Multi-channel Vibrating wire & Analog signal Acquisition Instrument

VTN4XX

（V：Vibrating wire T：Temperature N：ANalog）

User Manual

（V1.00）

HEBEI WINCOM TECHNOLOGY CO., LTD

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Document version: V1.00 for firmware version V1.00 Technical support: 0316-3093523 info@geo-explorer.cn
Address: CHUANGYE BUILDING YANJIAO DEVELOPMENT ZONE LANGFANG CITY HEBEI PROVINCE CHINA

Multi-channel
Vibrating wire & Analog signal
Acquisition Instrument

Overview

VTN4XX is a multi-channel vibration wire, temperature, and analog sensor signal acquisition device, which can collect and store up to 32 channels vibrating wire frequency, 32 channels temperature sensor (NTC or DS18B20) and 32 channels analog quantity sensor (voltage or current) in real time or in full automatic timing. An adjustable power output can supply power to other sensors. The programmable multi-channel 16 DAC output can be used to convert the vibrating wire frequency into analog signal or for output control (H or L). RS485 data interface, industrial MODBUS or customized AABB simple communication protocol can directly access existing measurement and control systems (such as PLC, wireless transmission device, etc.).

(Violet Red)

(Medium Blue)

(Dim Gray)

Characteristics

- **Dimensions:** 200mm*123mm*23mm
- **Power Supply:** DC8~24V @500mA
- **Power Consumption:** <60mW(average, current consumption 5mA)
- **Electrical Interface:** Spring press connector
- **Input Signal:** Up to 32 vibrating wire +32 temperature +32 voltage or current
- **Measuring Rate:** Advanced FER(Fast Excitation Reading) 200ms/CH
  16 channel frequency measurement in 3 seconds, 32 channel in 5 seconds
- **Digital Interface:** RS485@MODBUS standard industrial communication protocol, Communication rate 1.2~256kbps
- **Analog Interface:** 1 channel programmed power output +16 channel analog output
- **Parameter Setting:** The parameters can be set using a dial switch, key or an instruction
- **Work Mode:** Real-time online and automatic startup
- **Memory Space:** 8Mbytes(2 years) 16Mbytes(4 years) 32Mbytes(8years)
- **Temperature Range:**-40~85'C
- **Other Features:** Key + digital tube parameter setting, real-time data display, power supply low reminder, radio frequency or mobile network wireless function expansion

Characteristics

(Environment Temperature = 25 ℃, VIN = 12 v)

Parameter	Test Conditions	Min	Typ	Max	Unit
Power Supply					
VIN		8	12	24	V
VOUT		1.5		VIN	V
I_{WORK}			---		mA
I_{SLEEP}			2.5		uA
digital interface RS485					
Communication Rate		1.2	9.6	256	Kbps
Differential Driver Output	RL = 100Ω	2.0			V
Output High Voltage		2.9			V
Output Low Voltage				0.4	V
Input Resistance			12		KΩ
Load Capacity					
Vibrating wire (frequency) sensor					
Measured Frequency Range		100		8000	Hz
Excitation Voltage	Low-voltage sweep	3		20	V
	High-voltage pulse	30		220	V
Frequency Resolution			0.01		Hz
Frequency Accuracy		0.01		0.05	Hz
Rate of Frequency Measurement	High-voltage pulse		1		S/CH
	Frequency feedback sweep	0.1			S/CH
	Full frequency sweep	1		10	S/CH
Temperature (NTC) sensor					
Resistance Range		1	2	10	KΩ
Temperature Resolution			0.1		℃

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Temperature Accuracy			0.3		℃
ADC					
Voltage Range		Custom	5	Custom	V
Current Range		Custom	20	Custom	mA
Resolution	12 bits ADC		1/4095		
	16 bits ADC		1/65535		
DAC					
Voltage Range		0		5	V
Resolution			1/4095		
Short-circuit Current				25	mA
Other					
RTC Accuracy			2	3.5	ppm
Auto Start Interval		10	3600	65535	sec
Internal Storage			8	32	MByte
External Storage				32	G
Operation Temperature		-40		+85	℃

Ordering Information

VTN A B _ C _ D _ E

- **VTN:** Mixed signal collector (vibrating wire, temperature, analog)
- **A:** Number of embedded VM devices (1~4)
- **B:** Number of vibrating wire channels by two digits (04, 08, 16, 32)
- **C:** Number of temperature channels (T1608:16 channel NTC, in which 8 channels can be configured by software as DS18B20)
- **D:** Number of ADC channels (A1604:16 channels of analog input, of which 4 channels are high-resolution channels)
- **E:** Number of digital-analog channels (D16)

	TYPE	Vibr	NTC/ DS18B20	ADC (16bits)	DAC	MSRP (CNY)
BASE vibrating wire	VTN208V(T0808_A0000_D00)	8	8/8	0(0)	0	
	VTN216V(T1608_A0000_D00)	16	2/2	0(0)	0	
	VTN416V(T1616_A0000_D00)	16	16/16	0(0)	0	
	VTN432V(T1604_A0000_D00)	32	4/4	0(0)	0	
PLUS mixed signal	VTN208M(T0808_A1604_D16)	8	8/8	16(4)	16	
	VTN216M(T1602_A0804_D08)	16	16/2	8(4)	8	
	VTN416M(T1616_A1604_D16)	16	16/16	16(4)	16	
	VTN432M(T1604_A0804_D08)	32	16/4	8(4)	8	
CUSTOM						

Note: other models are available. Up to 32 channels for vibrating string, 32 channels for temperature or analog quantity, and 16 channels for digital-analog conversion.
Mass purchase can be customized firmware and working logic, can directly external or internal embedded wireless function devices.
Optional built-in battery, can work continuously for no less than 1 year without external battery.

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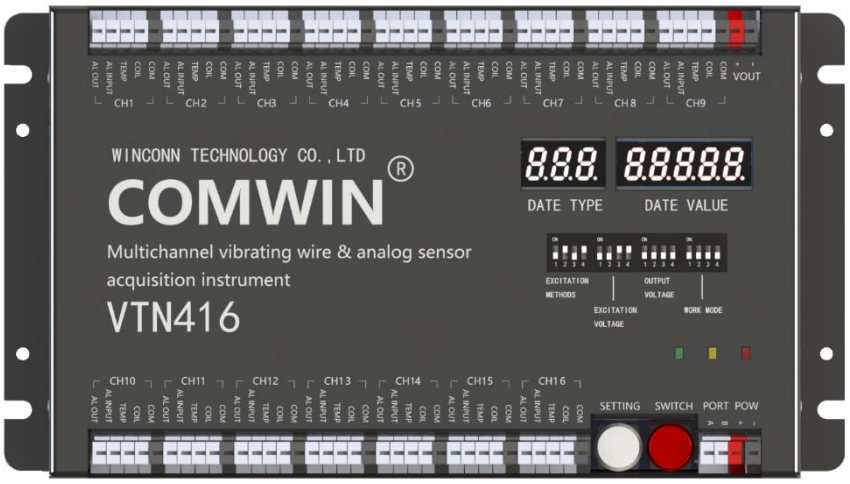
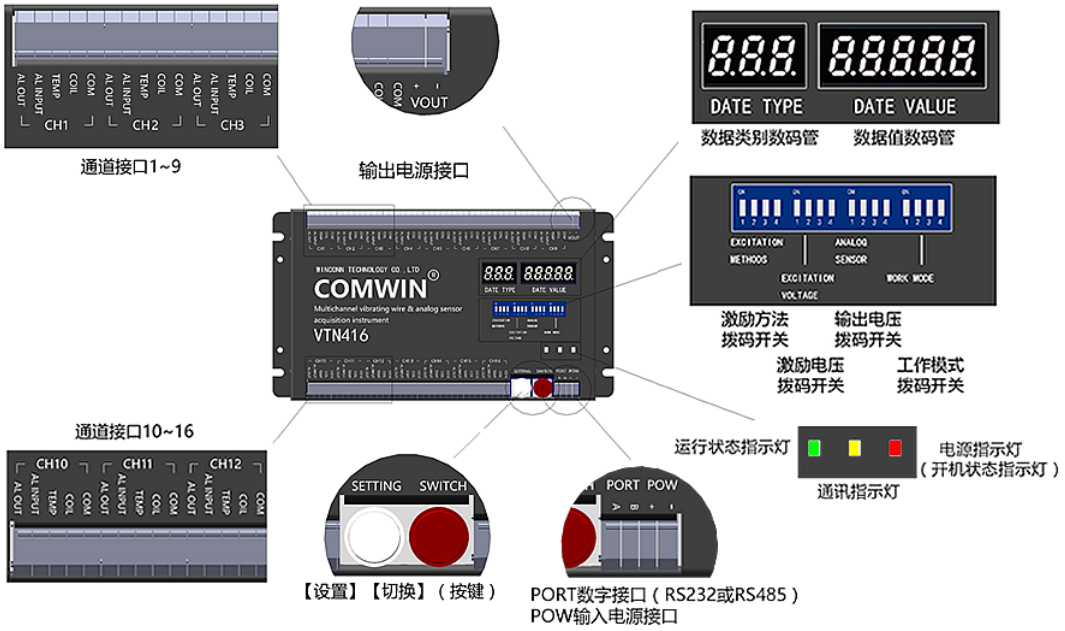
Structure


