INSTRUCTION MANUAL

TURBINE FLOW METER

HFT-7000 Series

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1. Introduction

The HFT-7000 Series has the functions to receive various kinds of flow signals for measuring fluids flowing in Process Pipes in order to measure current net flow rates, resettable net total flow rates, and accumulated total flow rates.

Depending on the types of flow element, it can receive diverse kinds of Pulse signals. In addition, depending on the purpose of control, options- 4-20mA Analog Outputs according to Flow Rates and two Alarm Relays-can be added.

Since it converts and outputs the signals coming from flow rate measuring sensors into Scale Pulses, the same quantities as those indicated in its measuring instrument at other places easily by installing other Counters, etc. in the outside.

The LCD Display on the front was made to show all kinds of Parameters and indicated values so that the operator can easily operate this equipment. Using the Key on the front, net flow rates, resettable net total flow rates, and accumulated total flow rates can be selected and read and the user can easily program set values to fit the purpose of flow rate at the site.

Data set by the user or resettable net total flow rates, etc. are stored in the internal non-volatile Memory so that all current values can be maintained for 10 years even if the power is turned off.

2. Technical specification of Turbine Flow Meter

▪ General

Display	12*2 characters LCD with LED back light
DisplayUpdateRate	0.25 seconds
TransducerSupply	8VDC 50mA, 12VDC 50mA, 22VDC 50mA
OperatingTemperature	0to50℃
StorageTemperature	-20to70℃

▪ Frequency Input

FrequencyRange	0Hz to 5KHz
SignalType	Sine wave, open collector, reed switch, proximity switch, Voltage or current pulse
K-factorRange	0.0100 to 999,999(the pulse per units)

▪ Relay Output

Max.SwitchingPower	60W DC / 100VA AC
Max.SwitchingVoltage	220V DC / 250V AC
Max.SwitchingCurrent	2A DC / AC

▪ 4-20mA Output

Resolution	12-bit
Accuracy	0.05% of Range
MaximumLoad	500 ohms internally powered. 950 ohms from DC24V
Isolation	Non-isolated

▪ Pulse Output Signal

Function	The Pulse output is scaled and outputs one pulse each time the total increments.
Output	An open collector transistor will sink 50mA max.
DutyCycle	49 Pulse/sec. Max.
PulseWidth	10ms(negative going)

▪ Communication

Type	RS485
BaudRate	1200 to 19200BPS
Parity	none
Databit	8-Bit
IDCode	For multi point communications, a unique address can be programmed

3. Connection

3.1. AC Power Connection

Can be connected and used regardless of the polarity.

| 1	3
AC120V	AC120V
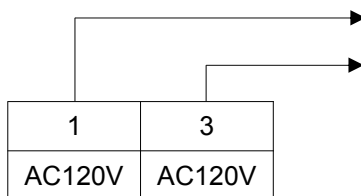
3.2. Input Connection

Because output signals vary with Flow Meters, set the DIP(Dual In-line Package) Switch inside the equipment correctly according to the kinds of signals. The equipment is basically set to receive open collector signals when it is shipped. Since DC 8V, DC 12V, and DC 24V are output from Sensor Terminal no. 1, it can be connected and used when any flow meter requires power.

| Input Signal Type	INTERNAL Terminal			Switch Setting							
	V out	+	-	1	2	3	4	5	6	7	8
1.Open Collector	1	2	3	off	off	off	off	on	off	off	on
2.TTL Logic Pulse	1	2	3	off	off	off	off	off	off	off	on
3.Reed Switch	1	2	3	off	off	off	on	on	off	off	on
4.Coil(20mVp-p min)	1	2	3	off	off	off	off	off	on	off	off
5.Coil(low impedance)	1	2	3	off	on	off	off	off	on	off	off
6.Current Pulse	1	2	3	on	off	off	off	off	off	off	on
7.NamurProximity	1	1	3	off	off	on	off	off	off	on	on

