F191x-Ex Series

Integrated Display Explosion-proof Dewpoint Transmitter

· Instruction Manual ·

Version : 1.04

Experts in Compressed Air & Fluid Measurement

Fast · Accurate · Management

Preface

- Dear customer, thank you for choosing our products.
- This manual is a description of the use range, functions, installation and operation methods, troubleshooting, and maintenance of the product.
- The user must read this operation manual completely before using the device to properly use the product.
- After you read it, keep it in an accessible place for the next operational reference.

Notice

- YUA Instruments is not responsible for damage caused by unauthorized changes to the equipment without reviewing the operation manual or violating the provisions of this operation manual, and the instrument guarantee will be automatically voided.
- YUA Instruments is not responsible for incidental damage caused by transportation, equipment performance, or mishandling.
- YUA Instruments do not promise the suitability of this equipment for any application not described herein.
- YUA Instruments have tried to make the information in this manual correct. If you find any problems, you are welcome to contact us.
- The contents of this manual are forbidden to be reproduced, copied, or modified without permission.

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1 Safety Instructions

1.1 General Safety Instructions



Danger!

Compressed air!

Any contact with rapid air leaks or pressurized parts of the compressed air system can lead to significant injury or even death.

- Never exceed the recommended pressure range.
- Make sure air tools & hoses are in good condition.
- Ensure the system is not under pressure when performing repair & maintenance.



Danger!

Power voltage!

Any contact with the electrical parts of the product can lead to significant injury or even death.

- Consider all electrical installation-related regulations.
- Any power connections must be disconnected when performing repair & maintenance.
- Any electrical work on the system is to be performed by authorized personnel only.



Attention!

Operating conditions!

Please check the permissible operating conditions. Any operation beyond these limits could potentially cause measurement failure or even damage the instrument or the entire system.

- Please review national standards and regulations during the preparation and installation process.
- The product is prohibited for use in explosive areas.
- Ensure the product operates within the allowed working conditions.



Caution!

Product malfunction!

Incorrect handling and improper transport could cause product malfunction.

- Unauthorized disassembly of the product is prohibited.
- Use correct and appropriate tools to operate to product.
- In case the product malfunctions, please stop using it and contact customer support.

1.2 Storage and Transport Safety

- Ensure the product is transported at a temperature of -20 ... +60 °C.
- It is recommended to use the product's original packaging for storage and transport.
- Make sure the product is stored at a temperature of -40 ... +80 °C.
- Avoid exposure to sunlight and UV rays.
- The storage humidity must be < 90% and free of condensation.

2 Product Overview

2.1 Application

The F191x-Ex series is designed for dewpoint monitoring in harsh environments and industrial hazardous sites. It is widely used in petrochemical, electric power, pharmaceutical, industrial gas, heat treatment, aviation, natural gas, drying equipment and medical industries, providing users a safe and reliable dewpoint monitoring solution. F191x-Ex can integrate a variety of latest technology humidity sensors: YUA-P polymer film capacitive sensor, YUA-A ultra-fast response aluminum oxide sensor with innovative moisture sensitive materials and processes. These sensors provide F191x-Ex with the ability to accurately measure a wide range of dewpoint from -110 … +60 °Ctd.

Explosion-proof class: Ex db IIC T6 Gb / Ex tb IIIC T80°C Db

Protection class: IP67

Revolutionary auto-calibration circuit design automatically compensates for measuring drift caused by temperature, contamination, and aging, providing long-term stability and high accuracy measurements. The innovative temperature compensation algorithm and multi-point temperature compensation calibration before leaving the factory greatly improve the temperature drift of the sensor, ensuring high-precision measurement within a wide temperature range.

2.2 Features

- ✓ Compatible with various sensor technologies: polymer thin film, aluminum oxide, QCM crystal type sensors that can be used in different measurement ranges
- ✓ Explosion-proof certification: Ex db IIC T6 Gb / Ex tb IIIC T80°C Db
- ✓ IP67 metal housing provides good protection even in harsh industrial environments
- ✓ MEMS based pressure sensor for online pressure and atmospheric dewpoint (Abs. pressure 0 … 1.7 MPa.a) monitoring
- ✓ Accurate to ±2 °Ctd with up to 10+ dewpoint calibration and multi-point temperature compensation (Refer to **Technical Data**)
- ✓ Ultra-fast response time and outstanding long-term stability
- ✓ Anti-condensation, resistant to particulate contamination, oil vapor and most chemicals
- ✓ The capacitive touch 2.0" IPS LCD with an ultra-wide viewing angle
- ✓ Relay alarm output

