@8  
 Set S1 in '0' Position

If the gallons per unit volume such as 7.48 gallons per FT<sup>3</sup> is known, but not the unit volume per gallon as required to calculate the calibration factor; take the reciprocal of gallons per unit volume to derive the unit volume per gallon.

$$7.48 \text{ gallons per FT}^3 \quad 1/7.48 = .13369 \text{ FT}^3 \text{ per gallon}$$

Example #6: The engineering unit is ACF (FT<sup>3</sup>)  
 K-Factor = 250 pulses per gallon  
 ACF = .13369 per gallon  
 C.F. = .13369 / 250  
 C.F. = .0005348

On the Factoring P.C.B.:  
 Set S6 #4 'ON' (↓ Position) Moves decimal point right 3 places  
 Set S2@5, S3@3, S4@4, S5@8  
 Set S1 in '0' Position

Example #7: Desired Engineering Unit is ACF x 10  
 K-Factor = 250 pulses per gallon  
 ACF = .13369 per gallon

In order to establish x 10, decrease ACF/gal by a factor of 10  
 C.F. = .013369 / 250 = .00005348

On the factoring P.C.B.:  
 Set S6 #5 'ON' (↓ Position) Moves decimal point right 4 places  
 Set S2@5, S3@3, S4@4, S5@8 (.5348)  
 Set S1 in '0' Position (0.5348)

### **Field Correction of Calibration Factor**

To adjust the calibration factor to reflect the turbine's actual response to the operating conditions, incorporate the following formula:

$$\text{New C.F.} = \frac{\text{Actual Quantity}}{\text{Displayed Quantity}} \times \text{Present C.F.}$$

Example #8: Actual = 50  
 Displayed = 52  
 C.F. = .4000  
 New C.F. =  $50/52 \times .4000$   
           =  $.9615 \times .4000$   
           = .3846

On the factoring P.C.B.:  
 Set S2@3, S3@8, S4@4, S5@6

In the above example, .96 denotes that the meter is operating 4% fast. Multiplying by the present C.F. (.4000) by the Displayed:Actual Ratio (.96) effectively reduces the error by decreasing the C.F. by 4%.

Example #9: Actual = 52  
 Displayed = 50  
 C.F. = .4000  
 New C.F. =  $52/50 \times .4000$   
           =  $1.04 \times .4000$   
           = .4160

On the Factoring P.C.B.:  
 Set S2@4, S3@1, S4@6, S5@0

In the above example, 1.04 denotes that the meter is operating 4% slow. Multiplying the present C.F. (.4000) by the Displayed:Actual Ratio (1.04) effectively reduces the error by increasing the C.F. 4%.

