Operation Manual

eyc-tech FDM06-X

Thermal Mass Diff. Pressure Signal Processor

Contents

I. Security considerations

Please read this Specification carefully, prior to use of this, and keep the manual properly, for timely reference.

Solemn Statement：

This product can not be used for any explosion-proof area.

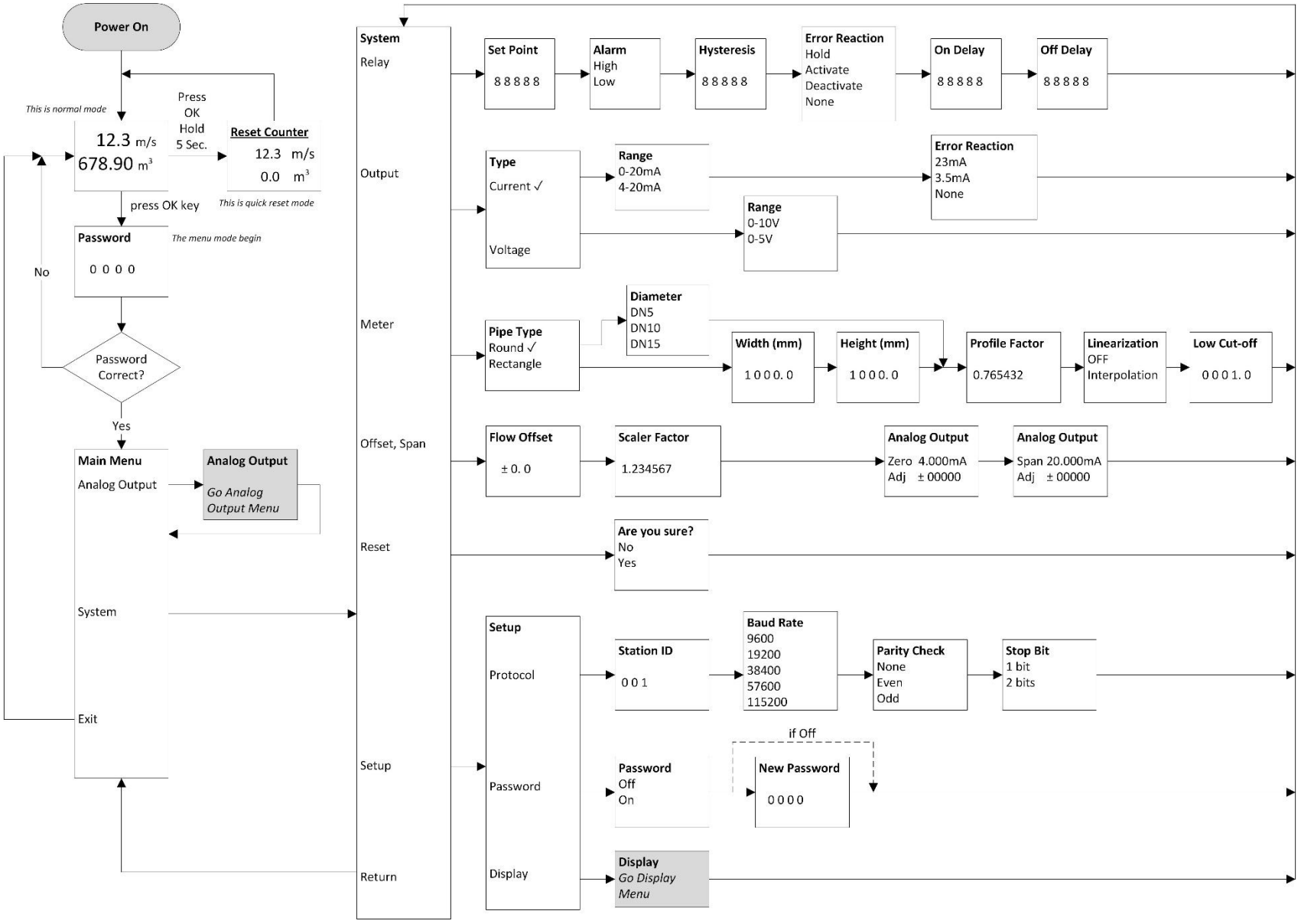
Do not use this product in a situation where human life may be affected.

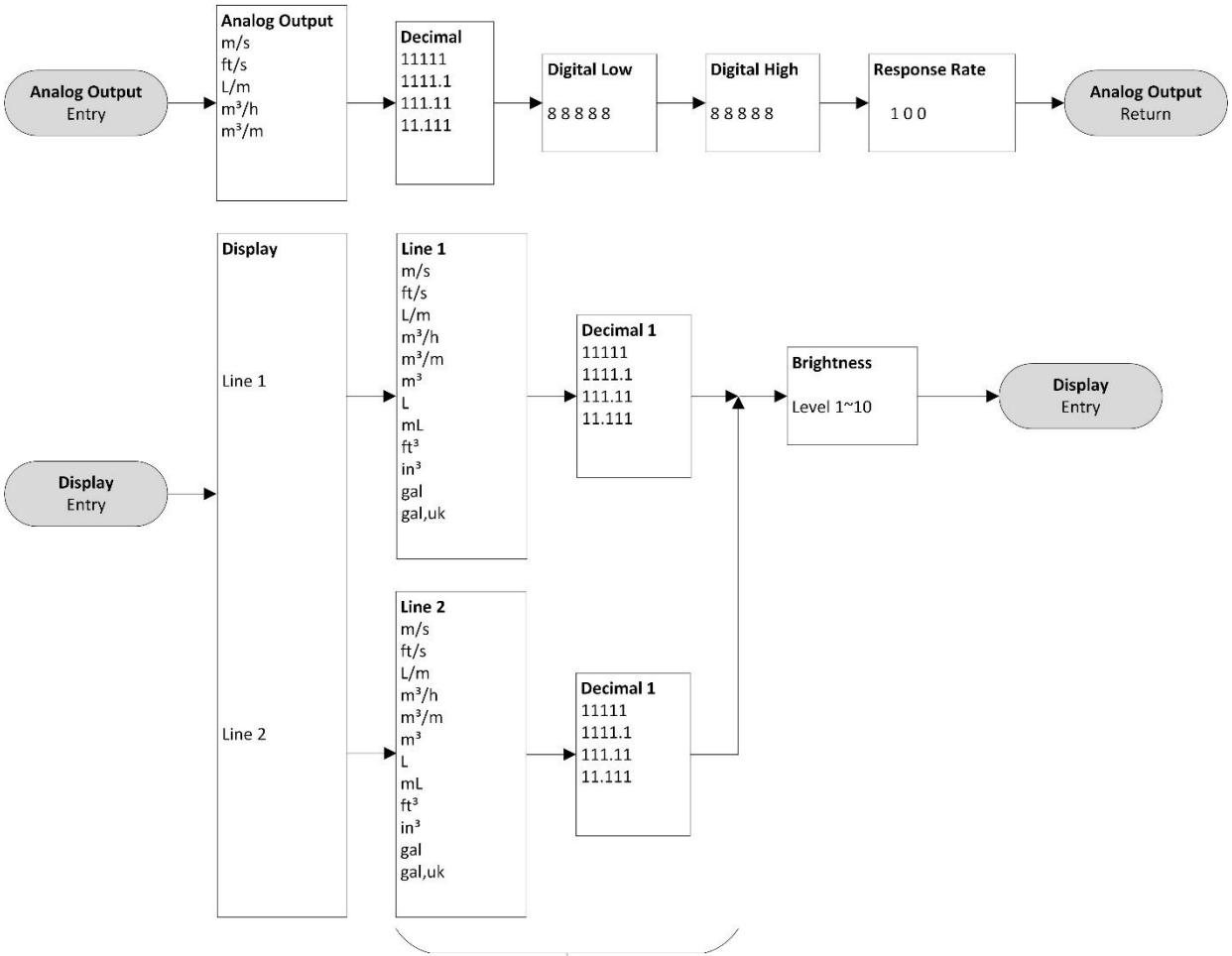
eyc-tech will not bear any responsibility for the results produced by the operators！

Warning!

- Installation and wiring must be performed by qualified personnel in accordance with all applicable safety standards.
- This product must be operated under the operating conditions specified in manual to prevent equipment damages.
- Please using the product under the ordinary pressure, or it will influence safe problem.
- This product must be operated under the operating condition specified in this manual to prevent equipment damages.
- This product must be operated under the normally atmospheric condition to prevent equipment damages.
- To prevent products damage, always disconnect the power supply from the product before performing any wiring and installation.
- All wiring must comply with local codes of indoor wiring and electrical installation rules.
- Please use crimp type terminal.
- To prevent personal injury, do not touch the moving part of product in operation.
- It may cause high humidity atmosphere during the product was breakdown. Please take safety strategy.