2.3 Technical Data

Measuring Range
Dewpoint

F191A-Ex	-60 ··· +60 ℃td
F191B-Ex	-110 ··· +20 ℃td
Temperature	-40 ··· +100 ℃
Pressure	0 ··· 1.7 MPa(a) (Option)
Accuracy	
Dewpoint (Air or Nitrogen)	
+20 ··· -60 ℃td	±2 °Ctd
-60 ··· -100 ℃td	±3 °Ctd
Temperature (Customizable)	
0 ··· +50 ℃	±0.3 °C (Standard)
-40 ··· 0 ℃ & +50 ··· +100 ℃	±0.5 °C (Standard)
Pressure	
Accuracy @23 °C	±0.3% FS
Pressure drift with temperature	±0.001 MPa/10 °C
Response Time	
Dewpoint: 63 % [90 %], Reference: 20 °C, 1 bar(a), 4 L/min	
-50 → +20 ℃td	20 sec [40 sec]
+20 → -50 ℃td	1 min [3 min]
Pressure	< 1 sec
Power	
Measuring State	16 ··· 30 VDC Max 4.5 W @ 24 VDC
Output	
Analog Output (Customized)	4 ··· 20 mA (4-wire)
Analog Resolution	0.002 mA
Analog Drift	0.01 % of span/℃
Analog Load	Max. 500 ohm
Digital Output	Modbus RTU (RS485)
Relay Output	Normal open 32 VDC/500 mA

Connector	Wiring terminal
Operating Environment	
Operating Temperature	-30 … +50 ℃
Storage Temperature	-40 … +80 ℃
Relative Humidity	0 … 95 %RH
Sample Gas Flow Rate	> 1 L/min
Pressure (Integrated pressure sensor)	0 … 1.7 MPa(a)
(Without pressure sensor)	0 … 5 MPa(a) 0 … 35 MPa(a) Option
Other	
Process Connection	ISO G1/2" thread (Standard) 3/4" - 16 UNF thread (Customized) 5/8" - 18 UNF thread (Customized)
Explosion-proof Class	Ex db IIC T6 Gb / Ex tb IIIC T80°C Db
Protection Code	IP67
Housing Material	SUS304 + ZL102
Sensor Filter	Stainless steel sinter filter (Filtration class 30~45 μm)
EMC	Compliant with IEC 61326-1

3 Dimension & Installation

3.1 Dimension (in mm)

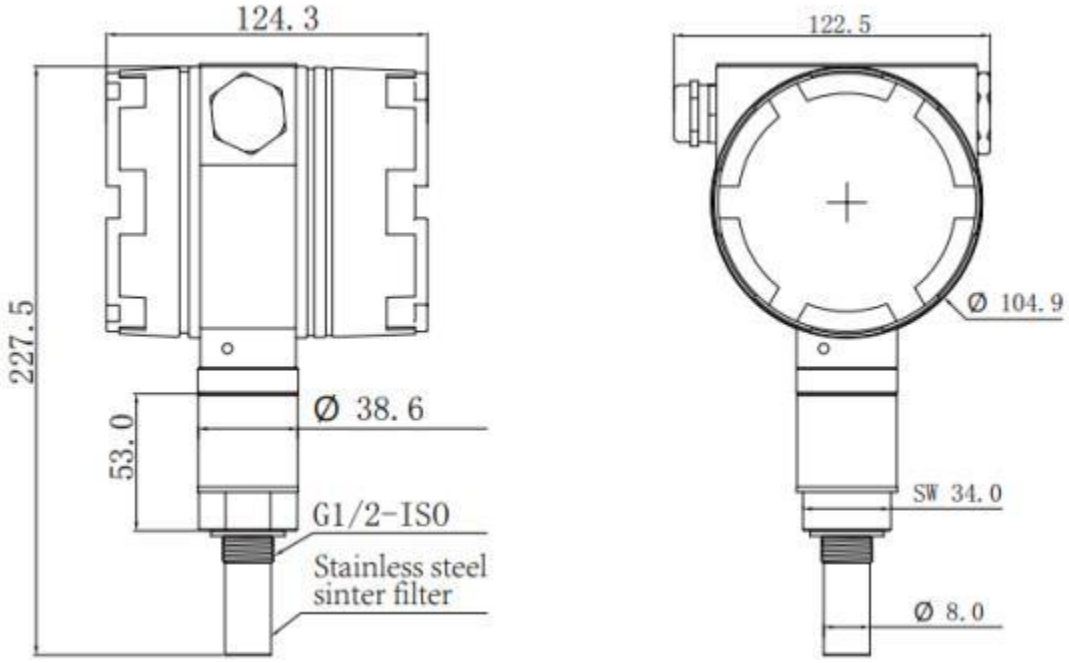


Figure 3-1 F191x-Ex Series Dimension Diagram

3.2 Installation Procedure

The following situations are recommended for installation with measuring chambers:

A: Risk of water splashing on the sensor

B: High process temperature

C: Required to install or remove measurement devices in operating, pressurized condition

