IN-889B Flow Transmitter

Programmable flow or frequency input to 2 wire 4~20mA loop powered output

Features.

- **Programmable.**
- **Cost Effective.**
- **Easily Calibrated.**
- **DIN Rail Mount. (Optional IP67 Case.)**
- **Solid State Reliability.**
- **Reverse Polarity Protected.**
- **Zero Adjustment.**
- **Span Adjustment.**
- **Board and Components Coated With Isonel 642. (Except Terminals and DIP Switches.)**

IN-899B-E

Description.

The model IN-889B Loop Powered Transmitter was primarily designed and manufactured for use with flow transducers to provide a calibrated signal for accurate flow measurement of liquids. The voltage input signal from the flow transducer is amplified and converted into a 4~20 mA current. The first 4 mA of current is used to power the transmitter. DIP switches provide easy and accurate means of calibrating the transmitter into the required engineering units. This unit is available in either DIN rail mount or polycarbonate case (IP67).

Ordering Information.

IN-899B-D	Paddle Wheel Input, DIN Rail Mount Unit.
IN-899B-E	Paddle Wheel Input, IP67 Unit.
IN-899B-D-PROX	Reed Switch or Proximity Switch Input, DIN Rail Mount Unit.
IN-899B-E-PROX	Reed Switch or Proximity Switch Input, IP67 Unit.

Note: Standard Calibration = 0~100Hz Input, 4~20mA Output.

Specifications.

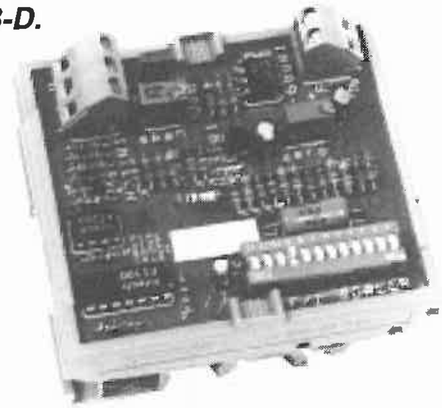
Input Frequency Range	0~6Hz to 0~500Hz. Input frequency ranges outside this range are also available on request.
Output	4~20mA.
Output Damping	Automatic increase in damping for lower input frequency ranges.
Power Supply	8~32Vdc.
Supply Voltage Sensitivity	<±0.01%/V FSO.
Maximum Current	Limited to <25mA.
Load Resistance	800Ω Max. @ 24Vdc. (50Ω/V Above 8Vdc.)
Linearity Error	<±0.3% FSO. Typical.
Temperature Drift	<±0.04%/C FSO. Typical.
Operating Temperature	0~70C.
Storage Temperature	-20~80C.
Operating Humidity	90%RH Max. Non-condensing. (IN-889B-D)

Note 1. Specifications based on Standard Calibration Unit, unless otherwise specified.
Note 2. Due to ongoing research and development, designs, specifications, and documentation are subject to change without notification. No liability will be accepted for errors, omissions or amendments to this specification.
Note 3. Further ranging and installation information supplied with each unit, and is available upon request.

Quality Assurance Programme.

The modern technology and strict procedures of the ISO9001 Quality Assurance Programme applied during design, development, production and final inspection grant long term reliability of the instrument.

IN-889B-D.



Dimensions.

IN-899B-D	L=68mm	W=77mm	H=44mm
IN-899B-E	L=140mm	W=80mm	H=65mm

DIP Switch Settings Table.

Use these DIP switches to set input frequency range.

Dip Switch	1	2	3	4	5	6	7	8	9	10	11	12
Switch Value	1	2	4	8	10	20	40	80	100	200	400	800

IN-889B Calibration and Connections.

Formula: DIP switch value = 10,000 divided by full scale frequency.
Example: We want 4~20 mA out from an IN-889B to represent 0~2000 l/min in a 4" schedule 40 pipe.

(1) From the 'Flow Research Impellor Transducer Calibration Data' (next page) for schedule 40, 4"

Total number of pulses/min => 2000l x 2.074pulses/l = 4148pulses

(2) Full scale frequency => 4148 / 60sec = 69.1Hz.

(3) Put this figure into the formula.
DIP switch value = 10,000 divided by 69.13 = 144.648

(4) Take this DIP switch value to the nearest whole number. = 145.

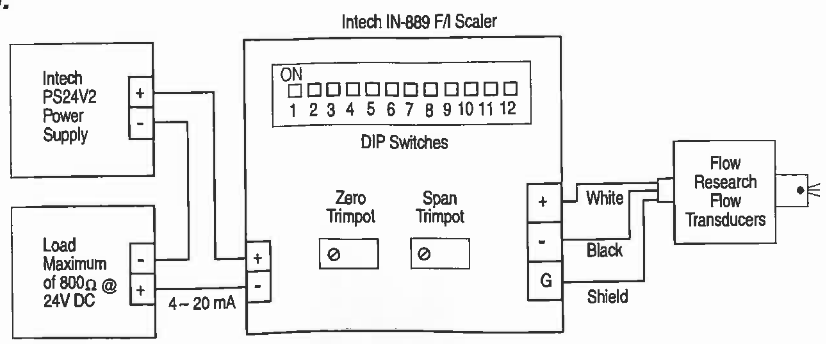
(5) 145 = 100 + 40 + 4 + 1 } From DIP Switch Settings Table.

