



VCT 160 D/S Pirani Vacuum Gauge

Instruction Manual

Overview

VCT160 is a fully intelligent economical Pirani vacuum gauge. Using innovative intelligent technology and leading manufacturing process, aiming at the problems in practical application in low vacuum environment, VCT160 is optimized in all aspects of structural design, appearance and operation mode, so that VCT160 has incomparable advantages in reliability, ease of use and cost performance.

Features

- Two-sensor two-line display (type D) or one-sensor one-line display (type S)
- Display: 5-digit LED exponential or floating method display
- Probe: TP 052 Pirani gauge with all stainless steel metal welding
- Setpoint: Controlled by four SPDT relays, and is set by the keys
- Analog output: 10VDC, logarithmic output
- Support 4 ~ 20mA current output (optional)
- Support RS-485 MODBUS-RTU communication

Product Validity

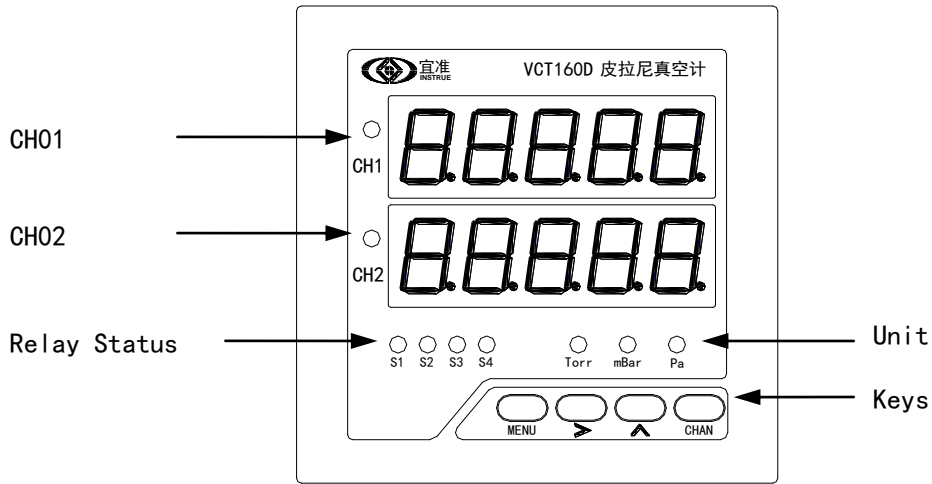
- VCT160S single-channel Pirani vacuum gauge
- VCT160D dou-line display two-channel Pirani vacuum gauge

Specifications

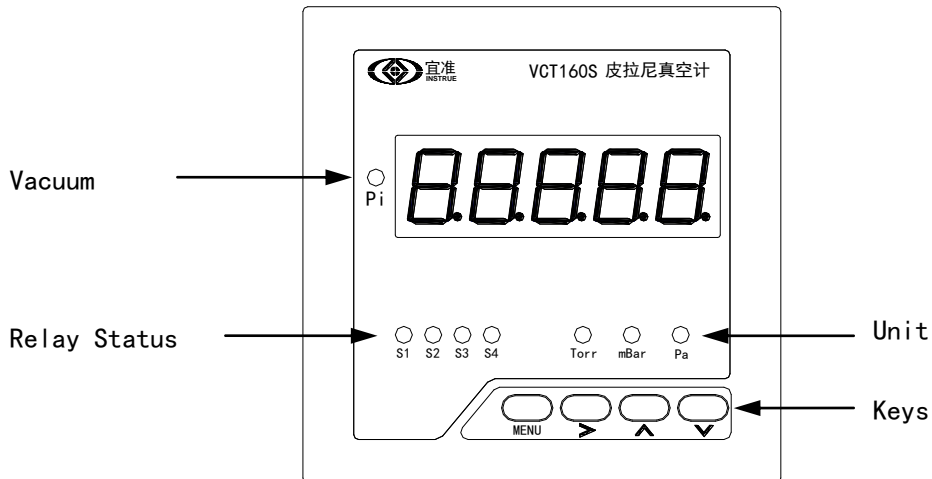
TYPE	VCT 160S /VCT 160D
Measurements Range	1.0E-1 ~ 1.0E+5 Pa (Air, N ₂)
Accuracy	1.0E+4 ~ 1.0E+5 Pa : ±50%; 1.0E-1 ~ 1.0E+4 Pa : ±20%
Data Acquisition	response time: <100 ms; update rate of display: 1S
Inputs	Four buttons for: units、calibration、setpoints, etc.
Outputs	RS485; Voltage analog
Control units	Four SNTD relays; 3A/220VAC, non inductive load; response time: <1s
Temperature	Working temperature: 0 ℃ ~ +45 ℃; storage temperature: -40 ℃ ~ +75 ℃
Power supply	85VAC ~ 265VAC\0.5A; total power consumption: < 5W
Weight	450g (including two sensors and 3 meters long cable)
Size	Panel:96mmX96mmX15mm; Box: 89mmX89mmX75mm
Mounting	Embed hole: 91 X 91 (+0.2/-0.0)mm

