KSR KUEBLER 柯普乐®

2016L260-31 沪制 02270160 号

Q31/0117000277C001-2022

FLR 浮球液位传感器/变送器

Float Level Sensor/Transmitter

安装和操作说明书

Mounting and operating instructions

上海柯普乐自动化仪表有限公司
Shanghai KSR-KUEBLER Automation Instrument Co., Ltd.

V1.4.FLR(C/E).05.2022

工作原理　根据浮力原理，并采用三线分压器原理对液位进行测量及信号变送。
浮球内磁钢的磁力线穿过导管，感应导管内干簧与电阻链，由此产生的电压与液位成正比例关系；干簧与电阻链排列非常紧密，从而导致电压近似连续变化；根据用户要求我们可以提供 5 毫米至 20 毫米的分辨率。

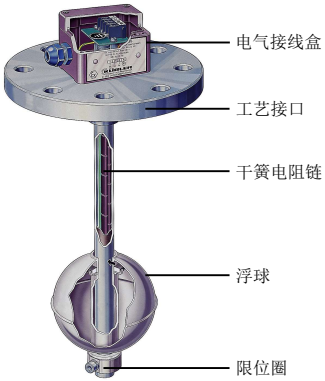


图 1 结构图

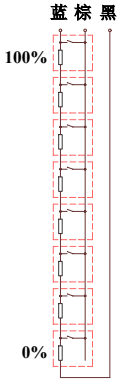


图 2 电气原理图

适用范围　耐腐蚀性强，适用于各种工业场所，广泛应用于化工、石油化学、天然气、制药业、海上勘探、造船业、发电厂、动力装置、机器制造业、纯净水净化装置、饮料和食品工业等。

技术指标　测量范围：0mm～300mm 至 6000mm
示值最大允许误差：K5：±5mm，K10：±10mm，K15：±15mm，
K20：±20mm
输出值误差：当 300≤M＜1000mm 时，输出值误差为±1.7%FS
当 1000≤M≤6000mm 时，输出值误差为±0.5%FS

结构安装　安装时应考虑其与水平面的垂直度，垂直方向最大值为±15°。当设备内的液体是有压、有毒、易燃的危险性液体时，安装前应放空设备内的液体，必要时应进行冲洗，待内部干净后再进行安装。

