

# 说明书

## User Manual



ZMJ100P/PR型  
密度继电器/远传密度继电器

ZMJ100P/PR  
Density Monitor/Remote  
Density Monitor

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## 1. 安全提示 Safety tips



在安装、启动和操作此仪表时，必须遵守相应国际安全规范，所有的工作必须在无电压状态进行。如果不按规程程序操作，会造成严重的人身伤害或财产损失。只有经过专业培训的人员可以调装此仪表。

During installation, startup and operation of this instrument, all relevant international safety codes must be obeyed and all the work must be conducted under the voltage-free status. Failure to comply with specific instructions may cause severe injury or property damage. Only professionally trained personnel can debug or install this instrument.

## 2. 一般性提示 Common tips

### A. 功能原理

#### Working principle

电接点式气体密度继电器是改型的带信号输出的压力表。气体密度继电器实现了测量和开关功能的一体化。温度对气体密度的影响由一个补偿系统平衡。气体密度继电器是针对每一个设备特殊设计的(气体的纯度, 校验压力, 开关点...)

Snap-action contact gas density monitor is a modified pressure gauge with signal output. Gas density monitor integrates measurement and switching functions. The impact of temperature on gas density is balanced by a compensation system. Gas density monitor is specially designed for each device (Gas purity, calibration pressure, switch points ...).

远传密度继电器既有传统的报警、闭锁接点输出, 又有电子式数字信号输出。

Remote density monitor has not only traditional alarm and locking contact output but also digital signal output.

### B. 使用前检测

#### Pre-use inspection

在运输或仓储过程中, 可能使气体密度继电器/远传密度继电器变冷或变热。当温度不等于参考温度(20°C)时指针会动。这种现象是正常的, 因为温度补偿系统在工作。During transportation or warehousing, gas density monitor/ remote gas density monitor may become cold or hot. When the temperature is not equal to reference temperature (20°C), the pointer will move, which shows the temperature compensation system is working.

为确定远传密度继电器与周围温度是否适应, 必须在温度 $20 \pm 1^\circ\text{C}$ 环境下, 恒温至少2小时。指针才能指示到允许的误差范围内。

In order to determine whether remote gas density monitor adapts to ambient temperature, the temperature of  $20 \pm 1^\circ\text{C}$  must be maintained for at least 2 hours so that the pointer can work within the allowable error range.

### C. 零位补偿区域

#### Zero compensation area

密度继电器/远传密度继电器带有零位补偿区域。仪表指针在无压力状态下, 因为温度的升高或降低, 会在零位补偿区域摆动, 例如:  $60^\circ\text{C}$  指针指示在低于零位的零位补偿区域下边缘, 从而简单的测量出温度补偿值, 当仪表温度降低, 指针将移向零位补偿区域的正值区域。

Density monitor / remote density monitor of this model has a zero compensation area. In the pressure-free state, the pointer swings within the zero compensation area due to temperature rise or fall. For instance, 60°C pointer stays at the lower edge of zero compensation area below zero position and the temperature compensation value can be calculated in a simple way. When the instrument temperature falls, the pointer will move to a positive value of zero compensation area.

### 3. 报警功能点 Alarm functional points

磁助式电接点开关也就是辅助电源开关,整个电源回路的开断是通过内部的机械结构达到预先设定的极限值时触发电接点开关。

Magnetic snap-action contact is also auxiliary power switch. The entire power circuit is disconnected or connected by activating the contact when the preset limit value is reached through internal mechanical mechanism.

### 4. 安装 Installation

#### A. 机械接口

##### Mechanical interface

一般仪表常用的技术性规范这里也适用(如:En837-2),旋转安装时所用的力不允许直接作用到表壳或接线盒上,而是通过合适的工具作用到扳手面上。

Technical codes (e.g., En837-2) applicable to ordinary instrumentation also apply here. The force applied for rotation installation shall not directly act upon the instrument housing or terminal box but act upon the wrenching face through a suitable tool.



#### B. 电气接口

##### Electrical interface

接线必须由经过专业培训的人员操作。接线分布和开关功能都在仪表型号牌上给出,并注明了接线柱和接地柱。规定供电电线必须考虑仪表的上限电流需求量并符合IEC227 或 IEC245 标准。

The wirings shall be performed by professionally trained personnel. Wiring distribution and switching functions are displayed on the instrument type plate with terminal binding posts and ground pole also indicated. The specifications of power line must allow for the upper limit current requirement of the instrument and comply with IEC227 or IEC245.

