INSTALLATION & OPERATION MANUAL

IT200N REV. D
Remote Rate Indicator

DOC#: MN-200N-D.doc

LIQUID CONTROLS SPONSLER, INC.
FLOW MEASURING DEVICES AND CONTROLS
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IDEX
LIQUID CONTROLS GROUP

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SPECIFICATIONS

TEMPERATURE:
Operating -40 to 85°C
Storage –65 to 125°C

INPUT VOLTAGE:
Internal AA Lithium Battery
Battery Operating Life –
Rate Function: 3 years typical
(Assuming 24 hr. operation at max. flowrate)

INPUT SIGNAL:
Frequency 0-2500 Hz
Amplitude 25 mV – 36V sine or squarewave
Sensitivity field adjustable
Impedance 10K

DISPLAY:
LCD, 6 Digit .35" characters
Rate Indicator – 5 Digit
Leading zero blanking on rate display
Engineering units – Input factoring 1 – 99,999

OUTPUT:
Factored pulse output via open drains @ 1A
Pulse width 2ms

ACCURACY:
Rate Indicator +/- 1%

FEATURES:
Mounts directly on flowmeter
Reset externally initiated

ENCLOSURE:
FM Approved, C.S.A. Certified
Class I, Groups B,C,D
Class II, Groups E,F,G
Nema 4
Weight @ 2.5 lbs.

INTRODUCTION

General

The Model IT200N Industrial Remote Rate Indicator is a battery powered device that provides flow rate in any engineering unit. Rate is displayed via a 6-digit liquid crystal display. Selection of the reset function is accomplished externally by a magnetic field. This particular feature retains the unit's integrity permitting complete operational control in hazardous environments.

Negatives previously associated with LCD's – poor cold temperature performances, condensation which is a byproduct of heaters and display ghosting have all been eradicated by incorporating a low temperature coefficient LCD (-35^{o}C). All monolithic and discrete devices of the IT200N have temperature specs of –40 to 125^{o} C.

In addition, the IT200N provides 1 digital interface output. The scaled pulse output is an open drain configuration in which the pulse amplitude assumes the level of the host device. The output is a 2ms negative pulse for each unit of displayed rate.

Theory of Operation

The IT200N amplifies and shapes the incoming pulses generated by the turbine's response to flow. The amplified pulse train is then divided, factored by a phase locked loop (PLL) and combined with a timebase circuit for absolute accuracy.

Calibration

Field Calibration is accomplished by incorporating a calibration factor based on the turbine K-Factor. Divider switches provide divisional increments of 1-99,999. The calibration factor is entered via 5 BCD switches.

(SPONSLER, INC. STRONGLY RECOMMENDS THOROUGH REVIEW AND UNDERSTANDING OF THIS MANUAL PRIOR TO INSTALLATION)

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 impropriety or damage that may have occurred during shipment. Report any discrepancy to the factory immediately.

Physical

The IT200N Remote Rate Indicator is meter mounted and should be positioned as practically as possible taking into account display visibility, accessibility, etc. The IT200N enclosure is rated Class I Groups B,C,D; Class II Groups E,F,G; and Class III Nema 4 and will withstand the harshest environment.

Electrical

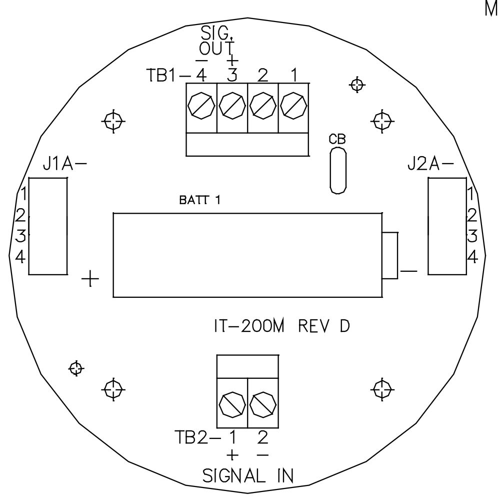
The IT200N Remote Rate Indicator is designed to operate with a single internal AA battery and requires no external wiring for power. Wiring of the digital output can be accomplished in a couple of different methods to fit the application. For the digital output, shielded cable (ALPHA 1710) is recommended to insure adequate noise immunity.

