

XR 系列微波料位开关
用户手册 (中英文)



XR series microwave level switch

User manual

XRUN

用户手册 (User Manual)

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XR05 通用型微波料位开关



UG2020-001-1

使用手册

2020.09.01 Rev. D

1. 标志符号说明

1.1 警告符号



警告：如果用户忽略或者不遵守使用说明，将可能带来安全危险，导致严重伤害。



注意：如果用户忽略或者不遵守使用说明，将可能损坏设备或者造成数据丢失。



ESD：如果用户忽略或者不遵守使用说明，将可能对设备造成静电放电损害。

1.2 其他符号



提示

1.3 注意事项



注意：本产品仅适用于检测介电常数大于等于 1.5 的固体颗粒，液体及浆料。



注意：不能用于测量对探头材料（PEEK）或者壳体材料有腐蚀性的介质。



警告：用户在安装，配置，调试前必须阅读过并能够正确理解本手册。



警告：用户安装时，只能使用功能正常的仪表。



警告：用户安装时，使用自制或其他厂家的套管，焊接底座等配件，我司不承担由该配件造成的问题责任。



警告：测量高温介质时，产品的外壳温度可能会超过 50°C，此时用户必须采取防护措施，避免可能的烫伤风险。



警告：在有防爆需要的应用中，用户不能在危险区域，使用 KOMM700 手操器配置料位开关。

2. 简介

XR05 通用型料位开关，适用于卫生、食品及工业应用。具有优秀的抗导电挂料能力，适应多种测量介质，并提供多种过程连接形式和多种输出信号。本产品是传统的机械式、音叉、阻旋开关的理想替代产品。

2.1 产品结构

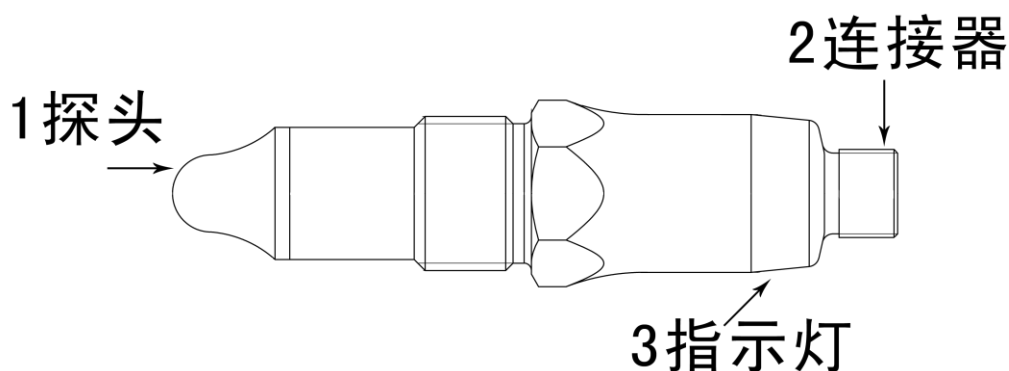


Fig. 1 XR05 结构图

2.2 工作原理

本产品的探头、金属机壳与内部电子单元形成一个高频谐振电路。探头附近形成高频微波电场。探头被介质覆盖或介质的介电常数改变时，谐振频率将发生较大的变化，内部电子单元通过比较当前谐振频率及用户设定阈值，开启或者关闭报警信号。该测量方法可有效的排除粘附性导电挂料的影响。

2.3 特点及应用场合

■应用性广	适用于介电常数 ≥ 1.5 的固体及液体
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■检测稳定	不受泡沫的影响
■抗挂料性	可有效检测粘附性导电浆料
■结构紧凑	适合在狭小空间安装
■接液材质 PEEK 及不锈钢	适合卫生及工业场合
■使用方便	可使用手操器在现场设定报警阈值，并查看测量值
■最高工作温度	标准型 115℃，散热型 150℃
■常开 (NO) 常闭 (NC) 输出	同时提供 NO 及 NC 输出，通过接线选择，方便现场应用