II. Operation Form





The available unit varies depending on the model type.
Volumetric decimal up to 2 digits, otherwise 3 digits max.

※Key Pad Operation Mode

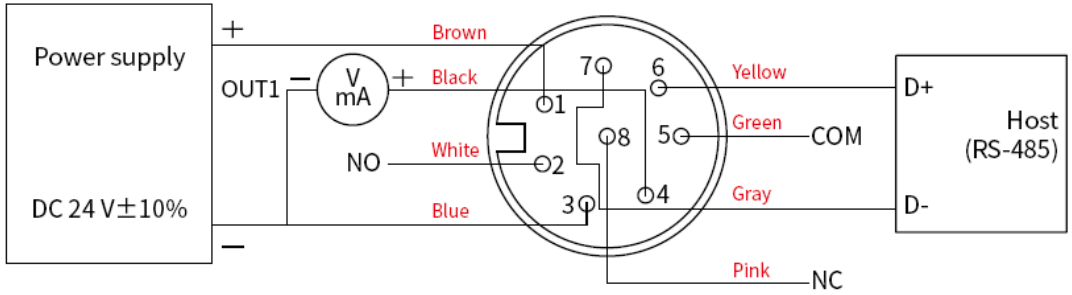
Button Instruction	Operation Mode	
	Normal Mode	Menu Mode
Press UP once	Reserved	increase number or option once
Press OK once	Go Menu Mode	Submit the selection, go on next menu or complete the setting and then return to the normal mode
Press DOWN once	Reserved	decrease number or option once, shift cursot if numerical menu
Hold UP	Reserved	increase number or option faster
Hold OK 5 seconds	Reset Totalizer	Return to previous menu, or leave menu mode
Hold DOWN	Reserved	decrease number or option faster
Press UP and DOWN simultaneously	Set Flow Zero	Not Available

UP

OK

DOWN

III. Connection Diagram



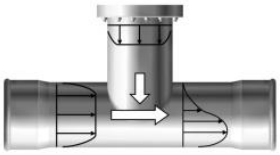
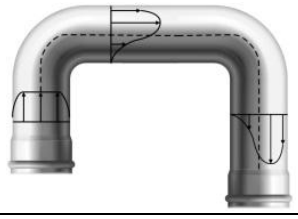
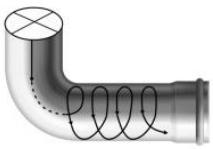
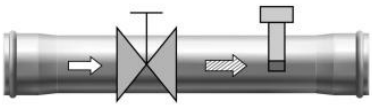
*Please make sure the product and the device which connect with RS-485 are on common ground, avoid damaged product.

IV. Installation

The installation method and conditions of the thermal mass differential signal processor will directly affect its measurement accuracy and stability. To ensure optimal performance, be sure to follow these recommendations:

1. Installation location and flow conditions

The measuring probe should be installed in the laminar flow state of the flow field, avoiding the turbulent section. It is recommended to keep a long enough straight pipe section before and after the throttling devices to ensure the flow field conditions. Because elbows, valves, reducers, filters, etc. can cause airflow turbulence and affect measurement accuracy, please refer to the table below to calculate the recommended straight pipe length based on different pipe diameter styles.

Type	Drawing	Upstream straight pipe	Downstream straight pipe
Light bend (< 90°)		10 x D	10 x D
T-junction		15 x D	10 x D
Two 90° bends in one plane		20 x D	5 x D
Two 90° bends with 3-dimensional Change in direction		35 x D	10 x D
Shut-off valve		45 x D	10 x D

2. Keep away from heat or cold sources
   Because thermal mass differential pressure sensors are extremely sensitive to temperature, they should be installed away from equipment that produces significant thermal effects (such as electric heaters, air conditioning vents, etc.). This especially refers to temperature changes caused by cold and heat sources. Drastic changes in gas temperature will affect measurement stability and may even result in measurement values that exceed accuracy specifications.

3. Probe insertion depth and angle requirements
   - Pitot tube / mean air velocity tube / Annubar tube
     The probe must be inserted to the centerline of the pipe, or ensure that the sampling port fully covers the average flow field across the pipe cross-section. An insertion depth of ≥ 1/2 the pipe diameter is generally recommended.
   - Venturi tube / orifice plate / V-cone
     These are full-section differential elements. During installation, they must ensure full coverage of the pipe diameter. No additional insertion depth is required, but concentricity with the pipe is important.
   - Probe-type differential elements (Pitot tube, Annubar tube, etc.) must be parallel to the flow direction (0° ± 3°). Failure to do so will result in differential pressure errors.
   - Avoid tilting or deflection.
   - A deviation of more than 3° from the airflow direction will result in significant measurement errors.
   - It is recommended that the probe be installed horizontally or vertically, depending on the on-site piping configuration, to prevent condensation or dust from accumulating on the pressure tapping port.

4. Gas Condition Effects and Scaler Factor
   Thermal mass differential pressure signal processor calculates flow rate based on the thermal conductivity and specific heat capacity of the gas. Therefore, when the measured gas is different from the calibration conditions, the thermal mass differential pressure signal processor will calculate a different flow rate. The measuring range of this product is defined under standard conditions of 1013 mbar and 20 °C. The fluid medium is air and it is suitable for measuring applications such as compressed air. When measuring a gas different from the calibration standard, the following table gives correction suggestions based on the thermal properties of the gas such as thermal conductivity, specific heat, density, etc., reflecting the difference in heat transfer caused by the thermal mass sensor. It should be noted that the actual value will also be affected by the gas composition and concentration.

gas	Scaler Factor (Approx.)	Remark

Nitrogen (N_2)	~ 1.00	Very similar to the properties of air (about 78% of air is N_2)
Oxygen (O_2)	~ 1.03	Slightly higher thermal conductivity, but also slightly higher density
Carbon dioxide (CO_2)	~ 1.33	High density, low thermal conductivity, poor heat transfer, low readings
Argon (Ar)	~ 1.18	Inert gas, high density, low thermal conductivity

5. Flow volumetric rate calculation and profile factor

The FDM06-X thermal mass differential pressure signal processor is compatible with a wide range of throttling devices (differential elements). Depending on the characteristics of the differential pressure element, installation method, and application, the corresponding K value should be entered before actual measurement to achieve alignment and traceability to the true value (standard component). The sensing principle of the thermal mass anemometer is proportional to the theoretical differential pressure formula established by differential elements (such as Pitot tubes, Annubar tubes, and Venturi tubes). By comparing with the standard component, a wind speed correction factor (Scalar Factor) is derived to align the measured value with the standard. Please note: Different differential elements, probe shapes, and installation methods will affect the Scalar Factor.

$$K_V = \frac{V_{\text{True (Max)}}}{V_{\text{FM06-X measured}}}$$

K_V = velocity correction factor

V = velocity

Enter the determined Kv into the Scalar Factor field in Section 7.7.

In actual ducts, the velocity distribution is not completely uniform. The difference in velocity between the center of the cross-section and the boundary layer can affect the average velocity calculation. Therefore, a Profile Factor (velocity distribution correction factor) is required for volume flow calculations:

$$K_Q = \frac{Q_{\text{True (Max)}}}{Q_{\text{FM06-X measured}}}$$

K_Q = flow correction factor

Q = flow

Enter the determined K_Q into the Profile Factor field in Section 7.7.

6. Other considerations

During installation, strong vibration or pipe bending and deformation should be avoided, which may affect the stability of the sensor or damage the probe, and avoid vibration and mechanical stress. A location that is easily accessible should be chosen to facilitate subsequent inspection, correction or cleaning. If the installation environment is humid or

the gas contains a lot of dust, it is recommended to use a filter or clean it regularly. Because the probe of the thermal mass sensor is particularly sensitive to dust and dirt, the readings will be affected over the long term.

V. RS-485 and Modbus

FDM06-X integrates a RS-485 interface for digital communication as an option feature. Based on Modbus protocol makes the general convenience on PLC, HMI and PC connection. For Modbus protocol information please download the file from website. Besides the PLC, HMI application, the user software provide the device setting and data logging function, it also can free download from website.