### Rate Display Considerations

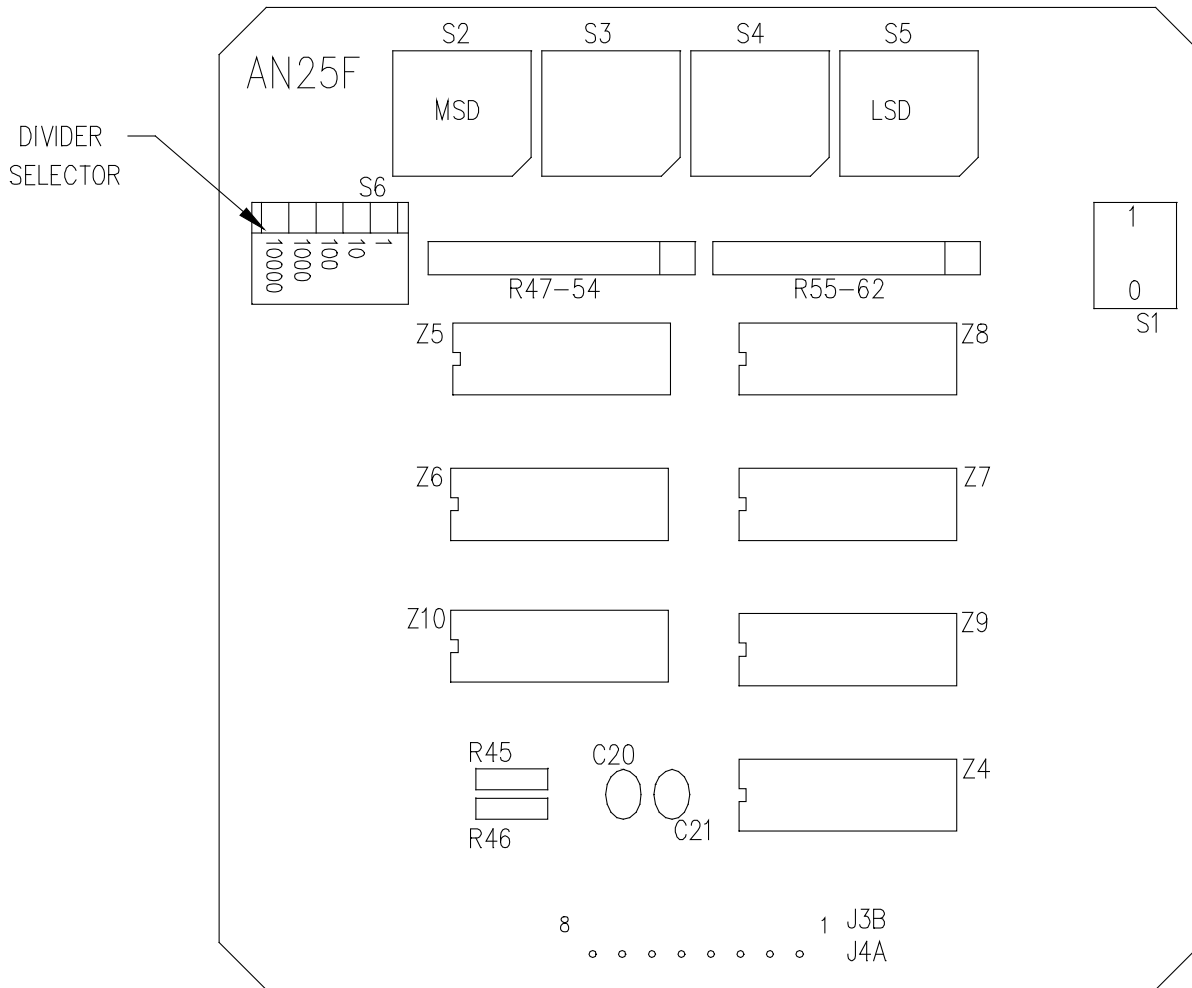
The displayed rate is limited to a maximum of 30,000. This characteristic must be considered when determining the displayed engineering unit. Note that if the desired rate displayed is other than 'Per Minute', the calibration factor is only correct for the rate displayed.

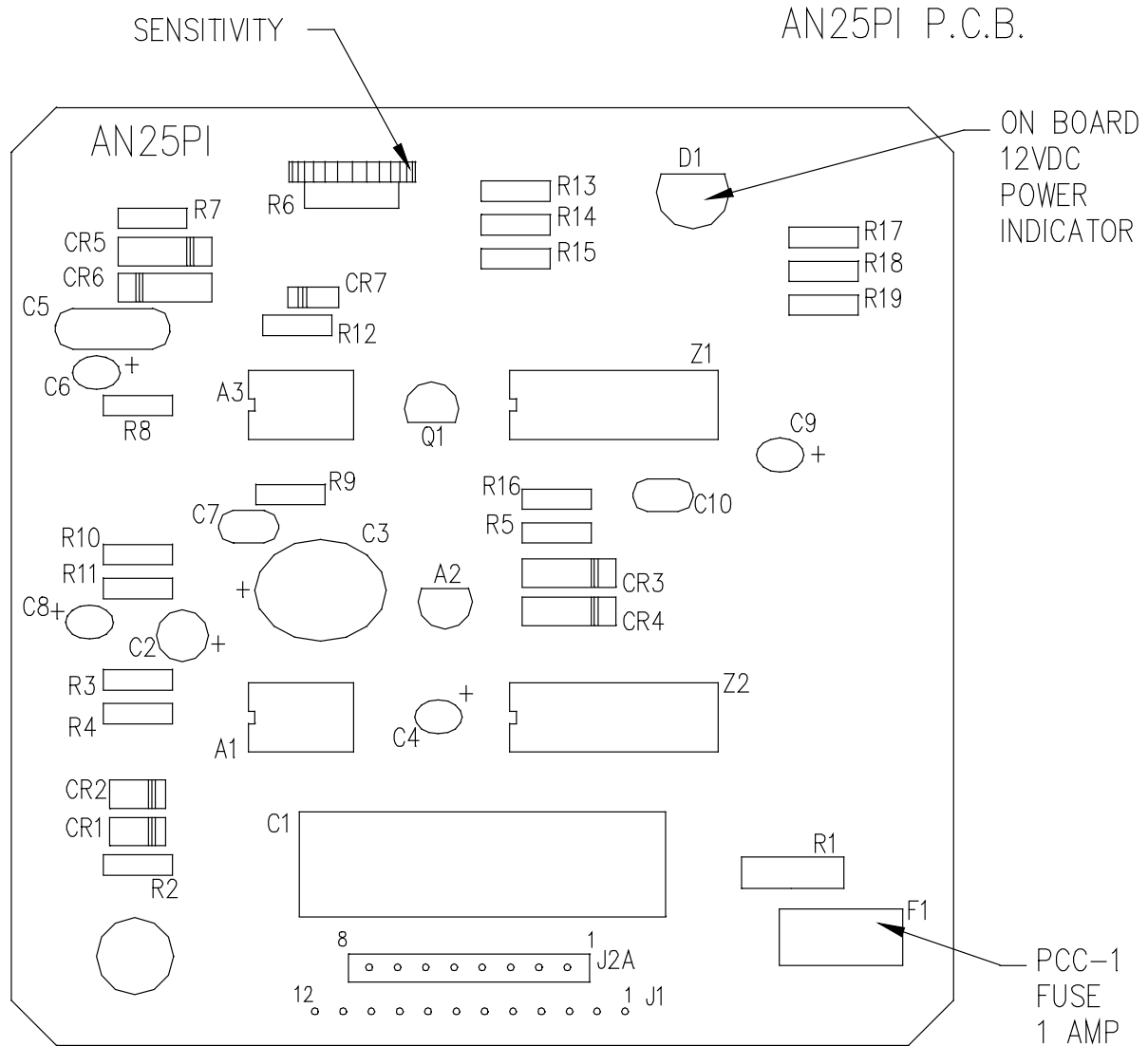
Example #10: A 1" turbine meter has a maximum flow rate of 60 GPM and a K-Factor of 970 pulses per gallon in Liquid Oxygen. The desired engineering unit is SCFH.  
 Given: 1 gallon O<sub>2</sub> = 115 SCF

