

## General Information

# HFT-7100 Series

## Turbine Flowmeter



General Information



# HITROL CO., LTD.

**General**

HFT-7100 Series flow meter is a high precision turbine flow meter, wetted components with fluids to be measured are made with stainless steel, and therefore, it is of an excellent anti-corrosion. Rotor(turbine) inside the flow meter rotates by fluid's energy when the

fluid is coming into the flow meter, flow rate can be measured by counting the electrical pulses generated by the pick-up coil and the rotating rotor.

Totalized flow(m<sup>3</sup>, liter, gallon) or instantaneous flow rate can be measured separately or simultaneously.

**Specifications**

<b>Flow Range</b>		See 7000 Series Brochure.	
<b>Pressure Rating</b>		688 Bar(10,000 lbf/in <sup>2</sup> ) depending on end connection 's size/rating	
<b>End Connections</b>	Flanged	ANSI B16.5(BS1560); DIN(BS4504); BS10	
	Screwed(up to 2 ")	BSSPP; UNF; NPT	
		Others by special order	
<b>Materials</b>	Rotor Blades	430 Stainless Steel	
	Bearings	Tungsten Carbide	
	All others	304 SS(316 SS may be used according to availability)	
		Others to special order	
<b>Temperature</b>	Meter Only	-160 to + 300 (-75 to + 150 ) (Standard)	
		-160 to + 990 (-75 to + 530 ) (Special order)	
	Coil Only	Type 2112 coil: -440 to + 500 (-260 to + 120 )	
		Type 2113 coil: +15 to + 250 (-10 to + 120 )	
		Type 2114 coil: -440 to + 990 (-260 to + 530 )	
		Note : Pre-Amplifier temperatures must be limited to -40 to + 160 (-40 to + 70 ) on the surface of the printed circuit board.	
		(Line temperatures should be restricted to + 390 {+200 }).	
Remote Pre-Amplifiers are available by special order.			
<b>Pressure Drop</b>		0.27 bar (4 lbf/in <sup>2</sup> ) at maximum flow rate when metering water (for specific flow rate values, see pressure drop charts that follow).	
<b>Linearity</b>		Better than ± 1% of reading over linear flow range of fractional size Meters. Better than ± 0.25 % of reading over linear flow range of Meter 1 "size and above.	
<b>Repeatability</b>		± 0.02 % of reading	
<b>Output</b>	Coil	Type	Sine-wave
		Voltage	Dictated by Meter size: typically 10-500 mV r.m.s.on 1/4 "(8 mm)
			Meter. 0.5-5 V r.m.s. on 12 "(300 mm)
	Frequency	Proportional to flow - See 7000 Series Brochure.	
	Pre-Amplifier	Type	Current pulses or voltage pulses
		Current	4-20 mA/0-20 mA
		Frequency	As coil
		Load	700
		Display	6 Digit total flow(Total flow)

## Features

- \* HFT-7100 Series is a high precision turbine flow meter, it can be applied to various systems requiring a high accuracy.
- \* HFT-7100 Series can be manufactured for the applications of petrochemical plants or anti-explosion or intrinsic safety for explosion area.
- \* Sensor for flow detection can detect the voltage generated at the pick-up coil, it is amplified by the insertion amplifier and connected to the converter, and therefore, it can be transmitted with a high stability even for a long distance transmission.
- \* HFT-7100 Series flow meter has an excellent reproducibility and linearity, and it is a very suitable flow meter for mixing of liquids, control of processes and measurements of high-priced liquids such as petroleum products.
- \* This flow meters can be applied to petrochemical plants or explosion area.

Possible measuring range of HFT-7100 Series flow meter is shown in Table given below, and it is possible to measure the flow accurately within the specified maximum and minimum flow range.