2.4 应用限制

- 不适用于粗糙的介质（如石英砂）和很重的块状材料。
- 不适用于对探头及接液部分有腐蚀性的介质（如：臭氧化水）。
- 探头不能受紫外线辐射。

3. 铭牌及存储运输

3.1 铭牌

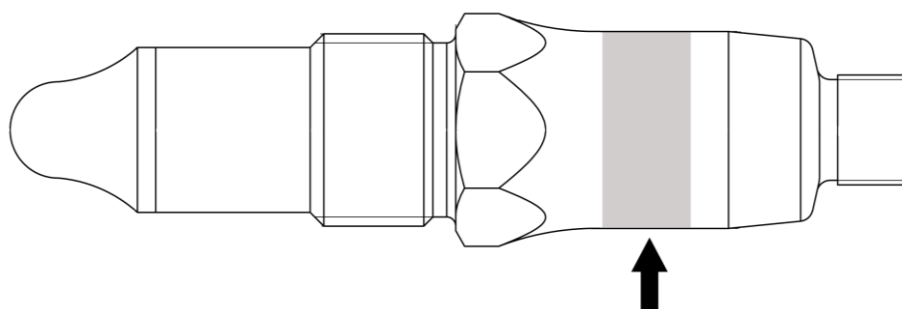


Fig. 2 铭牌示意图

TYPE	选型编号
IN	输入电压和最大功耗电流 12 ~ 30V, 40mA

OUT	PNP、NPN, 最大外部负载 20mA
TAMP	-40°C < 环境温度 < 85°C
SN	序列号
DATE	制造日期

3.2 储存和运输

储存条件:

储存温度: -40~85°C

使用原包装。

运输至测量点:

使用原包装将设备运输到测量点。

4. 安装

4.1 安装位置

料位开关可以安装在管道或罐体中的任意位置处。使用套筒扳手可以将料位开关安装在难于操作的测量点。

- 料位上限
- 料位下限
- 干运行保护

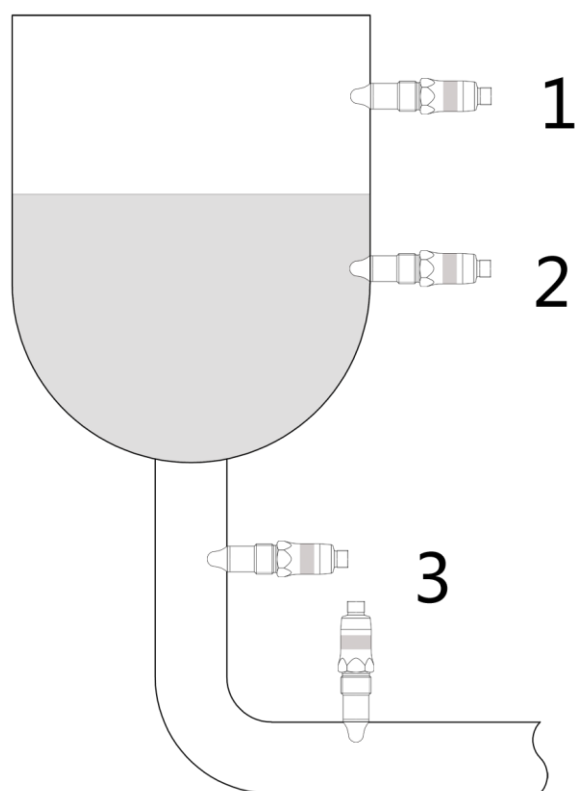


Fig.3 安装位置图

4.2 工业型场合安装




危险介质可导致伤害风险

- ▶ 穿戴针对危险介质（例如，各种酸、碱性溶液等）的防护装备。
- ▶ 安装前，清空容器和管道。

4.2.1 直接安装

具体步骤如下：

1. 安装前和安装时，确保容器和管道内没有介质。
2.  必须用 PTFE 胶带缠绕在料位开关的螺纹上。
3. 用扳手（22AF）将料位开关旋进安装孔。
4. 旋紧力矩 30 Nm。

4.2.2 使用不锈钢过程连接器安装



注意：使用不锈钢过程连接器时，可以利用密封垫圈或者连接器的锥面密封，PTFE 胶带不是必须的。

具体步骤如下：

1. 安装前和安装时，确保容器和管道内没有介质。
2. 首先在现场容器或管道上安装过程连接器。
3. 将料位开关旋进过程连接器。
4. 旋紧力矩 15~20 Nm 。

