INSTALLATION & OPERATION MANUAL

IT275N REV. A
Remote Totalizer & Rate Indicator

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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 – 2 years assuming 24 hr. operation Battery Shelf Life – 10 years
INPUT SIGNAL:	Frequency 0-2500 Hz Amplitude 20 mV – 28V Sine or Squarewave Sensitivity field adjustable Impedance 10K
DISPLAY:	Totalizer: LCD, 8 Digit .3” characters Rate Indicator: LCD, 6 Digit, .35” characters Leading Zero Blanking on Rate Indicator Input Factoring .00000001 – 1.9999 allows totalization and rate in any engineering unit
OUTPUT:	4-20mA Control Loop 5-56V Loop Voltage 4-20mA Representation Proportional to flow Independent Zero & Span adjustments Loop Control Circuitry consumes no power from loop
ACCURACY:	Totalizer +/- 1 count Rate Indicator +/- 1% 4-20mA output .3% F/S
FEATURES:	Mounts directly on flowmeter Totalizer externally reset
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 IT275N Industrial Remote Totalizer & Rate Indicator is a battery powered device that provides flow totalization & rate in any engineering unit. Total is displayed via an 8-digit liquid crystal display; Rate via a 6-digit liquid crystal display. The Totalizer 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 IT275N have temperature specs of –40 to 125^{o}C.

In addition the IT275N provides 1 analog interface output. The 4-20mA loop control extracts no power from the loop.

Theory of Operation

The IT275N amplifies and shapes the incoming pulses generated by the turbine's response to flow. The amplified pulse train is then factored and divided to produce a totalized display in the desired engineering unit. In the rate circuit, the divided pulse train is factored by a phase locked loop (PLL) and combined with a timebase circuit for absolute accuracy. This configuration permits the calibration factor to be universal for the total and rate displays.

Calibration

Field calibration is accomplished by incorporating a calibration factor based on the turbine's K-Factor. The calibration factor range is .00000001 – 1.9999. The calibration factor is entered via 4 BCD switches, a divider switch and a '0-1' switch for the total and rate functions.

Calibration of the 4-20mA loop control is established by a F/S Frequency selector switch in conjunction with the zero and span adjustments. 4-20mA calibration is independent of the calibration factor entered for total & rate display units.

(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 IT275N Remote Totalizer & Rate Indicator is meter mounted and should be positioned as practically as possible taking into account display visibility, accessibility, etc. The IT275N 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.

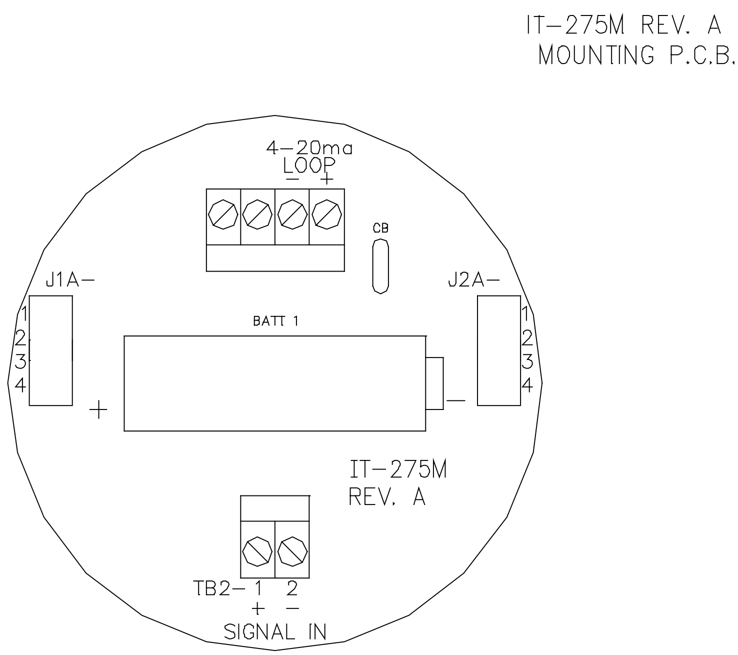
Electrical

The IT275N Remote Totalizer & Rate Indicator is designed to operate with a single internal AA battery and requires no external wiring for power. Wiring of the analog output can be accomplished in a couple of different methods to fit the application. For the analog output, shielded cable is not required.