### \* Method for size selection

$$\text{Minimum Linear Flow Rate} = \frac{1}{\sqrt{\text{Sp. Gr.}}} \times \text{Rated Min. Linear Flow Rate}$$

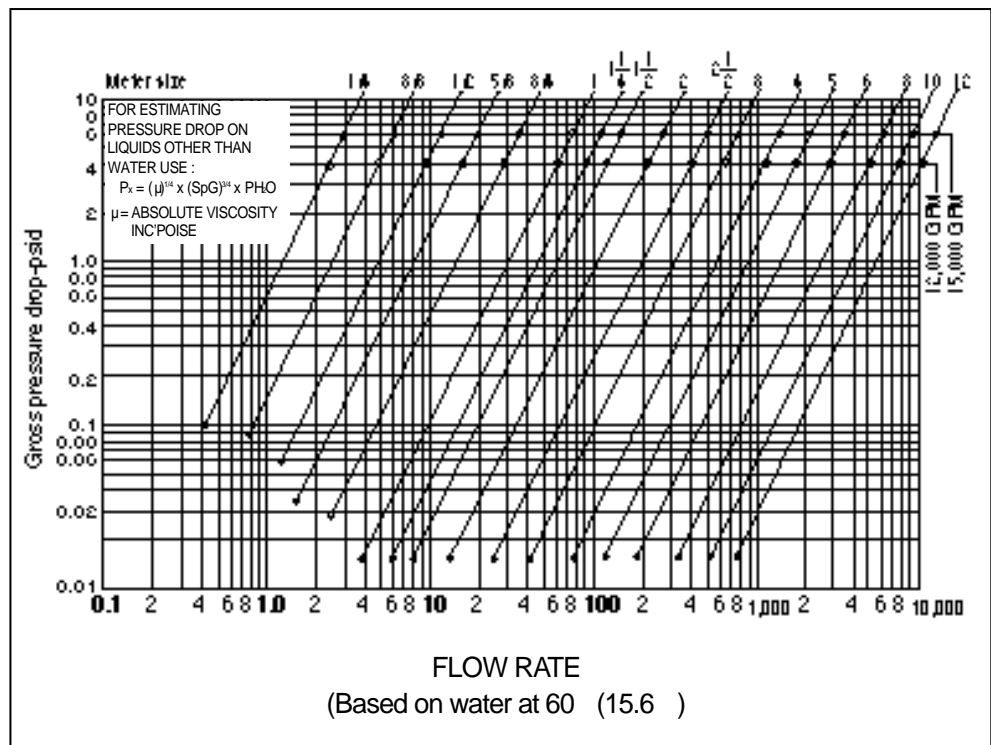
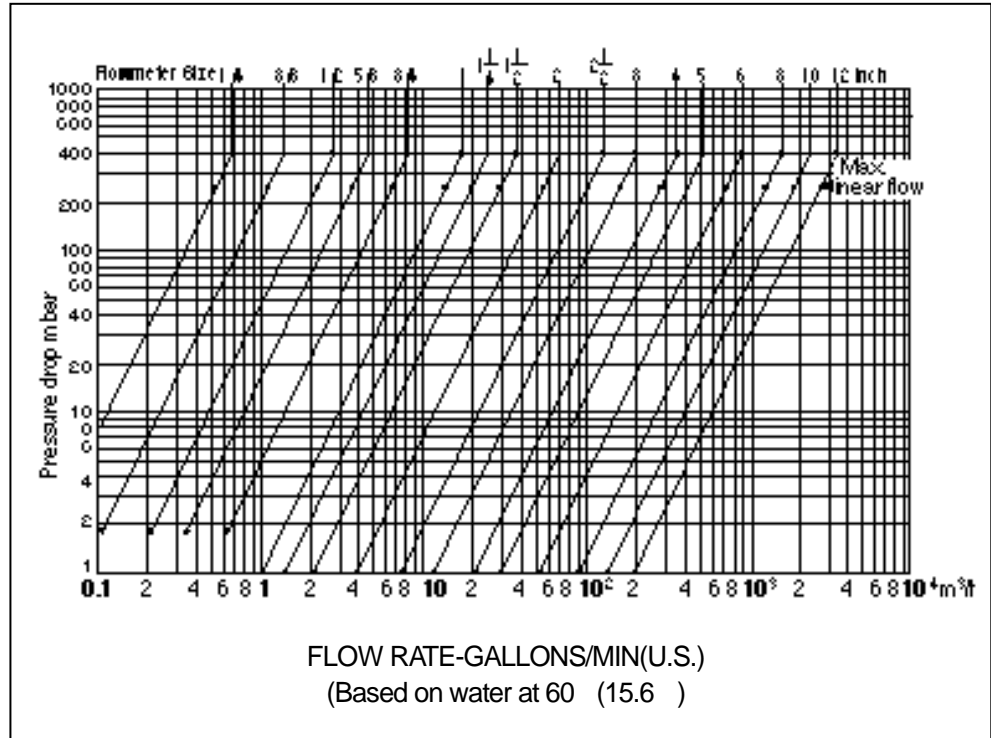
## Flow Range