- 1) Determine maximum flow rate; does it exceed 30,000?  
 $60 \text{ GPM} \times 115 \text{ SCF} = 6900 \text{ SCFM}$   
 $6900 \text{ SCFM} \times 60 = 414,000 \text{ SCFH}$   
 414,000 exceeds 30,000. Therefore, direct SCFH units are not permissible and some factor of SCFH must be determined.
- 2) Determine what factor of SCFH is permissible –  
 4140 is the largest SCFH factor under 30,000; 1/100 of the actual SCFH flow rate.
- 3) Determine the calibration factor for SCFH x 100-  
 K-Factor = 970 Pulses per gallon  
 SCF O<sub>2</sub> = 115 per gallon  
 A) In order to establish x 100 decrease SCF/Gal by a factor of 100 ( $115/100 = 1.15$ )  
 B) In order to establish per hour increase SCF/Gal by a factor of 60 ( $1.15 \times 60 = 69$ )  
     C.F. =  $69/970$   
     = .07113

On the Factoring P.C.B.:  
 Set S6 #2 'ON' (↓ Position) for ÷ 10 (moves decimal point right 1 place)  
 Set S2@7, S3@1, S4@1, S5@3 (.7113)  
 Set S1 in '0' Position (.07113)

AN25F P.C.B.





## Calibration of Analog Outputs

REQUIRED EQUIPMENT:      Power Supply 110 VAC or 12-16.5 VDC  
    2 Digital Multimeters (DMM)  
    Frequency Generator  
    Frequency Counter

NOTE: All test equipment power cords should be equipped with 2 prong "cheater" plugs.

- a) Connect power supply Positive (HOT) & Negative (NEU) leads to TB1-1,2 respectively.
- b) Connect #1 DMM Positive lead TB1-4. Connect #1 DMM Negative lead to 250  $\Omega$  resistor; Connect other end of resistor to TB1-5. Set DMM function to mA DC.
- c) Connect #2 DMM Positive & Negative leads to TB1-6, 7 respectively. Set DMM function to Volts DC.
- d) Connect frequency generator Positive & Negative leads to TB1-10, 11 respectively. Set output to sinewave and amplitude to zero.
- e) Set "Sensitivity" adjust R1 fully clockwise
- f) Install jumpers at JU1 or JU2 and JU3 or JU4 for desired frequency range.
- g) Select desired voltage output level. Install JU5 for 0-10V; omit for 0-5V.
- h) Turn Power Supply & Frequency Generator "ON"
- i) Adjust "ZERO" (R25) for 4.00mA #1 DMM indication.
- j) Adjust "ZERO" (R40) for .000VDC #2 DMM indication.
- k) Adjust signal amplitude of frequency generator to 50mV & frequency to maximum desired point (full scale frequency)
- l) Adjust "SPAN" (R22) for 20.00mA #1 DMM indication.
- m) Adjust "SPAN" (R36) for 5.00V or 10.00VDC #2 DMM indication.
- n) Reduce signal amplitude of frequency generator to zero. Adjust "ZERO" (R25) for 4.00mA #1 DMM indication, if necessary. Adjust "ZERO" (R40) for .000VDC #2 DMM indication, if necessary.
- o) Adjust signal amplitude of frequency generator to 50mV. Adjust "SPAN" (R22) for 20.00mA #1 DMM indication, if necessary. Adjust "SPAN" (R36) for 5.00V or 10.00VDC #2 DMM indication, if necessary.
- p) Adjust frequency of frequency generator to exactly 50% of maximum frequency point in step K. #1 DMM should indicate 12.00mA +/- .06mA; #2 DMM should indicate 2.50V or 5.00V +/- .02V.

