

TFM VT-222 Multi Variable Vortex Flow Meter

Goes with ModBus

QUICK User Manual



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QR Code for Website with Videos. Open Video tab and watch the first video for

simple user configuration instructions





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H86CT1 Product Manual

Technical Support

TacticalFlowMeter VT-222 Vortex flowmeters utilize piezo sensors to detect the Vortex Shedding Frequency. We integrate internal Pressure and Temperature sensors to provide for full multivariable operation. Please read this manual carefully before using the meter. If you have any questions, please do not hesitate to contact us.

Company: Take 5, Inc. dba TacticalFlowMeter.Com

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Website: www.TacticalFlowMeter.com

Electronics Specifications

DC Power Supply: 12-32VDC or optional
AC Power Supply: 85-220 VAC 50/60 Hz
Operating Temperature: -20°C to 70°C(with LCD -40°C to 85°C(without LCD)
Output: 4-20mA output (4 Wire.. Do not put 24 VDC into 4-20 mA)
Configuration: Flow mode, Flow unit, Range (Qmax), Density, Temperature, etc.
Alarm: Low alarm outputs 3.8 mA & high alarm can output
K-Factor linearity: The VT-222 provides 2 to 5 points of K-Factor linearity correction.
Local adjustments: Setting range and PV units, Density, Flow mode, damping, high alarm percent, low alarm percent and data recovery etc.
LCD display: Line 1 shows the instantaneous flow. Line 2 shows the totalized flow. Line 3 can display the percentage, output current, temperature, pressure, density and more combinations easily selected by the user.
Multivariable Operation: The VT-222 supports real-time temperature and pressure compensation for gas, and utilizes the international standard for the steam and density tables for temperature and pressure compensation as well for superheated steam with pressure compensation or temperature compensation for saturated steam.

Temperature trim: High trim and low trim.

Pressure trim: High trim and low trim .

The VT-222 provides power-down protection and flow totalizer value storage functions.

Hardware

Terminal Board Wiring

The terminal board is used for connection to the external power supply, output pulse, the external pressure sensor and temperature sensor.



DC Power



+: 24 VDC

- : Ground for Power, 4-20, Pulse
- 5: 4-20 +
- : Pulse +
- A : ModBus
- B : ModBus

1-4 Pressure Transducer

Note: DVM is connected to - and pin 5 to indicate 3.998 mA at ZERO flow.

The 4-20 is a 4 wire system. DO NOT PUT 24 VDC into 4-20 terminals

AC Power





4-20mA output HART External Pressure



Pulse Output External Pressure and Temperature sensors



Sensor Interface

Vortex Sensor

The 2-Pin green XT terminal is used for connecting the vortex piezo sensor that has no polarity.



Note: The main circuit board must be properly safety grounded according to NEMA safety standards





Pressure Sensor

Use the XF3 socket to connect the pressure sensor (pressure sensor must be a bridge type

sensor). I+ and I- are the power supply, A + and A- are the sensor signal outputs.

The bridge impedance of the pressure sensor must be between 3 to 6000 ohms. The supply current for the pressure sensor is about 0.3 mA. As long as the sensor output does not exceed 50mV@0.3mA, you may use an external sensor of your choice.

Socket XF3 defined as follows:



Temperature Sensor

Socket XF5 supports Pt1000 and Pt100, two-wire connection.





Note: The main circuit board must be properly safety grounded according to NEMA safety standards

Vortex Inline Meter Dimensions:



ANSI CLASS 150 FLANGE TYPE VORTEX FLOW METER DIMENSION
--

ANSI Size	DN(mm)	L(mm)	L(in)	D(mm)	D(in)	D1(mm)	D1(in)	H(mm)	H(in)	Number	d(mm)	d(in)
1/2	15	200	7.87	90	3.543	60.5	2.382	379	14.92	4	16	0.630
3/4	20	200	7.87	100	3.937	70	2.756	384	15.12	4	16	0.630
1	25	200	7.87	110	4.331	79.5	3.130	389	15.31	4	16	0.630
1 1/4	32	200	7.87	120	4.724	89	3.504	394	15.51	4	16	0.630
1 1/2	40	200	7.87	130	5.118	98.5	3.878	409	16.10	4	16	0.630
2	50	200	7.87	150	5.906	120.5	4.744	419	16.50	4	16	0.630
2 1/2	65	200	7.87	180	7.087	139.5	5.492	444	17.48	4	18	0.709
3	80	200	7.87	190	7.480	152.5	6.004	460	18.11	4	18	0.709
4	100	200	7.87	230	9.055	190.5	7.500	476	18.74	8	18	0.709
5	125	250	9.84	255	10.039	216	8.504	502	19.76	8	22	0.866
6	150	250	9.84	280	11.024	241.5	9.508	528	20.79	8	22	0.866
8	200	300	11.81	345	13.583	298.5	11.752	586	23.07	8	22	0.866



Vortex Insertion Meter Dimensions:



Plumbing requirements





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LCD Display

The LCD display features a 128 x 64 dot matrix full graphics display, allowing for convenient display modes to suit specific needs. The instrument supports two display modes :

Three-line display mode

102 456	Line 1 displays the Instantaneous flow.
123.430 Nm ³ /h	Line 2 displays the totalized flow
Σ : 123456.789 Nm ³	Line 2 displays the totalized now.
P-1224 5 1 Po T-122 4℃	Line 3 displays frequency, pressure, fluid temperature, density,
F-1254.5 KFa 1-125.4 C	current, or percentage.

