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# 1 Models and Technical Specification

Model	No.of Axis	Resolution	Measuring Range	Measuring Accuracy
3X	Single	0.0001um	0.05~3mm	±0.5μm
25X	Single	0.001mm	0.1~25mm	±1um
40X	Single	0.001mm	1~40mm	±1um
50X	Single	0.001mm	1~50mm	±3um
70X	Single	0.01mm	1~70mm	±10μm
100X	Single	0.01mm	1~100mm	±10μm
15XY	Dual	0.001mm	0.1~15mm	±1μm
25XY	Dual	0.001mm	0.1~25mm	±1um
50XY	Dual	0.001mm	1~50mm	±3um
70XY	Dual	0.01mm	1~70mm	±10μm
100XY	Dual	0.01mm	1~100mm	±10μm

Table 1

Supply Voltage: 85~264VAC 50/60Hz

Operation Condition: -5~+45℃ ≤85%RH

Consumed Power: ≤10W

Protection Grade: IP65

## 2 Gauge Operation and Setting Menu

The Operation Panel is a full digital key operation panel, which is made of metal die-casting and has good reliability. It has three displaying screens, convenient for operation and observing data. The functional layout of the panel is shown in Figure 2-1.

### 2.1 Display and Indicating Lights

The first screen displays actual measured diameter.

The second and third screens can be set via parameter dP2\_S and dP3\_S

Shrinkage Light: when it is on, diameter value = actual measured value\*shrinkage ratio.

Feedback Light: remote controller switch indicator for analog feedback control

Upper Deviation Light

Normal Light

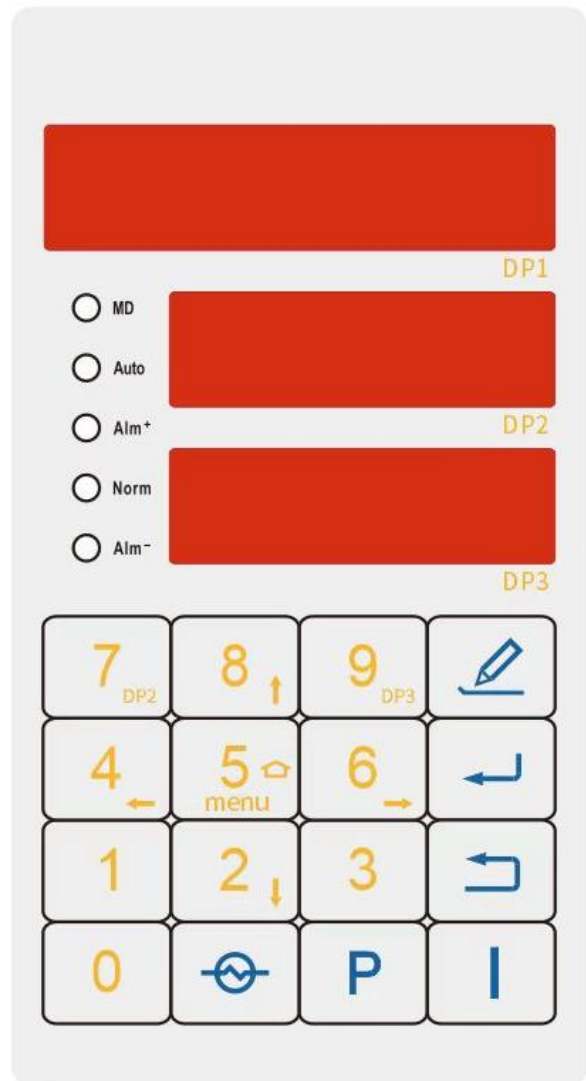
Lower Deviation Light

Pls refer to section 2.3 for button functions.

### 2.2 Operation Panel Instruction

Menu operation: in the non-menu interface, long press the Menu button for 1 second to enter into the menu. The first screen displays parameter category, the second screen displays the parameter value and the third screen displays the parameter code. Scroll through the button number Left or Right to browse the menu. When you need to modify a certain parameter, press the edit button. The second screen displays the content, that is, the parameter value. When the digit in the highest order flashes, it means that you can input the number through the number key at this time. Each time you input a number, the flashing position automatically moves one digit to the right until the lowest order digit. In the process of parameter editing, you can press the Confirm button to confirm the input, or press the Return button to cancel the input.

Enter into secondary menu: under the "AdSET" parameter, press the Edit button and input the password (Default password 12312). After inputting the password, press the Confirm button to enter into the secondary menu. If the password is wrong, the second line will show "Err", you can input the password again.















In the non-editing state of the secondary menu, press the Return button to return to the primary menu, and press the Return button again to return to the non-menu interface, that is, measuring value displaying.

When not in editing mode, you can quickly flip through the parameter category menu by pressing the button 8 (Up) or 2 (Down). For example, in the pre-diameter parameter interface, it can be directly flipped to the display settings menu when press Up and Down buttons. At the communication baud rate parameter setting menu, press the Enter button, the displayed value will flash as a whole. You can directly select the list content by pressing the button 8 (Up) or 2 (Down).

Common menu operation: P and I are shortcut buttons. See the parameter table for more details. In the measurement interface, press these shortcut buttons to directly enter into the corresponding parameter, press the Edit button to modify such parameter, and press the confirm button to save the parameters. After saving the parameters, press the return button to exit to the measurement interface.

Displaying selection menu: button 7 and 9 are the shortcut buttons for the displaying content of the second and third screen. In the measurement state, press these buttons to enter into the displaying selection menu. After entering into the menu, press the Edit button to input the corresponding display selection parameters, and press the Confirm button to complete the modification. See "dP2-S" and "dP3-S" selection parameters in table 2.4 for the displaying menu parameter.

## 2.3 Button Functions

Button	Description
	at input status: input number “0” ; at measuring status: clear the upper and lower limit value and make recalculation;
	at input status: input number “1” ;
	at input status: input number “2”; at baud rate setting menu: make UP adjustment for baud;
	at input status: input number “3”
	at input status: input number “4” ; at setting menu status: backward.
	at input status: input number “5”; at measuring status: press it for 1s to enter into setting menu;
	at input status: input number “6”; at setting menu status: forward;
	at input status: input number “7”; at measuring status: Enter into DIS2 display selection menu.
	at input status: input number “8” ; at baud rate setting menu: make Down adjustment for baud;
	at input status: input number “9” ; at measuring status: Enter into DIS3 display selection menu.
输入	Edit key: Press it and modify parameter value
确认	Confirm key: Confirm the modified parameter.
返回	Return key: Cancel the modified parameter and back to previous menu.
	Shortcut key for entering into PID control parameter P at measuring status.
	Shortcut key for entering into PID control parameter I at measuring status.
缩放	Shrinkage Ratio Switch: when the light on, the displaying value is diameter *shrinkage ratio.