### 5. 使用和维护 Use and maintenance

密度继电器/远传密度继电器应垂直安装,用在室外的密度继电器/远传密度继电器应避免阳光直射到仪表上,考虑在仪表上加装防护罩。

Density monitor/remote density monitor shall be installed upright. For density monitor used outdoors, direct exposure to sunlight is not allowed, and it is advisable to use a shield.

密度继电器/远传密度继电器安装部位应能较真实地反映设备内气体的温度。  
Density monitor/remote density monitor shall be erected at a proper position to reflect the temperature of gas in relevant equipment.

用肥皂水浸湿的擦布清洁仪表, 要清洁接线盒或插头时要先把电源断开, 再接通电源前确保所有部件不潮湿。

Clean the instrument with a wiping cloth soaked in soap water. Cut off the power supply before cleaning the terminal box or plugs. Make sure that all components are dry before turning on the power again.

## 6. 技术参数 Technical parameters

### A. 一般参数 General parameters

外形尺寸 External dimension	Φ100mm
量程范围 Measuring range	依据用户要求定制 customized
测量介质 Measuring medium	SF <sub>6</sub> 、Air、N <sub>2</sub> 、SF <sub>6</sub> +N <sub>2</sub> 、SF <sub>6</sub> +CF <sub>4</sub> 等气体 SF <sub>6</sub> 、Air、N <sub>2</sub> 、SF <sub>6</sub> +N <sub>2</sub> 、SF <sub>6</sub> +CF <sub>4</sub> etc.
测量精度 Measuring precision	±1.0%FS (+20±1°C), ±1.8%FS (-20°C~+60°C) (气态) (gas phase); 可选 (options) ±1.6%FS (+20±1°C), ±2.4%FS (-20°C~+60°C) (气态) (gas phase); 可选 (options) ±1.5%FS或 (or) 1.0%FS (+20±1°C) ±2.5%FS (-55°C~+60°C) (气态) (gas phase);
抗振性能 Vibration resistance	20m/s <sup>2</sup> (充油), 10m/s <sup>2</sup> (不充油) 20m/s <sup>2</sup> (oil filled), 10m/s <sup>2</sup> (no oil filled)
抗冲击性能 Shock performance	50g (充油), 30g (不充油) 50g (oil filled), 30g (no oil filled)
电接点容量 Contact capacity	AC380V/DC220V, 30W/50VA 电流1.0A (上限) /Current 1.0A (upper limit)
电接点材料 Material of contact	银镍合金, 镀金处理 Silver-nickel, gold-plated
工作环境 Working environment	-20°C~+60°C 相对湿度 (relative humidity) ≤95 %RH 可选 (options) -40°C~+60°C或 (or) -60°C~+60°C
压力范围 Pressure range	-0.1MPa ~+0.9MPa
防护等级 Protection grade	IP 65
密封性能 Sealing performance	气路(Measuring system): ≤1X10 <sup>-9</sup> Pa·m <sup>3</sup> /s
开关点数量 Quantity of switch points	上限4组 Upper 4 groups

开关动作点 Switch action points	依据用户要求定制 customized
外壳材质 Casing material	304不锈钢 SUS304
感压元件 Pressure sensing element	波登管 Bourdon tube
压力接口 Pressure interface	依据用户要求定制 Customized
电气接口 Electrical interface	依据用户要求定制 Customized
通讯协议 Communication protocol	ModBus RTU
传输速度 Transmission rate	9600bps
远传工作电源 Remote Operational power supply	DC24V, ≤0.5W

B.电气性能(不包括远传部分)Electrical properties (exclude remote parts)

绝缘电阻 Insulation resistance	>100MΩ ( DC500 V)
绝缘耐压 Insulation& withstand voltage	2000V, 50/ 60 Hz 1 min 接线端子间耐压 2000V, 50/60 Hz 1min connecting terminal's withstand voltage 2000V, 50/ 60 Hz 1 min 接线端子对地耐压 2000V, 50/60 Hz 1min connecting terminal's withstand voltage to earth

7. 远传密度继电器的通信协议 (RS485)

Communication protocol for remote density monitor (RS485)