1. Open Collector
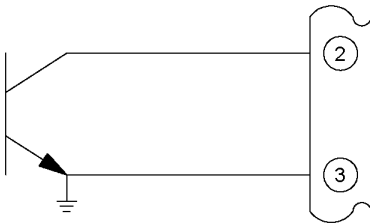
2. Square Wave, CMOS or Logic Pulse
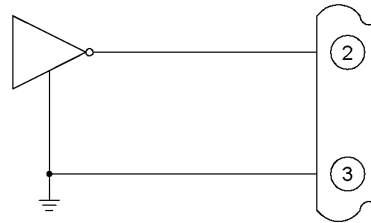
3. Reed Switch
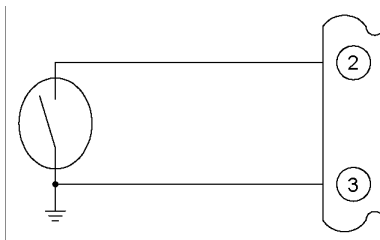
4. Coils
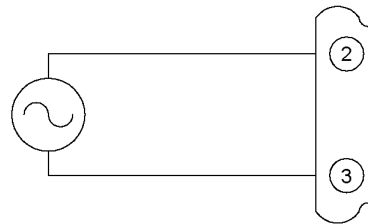
5. Current Pulse
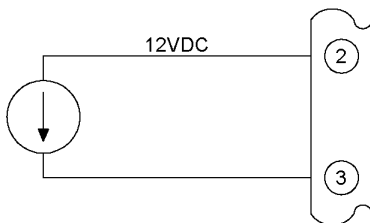
6. Namur Proximity
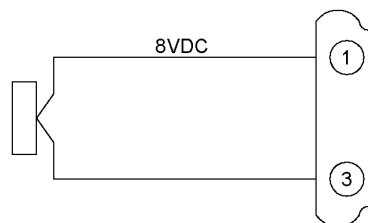
3.3. Relay Output

To control external devices, two Relay Outputs can be selected as an Option. Each Relay provides only Normally Open Contacts.
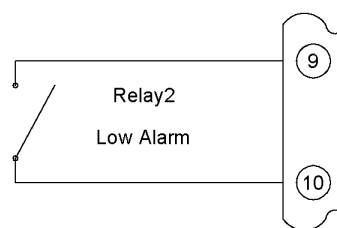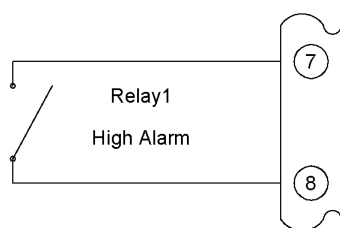
3.4. Pulse Output

Carefully connect it because it will not operate if the polarity is not correct since its internal circuit is composed of Open Collectors.

The outputs are 50mA @30VDC Current Sink outputs. A power source and Current Limit resistor are necessary outside this device. The pulse output width is basically selected as 10ms when this device is shipped. If there are equipment units that cannot receive the signals because the pulse width is too narrow, 50ms or 100ms can be selected and used to solve the problem.

The Pulse Outputs may not exceed 49-pulses per sec at the maximum when the Pulse width is 10ms.

<Output circuit>   <Output signal>
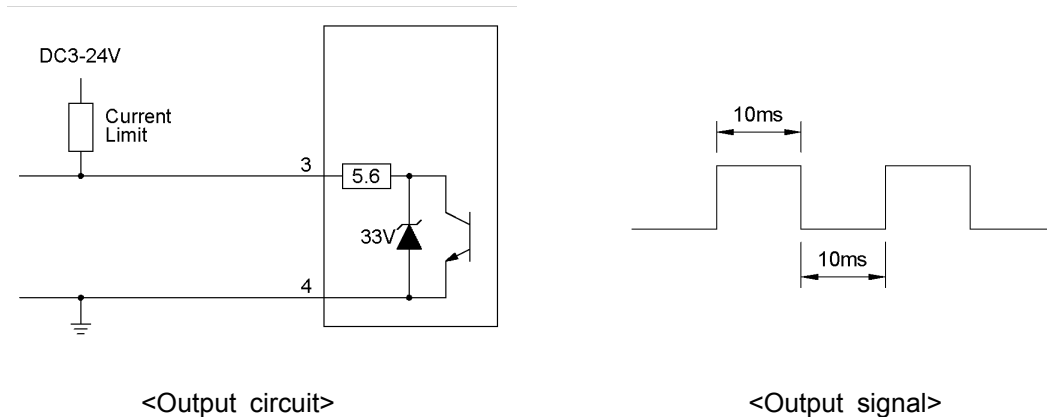
3.5. Analog Output

HFT-7000 series can convert net flow rate values into 4-20mA signals transmit the signals to other instruments to record or control the flow rates. This can be operated only when the internal power source of the Controller is used.
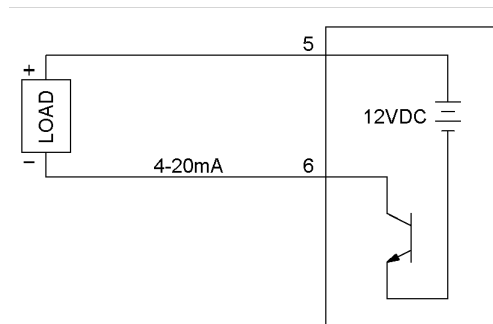
3.6. Communication Connection

Communication lines can be connected to the Computer or other Controllers to identify the content of the current Flow Controller. In addition, simple settings can be made with communication.

