天康集团

2018年版

物位计选型样本

MATERIAL LEVEL METER

PRODUCT SELECTION CATALOGUE

安徽天康（集团）股份有限公司

ANHUI TIANKANG(GROUP) SHARES CO.,LTD

企业介绍
company profile



安徽天康（集团）股份有限公司创建于1974年，总部位于“长三角”经济圈核心区域—天长市，是中国民营企业制造业500强企业、中国电子信息百强企业、国家级守合同重信用企业、国家高新技术企业、安徽省依法纳税先进企业、银行资信AAA级企业、中国仪表行业十强企业、中国电线电缆十强企业、安徽省重点骨干企业、“全国五一劳动奖状”获得者等荣誉。

天康集团历经四十年的蓬勃发展，已形成集仪器仪表、光电缆、医疗卫生、锂电池等跨行业、多元化的集团公司，下属子公司达二十余家。旗下产品凭借良好的质量与服务，被广泛应用于石油、电力、化工、通讯、卫生、新能源汽车及储能等行业和领域。其自主研发、生产的纳米钛酸锂动力/储能电池产品属国家重点新产品。经业内专家评定，达到国内领先、国际先进水平。

作为皖东经济最具活力与贡献的骨干企业之一，天康集团以“追求卓越，缔造满意”为目标，依托一流的产品、一流的管理、一流的服务，不仅在国内市场中赢得了广泛赞誉；在国际市场中，天康产品远销欧洲、非洲、亚洲等46个国家和地区。

天康集团在发展中逐步形成了独特的品牌文化及着眼全球的经营布局，全力塑造“高科技、高品质、国际化”的品牌形象。始终秉承“有跨越才有卓越”的天康精神，在创建和谐企业的基础上，引进国际先进的构架与模式，组织企业的生产经营管理体系。在积极参与国际化竞争的基础上，不断把握市场发展脉搏，寻求经济战略联盟，与全球伙伴共同发展与进步。如今天康人将全新的投入化为无私的奉献，与世界共同发展，与人类一起进步。

竭诚为客户提供一流的产品和至上的服务

Wholeheartedly Provide Customers With First-class Products and Service



Anhui Tiankang (Group) Co., Ltd. created in 1974, the headquarters is located in the "Yangtze River Delta" economic circle core area - Tianchang City, is China's private enterprises in the manufacturing industry 500 strong enterprises, China's electronic information hundred enterprises, state-level keep contract re credit enterprise, national new and high technology enterprise, Anhui Province tax law advanced enterprises, bank credit AAA level enterprise, China instrument industry ten strong enterprises, top ten enterprises in the Chinese wire and cable, Anhui province key enterprises, "national labor certificate" get "and other honorary.

After forty years of vigorous development, the group has formed a set of instruments, optical cable, medical and health, lithium batteries, such as cross industry, diversified group companies, subsidiaries of more than twenty. Products with good quality and service, is widely used in oil, electricity, chemicals, communications, health, new energy vehicles and energy storage and other industries and areas. Its independent research and development, production of nano lithium titanate power / energy storage battery products are national key new products. By industry experts, to achieve the domestic leading and international advanced level.

As one of the backbone enterprises in Anhui east economy the most vitality and contribution, tecon group to "the pursuit of excellence, creating satisfaction" as the goal, relying on the first-class products, first-class management, first-class service, not only in the domestic market won wide acclaim; in the internationalmarket, the day Kang products are exported to 46 countries and regions, including Europe, Africa, and Asia.

TianKang group in the developing gradually formed a unique brand culture and focus on global business department bureau, spare no effort to shape the brand image of "high-tech, high-quality, internationalization". Always adhering to the "excellence," the spirit of Tiankang across only, to create the basis for a harmonious enterprise, the introduction of international advanced framework and patterns, organization of production management system. Actively participate in the international competition, and continue to grasp the pulse of the market development, to seek economic and strategic alliances, and global partners to develop and progress. Such as today, the people will be a new investment into the selfless dedication, and the common development of the world, together with the progress of mankind.