Technical Data：

(1) Max. network size：32 transmitters
(2) Communication：with COM-Port (serial interface) of PC
(3) Max. network expansion：1200m (3937ft) total length at 9600 baud
(4) Transmission rate：9600, 19200, 38400, 57600, 115200 Baud
(5) Parity：None, Even, Odd
(6) Data length：8 bit
(7) Stop bit：1 or 2 bit
(8) Factory default Station address = 1, Data format= 9600, N81

VI. Autozero

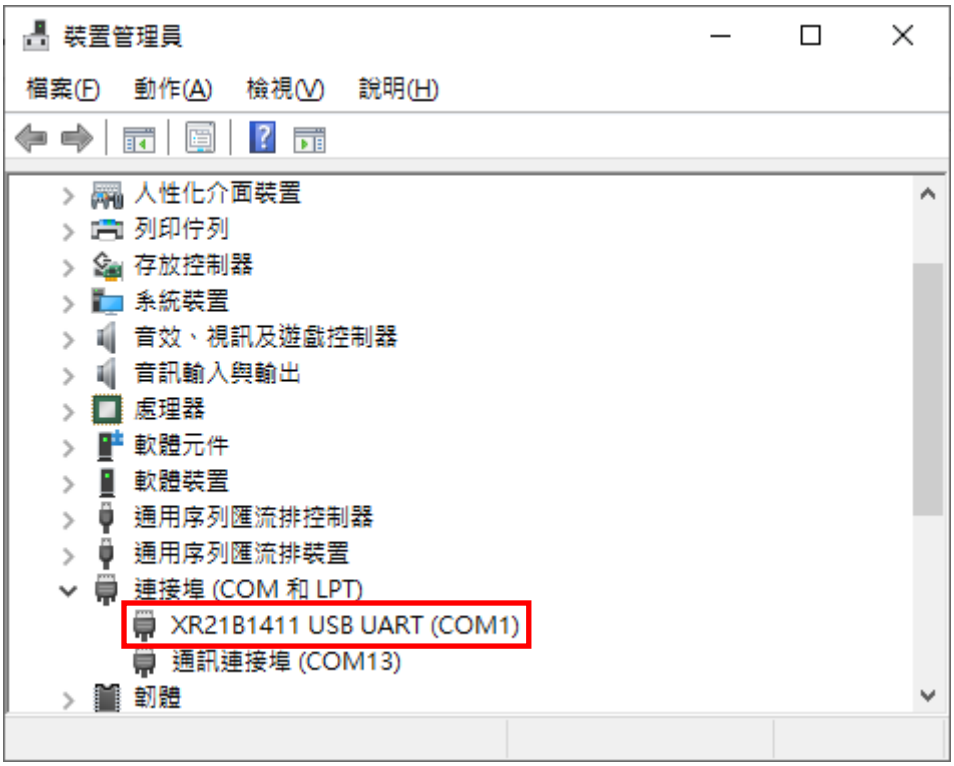
The middle button allows user to set the current flow rate to zero point. It is required to press the button about 5 seconds, and user can see Auto Zero will be display. Then user can release this button and will see the prompt Auto Zero Done, and the new zero point has been set. Please make sure that the gas is completely still prior to execute this function.

This button also allows user to restore factory default setting. It is required to press the button about 10 seconds, user will first see Reset Zero will be display. Then user can release this button and will see the prompt Reset Zero Done, and the new zero point has been set.

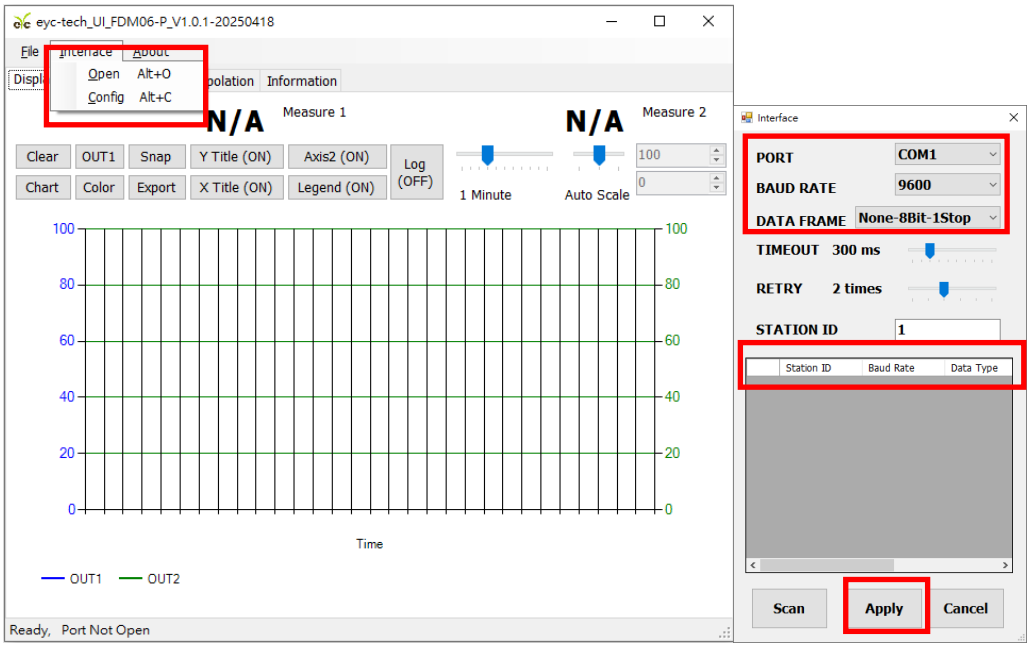
VII. Software and configuration step

User may download the configuration software on eyc-tech web site. Please decompress the application prior to execute it. Operating System requirements：above Windows 10.

1. Hardware connection：Connect the FDM06-X to PC through USB to RS-485 or RS-232 to RS-485 converter
2. Check the COM port number from Device Manager in Computer Management. e.g. COM1 in illustration

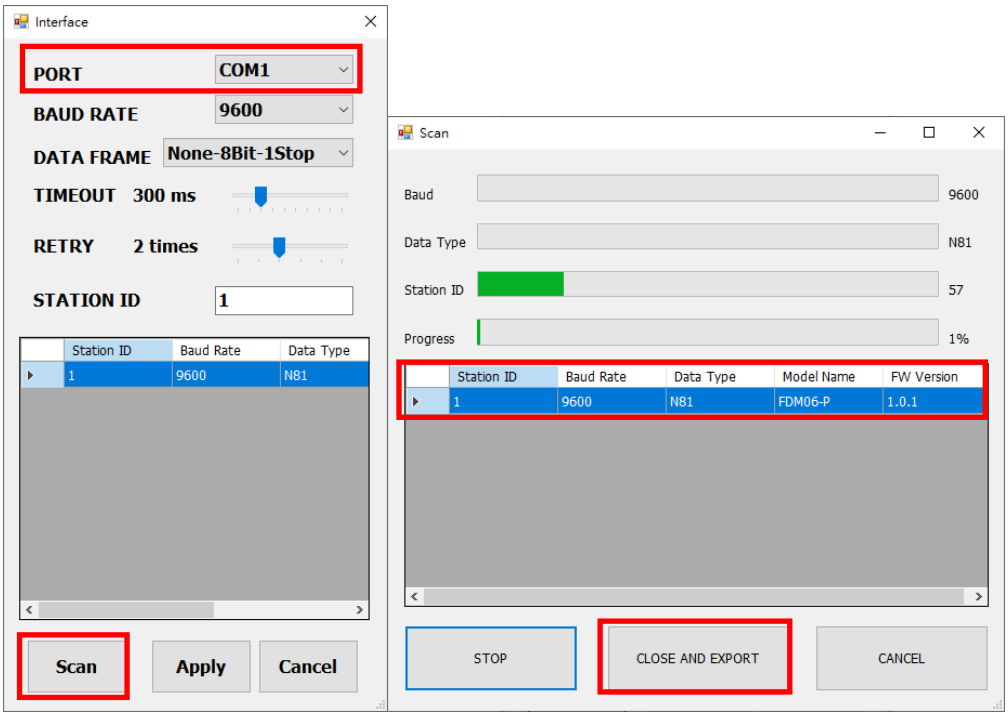


3. Open the FDM06-XC UI, go to function " Interface " , click item " Config " and then setting COM port, BAUD rate, data format and Station ID, pressed " Apply " for connection



4. Scan RS-485 connection

Open the FDM06-X UI, go to function " Interface " , click item " Config " and then setting COM port, pressed " Scan " bottom for scan devices and pressed " Close and Export " when the interested devices found.



Pick up the device that you want to connect to and then press "Apply" to go.

5. Setting on Analog Output

In the group of Analog, Output tab. The output1 related setting could be found.

Quantity：Flow Velocity in unit of m/s, Flow Velocity in unit of ft/s, Flow Rate in unit of L/min, Flow Rate in unit of m/h, Flow Rate in unit of m/min

(1) Response rate： 1st order low pass filter inside, set 100 if filter disable and set 0 if the maximum response time. 100~0 possible. Lower value if lower fluctuation but longer response time, higher value if allow higher fluctuation but shorter response time.