Notes:

► When using the onboard pressure sensor, and the pressure signal has a fault condition, the corresponding pressure value will be replaced with the set pressure value and it will flash.

When using the onboard temperature sensor, and the temperature signal has a fault condition, the corresponding temperature value will be replaced with the set temperature value and it will flash as well.
 When the flow mode is Sat_Steam(P), indicating it is in saturated steam pressure compensation, the temperature value will display as " ", which indicates the measurement of the temperature sensor is not enabled.

► When the flow mode is Sat_Steam(T), indicating it is in saturated steam temperature compensation, the pressure value will display as "", which indicates the measurement of the pressure sensor is not enabled.



Note: Long Press KEY-D to change the third line display variable(s) to one of the following: Note this meter can accurately indicate the DENSITY!

]	Indicator	F:	Den:	P:	T:	Curr:	Per:	P= T=	
-	variable	frequency	density	pressure	temperature	current	percentage	Pressure	and
								temperatu	re

Two-Line Display:

123.456 Nm ³ /h	Bar Graph 0- 100% Full Scale Line 1 displays the Instantaneous flow.
Σ: 123.45678	Line 2 displays the totalized flow.



Local Adjustment:.. Probably do not need this below....



Blue means that these items must be done. be done, and easily forgotten or incorrectly set. Red means that these items must be set



Data Entry:

Data is entered using the 3 keys D, U and E on the display.



Enter or Exit Menu Mode

Enter Menu Mode

In the operating mode, press the "E" key to Enter the menu mode (data entry).

Exit Menu Mode

In the menu mode, press the "E" key to Exit the menu mode and Enter the operating mode.

Data Entry Method

There are two ways to set parameters, one is using the "Keypad Method" with the3 button interface on the

electronics and the other way is to use ModBus to set the parameters. To make it easier be sure to watch the videos

on the website that demonstrates the methods clearly.

'Keypad' Method

- 1. Long press the D-Key to enter the setting, and the sign flag will start flashing.
- 2. Short press the D-Key to select the sign.
- 3. Press the U-Key to shift the setting number. The number bit will start flashing, which means that you can set. Press D-Key to increase the setting number.
- 4. Press the U-Key to shift the setting number again. All digits can be set using the same method.
- 5. After setting all 6-digits, press U-Key to set the decimal point position. All five decimal points will flash simultaneously, indicating they can be set. Short press D-Key to change the decimal point position.
- 6. After completing data entry, you can long press D-Key to save the parameters. Or Press E Key to abort and exit. The D and E Keys are important to select based on your needs. Long hold the D-Key to save your changes.

For example, On the next pages we show changing the Full Scale from 200, the new input range limit of 400. Setting the range limit, Full Scale, is important for driving the 4-20 mA and Frequency Outputs.

- Long press D-Key to enter settings, and the menu options will start flashing.
- Short press D-Key or S-Key to scroll backward or forward in the menu.
- Long press D-Key to access, and then save, the parameter.

Refer to the key names below.:





>	Press the E-key to enter the menu mode.	Setting the Full Scale
>	Press the D-Key or the U-Key to scroll backward or	20000
	forward the menu until it displays 6 in the bottom-left.	200.000
		6
		Enter setting the range limit
>	Long press D-Key to enter setting, and the sign flag will start	
	flashing.	1 0 0.0 0 0 m ³ /h
		6
>	Short press the D-Key to select the sign between "+" and "-".	Setting negative data
	"-"means input is negative (The vortex flowmeter range limit	
	must be a positive number).	1 0 0.0 0 0 m ³ /h
		6
>	Press the U-Key, the first digit "2" will flash, which	Setting first bit
	means you can change this digit.	200000
		2 0 0.0 0 0 m ³ /h
		6
>	Press the D-Key until you see the desired display of "4".	Setting first bit
		400000
		m ³ /h
		6
>	Press U-Key, the second digit "0" will start flashing,	Setting the second bit
	which means you can change this digit.	400000
1	Press D-Key to set new data.	m ³ /h
		6
۶	Press the U-Key to shift the digit again. All digits can be	Setting the last bit
	set according using this operation.	40000
		m ³ /h
		6
>	After setting all 6-digits, press U-Key to set decimal	Setting decimal point
	point position. All five decimal points will start	4.0.0000
	nashing simutaneousiy, which means that you can set.	m ³ /h
		6



		Setting decimal point
>	Short press M-Key to select the desired decimal point position.	$ \begin{array}{c} 4 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ $
•	After data entry is complete simply long press D-Key to	
•	After data entry is complete simply long press D-Key to	
	save the data. Or Press E -Key to abort and exit	

Pipe diameter

The pipe size is selected from a range of sizes.

The flow meter size can be set through RS485 communication or keys, the setting range is 2-2000, and the unit is fixed in mm. For insertion meters we adjust the K-Factor to match your given pipe ID. The pipe size is not selected via the user interface.

The diameter is manually input, and the flow lower limit, flow upper limit, and maximum magnification must be manually input.temperature unit

The temperature unit is increased by °F (Fahrenheit), that is, the temperature unit can be switched between Celsius and Fahrenheit.

Pressure Unit

The pressure unit is increased by PSI, that is, the pressure unit can be switched between KPa or PSI. Standard pressure point and standard temperature point

The standard state of H880TBR corresponds to a fixed 20°C and 101.325KPa.

Now H86CT1 supports users to set standard pressure value and standard temperature value, that is, pressure point and temperature point in standard volume state. For example, it can be set to 68 degrees Fahrenheit, 101325 Pa or 32 degrees Fahrenheit 100KPa, and the corresponding state is used as the standard state. When the set unit is the standard condition unit, the condition flow rate will be converted to the standard condition flow rate of the set point.