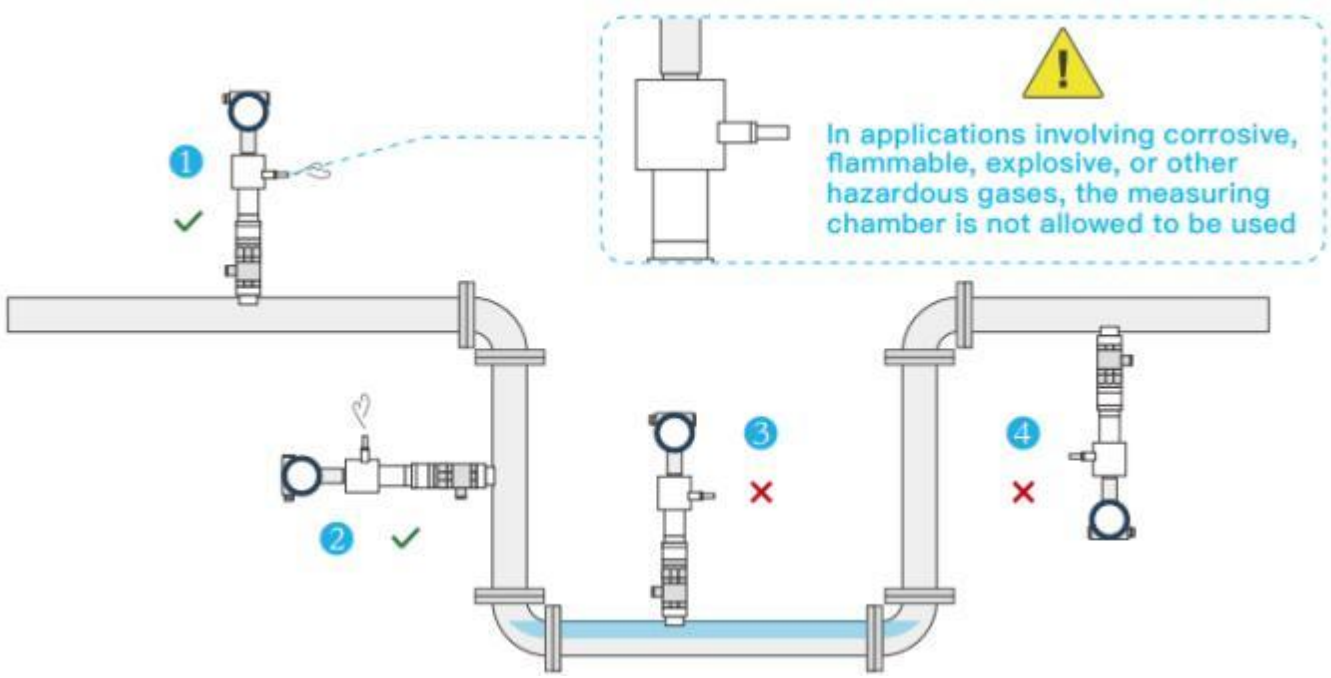


Figure 3-2 Installation with Measuring Chambers

The following situations are recommended for installation directly on the pipe:

A: The gas in the pipeline cannot be exhausted directly (for example: dangerous gases or expensive process gases)

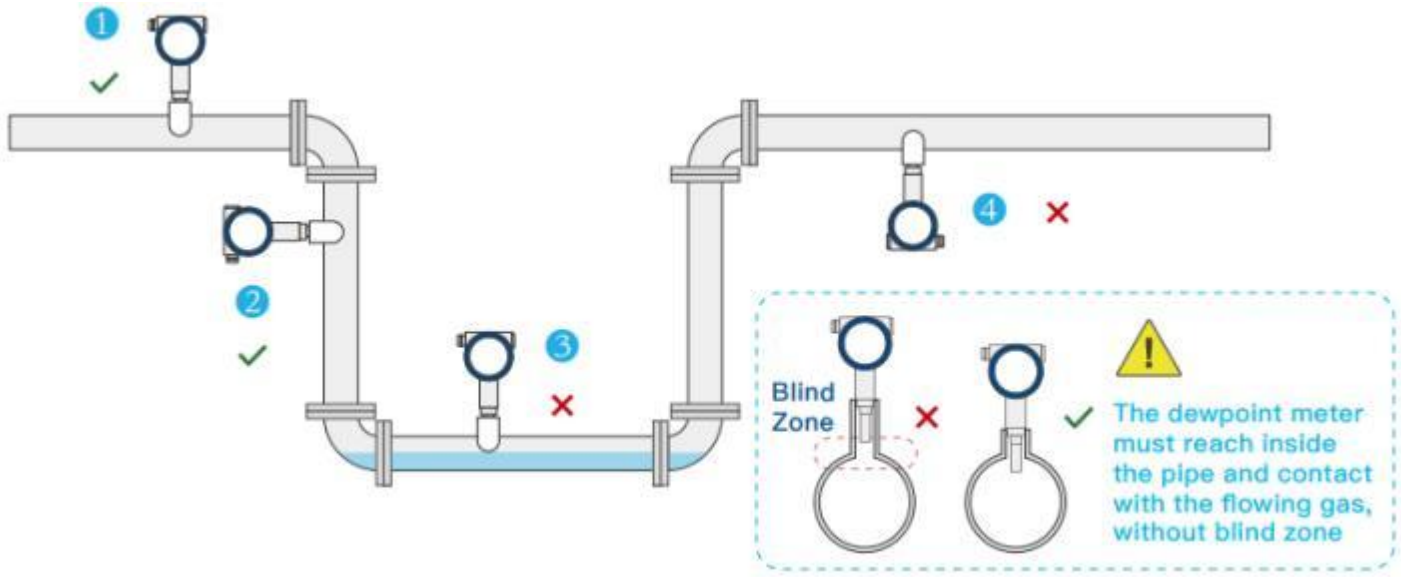
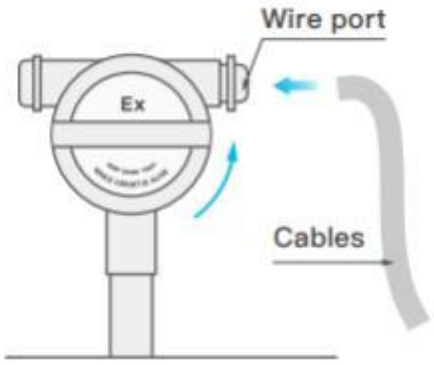