## 2.4 Parameter Code Illustration

Code	Code Description	Model	Range	Default
<b>PRE-E</b>	Reference Diameter	25X/25XY	0 – 25mm	5mm
		50X/50XY	0 – 50mm	10mm
		70X/70XY	0 – 70mm	50mm
		120X/XY	0 – 120mm	50mm
<b>AL-EU</b>	upper deviation in gate	Single/Dual	0 – 2/20mm	0.1/1mm
<b>AL-ED</b>	lower deviation in gate	Single/Dual	0 – 2/20mm	0.1/1mm
<b>PRE-X</b>	Reference Diameter of X axis	25XY	0 – 25mm	5mm
		50XY	0 – 50mm	10mm
		70XY	0 – 70mm	50mm
		120XY	0 – 120mm	50mm
<b>AL-XU</b>	upper deviation in gate of X axis	Dual Axis	0 – 2/20mm	0.1/1mm
<b>AL-XD</b>	lower deviation in gate of X axis	Dual Axis	0 – 2/20mm	0.1/1mm
<b>PRE-Y</b>	Reference Diameter of Y axis	25XY	0 – 25mm	5mm
		50XY	0 – 50mm	10mm
		70XY	0 – 70mm	50mm
		120XY	0 – 120mm	50mm
<b>AL-YU</b>	upper deviation in gate of Y axis	Dual Axis	0 – 2/20mm	0.1/1mm
<b>AL-YD</b>	lower deviation in gate of Y axis	Dual Axis	0 – 2/20mm	0.1/1mm
<b>ovAL</b>	Ovality Alarm Limit	Dual Axis	0 – 2/20mm	
<b>dP1-S</b>	Main display option for the first screen: 0: average diameter 1: X axis diameter 2: Y axis diameter value 3. ovality (f), $f =  X - Y $	Dual Axis	0-2	0
	Display Contents for the second and third screens: 0: display deviation value (the balance between the measured and the reference diameter) 1: display position value 2: display reference diameter value 3: display the minimum diameter value 4: display the maximum diameter value 5: Display the real time diameter value			
<b>dP2-S</b>		Single Axis	0—5	DP2-S:0 DP2-S:2
<b>dP3-S</b>				

Code	Code Description	Model	Range	Default
<b>DP2-S</b> <b>DP3-S</b>	Display Contents for the second and third screens: 0: display average diameter of XY axis 1: display average deviation value of XY axis 2: display oval concentricity (f), f=semiminor axis/ semimajor axis 3 and 4:display the diameter value of axis X and Y 5 and 6: display the deviation value of axis X and Y 7 and 8: display the position value of axis X and Y 9: display average reference diameter value 10: display the min average value of the average diameter, press 0 to clear 11:display the max average value of the average diameter, press 0 to clear 12: display average diameter deviation times	Dual Axis	0—11	DP2-S:1 DP3-S:9
<b>UNI-T</b>	Measuring unit selection: 0: millimeter; 1: inch.	General	0、1	0
<b>DECIM</b>	Decimal places	General	0 display accuracy	display accuracy
<b>DIS-T</b>	Display refresh time =(parameter value *40ms)	General	1-50	1
<b>BUZ-M</b>	audible and visual alarm : 0 disable alarm; 1 enable alarm; audible and visual alarm : 0 disable; 1 enable alarm for average deviation 2 enable alarm for X or Y deviation 3 enable alarm for X deviation 4 enable alarm for Y deviation 5 enable alarm for ovality	Single Axis  Dual Axis	0、1  0-5	0  0
<b>BUZ-T</b>	alarm delay	General	1-600	0
<b>ADSET</b>	Advanced setting: input password to enter into the secondary menu	General	5digits	12312
<b>EVEN</b>	Average number for data sampling	General	1 – 1000	10
<b>obj-t</b>	Measuring object:0 non-transparent; 1 transparent	General	0、1	0
<b>SHR-X</b>	X axis diameter shrinkage ratio	Single/Dual	0.8—1.2	1
<b>SHR-Y</b>	Y axis diameter shrinkage ratio	Dual Axis	0.8—1.2	1
<b>SHW-X</b>	X axis diameter shrinkage value	Single/Dual	0-1	0

Code	Code Description	Model	Range	Default
<b>SHW-Y</b>	Y axis diameter shrinkage value	Dual Axis	0-1	0
<b>LIM-T</b>	Detect the diameter peak period (max and min value detection)	Single/Dual	0-8S	1
<b>AnPrE</b>	Analog reference value: 0 average diameter; 1 X diameter; 2 Y diameter	Dual Axis	0-2	0
<b>PAR-P</b>	PID control mode parameter P	General	1-250	27
<b>PAR-I</b>	PID control mode parameter I	General	0-250	10
<b>PAR-D</b>	PID control mode parameter D	General	0-250	0
<b>PAR-F</b>	PID control mode parameter F	General	0-250	50
<b>WArP</b>	Feedback control limit	General	0-2	0.5
<b>ADD</b>	Communication address: bus address	General	0 – 127	1
<b>BAUD</b>	Communication baud rate: bus baud rate	General	1200 2400 4800 9600 19200 38400 57600 115200	9600
<b>CH-T</b>	Check method: 0 for CRC Check; 1 for BCC Check; 2 for Modbus RTU; 3~5 for ODD Parity Check; 6~8 for EVEN Parity Check	General	0~8	0
<b>ADD1</b>	Not used			
<b>BAUD1</b>	Not used			
<b>CH-T1</b>	Effective for remote display when set to 9		0-9	9
<b>MASTE</b>	active sending interval (Unit: ms)	General	1-200	1
<b>REPAS</b>	Password change: change the secondary menu entering password	General		
<b>DOT0</b>	Calibration point 0			
<b>DOT1</b>	Calibration point 1	General		
<b>DOT2</b>	Calibration point 2			

Code	Code Description	Model	Range	Default
<b>DOT3</b>	Calibration point 3			
<b>DOT4</b>	Calibration point 4			
<b>DOT5</b>	Calibration point 5			
	version number (the third screen display the device model)	General		
-----	Initial status	General		
-- --	standby or measuring object exceeds the measurement area	General		
<b>Err-3</b>	Too dirty or multiple measuring objects found at non-transparent measuring mode	General		
<b>FAUL</b>	Fault	General		

Note:

1. Deviation value = actual measured value-reference diameter value
2. The position value indicates the position of the measured object in the vertical laser beam, shown in percentage. When the object to be measured is at the center of the laser beam, it is displayed as "0", when it is upward, it is "+", and when it is downward, it is "-". The measured value only indicates the position of the measured object in the measuring area when adjusting the height of the instrument, see chapter "Laser Diameter Gauge".

### 2.5 Alarm Function

The operation panel has inbuilt acousto-optical alarm function. When parameter BUZ-M is set to 0, the alarm function is disabled; when set to non-0 value, the alarm function is enabled. See 4.4 for details.

If the alarm function is enabled, the gauge will give an alarm when the measuring object is out of tolerance. When the alarm has been given, if the measuring object is taken away or any button is pressed, the alarm will be automatically turned off. If the object is put back, continue to detect whether alarm or not.

When Actual Dia > Ref Dia + Upper Deviation Limit in gate , “Alm+” will be illuminated.

When Actual Dia < Ref Dia- Lower Deviation Limit in gate, “Alm-” will be illuminated.

When Ref Dia- Lower Deviation Limit in gate  $\leq$  Actual Dia  $\leq$  Ref Dia + Upper Deviation Limit in gate, “Norm” will be illuminated

Once the measured diameter value exceeds the upper and lower limit in gate (alarm enabled), the operation panel will give an alarm sound, and indicating light on the top will flash.