Nom. Meter Size	FLOW RANGE(GPM)					Meter Output(Nom.)	
	Min. Repeatable	Linear Range					
		Min.	Min.	Rated Max.	Extended Range	Pulses/Gal.	Freq. Hz Rated Max.
1/4	.15	.25	.25	2.5	3.0	49,000	2040
3/8	.30	.50	.50	5.0	6.0	18,600	1550
1/2	.50	.90	.90	10	12	12,600	2100
5/8	.80	1.4	1.4	16	20	7700	2050
3/4	1.5	2.5	2.5	28	35	3220	1500
1	2.0	3.7	3.7	60	75	1350	1350
1-1/4	4.0	6.0	6.0	90	110	620	930
1-1/2	5.0	8.0	8.0	130	160	380	823
2	9.0	15	15	240	300	230	920
2-1/2	15	26	26	450	560	110	825
3	20	50	50	700	875	70	816
4	50	75	75	1250	1560	30	625
5	69	130	130	1820	2180	16.6	485
6	120	180	180	3000	3750	8.7	435
8	240	330	330	5400	6750	3.7	333
10	400	650	650	8200	10,200	2.5	340
12	550	900	900	12,000	15,000	1.6	320

**\* Pressure loss calculation method**

Pressure drop for any given flow of water is calculated using the appropriate Pressure Drop Chart. For liquids other than water, pressure drop is calculated using the following equation :

Where :  $P = \mu^{1/4} \times s.g.^{3/4} \times PH_2O$   
 P = pressure drop  
 s.g = specific gravity  
 $\mu$  = absolute viscosity in centipoise



HFT-7100 Series flow meter can be widely utilized as a flow indicator, a totalizer, a recorder, or a process controller and etc., customers can select according to purpose of the system, and it is composed below.

- 1) Flow detection sensor : HFT-7100 Series
- 2) Flow indicator

### Range of Measurable Flow Rate

The operating principle of HFT-7100 series flow meter follows a simple fluid mechanics. The rotor fixed to bearing is rotating according to the kinetic energy of fluid passing the flow meter. Speed of rotation is proportional to the averaging velocity of fluid, a pick-up coil installed

outside can detect the pulses proportional to the revolutions of rotor.

A signal amplifier is used to amplify and conditioning the weak signal, K-factor is set up at the indicator and totalizer, and flow rate is measured by a desirable unit.

### Operating Principle

- 1) Check that the installation condition is suitable or not prior to installation.
- 2) It can be installed on either vertical pipeline or horizontal pipeline.
- 3) Pipeline for installation should be long enough and straight, upstream length should be at least 10 D, and downstream length should be at least 6 D. However, for the case that a valve, elbow, reducer, or expander is installed upstream, longer straight upstream and downstream straight pipe should be secured to get a desirable flow measurement accuracy.
- 4) When the above condition mentioned at 3) is not met, it should be consulted to HITROL.
- 5) Flow meter should be installed so that the pipe is full at all times.