Figure 3-3 Installation Directly on the Pipe

3.3 Electrical Wiring



Unscrew the back cover anticlockwise to view the terminal block

Note: Rotatable display direction, if the installation scene requires rotation of display direction, please contact YUA service team

Figure 3-4 Diagram of Wire port

Note:

Please use cable with shield for RS485 communication and connect the shield to the respective G terminal

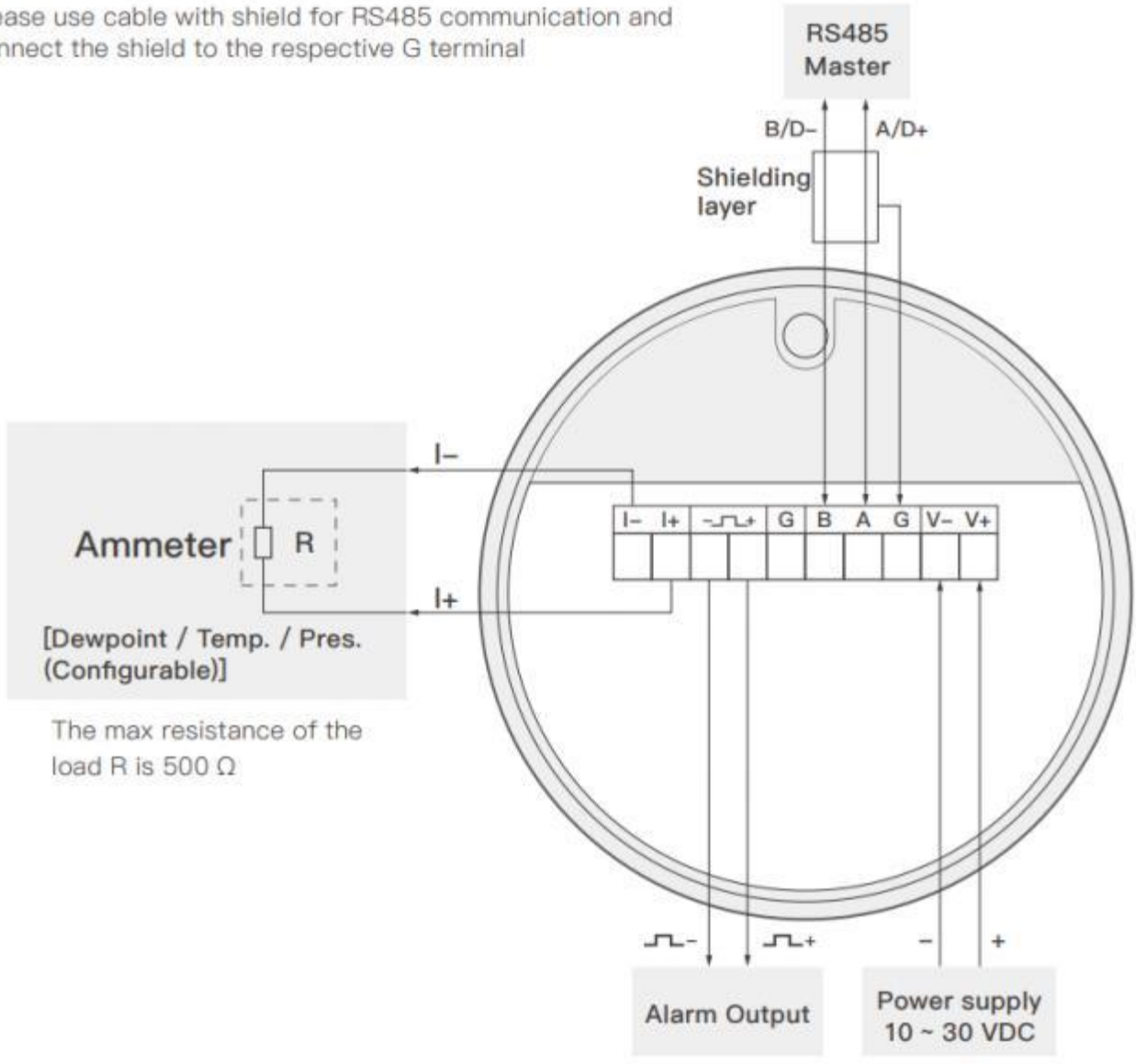
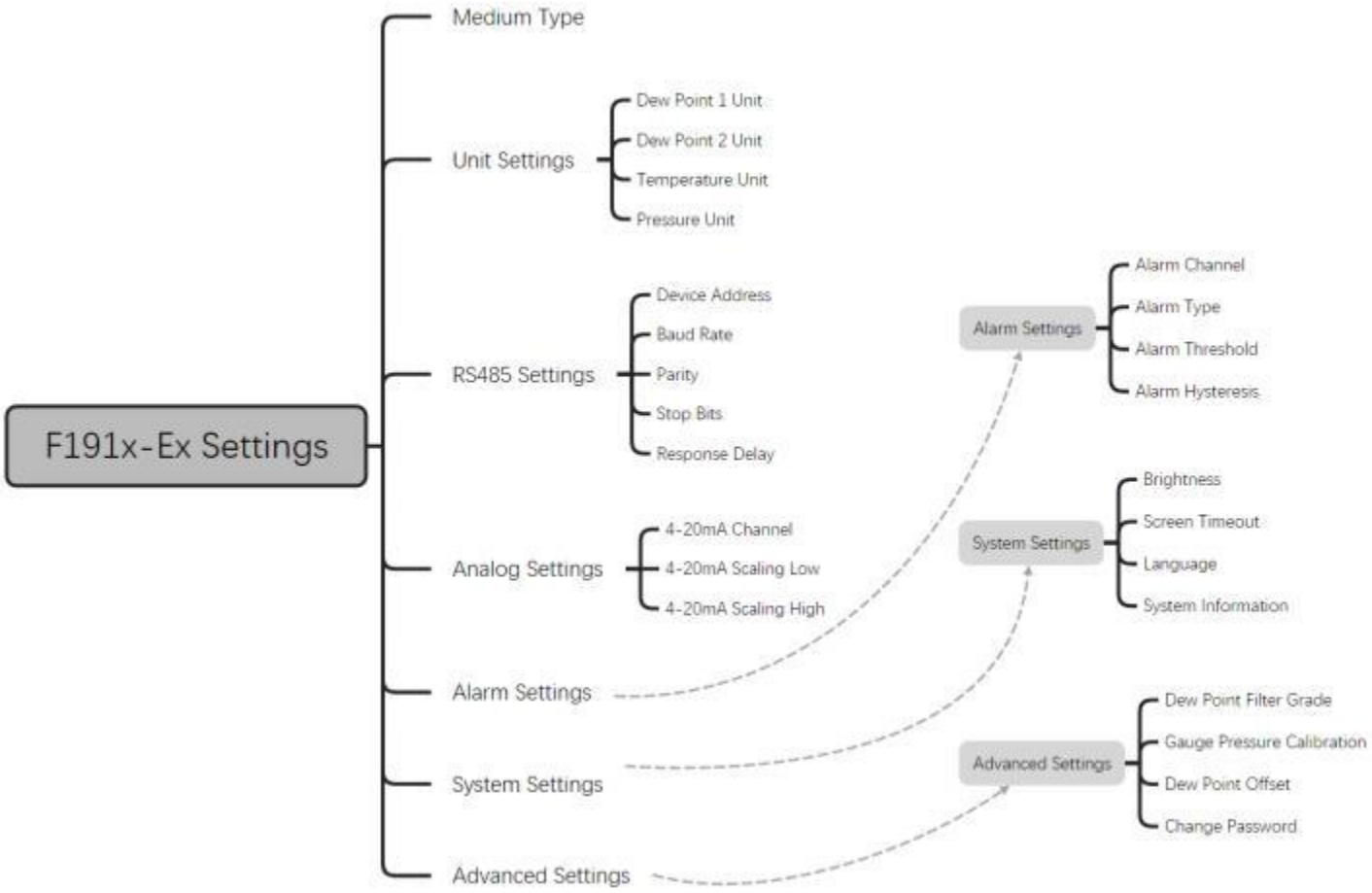


Figure 3-5 Electrical Connection Diagram

4 Setting Menu

Note: Due to software upgrades, the menu and content may be updated. Please refer to the actual situation or contact YUA technical support for details.