WINCONN TECHNOLOGY CO.,LTD
COMWIN
Multichannel vibrating wire & analog sensor acquisition instrument
VTN416
DATE TYPE
DATE VALUE
SETTING
SWITCH
PORT
POW
VOUT


通道接口1~9
输出电源接口
数据类别数码管
数据值数码管
激励方法拨码开关
输出电压拨码开关
激励电压拨码开关
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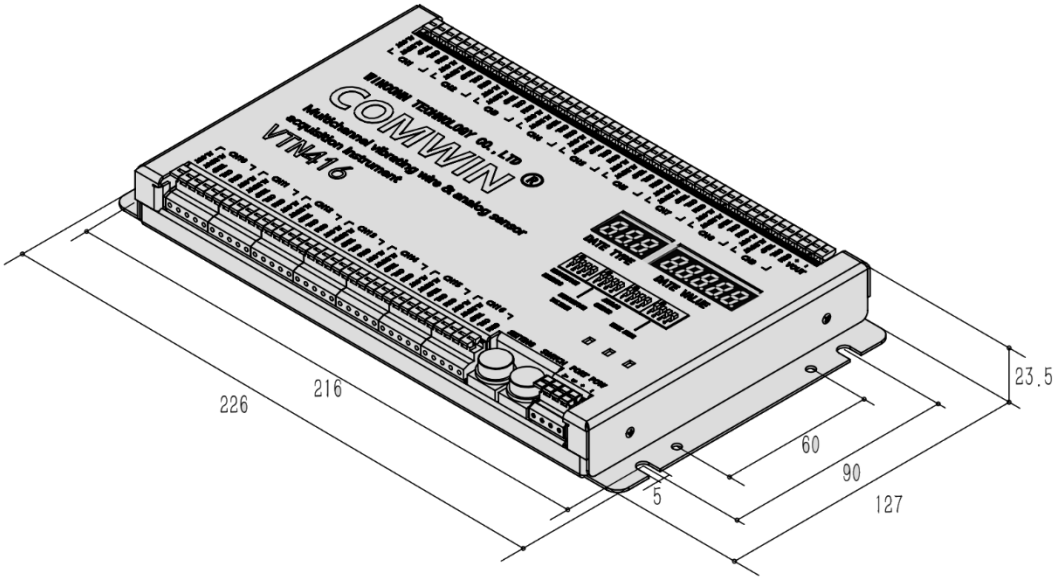
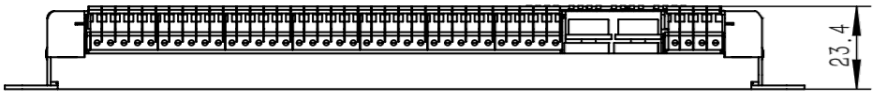
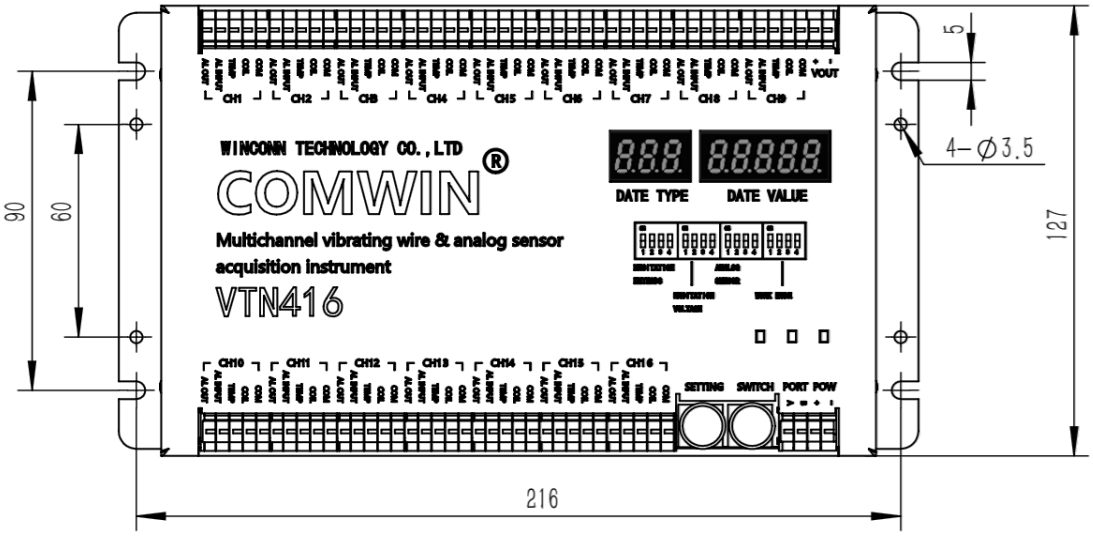
通讯指示灯
【设置】【切换】（按键）
PORT数字接口（RS232或RS485）
POW输入电源接口

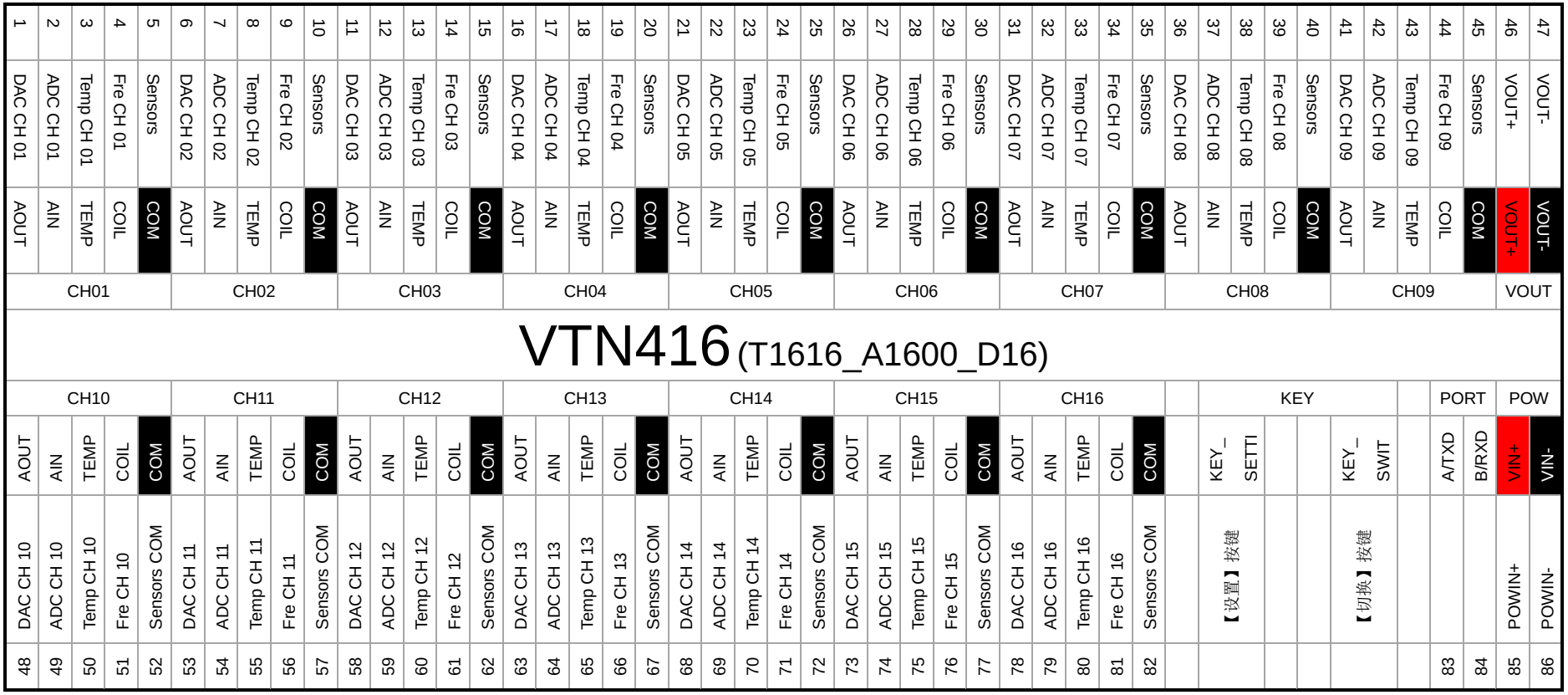
Dimension


COMWIN
VTN416
226
216
23.5
60
90
127
5


23.4


WINCOMN TECHNOLOGY CO., LTD
COMWIN
Multichannel vibrating wire & analog sensor
acquisition instrument
VTN416
DATE TYPE
DATE VALUE
SETTING
SWITCH
PORT
POW
VOUT
90
60
5
4-Ø3.5
127
216