(2) Analog Type：Voltage or Current

(3) Analog Range：0 ... 20 mA / 4 ... 20 mA (if output current) / 0 ... 10 V (if output voltage)

(4) Decimal Places：Up to 4 decimal places. Please note that the number of displayed digits is a fixed maximum of 5 digits, and the decimal digits need to occupy integer digits.

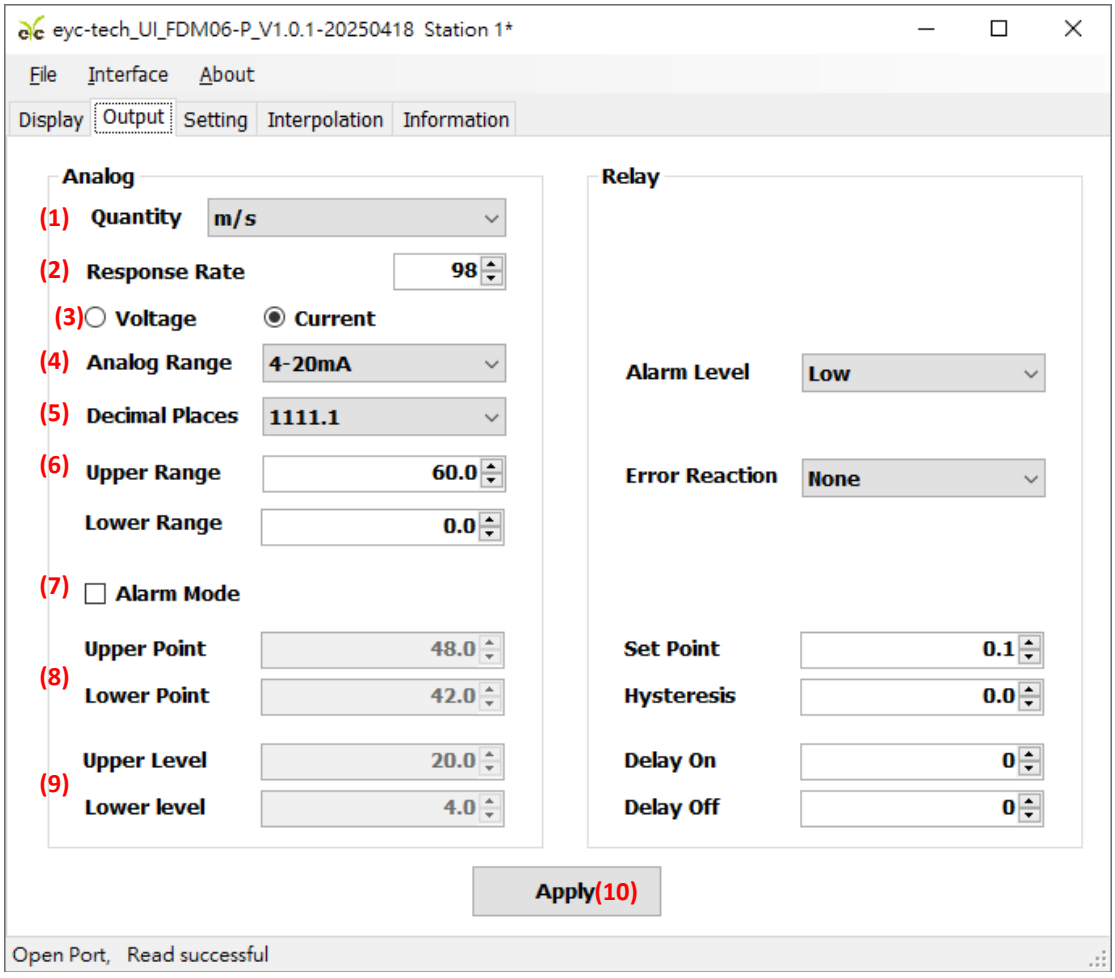
(5) Range for Display Upper and Lower

(6) Alarm Mode: Check the box if analog output pretends an alarm switch output

(7) Alarm Trigger Point: Upper and Lower

(8) Alarm Output Level: Upper and Lower

(9) Apply: Write the setting value to the device. If this button is not clicked, the changes will be discarded.



6. Setting on Relay Output

In the group of Relay, Output tab. The relay related setting could be found.

(1) Alarm Level：Relay activate mode, activate at increasing signal (High) or activate at decreasing signal (Low)

(2) Error Reaction Mode：None if disable, Hold if memory and hold the first alarm until reboot, Action if active when alarm assert, Deaction if inactive when alarm assert

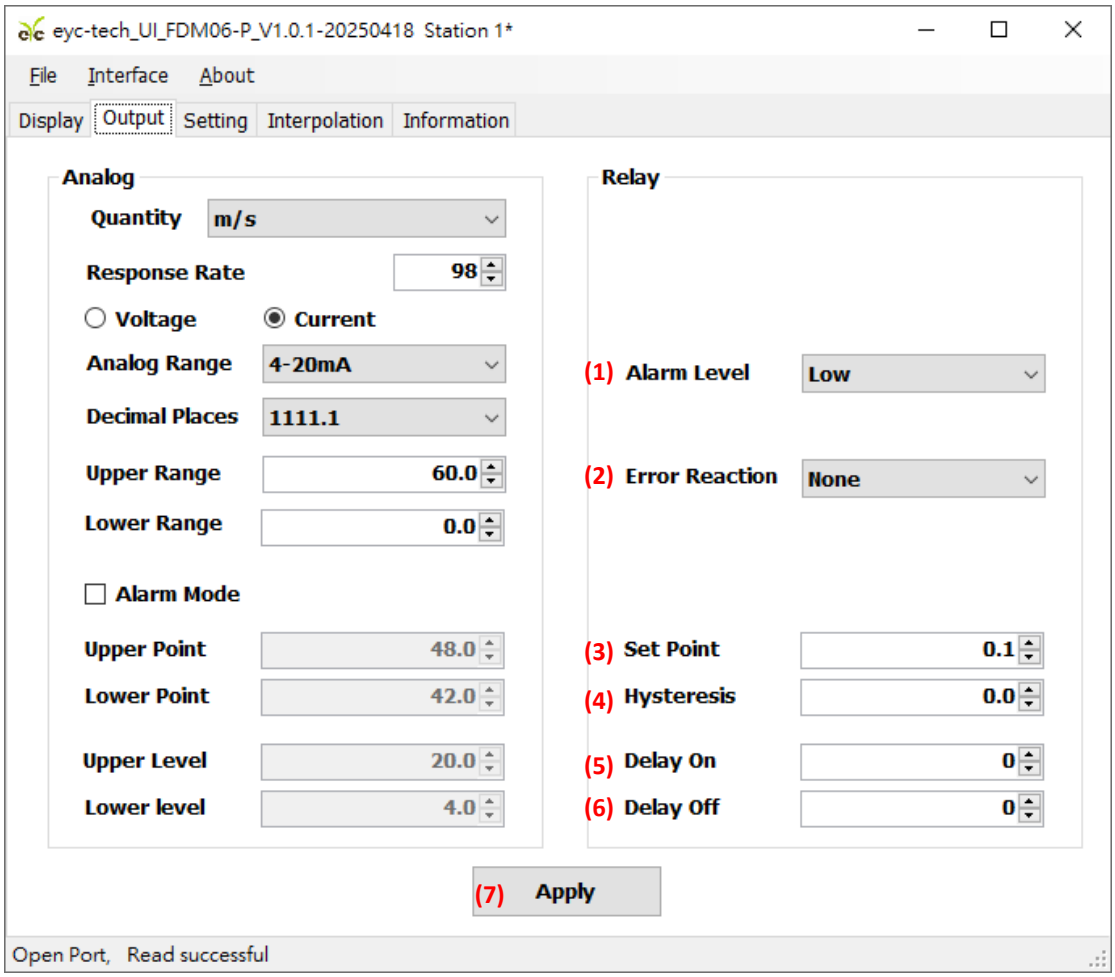
(3) Set Point：Activation Set Point

(4) Hysteresis：Activation Hysteresis Gap

(5) Delay On：Relay Activate Delay Time in second

(6) Delay Off：Relay Deactivate Delay Time in second

(7) Apply: Write the setting value to the device. If this button is not clicked, the changes will be discarded.



7. Offset adjustment and RS-485 Setup

There are 3 groups in setting tab. The description of each item as below.