Flow correction factor

Global flow correction factor, the setting range is 0.1-10. For example, if it is set to 1.1, the flow will be increased by 10%.

Test modes

Use the 3 button interface to enter the Code screen, and enter the password 02086 to enter the test menu. Users can choose any function: flow test, frequency test or current test.

Note: In the test mode, the cumulative flow does not participate in the accumulation.

The specific test functions and operation instructions are as follows:

Traffic test mode

- 1. After selecting the flow test menu, the interface prompts "flow test", the unit is the current instantaneous flow unit, and the second line prompts the current flow (it may also be initially 0, depending on the programming). It doesn't really go into test mode at this point.
- 2. After inputting the new flow rate and saving it, it enters the test mode. At this time, the meter calculates the percentage, outputs the current value, output pulse value, etc. according to the input instantaneous flow rate value, and outputs it accordingly. The backlight flashes to alert the operator that it is in the test mode at this time. If there is no new key operation within 10 minutes, it will automatically exit.



Frequency test mode

- 1. After selecting the frequency test menu, the interface prompts "frequency test", the unit is Hz, and the second line initially prompts 0. It doesn't go into test mode at this point.
- 2. After inputting the new frequency and saving it, after selecting the current test menu, the interface prompts "current test", the unit is mA, and the second line initially prompts 0. It doesn't really go into test mode at this point. Enter the test mode, at this time the instrument outputs the specified pulse frequency value. The backlight flashes to remind the operator that it is in the test mode at this time. If there is no key operation within 10 minutes, it will automatically exit.

Current test mode

1. After inputting the new current value and saving it, it actually enters the test mode, and the meter outputs the specified current value at this time. The backlight flashes to remind the operator that it is in the test mode at this time. If there is no key operation within 10 minutes, it will automatically exit.

Loop current calibration



Custom units

The current custom unit is fixed at **/s. Change the custom unit to 3, namely SPC/h, SPC/m, SPC/s. The user can set the corresponding unit through the key or RS485 communication.

When the instantaneous flow unit is set, the cumulative flow unit is also automatically determined. The corresponding relationship table is below:

Instantaneous flow unit	Corresponding total flow unit
Nm³/h, Nm³/m, Nm³/s	Nm ³
m ³ /d, m ³ /h, m ³ /m, m ³ /s	m ³
l/h, l/m, l/s	L
Scf/s, Scf/m, Scf/h,	Scf
cf/s, cf/m, cf/h,	cf
USG/s, USG /m, USG /h,	USG
UKG/s, UKG /m, UKG /h,	UKG
bbl/h, bbl/d,	bbl
g/h, g/m, g/s	g
kg/d, kg/h, kg/m, kg/s	kg
t/d, t/h, t/m	t
lb/h, lb/d	lb
SPCL/d (instantaneous unit displays	SPCL
SPCL/d, the internal calculation is the	
same as m3/m * 1440)	
SPCL/h, (instantaneous unit displays	SPCL 4 CHARACTERS



SPCL/h, the internal calculation is the	
same as m3/h)	
SPCL/m (instantaneous unit displays	SPCL
SPC/h, the internal calculation is the	
same as m3/m)	
SPCL/s (instantaneous unit displays	SPCL
SPC/h, internal operation is the same	
as m3/s)	

Basic Functions No Password Required

Menu	Setting method	Notes
Contrast	from table	15
Write Protect	from table	ON / OFF
Min Alarm(%)	numeric	Set low alarm value. Unit: %
Max Alarm(%)	numeric	Set high alarm value. Unit: %
MeterSize	Read Only	View meter size setting.
Flow mode	from table	Liquid Qv: Liquid volume
		Liquid Qm: Liquid mass
		Gas Qv:Gas volume
		Gas Qm: Gas mass Steam
		Qv: Steam volume
		Steam(P/T): Steam mass
		Sat_Steam(T) : Saturated steam mass (temperature
		compensation)
		Sat_Steam(P) : Saturated steam mass(pressure
		compensation)
Flow unit	from table	Volume units supported: Nm ³ /h, Nm ³ /m, Nm ³ /s, I/s,
		$1/m$, $1/h$, m^3/s , m^3/m , m^3/h , m^3/d , Sc f/, Scf/m, Scf/h
		, cf/s, cf/m, cf/h,
		USG/s, USG /m, USG /h, UKG/s, UKG /m, UKG /h
		, bbl/h, bbl/d,
		Mass units supported : g/s , g/m, g/h, kg/s, kg/m, kg/h
		, Kg/d, t/m, t/h, t/d, lb/h, lb/d Note: Totalizer flows are based on the flow unit

Range 100% Full Scale	numeric	Set the Qmax value for selected flow mode (= 20 mA)
Density (kg/ m ³)	numeric	Set Gas density (unit: Kg/m3)
Density (g/c m ³)		Set Liquid density (unit: g/cm3)
Gauge Pre.(kPa)	numeric	Use for gas or steam measure. Unit: kPa.
Temperature (°C)	numeric	Use for gas or steam measure. Unit: $^{\circ}$ C.
PV Cutoff (%)	numeric	Range: 0% - 20% low range cut off.
Damping	numeric	Range: 0 - 64 Seconds.
Line 3 Disp. Value	from table	Set the third line display value, values of 0,1,2, or 3.
Display Mode	from table	Set display mode.