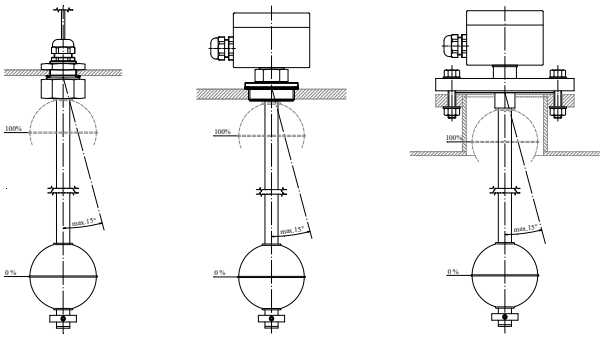


图 3 安装示意图

电气连接

电气接线在浮球液位传感器/变送器安装好后进行，接线时先打开接线盒盒盖，连接电缆穿过电缆接口进入到接线盒内，接线按不同变送器及接线盒的形式来进行。

注意：电缆敷设和电气连接必须按照设备适用的规则进行，并由具有资格的人员完成；用于本安区域时，必须配有安全栅或本安控制电路。

警告！连续量信号可能因使用较长的电缆或线路与动力线路一并敷设而引发故障，所以必须使用屏蔽电缆并一端接地。

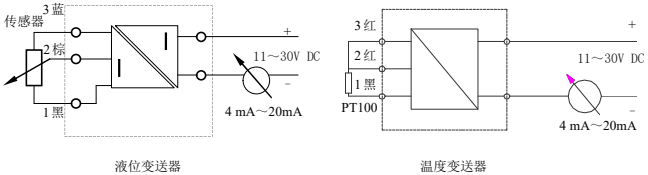


图 4 电气接线图（变送器）

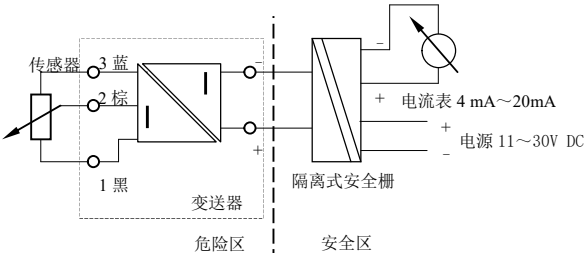
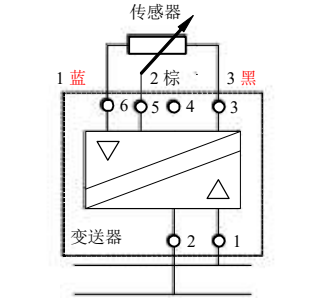


图 5 电气接线图（本安变送器）



PROFIBUS-PA 或 FOUNDATION FIELDBUS 总线

图 6 电气接线图（总线）

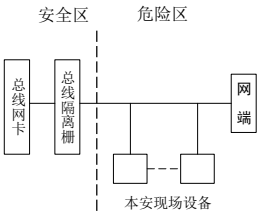
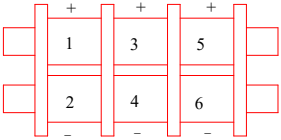
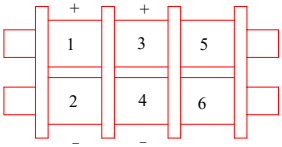


图 7 隔离栅应用图（FISCO）



1~2端子	连续信号二线制端子
3~4端子	上位开关信号端子（LCD 现场显示）
5~6端子	下位开关信号端子（LCD 现场显示）

图 8a 接线端子图（隔爆及现场显示接线盒）



1~2端子	液位变送器二线制端子
3~4端子	温度变送器二线制端子

图 8b 接线端子图（液位、温度变送器双输出）

信号调试

注意：当变送器工作在危险区域时请将变送器移至安全的场所进行调试。

1. 模拟信号输出变送器调试

调试时先让变送器的浮球工作在 0%处，此时调试电流表的值应为 4mA。如果电流值有误差，则可调节变送器的 4mA 调校电位器直至调试电流表的值为 4mA 为止；然后让变送器的浮球工作在 100% 处，此时调试电流表的值应为 20mA。如果电流值有误差，则可调节变送器的 20mA 调校电位器直至调试电流表的值为 20mA 为止。重复上述的过程直到调试电流表的值正确不需要再调整为止。

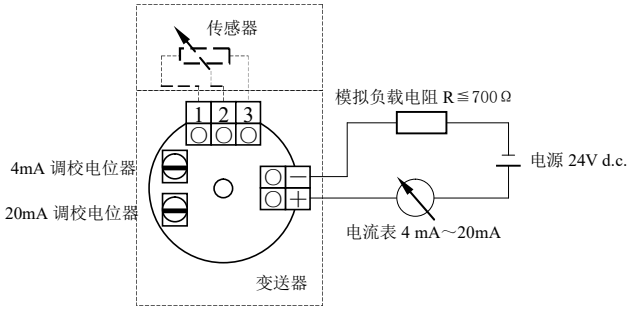


图 9 信号调试图（模拟信号输出）

2. HART®及总线协议数字信号输出变送器调试

调试时先让变送器的浮球工作在 0%处或按实际需要的起步状态，此时通讯设备上变送器输出的值应为变送器起步处的设定下限值。如果此下限值有误差，则可通过总线程序进行调整直至正确的下限值为止；然后让变送器的浮球工作在 100%处或按实际需要的满量程状态，此时通讯设备上变送器输出的值应为变送器满量程处的设定上限值。如果此上限值有误差，则可通过总线程序进行调整直至正确的上限值为止。重复上述的过程直到通讯设备上测得的变送器起步和满量程时所设定的相应下限值和上限值正确不需要再调整为止。