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

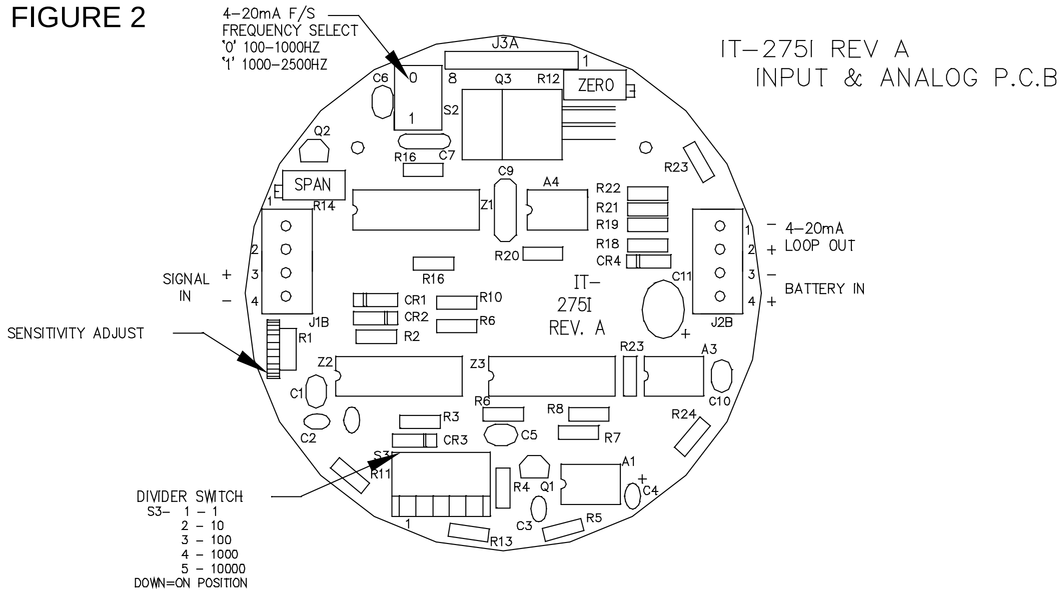


CALIBRATION

Sensitivity

The sensitivity adjust R1 is located on the IT275I (Input and Analog) PCB. 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).

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

The calibration factor is used for total and rate; the desired engineering unit for totalization is also the engineering unit for displayed rate per minute. 2 different engineering units for total and rate is not possible.

Example 1: K-Factor = 250 pulses per gallon
Engineering Units = gallons
∴ C.F. = 1/250 = .004000

On the IT275I PCB:
Set S3 #3 'ON' (↓ Position) for ÷ 100 (moves decimal point right 2 places)

On the IT275F PCB
Set S5@4, S6, 7, 8@0 (.4000)
Set S4 in ‘0’ position (0.4000)

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

$$\text{Total} = \frac{F \times T \times C.F.}{D}$$ **Formula 2**

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

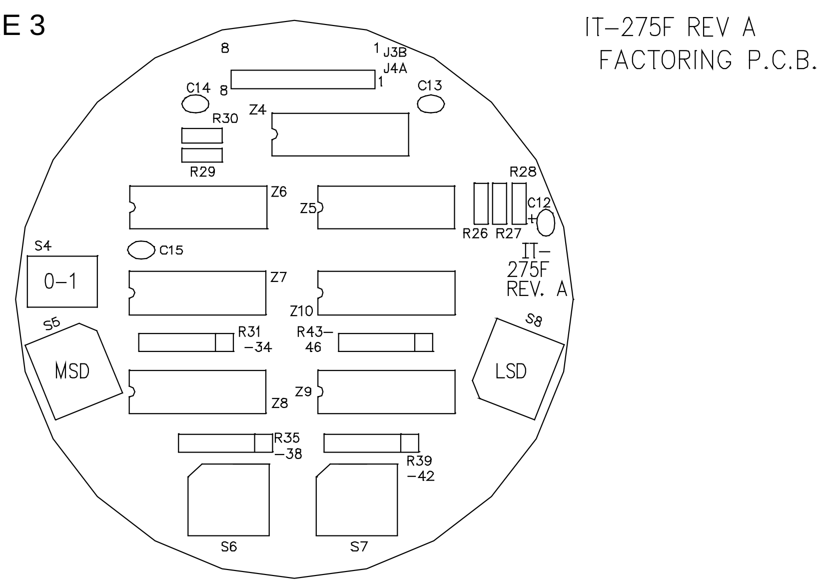
T = Time (Duration) of test in seconds
C.F. = Calibration Factor as entered in S4-S8
D = Divider as entered in S3

Example 2: F = 500 Hz T = 1 minute (60 sec) C.F. = .4000

$$\text{Total Displayed} = \frac{500 \times 60 \times .4000}{100} = \frac{30{,}000 \times .400}{100} = \frac{12000}{100} = 120 \text{ in 1 minute}$$

Rate Indicator will display 120 continuously.