Front Panel

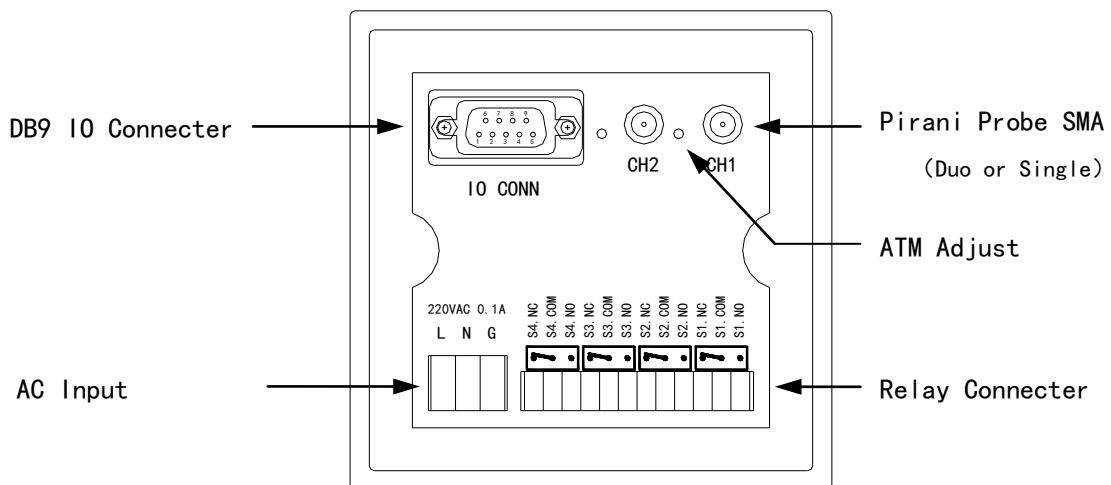
Duo Channel



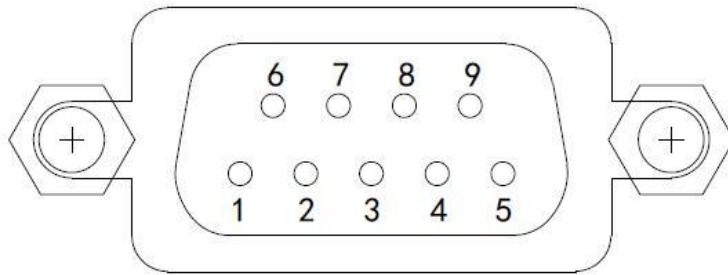
Single Channel



Rear



D-Sub9 Connector



Pins	Functions	Pins	Functions
Pin 1	RS485 D-	Pin 2	TID 温控型判别
Pin 3	GND (PIO : Pirani Filament B)	Pin 4	OT+ Output (Option: Voltage or Current)
Pin 5	OT+ Output (Option: Voltage or Current)	Pin 6	RS485 D+
Pin 7	+3.3VDC output	Pin 8	TEM: Temperature Sensor
Pin 9	PIO : Pirani Filament A		