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TKWL-1700系列电容式物位计

TKWL-1700 Capacitance level meter

一、工作原理

电容式物位计由电容式物位传感器和检测电容的线路组成。其基本工作原理是电容式物位传感器把物位转换为电容量的变化，然后再用测量电容量的方法求知物位数值。

电容式物位传感器是根据圆筒电容器原理进行工作的。其结构如同2个长度为L 、半径分别为R和r的圆筒型金属导体，中间隔以绝缘物质，当中间所充介质是介电常数为ε1的气体时，两圆筒的电容量为：

$$C_1=2\pi\varepsilon_1 L/R/(\ln R/r) \quad (1)$$

如果被测介质为导电性液体时，电极要用绝缘物（如聚乙烯）覆盖作为中间介质，而液体和外圆筒一起作为外电极。假设中间介质的介电常数为ε3，电极被浸没长度为l，则此时电容器所具有的电容量为：

$$C=2\pi\varepsilon_3 L/R/(\ln R/r) \quad (3)$$

其中：R 和r 分别为绝缘覆盖层外半径和内电极外半径。由于ε3 为常数，所以C 与l 成正比。

如果电极的一部分被介电常数为ε2的液体（非导电性的）浸没时，则必须会有电容量的增量△C 产生（因ε2＞ε1），此时两极间的电容量C=C1+△C。假如电极被浸没长度为l，则电容增量为：

$$\triangle C=2\pi\varepsilon_3 L/R/(\ln R/r) \quad (2)$$

当ε2、ε1、R、r不变时，电容量增量△C与电极浸没的长度l成正比，因此测出电容增量数值便可知道液位高度。

电容式物位计液位计在应用中应注意的几个问题

1、选型

由于被测介质的不同，电容式物位传感器有不同的型式。

（1）测量非导电液体的电容物位传感器，当用于较稀的非导电液体（如轻油等）时，可采用一金属电极，外部同轴套上一金属管，相互绝缘固定，以被测介质为中间绝缘物质构成同轴套筒形电容器。

（2）测量导电液体的电容物位传感器，容器（规则）和液体作为电容器的一个电极，插入的金属电极作为另一电极，绝缘套管作为中间介质，三者组成圆筒形电容器。当容器为非导电体时，需另加一个接地极，其下端浸至被测容器底部，上端与安装法兰有可靠的导电连接，以使二电极中有一个与大地及仪表地线相连，保证仪表正常测量。

Working principle

Capacitance level meter is composed of capacitive material level sensor and circuit checking capacitance, whose basic working principle is the change of converting material level into capacitance with capacitive material level sensor, and then calculate the value of material level with the method of measuring capacitance.

Capacitance level meter works based on the principle of cylinder capacitor, whose structure is similar to two cylindrical metal conductors with length of L, radiuses of R and r respectively; the middle is separated with insulating material and when the filled medium in the middle is the gas with dielectric constant of ε1, the capacitance of two cylinders is:

If the measured medium is conductive liquid, the electrode needs to be covered with insulator (such as polyethylene) as intermediate medium, while the liquid and external cylinder are as outer electrodes. Presume the dielectric constant of intermediate medium is ε3 and the immersed length of electrode is 1, and then the capacitance of capacitor is:

In which R and r are outer radius of insulating coating and outer radius of inner electrode. As the ε3 is constant, so C and l are in direct ratio.

If part of electrode is immersed by liquid (non-conductive) with dielectric constant atε2, and then there must be increase of capacitance △C produced (becauseε2>ε1) , now the capacitance between these two electrodes is C=C1+△C. Presume the immersion length of electrode is l, and then the increase of capacitance is:

When ε2, ε1, R, r keep unchanged, the increase of capacitance △C and immersed length of electrode l are in direct ratio, therefore, the liquid level can be gotten after the value of capacitance increase is measured.

A few problems need to be paid attention to during the application of capacitance level meter

1. Selection

Due to the differences of measured medium, capacitance level meter has different models.

(1) When apply the capacitive level sensor of measuring non-conductive liquid to more dilute non-conductive liquid (such as light oil), it can adopt one metal electrode and put a metal tube on external coaxial, mutually insulated and fixed, form coaxial sleeve type capacitor by taking measured medium as intermediate insulating material.

(2) For capacitive level sensor of measuring non-conductive liquid, take container (rule) and liquid as one electrode of capacitor, the inserting metal electrode as another electrode, the insulating tube as intermediate medium, and these three compose cylindrical capacitor. When the container is non-conductive, it needs to add another earth electrode, whose bottom part will be immersed to the bottom of the container and the top part will make reliable electrical connection with installation flange to make one of the electrodes connected with earth and meter ground line and ensure the normal measurement of meter.