Signal

A 2-wire twisted pair with molex and tinned terminations is standard. Pin orientation of the molex connector or the tinned terminations is negligible.

FIGURE 1

IT200M REV D
MOUNTING P.C.B.

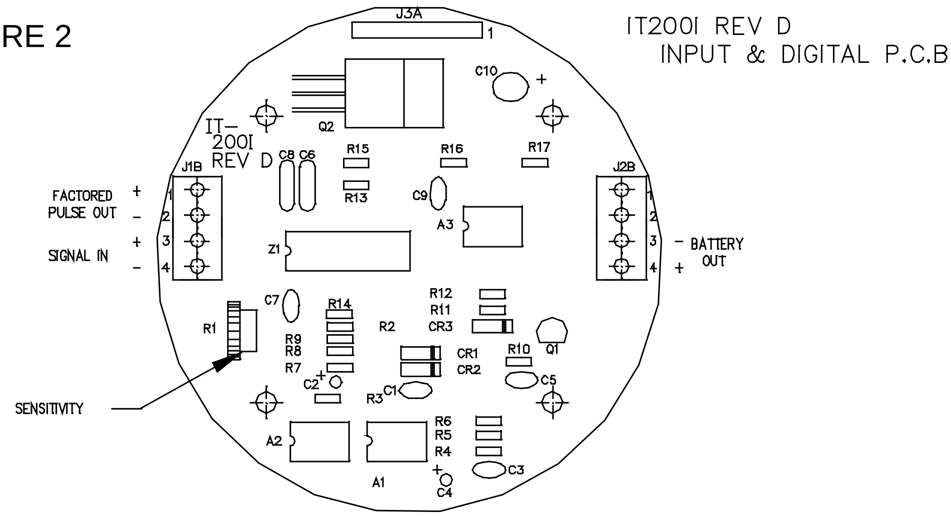


CALIBRATION

Sensitivity

The sensitivity adjust R1 is located on the IT200I (Input and Digital) 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 R1 completely counterclockwise then slowly rotate R1 clockwise until the display correctly responds then increase R1 slightly clockwise. The nominal R1 position is with the arrow indicating 11 o'clock.

FIGURE 2



Calibration Factor

The calibration factor is derived from the turbine's K-Factor (Pulses per gallon or other desired engineering unit).

$$C.F. = \frac{\text{K-Factor (Gallon)}}{\text{Engineering Units}}$$ **Formula 1**

EXAMPLE 1: K-Factor = 250 pulses per gallon
Engineering Units = gallons
$\therefore$ C.F. = 250/1 = 250

On the Factoring P.C.B.:
Set S1@0, S2@5, S3@2, S4@0, S5@0 (S5 is most significant digit, $\therefore$ CF entered is 00250)

The Calibration Factor is initially loaded @ 'POWER ON' or by activating RESET.

The electrical accuracy can be verified by injecting a stable frequency @ TB2-1,2 on the Mounting P.C.B. and incorporating the following formula:

$$\text{Rate} = \frac{F \times 60}{C.F.}$$ **Formula 2**

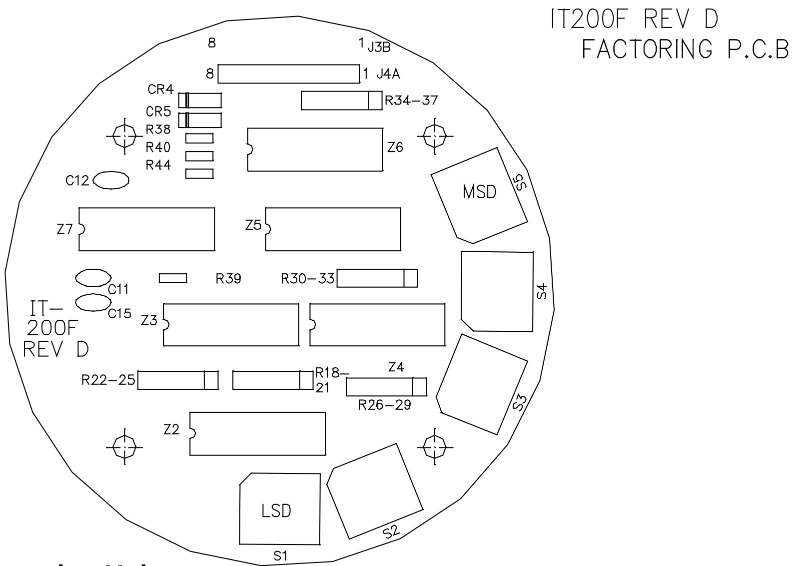
Where F = Frequency in Hz ($\text{Frequency} = \frac{\text{K-Factor x Flowrate}}{60}$)