Analog Output

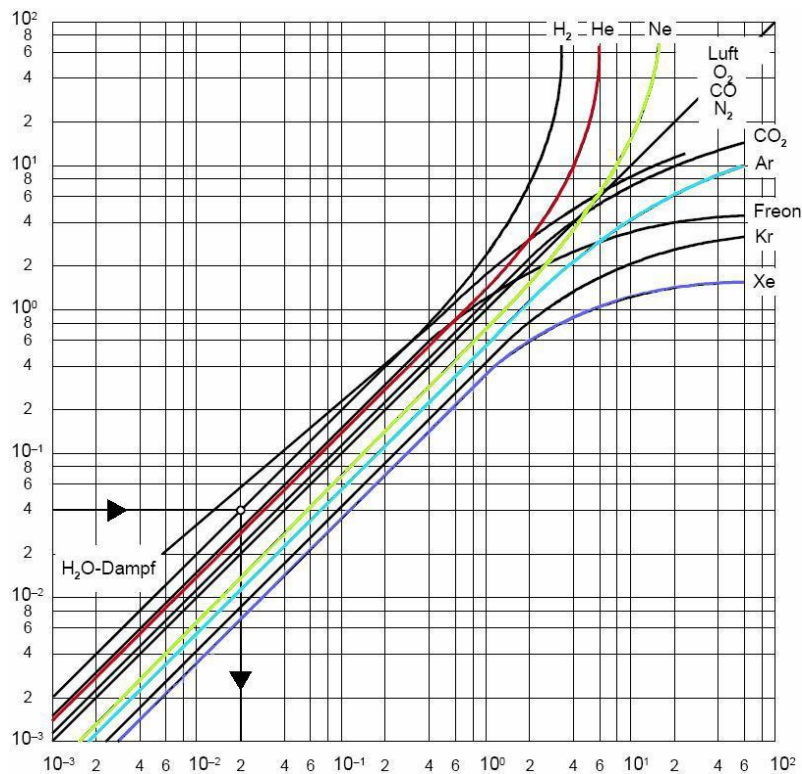
$$P=10^{((U-c)/1.286)} \quad \longleftrightarrow \quad U=c+1.286 \times \lg P$$

Where **P** : Pressure
U : Voltage (V)
C : Constant
(Pressure Unit Dependent)

U	P	C
(V)	Pa	3.572
(V)	mBar	6.143
(V)	Torr	6.304

Gas Type Dependence

For Pirani vacuum gauge, the measurement is sensitive to the type of gas in the system. The different gases have different masses and hence will take different amounts of heat out of the wire. However, this does mean that if the gauge is calibrated using air or N₂ and is then used to measure a process gas such as Argon, there will be an error in the pressure measurement. The error is reproducible and so in most cases the pressure is accepted as being a relative, but reproducible, measure of pressure.



Therefore, when the measured gas is other gases than air/N₂ and the pressure is below 100Pa, a calibration factor is need to calculate the effective pressure:

$$P_{\text{effective}} = C * \text{PressureReading}$$

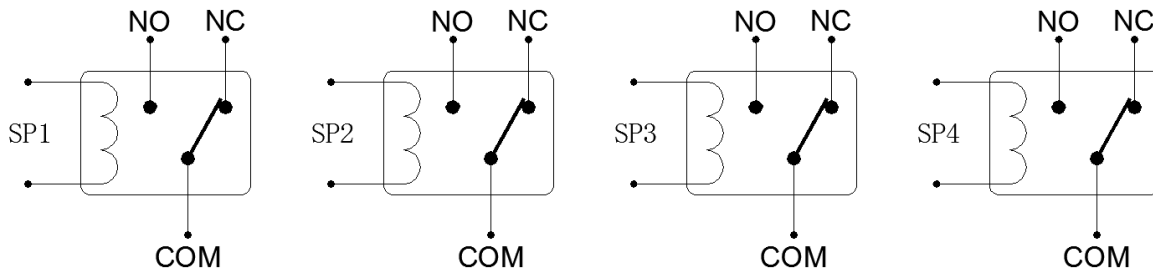
Gases	C	Gases	系数 C
Air, O ₂ , CO, N ₂	1.0	CO ₂	0.9
H ₂	0.5	Kr	2.4
He	0.8	Xe	3.0
Ne	1.4	H ₂ O Vapor	0.5
Ar	1.7	Freon	0.7

Setpoint Switch Setting

VCT160 has four SNTD control relays that can be set independently, and the vacuum pressure at the switching point can be set through the four keys on front panel.

The set value range of the change-over switch is $5.0 \times 10^{-1} \text{ PA} \sim 9.9 \times 10^4 \text{ PA}$.