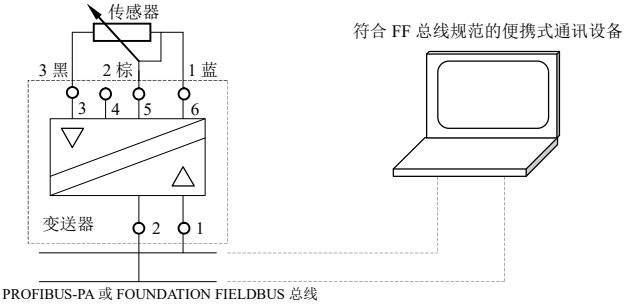


图 10 信号调试图（数字信号输出）

注意：一些带 HART®通信协议或其它可编程的变送器在使用时可阅读附带的变送器说明书或在提供的网页上查阅。

使用

1. 变送器使用时如果设备内有碎屑或铁粉类杂质，则变送器浮球移动的通道有可能被堵塞，这样变送器的使用就会受到影响；
2. 变送器工作时，其承受的压力极限在技术指标中都已规定，如果使用中设备中的压力超过所规定的指标，变送器就有可能被损坏；
3. 变送器使用时设备内的液位变化应平稳过渡，当出现有突变时，变送器的输出信号有可能会出现反常现象，此时只要待液面重新稳定后信号即会立刻恢复正常；
4. 变送器使用时不能在邻近强电磁场的地方工作，以避免影响变送器本身的工作磁场；
5. 变送器工作时的电气供电应该稳定，信号传输应考虑电气的屏蔽；另外，安装的牢固和接线的可靠也是变送器正常工作的首要保证。

注意：

- 变送器工作时应避免强烈的振动；
- 故障检查应在安全场所进行，且故障排除后应仍确保其防爆性能；
- 不带接线盒的以及电气连接为赫斯曼接头的产品，客户的罐体必须安装接地，并且液位变送器安装时螺纹不许使用生料带密封。

维护

1. 变送器工作时一般不用进行特别的维护，只是当工作介质的流动性和洁净度不够理想的情况下，请注意对变送器进行经常的清洗；
2. 如果变送器一经工作后又需经长期的停用，此时应将变送器的表面工作介质冲洗干净；
3. 长期不用的变送器其浮球最好能与传感器适当分开，以避免浮球的磁性与电气吸引造成的长期静态工作而影响变送器的使用性能。

故障检查

1. 变送器如不能正常工作时，可按如下步骤进行检查：

- 变送器连接口处的密封是否完好；
- 变送器的浮球是否有损坏或脱落；
- 变送器信号传输的连接是否有断损；
- 变送器的易损件是否损坏（包括：浮球，干簧电阻感应电路，变送器模块）。

2. 变送器易损件的检查：

- 当罐体内确实有液体而变送器的输出信号始终为起始值时，检查浮球是否损坏；如浮球完好，则手动浮球模拟液位上下移动，观察输出信号有无变化，无变化则检查变送器的传感器引出线上有无输出电阻值的变化，如有变化则变送器损坏或者传感器和变送器的连接有误；如无变化则传感器损坏或传感器内的接线有误；
- 当罐体内有液体上下的运行而变送器的输出在液位到达某一位置时其信号始终保持不变时，先检查其浮球是否损坏或被卡住；如浮球完好则传感器有可能损坏或传感器内的接线有误，更换传感器或检修传感器再让变送器重新投入运行；
- 当罐体内的液体有波动并有规律平稳的运行，而变送器的信号输出有明显反常或非线性的现象，则先检查浮球是否损坏或被卡住，然后手动浮球模拟液位上下移动，再观察变送器输出的信号是否和浮球的位移同步，如