### 2.6 Gauge Calibration

When the measured value of the gauge is quite different from the actual value, users can calibrate the gauge by themselves. Pls refer to the below calibration method for single and dual axis laser gauges.

Preparation before calibration: take 5 standard bars and wipe them clean. The calibration points "dot1-dot5" correspond to five standard bars, which are arranged in the order of small to large (When the standard rods are insufficient, at least two standard rods shall be needed for correction.)

- In the measurement interface, press button 5 for about 1 second to enter into the menu. Use the button 4 or 6 to turn to ADSET menu. After pressing the Edit button, the cursor in the second screen of input field flashes. After inputting the password 12312 in turn, press the Confirm button to enter into the secondary menu.
- Enter the secondary menu, use the button 4 or 6 to turn to Dot1, put the smallest standard bar in the measurement area, press the Edit button, and then use the numeric keyboard to input, so that the displayed value is equal to the standard bar value, and press the Confirm button to confirm. After finishing, use the button 6 to turn the page to Dot2 and use the second standard bar for calibration. According to this method, switch the menu interface to Dot3, Dot4 and Dot5 in turn, and put other standard rods for adjustment. If there are less than 5 standard rods, the following points need not be adjusted (Dot0 need not be adjusted).
- Once calibration completed, press the Return button to return to the measurement interface.
- Note 2: if there is a guide roller bracket with adjustable height on the gauge, the guide roller bracket gear corresponding to the standard rod should be selected during calibration. The calibration method of dual axis gauge is same as that of single axis gauge.

### 3 Remote Controller

The remote controller can directly connect to the existing single and dual dimensional models of our diameter gauges and it can automatically recognize the gauge model and version. It can be used for feedback control, alarm output and parameter remote adjusting. The panel layout is shown in below figure.

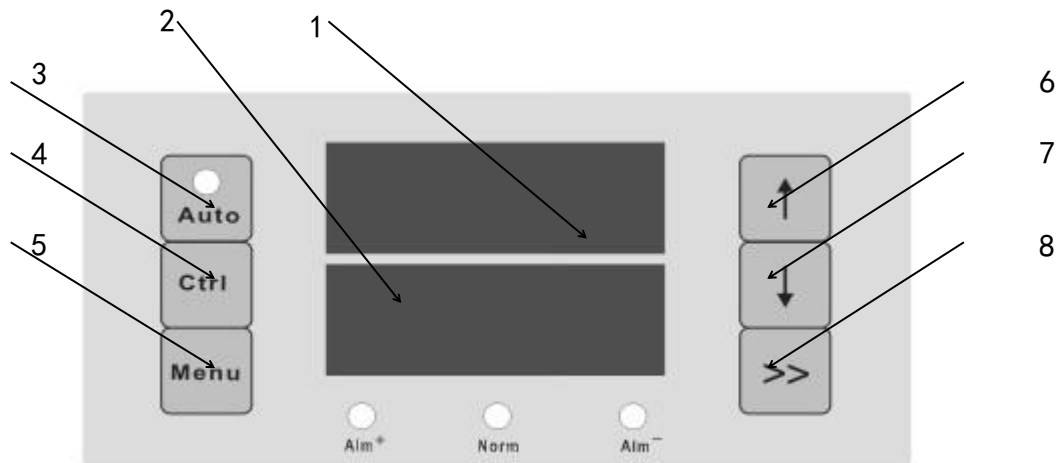


Figure 3-1

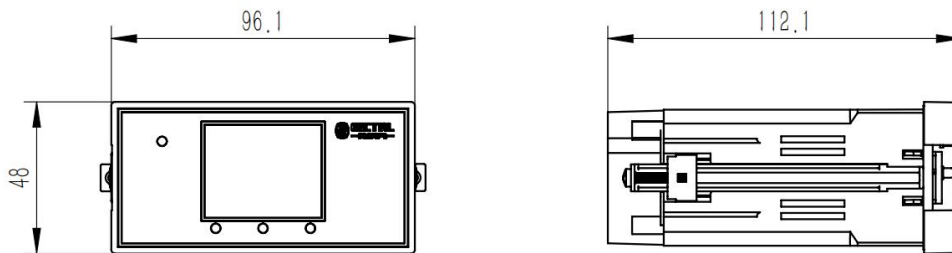
1. Main Display Screen: Display diameter value and parameter contents
2. Secondary Display Screen: display deviation, position and parameter code
3. Automatic Control Indicating Light: it will be lit in PID operation control
4. Automatic Control: press this button to enter into PID operation control mode, press it again to exit
5. Menu/Return button: Press this button to enter into menu; then long press it for 3 seconds to exit the menu; When modifying parameters, confirm the parameter modification..
6. Up Adjust Button
7. Down Adjust Button
8. Shift Button

#### 3.1 Function Diagrams of Terminal Block

Analog Output PID 反馈输出			Feedback switch 反馈开关		Connct Laser Diameter Gauge RS485接测径仪		
9	10	11	12	13	14	15	16
V1	VG		S1	S1	G1	HB1	HA1
220VAC电源 Power Supply		Ground 大地	超差触点X/Upper Relay Contact		超差触点Y/Lower Relay Contact		
1	2	3	4	5	6	7	8
N	L	PE	K1	K1	K2	K2	

(Figure of terminal Diagrams)

## 3.2 Overall Dimensions



## 3.3 Feedback Control

The laser diameter gauge and the remote controller can form a feedback control system, which can adjust the speed of the tractor or extruder according to the deviation of the diameter, and dynamically adjust the wire diameter. The control of the wire and cable production line will be described here, and other applications can follow this accordingly.

If the laser diameter gauge is installed in front of the cooling water tank. The wire dia change feedback is timely, which is conducive to control, but the measured dia value is heated value of the wire with a certain difference from cooled value (real value). In addition, due to the soft scarfskin caused of high temperature near extrusion port, guide roller cannot be installed, and the wire is easy to shake. If the laser gauge is installed behind the cooling water tank, the measured value is the actual value after cooling, but the feedback delay of the wire diameter change will affect the accuracy control. The remote controller is normally installed on the electrical cabinet. It is connected to the laser diameter gauge through a cable.

## 4 Communication

Our laser diameter gauges are equipped with a two-wire RS-485 half duplex communication interface, which can be used to not only connect with our remote controller, but also connect with industrial control computer, PLC or touch screen, configuration software, etc.

### 4.1 RS-485 Hardware Interface

The communication interface of the laser diameter gauge uses a standard 9-pin D-type connector. The communication interface pins and the color of the serial cable are as shown in Table 4-1.

DB9 Pin	Wire Color	Function
2	Orange	A
3	Orange-White	B
5	Blue and Blue-White	Data GND
Other pins	Not used	Not used

Table 4-1

### 4.2 Communication Parameter

The communication parameters of the laser diameter gauge are in the parameter setting. Before operation, confirm whether the required parameters are consistent with the actual requirements. DB9 communication ports are respectively ADD (communication address, factory default is 1), bAUd (baud rate, factory default is 9600) and CH-t (communication mode, factory default is 0).

#### 4.2.1 Device Address

When communication, the communication interface must have a unique address for identification.

Parameter range: 0-127. The factory default value is 001.

Setting method: If you want to view or change the communication address, pls refer to below procedures.