Interface Definition



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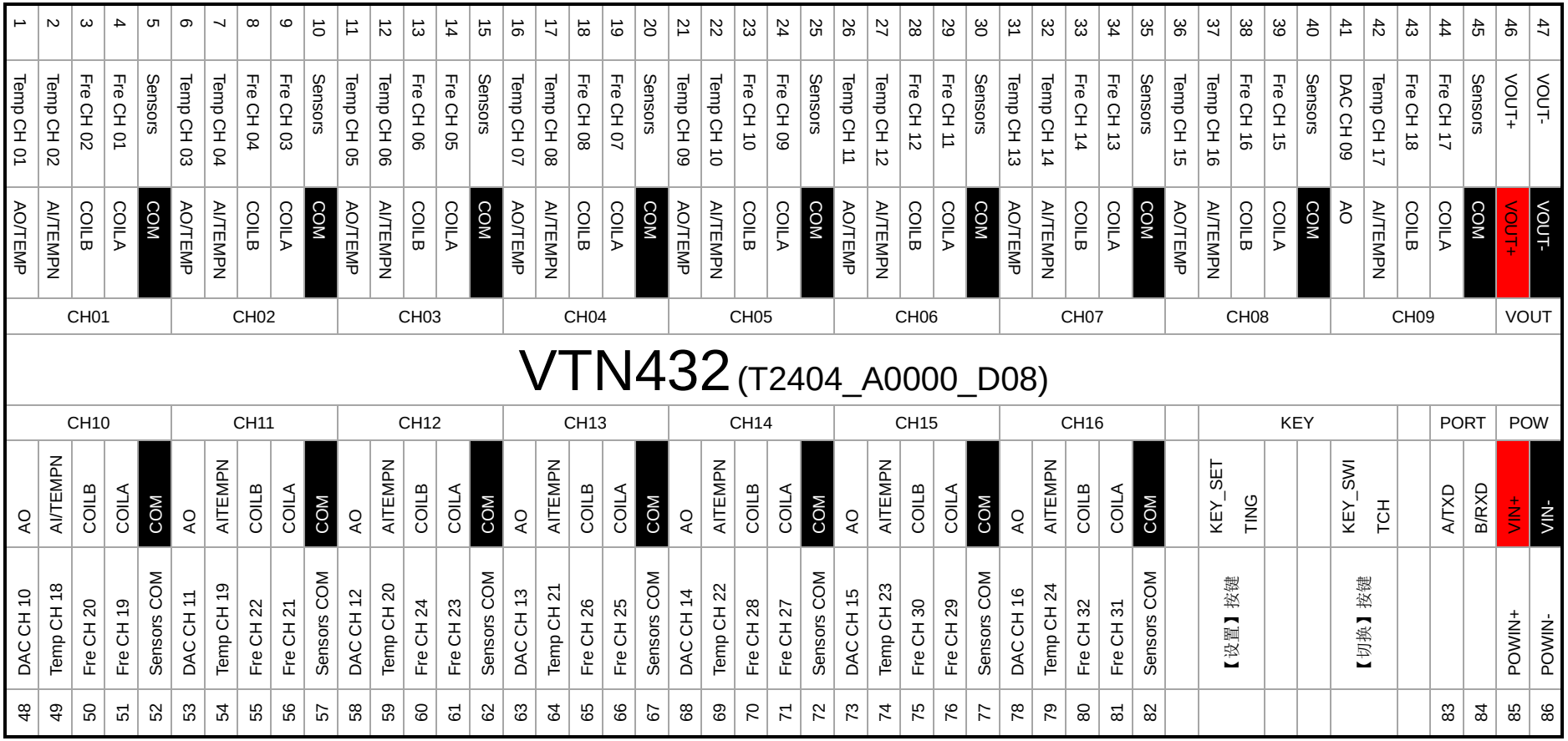
VTN432 (T2404_A0000_D08)
CH01 CH02 CH03 CH04 CH05 CH06 CH07 CH08 CH09 VOUT
1 Temp CH 01 AO/TEMP
2 Temp CH 02 AI/TEMPN
3 Fre CH 02 COILB
4 Fre CH 01 COILA
5 Sensors COM
6 Temp CH 03 AO/TEMP
7 Temp CH 04 AI/TEMPN
8 Fre CH 04 COILB
9 Fre CH 03 COILA
10 Sensors COM
11 Temp CH 05 AO/TEMP
12 Temp CH 06 AI/TEMPN
13 Fre CH 06 COILB
14 Fre CH 05 COILA
15 Sensors COM
16 Temp CH 07 AO/TEMP
17 Temp CH 08 AI/TEMPN
18 Fre CH 08 COILB
19 Fre CH 07 COILA
20 Sensors COM
21 Temp CH 09 AO/TEMP
22 Temp CH 10 AI/TEMPN
23 Fre CH 10 COILB
24 Fre CH 09 COILA
25 Sensors COM
26 Temp CH 11 AO/TEMP
27 Temp CH 12 AI/TEMPN
28 Fre CH 12 COILB
29 Fre CH 11 COILA
30 Sensors COM
31 Temp CH 13 AO/TEMP
32 Temp CH 14 AI/TEMPN
33 Fre CH 14 COILB
34 Fre CH 13 COILA
35 Sensors COM
36 Temp CH 15 AO/TEMP
37 Temp CH 16 AI/TEMPN
38 Fre CH 16 COILB
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86 POWIN- VIN- POW
【设置】按键 KEY_SETTING
【切换】按键 KEY_SWITCH

Cautions

✓ Case Ground

The equipment power supply negative pole (case) should be connected with the earth reliably, Otherwise, it may lead to signal acquisition noise or shock hazard。

✓ Prevent Electrostatic

Static electricity can cause serious damage to instrument components and accessories.

✓ Do not overvoltage

Use only the power cord and power adapter provided by the product manufacturer.

✓ Do not exceed the drive capacity

Connect other devices strictly in accordance with the power output and analog output indicators specified in this manual, and do not overload.

✓ Handle with care

Strong vibration shall be prevented during operation and transportation.

✓ Avoid pressing

There is no load-bearing capacity in the equipment shell, and extrusion deformation can cause short circuit between the metal shell and the internal electronic components.

✓ avoid the rain

This product does not have the waterproof ability, and is not allowed to contact with the water in any form, do not install in the outdoor environment.

✓ Dry storage

For a long time stored in a humid environment, the enclosure and internal electronic components will rust. Before connecting the power source, the equipment should be dry on the outside and inside.

✓ careful of range

Do not attempt to connect the signal line beyond the measured range to the input terminal.

✓ Replace button batteries on time

Low internal clock battery power can cause the device to fail to work properly and it is recommended to replace it every one to two years.

2. Hardware Interface

2.1 Power Port

2.1.1 Input Power

VTN4XX can automatically adapt to the wide voltage power supply of dc8-24v, with a maximum current consumption of about 500mA. It is recommended to use a power source with output capacity greater than 1A to power the equipment. The working power supply provides power for both the excitation of the vibrating wire sensor and the output VOUT of the power supply. The voltage of the working power supply should not be lower than the expected excitation voltage and output voltage.

Recommended: DC12V @2A power supply.

Warning: this equipment does not have overvoltage and polarity reverse connection protection measures. If the maximum voltage or reverse connection is exceeded, permanent damage will be caused.

2.1.2 Output Power

VOUT interface can output controlled voltage, output voltage is set by dial switch, output range is 5.0~VIN-1.0, maximum output current 3A.Can be controlled via digital interface to enable or disable voltage output.

2.1.3 Back up Supply

The device is equipped with a real-time clock button battery, which can keep the clock running when the external power supply is cut off, or automatically start up when the device is shut down. Button battery model is CR1220 or ML1220. Please use the same model as the original battery when replacing.