Totalizer reset	from table	Long hold D key until cursor is under NO and Long Hold. When the LCD shows "Yes", long press D-Key to reset the totalizer and overflow counter.
Number of totalizer overflows	read only	Display of the number of totalizer overflow events; 1 overflow = 10,000,000
K-Factor	read only	View the Flow Meter Calibration K-Factor.

Password Protected Functions

OpCode	Code	Password	Input	Input 00050, set 51- 57 menus,Main Input 00060, set menus,K-Factor 5 Points Input 00061, set menu,Frequency Factor Input 00062, set menu,Amp Channel for sensor Input 00063, set menu,Amp Channel for sensor Input 00070, set menu,Temp and Press vars Input 00040, set menu,Adjust/Test 4-20 Input 00038, set menu,Adjust/Test 4-20 Input 00038, set menu,Steam Variables Input 00011, view menu,Version Input 00090, set menu ModBus settings Input 00111, set menu, preset total, set value Input 00721, set menu, temp. sensor trim Input 00741, set menu, set pressure sensor trim Input 02086, set menu, Validation Mode
Enter the passwo	ord 00050 to enter:			
Signal monitoring	Signal Monitor	Signal	Read Only	Constant
Vortex Size	MeterSize	Pipe Size	direct input	The input data range is 2- 10000 mm Note: LCD displays 100, which means the diameter is 100 mm. After changing the diameter of the vortex street, the lower limit flow rate, the maximum magnification and the meter coefficient (K value) must be reset.
medium	Fluid Type	medium	menu selection	Options: Gas, or Liquid. Note: When changing the fluid type, confirm all values from 53 to 56. Why is this necessary? Do they automatically change?
Lower limit flow	Low Flow Limit	Lower limit flow	direct input	Depending on the meter size and measuring media, set the corresponding low limit of the flow. The unit of "Low Flow Limit" is in units of m ³ /h.
upper limit flow	High Flow Limit	upper limit flow	direct input	The "High Flow Limit" defaults to 10 times the "Low Flow Limit", the actual measurement of the upper limit of 2.5 times the set value. The unit of "High Flow Limit" is in units of m³/h.
gain	Max AMP.	set magnification	direct input	Select between 200 and 1000. Typically about 400.



Meter factor (K value)	K-Factor	Meter factor	·Κ	direct input	Calibration K-Factor Factory set and on the label Units of hz/m3				
Pulse output mode	Pulse Out Mod	e Pulse output mode		menu selection	Select frequency or pulse output. 1-5000 Hz. Default 5000 Hz			1-5000 Hz. Default	
Impulse coefficient unit	Pulse Factor U	nit Impulse coefficient u	init	menu selection	Options:m lb.	³ , N m	³ , t, kg,	Scf, c	f, USG,UKG, bbl,
Output pulse coefficient	Pulse Factor	Output pulse coefficient	2	direct input	Set the outp "Pulse Fact Note:To ou [57]' and ' and set 'Pu m3.	put pul tor Un 1 tput 1 Pulse ulse Fa	lse num it [«] . the orig factor actor U	ber co ginal p [59]' t nit [58	prresponding 1 pulse, set 'K-factor to the same value, 8]' in units of
Range frequenc	y Frequency Ma	x. The frequence corresponding the upper ling of the range	cy ng to nit	direct input	500-5000 (default 5000)				
Enter passwor	d 00060 to enter:	I							
Five point K-Factor Trim Fi Five-point direct input correction [60] K-Factor Trim Yi correction frequency i, Five-point correction coefficient i,		direct input	Five-point Where Fi i Yi is the co i=1,2,3,4,5	K-Fa is the 1 orrecti	ctor cor referen ion coef	rrectio ce freo fficien	on. quency, t K.		
POINT 1	Frequency	K-factor	Av	varge K-	Factor	FV.	ALVE	Ϋ́	VALVE
1	100	69.3		73.4	5	F1	100	¥1	1.059885
2	200	70.5		73.4	5	F2	200	¥2	1.041844
3	300	72.1		73.4	.5	FЗ	300	¥3	1.018724
4	400	75.6		73.4	5	F4	400	¥4	0.971561
5	500	77.6		73.4	5	F5	500	¥5	0.946521
Five-point correction frequency coefficient setting [61]	Frequency Fac	tor Five-point correction frequency coefficient		direct input	The reference frequency value of the five-point correction is multiplied by the Frequency Factor, and the new reference frequency. By default, this value is set to 1				
	AMD Channel	<u>Channel art</u>	·						
4mA calibration [40] Channel Setting [62]	AMP. Channel	Channel sett	ings	menu selection	There are 3 channel options: CH_1, CH_2, CH_3 CH_3 gain maximum CH_1 gain minimum Note: CH_2 generally used for liquid measurement, which corresponds to the configuration software, select X1 and X2.				
					CH_3 gene which corre	erally u	ised for <u>ls to the</u>	gas m confi	neasurement, guration software,