1. Press the Menu button (button 5) for about 1 second to enter into the menu
2. Use the button 4 or 6 to turn the menu to ADSET parameters
3. Press the Edit button and then input the password 12312. After inputting the password, press the

Confirm button to enter into the secondary menu.

4. Use the number 4 or 6 to turn the page to ADD parameter. Press the Edit button and input the required address parameters. Then press the confirm button.

5. If you need to change other parameters, press the button 4 or 6 to turn the page to relevant parameters, and then modify it accordingly. If parameter modification is completed, press the Return button twice to exit the secondary menu.

## 4.2.2 Communication Baud Rate

When communication, the diameter gauge must have the same baud rate as the matched communication equipment. Parameter bAUd.

Parameter Range: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200bp. The factory default is 9600.

Setting method: Same as 4.2.1. (Note: In the edit state, the baud rate is adjusted by using the button 2 or 8).

## 4.2.3 Communication Mode

The diameter measuring instrument supports free port communication and Modbus RTU communication, which can be set according to the user's needs.

Parameter range: 0-8. The factory default value is 0.

Setting method: Same as 4.2.1.

The communication mode is as shown in below table.

CH-t/CH-t1 Parameter	Function	Data Frame
0	Free Port Communication Use CRC Check	1 start bit; 8 data bits; 1 stop bit; without parity check
1	Free Port Communication Use BCC Check	
2	Modbus RTU Protocol	
3	Free Port Communication Use CRC Check	1 start bit; 8 data bits; 1 stop bit; with odd parity check
4	Free Port Communication Use BCC Check	
5	Modbus RTU Protocol	
6	Free Port Communication Use CRC Check	1 start bit; 8 data bits; 1 stop bit; with even parity check
7	Free Port Communication Use BCC Check	
8	Modbus RTU Protocol	

### 4.3 Free Port Communication

For free port communication of the device, if it is used for communication with remote controller, parameter CH-t must be set to 0, and communication address and baud rate of both communication devices must be kept consistent. If user develops his own communication program, the parameter can be adjusted according to the user's demand.

Transmission format: when the CH-t parameter is set to free port communication, table 4-4 is the transmission format for reading a parameter and table 4-5 for writing.

Reading	ADD	PARM		
Output	ADD	PARM	2 Byte Data.The high bit is in the front and low in the back.	CRC Check

Table 4-4

Writing	ADD	PARM	2 Byte Data.The high bit is in the front and low in the back.	CRC Check
---------	-----	------	---	-----------

Table 4-5

The CRC check code is the CRC check result value of all the previous bytes (1 byte). The CRC check adopts the 8-bit cyclic redundancy check code of CCITT (CRC-CCITT), and its generating polynomial is  $G(x) = X^8 + X^5 + X^4 + 1$ . The position value is represented by a symbolic integer.

Example 1: reading diameter.

Suppose the address of the gauge is 1 (01H), and current diameter is 6.234(185aH), then

Input: 01H 41H

Device Output: 01H 41H 18H 5aH CRC-check-code

Example 2: writing diameter

Suppose the gauge address is 1 (01H) and want to change the reference diameter to 4.000 (1770H). Then

Input: 01H 66H 17H 70H CRC-check-code

Read (HEX)	Write (HEX)	Parameter Description	Property
41H		Average Diameter	Read only
42H		X axis Diameter	
43H		Y axis Diameter	
44H		X axis Position	
45H		Y axis Position	
46H	66H	Reference Diameter	Read-Write
47H	67H	Preset Upper Deviation	
48H	68H	Preset Lower Deviation	
49H	69H	Display Contents Selection	
4aH	6aH	Alarm Switch	
4bH	6bH	Average Times	
4cH	6cH	Parameter P	
4dH	6dH	Parameter I	
50H	70H	Voltage Polarity	
51H	71H	Control Mode	
52H	72H	Feed Switch	

Table 4-6 Communication Parameter

## 4.4 Modbus RTU Communication

Enter the secondary menu and set the "Ch-t" parameter to the corresponding parameter, which can be used in Modbus communication mode.

Example 4: Modbus read diameter value

Assuming that the address of the laser diameter gauge is 1 (01H) , the current diameter is 4.000 (1770H), then :

Input: 01H 03H 00H 41H 00H 01H D4H 1EH

Gauge Output: 01H 03H 02H 17H 70H B6H 9CH

Modbus specifies that the register address starts from 1, so if communicating with MODBUS standard module, the register address written by standard module should be increased by 1 (see combination address).

## 4.5 Modbus RTU Communication Address

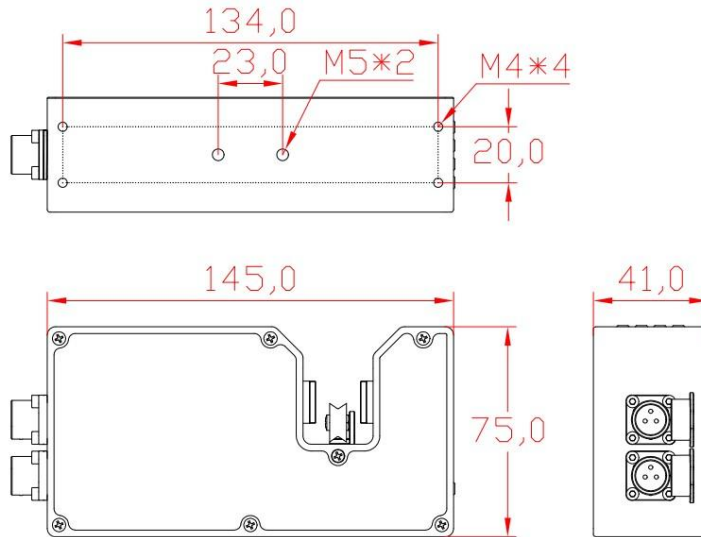
Register Add (HEX)	Combination Add	Parameter Description	Parameter Range	Property
41H	40066	Diameter	See 4.4	Read Only
42H	40067	Diameter	See 4.4	
43H	40068	Diameter	See 4.4	
44H	40069	Position	-99-99	
45H	40070	Position	-99-99	
46H	40071	Reference Diameter	See 4.2	Read-Write
47H	40072	Preset Upper Deviation	See 4.2	
48H	40073	Preset Lower Deviation	See 4.2	
49H	40074	PID Control Output PID	-32765-32767	Read Only
4aH	40075	Alarm Switch	0-4	Read-Write
4bH	40076	Average Times	1-1000	
4cH	40077	Parameter P	1-255	
4dH	40078	Parameter I	0-255	
4eH	40079	Parameter D	0-255	
4fH	40080	Parameter F	1-255	
50H	40081	Voltage Polarity	0-1	
51H	40082	Control Mode	0-1	
52H	40083	Control Mode	0-1	