Suggestion: replace the spare battery (clock button battery) every 1-2 years.

Warning: when the standby battery power is low or exhausted, it will cause real-time clock reset and fail to complete automatic startup.

2.2 User Interface

2.2.1 Button

VTN4XX has two light touch buttons, through which data viewing and parameter modification can be completed.

Short press: press the button once within 1 second;
Long press: hold the button for at least 3 seconds before releasing.

State	Button	Event	Description
power off	SWITCH	Long	Power on (display next class/save data)
Data view		Short	next data item
	SETTING	Short	Previous data item
		Long	Shutdown (enter parameter edit mode)
Data modification	SWITCH	Short	Modify to the next available value
	SETTING		Modify to the Previous available value
	SWITCH	Long	Exit the parameter edit mode ①
	SETTING		Exit the parameter edit mode ②
Note①：Parameter restored after restart；Note②：Permanent save			

2.2.2 Indicator lamp

VTN4XX has three indicators from right to left: power indication, data transmission indication and operation status indication.

- Power supply indication (red) : it is always on after starting up
- Data transfer indication (yellow) : flashing when receiving or sending data
- Operational status indicator (green) : flashing once per second during normal operation

2.2.3 Nixie tube

VTN4XX has two 8-segment digital tubes for displaying data categories, data Numbers, and data values.

The first digital tube is three bits: the following is called "data name digital tube". The first represents the data category, and the last two represent the data item Numbers.

The second digital tube is five bits: it is called "data value digital tube". Displays current data or parameter value.

 ：FXX, frequency data, XX is the channel number, and the last 5 digits are frequency values

 ：TXX, temperature data, XX is the channel number, and the latter 5 are temperature values

 ：AXX, ADC data, XX is the channel number, and the last 5 bits are the conversion values

 ：PXX, parameter data, XX is parameter address, and the last 5 bits are current parameter values

2.2.4 Toggle switch

Excitation Method

Excitation Voltage

Output Voltage

Work Mode

The relation between dial switch and output voltage

Value	Bits Stat				Vol	Value	Bits Stat				Vol
	1	2	3	4			1	2	3	4	
0	□	□	□	□	5.0	8	■	□	□	□	17.0
1	□	□	□	■	6.5	9	■	□	□	■	18.5
2	□	□	■	□	7.5	10	■	□	■	□	20.0
3	□	□	■	■	9.0	11	■	□	■	■	21.0
4	□	■	□	□	11	12	■	■	□	□	23.0
5	□	■	□	■	12.5	13	■	■	□	■	24.5
6	□	■	■	□	13.5	14	■	■	■	□	26.0
7	□	■	■	■	15.0	15	■	■	■	■	27.0
■： ON；□： OFF											

The relation between dial switch and Excitation Voltage Source(VSEN)

Value	Bits Stat				Vol	Value	Bits Stat				Vol
	1	2	3	4			1	2	3	4	
0	╳	□	□	□	5.0	4	╳	■	□	□	11
1	╳	□	□	■	6.5	5	╳	■	□	■	12.5
2	╳	□	■	□	7.5	6	╳	■	■	□	13.5
3	╳	□	■	■	9.0	7	╳	■	■	■	15.0

■：ON；□：OFF；×：Ignore

The energy to excite the vibrating wire sensor comes from VSEN，The high voltage required for impulse excitation can be obtained through VSEN. When the frequency sweeping method is used to excite the sensor, VSEN is the excitation voltage.

bit	Functional description		Descr
1	use more compatible excitation method		Improved compatibility, but longer measurement time
	□	Normal	
	■	Slow	

The relation between dial switch and Excitation Method

Value	Bits Stat				激励方法	Descr
	1	2	3	4		
0	□	□	□	□	HPM	Pulsed Excitation,120V

1	□	□	□	■		Pulsed Excitation,150V
2	□	□	■	□		Pulsed Excitation,200V
3	□	□	■	■	FFF	Frequency feedback fixed frequency sweep method ①
4	□	■	□	□	FFG	Frequency feedback gradient frequency sweep method ①
5	□	■	□	■	FFF	Frequency feedback fixed frequency sweep method ②(recommended)
6	□	■	■	□	FFG	Frequency feedback gradient frequency sweep method ②
7	□	■	■	■	SGF1	Piecewise frequency sweep 1,300~1500Hz
8	■	□	□	□	SGF2	Piecewise frequency sweep 2,1500~2700Hz
9	■	□	□	■	SGF3	Piecewise frequency sweep 3,2700~3900Hz
10	■	□	■	□	SGF4	Piecewise frequency sweep 4,3900~5100Hz
11	■	□	■	■	FFS	Full frequency sweep,300Hz~5000Hz
12~14	■	■				Undefined
15	■	■	■	■		The excitation method is no longer controlled by the dial code switch and can be switched by modifying the register EX_METH
Note①：First excitation method is HPM; Note②：First excitation method is FFS						

The relation between dial switch and Work Mode

bit	Functional description		Descr
4	Power on control switch		
	□	Startup manually or automatically and shut down automatically	
	■	Connect the power immediately to start, never shut down	Power on and off are controlled by input power
3	Working mode switch		
	□	manual	
	■	Automatic timed start	
2,1		Reserved	

2.3 Communication Interface

The equipment has a standard three-wire RS232 or two-wire RS485 interface with the main features as follows:

Communication rate:1200、4800、9600、14400、19200、38400、57600、115200、128000、256000bps

Data bits: 5, 6, 7, 8

Parity bit： None, Odd, Even

Stop bit: 1, 1.5, and 2

Recommendation: use low communication rate for remote communication.

2.4 Sensor Interface

VTN4XX has 16 groups of sensor physical interfaces, each group is composed of 5 terminals and marked with Numbers 1-5. Among them, terminal 1 (wiring hole) is the common terminal COM and the color is black.The five terminals are defined as follows:

Sensor interface definition For VTN416

Number	Name	Color	Descr
1	COM	Black	Common, Connect the negative pole of the sensor
2	COIL		Connect the anode of the coil of the vibrating wire
3	TEMP		Connect the anode of the temperature sensor
4	AIN		Analog signal input
5	AOUT		Analog signal output

Sensor interface definition For VTN432

Num	Name	Color	Descr
1	COM	Black	Common, Connect the negative pole of the sensor
2	COILA		Connect the anode of the coil of the vibrating wire ①
3	COILB		Connect the anode of the coil of the vibrating wire ①
4	AIN/TEMP		Analog signal input/ temperature sensor ②
5	AOUT/TEMP		Analog signal output/ temperature sensor ②
Note①：Each group can connect two coils. All 16 groups can measure 32 frequency. **Note②：Set by the manufacturer before delivery**			

2.4.1 Coil interface of vibrating wire sensor

It's made up of COM and COIL, Connect the positive and negative poles of the coil。

Tip: the coil of vibrating wire sensor does not distinguish between positive and negative poles.

2.4.2 Temperature sensor interface

The temperature sensor interface is represented on the housing by TEMP or TEMPN, TEMP means that this channel can connect DS18B20 or NTC (configured via software),

and TEMPN means that this channel can only connect thermistor NTC.The device can be connected with thermistor with nominal value of 1k~10k.

2.4.3ADC interface

VTN4XX provides the "analog-to-digital" conversion function of 4-channel 16-bit resolution and 16-channel 12-bit resolution, and it can be configured with software to add constants and multiply constants to each channel to directly convert analog signals to physical values. The input range of the analog signal (voltage or current) is fixed at the factory, and the maximum and minimum values can be checked through parameters (generally 0~10V or 0~20mA).

Warning: connection of voltage or current beyond the acquisition range will result in permanent damage to the channel and the equipment will be unable to be used in severe cases.

2.4.4DAC interface

VTN4XX provides analog output channels with 16 channels at 12-bit resolution. Through parameter configuration, it can be specified whether the analog output channel can be controlled by the instruction (programmable). When the analog output is not programmable, each channel is controlled by the device internally, and the output voltage signal represents the frequency value.

3. Work Mode

VTN4XX has three working modes: real-time online, timed startup and manual startup. All three work modes are set by dial - code switch. See "2.2.3 dial switch" for details.

- **Real-time Online：** Start up immediately after connecting the external power source, never shut down, and measure the channel sensors in real time.
- **Timed Startup：** Startup according to the preset time interval, collect and store data and send data, automatically shut down after the work is completed, start up again automatically after the preset time interval, and run in a loop.
- **Manual Startup：** Power on only by manual button, when no operation timeout after automatic shutdown.