果信号输出仍有明显反常或非线性的现象则变送器损坏或变送器的整定有误，更换变送器或检修变送器再让变送器重新投入运行。

防爆说明

1. 隔爆产品的使用应严格遵循下列内容：

隔爆产品经国家级仪器仪表防爆安全监督检验站（NEPSI）检验，符合标准 GB/T3836.1-2021、GB/T3836.2-2021 的有关要求，其防爆标志为 Ex d ⅡC T3~T6 Gb。

- 产品使用环境温度：-40℃～+60℃；
- 现场使用应遵守“严禁带电开盖”的原则；
- 引入电缆护套外径应为 Ø8±1mm，用户应保证夹紧电缆护套；
- 产品使用时外壳应可靠接地；
- 温度组别与被测介质最高温度的关系如下：

温度组别	T3	T4	T5	T6
被测介质最高温度（℃）	190	130	95	80

- 安装现场应不存在对铝合金有腐蚀作用的有害气体；
- 维修必须在安全场所进行；当现场确认无可燃性气体存在时方可维修
- 产品的安装、使用、维护、检查应同时遵守产品说明书、GB/T3836.15-2017“爆炸性气体环境用电气设备 第 15 部分：危险场所电气安装（煤矿除外)”、GB50257-1996“电气装置安装工程爆炸和火灾危险环境电力装置施工及验收规范”、GB/T3836.13-2021“爆炸性气体环境用电气设备 第 13 部分：爆炸性气体环境用电气设备的检修”和 GB/T3836.16-2017“爆炸性气体环境用电气设备 第 16 部分：电气装置的检查和维护（煤矿除外）”的规定。

2. 本安产品的使用应严格遵循下列内容：

本安产品经国家级仪器仪表防爆安全监督检验站（NEPSI）检验，符合标准 GB/T3836.1-2021、GB/T3836.4-2021 的有关要求，其防爆标志为 Ex ia ⅡC T3~T6，产品必须与安全栅配套组成本安防爆系统。

- 产品使用环境温度：-40℃～+60℃；
- 温度组别与被测介质最高温度的关系如下：

温度组别	T3	T4	T5	T6
被测介质最高温度（℃）	190	130	95	80

- 本安参数为：Ui=30V,Ii=120mA,Pi=1.2W,Ci=0uF,Li=0uH；
- 安装现场不存在对产品外壳有腐蚀性作用的气体；
- 该产品与安全栅本安端之间的连接电缆为本安电缆（必须有绝缘护套），每根线芯截面积>0.5mm^2，其接地线在安全场所接地。电缆布线应尽可能排除电磁干扰的影响；
- 用户不得自行更换该产品的零部件，应会同产品制造商共同解决运行中出现的故障，以杜绝损坏现象的发生；
- 产品的安装、使用和维护应同时遵守产品说明书、GB/T3836.13-2021“爆炸性气体环境用电气设备 第 13 部分：爆炸性气体环境用电气设备的检修”、GB/T3836.15-2017“爆炸性气体环境用电气设备 第 15 部分：危险场所电气安装（煤矿除外）”、GB/T3836.16-2017“爆炸性气体环境用电气设备 第 16 部分：电气装置的检查和维护（煤矿除外）”和 GB50257-1996“电气装置安装工程爆炸和火灾危险环境 电气装置施工及验收规范”的有关规定。

防护说明

为了满足电气防护等级，按照产品上电缆锁口的线径范围、防爆等级选择合适的电缆线，接线完成后，使用开口扳手拧紧电缆锁口；接线盒盒盖的密封件放置平整，接线盒盒盖安装均匀受力，用工具拧紧；冗余电气接口需要用螺塞封堵，并拧紧。

质量保证

在用户按文件规定使用的前提下，从发货日起 12 个月的保证期内，产品因质量问题而不能正常工作或不符合文件的技术条件时将给予无偿修理或更换。

产品附件

装箱单；产品说明书；产品合格证；用户附加定购的配件或附件。

特别声明：本手册以中文版本为标准，英文版本仅供参考

Operating Principle

Based on Buoyant effect and 3-wire potentiometer principle, it can carry out measurement and signal transmission for liquid level. Lines of magnetic force of magnet in float ball pass through pipe and induce the reeds and resistance chains in the pipe, the electrical potential generated thereby proportional to the liquid level; The resistance chains and reeds are arranged tightly, resulting in the continuous change of electrical potential. Depending on requirements of users, we can supply the resolution varying from 5 to 20 mm.