Dip Switch: **9** **7** **3** **1**
Turn DIP switches 9, 7, 3 & 1 off and all others on.
Note: Do not enter a DIP switch value of less than 20.

(6) For high calibration accuracy, all settings should be checked using a frequency generator and fine tuned using the zero and span trimpots.
Use Zero trimpot for 4.00 mA at zero frequency input. (Turn clockwise to increase the reading.)
Use Span trimpot to adjust for 20.00 mA at full scale frequency input. (Turn clockwise to increase the reading.)

IN-889B Connection Diagram.

Note: This diagram applies to a paddle wheel input. ie IN-889B-D or IN-889B-E.



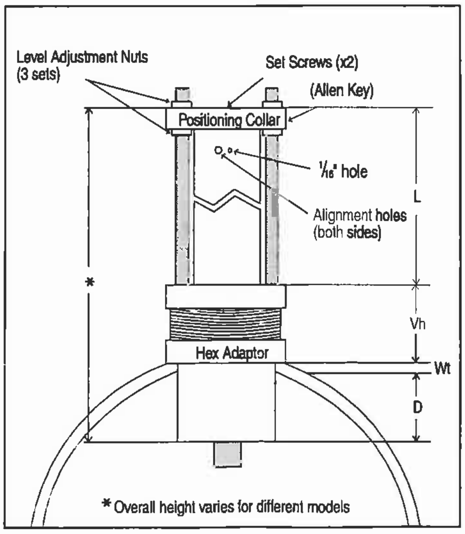
Flow Research Corporation Impellor Transducer Output Calibration.

Model	Pipe Size			Minimum Flow Rate (l/min)	Maximum Flow Rate (l/min)	Output (pulses/l)
	Schedule*	Nominal (")	I.D. (mm)			
TR475		½	12.7	3.6	107.6	65.722
TR475		¾	19.05	6.3	188.8	42.346
TR475		1	25.4	10.2	305.8	23.194
TR475		1¼	31.75	17.6	529.4	12.724
TR475		1½	38.1	24.0	720.5	9.52
TR400/500	80ST,80S	2	49.3	34.8	1045.2	8.542
TR400/500	40ST,40S	2	52.5	39.6	1187.8	7.08546
TR400/500	40ST,40S	2½	62.713	56.5	1694.7	5.01338
TR400/500	80XS,80S	3	73.7	77.9	2338.0	3.2265622
TR400/500	40ST,40S	3	77.92	87.2	2616.7	2.74791
TR400/500	40ST,40S	4	102.26	150.2	4506.0	2.07418
TR400/500	40ST,40S	5	128.19	235.9	7078.5	1.2112
TR400/500	40ST,40S	6	154.05	340.9	10226.0	0.813775
TR400/500	40ST,40S	8	202.7	590.3	17707.6	0.4275536
TR400/500	40ST,40S	10	254.5	930.4	27911.3	0.2712331
TR400/500	80S	10	247.7	880.9	26427.4	0.2864488
TR400/500	ST,40S	12	304.8	1334.4	40032.0	0.1890966
TR400/500	40	12	303.2	1320.6	39619.4	0.1910668
TR400/500	XS,80S	12	298.5	1279.4	38381.4	0.1972742
TR400/500	30,ST	14	336.6	1626.9	48806.4	0.1551093
TR400/500	40	14	333.3	1596.1	47882.5	0.1581373
TR400/500	30,ST	16	387.4	2155.1	64652.4	0.1171079
TR400/500	40,XS	16	381	2085.0	62550.0	0.1210443
TR400/500	40	18	428.7	2639.1	79174.2	0.0956091

'Perry's Chemical Engineers' Handbook, Pages 6-42, Table 6-6.
Calibration figures for in between pipe sizes are available on request.

Installation of TR400 Series Transducer.

Never attempt this procedure without proper safety equipment.
Make sure necessary pumps are off or valves closed.



(1) Install a 2" weld on threaded fitting or service saddle according to the manufacturer's instructions.

(2) Calculate 'L' as follows:
L = 161.93 mm - (D + Vh + Wt) TR400 model.
L = 390.53 mm - (D + Vh + Wt) TR500 model.

Abbreviations:

D = 0.125 X pipe I.D. (insertion depth)
Vh = Distance between the top of the pipe and the top of hex adaptor. (When the TR400 is seated in the pipe.)
Wt = Pipe wall thickness.

(3) Wrap threads of the TR400 with teflon tape and install the TR400 transducer into the pipe.