4. Normal Operation

4.1 Startup & Shutdown

4.1.1 Startup

VTN4XX has three ways of starting up: manually starting up, automatically timing starting up and power-on starting.

Power-on starting: When the fourth bit of "work mode dial code switch" is ON, it can be started up by connecting the external power supply directly.

Automatically timing starting up: The device will start up automatically at a preset time interval.

Manually starting up：In the shutdown state, press the [SWITCH] button and hold it for 3 seconds. The digital tube displays "416 HELLO"  . When the buzzer is heard, release the button.

4.1.2 Shutdown

When the dial code switch on the power on is ON, it will be ON until the external power source is removed (never off).

When the dial code switch on the power on is OFF, it will automatically shut down after completing the automatic working process or no operation timeout.

Manual power off: long press [SETTING] key, the digital tube shows "BEY"  , release the key.

4.1.3 Version Information

At startup, the device outputs a string containing the device model and version information via a digital interface, as shown below:

```
==================  COPYRIGHT INFORMATION  ==================
TYPE:       VTN416B
COPYRIGHT:  Copyright(c)2010-  HEBEI WINCOM TECH CO.,LTD.All Rights Reserved
SITE:       http://www.winkooo.com

==================  VERSION INFORMATION  ==================
TYPE:       VTN416B
HWVER:        100
SFVER:      100
```

Please note if the equipment version information is consistent with this manual, and ask us for the applicable user manual if necessary.

During device operation, you can get version information by sending string instruction $INFO to the device, as shown in "6.9 view production information".

4.2 Data Viewing

By pressing the button, the digital tube can display real-time data and operation parameters of different categories. The data name digital tube shows 3-digit symbol, the first digit is the letter, representing data category, and the last two are the Numbers of data. Data categories are denoted by letters, F denotes frequency categories, T (lowercase t) denotes temperature categories, and P denotes system parameter categories.

4.2.1 Frequency data

Frequency value is represented by FXX, XX represents channel number, short press [SWITCH] to display the next channel, short press [SETTING] to display the prior channel, long press [SWITCH] to display the next category data.

4.2.2 Temperature data

Temperature value is represented by TXX, XX represents channel number, short press [SWITCH] to display the next channel, short press [SETTING] to display the prior channel, long press [SWITCH] to display the next category data.

4.2.3 ADC Data

ADC value is represented by AXX, XX represents channel number, short press [SWITCH] to display the next channel, short press [SETTING] to display the prior channel, long press [SWITCH] to display the next category data.

4.2.4 System Parameters

System Parameters value is represented by PXX, XX represents parameter address, short press [SWITCH] to display the next parameter, short press [SETTING] to display the prior parameter, long press [SWITCH] to display the next category data.

4.3 Modify Parameters

The method to modify a parameter by using the button is as follows:

(1) On the system parameter page (PXX page), press [SWITCH] or [SETTING] to select the parameter item to be modified.

(2) Long press [SETTING], and when the digital tube of data value starts flashing, it indicates that the current state of parameter modification has been entered.

(3) Click [SWITCH] to SWITCH the current parameter value to the next standby value or click [SETTING] to SWITCH the current parameter value to the previous standby value.

(4) Long press [SETTING] or [SWITCH] to indicate that the modification of this parameter has been completed when the digital tube of data value does not flash.

Note: long press [SWITCH] or [SETTING] to exit the parameter modification state. The difference is that the parameter value will be saved permanently by the latter.

Use instructions to modify parameters, See "5. Communication protocol" for details.

5. Communication Protocol

Register mechanism

VTN4XX internal maintenance has several registers, and the device completes the measurement of the vibrating wire sensor under the control of the register parameter values. The value of the register always exists as an integer. The basic operation unit is "word" (2-byte integer, big-end mode). There are two types of power-off saving and power-off loss (corresponding to the two attributes of "read/write" and "read only").

Data mode

The register data value is in big endian mode, the high byte of the data is stored in the low address of the memory, and the low byte of the data is stored in the high address of the memory. When the data frame is transmitted, the low byte is transmitted first and then the high byte is transmitted. . Each register corresponds to two bytes, then the value of a single register = low byte value * 256 + high byte value.

Communication Protocol

This device supports the standard industrial MODBUS communication protocol (03, 06 instruction codes), simple AABB protocol and $string instruction set. Both protocols support “One host multiple slave” application structure based on device address and bus connection. In the bus, the VTN4XX is always used as a slave (Passively wait for instructions, do not upload data actively).

5.1 MODBUS communication protocol

Under the MODBUS protocol, all registers in VTN4XX are defined as "hold registers" (see MODBUS communication protocol standard description). The device supports multiple consecutive register reads, single register writes, multiple consecutive register writes. Three kinds of instructions, the corresponding instruction codes are 0x03, 0x06.

(1) 03 (0x03) instruction code: read multiple consecutive register data, the instruction format is as follows

Instruction data frame structure

address code	Function code 0x03	Start address	Number of registers	CRC
1 byte	1 byte	2 byte	2 byte	2 byte

Return data frame structure

address code	Function code 0x03	Data length	datas	CRC

1 byte	1 byte	2 byte	n byte	2 byte

Example: Read the device register value with address 0x01, the register start address is 0, and 10 registers are read continuously.

The host sends the command: 0x01 0x03 0x00 0x00 0x00 0x0A ***0xC5 0xCD***

The slave return: 0x01 0x03 0x14 0x00 0x01 0x00 0x60 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x01 0x01 0xF4 0x00 0x00 0x00 0x64 0x00 0xC8 ***0x5F 0x8F(underscore is the 10 register values)***

When reading multiple consecutive registers, do not exceed 64 registers in a single read. Do not attempt to read a non-existing register.

(2) 06 (0x06) instruction code: modify the value of a single register, the instruction format is as follows

Instruction data frame structure

address code	Function code 0x06	Register address	Register value	CRC
1 byte	1 字节	2 byte	2 byte	2 byte

Return data frame structure

address code	Function code 0x06	Register address	Register value	CRC
1 byte	1 byte	2 byte	2 byte	2 byte

Example: Modify the value of register 8 in the device with address 0x01 to 100.
The host sends the command: 0x01 0x06 0x00 0x08 0x00 0x64 0x09 0xE3
The slave return: 0x01 0x06 0x00 0x08 0x00 0x64 0x09 0xE3

5.2 AABB communication protocol

AABB communication protocol is a non-standard custom protocol. Compared with MODBUS communication protocol, the structure is simpler and the instruction generation method is easier, which is convenient for quick test. The AABB communication protocol supports single register reads and writes two instructions.

(1) Read a single register

Instruction data frame structure

head 0xAA 0xBB	address code	Register address	Add check
2 byte	1 byte	1 byte	1 byte

Return data frame structure

head 0xAA 0xBB	address code	Register address	Register value	Add check
2 byte	1 byte	1 byte	2 byte	1 byte

Command header: fixed to hexadecimal AABB

Address code: The address of the VM3XX device (1~255, where address 255 is the general address, see the description of the following "Universal Device Address" for details)

Register address: The address of the register to be accessed (0~63). The highest bit of the register address byte is the read/write flag. When it is 0, it indicates the read register. When it is 1, it indicates the write register.

Add check: the sum of all previous data, 0xAA + 0xBB + address code + register address, when the checksum exceeds 255, only the low byte is used. In the following example, the checksum = 0xAA + 0xBB + 0x01 + 0x08 = 0x016E, then only 0x6E is used as the final checksum.

Example: Read the device register value with address 0x01, register address is 8

The host sends the command: 0xAA 0xBB 0x01 0x08 0x6E

The slave returns a response: 0xAA 0xBB 0x01 0x08 0x00 0x60 0xCE

(2) Modify a single register

Instruction data frame structure

head 0xAA 0xBB	address code	Register address |0x80	Register value	Add check
2 byte	1 byte	1 byte	2 byte	1 byte

In the write register instruction, the most significant bit of the register address byte should be 1, that is, the address value is “OR” with 0x80.

Return data frame structure

head 0xAA 0xBB	address code	Register address	Register value	Add check
2 byte	1 byte	1 byte	2 byte	1 byte

Example: Modify the device register value with address 0x01, the register address is 8, and the modified value is 100.

The host sends the command: 0xAA 0xBB 0x01 0x88 0x00 0x64 0x52

Slave return response: 0xAA 0xBB 0x01 0x08 0x00 0x64 0xD2

(3) Universal device address

The AABB communication protocol supports the device's general address. Regardless of the current address of the device, using 0xFF as the address to send read and write instructions to the device, the device can respond correctly.