FIGURE 3



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 1ST digit right of decimal is 1
2) C.F.’s 5th 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

C.F. = 1/79.58 = .0125659 = .12566 ÷ 10 Note: Both conditions are met

Without the '0-1' function: S3 #2 'ON' (↓ Position) for ÷ 10 (moves decimal right 1 place)
S5@1, S6@2, S7@5, S8@7 (.1257 rounding 4th digit)
S4 in '0' Position (0.1257)

A usage of 520,000 SCF = 41,381,600 total pulses (520,000 x 79.58) and using the C.F. of S4-S8 the displayed quantity is 520,166 SCF ($\frac{41{,}381{,}600 \times .1256}{10}$)
rather than 520,000 for a difference of 166 SCF.

With the '0-1' function: Set S3 #3 'ON' (↓ Position) for ÷ 100 (moves decimal right 2 places)
Set S5@2, S6@5, S7@6, S8@6 (.2566)
Set S4 in '1' Position (1.2566)

As stated above the 24 hr usage is 520,000 SCF. The displayed quantity is now 520,001 SCF ($\frac{41{,}381{,}600 \times 1.2567}{100}$) for a difference of 1 SCF

<u>Change of Calibration Engineering Units</u>

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

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

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

C.F. = 3.785/250 = .01514 for display of liters

On the IT275I PCB:
Set S3 #2 'ON' (↓ Position) moves decimal point right 1 place

On the IT275F P.C.B:
Set S5@1, S6@5, S7@1, S8@4 (.1514)
Set S4 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 1st digit right of decimal is 1

Example 5: 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. = 84.7/250 = .3388

On the IT275I PCB:
Set S3 #1 'ON' (↓ Position) does not move decimal point

On the IT275F PCB:
Set S5@3, S6@3, S7@8, S8@8 (.3388)
Set S4 in '0' Position (0.3388)

Note: If the gallons per unit volume such as 7.48 gallons per FT^3 is known, but not the unit volume per gallon as required to calculate calibration factor; 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

Example 6: The engineering unit is ACF (FT^3)
K-Factor = 250 pulses per gallon
ACF = .13369 per gallon
C.F. = .13369 / 250 = .00053476

On the IT275I PCB:
Set S3 #4 'ON' (↓ Position) moves decimal point right 3 places

On the IT275F PCB:
Set S5@5, S3@3, S7@4, S8@8 (.5348 rounding the 4th digit)
Set S4 in '0' Position (0.5348)

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 IT275I PCB:
Set S3 #5 'ON' (↓ Position) moves decimal point right 4 places

On the IT275F PCB:
Set S5@5, S6@3, S7@4, S8@8 (.5348 rounding the 4th digit)
Set S4 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:

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

Formula 4

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

On the IT275N PCB:
Set S5@3, S6@8, S7@4, S8@6

In the above example, .9615 denotes that the meter is operating 4% fast. Multiplying by the present C.F. (.4000) by the Actual: Displayed Ratio (.9615) 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 x .4000
= 1.04 x .4000
= .4160

On the Factoring PCB:
Set S5@4, S6@1, S7@6, S8@0

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

4-20mA Analog Output

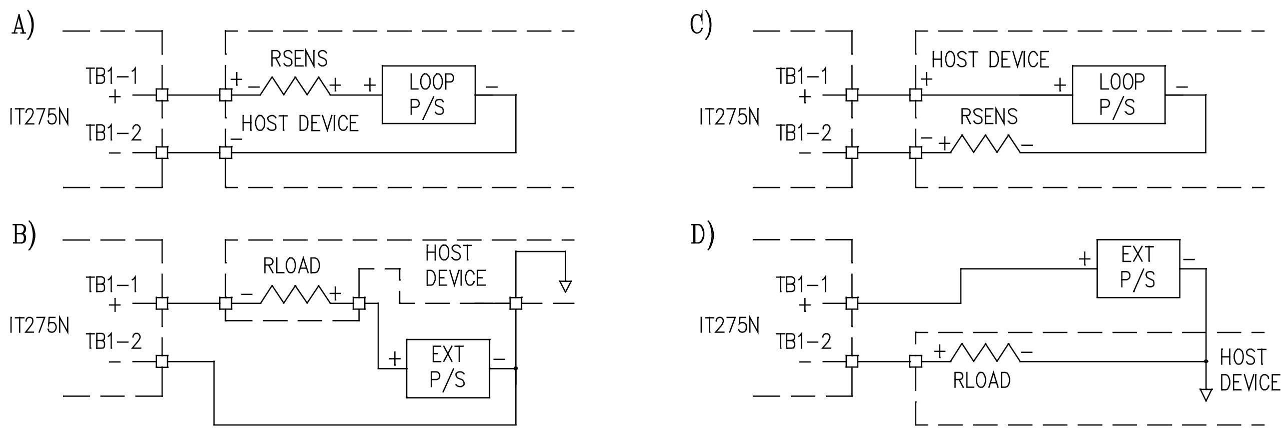
The IT275N provides a 4-20mA loop control that is proportional to the flow rate. The frequency-current converter output is intended to control a 4-20mA loop, but will transmit a 4-20mA signal into a load if an external excitation voltage is provided.