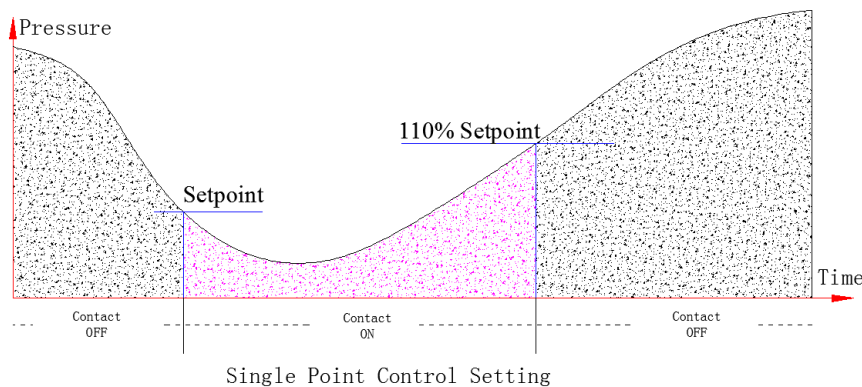
The contact capacity of the relay is 60VDC 0.5A. The setting value is defined as that the relay switches from NC to NO.



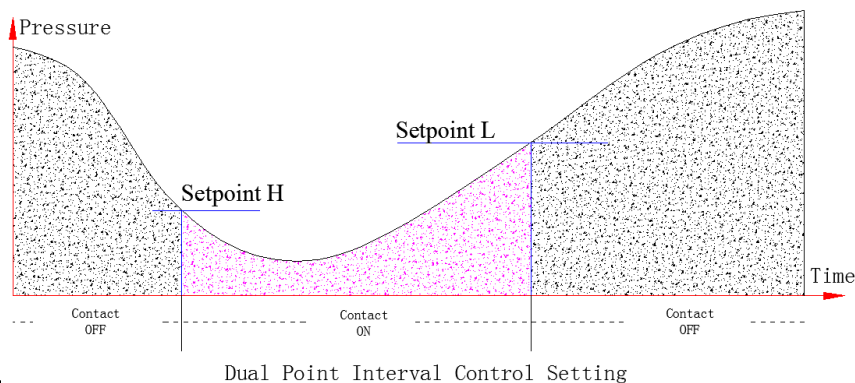
4-Channel SNTD Relay Control

There are two ways to set relay control points. 1) single point control mode and 2) dual-point interval control mode. The standard configuration is single-point control mode. If dual-point interval control mode is needed, please confirm it when ordering.

1) Single point control mode



2) Dual-point interval control mode



Key Operation

VCT-160D

MENU	LED	> Key	∧ Key	CHAN.
Press 1	ATP1	Channel 1 atmosphere calibration	NA	NA
Press 2	ATP2	Channel 2 atmosphere calibration	NA	NA
Press 3	HUC1	Channel 1 high vacuum calibration	NA	NA
Press 4	HUC2	Channel 2 high vacuum calibration	NA	NA
Press 5	SP1	Select which digit to change for setpoint value S1	Set value for current selected digit (between 0-9)	Choose target channel (Channel 1 or Channel 2) to set for relay S1
Press 6	SP2	Select which digit to change for setpoint value S2	Set value for current selected digit (0-9)	Choose target channel (Channel 1 or Channel 2) to set for relay S2
Press 7	SP3	Select which digit to change for setpoint value S3	Set value for current selected digit (0-9)	Choose target channel (Channel 1 or Channel 2) to set for relay S3
Press 8	SP4	Select which digit to change for setpoint value S4	Set value for current selected digit (0-9)	Choose target channel (Channel 1 or Channel 2) to set for relay S4
Press 9	U	Select unit for display: Pa、Torr、mBar	NA	NA
Press 10	d	Select data display mode: S for science and n for floating	NA	NA
Press 11	Ad	Show the RS485 address	Set the address number	NA
Press 12	dFL	Restore factory settings	NA	NA

VCT-160S

MENU	LED	> Key	∧ Key	CHAN.
Press 1	ATP	Atmosphere calibration	NA	NA
Press 2	HUC	Zero calibration	NA	NA
Press 3	SP1	Select which digit to change for setpoint value S1	Set value for current selected digit (between 0-9)	NA
Press 4	SP2	Select which digit to change for setpoint value S2	Set value for current selected digit (0-9)	NA
Press 5	SP3	Select which digit to change for setpoint value S3	Set value for current selected digit (0-9)	NA
Press 6	SP4	Select which digit to change for setpoint value S4	Set value for current selected digit (0-9)	NA
Press 7	U	Select unit for display : Pa 、 Torr、 mBar	NA	NA
Press 8	d	Select data display mode: S for science and n for floating	NA	NA
Press 9	Ad	Show the RS485 address	Set the address number	NA
Press 10	dFL	Restore factory settings	NA	NA