5 Other Optional Accessories

5.1 Measuring Chamber

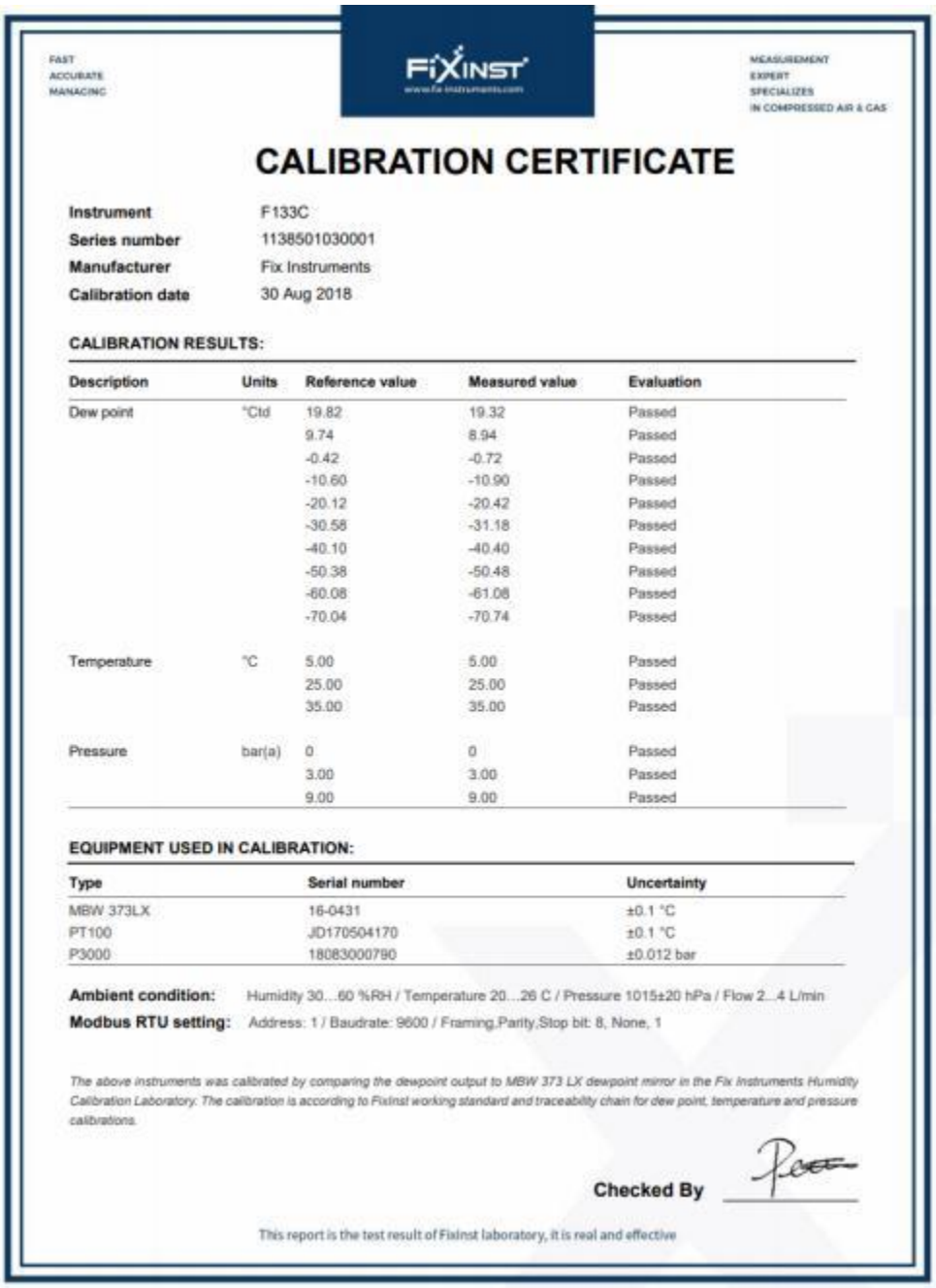
Many different types of measuring chambers such as quick connector type, by-pass type, dryer-specific type and high pressure type. For more information, please contact local distributor or manufacturer.

5.2 Service Kit

The service kit is used to connect the sensor to a personal computer. Parameters of the sensor, such as analog output range, alarm threshold, units and etc. can be modified via the service kit.

5.3 Calibration

The product is factory calibrated and the calibration certificate is attached to the product. Since the measurement accuracy of the product is affected by the on-site environment (oil, high humidity, or other impurities can affect the accuracy), we recommend the user perform calibration once a year. Calibration service is not covered by the product guarantee. Please contact the manufacturer in case calibration is required.



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CALIBRATION CERTIFICATE

Instrument F133C
Series number 1138501030001
Manufacturer Fix Instruments
Calibration date 30 Aug 2018

CALIBRATION RESULTS:

Description	Units	Reference value	Measured value	Evaluation
Dew point	°Ctd	19.82	19.32	Passed
		9.74	8.94	Passed
		-0.42	-0.72	Passed
		-10.60	-10.90	Passed
		-20.12	-20.42	Passed
		-30.58	-31.18	Passed
		-40.10	-40.40	Passed
		-50.38	-50.48	Passed
		-60.08	-61.08	Passed
		-70.04	-70.74	Passed
Temperature	°C	5.00	5.00	Passed
		25.00	25.00	Passed
		35.00	35.00	Passed
Pressure	bar(a)	0	0	Passed
		3.00	3.00	Passed
		9.00	9.00	Passed

EQUIPMENT USED IN CALIBRATION:

Type	Serial number	Uncertainty
MBW 373LX	16-0431	±0.1 °C
PT100	JD170504170	±0.1 °C
P3000	18083000790	±0.012 bar

Ambient condition: Humidity 30...60 %RH / Temperature 20...26 C / Pressure 1015±20 hPa / Flow 2...4 L/min
Modbus RTU setting: Address: 1 / Baudrate: 9600 / Framing,Parity,Stop bit: 8, None, 1

The above instruments was calibrated by comparing the dewpoint output to MBW 373 LX dewpoint mirror in the Fix Instruments Humidity Calibration Laboratory. The calibration is according to FixInst working standard and traceability chain for dew point, temperature and pressure calibrations.