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				select X1, X2 and X3.
Working Mode[63]	Work Mode	Operating mode	menu	F_1, F_2, F_3, & F_4 options.
Mode[05]			selection	F_1: Anti-vibration Mode
				F 2: Normal Mode
				F 3: Turbine Mode
				F 4: Test Mode
				– Note: Default Value is F 2.
	000404			
Enter password	00040 to enter:	Am A collibration	1	Calibration stans:
20mA calibration	20mA Trim	20mA		1 Press and hold the "D" key for three seconds to
[41]		calibration		enter the calibration;
				2. Short press the D key to decrease the current; press
				the \cup key to increase the current, the step is 16 microamps:
				3. Press and hold the "D" key for three seconds to
				save the calibration; or press the E key to exit
				without saving.
				Test mode drives 4-20& frequency outputs for
Enter password	00038 to enter:			testing
Minimum	Min Pre. (Kpa)	Minimum	direct input	This parameter is only used for steam mass
pressure 38		pressure value		measurement
				In the steam mass measurement mode if the
				nressure is less than the set "minimum pressure
				value" when the pressure compensation is
				activated the flow will
				automatically return to zero
Minimum	Min Temp. (°C)	Minimum	direct input	This parameter is only used for steam mass
temperature 39		temperature		measurement
		value		In the steam mass measurement mode if the
				temperature is less than the set "minimum
				temperature value" when the temperature
				compensation is activated
				the flow will automatically return to zero
Version	Version	Version	read only	Firmware version 118
maximum	Max Frequency	maximum	read only	The internal conversion frequency value
frequency	1 5	frequency		corresponds to the "High Flow Limit"
				"High Flow Limit"/K-FACTOR*3.6
Minimum	Min Frequency	Minimum	read only	The internal conversion frequency value
trequency		trequency		corresponds to the "Low Flow Limit" "Low Flow
				Limit"/K-FACTOR*3.6
Enter password	00090 to enter:			



Slave ID	Modbus Addr.	Modbus address	direct input	Enter Modbus address. Default 001
baud rate	Modbus Baud.	Modbus rate	menu	Options: "9600", "4800", "2400", "1200", "600"
			selection	
Enter the passwo	ord 00111 to enter:		1	
Preset	Total Reset or	Accumulated	direct input	Directly sets the current cumulative flow value. To
cumulative flow	Preset	flow preset		reset the totalizer use the main password free menu.
111				I his may ALSO be used to set to 0 as well.
Enter negeword	00070 to optom			
Enter password	Tomp Maggura	tomporatura	monu	
collection	Temp. Measure	collection	selection	Temperature acquisition mode setting.
method settings		concetion	sciection	Options: Manual, or Auto.
intenieu settings				Manual: Temperature uses an input reference
				value.
				Auto: Temperature uses automatic acquisition with
				an internal Pt1000 or Pt100 sensor
D		D		
Pressure	Pressure Measure	Pressure	menu	Pressure acquisition mode setting.
setting		acquisition	selection	Options: Manual, or Auto.
setting				Manual: Pressure uses an input reference
				value Auto: Pressure uses automatic
				acquisition with
	— — — —			the internal pressure sensor.
temperature unit	Temp. Unit	temperature unit	menu	Celsius (°C)
			selection	Fanrennett (*F)
Temperature low	Temp. Low Trim	Temperature low	direct input	Enter the lower calibration resistor value unit:
point calibration	1	point calibration	1	the lower cambration resistor value, and
				onm. Use standard resistance as input.
T 111	— — — — — — — — — —		1	For example: 1000 for Pt1000, or 100 for Pt100.
Temperature high	Temp. High Trim	l'emperature	direct input	Enter the high calibration resistor value, unit:
point canoration		calibration		ohm. Use standard resistance as input
		canoration		For example: 2500 for Pt1000, or 250 for Pt100.
pressure type	Gas Pre. Type	Gas pressure	menu	Select gauge/absolute pressure
1 91	51	type	selection	
pressure unit	Temp. Unit	pressure unit	menu	Kpa, PSI
			selection	
Pressure zero	Pre. Low Trim	Pressure zero	direct input	Enter the calibration reference pressure value, unit
canoration		canoration		is Kpa
				Apply the standard pressure to the sensor.
				For example: 0 Kna
full pressure	Pre. High Trim	full pressure	direct input	Enter the calibration reference pressure value unit
calibration	Ũ	calibration	1	
				is Kpa
				Apply the standard pressure to the sensor.
				For example: 1000 Kpa
Low pressure	Pre. Cutoff	low pressure	direct input	Set the low pressure cutoff value. Unit is Kpa.
cutoff		excision		If the measured pressure value is less than "Pre.
				Cutoff", the pressure will be set to 0 kpa.
				-
pressure transfer	Set Pre. Bias	pressure transfer	direct input	Set the pressure bias value. Unit is Kpa.
at any point		at any point		Enter the current actual pressure value to achieve
				bias. The pressure will be set to input value.



Enter the passw	ord 00721 to enter:	-	-	
temperature calibration data	Temp. Data X0; Temp. Data Y0; Temp. Data X1; Temp. Data Y1;	Temperature low point collection value; Low temperature resistance; Temperature high point collection value; high temperature resistance;	direct input	Directly view and modify the temperature sensor calibration values. Temp. Data X0 and Temp. Data X1 are internal ADC measurements. Temp. Data Y0[73] and Temp. Data Y1[74] are the input calibration values.
Enter the passw	ord 00741 to enter:			
Pressure Calibration Data	Pre. Data X0; Pre. Data Y0; Pre. Data X1; Pre. Data Y1;	Pressure zero point collection value; pressure zero value; Collected value of pressure full point; pressure full point value;	direct input	calibration values. Pre. Data X0 and Pre. Data X1 are internal ADC measurements. Pre. Data Y0[75] and Pre. Data Y1[76] are the input calibration values.
Enter the passwo	ord 02080 to enter:	L		
Standard gas pressure (gauge pressure)	Standard Pre.	Gas gauge pressure	direct input	Unit: Current pressure unit
Standard gas temperature	Standard Temp.	gas temperature	direct input	Unit: current temperature unit.
Flow correction factor	Flow correction factor	Flow correction factor	direct input	Global K-Factor to adjust the indicated flow value over the entire range. Value can be from 0.1 to 10
Unit correction factor	Unit correction factor	Unit correction factor	direct input	Unit K-Factor to adjust the SPCL units to allow using SPECIAL units. This should be a U32/10000 so we can cover mScf/h and mSCF/d Value can be from 0.1 to 10
Enter the passwo	ord 02086 to enter	the test mode:		
Traffic test	Flow Test	Traffic test	direct input	Unit: HZ (1-5000) Note 1: Calculate the corresponding instantaneous flow rate, current value, and pulse (frequency) value according to the input sensor frequency value, and output it. These values are also read through RS485. The cumulative flow advances just like the real mode for validation. Note 2: The test mode will only be executed after a new value must be entered, and the LCD backlight will flash at this time.
Frequency testCurrent test	Frequency Test	Frequency test	direct input	Unit: HZ (10-5000) Note 1: This function only outputs the specified frequency value. The instantaneous flow rate value and current value at this time are not affected. The cumulative flow remains the same. Note 2: The test mode will only be executed after a new value must be entered, and the LCD backlight will flash at this time.