Table 4-8 Register Address

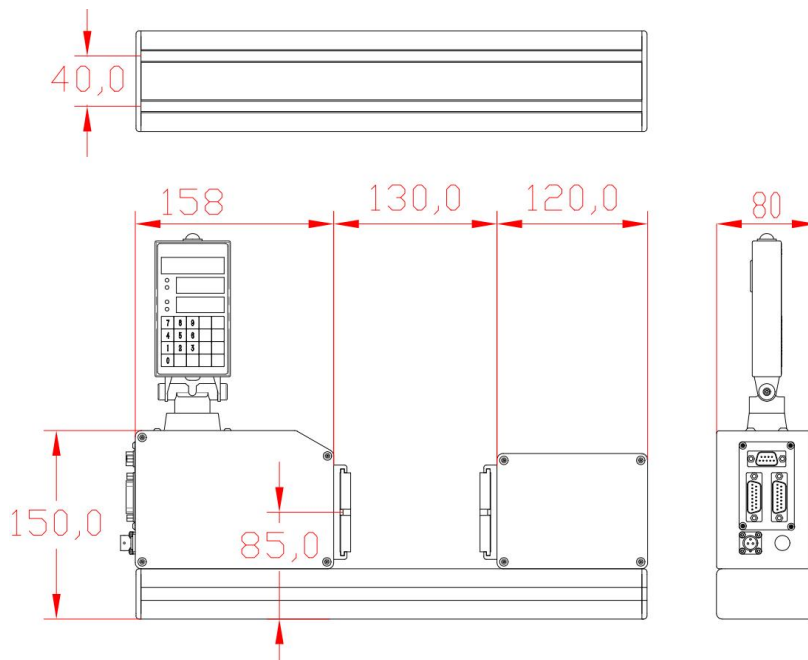
The Modbus RTU combination address can be used for reading reference addresses during PLC, configuration software, and touch screen development. If there are any questions during the specific development process, you can contact with our after sales team.

## 5 Overall Dimensions

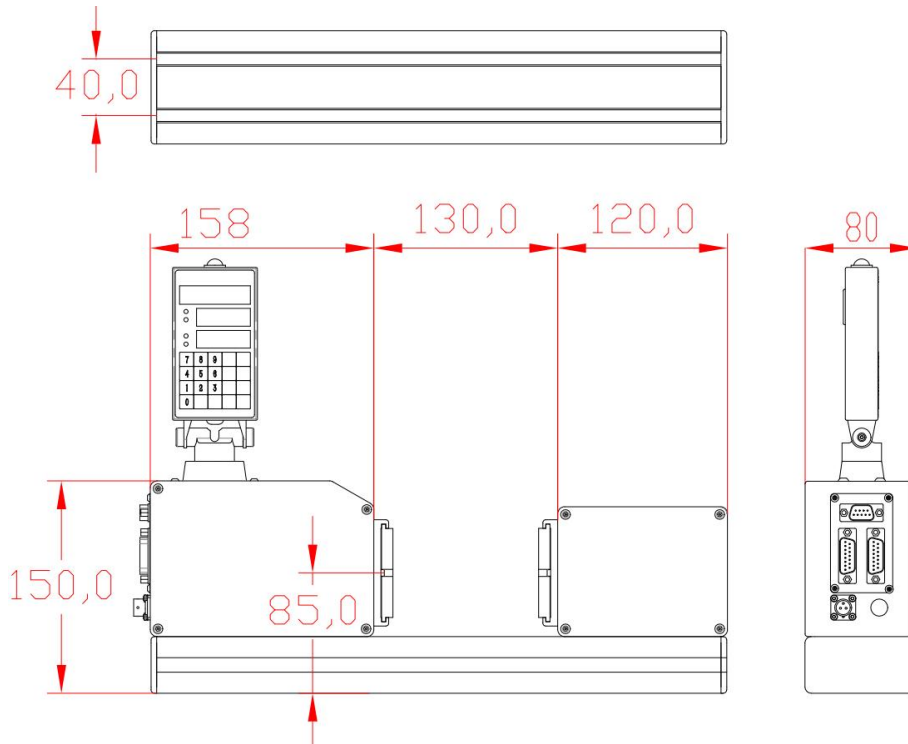
The outline and overall dimensions of the instrument is as shown in below figures