### Installation Method

- 1) Electrical connections should be properly made as shown in the system diagram.
- 2) All of the signal cables connected from flow meter to electronic unit should be properly shielded cables. It requires shielded cables of two cores. Materials of shielded cable are vinyl, rubber, neoprene, teflon, and etc. It is better to select Belden No. 8412 made with rugged rubber or equivalent substitutes for easy applications.
- 3) Flow meter should not be installed within the magnetic field generated from electrical motor or similar electrical appliances. It is better to separate about several meters usually.
- 4) Signal cables from flow meter should not be connected and installed using the same cable conduits.
- 5) All of the electrical wiring should be shielded and not be affected by humidity or corrosion. It is properly connected using terminal plate within the shielded terminal box.
- 6) Grounding(earth) should be checked between shielded cable, flow meter and receiving instrument. This job is fundamental to protect the interference of signals.
- 7) After installation of all required components, and prior to installation of flow meter, it is desirable to check the proper operation of flow meter system through a simple experiment.
- 8) Please check the operation manual again before supplying the power.

### Electrical Considerations

# HFT-7100 Controller

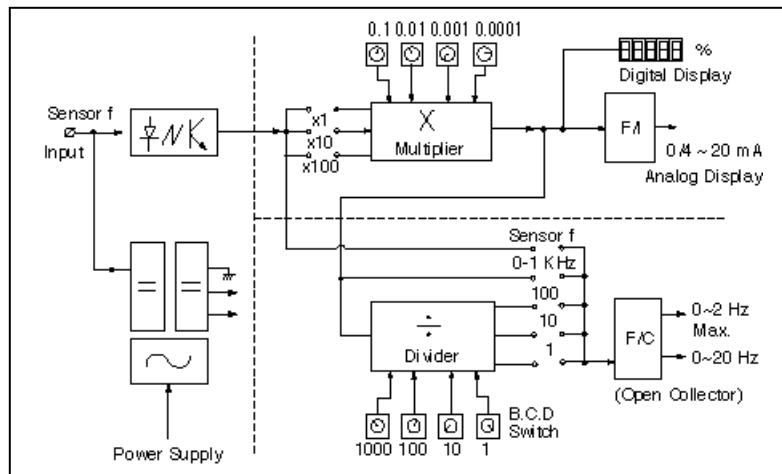
## General

This controller is receiving various flow signal, continuously indicating instantaneous flow rate and totalized flow using a

totalized counter. It gives separate outputs of analog and pulse signals.

## Operating Principle

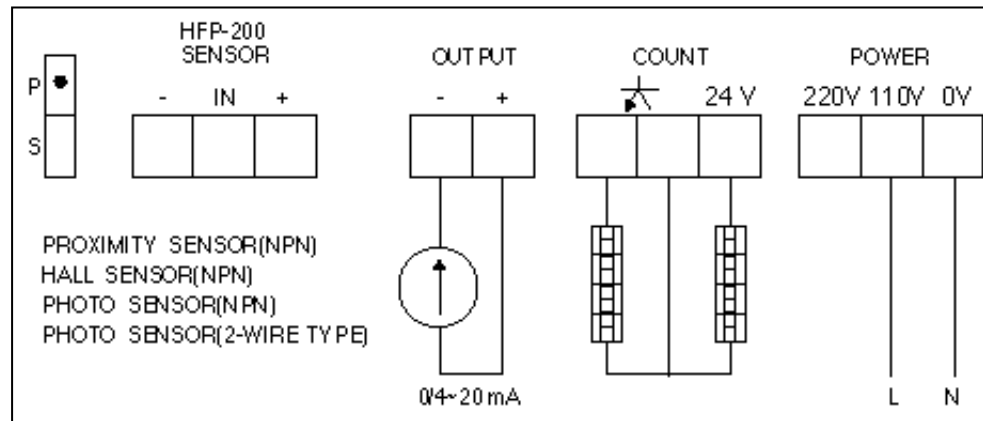
HFT-7100 Series controller is receiving frequency input from the sensor having various pulse outputs, gives frequency output of 0-1 kHz through a BCD rate multiplier (high precision phase comparator) and a 4 bit counter drive. This frequency output of 0-1 kHz is input to the analog PC-Board (F/I) and pulse output PC-Board (F/C), and gives outputs of 0/4-20 mA and pulse signal.