※ Offset adjustment：

(1) Flow Velocity/Rate Offset

(2) Flow Velocity/Rate Low Cut Off Level

(3) Flow Velocity/Rate scaler factor

※ Process Parameter

(4) Pipe Type

(5) Pipe Dimension, specify diameter or width and height

(6) Flow profile factor

※ Display：

(7) LCD display of measurement: Two programmable on-site display columns are provided, namely the first and second lines of the display. The possible measurement including flow velocity unit in m/s, ft/s and flow rate unit in L/m, m^3/h and m^3/m. The position of decimal places can be specified individually.

(8) Device menu access password

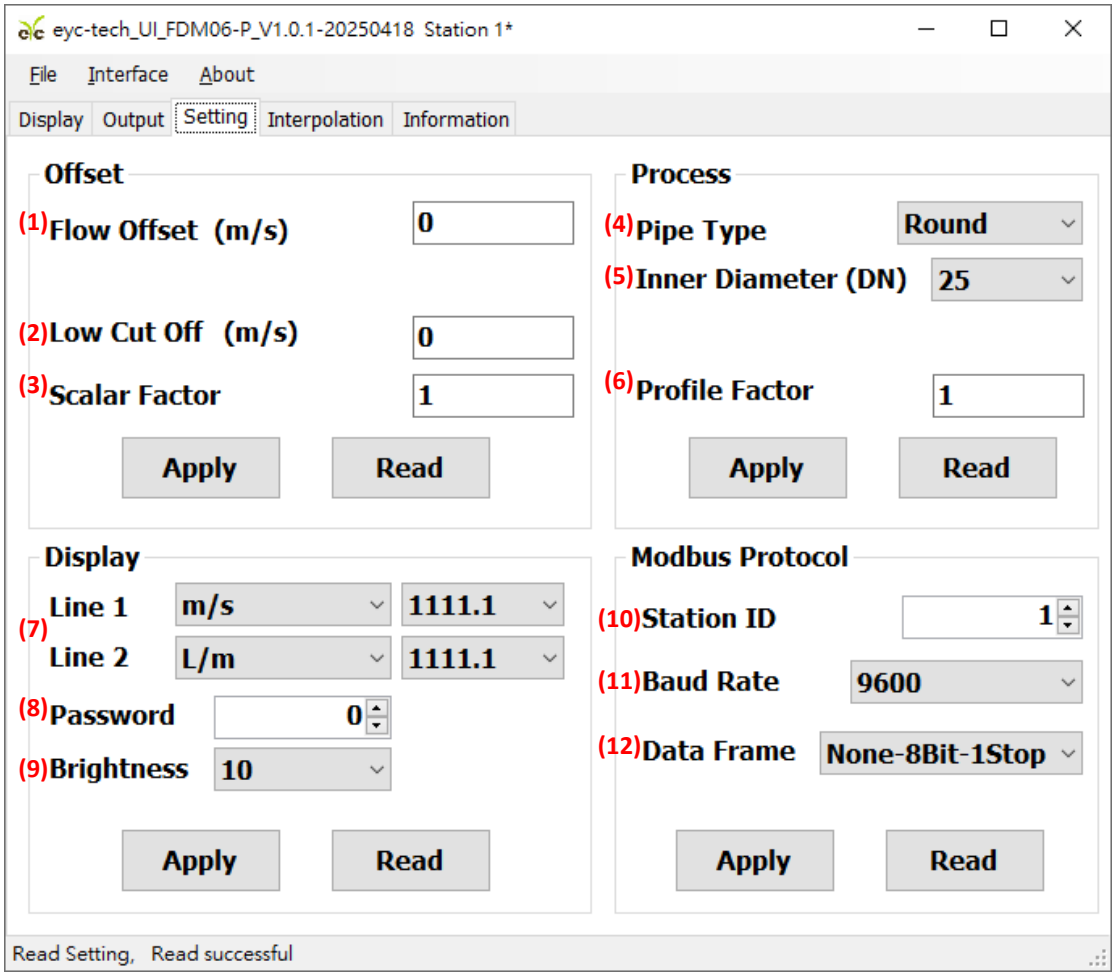
(9) LCD brightness

※ Modbus Protocol：

(10) Station ID

(11) Baud Rate

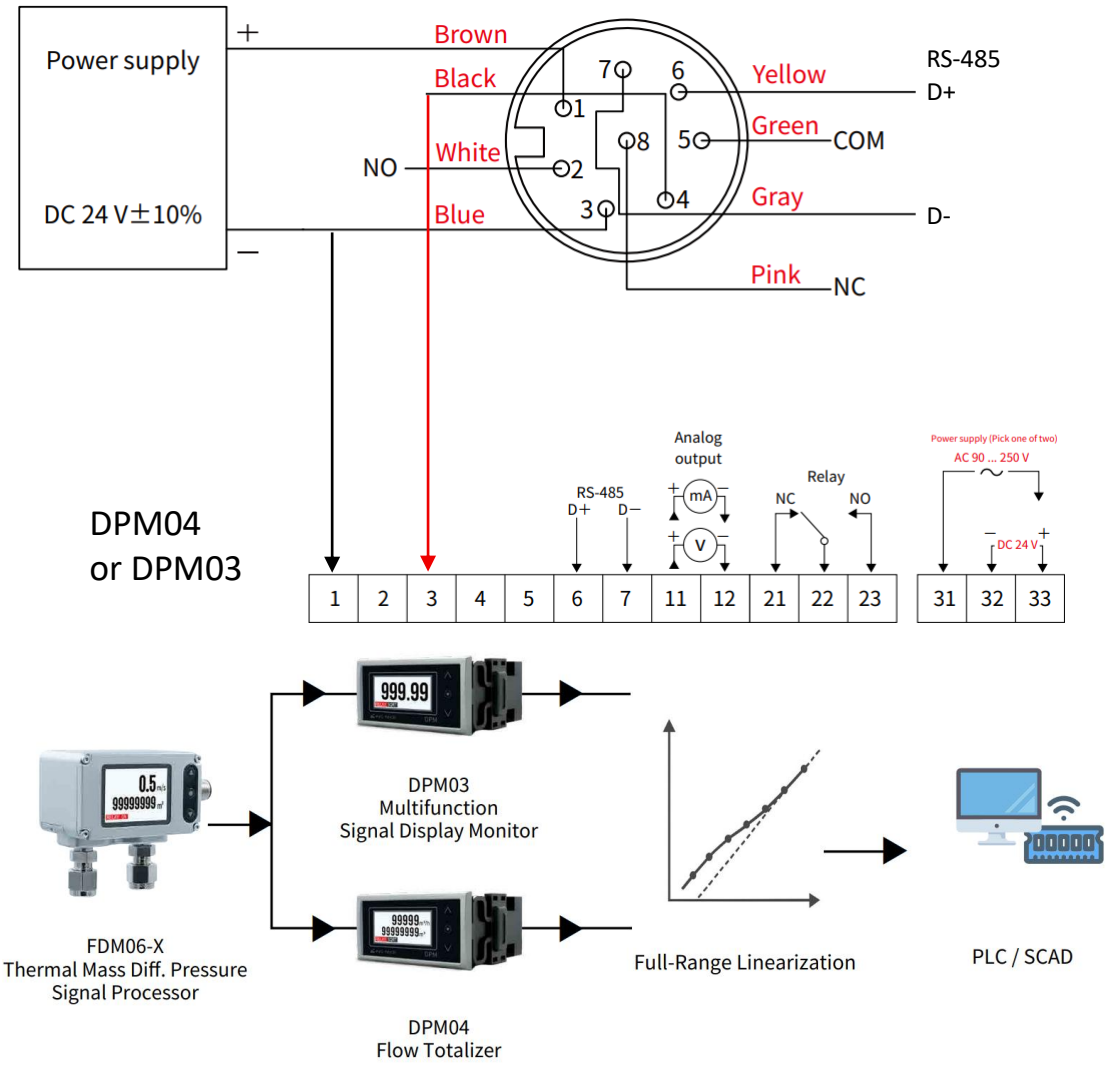
(12) Data Frame, the combination of parity check and stop bit



8. Linear Interpolation

Use the DPM03 Multifunction Signal Display Monitor or the DPM04 Flow Totalizer to perform flow velocity or flow rate linearity correction. First, set the consistence span in both FDM06-X and target device, e.g. DPM03 or DPM04. The wiring diagram uses current output as an example.

FDM06-X



Next, executes the DMP03 or DPM04 configuration software and enables the linear interpolation function. After connecting the device, click the Interpolation tab to specify linear interpolation points. This example uses DPM04.