VCT-160S

MENU	LED	> Key	∧ Key	CHAN.
Press 1	ATP	Atmosphere calibration	NA	NA
Press 2	HUC	Zero calibration	NA	NA
Press 3	SP1H	Select which digit to change for H setpoint value S1	Set value for current selected digit (between 0-9)	NA
Press 4	SP1L	Select which digit to change for L setpoint value S1	Set value for current selected digit (between 0-9)	
Press 5	SP2H	Select which digit to change for H setpoint value S2	Set value for current selected digit (between 0-9)	NA
Press 6	SP2L	Select which digit to change for L setpoint value S2	Set value for current selected digit (between 0-9)	
Press 7	SP3H	Select which digit to change for H setpoint value S3	Set value for current selected digit (between 0-9)	NA
Press 8	SP3L	Select which digit to change for L setpoint value S3	Set value for current selected digit (between 0-9)	
Press 9	SP4H	Select which digit to change for H setpoint value S4	Set value for current selected digit (between 0-9)	NA
Press 10	SP4L	Select which digit to change for L setpoint value S4	Set value for current selected digit (between 0-9)	
Press 11	U	Select unit for display: Pa、Torr、mBar	NA	NA
Press 12	d	Select data display mode: S for science and n for floating	NA	NA
Press 13	Ad	Show the RS485 address	Set the address number	NA
Press 14	dFL	Restore factory settings	NA	NA

Coarse Atmospheric Calibration

Regular Calibration:

If the display value is between $1.0E+4 \sim 1.0E+5$ when the probe is exposed to atmospheric pressure, you only need to calibrate VCT160 through the push buttons on front panel.



Calibration:
Push "MENU" until display "ATP" and hold the key then push ">" same time, and then release both keys,

Coarse Adjustment:

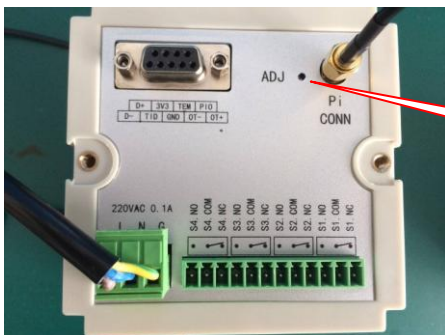
When one of the following cases causes that atmospheric pressure is unable to calibrate to $1.0E+5$ Pa by digital buttons, you should manually adjust the potentiometer through the small hole ADJ on back panel by a tiny flat screw driver.

- Replacement of new probe which may results in the LED display below $1.0E+4$ Pa at atmospheric pressure.
- Replacement of new probe which may results in too slow response to vacuum pumping from atmospheric pressure.
- Extreme temperature changes lead to LED display less than $5.0E+3$ Pa at atmospheric pressure.

Adjust Procedure

- 1) Turn the potentiometer with the counterclockwise or clockwise counterpart by a tiny flat screw driver until the LED shows $9.5E+4$ Pa.
- 2) Carry on atmospheric pressure calibration by front key operation for fine tune.

Note: Compensation adjust by screw driver is only for atmospheric pressure calibration, there is no need for zero point (high vacuum) calibration.



Coarse Adjustment

RS485 MODBUS RTU Communication Protocol

1) Communication Setup:

Baud rate: 9600 Start Bit: 1 Data Bit: 8 Stop Bit: 1 Checkout bit: No

2) Instruction format:

a. Read instruction:

- Upper computer sends instructions to vacuum gauge:

Add	Com mand	Register Hi	Registe r Low	Data Word (Hi 8bit)	Data Word (Low 8bit)	CRC Check (Low8bit)	CRC Check (Hi 8bit)
1-99	03	00	XX	00	XX	XX	XX

- Return Instruction:

Add	Comm and	Data Byte	Data	CRC Check (Low 8bit)	CRC Check (Hi 8bit)
1-99	03	XX	XX Byte	XX	XX

b. Write Instruction:

- Upper computer sends instructions to vacuum gauge:

Add	Com mand	Register Hi	Register Low	Data Length (Hi 8bit)	Data Length (Low 8bit)	Data Byte	Highest Data Byte
1-99	16	00	XX	00	02	4	Bit31-24

Data Mid Byte	Data Mid Byte	Data Mid Byte	CRC Check (Low 8bit)	CRC Check (Hi 8bit)
Bit23-16	Bit15-8	Bit7-0	XX	XX

- Return Instruction:

Add	Com mand	Register Hi	Register Low	Data Length (Hi 8bit)	Data Length (Low 8bit)	CRC Check (Low 8bit)	CRC Check (Hi 8bit)
1-99	16	00	XX	00	02	XX	XX

3) Register address table :

Register address (16hexadecimal)	Data byte length	Storage content
01	2	Gauge Ch1: Vacuum data of scientific counting format
03	2	Gauge CH2: Vacuum data of scientific counting format
11	2	Gauge Ch1: Vacuum data of floating point format
13	2	Gauge CH2: Vacuum data of floating point format
21	2	Set Point 01: Floating Format
23	2	Set Point 02: Floating Format
25	2	Set Point 03: Floating Format
27	2	Set Point 04: Floating Format
29	2	Set Point 05: Floating Format
2B	2	Set Point 06: Floating Format
31	1	Set Point 01 correspond Gauge 1: Gauge Ch1; 2: Gauge Ch2
32	1	Set Point 02 correspond Gauge 1: Gauge Ch1; 2: Gauge Ch2
33	1	Set Point 03 correspond Gauge 1: Gauge Ch1; 2: Gauge Ch2
34	1	Set Point 04 correspond Gauge 1: Gauge Ch1; 2: Gauge Ch2
35	1	Set Point 05 correspond Gauge 1: Gauge Ch1; 2: Gauge Ch2
36	1	Set Point 06 correspond Gauge 1: Gauge Ch1; 2: Gauge Ch2
40	1	Implement Calibration: 1: Gauge Ch1 atmosphere 2: Gauge Ch1 Zero 4: Gauge Ch2 atmosphere 8: Gauge Ch2 Zero

a. Scientific count format:

For example, the vacuum gauge display data is 1.2E+3, and the ASCII code stored in the register is the corresponding data, that is, 0x31, 0x32, 0x2b, 0x33.

For example, the vacuum gauge displays the data 1.0E-1, and the data stored in the register are 0x31, 0x30, 0x2d and 0x31.

b. Floating format:

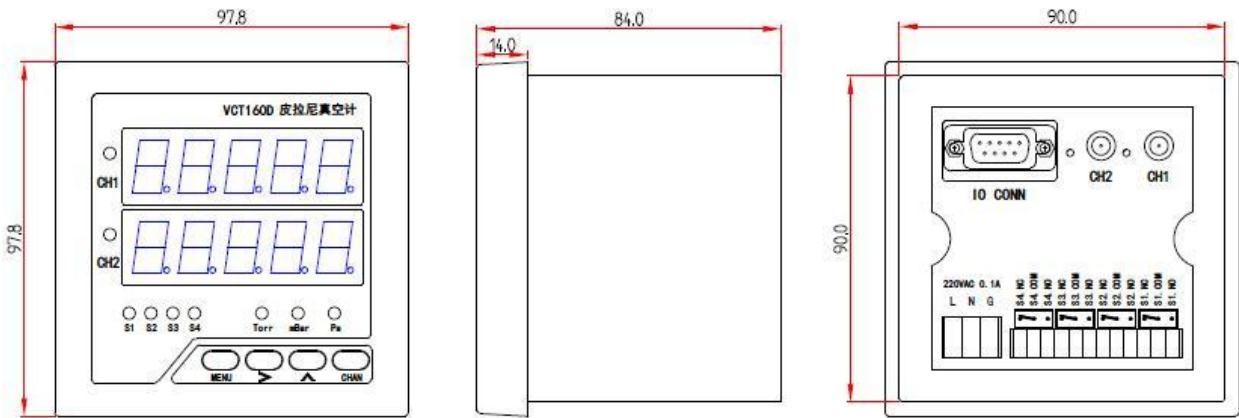
The 32 bit floating number is stored in the register.

c. Vacuum gauge address setting:

Through Gauge Reader 3.0 application software interface, you can set the vacuum meter local address, factory address set to 01.

Dimensions (mm)

ECU



Sensor Probe