## Specifications

Housing	Stainless Steel.
Protection Regulation	IP 65
Environmental Temp.	-20 ~ +60
Power Supply	AC 110/220 V ± 10 % 60 Hz
Power Consumption	5 VA
Input Signal	PULSE (10 ~ 1,000 Hz) 1) Proximity Sensor (NPN Type) 2) Hall Sensor (NPN Type) 3) Photo Sensor (NPN Type) 4) Photo Sensor (2-wire)
Output Signal	1) Analog Output (0/4~20 mA) RL 700 2) Pulse Output Electromechanical Counter 2 Hz for RL 150 Electronic Counter (Open Collector) 20 Hz

## Wiring Method



Adjustment Method

1. Analog output (Instantaneous indication adjustment)

$$F_{max}(\text{Hz}) = \frac{K [ \text{Imp/dm}^3 ] \times \dot{V} [ \text{m}^3/\text{h} ]}{3.6}$$

$$M = \frac{1000 [ \text{Hz} ]}{F_{max} [ \text{Hz} ] \times \text{Decade}}$$

K : Sensor Factor

M : Analog Switch 1

V̇ : Flow Range

Example

V = 200 m³/h

K-Factor = 0.9180 P/dm³

OUTPUT = 4~20 mA

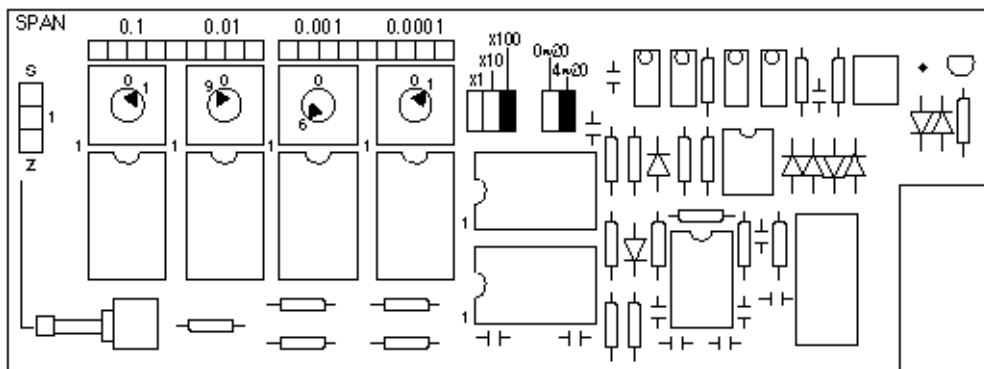
$$F_{max} = \frac{0.9180 \times 200}{3.6} = 51 [ \text{Hz} ]$$

Since 51 Hz is within 10~100 Hz

Decade 100

$$M = \frac{1000}{51 \times 100} = 0.196078$$

Instantaneous indicating : 1961



Decade(Jumper Position)	
1	1 KHz
10	100 - 1000 HZ
100	10 - 100 HZ

2. Pulse output (Totalizing counter)

$$T = \frac{IV(\text{dm}^3/\text{Imp}) \times 3600}{V(\text{m}^3/\text{h})}$$

$$F_{OUT} = \frac{1000}{T} \quad 2 \text{ Hz} / 20 \text{ Hz}$$

Decade(Jumper Position)