(1) interpolation table

(2) interpolation curve

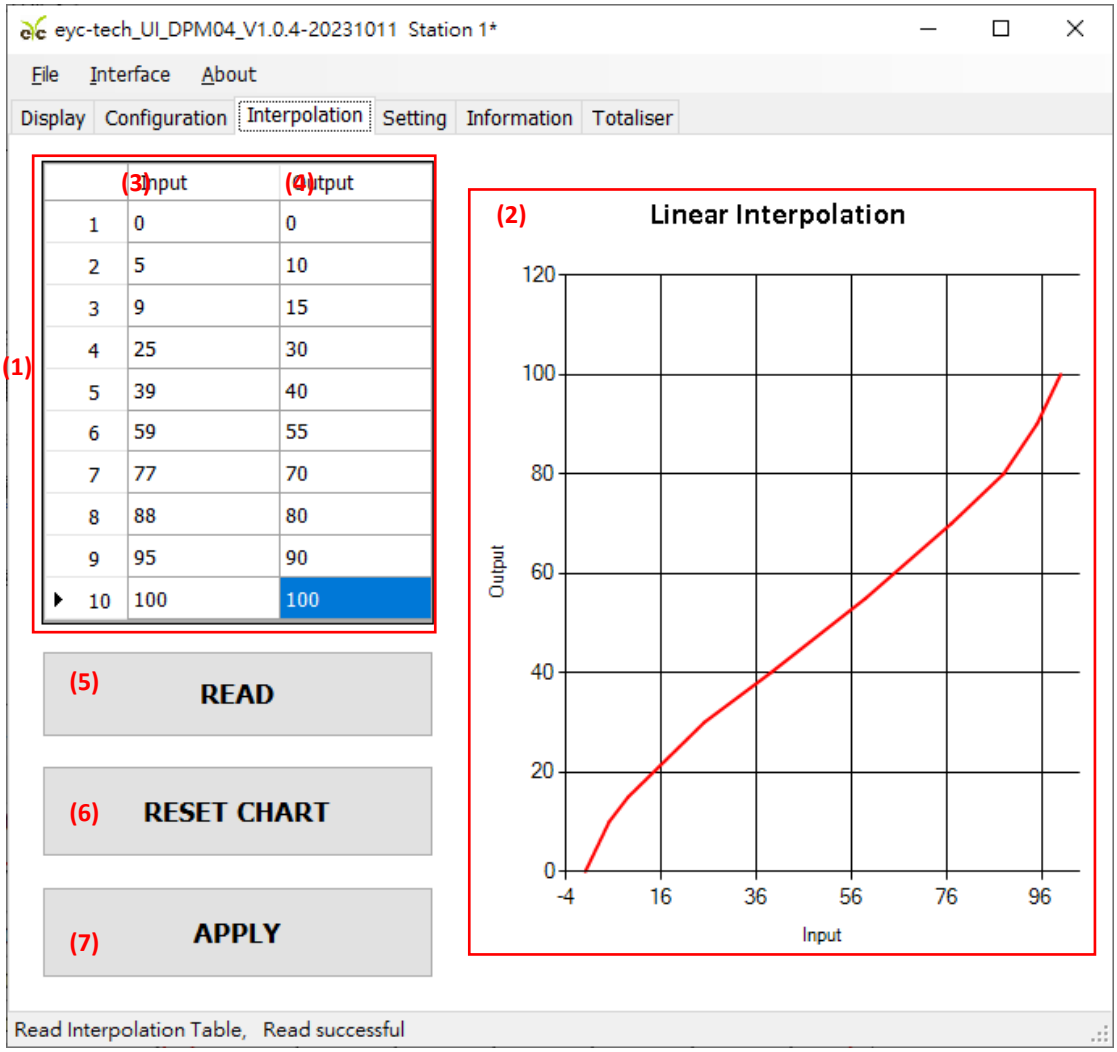
(3) interpolation input column, FDM06-X measures value (raw value)

(4) interpolation output column, device output value (standard value or correction value)

(5) read the interpolation table of connected device

(6) Clear the interpolation table on configuration software. Note: this action will not modify the interpolation table of the device

(7) apply, the interpolation would be written in device


eyc-tech_UI_DPM04_V1.0.4-20231011 Station 1*
File
Interface
About
Display
Configuration
Interpolation
Setting
Information
Totaliser
(1)
(3)
(4)
Input
Output
1 0 0
2 5 10
3 9 15
4 25 30
5 39 40
6 59 55
7 77 70
8 88 80
9 95 90
10 100 100
(2)
Linear Interpolation
120
100
80
60
40
20
0
Output
-4
16
36
56
76
96
Input
(5)
READ
(6)
RESET CHART
(7)
APPLY
Read Interpolation Table, Read successful

9. Data display and logging

On the Display tab, display the measurement data and log the data. The settings are as follows.