Example: Use the general address to read register 8 of any device

The host sends the command: 0xAA 0xBB 0xFF 0x08 0x6C

The slave returns a response: 0xAA 0xBB 0x01 0x08 0x00 0xC8 0x36

Note: When multiple devices are connected to the bus (usually RS485 bus), all devices on the bus will respond to the command when the general address is used, resulting in the instruction not working properly.

Note: It is strictly forbidden to use a general address to modify the device address in a bus connected to multiple VM3XX devices.

Device address register (0x00)

Bit	symbol	value	description	Reset value
bit15:8			Not yet defined	0
bit7:0		1~254	Device address	1

5.3 $String communication protocol

String communication protocol is a custom string communication protocol with English character '$' as a fixed frame head. It can read and write single register (parameter), which is convenient for quick and easy testing.

(1) Read a single register

Instruction data frame structure

head $GETP	separator '='	Register address	\r\n
5 byte	1 byte	1~2 byte	2 byte

Return data frame structure

head $REG	separator[	Register address	separator]	separator '='	Register value	\r\n
4 byte	1 byte	1~3 byte	1 byte	1 byte	1~5 byte	2 byte

Example: read the value of the register (register address is 21)
The host sends the command: $GETP=21\r\n
The host sends the command: $REG[21]=96\r\n

(2) Modify a single register

Instruction data frame structure

head $GETP	separator '='	Register address	separator ','	Register value	\r\n
5 字节	1 字节	1~2 字节	1 字节	1~5 字节	2 字节

Return data frame structure: OK\r\n

Example: the modified register (address 21) has a value of 1152

The host sends the command: $SETP=21,1152\r\n

The host sends the command: OK\r\n

Note: after the parameter is modified using the string instruction, it is saved using $SAVE.

5.4 Check code algorithm

Whether the instruction is sent to the module or the response data returned by the receiving module, the data verification should be strictly performed. In rare cases, there will be errors in the response data returned by the module, and the verification of the data frame can completely avoid reading the wrong data.

（1）CRC16-MODBUS

```
unsigned int crc16(unsigned char *dat, unsigned int len)
{
    unsigned int crc=0xffff;
    unsigned char i;

    while(len!=0)
    {
        crc^=*dat;
        for(i=0;i<8;i++)
        {
            if((crc&0x0001)==0)
                crc=crc>>1;
            else
            {
                crc=crc>>1;
                crc^=0xa001;
            }
          }
          len-=1;
          dat++;
        }
    return crc;
}
```

（2）And check

```
unsigned char AddCheck(unsigned char *dat,unsigned char count)
{
    unsigned char i,Add=0;
```

```
    for (i=0;i<count;i++)
        Add+=dat[i];
    return Add;
}
```

5.5 Register (parameters) summary table

System parameters

Addr	Mark		Descr	Unit
0	ADDR	R/W	Device Address	
1	BAUD	R/W	Communication rate	100bps
2	WKMOD	R	Work Model	
11	DISP_SEC	R/W	Display Seconds	sec
12	SHDN_SEC	R/W	Shutdown Seconds	sec
17	EX_METH	R	Excitation Method	
19	TEMPTYPE	R/W	Type of temperature sensor	
20	NTC_B	R/W	B value of thermistor	
21	DT_YEAR	R/W	RTC - Year	
22	DT_MONTH	R/W	RTC - Month	
23	DT_DAY	R/W	RTC - Day	
24	DT_HOUR	R/W	RTC - Hour	
25	DT_MIN	R/W	RTC - Min	
26	DT_SEC	R/W	RTC - Sec	

Automatic start parameters

Addr	Mark		Descr	Unit
6	STORE_MIN	R/W	Data Storage Interval	min
7	SEND_MIN	R/W	Data Send Interval	min

Data send parameters

Addr	Mark		Descr	Unit
4	SENDMOD	R/W	send mode	
5	DATPRO	R/W	Data Protocol	
9	SMIN_SEC	R/W	Sending time limit	

real-time data

Addr	Mark		Descr	Unit	Addr
62	DAC_PRG_EN	R/W	DAC 可编程		
64~79	DAC01~DAC16	R/W	DACs Values		
80	SYSERR	R			
81	STT_NUM	R			
82	SYS_FUN	R			
83	VIN	R	Battery Vol		
87	INDISK_TOTAL	R			
88	INDISK_FREE	R			
89	INDISK_USED	R			
100~163	CH01~CH64	R	Chs values		

6. Start To Use

6.1 Preparation before power on

(1)Set Work Mode

Set to power-on start work mode: switch the dial code switch of work mode to ON, and the dial code switch to OFF.

Set to manual startup mode: switch the dial code switch of work mode to OFF, and the dial code switch to OFF.

Set to auto start mode: switch the dial code switch of work mode to OFF, and the dial code switch to ON.

（2）Set Excitation Method

The recommended method is method 5.That is: dial code switch, bit 2, bit 4, switch to ON.

（3）Set Excitation Voltage

The recommended excitation voltage is about 8V, that is: dial code switch, bit 3 switch to ON and the other bit to OFF.。

（4）Set Output Voltage

If the output power is used to supply power to other devices or sensors, the dial switch shall be set according to the applicable voltage range of the external device. If the output power is not used, it is recommended to set the output voltage to be close to the voltage of the input voltage POW.

（5）Connected sensors

Connect all sensors to corresponding terminals (see "interface definition" for terminal definition).

（6）Connect the power and turn it on

When VTN4XX is connected to the power supply (note that the voltage range is DC8~24V), indicator light and digital tube can be observed when the working mode is "power-on mode"; if the working mode is "manual power on mode" or "automatic power on mode", long press the [SWITCH] button to start up. The device that is set to start working mode automatically and regularly needs to be started manually at least once before it can take effect.

Power supply negative GND must be reliably connected to earth.

6.2 Communication interface parameter configuration

Physical configuration refers to the configuration of communication rate, data bit, stop bit and check bit of digital interface. These parameters can be modified through buttons or digital interfaces, which are stored in the communication rate register BAUD and the auxiliary function register AUX. Register BAUD.[11:0] is used to set the communication rate, in units of 100bps, for example: 96 means the communication rate is 9600bps, and 1152 means the communication rate is 115200bps. Register AUX.[1:0] is used to set the data number of the interface, AUX.[3:2] is used to set the check bit, and AUX.[5:4] is used to set the stop bit.

Communication rate register BAUD

Bit	symbol	value	description			Reset value
bit15:2		0	Reserved			0
bit11:0		communication rate, unit is 100bps				96
		value	rate	value	rate	
		12	1200 bps	384	38400 bps	
		24	2400 bps	576	57600 bps	
		48	4800 bps	1152	115200 bps	
		96	9600 bps	1280	128000 bps	
		144	14400 bps	2560	256000 bps	
		192	19200 bps			

Auxiliary function register AUX

Bit	symbol	value	description	Reset value
bit15:6		0	Reserved	0
bit5:4		stop bit		0
		0	1 bit	
		1	2 bit	
		2		
		3		
bit3:2		check bit		0
		0	NONE	
		1	ODD	
		2	EVEN	
bit1:0		data bit		3
		0	5 bit	
		1	6 bit	
		2	7 bit	

		3	8 bit	

Possible interface parameter values of the AUX register (register low by 6 bits)

check bit	data bit	stop bit	value	
NONE	7	1	0x02(2)	
NONE	8	1	0x03(3)	Default
NONE	7	2	0x12(18)	
NONE	8	2	0x13(19)	
ODD	7	1	0x06(6)	
ODD	8	1	0x07(7)	
ODD	7	2	0x16(22)	
ODD	8	2	0x17(23)	
EVEN	7	1	0x0A(10)	
EVEN	8	1	0x0B(11)	
EVEN	7	2	0x1A(26)	
EVEN	8	2	0x1B(27)	

6.3 Read Real-time data and parameter

See "4.2 data view" for the method of viewing real-time data using buttons and digital tube. In addition, the digital interface can be used to send register read instruction to obtain real-time data and parameters.

For example, read parameter values using MODBUS communication protocol: read 32 parameters

Send instructions to the device: 01 03 00 00 00 20 44 12(Start with register 0 and read 32 registers)

Device response: 01 03 40 ***00 01 00 60 00 00 00 03 00 00 00 02 00 05 00 0A 00 05 00 3C 02 D0 00 1E 00 78 1F 40 00 06 00 64 07 D0 00 05 00 82 00 02 0F 6E 00 12 00 0A 00 10 00 0B 00 37 00 0A 00 00 00 00 00 00 00 01 00 78*** 04 41

The italic character is the returned register value, and each two bytes represents a register.