1	0050~9999
10	10000~99999
100	100000~999999

IV = Pulse Volume

V̇ = Max. Flow Range

T = Pulse switch Setting

F<sub>OUT</sub> = Max. Pulse Outpt Frequency

\* Electromechanical counter 2 Hz for RL 150

\* Electronic counter (open collector) 20 Hz

Example

Range(V) = 200 m³/h

Pulse Volume(IV) = 1000 dm³/Imp

Counter type = Electromechanical

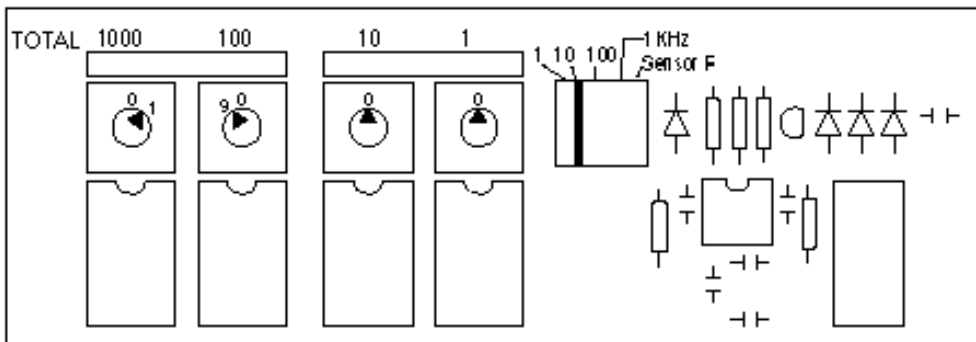
$$T = \frac{1000 \times 3600}{200} = 18000$$

Decade 10

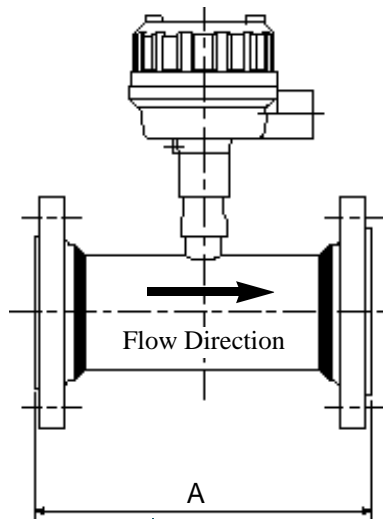
Since 18000 Hz is within 10000~99999 Hz

$$F_{OUT} = \frac{1000}{18000} = 0.196078$$

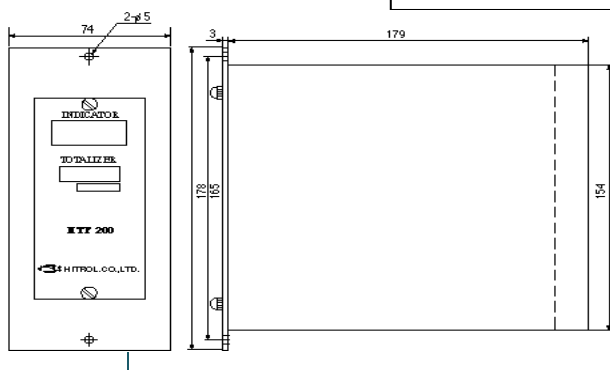
\* F<sub>OUT</sub> 2 Hz



**Dimension**



RATING BS 1560 (ANSI)		A					
		Up to ANSI 600		ANSI 900 & 1500		ANSI 2500	
BS 4504 (DIN)		Up to NP 64		NP 100 & 160		NP 250 & 320	
BS 10		Up to Table R		Tables S & T			
Model No.	Nom. Meter Size	mm	inch	mm	inch	mm	inch
7182, 7183 & 7184	1/4, 3/8, 1/2	127	5	178	7	178	7
7185 & 7186	5/8, 3/4	140	5 1/2	178	7	178	7
7101	1	140	5 1/2	203	8	103	8
7145	1-1/4	152	6	203	8	203	8
7146	1-1/2	152	6	229	9	229	9
7102	2	165	6 1/2	229	9	229	9
7125	2-1/2	178	7	254	10	254	10
7103	3	254	10	254	10	279	11
7104	4	305	12	305	12	305	12
7105	5	356	14	356	14	406	16
7106	6	356	14	356	14	406	16
7108	8	406	16	406	16	457	18
7110	10	508	20	508	20	559	22
7112	12	610	24	610	24	610	24



**Precautions for handling**

- 1) Shielded cable should be used when wiring the sensor and the transmitter, power cable, magnetic switches, and other cables should be separately connected.
- 2) The third class grounding or higher class should be used when grounding(grounding resistance should be less than 100 ).
- 3) It should not be installed at a space that can generate the corrosive gases.
- 4) The following items should be checked thoroughly before connecting power.
  - Check the power supply.
  - Check the polarity of input signal cable.

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