To check for linearity @ any frequency point:

Voltage output:

$$F/F \text{ Max} \times \text{Full Scale Output} = \text{Volts}$$

Example: Assume maximum frequency point = 2KHz & full scale output = 10v. Check for linearity @ 750Hz point

$$750/2000 \times 10 = 3.75V \text{ #1 DMM should indicate } 3.75V \text{ +/- } .03V$$

mA output:

$$(F/F \text{ Max} \times 16) + 4 = \text{mA}$$

Example: Assume maximum frequency point = 2KHz  
 Check for linearity @ 750Hz point

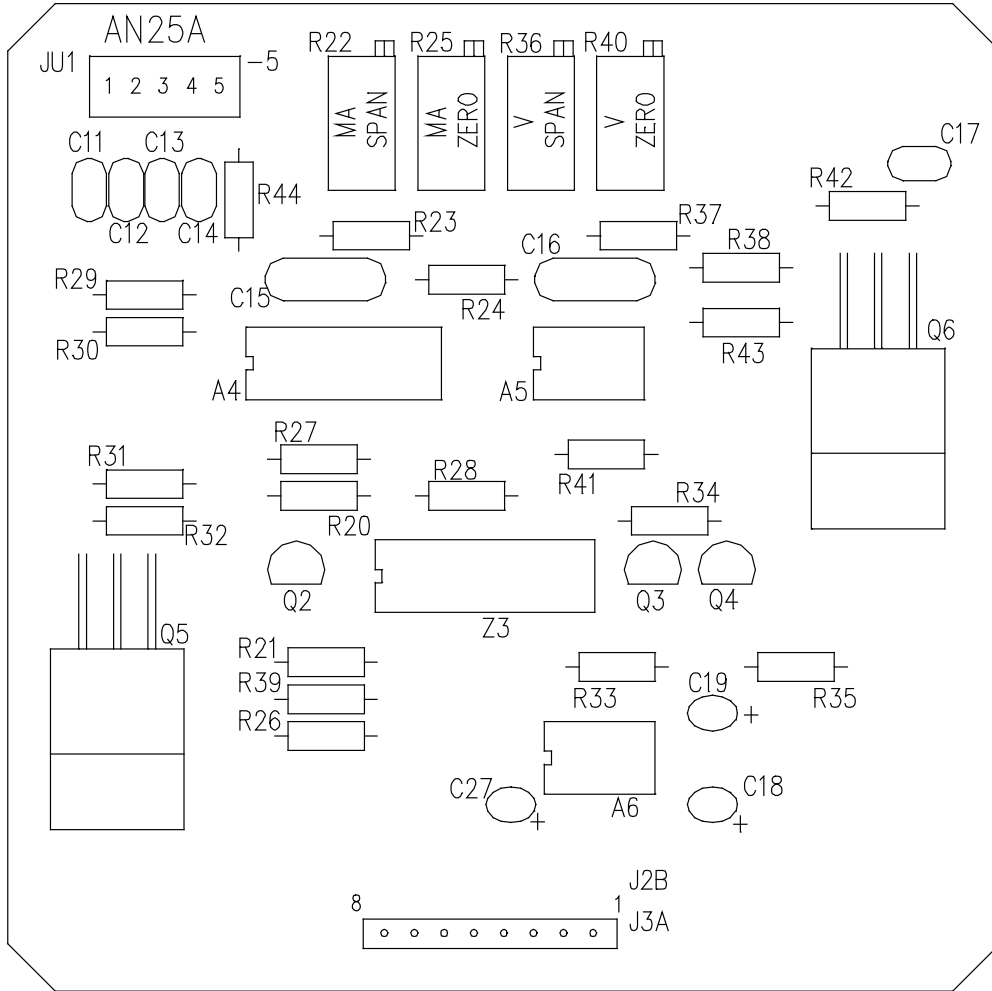
$$(750/2000 \times 16) + 4 = \text{mA}$$