The IT275N requires 5.6V of the loops total voltage; therefore, if a 250 ohm sense or load resistor is incorporated the minimum loop or excitation voltage must be 10.6V, 5.6V + (.02 x 250). The maximum loop or excitation is 57.6V, 56.6V + (.004 x 250).

Minimum Loop Voltage = 5.6 + (.02 x R)   Maximum Loop Voltage = 56.6 + (.004 x R)

All adjustments for the 4-20mA output are located on the IT275I PCB (Refer to FIGURE 2). The full-scale frequency is selected by F/S range select S2, ‘0’ = 100 – 1000 Hz, ‘1’ = 1000 – 2500 Hz F/S Frequency. To calibrate the 4-20mA output adjust ‘Zero’ (R12) for 4mA @ 0 Hz and ‘Span’ (R14) for 20mA @ the full-scale frequency. The zero and span adjustments are independent.

Typical Output Configuration –



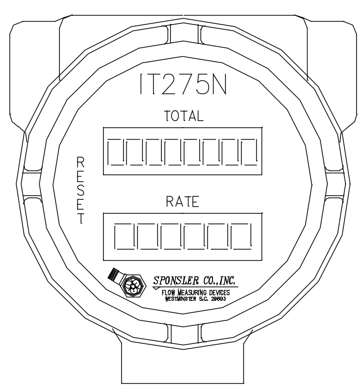
Although the IT275N will function in all configurations caution must be exercised when incorporating configurations C and D because the IT275N ground assumes the potential developed across the sense or load resistance and must be considered when an external signal source such as a frequency generator is used for calibration. A ‘cheater’ plug may be required to allow all test equipment to float and assume IT275 ground potential.

FUNCTION SELECTION

Reset Function

Reset is incorporated to set the TOTAL Display to 00000000.
Reset is initiated externally by placing a magnet in the proximity of reset S9 located on the Display PCB and indicated on the enclosure label as ‘RESET’.