（3）当测量粉状非导电固体料位和粘滞性非导电液体液位时，可采用金属电极直接插入圆筒型容器的中央，将仪表地线与容器相连，以容器作为外电极，料或液体作为绝缘介质构成圆筒型电容器。

所以应根据现场实际情况，即被测介质的性质（导电特性、粘滞性）、容器类型（规则/非规则金属罐、规则/非规则非金属罐），选择合适的电容物位计。

2、测量回路中接地点的处理

仪表测量回路中接地点的正确、可靠与否直接影响被测参数的测量。电容物位计对油品精制8个碱液罐进行液面监控，由于碱液罐位于防爆区，所以最初设计测量回路中引入齐纳式输入安全栅（见图1）。

(3) When measuring the material level of powder non-conductive solid and the liquid level of viscous non-conductive liquid, can adopt metal electrode to insert into the center of cylindrical container directly, connect the ground line of instrument with container and construct cylindrical capacitor by taking the container as outside electrode, material or liquid as insulating medium.

So it should choose suitable capacitance level meter based on real site situation, that is the property of measured medium (conductivity, viscosity) and type of container (regular/irregular metal tank, regular/irregular non-metal tank).

2. Treatment of ground point in measurement circuit

Whether the ground point in meter measurement circuit is correct and reliable or not affects the measurement of measured parameters. Liquid monitoring for eight soda solution tank of oil refining during overhaul. As the soda solution tank locates at explosion proof area, so it introduces zenner diode safety barrier in the initital design of measurement circuit (as shown in pic.1)

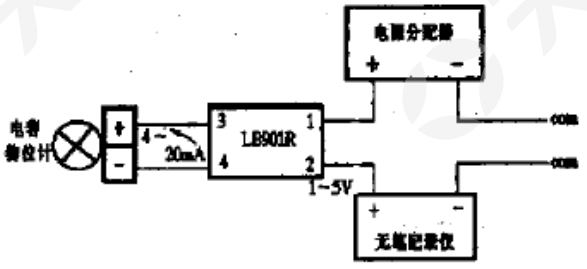


图1 采用齐纳式输入安全栅的系统接线图
Pic. 1 System wiring diagram with adoption of zenner diode safety barrier

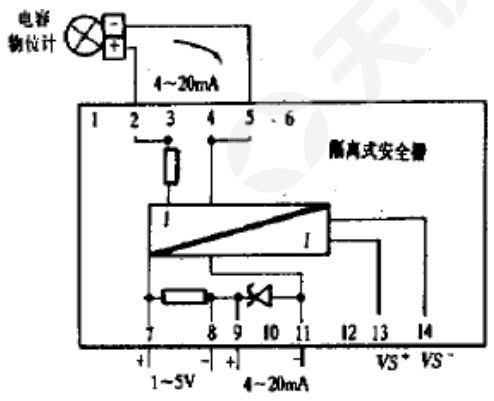


图2 采用隔离式安全栅的系统接线图
Pic. 2 System wiring diagram adopting isolating safety barrier

安装调试发现，系统无法正常工作：安全栅2端电压高达23V，而变送器（电容物位计）供电电压为0V，也就是说已短路。仔细查找原因，发现是由于电容物位计的电路结构所致。电容物位计的探头为等效电容的一极，对于外壁规则的金属容器，其罐壁为电容的另一极。因此变送器信号负接地，而齐纳栅也接地则变送器被短路。于是将接地COM点悬空，观察到开始时变送器输出在4mA，安全栅2端电压在0.86V，不长时间变为1.6V，7V，变送器工作很不稳定，这是由于COM点悬空，系统回路受外部干扰所致。于是抛开安全栅与COM板，将24V电源直接送到变送器，串入标准电流表检测变送器工作情况，变送器工作正常。得出结论：由于电容物位计信号负与大地（罐壁）相连，因此不能选用齐纳式安全栅。经与厂家协商，选用隔离式安全栅，因为电容物位计与隔离式安全栅已进行系统安全防爆联合取证。选用隔离式安全栅系统接线如图2所示。由于隔离式安全栅的电源、输入、输出信号三者隔离，避免了系统间的相互干扰，以及系统多点接地问题。