Checked By

This report is the test result of FixInst laboratory, it is real and effective

Figure 5-1 Dewpoint Calibration Certificate (for Reference Only)

5.4 Maintenance

Please check the sinter filter regularly. If contamination of the sinter filter is found, it is recommended to replace it promptly. Contact the manufacturer for details.



Caution!

Wet or contaminated sinter filter or sensor will result in longer response time or even incorrect measurement result.

6 Signal Output

6.1 Analog Output

F191x-Ex Series come standard with a 4 ··· 20 mA output, with a 4-wire active analog output. 4 mA corresponds to the lowest dewpoint, 20 mA corresponds to the maximum dewpoint of the model.

For other ranges, please contact the manufacturer. The analog output can be configured to correspond to temperature, dewpoint, or humidity.

6.2 Relay Output

The sensor has a relay output that can monitor the dewpoint. For example, when the dewpoint reaches the set value, the sensor will trigger an alarm.

Alarm relay maximum specifications: **32 VDC / 500 mA**.

Table 6-1 Relay Output

Status	Power Off	Powered On and Alarm Value Not Reached	Powered On and Alarm Value Reached
Relay Status	Open	Open	Closed

6.3 Modbus Output

F191x-Ex Series support Modbus RTU(RS485) communication.

6.3.1 Communication Parameters

The factory setting parameters are as follows.

- Address: 1
- Baud rate: 9600
- Data length: 8, Parity bit: None, Stop bit: 1
- Response timeout: 1 second
- Response delay: 0 ms
- Frame interval: 7 characters

6.3.2 Storage Register Definitions

Logical Channels, Data and Holding Registers

- Holding register data can be read with Modbus instruction 0x03
- Available Modbus Instruction 0x06 Write Single Holding Register, 0x10 Sequential Write Multiple Holding Registers

- Available Modbus Instruction 0x05 Write Coil Registers

6.3.3 Process Data Format

Supports two data types: IEEE 754 floating point and unsigned integer.

Table 6-2 Floating Point Format

Number (with decimals)	IEEE 754 Floating Point	Register N		Register N + 1	
		High	Low	High	Low
123.4	0x42F6CCCD	0xCC	0xCD	0x42	0xF6

Table 6-3 Unsigned integer

Number (decimal system)	Number (hex system)	Register N		Register N + 1	
		High	Low	High	Low
123456789	0x075BCD15	0xCD	0x15	0x07	0x5B

6.3.4 Byte Order

The format of the data is little-endian, with the least significant bit transmitted first.

- 32 bit: CD AB
- 64 bit: GH EF CD AB

6.3.5 Holding Register: Process Data Address Table

Register Address	Data Type	Byte Length	Data	Unit	Read/ Write	Applicable Flow meter Model
0	FLOAT_L	4	Temperature	ºC or ºF	R/W	① Single-point temperature calibration when writing
2	FLOAT_L	4	Relative Humidity	%RH	R	
4	FLOAT_L	4	Pressure Dewpoint	ºCtd or ºFtd	R/W	① Single-point dewpoint calibration when writing
6	FLOAT_L	4	Atm. Dewpoint	ºCtd or ºFtd	R	
8	FLOAT_L	4	Mixing Ratio	g/kg	R	
10	FLOAT_L	4	Absolute Humidity	mg/m³	R	

Register Address	Data Type	Byte Length	Data	Unit	Read/ Write	Applicable Flow meter Model
12	FLOAT_L	4	Absolute Humidity	g/m³	R	
14	FLOAT_L	4	Moisture (Weight)	PPMw	R	
16	FLOAT_L	4	Moisture (Volume)	PPMv	R	
18	FLOAT_L	4	Enthalpy	kJ/kg	R	
20	FLOAT_L	4	Line Pressure (abs)	Pa, hPa, kPa, MPa, mbar, bar, PSI	R/W	① Single-point pressure calibration when writing
22	FLOAT_L	4	Water Activity (aw)		R	
24	FLOAT_L	4	Gas Density	kg/m3	R	
26	FLOAT_L	4	Pressure (Normalize to 20°C)	Pa, hPa, kPa, MPa, mbar, bar, PSI	R	
28	FLOAT_L	4	Moisture (Volume) (Normalize to 20°C)	PPMv	R	
30	FLOAT_L	4	Gas Density (Normalize to 20°C)	kg/m3	R	