A.串行通信参数:Serial communication parameters:

Baud: 9600

Data: 8

Parity: No

Stop: 1

B.协议:Protocol: ModBus RTU

查询命令Query command:

设备地址 Device address	功能码 Function code	起始寄存器地址 Start register address		寄存器个数 Number of registers		校验码高低位 Check code high-low bit	
1 Byte	1 Byte	2 Byte		2 Byte		2 Byte	
Address	04	Register	Address	Register	Number	CRC_L	CRC_H

应答数据 Response data:

设备地址 Device address	功能码 Function code	数据长度 Data length	数据 2~6 Data2~6				校验码高低位 Check code high-low bit	
1 Byte	1 Byte	1 Byte	2~6 Byte				2 Byte	
Address	04	Data Length	DATA 1	...	...	DATA n	CRC_L	CRC_H

E.g.

01读取命令Read command:

01	04	00	00	00	03	B0	0B
----	----	----	----	----	----	----	----

远传表返回数据 Data returned by remote transmission table:

01	04	06	00	14	12	34	12	34	CRC_L	CRC_H
----	----	----	----	----	----	----	----	----	-------	-------

温度:0x0014,压力:0x1234,密度:0x1234

Temperature:0x0014, Pressure:0x1234, Density:0x1234

指令说明Instruction description:

设备地址 Device address	说明 Explain	功能码 Function code	说明 Explain	寄存器地址 Register address	说明 Explain
01	地址为1的设备 Device with address 1	04	读取数据 Read data	00 00	温度地址 Temperature address
...	地址为n的设备 Device with address n			00 01	压力地址 Pressure address
FF	地址为255的设备 Device with address 255			00 02	密度地址 Density address

寄存器个数 Number of registers	说明 Explain	数据长度 Data length	说明 Explain	数据 Data	说明 Explain
01	读取变量数据的个数,上限3个 Read the number of variable data, upper limit is 3	02	2 Byte		数据为两个一组 The data is in groups of two
02		04	4Byte		
03		06	6Byte		

数据处理:

温度: Temperature = (Temperature High | Temperature Low)/100 °C

例Example: Temperature High=0xF6; Temperature Low =0x05

Temperature = 0xF605/100 = -25.55 °C

压力: Pressure = (Pressure High | Pressure Low)/1000 MPa

例Example: Pressure High = 0x12, Pressure Low = 0x34

Pressure = 0x1234/10000 = 0.4660 MPa

密度: Density = (Density High | Density Low)/1000 MPa

例Example: Density High=0x56; Density Low= 0x78

Density = 0x5678/10000 = 2.2136MPa

● 返回的温度、压力、密度数据为2字节有符号整数。

The returned temperature, pressure and density data are 2-byte signed integers.

● 密度以对应20°C下的压力 $P_{20}$ 表示。

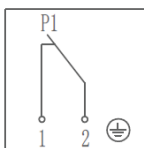
The density is expressed by the pressure  $P_{20}$  corresponding to 20 °C.

● 压力和密度用绝对压力表示,若转化为相对压力,减去标准大气压。

Pressure and density are expressed in absolute pressure. If converted into relative pressure, subtract the standard atmospheric pressure.

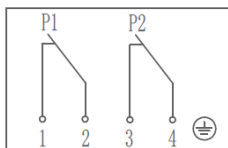
## 8. 接线图Wiring diagram

A. 接点回路 (P=0) Contact circuit (P=0)



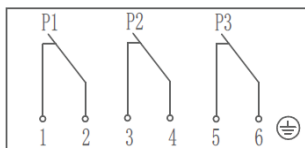
单接点

Single contact



双接点

Double contacts



三接点

Three contacts

B. 通讯端口 Communication ports

1	2	3	4
24V	A+	B-	GND

## 9. 远传密度继电器的地址设定Address setting for remote density monitor

读取地址/Read address:

发送/Send:

广播地址 Broadcast address	功能码 Function code	起始寄存器地址 Start register address		寄存器个数 Number of registers		校验码高低位 Check code high-low bit	
1 Byte	1 Byte	2 Byte		2 Byte		2 Byte	
00	04	FF	00	00	01	CRC_L	CRC_H



应答/Return:

设备地址 Device address	功能码 Function code	数据长度 Data length	地址 address		校验码高低位 Check code high-low bit	
1 Byte	1 Byte	2 Byte	2Byte		2 Byte	
Address	04	Data Length	H	L	CRC_L	CRC_H

E.g.