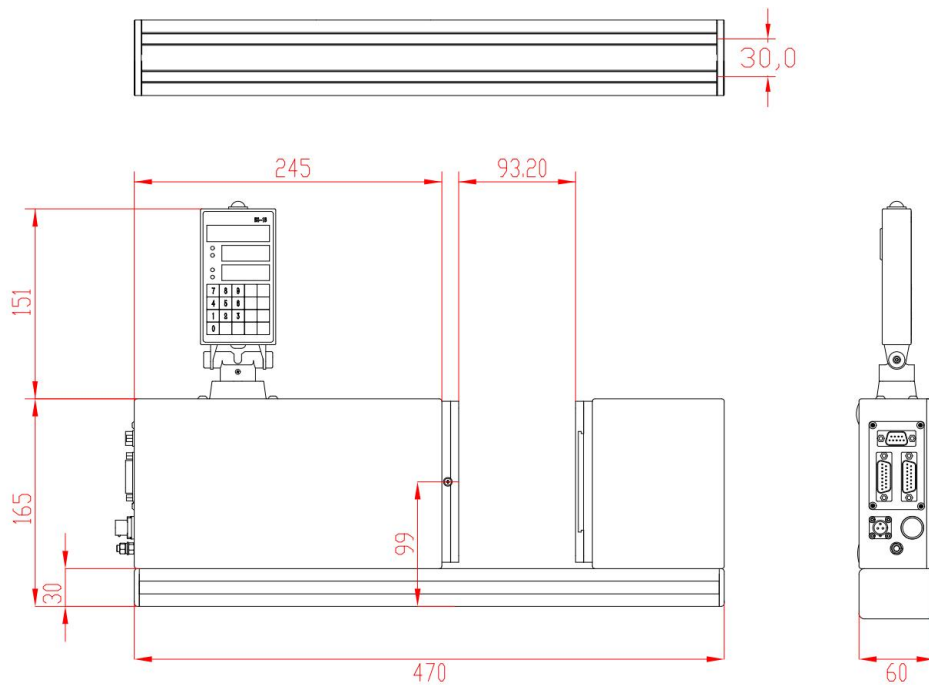
3X



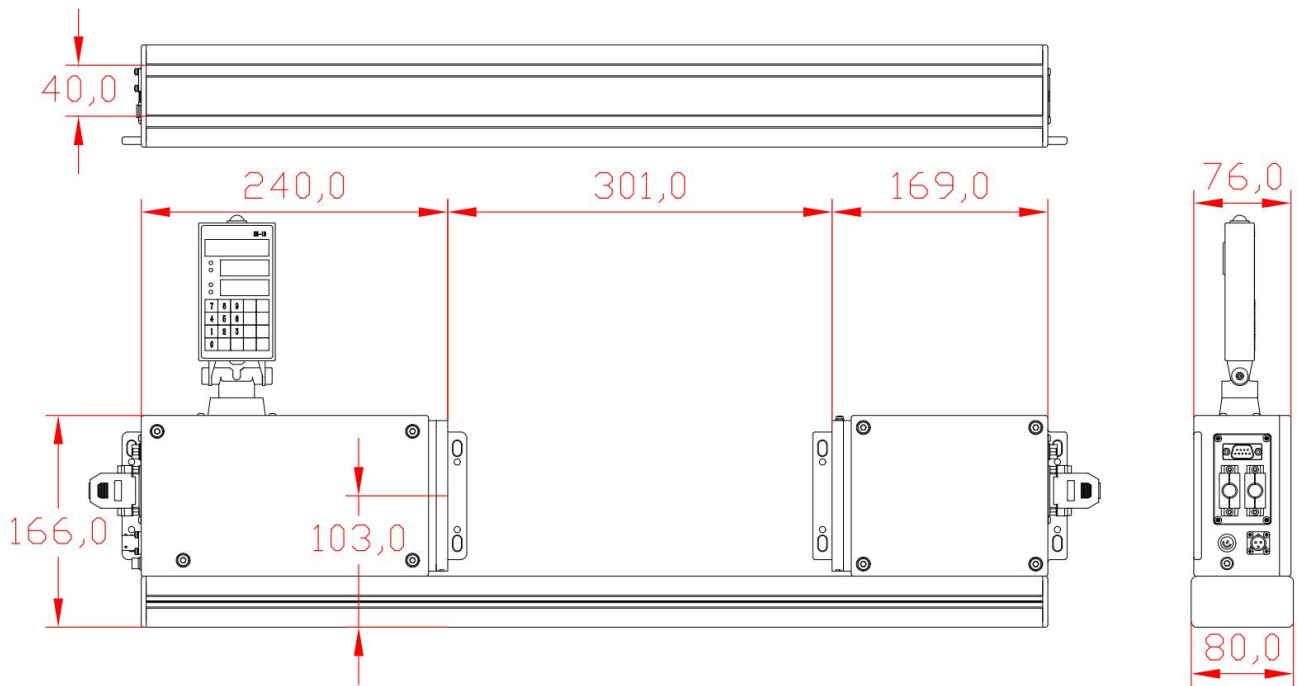
25X



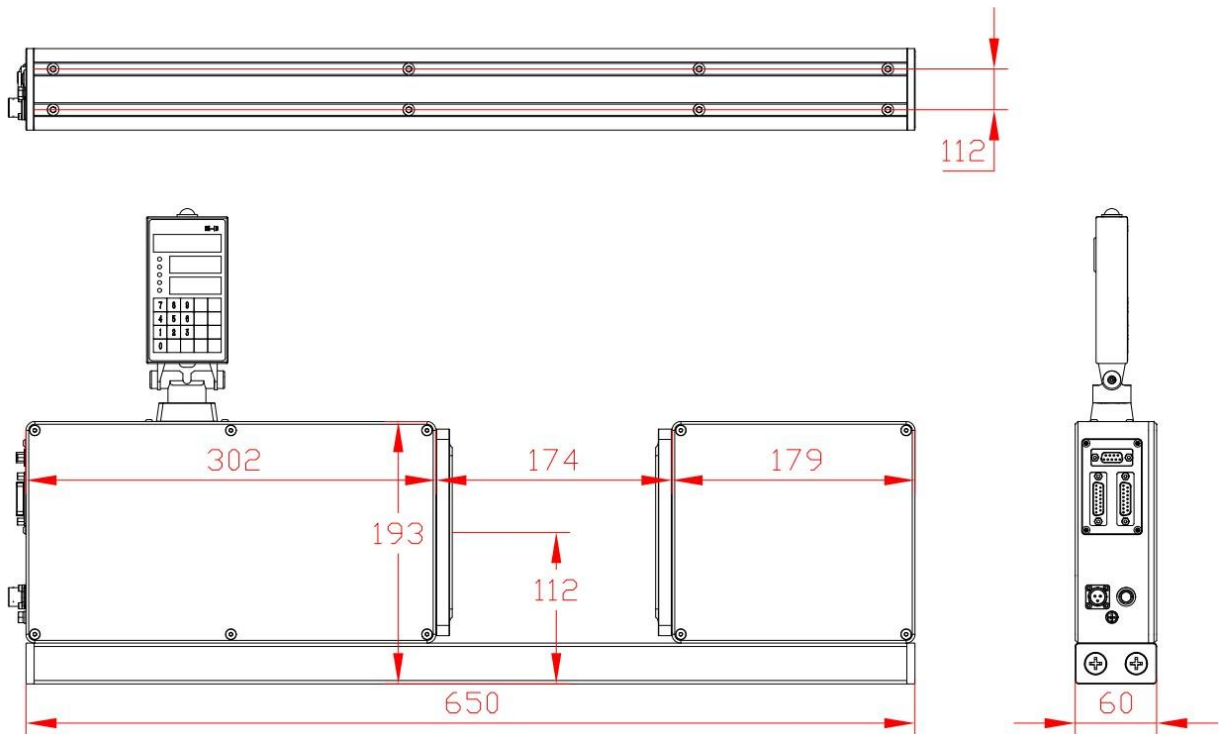
**40X**



**50X**



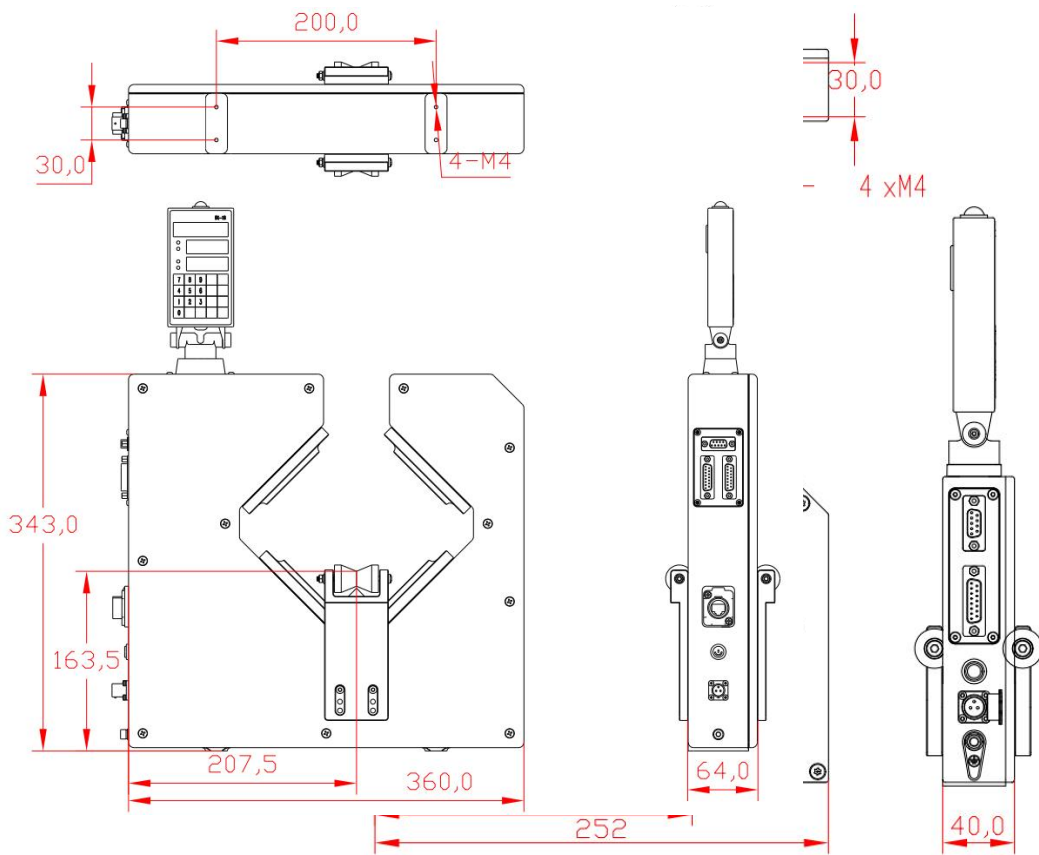
70X



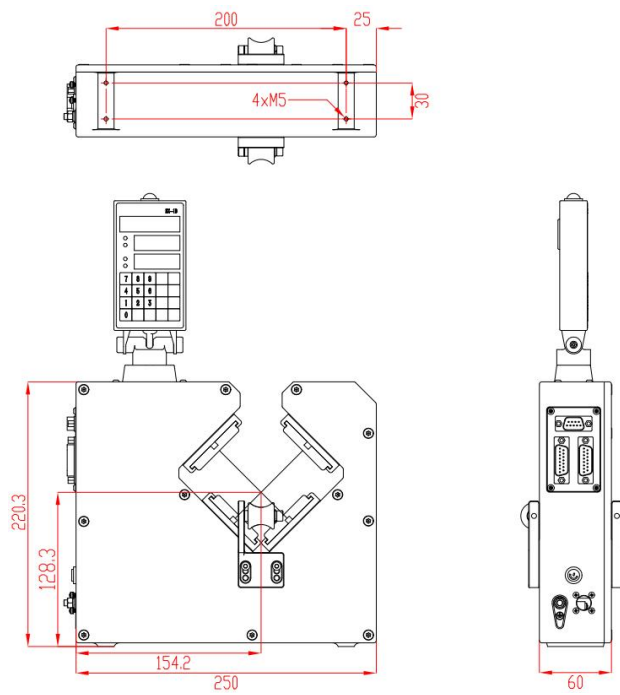
100X

M5 slider nuts are installed inside the aluminum base at the bottom of the caliper for fixing the caliper.