$$(.375 \times 16) + 4 = \text{mA}$$

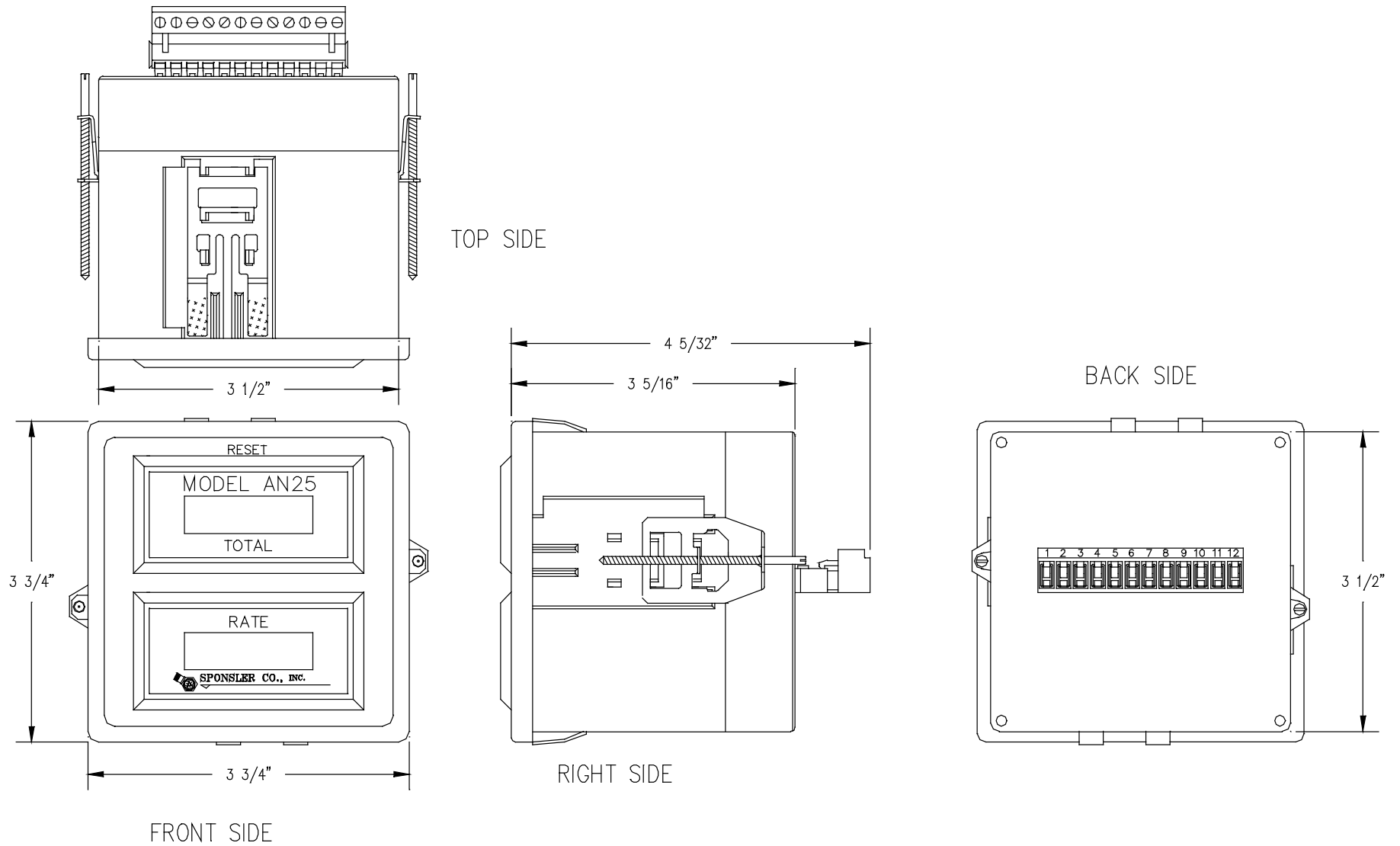
$$6 + 4 = 10\text{mA} \text{ #1 should indicate } 10.00\text{mA} \text{ +/- } .06$$

MA 1KHZ-10KHZ F/S  
MA 100HZ-1KHZ F/S  
MA 1KHZ-10KHZ F/S  
MA 100HZ-1KHZ F/S  
0-5/0-10 IN=0-10V  
1 2 3 4 5

AN25A P.C.B.



AN25: 1/4" DIN Dimensional Information





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