TX:00 04 FF 00 00 01 00 0F RX:02 04 02 00 02 7C F1

设备地址为: 02 / The device address is:02

更改地址/Change address:

发送/Send:

旧地址 Old address	功能码 Function code	起始寄存器地址 Start register address		新地址 new address		校验码高低位 Check code high-low bit	
1 Byte	1 Byte	2 Byte		2 Byte		2 Byte	
Address	06	FF	00	H	L	CRC_L	CRC_H

应答/Return:

旧地址 Old address	功能码 Function code	起始寄存器地址 Start register address		新地址 new address		校验码高低位 Check code high-low bit	
1 Byte	1 Byte	2 Byte		2 Byte		2 Byte	
Address	06	FF	00	H	L	CRC_L	CRC_H

E.g. Tx:02 06 FF 00 00 01 78 2D Rx:02 06 FF 00 00 01 78 2D

新地址为: 01 / The new address is 01.

## 10. 投诉/更换/修理 Complaint/replacement/repair

售后服务时请给出生产编号和产品型号, 生产编号印在表盘上, 产品型号印在标牌上。  
At customer service, please provide with the production number and product model. The production number is printed on the dial, while the product model is printed on the nameplate.

密度继电器/远传密度继电器必须长时间恒温才能达到温度补偿作用(至少两小时)。  
Density monitor/ remote density monitor must be kept in constant temperature for a long time (at least two hours) to achieve temperature compensation.

只有厂家可以进行维修, 不允许随便打开仪表, 否则会使显示和开关点产生误差。  
No one other than the manufacturer is allowed to disassemble the instrument for fear that any error may occur to the display and switch point.

## 11. 订货说明 Order instructions

型号/数量/量程/开关动作点/接口尺寸/其它特殊事项

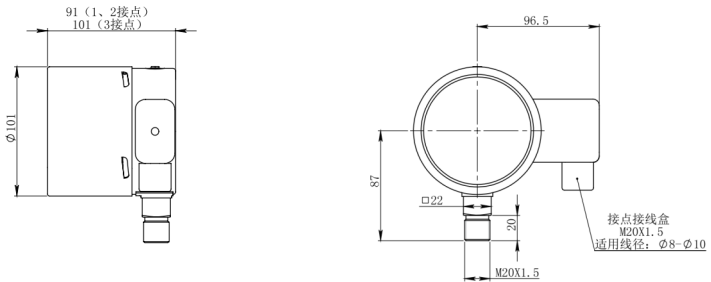
Model/quantity/measuring range/switch action point/interface size/other special issues

注：说明书中为基础配置，其余定制化需求见客户图。

Note: Basic type is included in the manual, and other customized requirements are shown in the customer's drawing.

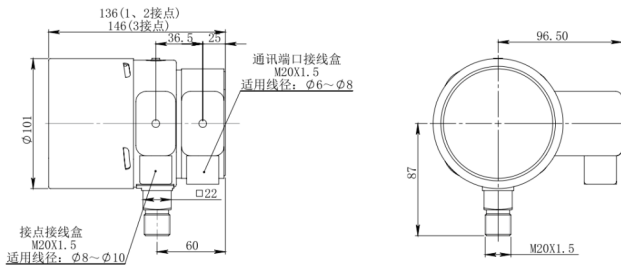
# 附图一：外形尺寸 Attached Drawing 1: External Dimensions

Density monitor:

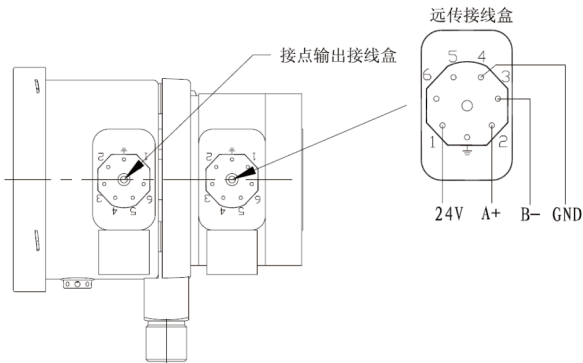


A(mm)	2接点	3接点
	91	101

Remote density monitor:



A(mm)	2接点	3接点
	136	146



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