(4) Turn the level adjustment nuts as required so that the distance between the top of the hex adaptor and the top of the positioning collar equals 'L'.

(5) After distance 'L' has been set, loosen the set screws in the positioning collar to allow for alignment of the impellor. Insert a rod through the alignment holes to reposition the transducer tube. Position the transducer tube so that the $^1/_{16}$" hole next to the alignment hole faces the upstream side of the pipe. Tighten the set screws.

Installation of Flow Research Corporation Flow Sensors

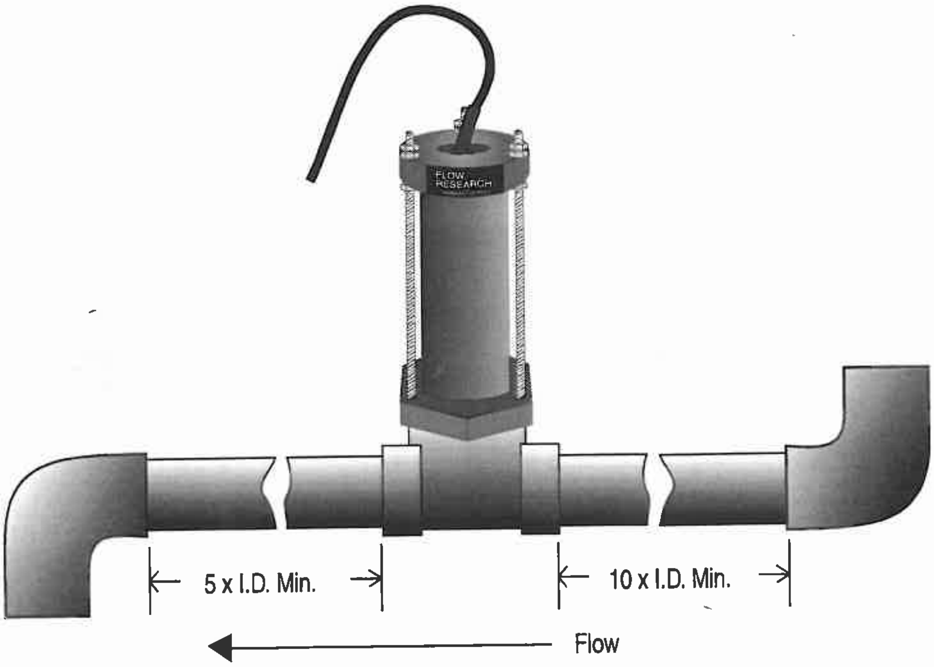


Figure 1

Elbow joints, valves, and other bends in your pipe run cause disturbances in the flow.
To get a proper flow reading, your sensor should be placed in a straight run section of the pipe in order to avoid those areas.
A basic rule is to allow at least 10 diameters of straight pipe run before the sensor and 5 diameters after the sensor. These are minimum recommended distances, some obstructions, such as butterfly valves, may require longer straight runs.

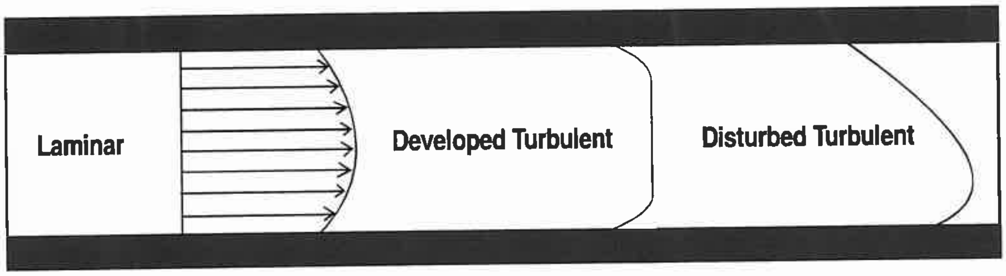


Figure 2

Knowledge of the flow profiles shown in Figure 2 is important for proper calibration and placement of a flow sensor in a pipe.
The most common flow profile found in industrial applications is developed turbulent flow, which is what flow sensors are calibrated for.
The second type of profile "known as disturbed turbulent flow" is less stable and occurs when the flow is interrupted by a valve, elbow or other internal obstruction.
By running 10 diameters of straight pipe ahead of the sensor, disturbed turbulent flow can achieve a well developed turbulent profile which can then be accurately measured.
Finally, laminar flow occurs only with highly viscous fluids which travel at extremely low velocities (contact the factory for details).

To determine which type of flow exists in your particular application, you need to know the fluids velocity (u), gravity (p), viscosity (μ) and the pipe diameter (D). This information is expressed in the form of a REYNOLDS NUMBER.

$$\text{REYNOLDS NUMBER} = \frac{D \times u \times p}{\mu}$$

Typically, a fluid with a REYNOLDS NUMBER greater than 5,000 is developed turbulent, and less than 2,000 is laminar.