Current test	Loop Test	Current test	direct input	Unit: mA (3.9-21)
				Note 1: This function only outputs the specified current
				value. The instantaneous flow rate value and pulse
				output value at this time are not affected. The
				cumulative flow remains the same.
				Note 2: The test mode will only be executed after a
				new value must be entered, and the LCD backlight will
				flash to indicate in test mode.

1 Protocol Overview

TFM VT-222 Multivariable Vortex Flowmeter communication protocol using MODBUS-RTU mode.

- Communication interface: RS-485.
- Support standard Modbus-RTU : Support functions codes 03, 04, 06, 16.
- **Register length limit**: Supports max 8 registers.

1.1 Serial Communication Parameters

Parameter	Ranges	Default Value
Address	1-247	1
Baud rate	9600, 4800, 2400, 1200, 600	9600
Data Length	8	8
Parity	None	None
Stop Bits	1	1

1.2 Communication DataFormat

TFM VT-222 supports the following data format types:

1) Float: Floating point data

The float data is a 4-byte floating-point number in standard IEEE-754 in the ABCD byte format. For example, in the case of 100.0 (hexadecimal representation: 0x42, 0xC8, 0x00, 0x00), the order of transmission is: 0x42, 0xC8, 0x00, 0x00. 100 is 42C80000 in IEEE 754 ABCD float

- U-16:2-byte 16 bit unsigned integer
 For example, in the case of 4660 (hexadecimal representation: 0x12, 0x34), the order of transmission is: 0x12, 0x34 in the AB format.
- 3) U-8: Single-byte unsigned 8 bit number

1.3 Communication Interface Functions Format

1.3.1 Function 03 (Read Holding Registers)

Example: Read the Full Scale value (assuming the current value is 100.0), the corresponding register starting address: 8204 (0x200C in hexadecimal). Note: 100 is 42C80000 in IEEE 754



ABCD float

Rea	uest	frame	•

	itequest it units								
	Address	Function Code	Register Address	Register count	CRC Check				
	0x01	0x03	0x20,0x0C	0x00,0x02	0x05,0xB0				
Т	The correct response frame :								
- 1									

Address	Function Code	Data Length	Data	CRC Check
0x01	0x03	0x04	0x42,0xC8,0x00,0x00	0x6F,0xB5

Function 04(Read Input Register) example

Example: To read total flow (assuming its current value is 100.0), the corresponding register starting address: 16394 (0x400A in hexadecimal). Note: 100 is 42C80000 in IEEE 754 ABCD float

Request frame:									
Address	Function Code	Register Address	Register Count	CRC Check					
0x01	0x04	0x40,0x0A	0x00,0x02	0x50,0xF9					
The correct response frame:									
Address	Function Code	Register Address	Register Count	CRC Check					
0x01	0x04	0x40	0x00,0x02	0x50,0xF9					

Function Code 16(Write Holding Registers) example 1.3.2

Example: Set the upper range value to 100.0, 9 0x42,0xC8,0x00,0x00) at register address is: 8204 (0x200C in hexadecimal) Note:100 is 42C80000 in IEEE 754 ABCD float

Request frame:

Address	Function Code	Register Address	Register	Data	Data Writing100	CRC Check
			Count	Length		
0x01	0x10	0x20,0x0C	0x00,0x02	0x04	0x42,0xC8,x00,0x00	0x7F,0x1C
a .						

Correct response frame:

Register Description 2

2.1 **Input Registers Table (Variables)**

Register Address (Dec/Hex)	Parameter Name	Access Type	Data Lengt h (word)	Data Type	Description
16386/x4002	Percentage	R	2	float	
16388/x4004	Instantaneous Flow	R	2	float	Register 0x021C stores the unit of instantaneous flow
16392/x4008	Vortex Frequency	R	2	float	Raw Sensor output frequency
16394/x400A	Total Flow	R	2	float	In Units of Register 8221/0x201D for total flow Unit index



16396/x400C	Overflows Number of Total	R	2	float	Each integer represents 10 million counts of the overflow of the totalizer
16404/x4014	Signal Gain	R	2	float	
16412/x401C	Signal Channel	R	1	U8	AMP CHANNEL 1 Unknown AMP CHANNEL 2 FOR LIQUID ANM CHANNEL 3 FOR GAS
16417/x4021	Current	R	2	float	mA
16419/x4023	Pressure	R	2	float	kPa Gage
16421/x4025	Temperature	R	2	float	Degrees C

16423/x4027	Density	R	2	float	kg/m3
16425/x4029	Pressure Sensor Raw Value	R	2	float	Raw Pressure Count
16427/x402B	Temperature Sensor Raw Value	R	2	float	RawTemperature Count

