

INSTALLATION & OPERATION MANUAL

IT200N REV. D Remote Rate Indicator

DOC#: MN-200N-D.doc



Precision Industrial Flow Measuring Devices and Controls

2363 Sandifer Boulevard, Westminster, South Carolina 29693 USA

Voice: (864) 647-2065 FAX: (864) 647-1255

1-800-258-1165 www.sponsler.com

TABLE OF CONTENTS

	PAGE #
SPECIFICATIONS	3
INTRODUCTION	4
General	4
Theory of Operation.....	4
Calibration	4
INSTALLATION	5
Installation	5
Physical	5
Electrical.....	5
Signal	5
CALIBRATION	6
Sensitivity	6
Calibration Factor	6,7
Change of Calibration Engineering Units.....	7,8
Field Correction of Calibration Factor	8,9
Rate Display Considerations.....	9
FUNCTION SELECTION	10
Reset Function	10
MISCELLANEOUS	10
Factored Digital Pulse Output.....	10
Battery Replacement	11
% of Flow Display	11
LIST OF ILLUSTRATIONS	
Figure 1 – Mounting P.C.B.	5
Figure 2 – Input & Digital P.C.B.	6
Figure 3 – Factoring P.C.B.	7
Figure 4 – Resetting the Display.....	10
Figure 5 – Board Stack Removal.....	11
Figure 6 – Dimensional Information	12

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°C). All monolithic and discrete devices of the IT200N have temperature specs of -40 to 125° 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 CO., 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.

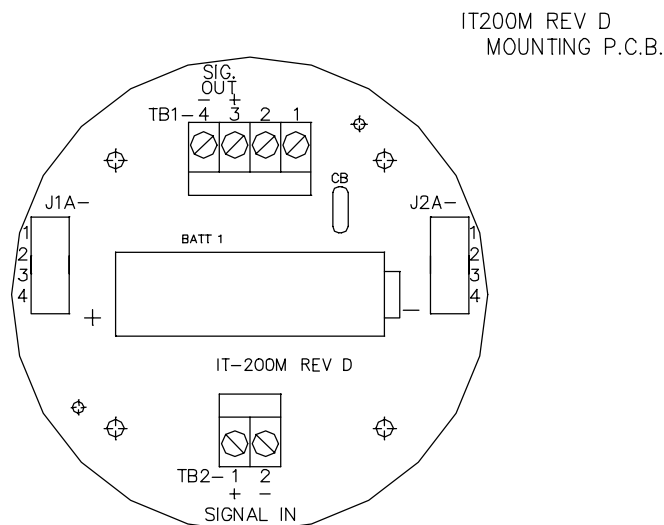
Electrical

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 moxex and tinned terminations is standard. Pin orientation of the moxex connector or the tinned terminations is negligible.

FIGURE 1

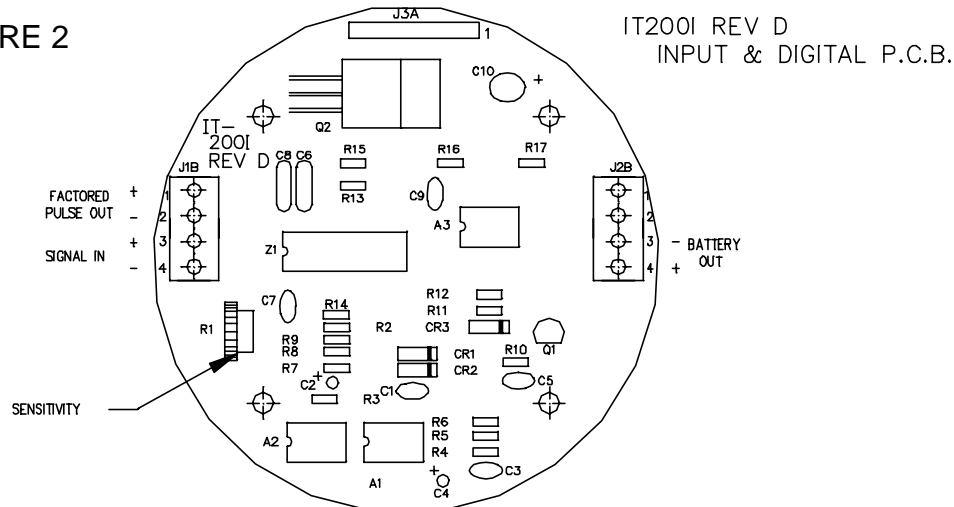


CALIBRATION

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).

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

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:

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

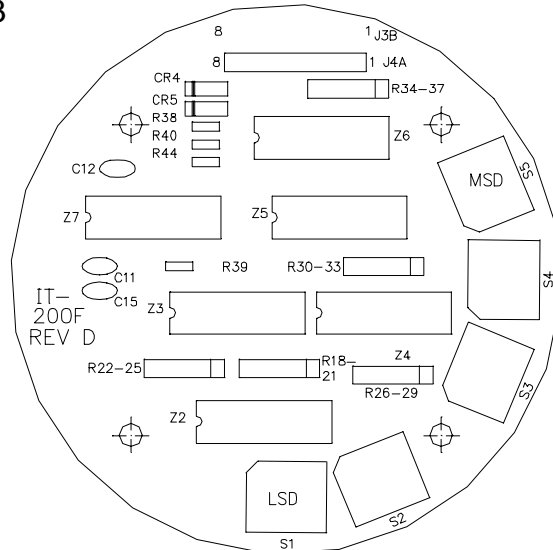
Where F = Frequency in Hz (Frequency = $\frac{\text{K-Factor} \times \text{Flowrate}}{60}$)

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

EXAMPLE #2: F = 500 Hz C.F. = .4000

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

FIGURE 3



IT200F REV D
FACTORING P.C.B.