FIGURE 4

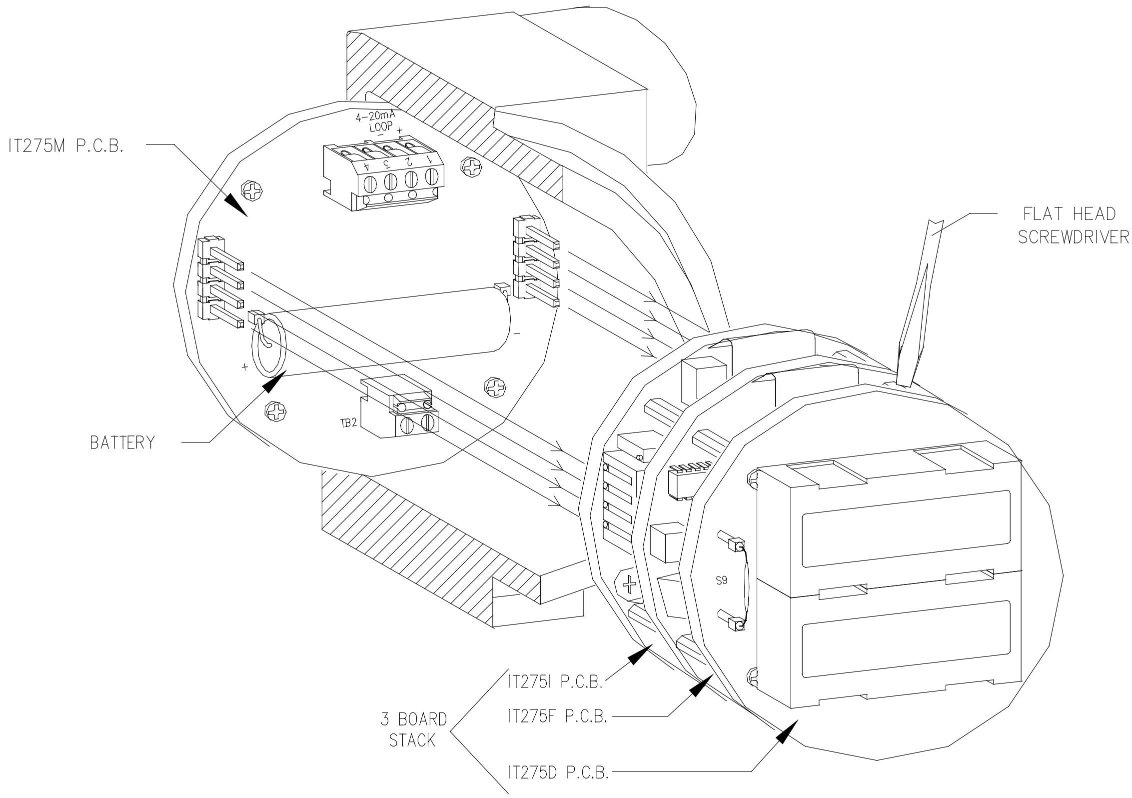


MISCELLANEOUS

Battery Replacement

The battery is located on the Mounting PCB 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



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

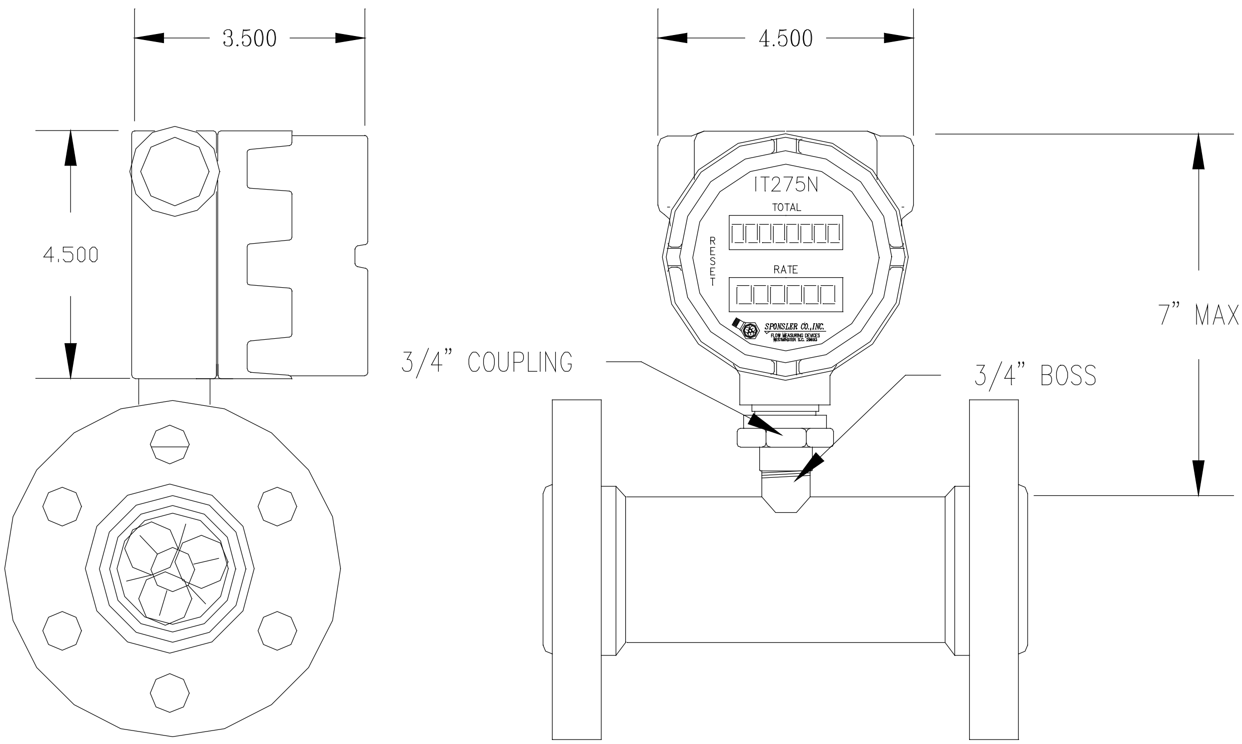
CAUTION: Do not use the LCD's or S9 as grip points to remove the board stack.

To Remove: Place a flat head screwdriver under the edge of the IT275D board and lift up gently until the board stack is far enough out of the condulet to grab hold of the outer edge of the top board.

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

Dimensional Information

FIGURE 6



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