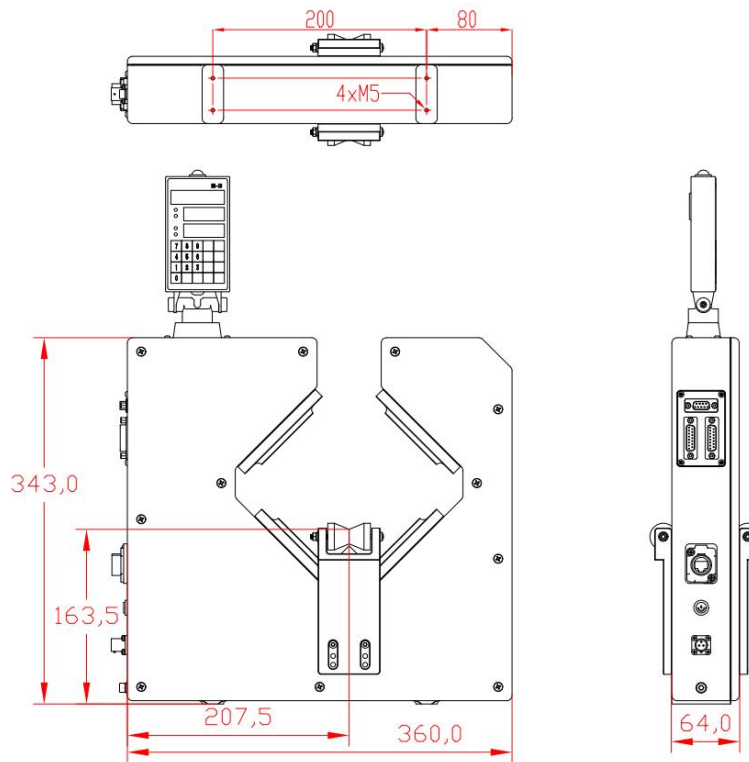
# Laser Diameter Gauge



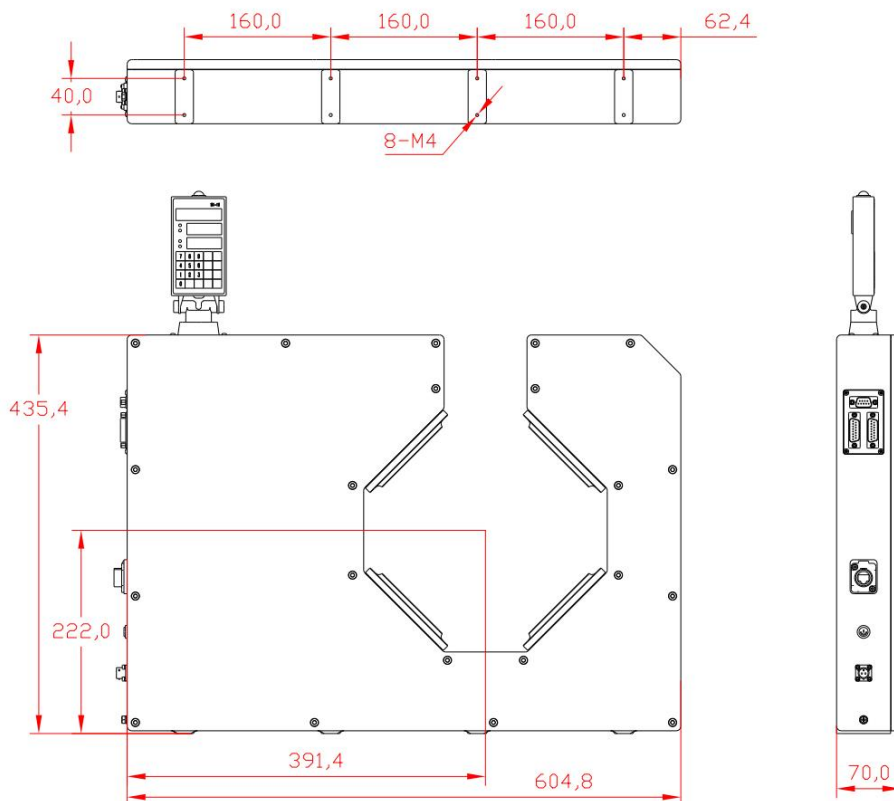
15XY



25XY

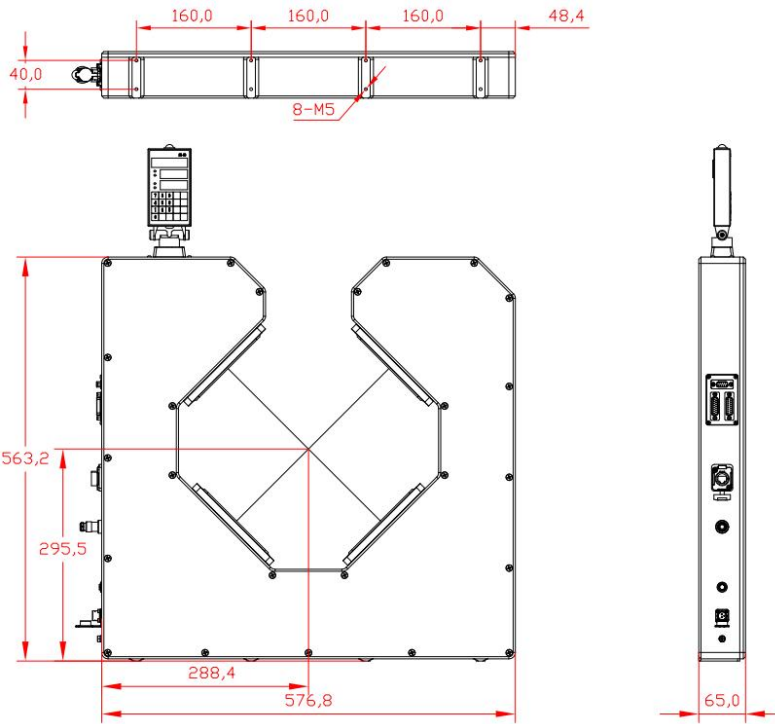


50XY

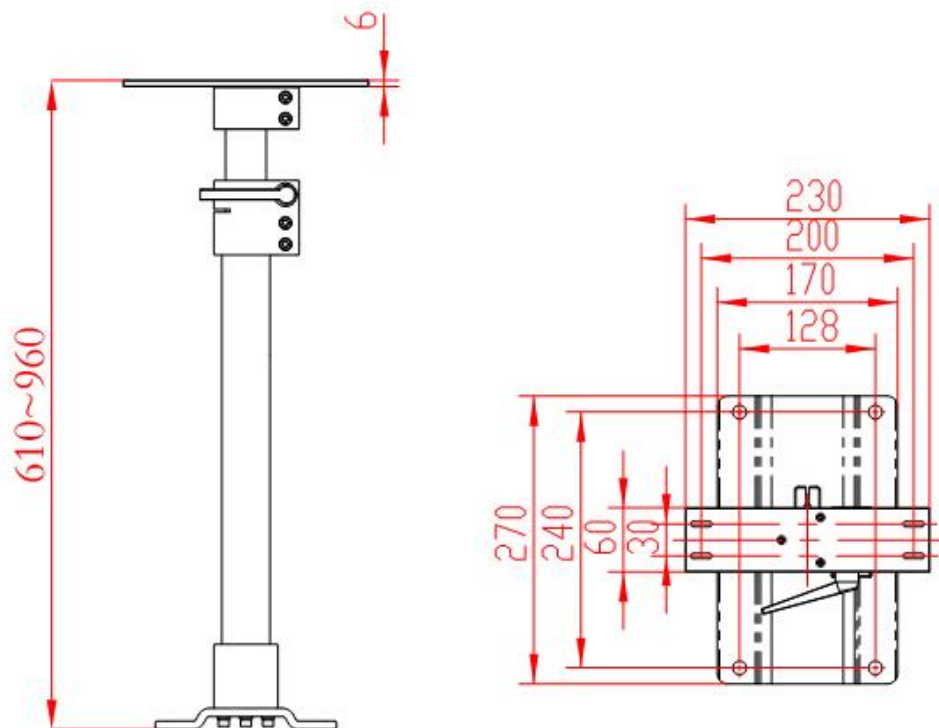


70XY

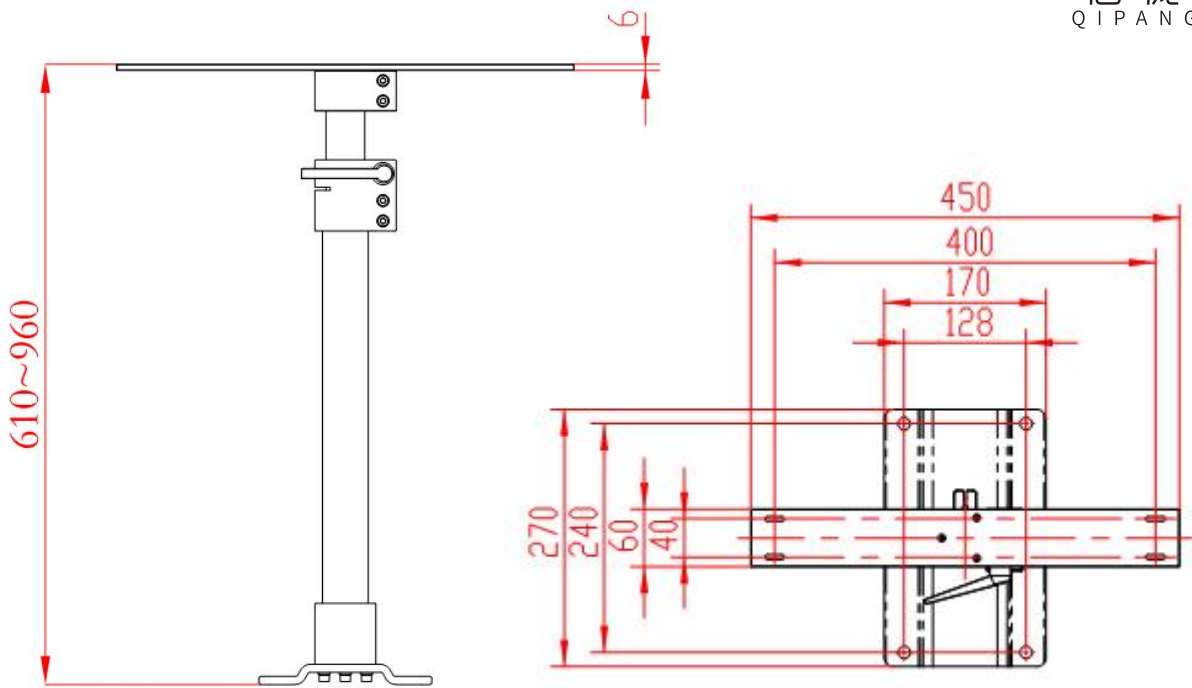
# Laser Diameter Gauge



100XY



Mounting Bracket (for 25-50X)



Mounting Bracket (for 70-120X)

## 6 Maintenance and Common Problem Solutions

When using the gauge, the protective lenses of the beam outlet and inlet should be kept clean. When the gauge is used in the online material production line, the wire should have a water blowing device to prevent water or water droplets from flying over the measurement area and affecting the measurement accuracy. The standard rod should be cleaned before each use, wiped clean with mirror paper or cotton swab, and coated with oil for rust prevention after use

**I.** If there is no scanning beam or partial beam at the light outlet, the screen will show "FAUL" or "Err-3".

The scanning motor does not rotate or the laser has no output, and the protective mirror cover of the light outlet is shifted to block all or part of the scanning beam. If dirt on the protective lens which blocks the scanning beam, use lens cleaning paper to clean the protective lens.

**II.** There is a measured object in the measurement area, but the display screen shows " \_ \_ \_ " or flashes alternately with the measurement data.

There are stains on the beam outlet or inlet, which weaken the beam. Clean the lens accordingly.

If the scanning motor speed slows down or the beam weakens, it is an internal fault of the instrument.

**III.** After power on, there is no display on the screen and the buttons do not respond.

The display board may be damaged or the internal power is in failure. Or the gauge is not fully reset by

immediate turning on after shutting down, just restart it.

**IV.** The measurement error is large.

The protective lens may have stains and the lens need to be cleaned. If there is much jittering for the measuring objects, the number of average times shall be increased or add stabilizing device.

**V.** Abnormal Communication

Wiring error or communication format error. If the internal communication module damaged, please contact with us for repair