Register Address	Data Type	Byte Length	Data	Unit	Read/ Write	Applicable Flow meter Model
32	FLOAT_L	4	Dewpoint single - point calibration	ºCtd or ºFtd	R/W	① Write “0” to clear single-point dewpoint calibration
34	FLOAT_L	4	Temperature single - point calibration	ºC or ºF	R/W	① Write “0” to clear single-point temperature calibration
36	FLOAT_L	4	Pressure single-point calibration	Pa, hPa, kPa, MPa, mbar, bar, PSI	R/W	① Write “0” to clear single-point pressure calibration
38	FLOAT_L	4	Moisture (Volume) (Normalize to Atm.)	PPMv	R	
40	FLOAT_L	4	Atm. Pressure	Pa, hPa, kPa, MPa, mbar, bar, PSI	R/W	Default: 1.01325 bar or 1013.25 hPa
42	FLOAT_L	4	Gauge Pressure	Pa, hPa, kPa, MPa, mbar, bar, PSI	R	= Addr 20 (Line Pressure) – Addr 40 (Atm. Pressure)

Note:

The unit "ºC or ºF" and the pressure unit are dependent on the setting of the dewpoint meter.

Note：

① This register address can be used to write single-point calibration, and support single-point calibration of "temperature", "pressure dewpoint" and "working condition pressure"

For example: the current measured pressure dewpoint value is 10 ℃td and needs to be adjusted to 12 ℃td. There are two methods to achieve this:

1. Write 12 directly to register address 4. The deviation 2 will be calculated internally in the dewpoint meter and written into the register address 32 automatically. To clear the single-point calibration value, write 0 to register address 32.
2. First manually calculate the adjustment value 2 and write it directly into register 32

An example write command is as follows：

Floating point number v=123.4 its corresponding hex 0x42F6 CCCD. write this value to device address 1, holding register address 36 (pressure single point calibration offset)

Send Modbus commands: 01 10 0024 0002 04 CCCD 42F6 EE0D

01: Device Address
10: Function code 16 in hexadecimal
0024: Keep register address 36 in hexadecimal
0002: Number of holding registers to be written
04: Number of holding register bytes (0x42F6 CCCD total 4 bytes)
CCCD: Floating point low 16 bits
42F6: Floating point high 16 bits
EE0D: CRC

Device Response: 01 10 0024 0002 01C3

01: device address
10: Function code 16 in hexadecimal
0024: Keep register address 36 in hexadecimal
0002: Number of holding registers already written
01C3: CRC

6.3.6 Holding Register: Communication Configuration Table

Holding Register Addr	Data type	No. of byte	Unit	Contents	Default	Read / Write
50	UNSIGNED INT	2		Restart device (Write “1”to restart device)		Write only

51	UNSIGNED INT	2		Device address（1…247）	1	Read / Write
52	UNSIGNED INT	2	bps	Baud rate: 12 = 1200 bps 24 = 2400 bps 48 = 4800 bps 96 = 9600 bps 144 = 14400 bps 192 = 19200 bps 384 = 38400 bps 560 = 56000 bps 576 = 57600 bps 1152 = 115200 bps	96	Read / Write
53	UNSIGNED INT	2		Parity 0 = None 1 = Odd 2 = Even	0	Read / Write
54	UNSIGNED INT	2		Stop bit 1: 1 bit 2: 2 bit	1	Read / Write
55	UNSIGNED INT	2	ms	Response Time Out: 0…255 ms 1 ms/step Value range: 0…255	0	Read / Write

Note:

These settings will take effect after writing a "1" to the holding register address 50. Then Modbus master must change communication settings accordingly in order to communicate with the slave

6.3.7 Coil Register Table

Coil Register Addr	Data type	No. of byte	Unit	Contents	Default	Read / Write
0	UNSIGNED INT	2		Restart Modbus Communication Read: Always 0 Write: 0x0000 = Do Nothing 0xff00 = Restart	0	Read / Write

7 Warranty Terms

Dear Customer:

Thank you for choosing YUA products. We have always been committed to providing our customers with high-quality, high-performance instrumentation products to meet your needs in a variety of application scenarios.

In order to ensure your satisfaction after purchasing the product, please read the following after-sales terms and conditions carefully, so that you can correctly and efficiently apply for the warranty service when needed.

7.1 Warranty Period

12 months from product shipment.

7.2 Warranty Coverage

1、Warranty period due to the product's own problems caused by performance failures, confirmed by the seller's test, will provide free maintenance services; human misuse or due to the site of the product working conditions and the product type does not match the damage caused by the exceptions.

The following are not covered by warranty:

① Product damage caused by force majeure factors (such as natural disasters, etc.).

② Products due to natural wear and tear, rough handling caused by the appearance of damage, scratches or wear (such as impact caused by the loss of paint, surface bumps, etc.).

③ Damage caused by disassembling the product without the Company's consent or unauthorized changes in the use of the product.

④ Damage to the product caused by repair or modification not authorized by the company.

⑤ Damage caused by improper use of the product by the user or operation in violation of the instructions.

⑥ Products purchased from unauthorized sources.

2、For non-warranty or non-warranty product failure, we will provide paid repair services, the specific cost depends on the actual situation.

7.3 Warranty Certificate

Users are required to provide valid proof of purchase (e.g., invoice, receipt, etc.) and product serial number when applying for warranty service.

7.4 Warranty Channels

Users can apply for after-sales warranty service by filling out our after-sales treasure system or contacting customer service personnel.