4.2.3 使用塑料（如 PTFE）过程连接器安装



注意：使用塑料过程连接器时，可以利用密封垫圈或者锥面密封，PTFE 胶带不是必须的。

具体步骤如下：

1. 安装前和安装时，确保容器和管道内没有介质。
2. 首先在现场容器或管道上安装过程连接器。
3. 根据过程连接器的密封性，决定是否使用 PTFE 胶带。
4. 将料位开关旋进过程连接器。
5. 旋紧力矩 15~20 Nm。
6. 接地处理：料位开关金属外壳与金属罐壁（Frame Ground）之间，应当通过导线或者金属夹连接。

4.3 卫生型场合安装



危险介质可导致伤害风险

- ▶ 卫生型场合安装只能使用焊接套管（不锈钢）。
- ▶ 卫生型场合不能使用 PTFE 胶带，或者其他弹性体密封。
- ▶ 必须由在卫生领域接受过培训的焊工完成焊接工作。

4.3.1 焊接套管安装

具体步骤如下：

1. 安装前和安装时，确保容器和管道内没有介质。
2. 焊入式套管或接合器以卫生的方式进行安装且内部齐平。
3. 焊缝打磨至 $Ra < 0.8 \mu m$ 。
4. 泄漏口指向下方。
5. 旋紧料位开关。
6. 旋紧力矩 10~15 Nm。

4.4 安装后检查

- ▶ 设备是否完好无损（目视检查）？
- ▶ 是否采取充足的防护措施防止设备直接日晒雨淋？
- ▶ 设备是否正确固定？

5. 电气连接



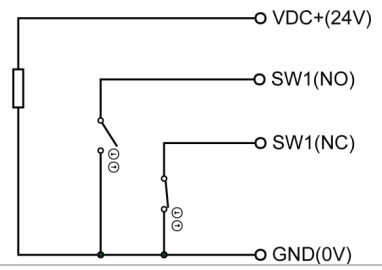
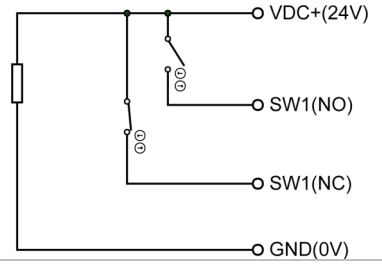
XR05 电气接口分为：**电缆直接引出型**、**M12 四芯连接器**两种。两种接口使用的导线颜色不同，安装时需特别注意。

5.1 电缆引出型的等效电路（线色：白绿黄棕）

输出类型	料位开关内部等效电路	引脚功能（颜色或线号）
NPN		VDC + 白 1 SW1 (NO) 黄 4 SW1 (NC) 棕 2 GND (0 V) 绿 3
PNP		VDC + 白 1 SW1 (NO) 黄 4 SW1 (NC) 棕 2 GND (0 V) 绿 3