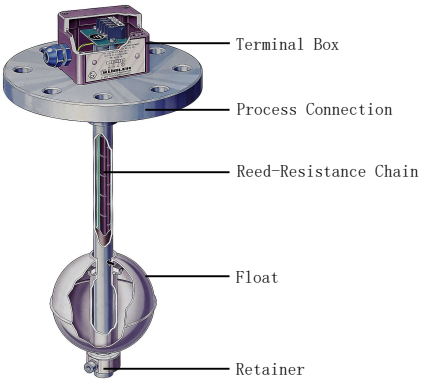


Fig. 1 Structure chart

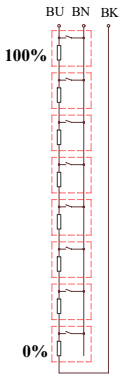


Fig. 2 Electrical schematic diagram

Application Scope

High corrosion resistant, applied in various industrial places: widely used in chemical industry, petrochemical, natural gas, pharmaceutical industry ,off-shore exploitation, ship-building, power plants, power units, machine building industry, water purification equipment, food and beverages industry, etc.

Technical parameter

Measuring range: L (according to actual dimension)/M: 0 ～ 300mm to 6000mm

Max. indicator error: K5：±5mm，K10：±10mm，K15：±15mm，K20：±20mm

Max. output error: $300 \leqslant M < 1000mm$ ±1.7%FS

$1000 \leqslant M \leqslant 6000mm$ ±0.5%FS

Structural Installation

During installation, the vertical degree to horizontal shall be considered, and the maximum deviation in vertical direction is ±15°.In the event that liquid in container is pressurized, toxic, flammable and dangerous, it shall be emptied before the installation and flushed if necessary; and installation shall not be performed until the inside of the tank is cleaned.

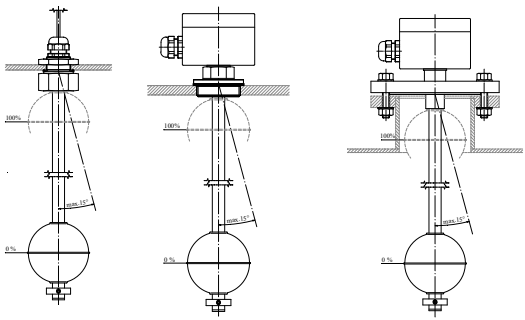


Fig. 3 Installation schematic diagram

Electrical Connection

Electric wiring can be carried out after installation of float level sensor/transmitter is completed. During wiring, the cover of terminal box is opened at first, and then introducing the cable into the terminal box via the cable port; the cables are wired depending on type of transmitter and terminal box.

Note: The cable laying and electrical connection shall be performed by qualified persons according applicable regulations of equipment. In the event that they are used in intrinsic safety zones, they must be equipped with safety barrier or IS control circuit.

Warning! The current pulse signal may be failure due to longer cables or the signal line is laid together with power line, so the shielded cable with grounding at one end must be used.

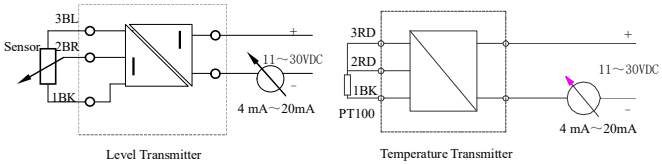


Fig. 4 Electrical wiring diagram (common transmitter)

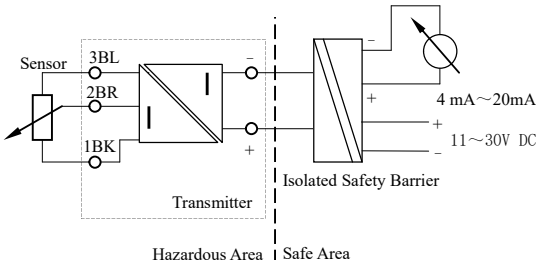


Fig. 5 Electrical wiring diagram (IS transmitter)