C.F. = Calibration Factor as entered in S1-S5 (S5 is the most significant digit)

EXAMPLE #2: F = 500 Hz C.F. = 250

$$\text{Rate Displayed} = \frac{500 \times 60}{250} = \frac{30{,}000}{250} = 120$$

FIGURE 3



Change of Calibration Engineering Units

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

Example # 3: K-Factor = 250 pulses per gallon

Liters = 3.785 per gallon

$$\text{C.F.} = \frac{\text{Pulses per Gallon}}{\text{Units per Gallon}}$$ **Formula 3**

C.F. = 250/3.875

C.F. = 66 Pulses per liter

On the Factoring P.C.B.:
Set S1@6, S2@6, S3@0, S4@0, S5@0

Example #4: The Engineering Unit is pounds in 10ths CO_2
K-Factor = 250 pulses per gallon
Pounds of CO_2 = 8.470 per gallon

In order to establish 10ths, increase lbs./gal. by a factor of 10
C.F. = 250/84.7

C.F. = 3

On the Factoring P.C.B.:
Set S1@3, S2, 3, 4, 5@0

Example #5: The engineering unit is ACF (FT^3)
K-Factor = 250 pulses per gallon
ACF = .13369 per gallon

C.F. = .250/.13669

C.F. = 1870

On the Factoring P.C.B.:
Set S1@0, S2@7, S3@8, S4@1, S5@0

Example #6: 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. = 250/.013369 = 18700

On the factoring P.C.B.:
Set S1@0, S2@0, S3@7, S4@8, S5@1

If the gallons per unit volume, such as 7.48 gallons per FT^3, is known but no the unit volume per gallon as required to calculate the calibration factor, simply take the reciprocal of gallons per unit volume to derive the unit volume per gallon i.e. 7.48 gallons per FT^3 – 1/7.48 = .13369 FT^3 per gallon.

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:

$$\text{New C.F} = \frac{\text{Displayed Quantity}}{\text{Actual Quantity}} \times \text{Present C.F.}$$ **Formula 4**

Example #7: Actual = 50
Displayed = 52
C.F. = 250

New C.F.= 52/50 x 250 = 1.04 x 250 = 260

On the factoring P.C.B.:
Set S1@0, S2@6, S3@2, S4@0, S5@0

In the above example, 1.04 denotes that the meter is operating 4% fast. Multiplying the present C.F. (250) by the Displayed : Actual Ratio (1.04) effectively reduces the error by increasing the C.F. 4%.

Example #8: Actual = 52
Displayed = 50
C.F. = 250

New C.F. = 50/52 x 250 = .96 x 250 = 240

On the Factoring P.C.B.:
Set S1@0, S2@4, S3@2, S4@0, S5@0

In the above example, .96 denotes that the meter is operating 4% slow. Multiplying by the present C.F. (.250) by the Displayed : Actual Ratio (.96) effectively reduces the error by decreasing the C.F. by 4%.

Rate Display Considerations

The displayed rate is limited to a maximum of 30,000. This limitation must be considered when determining the displayed engineering unit. Note that if the rate displayed is other than 'Per Minute', the calibration factor is only correct for the rate function. The factored output pulse is correct with rate per minute only.

Example #9: 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_2 = 115 SCF

1) Determine maximum flow rate; does it exceed 30,000?
60 GPM x 115 SCF = 6900 SCFM
6900 SCFM x 60 = 414,000 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_2 = 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 x 60 = 69)

C.F. = 970/69 = 14

On the Factoring P.C.B.:
Set S1@4, S2@1, S3@0, S4@0, S5@0

Example #10: Using the specifics of example #9 establish SCFM as an engineering unit.