For example, Read channel data using MODBUS communication protocol: CH01~CH64

Send instructions to the device: 01 03 00 64 00 40 05 E5(Start with register 100 and read 64 registers)

Device response: 01 03 80 ***35 A9 00 00 00 00 34 72 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 FF FF FF FF FF FF FF FF 01 65 00 E6 01 35 01 06 01 54 01 00 01 32 01 05 01 8E 01 1B 01 4E 01 50 00 F4 00 E0 00 EA 00 C4 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF*** 90 51

The italic character is the returned channels value, and each two bytes represents a channel.

6.4Channel assignment

VTN4XX has 64 read-only registers to store the real time value of the sensor. The order of channel data type is: frequency, temperature (NTC or DS18B20), ADC12 value and ADC16 value. According to the equipment type, ADC12 or ADC16 can be configured as NTC thermistor.。

Channel assignment

VTN416		VTN432	
Registers(Addr)	data type	Registers(Addr)	data type
CH01~CH16(100~115)	frequency 1~16	CH01~CH32(100~131)	frequency 01~32
CH17~CH32(116~131)	temperature 1~16	CH33~CH36(132~135)	temperature 1~4
CH37~CH52(136~151)	ADC12 1~16	CH37~CH52(136~151)	NTC or ADC12
CH53~CH56(152~155)	ADC16 1~4	CH53~CH56(152~155)	NTC or ADC16

6.5 Parameter setting of vibrating wire sensor

The value of EX_METH is controlled by the dial switch. When the dial switch is 0xF(15), the value of EX_METH can be modified by communication protocol or button.

Please refer to the above "2.3 parameter modification" for the parameter modification steps through the dial code switch.

The instructions to modify parameters through MODBUS or AABB communication protocol are as follows:

Instructions described	MODBUS	AABB
Modified excitation method is 0	01 06 00 11 00 00 D9 CF	AA BB 01 91 00 00 F7
modified excitation method is 1	01 06 00 11 00 01 18 0F	AA BB 01 91 00 01 F8
modified excitation method is 2	01 06 00 11 00 02 58 0E	AA BB 01 91 00 02 F9

modified excitation method is 3	01 06 00 11 00 03 99 CE	AA BB 01 91 00 03 FA
modified excitation method is 4	01 06 00 11 00 04 D8 0C	AA BB 01 91 00 04 FB
modified excitation method is 5	01 06 00 11 00 05 19 CC	AA BB 01 91 00 05 FC
modified excitation method is 6	01 06 00 11 00 06 59 CD	AA BB 01 91 00 06 FD
modified excitation method is 7	01 06 00 11 00 07 98 0D	AA BB 01 91 00 07 FE
modified excitation method is 8	01 06 00 11 00 08 D8 09	AA BB 01 91 00 08 FF
modified excitation method is 9	01 06 00 11 00 09 19 C9	AA BB 01 91 00 09 00
modified excitation method is 10	01 06 00 11 00 0A 59 C8	AA BB 01 91 00 0A 01
modified excitation method is 11	01 06 00 11 00 0B 98 08	AA BB 01 91 00 0B 02

The instructions to modify parameters through the $string instruction are as follows:

$SETP=17,X\r\n // X is the value of the excitation method(0~11)

6.6 Parameter setting of Temperature Sensor

VTN4XX has two temperature interfaces, one is a DS18B20 and NTC interface (called TEMP interface), and the other is an NTC interface Shared with ADC (called TEMPN interface) .This section is only for the first.

Select different temperature sensors by setting the value of register TEMP_TYPE, TEMP_TYPE=0 means the temperature sensor is DS18B20, TEMP_TYPE=1~10 means the temperature sensor is a thermistor NTC, and the value (1~10) set is the nominal resistance value of the thermistor. When configured as NTC, the NTC key parameter B register NTC_B needs to be modified synchronously. The default value of NTC_B register is 3950.

Please refer to the above "2.3 parameter modification" for the parameter modification steps through the dial code switch.

Use the digital interface to send instructions to modify parameters, not listed here, please refer to "5 communication protocol".

6.7 Parameter setting of ADC

Each ADC channel has three configurable parameters: additive constant, multiplication constant and channel type code.

Channel type code: A calculation method that defines the final value of the ADC channel.

channel type code

0	Disable this channel
1	Update to the CHXX register using the AD value
2	CHXX=(AD+ additive constant)* multiplication constant
3	This channel is NTC, the value of CHXX is temperature
4~15	Function is not defined yet
The channel type code is written out of the factory and cannot be changed by the user	

Channel additive constant setting instruction
$A16A=XXXXX,XXXXX,XXXXX,XXXXX\r\n XXXXX is additive constant of each channel
$A12A=XXXXX,XXXXX,XXXXX,.....,XXXXX\r\n

Channel multiplication constant setting instruction
$A16M=XXXXX,XXXXX,XXXXX,XXXXX\r\n XXXXX is multiplication constant of each channel
$A12M=XXXXX,XXXXX,XXXXX,.....,XXXXX\r\n

The additive constant is a 16-bit signed integer with a range of -32768~+32767
The multiplication constant is a 16-bit signed integer with a range of -32768~+32767 and a unit of 0.0001, namely -3.2768~3.2767.

Note: when configured as NTC, the nominal resistances and B values are Shared with the parameters in the previous section.
Note: the ADC channel parameters can be viewed using the $INFO instruction, as shown in "6.9 production information".

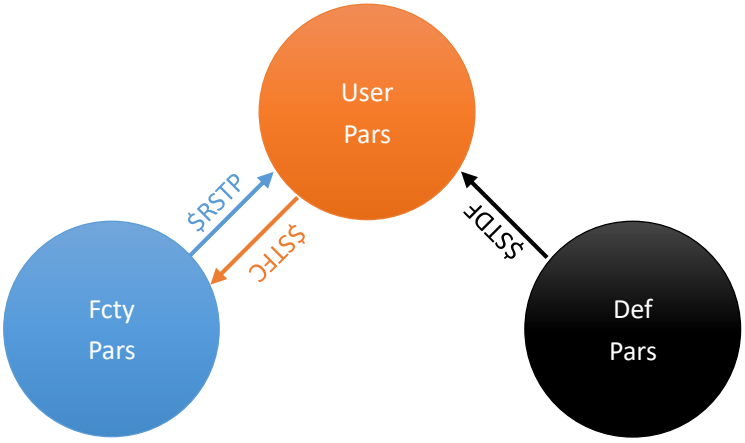
6.8 Factory parameter setting

Three types of system parameters are stored inside the device: user parameters, factory parameters and default parameters.

user parameters: Also known as "working parameters", it can be modified and saved, and automatically loaded every time it is powered up.Modification of parameters and operation logic of devices in the process of using devices refer to user parameters, and user parameters are the most frequently used parameter categories.

Factory parameters: Parameters stored in separate partitions.When the "restore factory parameters" instruction is received, the factory parameters are loaded and the user parameters are overwritten. In the process of device startup, if abnormal user parameters are detected, the device will automatically load the factory parameters and cover the user parameters. These parameters has been set by the manufacturer, it is not recommended to modify it (use with caution).

Default parameters: The default parameter is a set of fixed parameters, which can only ensure the communication of the device. The user cannot change the default parameters in any way. When factory parameters are restored, the default system parameters will be automatically loaded if communication parameters are found wrong, so that basic digital communication can be carried out.



6.8.1 Restore factory parameters

Read the parameters from the factory parameter area and override the user parameters.

Hardware method:

During the startup process, keep the key "SETTING" to press down. At this point, the digital tube display (416 RSTP) 8.8.8. 8.8.8.8. indicates that the parameter restored successfully.

Software method:

$RSTP\r\n

Return string after device response: OK\r\n

6.8.2 Modify factory parameters

Writes to the factory parameter area with the current user parameters. ***This operation is recommended for professional use, ordinary users do not easily modify factory parameters.***

Software method:

$STFC\r\n

Return string after device response: OK\r\n

Hardware method:

Press [SETTING] to perform the manual shutdown operation. When the digital tube is prompted to shut down (BEY)  , press [SWITCH] and release [SETTING]. The digital tube display (BEY STFC)  indicates that the current parameters have been successfully written into the factory parameter area.