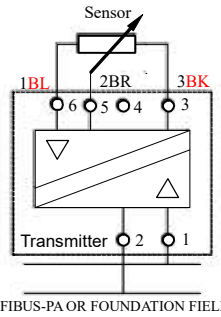


Fig. 6 Electrical wiring diagram (FIELDBUS)

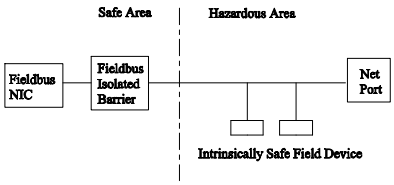
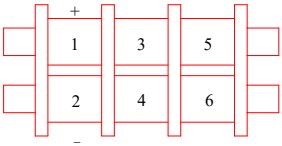
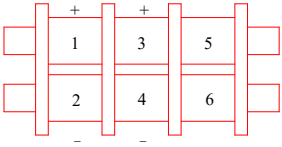


Fig. 7 Application diagram of isolated barrier (FISCO)



Terminal 1-2	Continuous signal 2-wire system terminal
Terminal 3-4	Upper switch signal terminal (LED local display)
Terminal 5-6	Lower switch signal terminal (LED local display)



Terminal 1-2	Level transmitter terminal
Terminal 3-4	Temperature Transmitter terminal

Fig. 8b Wiring terminal diagram (Level, Temperature Transmitter Dual Output)

Signal Commissioning

Note: in the event that the transmitters are operating in dangerous zones, they shall be moved to safe place for commissioning.

1.Commissioning of transmitter for analog signal output

During commissioning, making the float of transmitter operated at 0%, the value indicated on the test ammeter shall be 4 mA. If the current has error, you can adjust 4mA potentiometer of the transmitter until the value of ammeter is 4mA; and then make the float operate at 100%, at this time the value indicated on the ammeter shall be 20mA. If the value has error, you can adjust the 20mA potentiometer of the transmitter until the value is 20mA. Repeat the above-mentioned steps until the value indicated on ammeter is correct and no adjustment is made any more.

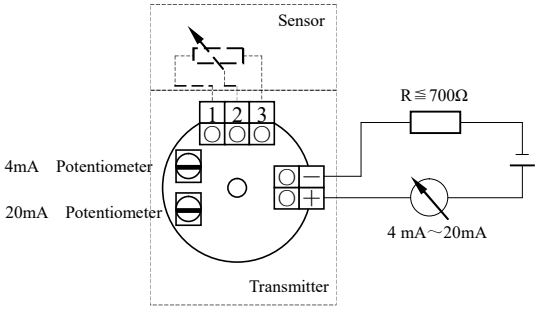


Fig. 9 Signal commissioning diagram (analog signal output)

2. Commissioning of HART® and Bus protocol digital signal output for transmitter

During commissioning, make the float of transmitter operated at 0% or any startup condition as necessary, and then the output value of the transmitter on communication device shall be lower limit value preset at startup condition of the transmitter. If the lower limit value has error, you can adjust with bus program until the correct lower limit value is reached; then the float of transmitter can operate at 100% or at full range as necessary, at the time the output value of the transmitter on communication device shall be upper limit value preset on the condition of full range. If the upper limit value has error, you can adjust with bus program until the upper limit value is reached. Repeat the above-mentioned steps until the measured lower limit value and upper limit value of the transmitter corresponding to startup and full range respectively are correct and do not require any adjustment any more.