It is found out during installation and debugging that the system can't work normally: voltage at two ends of safety barrier is as high as 23V, whle the power supply voltage of transmitter (capacitance level meter) is 0V, which means short circuit. After careful checking, it finds out that it is caused by the circuit structure of capacitance level meter. The probe of capacitance level meter is one electrode of equivalence capacitance, for the metal container with regular wall; the tank wall is another electrode of capacitance. Therefore, the signal of transmitter is negative ground, while zenner barrier is grounded, which makes the transmitter become short circuit. Hang the grounding COM point and it is observed that at the beginning stage, the output of transmitter is 4 mA, the voltage at two ends of safety barrier is 0.86V, and then changes into 1.6V, 7V shortly. The transmitter works unsteadily, which is caused by hang of COM point and the system circuit is affected by external disturbance. Therefore, throw off safety barrier and COM plate, send 24V power to transmitter directly, string into standard current meter to examine the working condition of transmitter and the transmitter works normally. It can draw a conclusion that as the negative signal of capacitance level meter is connected with ground (wall of the tank), therefore, it can't adopt zenner diode safety barrier. After negotiation with manufacturer, select isolating safety barrier, because capacitance level meter and isolating safety barrier have made joint forensics for system safety and explosion proof. Selecting isolating safety barrier system wiring is as shown in picture 2. Due to the isolation among power, input and output signal of isolating safety barrier, it avoids the mutual interference between systems as well as multiple points grounding problem of system.

二、技术参数

用于高温高压、强腐蚀等介质液位测量。在电力、冶金、食品、酿造、制药、污水处理、锅炉汽包等军工业场合广泛运用。

Technical parameters

Used for liquid level measure for mediums of high tempersure, high pressure and strong corrosive characteristics and is widely applied in electric power, metallurgy, food, brewing, pharmaceutical, sewage treatment, boiler drum and other military and industrial occasions.



产品型号 Product Model	TKWL-1700
测量范围 Measuring Range	6~30m
精　度 Accuracy	0.5级 0.5 grade
承受范围 Bearing Scope	负压、常压、高压 Negative pressure, normal pressure, high pressure
工作温度 Working Temperature	-50~240℃
环境温度 Environmental Temperature	-20~75℃
适用介质 Applicable Medium	酸、碱、盐或聚氟乙烯无腐蚀的任意介质 Acid, alkali, salt, PTFE, any non-corrosive medium
输出型号 Output Signal	4~20mA二线制 4-20 mA two~wire system
供电电源 Power Supply	负载电阻0~750Ω DC24V Load resistance 0~750 Ω DC24V
固定方式 Fixation Method	螺纹安装M20X1.5、M27X2，法兰安装DN15、DN25、DN50、DN80特殊规格可定制 Screw installation M20X1.5, M27X2Flange installation DN15, DN25, DN50, DN80 Speical specifications can be customized
现场显示 Site Display	铝合金 Aluminum alloy

用于高温高压、强腐蚀等介质液位测量。在电力、冶金、食品、酿造、制药、污水处理、锅炉汽包等军工业场合广泛运用。

Used for liquid level measure for mediums of high tempersure, high pressure and strong corrosive characteristics and is widely applied in electric power, metallurgy, food, brewing, pharmaceutical, sewage treatment, boiler drum and other military and industrial occasions.



产品型号 Product Model	TKWL-1701
测量范围 Measuring Range	0~6m
精　度 Accuracy	0.5级 0.5 grade
承受范围 Bearing Scope	负压、常压、高压 Negative pressure, normal pressure, high pressure
工作温度 Working Temperature	-50~240℃
环境温度 Environmental Temperature	-20~75℃
适用介质 Applicable Medium	酸、碱、盐或聚氟乙烯无腐蚀的任意介质 Acid, alkali, salt, PTFE, any non-corrosive medium
输出型号 Output Signal	4~20mA二线制 4-20 mA two~wire system
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现场显示 Site Display	铝合金 Aluminum alloy

TKWL-1700订购信息
Ordering information for TKWL-1700 capacitance level meter

TKWL-1700						
输出信号 **Output signal** 4~20mA D 智能 Intelligent S 4~20 MA+HART E						
安装接口 **Installation interface** 罗纹M20*1.5外 Ribbing M20*1.5 outside 0 罗纹1/2NPT 外 Ribbing 1/2NPT outside 1 法兰DN25 FlangeDN25 2 法兰DN40 FlangeDN40 3 法兰DN50 FlangeDN50 4 法兰DN80 FlangeDN80 5 特殊 Special 6						
传感器材质 **Sensor material** Φ5的软缆Φ5 Soft cable C1 Φ8的软缆Φ8 Soft cable C2 Φ14的软缆Φ14 Soft cable C3 Φ16的软缆Φ16 Soft cable C4 Φ8的软杆高压Φ8 Soft rod high pressure C5 特殊规格 Special specification C6						
电气接口 **Electrical interface** 0:M20*1.5内 within 1:1/2NPT内 within						
防爆等级 **Explosion proof class** 本安型 Instrinsically safe model I 本安型+隔爆 Instrinsically safe model+isolating explosion P						
长度 **Length**						