※button function description

Clear clear chart

Chart change chart drawing line style

OUT1 select the activate channel to be set color

Color set the activate channel line color

Snap capture drawing chart screen

Export export measurement data since the last "clear chart" or ui start up

Y Title (ON) Y-axis label On/Off

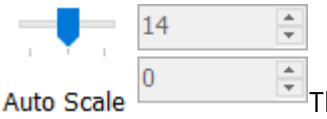
X Title (ON) X-axis label On/Off

Axis2 (ON) secondary Y-axis On/Off

Legend (ON) chart legend On/Off

Log (OFF) data log function On/Off

1 Minute The X-axis scale adjustment

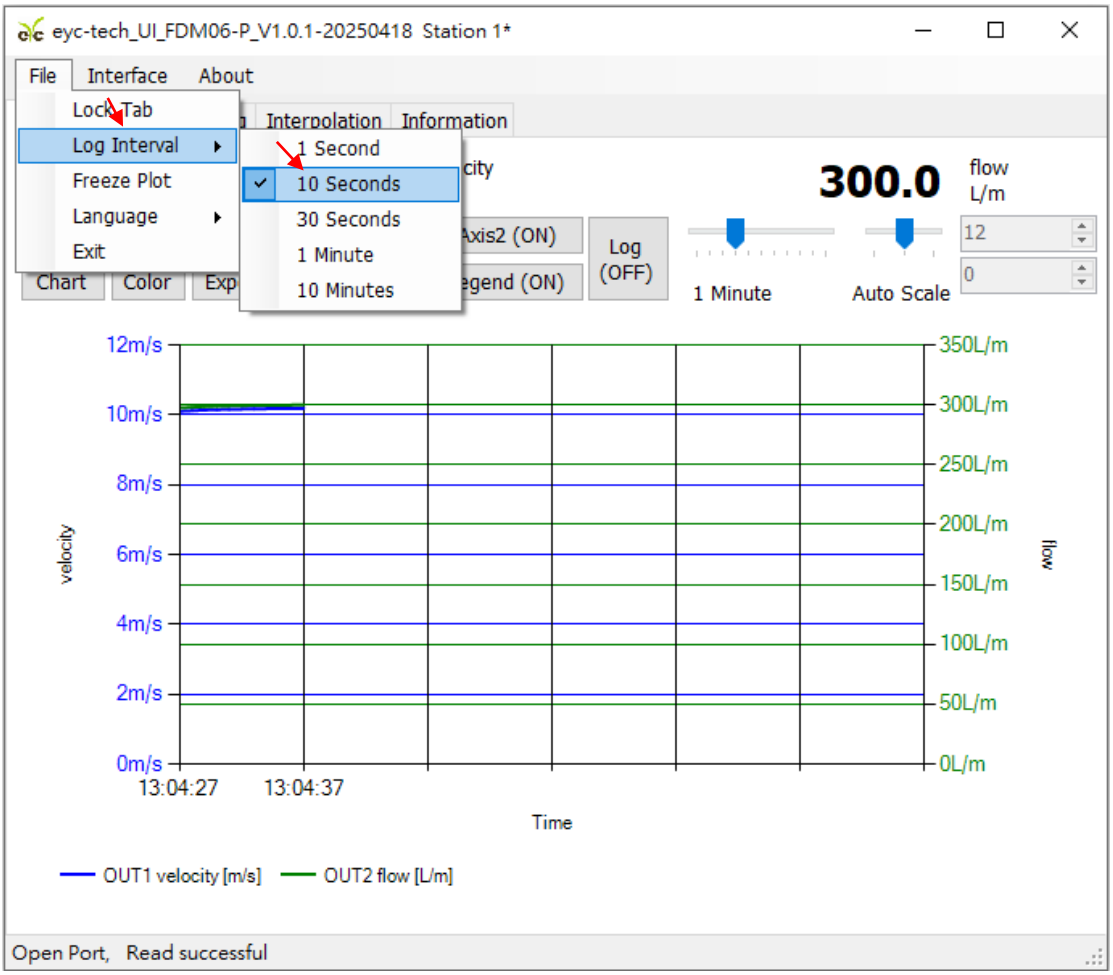


The Y-axis scale mode

※Set recording time interval

a. File > Log Interval

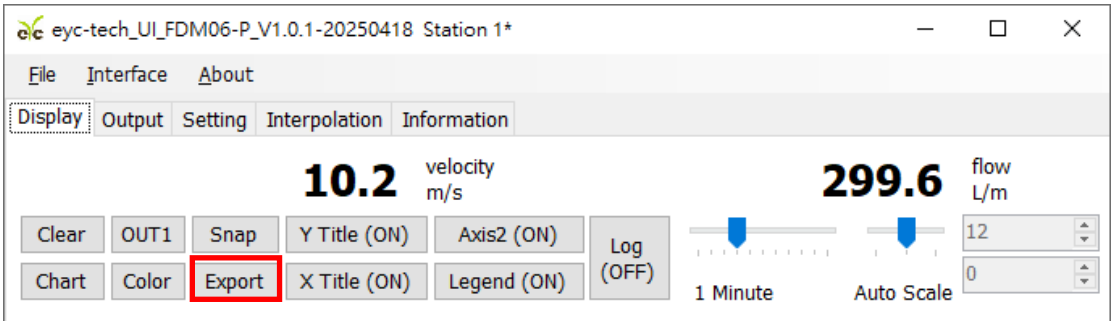
b. Select recording interval



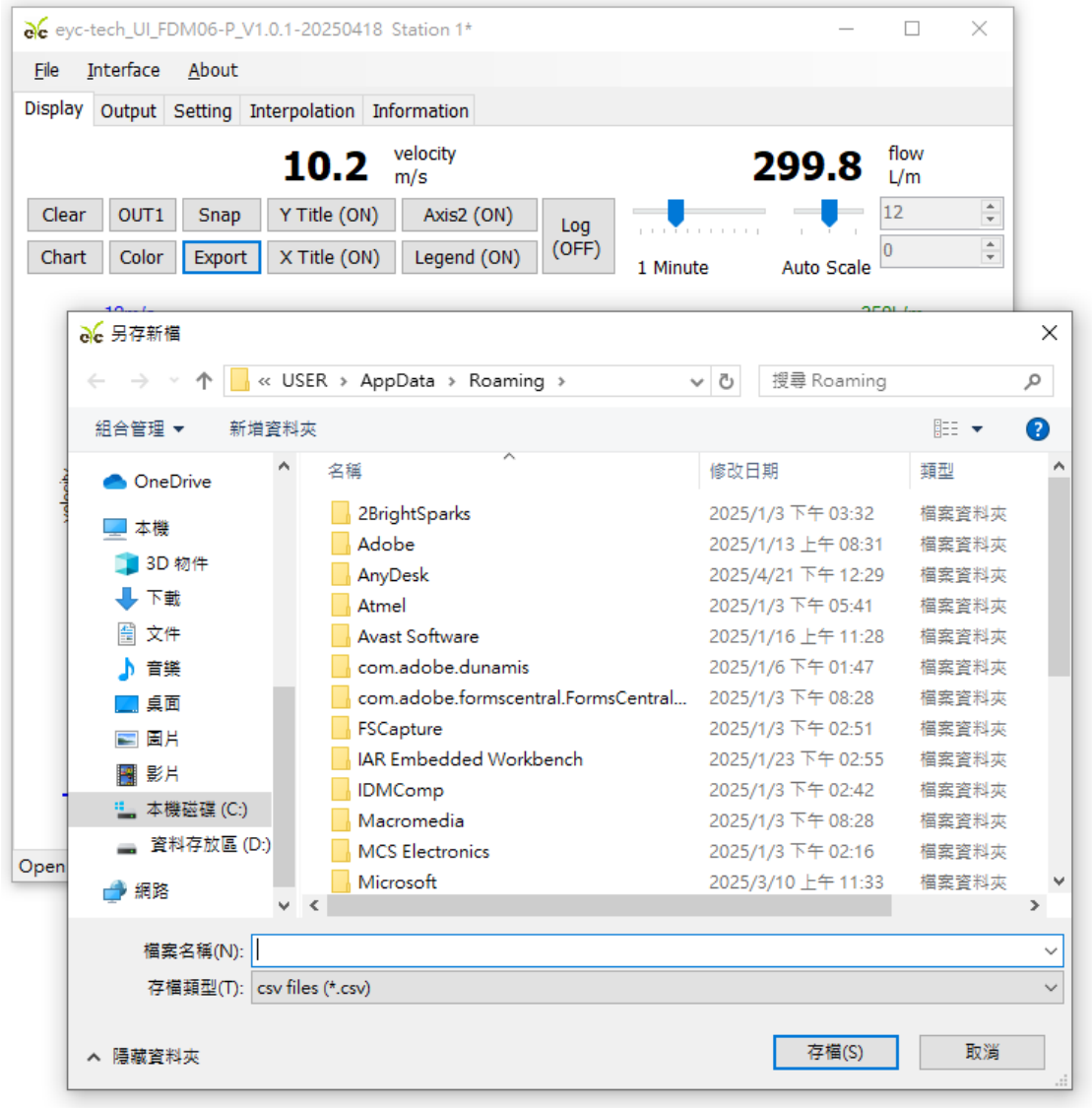
※Export/recording measurement

1. export measurement data since ui start up or the last "clear chart"

1-1. clock Display > Export



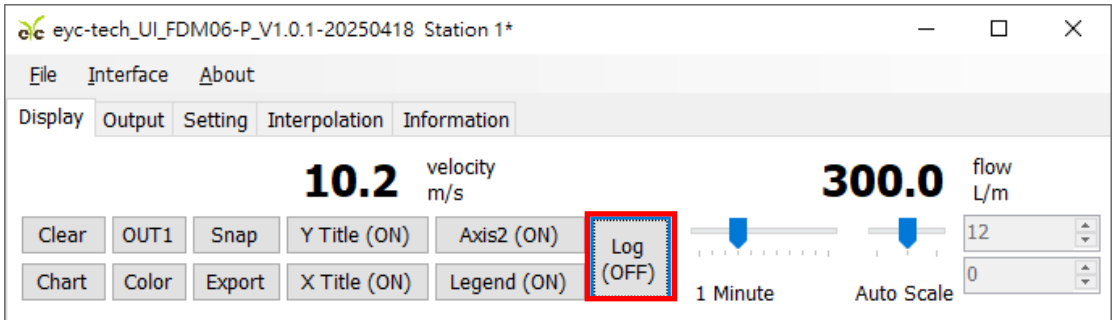
1-2. Specify the file path and file name > Save



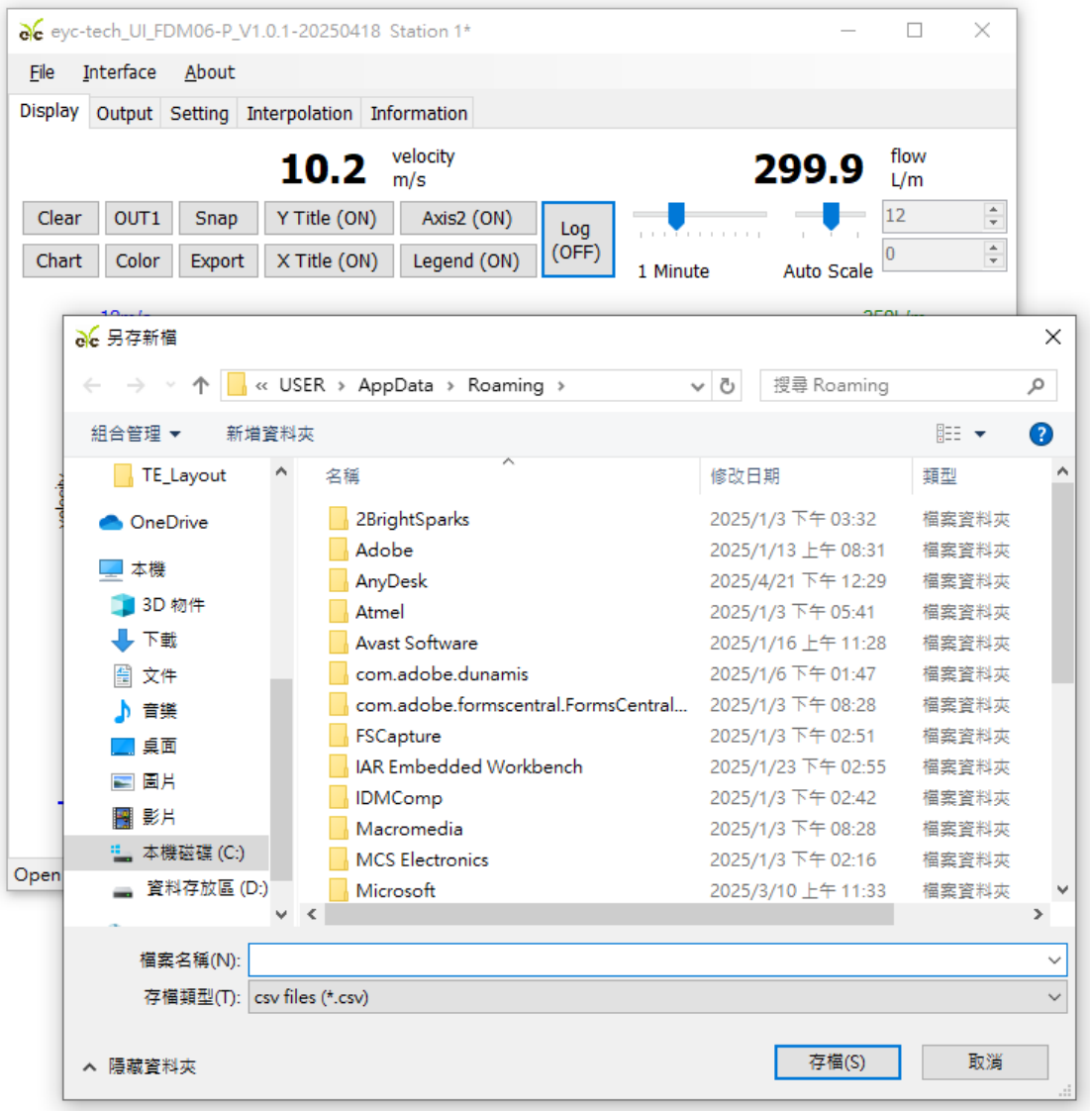
Note: If the specified file already exists, the data will be overwritten.