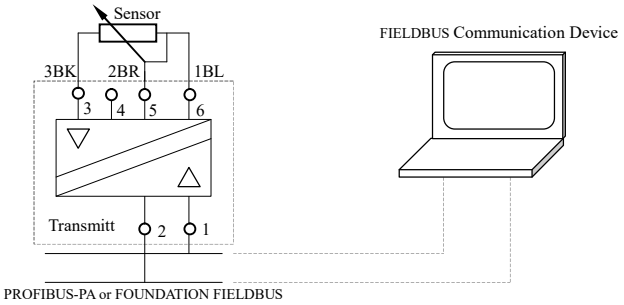


Fig. 10 Signal commissioning diagram (digital signal output)

Note: for operation of transmitter with HART® communication protocol or other programmable transmitter, you can read the attached instructions of transmitter or refer to available website.

Application

1. If there is any foreign substance such as scrap or iron powder inside the container when the transmitter is operating, the channel for movement of float may be clogged, then the use of the transmitter will be influenced;
2.When the transmitter operates, the allowable pressure limit of the transmitter is stipulated in technical specification; if the pressure is above the specified limit, the transmitter may be damaged;
3.The change of liquid level in container shall be stable when the transmitter operates, if sudden change happens, the output of transmitter may be abnormal, at this time, the signal can get right immediately after the level has settled down again.
4.The transmitter cannot operate at the place adjacent to strong magnetic field, to avoid affecting the magnetic field of the transmitter itself.
5.The power supply of the transmitter shall be stable, and electric shield shall be taken into consideration for signal transmission. It is the prerequisite of normal operation of the transmitter that the installation is firm and wiring is reliable.

Note:

●Strong vibration at the time of operation of transmitter shall be avoided;

●The check for failure shall be carried out in safe place, and the explosion-proof performance shall still be ensured after troubleshooting.

●For products without junction boxes or with hersman connectors for electrical connections, the customer's tank must be grounded, and the PTFE material tape shall not be used for screw mounting of level sensors.

Maintenance

1. In general, no special maintenance is necessary for transmitter when operation. In the event that fluidity and cleanliness of working medium is not good, regular cleaning shall be carried out for transmitter;
2. In the case of lengthy stoppages of the transmitter after running, be sure to clean the working medium on the surface of the transmitter;
3. If the transmitter is shut down for a longer period of time, the float of transmitter has to be separated properly from the sensor, in order to prevent electric attraction of magnetism of float and cause long-term static working of transmitter and affect its performance.

Troubleshooting

1.If the transmitter cannot operate normally, the check shall be carried out according to the following steps:

●Check seals at the connect of transmitter;

●Check float of transmitter for damage or spalling;

●Check connection of signal transmission of transmitter for breaking and damage;

●Check wearing parts of transmitter for damage (including: float, reed resistance induction circuit, transmitter module).

2.Check wearing parts of transmitter:

●If the tank contains liquid while the output signal of the transmitter is the initial value all the time, check the float for damage; if the float is in good condition, move the float manually for simulation of the level upwards and downwards, and observe the output, if the output has no change, then check whether output resistance value changes in the leads of sensor of the transmitter, if it has change, then it means the transmitter has been damaged or the connection between the sensor and transmitter is incorrect; if not, then it means the sensor has been damaged or wiring inside the sensor is incorrect;

●If the liquid in the container moves upwards and downwards, the output of transmitter doesn't change when the liquid level arrives at a position, check whether the float has been damaged or clogged; if the float is in a good condition, it means that the sensor may be damaged or wiring in the sensor is incorrect, replace or repair the sensor and then put it into operation again.

●When the liquid in the container varies and moves smoothly, and the output of transmitter is obviously abnormal or in non-linear, check whether the float for damage

or clogging firstly, and then move the float manually for simulation of the level upwards and downwards, observe whether the output of transmitter synchronizes with movement of the float; if the output is still abnormal obviously or in non-linear, it means the transmitter has been damaged or setting of transmitter is incorrect, replace or repair the transmitter and then put it into operation again.