2.2 Holding Register List (Configuration Data)

Register Address (Dec/Hex)	Parameter Name	Access Type	Data Length (word)	Data Type	Description
8192/x2000	Modbus Address Slave ID	R/W	1	U8	Range 1 - 247
8193/x2001	Flow Mode	R/W	1	U8	<pre>{ 0, "Liquid_QV Liquid Volume "}, { 1, "Liquid_QM Liquid Mass"}, { 2, "Gas_QV Gas Volume"}, { 3, "Gas_QM Gas Mass"}, { 4, "Steam_QV Steam Volume"}, { 5, "Steam_PT Steam Pressure and Temperature Compensation "}, { 6, "Steam_SAT_T Saturated Vapor (Temperature Compensation)"}, { 7, "Steam_SAT_P Saturated Vapor (Pressure Compensation)"}</pre>



					{0/x000, "Liquid N15" },
					{ 1/x001, "Liquid DN20" },
					{ 2/x002, "Liquid DN25" },
					3/x003, "Liquid DN32" },
					4/x004, "Liquid DN40" },
					{ 5/x005, "Liquid DN50" },
8194/x2002			1	1116	{6/x006, "Liquid DN65" },
0174/A2002	index	K/W	1	016	{7/x007, "Liquid DN80" },
	much				{8/x008, "Liquid DN100"},
					{9/x009, "Liquid DN125"},
					{10/x00A, "Liquid DN150"},
					{11/x00B,"Liquid DN200"},
					{12/x00C,"Liquid DN250"},
					{13/x00D,"Liquid DN300"},
					{14/x00E, "Liquid DN350"},
					{15/x00F, "Liquid DN400"},
					{16/x010, "Liquid DN450"},
					{ 17/x011, "Liquid DN500"},
					{ 18/x012, "Liquid DN600"},
					{256/x100, "Gas DN15" },

8194/x2002	Fluid/Meter Size index	R/W	1	U16	<pre>{257/x0101, "Gas DN20" }, { 258/x0102, "Gas DN25" }, { 259/x0103, "Gas DN32" }, { 260/x0104, "Gas DN40" }, { 261/x0105, "Gas DN50" }, { 262/x0106, "Gas DN65" }, { 263/x0107, "Gas DN80" }, { 263/x0107, "Gas DN100" }, { 264/x0108, "Gas DN100" }, { 265/x0109, "Gas DN125" }, { 266/x010A, "Gas DN150" }, { 266/x010B, "Gas DN250" }, { 269/x010D, "Gas DN300" }, { 270/x010E, "Gas DN350" }, { 271/x010F, "Gas DN400" }, { 273/x0111, "Gas DN500" }, { 274/x0112, "Gas DN600" },</pre>
8196/x2004	Maximum Signal Magnification	R/W	2	float	Range: 0-1500
8198/x2006	Minimum Frequency	R	2	float	
8200/x2008	Maximum Frequency	R	2	float	
8202/x200A	K-Factor Pulses/m3	R/W	2	float	>0 Pulses/m3



8204/x200C	Full Scale Upper Range	R/W	2	float	> 0 in m3/h
8206/x200E	Damping	R/W	2	float	0 to 64.0 Seconds
8208/x2010	High Alarm Limit	R/W	2	float	
8210/x2012	Low Alarm Limit	R/W	2	float	
8212/x2014	Gas Density(kg/m ³)	R/W	2	float	
8214/x2016	Gas Pressure (kPa Gauge)	R/W	2	float	
8216/x2018	Gas Temperature (°C)	R/W	2	float	
8218/x201A	Liquid Density (g/c m ³)	R/W	2	float	
8220/x201C	Flow Unit Index Value	R/W	1	U8	<pre>{ 188 , "Nm3/h" }, { 189 , "Nm3/min" }, { 190 , "Nm3/s" }, { 29 , "m3/d" }, { 19 , "m3/h" }, { 131 , "m3/min"}, { 28 , "m3/s" }, { 138, "l/h" },</pre>
					{ 17, "l/min" },



					{ 24, "l/s" },
					{ 185, "Scf/h" },
					{ 123, "Scf/m" },
					{ 186, "Scf/s" },
					{ 130, "cf/h" },
					{ 15 , "cf/m" },
					{ 26 , "cf/s" },
					{ 136, "USG/h" },
					{ 16 , "USG/m" },
	Flow Unit				{ 22 , "USG/s" }.
8220/x201C	Index Value	R/W	1	U8	{ 30 "UKG/h" }
					{ 18 "UKG/m" }
					{137 "LIKG/s" }
					(137, 01073),
					$\{133, 0074, \},$
					$\{134, 001/11\},$
					{ 253, "special_Qv" } Hides Units
					$\{ /9, "t/d" \},$
					{ /8, "t/h" },
					{ 77, "t/min" },
					{ 76, "kg/d" },
					$\{75, "kg/h" \},$
					{ 74, "kg/min"},
					$\{73, "kg/s" \},$
					$\{72, "g/h" \},$
					{ 71, "g/min" },
					$\{70, "g/s" \},\$
					$\{ 83, "lb/d" \},$
					$\{ 82, "lb/h" \},$
					{ 254, "special_Qm" } Hides Units
					{ 43, "m3" },
					{ 41, "l" },
					{ 172, "Nm3"},
					{ 168, "Scf" },
0001/ 0010	Total Flow Unit	П	1	I IO	{ 112, "cf" },
8221/x201D	Index	K	1	08	{ 40, "USGal" },
					{ 42, "UKgal"},
					{ 46, "bbl"},
					{ 61, "kg" },
					{ 60, "g" },
					{ 62, "ton"},
					{ 63, "lb"},
					{ 253. "special"}.
					{ 254, "special"}.
					x 2 -r J2