2. Record measurement data: record data since the Log function is turn on

2-1. Clock Display > Log(OFF)

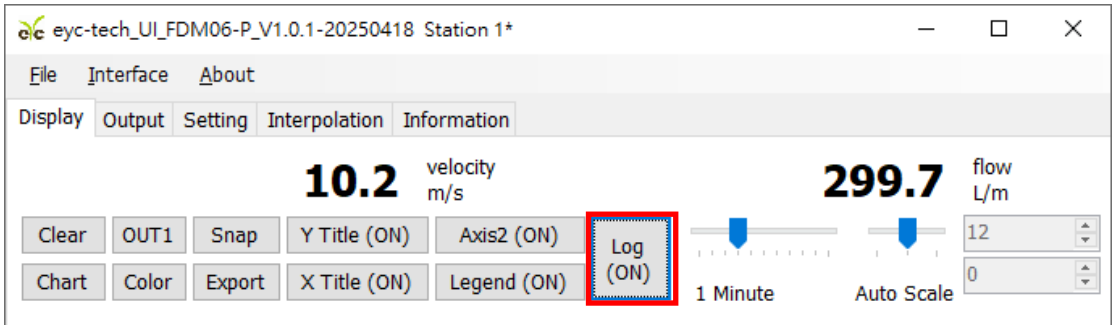


2-2. Specify the file path and file name > Save > Log(ON)



Note: If the specified file already exists, the data will be overwritten.

2-3. Finish recording measurement data: Click Log(ON) again. At this time, the button returns to displaying Log(OFF), and the recorded data file is stored in the specified file.



10. Device Information

(1) Serial Number of Device

(2) Model Name of Device

(3) Firmware Version of Device

(4) Factory Mode Status, default Disable

(5) Firmware Checksum

(6) Output equipment, supports analog output and relay functions

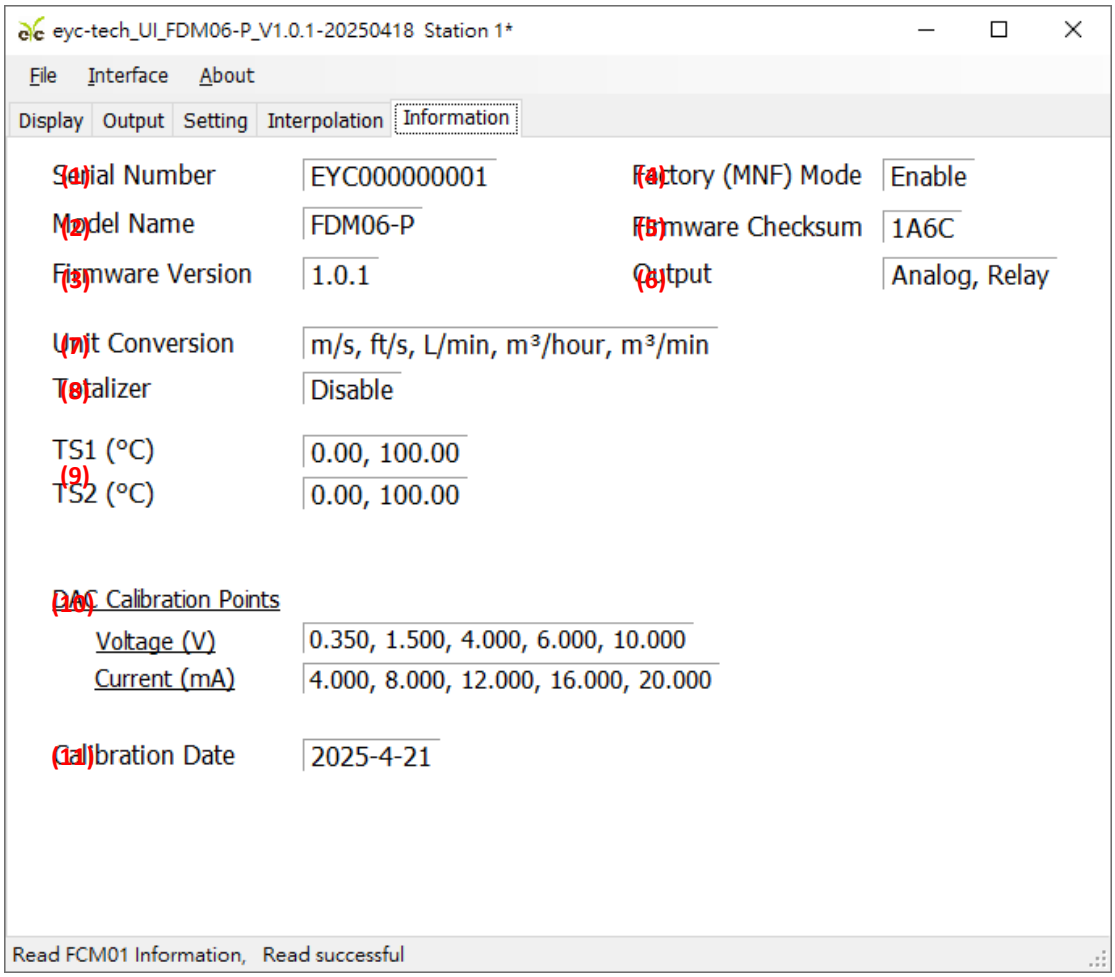
(7) Supported Unit Conversion

(8) Totalizer function, default enable

(9) Temperature Calibration Points

(10) Analog Output Calibration points

(11) Calibration Date



VIII. Inspection and maintenance

1. Maintenance

Since this product is inspected and calibrated for high accuracy at the factory before shipment, no calibration on the installation site is necessary when this product is installed

For inspection and maintenance follow the instructions below：

(a) Periodic inspection

Periodically inspect this product for its sensing accuracy, and clean the pitot tube channel. Set the period between inspections based on atmospheric dust and other contaminants in the installation environment

(b) Sensor maintenance

Do not damage sensor surface during maintenance process

(c) Troubleshooting

If any problem occurs during operation, refer to the table below for appropriate solutions

2. Troubleshooting：

Problem	Cleck items	Soluations
●No output ●Unstable output	●Disconnected wiring ●Loose wiring ●Power supply voltage ●Sensor damages	●Re-perform wiring ●Crew on terminal tightly or replace wires ●Clean up the pitot tube channel ●Replace the sensor
●Slow response to output ●Error in output	●Moisture / Condensation on the product ●Execute Autozero before measures ●Check installed location ●Check pitot tube channel ●Check dust and contamination on the sensor	●Remove the sensor cover and filter. Let the sensor unit dry naturally in a clean air environment ●Refer to the section 6. Autozero ●The straight length of pipe did not satisfy design specifications. Refer to the section 4. Installation ●Cleanup the pitot tube channel ●Calibrate ●Replace the sensor

eyc-tech Measuring Specialist

enhance your capability with sensor technology

Air flow | Humidity | Dew point | Differential pressure | Liquid flow

Temp. | Pressure | Level | Air quality | Signal meter

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