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

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

$$\text{C.F.} = 250/3.875$$

$$\text{C.F.} = 66 \text{ Pulses per liter}$$

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 CO₂

K-Factor = 250 pulses per gallon

Pounds of CO₂ = 8.470 per gallon

In order to establish 10ths, increase lbs./gal. by a factor of 10

$$\text{C.F.} = 250/84.7$$

$$\text{C.F.} = 3$$

On the Factoring P.C.B.:

Set S1@3, S2, 3, 4, 5@0

Example #5: The engineering unit is ACF (FT³)

K-Factor = 250 pulses per gallon

$$\text{ACF} = .13369 \text{ per gallon}$$

$$C.F. = .250/.13669$$

$$C.F. = 1870$$

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 FT³, is known but not 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 FT³ – 1/7.48 = .13369 FT³ 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:

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

Example #7: Actual = 50

Displayed = 52

C.F. = 250

$$\text{New C.F.} = 52/50 \times 250 = 1.04 \times 250 = 260$$

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

$$\text{New C.F.} = 50/52 \times 250 = .96 \times 250 = 240$$

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 O₂ = 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-

$$\text{K-Factor} = 970 \text{ Pulses per gallon}$$

$$\text{SCF O}_2 = 115 \text{ per gallon}$$

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 ($1.15 \times 60 = 69$)

$$\text{C.F.} = 970/69 = 14$$

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.

$$\text{C.F.} = 970/115 = 8$$

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:

$$\text{Frequency} = \text{K-Factor} \times \text{Flowrate} \div 60$$

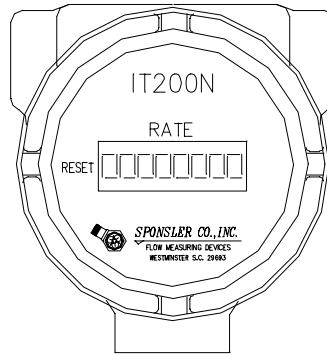
FUNCTION SELECTION

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'.

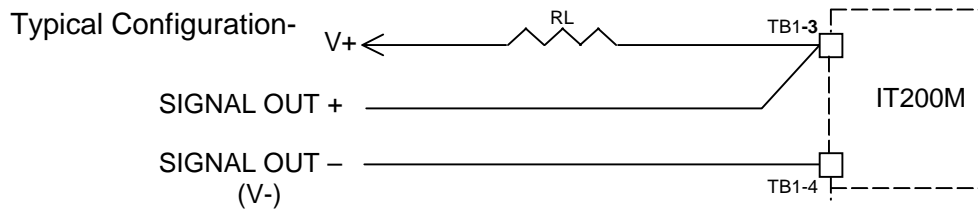
FIGURE 4



MISCELLANEOUS

Factored Digital Pulse Output

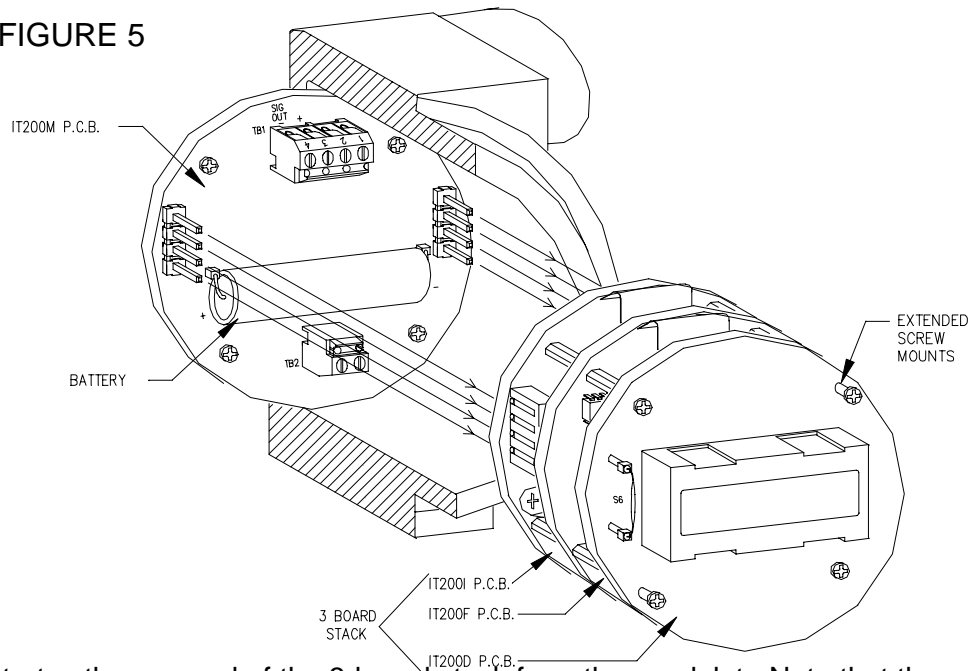
This signal output is an open drain configuration that can sink 1A continuously. The maximum drain voltage should not exceed 150VDC (V+). A pull-up resistor must be in series with V+ and TB1-3. The output is a 2ms negative pulse for each engineering unit i.e. 1 pulse for each gallon, lb., etc..



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

$$\% \text{ C.F.} = F/S \text{ Frequency} \times 60/100$$

Example #11: The calibration sheet indicates that the maximum flow rate of an 1 1/2" flowmeter is 130 GPM @ a frequency of 500Hz, 65 GPM (50%) = 250 Hz

$$\begin{aligned} \% \text{ C.F.} &= 500 \text{ Hz} \times 60/100 \\ &= 30,000/100 \\ &= 300 \end{aligned}$$

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