8272/x2050	Display Mode	R/W	1	U8	{ 0, "Three-line Display" },
8222/x201E	Third Line of display setting index. Note Density is available	R/W	1	U8	<pre>{ 1, "Wo-life Display }, { 0, "Current" }, { 1, "Percentage" }, { 4, "Frequency" }, { 6, "Density" }, { 6, "Density" }, { 7, "Pressure" }, { 8, "Temperature" }, { 9, "Pressure and Temperature" }.</pre>
8223/x201F	Flow Display Point Index	R/W	1	U8	{ 0, "0" }, { 1, "1" }, { 2, "2" }, { 3, "3" },
8224/x2020	Write Protection	R/W	1	U8	{ 0, " Write Enable " }, { 1, "Write Disable" }
8225/x2021	Number of K-Factor User Trim Points.	R/W	1	U8	{ 0/x00, "0" }:No User Trim { 2/x02, "2" }, { 3/x03, "3" }, { 4/x04, "4" }, { 5/x05, "5" }
8226/x2022	K-Factor User Trim: Frequency Value 1	R/W	2	float	
8228/x2024	K-Factor User Trim: Frequency Value 2	R/W	2	float	
8230/x2026	K-Factor User Trim: Frequency Value 3	R/W	2	float	
8232/x2028	K-Factor User Trim: Frequency Value 4	R/W	2	float	
8234/x202A	K-Factor User Trim: Frequency Value 5	R/W	2	float	
8236/x202C	K-Factor User Trim: Correction factor 1	R/W	2	float	
8238/x202E	K-Factor User Trim: Correction factor 2	R/W	2	float	
8240/x2030	K-Factor User Trim: Correction factor 3	R/W	2	float	
8242/x2032	K-Factor User Trim: Correction factor 4	R/W	2	float	
8244/x2034	K-Factor User Trim: Correction factor 5	R/W	2	float	
8246/x2036	Low Flow Cutoff %	R/W	2	float	0 - 20%



8251/x203B	Reset Totalizer	R/W	1	U8	{ 256/0x0100, "Total Flow Reset" },
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	Code			Туре	
8263/x2047	Output Pulse Unit	R/W	1	U8	<pre>{ 43, "m3" }, { 172, "Nm3" } { 61, "kg" }, { 62, "ton" }, { 168, "Scf" }, { 112, "cf" }, { 40, "USGal" }, { 42, "UKgal" }, { 46, "bbl" }, { 63, "lb" },</pre>
8255/x203F	Number of pulses per unit of flow in m3	R/W	2	float	>0
8260/x2044	Work Mode	R/W	1	U8	<pre>{ 0, "F1: Anti-vibration Mode " }, { 1, "F2: Normal Mode " }, { 2, "F3: Turbine Mode }, { 03, "F4: Test Mode " },</pre>
8261/x2045	Temperature and Pressure Acquisition Mode Setting Index	R/W	1	U8	<pre>{ 0/x000, " Pressure Manual Input, Temperature Manual Input "}, { 1/x001, " Pressure Manual Input, Temperature Auto Acquisition "}, { 16/x010, " Pressure Auto Acquisition, Temperature Manual Input "}, { 17/x011, " Pressure Auto Acquisition, Temperature Auto Acquisition "},</pre>
8262/x2046	Baud Rate	R/W	1	U8	<pre>{ 0, "9600bps,8bits,1stop, No parity " }, { 1, "4800bps,8bits,1stop, No parity " }, { 2, "2400bps,8bits,1stop, No parity " }, { 3, "1200bps,8bits,1stop, No parity " }, { 4, "600bps,8bits,1stop, No parity " }</pre>
8266/x204A	Low Flow Limit	R/W	2	float	Low Flow limit. 'Low Flow Limit' units are in m³/h.



8268/x204C High Flow Li	it R/W	2	float	The 'High Flow Limit' The default is 10 times the 'Low Flow Limit'
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					'High Flow Limit' units are m³/h.
8270/x204E	Frequency Factor	R/W	2	float	0 to 20 The reference frequency value for the five-point correction is multiplied by this Frequency Factor. The new reference frequency value of each correction point is generated for each point. Normally, this value should be 1.
9216/x2400	Pressure Sensor Low Trim: Internal ADC Measurements	R/W	2	float	Units:mV
9218/x2402	PressureSensorHigh Trim:InternalADC Measurements	R/W	2	float	Units: :mV
9220/x2404	Temperature Sensor Low Trim: Internal ADC Measurements	R/W	2	float	Units: :Ohm
9222/x2406	Temperature Sensor High Trim: Internal ADC Measurements	R/W	2	float	Units: :Ohm
9224/x2408	Pressure Sensor Low Trim: Input Calibration Value	R/W	2	float	Units: :kPa
9226/x240A	Pressure Sensor High Trim: Input Calibration Value	R/W	2	float	Units: :kPa
9228/x240C	Temperature Sensor Low Trim: Input Calibration Resistance Value	R/W	2	float	Units: :Ohm
9230/x240E	Temperature Sensor High Trim: Input Calibration Resistance Value	R/W	2	float	Units: :Ohm



9232/x2410	Pressure Cutoff	R/W	2	float	Unit: :kPa
9234/x2412	Pressure Bias Value	R/W	2	float	Unit: :kPa