C.F. = 970/115 = 8

On the Factoring P.C.B.:
Set S1@8, S2@0, S3@0, S4@0, S5@0

To check the C.F. calculations, formula #2 or #3 should be incorporated. Frequently, only the K-Factor is known, so it is necessary to determine the frequency for a given flow rate; to do so use this formula:

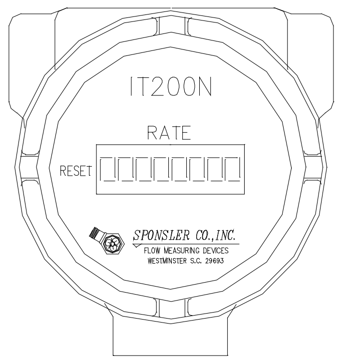
Frequency = K-Factor x Flowrate ÷ 60

FUNCTION SELECTION

Reset Function

Reset is valid only to load a new calibration factor.
Reset is initiated externally by placing a magnet in the proximity of reset S6 located on the Display P.C.B. and indicated on the enclosure label as ‘RESET’.

FIGURE 4

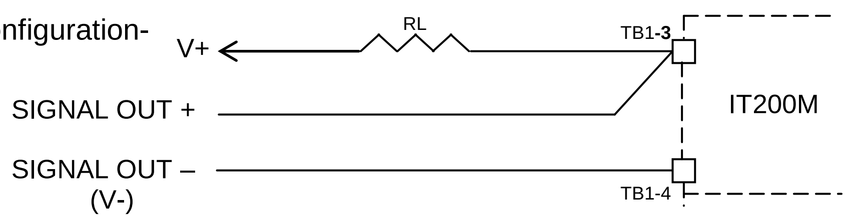


MISCELLANEOUS

Factored Digital Pulse Output

This signal output is an open drain configuration that can sink 1A continuously. The maximum drain voltage should not exceed 150VDC (V+). A pull-up resistor must be in series with V+ and TB1-3. The output is a 2ms negative pulse for each engineering unit i.e. 1 pulse for each gallon, lb., etc..

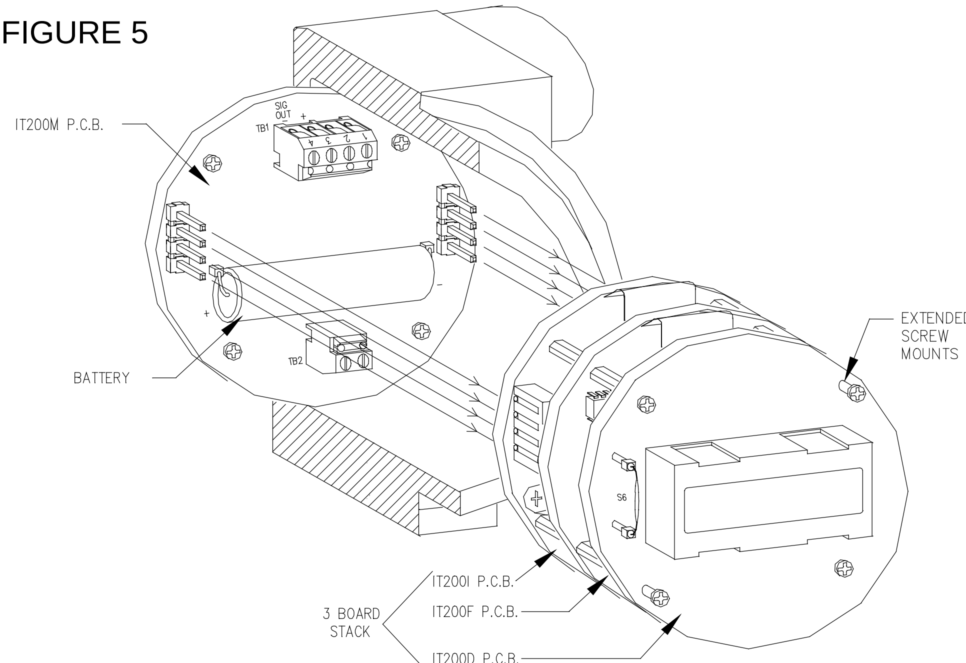
Typical Configuration-



Battery Replacement

The battery is located on the Mounting P.C.B. and inserts into 2 sockets. When installing the battery, it is imperative to OBSERVE POLARITY. Simply pull the 3-board stack (See Figure #5) out of the enclosure, install the battery and reinsert the board stack. The display will be all zeros.