In the case of general Computers, RS232 to RS485 Converters or Multi Ports that support RS-485 should be used.

RS-485 cannot transmit data exceeding 1.2km. If data exceeding 1.2km should be transmitted, equipment such as private line Modems should be used.
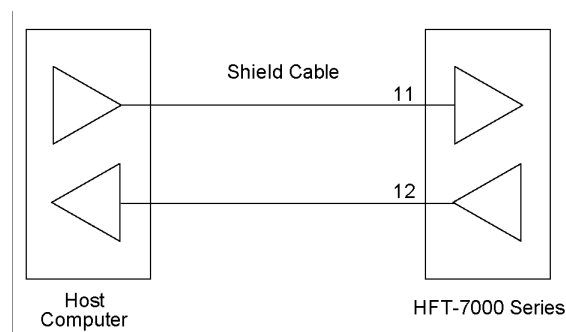
4. Operation

4.1. Flow measurement
- K-Factor : Pulse / unit volume, Determined by flow element or piping design.
- Rate: Volumetric flow Rate per unit time.

$$\text{Rate} = \frac{\text{Frequency} \times \text{Time base}}{\text{K-Factor}}$$

4.2. Flow Rate Display
At the beginning, net flow rates are displayed on the top of the Display and the Resettable Total net flow rates of the Process currently in progress are displayed on the bottom of the Display. If the Mode Key is pressed, the Accumulated Total flow rate will be displayed and if the Mode Key is pressed once again, the initial state will be recovered.

The Accumulated Total flow rate will be cleared to 0 only after selecting "YES" from the "ACC RESET" items out of the "Flow Set" items in the Program Mode and then pressing the Reset/Enter Key.

4.3. Pulse Output

Every time integrated values are increased by one, one pulse is output from the pulse output terminal. Convert the pulses without any unit coming from the flow rate measuring sensor into unit pulses and output them. Since these are open collector outputs, counters or separate integrating meters can be connected to the outside and used.

$$1 \text{ [Pulse Output]} = \text{K-Factor} / 10^{DecimalPoint}[\text{PulseInput}]$$

For instance, if the K-Factor has been set to 0.1 without setting any decimal point for integration, although one output will be generated per 0.1 input pulse, in fact, 10 pulses will be generated when one pulse has come in. If the K-Factor has been set to 10 and the decimal point has been set to 0.0, one output will be generated per one pulse. Likewise, if the K-Factor has been set to 10 and the decimal point has been set to 0, one output will be generated per 10 pulses.

4.4. Alarm Control(Relay Output)

The current net flow rate and the set Parameters are compared to generate high/low Alarms. The contact point provides only normally open contacts.
Relay1(high alarm) operates when the flow rate is the same as or higher than the parameter set under the item RLY1 S-POINT and Relay2(low alarm) operates when the flow rate is the same as or lower than the parameter set under the item RLY2 S-POINT.

4.4.1. Alarm Dead Band Setting

The alarm dead and is a function to give hysteresis characteristics in order to prevent the phenomenon for the alarm to be continuously turned on/off when net flow rates are close to the alarm set value.

The last two digits of the dead band can be set to 0-50000 and the meaning varies with the position of the decimal point. Therefore, attention should be paid to the decimal point. For instance, if the decimal point has been set to 0.0, the values can be set in a range of 0.0-5000.0.

4.5. Analog Output

4-20mA analog outputs are generated depending on the net flow rate.

If the net flow rate is lower than the value set under the item 4mA S-POINT, 4mA will be output and if the net flow rate is higher than the value set at the item 20mA S-POINT, 20mA will be output. If the flow rate value is between the value set under the item 4mA S-POINT and the value set under the item 20mA S-POINT, the current proportional to the flow rate value will be output.

When the analog value is not accurately displayed, the value can be simply calibrated on the spot using the program.

4.6. Variable K-Factor Function(Flowmeter Linearity Calibration Function)

If a flow meter has no linearity, the values can be processed using linearity calibration. In this case too, the factor for the relevant frequency should be substituted. Up to 10-Points can be stored and the point entry will be terminated if 0 is input in the last frequency. If a frequency that comes between frequency 1 and frequency 2 is input, the frequency will be corrected by calculating the factor between factor 1 and factor 2 values using interpolation.