Information on Explosion-proof

1.Application of explosion-proof product shall be strictly in accordance with the following:
The explosion-proof product has been inspected by National Supervision and Inspection Center for Explosion Protection and Safety of Instrumentation (NEPSI) and conforms to relative requirements in standard GB/T3836.1-2021, GB/T3836.2-2021, and its explosion-proof mark is Ex d II C T3 to T6 Gb

- Ambient temperature: -40℃ to +60℃;
- The principle of "DO NOT OPEN WHILE ENERGIZED" shall be adhered on site;
- Outer diameter of entry cable jacket shall be Ø8±1mm, be sure that the cable jacket is clamped tightly.
- Make absolutely sure that housing of the product shall be ground reliably during using the product;
- The relationship between temperature group and max. temperature of the medium to be measured is as following:

Temperature group	T3	T4	T5	T6
Max. temperature of the medium to be measured (℃)	190	130	95	80

- Dangerous corrosive gas to aluminum alloy shall not exist on the installation site;
- Repairing shall be carried out on safe site; repairing can be carried out only after making sure there is no inflammable gas exists on site.
- Installation, use, maintenance and inspection shall be carried out according to stipulations in Product instructions, GB/T3836.15-2017- Electrical apparatus for explosive gas atmospheres Part 15: Electrical installations in hazardous areas(other than mines), GB50257-1996-Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering, GB/T3836.13-2021- Electrical apparatus for explosive gas atmospheres Part 13: Repair and overhaul for apparatus used in explosive gas atmospheres and GB/T3836.16-2017- Electrical apparatus for explosive gas atmospheres Part 16: Inspection and maintenance of electrical installation (other than mines).

2. Application of IS product shall be strictly in accordance with the following:
The IS product has been inspected by National Supervision and Inspection Center for Explosion Protection and Safety of Instrumentation (NEPSI) and conforms to relative requirements in standard GB/T3836.1-2021, GB/T3836.4-2021, and its explosion-proof mark is Ex ia IIC T3 to T6. The product and safety barrier will comprise the IS explosion protection system.
The following points shall be observed during using this product:

- Ambient temperature: -40℃ to +60℃;
- The relationship between temperature group and max. temperature of the medium to be measured is as following:

Temperature group	T3	T4	T5	T6
Max. temperature of the medium to be measured (℃)	190	130	95	80

- IS parameters are: Ui=30V,Ii=120mA,Pi=1.2W,Ci=0uF, Li=0uH;
- Dangerous corrosive gas to housing of product shall not exist at the installation site;
- The connection cable between the product and safety barrier is IS cable (must have insulated shield), cross-sectional area of each core shall be more than 0.5 mm^2 and its earthing will earth at safe site. Routing of cable shall be prevented from electromagnetic interference as far as possible;
- No customer is allowed to change parts of the product. In case of any failure during the operation of the product, the customer shall work together with manufacturer to solve the product and eliminate the damage to product.Installation, use, maintenance and inspection shall be carried out according to stipulations in Product instructions, GB/T3836.13-2021- Electrical apparatus for explosive gas atmospheres Part 13: Repair and overhaul for apparatus used in explosive gas atmospheres, GB/T3836.15-2017- Electrical apparatus for explosive gas atmospheres Part 15: Electrical installations in hazardous areas(other than mines), GB/T3836.16-2017- Electrical apparatus for explosive gas atmospheres Part 16: Inspection and maintenance of electrical installation (other than mines) and GB50257-1996-Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering.

Ingressive protection

In order to meet the ingress protection, select the appropriate cable according to the wire diameter and explosion-proof grade of the cable gland. After wiring, tighten the cable gland with an open wrench. The sealing parts of junction box cover shall be placed in a flat way, and junction box cover shall be tightened with tools in uniform strength. The redundant electrical interface shall be sealed with a screw plug and tightened.

Warranty

Under the prerequisite that users operate the product according to stipulations in relative documents, within the guarantee period of 12 months from shipping date, if the products cannot operate normally due to quality issues or be not in accordance with technical conditions stipulated in documents, they can be repaired or replaced free of charge.

Accessories

Packing list; product instructions; product certificate; additional fittings or accessories to be ordered by customer.

Special Statement：This manual is subject to Chinese, English is only for reference

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