FIGURE 5



This figure illustrates the removal of the 3-board stack from the condulet. Note that the mounting board is not removed.

CAUTION: Do not use the LCD module or S6 as grip points to remove the board stack. Use the extended screw mounts provided.

To put the 3-board stack back in the condulet, align as illustrated and push down.

% of Flow Display

By incorporating a calibration factor formula the IT200N can be used to display rate of flow as a percentage

% C.F. = F/S Frequency x 60/100

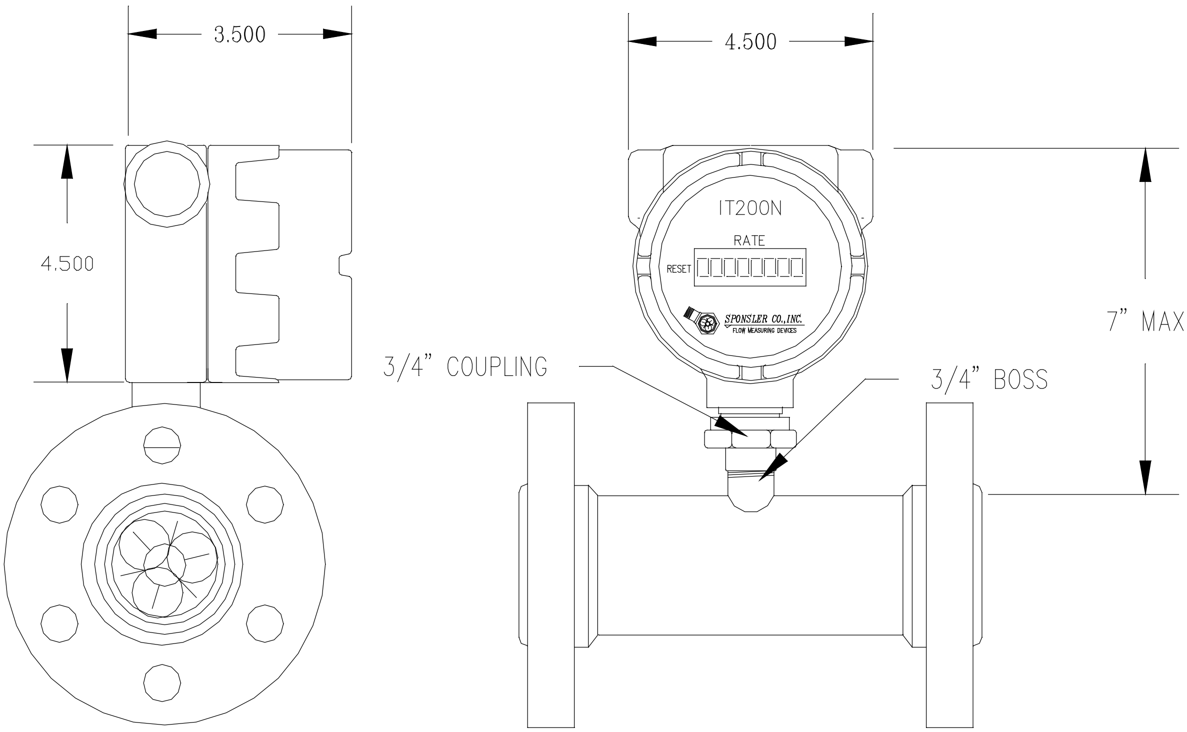
Example #11: The calibration sheet indicates that the maximum flow rate of an 1 ½” flowmeter is 130 GPM @ a frequency of 500Hz, 65 GPM (50%) = 250 Hz

% C.F. = 500 Hz x 60/100
= 30,000/100
= 300

On the Factoring P.C.B.:
Set S1@0, S2@0, S3@3, S4@0, S5@0
Given 65 GPM = 250 Hz = 50%   % = 250 Hz x 60/300 = 50% displayed

Dimensional Information

FIGURE 6



3.500
4.500
4.500
IT200N
RATE
RESET
SPONSLER CO.,INC.
FLOW MEASURING DEVICES
7" MAX
3/4" COUPLING
3/4" BOSS