4.6.1. How to Input Parameter in the setting mode

If you enter the flow parameter group under the setting, a LINEARITY selection field will appear and LINEAR and NON-LINEAR will be toggled. Select NON-LINEAR to proceed.

The entry of the (frequency, K-Factor) pair will be repeated by point. The entry should proceed as follows; (FREQUENCY-1 entry, K-Factor 1 entry) -> (FREQUENCY-2 entry, K-Factor 2 entry) ……. Enter Frequency1 first beginng from the highest frequency.

That is, in the case of the above graph, (Freq 5, Fact 5) should be entered into Point-1 and (Freq 4, Fact 4) should be entered into Point-2. The frequency of the point entered last should be 0. For instance, if only five Points are to be used, 0 should be entered as the frequency of the 5th point to finish the entry with five points.
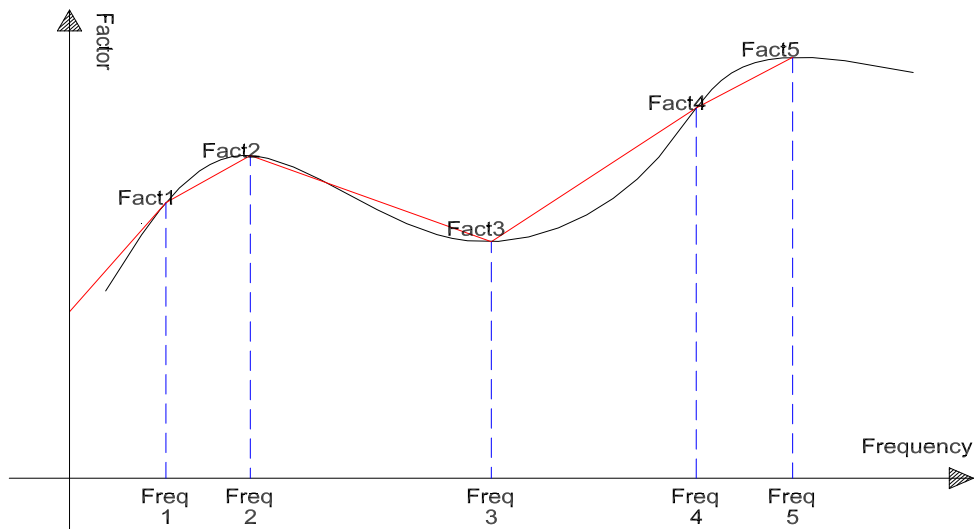
5. Setting

5.1. Key-Operating Method In The Setting Mode

To enter the program mode in order to change set values(parameters), keep pressing the up key and shift key simultaneously for three seconds. The type of the model(HFT-7000) will be displayed on the top and the option currently installed will be displayed on the bottom.

If the up key and the shift key are replaced when the model and the option have been displayed, the program version("Ver-xxx ") will blink three times and then the model and version will be displayed. If the enter key is pressed in this state, "Flow Set" will be displayed and set items can be changed hereafter.

5.2. How To Move In The Setting Mode

The program mode is largely divided into a total of three groups; Flow Set, Option, and Test. Different parameters appear depending on models. The up key can be used to move to individual groups. If the enter key is pressed after moving to the group for which the program is to be changed, the items under the relevant group will be displayed and the enter key can be used to move among the individual items.

5.3. How To Exit From The Setting Mode

When the setting has been completed, or to get out from the setting mode and move to the normal operation mode after identifying set parameters, if the group name is being displayed, move to the "EXIT/PROGRAM MENU" using the up key and then press the enter key to get out from the setting mode.

The last item of the program inside each group is "End of Set" which is an item immediately before "EXIT/PROGRAM MENU".

5.4. How To Change Set Value

When the setting has been completed, or to get out from the setting mode and move to the normal operation mode after identifying set parameters, if the group name is being displayed, move to the "EXIT/PROGRAM MENU" Using the up key and then press the enter key to get out from the setting mode. If the enter key is pressed when the last item "end of set" is displayed after changing the program in the relevant group, the screen will be immediately moved to the "EXIT/PROGRAM MENU".

In the case of parameters for which numbers are to be entered, if the shift key is pressed, the cursor will be moved to the right by one digit at a time and if the cursor is at the last digit, it will move to the first digit. In the case of those items in which analog output values are adjusted, the current value to be output will decrease.