6.8.3 Restore default parameters

Load the device's pre-set fixed parameters into user parameters.The instructions are as follows:

$STDF\r\n

Return string after device response: OK\r\n

6.9 View production information

Command $INFO\r\n to view production information and channel parameters.

```
MCODE=017CC993190000A4
M DATE:      1810
F DATE:      1811
VMINFO:          6XX 4    4
ADC16INFO: 1     1    1    1
ADC12INFO: 1     1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
ADC16ACONST:  1    2    3    4
ADC16MCONST: 10000    10000    10000    10000
ADC12ACONST: 0    0    0    0    0    0    0    0    0    0    0    0
ADC12MCONST: 10000    10000    10000    10000    10000    10000    10000    10000
     10000    10000    10000    10000
```

M DATE: Manufacture Date, YYMM
F DATE: Factory Date, YYMM
VMINFO: VM Module model, number, number of channels
ADCXXINFO: The channel type code of ADCXX
ADCXXACONST: additive constant of ADCXX
ADCXXMCONST: multiplication constant of ADCXX, Unit: 1/10000

6.10 Data storage and Send

Automatic storage and Send

The automatic storage and automatic send is effective only when the device is in

"automatic timing startup mode". In this mode, the register STORE_MIN is used to set how long the interval is for data saving, and the register SEND_MIN is used to set how long the interval is for data sending, both of which are in "minutes". Note that the value of the register SEND_MIN should be a multiple of STORE_MIN. For example, if STORE_MIN is set to 5 minutes, the value of SEND_MIN should be set to 5, 10, 15, 20, etc.

When VTN4XX is working in the automatic startup mode, the sensors data acquisition, storage and sending are automatically completed after each startup, and automatically shut down after completion of the work. According to the signal quality of the external sensor, the time of the whole working process will be different. Register SMIN_SEC is used to set the minimum time length of the working process after each automatic startup, Unit is "seconds". If the measurement of all channels cannot be completed after the time specified by SMIN_SEC, the device will save or send data after the time specified by SHDN_SEC and then shut down.

The data is sent prefixed with the string "$CHDAT=", followed by the 64 channel value of the MODBUS protocol. Examples are as follows:

24 43 48 44 41 54 3D 01 03 80 34 72 00 00 00 00 00 00 00 00 00 00 35 AF 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF 01 2F 01 5F 00 CE 00 F6 00 E7 01 0A 01 74 01 3B 01 5C 01 1C 01 4F 00 C4 01 06 01 4E 01 2A 01 4A FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF 01 18（The above data are all in hexadecimal）

24 43 48 44 41 54 3D：ASCII code for the string "$CHDAT="
The following content is MODBUS protocol 64 channel data
01 03 80: Register value output by device 01, total 128 bytes data (each 2 bytes represents a register)
34 72: Channel 1 value, 0x3472=13426, i.e.: 1342.6Hz
......
FF FF: Channel 64 value
01 18: CRC16

Manual data storage

Long press the [SWITCH] button, do not release the button when the digital tube displays the type SWITCH, and automatically store a piece of data after about 2 seconds. The digital tube displays "DAT SAVOK"  , and the short buzzer indicates successful storage.

6.11 Export the stored data

The saved data can be downloaded using FileSYNC (a dedicated tool). See "FileSYNC user manual" for details.

6.12 Use DAC

VTN4XX has 16 channels of DAC output at most, the corresponding register is DAC01~DAC16 (address 64~79), the optional resolution is 8-bit, 10-bit and 12-bit, and the output voltage range is 0~4095mV. When the register DAC_PRG_EN is set to 1, the output voltage of each channel can be controlled by writing a millivolt unit voltage value to the register DACXX. When the register DAC_PRG_EN is set to 0, the output of the 16-channel DAC will automatically synchronize with the measured frequency value. At this point, the voltage value represents the frequency value, and 0~4095mV represents 0~4095Hz.

VTN416 has 16 DAC channels and VTN432 has 8.

When the DAC is programmable, if only 0 or 4095 (output 0mV and 4095mV) is written to the DACXX register, the DAC channel is similar to the IO port and can be used to control the external device switch.

DAC Working register DAC PRG EN

Bit	symbol	value	description	Reset value
bit15:4		0	Reserved	0
bit3:1		DAC channel state at startup		0
		0	Hi-Z	
		1	Low, 0mV	
		2	Mid, 2048mV	
		3	High, 4096mV	
		4	The DACXX value saved last time	
bit0		DAC Programmable		0
		0	Unprogrammable, the output voltage represents the measured frequency value	
		1	Programmable, output voltage controlled by DACXX register	

7. Frequently Asked Questions

7.1 Device cannot be started

(1) Check whether the power connection is correct, the input voltage range should be DC8~24V, and the load capacity should not be lower than 1A, and the positive and negative connections are correct. If the battery polarity is reversed, the equipment will be permanently damaged even if it is not switched on.

(2) Check whether the power output connection load is too large, and restart it after disconnecting from the load when necessary.

(3) In case of battery power supply, measure whether the battery voltage is too low while keeping the power button pressed.

7.2 Can't communication

(1) Check whether the type of digital interface is correct. This device has two interfaces, RS232 and RS485, which share the terminals of digital interface. The upper computer should use the correct interface connection before normal communication.

(2) Check whether the wiring sequence is correct.

(3) The communication rate does not match. Try to use the button to restore the factory setting and then use the 9600bps rate for sending and receiving test.

7.3 Automatic mode failure

(1) Try to start the machine manually and check whether the date and time are correct. If the date and time are not correct, replace the internal button battery.

(2) Check whether the time register value setting related to the automatic mode is correct, and note the data unit.

7.4 frequency is 0

(1) Not connected sensor or poor contact, or the sensor circuit is open circuit or short circuit, please disconnect sensor and terminal equipment of electric resistance sensor is normal after (most of the vibrating wire sensor coil resistance between 100 ~ 2 k Ω).

(2) The Excitation method is not correct, please confirm again whether the equipment you use supports the current setting.

(3) The Excitation voltage selection is too low or too high. The recommended Excitation voltage source is 5-10v. Please check whether the setting of the voltage dial switch is correct.

7.5 Frequency values are unstable

(1) Adjust the excitation voltage dial switch and use higher excitation voltage source (e.g., 10V).

(2) Adjust the dial code switch of the excitation method, and the fifth excitation method is recommended.

(3) Use the slow measurement scheme (switch the second bit of the dial code switch in work mode to ON).

(4) Shorten the length of the cable between the sensor and the device, or use a low resistivity cable with good shielding performance.
(5) The equipment case or the power supply negative terminal must be reliably connected with the earth (ground wire).
(6) Replace the linear power supply or use the battery power supply and disconnect any lines related to alternating current.
(7) Disconnection all terminals except the vibrating wire sensor (other sensors, power output, digital interface, etc.); use the digital tube to view data; only connect single sensor if necessary.
(8) Check whether there is strong electromagnetic interference and large ac equipment around the measuring system (such as power distribution frame, motor, large engineering equipment, radio, etc.).
(9) The return signal of some sensors is very weak and vulnerable to the influence of the excitation signal of other channels, which will result in the data of this channel approaching that of other channels. It is recommended to change the sensor manufacturer or consult us to get the recommended sensor model.

Summary table of $string instructions

Instruct	Functional description
$GETP=AA\r\n	Read the register value, AA is the register address
$SETP=AA,BB\r\n	Modify the register value. BB is the register value
$INFO\r\n	Get Version Information
$ERIF\r\n	
$SAVE\r\n	Save User Parameters
$REST\r\n	Restart
$STDN\r\n	Shutdown
$RSTP\r\n	Load Factory
$STFC\r\n	Write Factory(used with caution)
$STDF\r\n	Load Default
$A16A=XXXXX,XXXXX,XXXXX,XXXXX\r\n	Set ADC16 additive constant
$A16M=XXXXX,XXXXX,XXXXX,XXXXX\r\n	Set ADC16 multiplication constant
$A12A=XXXXX,XXXXX,XXXXX,.....,XXXXX\r\n	Set ADC12 additive constant ①
$A12M=XXXXX,XXXXX,XXXXX,.....,XXXXX\r\n	Set ADC12 multiplication constant①
$CHDAT=(133 byte)	Active upload of 64 channel data
Note①: ADC12 has 16 channels and requires 16 sets of parameters	

Summary table of @string instructions

Instruct	Functional description
@SETDT:YYYY/MM/DD HH:mm:SS\r\n	Set the clock value
@STTN=NUM\r\n	Set transparent transmission, 0 is impervious, 1~4 corresponds to vibrating wire module 1~4
@ENDOS	Enter DOS mode to operate internal files
@EXDOS	Exit DOS mode

Summary table of DOS instructions

Instruct	Functional description
FORMAT\r\n	Format internal storage
DIR1	
DIR2	
TYPE	Prints the contents of the file
MD	Create a new directory
NF	Create a new file
DF	Delete file
UP	Upload files to the device

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DN	Download files from the device
This instruction set is valid only if the device is in DOS mode	

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