If the up key is pressed, the number will increase by 1 at a time and when the number is 9, it will be changed into 0. When the decimal point is set, the decimal point digit will increase by one at a time. When the time base is set, seconds will be changed first followed by minutes, hours, and days in order of precedence. In items whee analog output values are to be adjusted, the output current value will increase.

If the enter key is pressed after correcting or checking the parameters, the screen will go out of the relevant item and display the next item.

5.5. Setup Parameter

In the case of items for which numbers are to be entered, use the shift key and up key. In the case of items for which the contents are to be selected, use the up key to select the contents. If the enter key is pressed after completing setting in each item, the next item will be displayed.

5.5.1. Flow Parameter Group

Flow meter related basic matters are to be set.

Parameter	Description	Value
K-FACTOR	In the case of frequency output Type Flow Meters, enter the K-Factors (Pulse/Unit Vol.); provided that, this model is a special case and the values should be entered in m^3 units.	0.0100 to 999,999
TOTAL DECIMAL	Enter the decimal point of integrated quantities. This value is applied to both integrated values and accumulated integrated values.	0000 / 000.0 / 00.00 / 0.000
RATE DECIMAL	Enter the decimal point of net quantities.	0000 / 000.0 / 00.00 / 0.000
TOTAL UNIT	Enter the units necessary for integration and accumulated integration. If the unit is changed into gallon based on m^3 , flow rates will be automatically calculated even when the k-factor has not been corrected.	GALLON / m^3

TIME BASE	Enter the time base of net flow rates	sec. / min. / hr / day
PULSE WIDTH	Select the range of pulse outputs.	10ms / 50ms / 100ms
ACC RESET	Clear accumulated total quantities. Select "YES" and press the enter/reset key to clear the values	YES, NO

5.5.2. Option Group

Set various option related parameters.

Parameter	Description	Value
RLY1 S-POINT	Set the operating point of Relay 1. The operating point moves along with the decimal point of net quantities. The set value should be always bigger than that of Relay 2.	0 to 50000
RLY2 S-POINT	Set the operating point of Relay 2. The operating point moves along with the decimal point of net quantities. The set value should be always smaller than that of Relay 1.	0 to 50000
RLY DEAD-BAND	Enter the hysteresis characteristic value of Relays. The decimal point moves along with the decimal point of net quantities.	0 to 50000
4mA S-POINT	Enter the Set-Point when the current is 4mA. Refer to the value set forth under the item "RATE DECIMAL" for the decimal point.	0 to 50000
20mA S-POINT	Enter the Set-Point when the current is 20mA. Refer to the value set forth under the item "RATE DECIMAL" for the decimal point.	0 to 50000
BAUD RATE	Determine the communication speed. The unit is BPS(Bit Per Second).	1200 / 2400 / 4800 / 9600
ACC RESET	Clear accumulated total quantities. Select "YES" and press the Enter/Reset key to clear the value.	YES, NO

5.5.3. Test Group

Set calibration or test related contents.

Parameter	Description	Value
FREQUENCY	Show the frequency entered when the input is a Frequency Type. The unit of the frequency is Hz and frequencies up to 5000Hz can be measured.	0.0Hz
4mA ADJUST	Adjust 4mA values. The current will increase if the up key is pressed and decrease if the shift key is pressed.	**>** / **<**
20mA ADJUST	Adjust 20mA values. The current will increase if the up key is pressed and decrease if the shift key is pressed.	**>** / **<**
RLY1 ON/OFF	Contact points can be tested by turning Relay 1 on/off. if the up key is pressed, the display will be changed into "RELAY ON" or "RELAY OFF" and Relay 1 contact points will be turned on/off.	RELAY ON / RELAY OFF
RLY2 ON/OFF	Contact points can be tested by turning Relay 2 on/off. if the up key is pressed, the display will be changed into "RELAY ON" or "RELAY OFF" and Relay 2 contact points will be turned on/off.	RELAY ON / RELAY OFF

6. Wiring Designations

FROM FLOWMETER

45.5(1-⁴⁄₅")

7.93(³⁄₁₀")

22(⁷⁄₈")

AC 120V INPUT

TERMINAL BLOCK(TB-01)

FROM FLOWMETER

55(2-⅛")

7.93(³⁄₁₀")

22(⁷⁄₈")

M3

PULSE OUTPUT   DC 4~20mA OUTPUT

TERMINAL BLOCK(TB-02)

6(¼")

3.4(⅛")

TERMINAL LUG