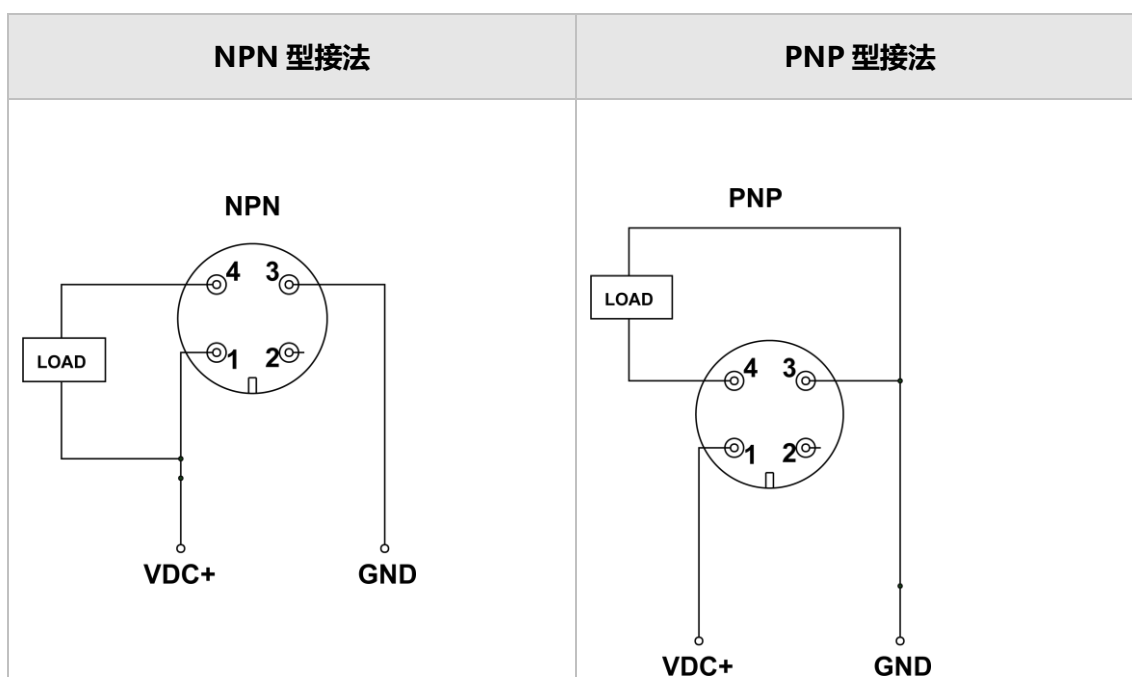
5.2 M12 连接器型的等效电路（线色：棕蓝黑白）



输出类型	料位开关内部等效电路	功能	M12 端子号	导线颜色
NPN		VDC + SW1 (NO) SW1 (NC) GND (0 V)	1 4 2 3	棕 黑 白 蓝
PNP		VDC + SW1 (NO) SW1 (NC) GND (0 V)	1 4 2 3	棕 黑 白 蓝

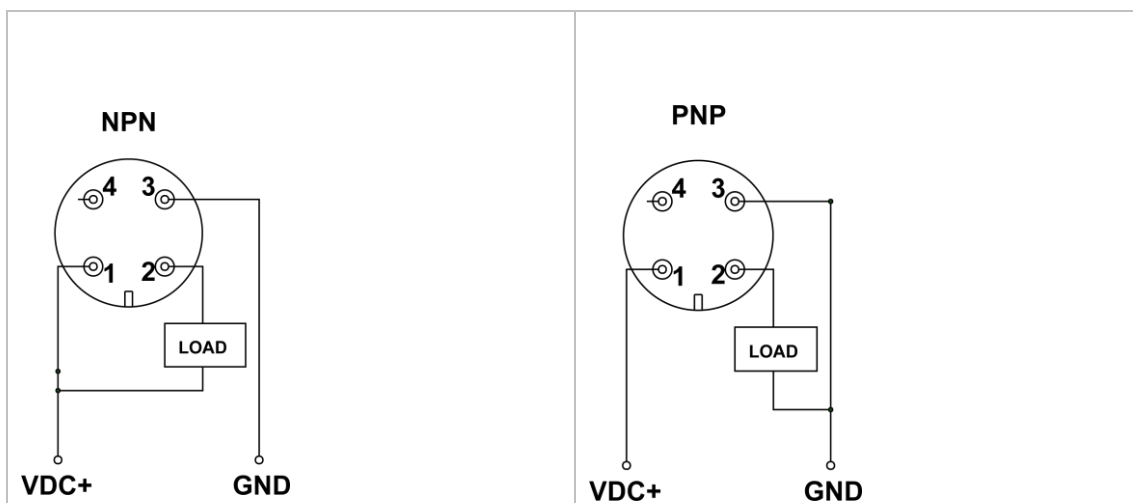
5.3 接线示意图

5.3.1 常开 (NO) 接法



5.3.2 常闭 (NC) 接法





5.4 连接后检查

- ▶ 设备或电缆是否完好无损(目视检查)?
- ▶ 电缆是否符合要求?
- ▶ 电缆是否已经完全消除应力?
- ▶ 供电电压是否与铭牌参数一致?
- ▶ 连接器插头是否旋紧?

6. 配置

- ▶ 手操器由 5V USB 供电，经内部升压后，手操器为料位开关提供 12V 直流供电。
- ▶ 手操器内置蜂鸣器，当接收到料位开关的报警信号后，蜂鸣器响。

6.1 NPN 型开关与手操器接线(有 1k 上拉电阻)

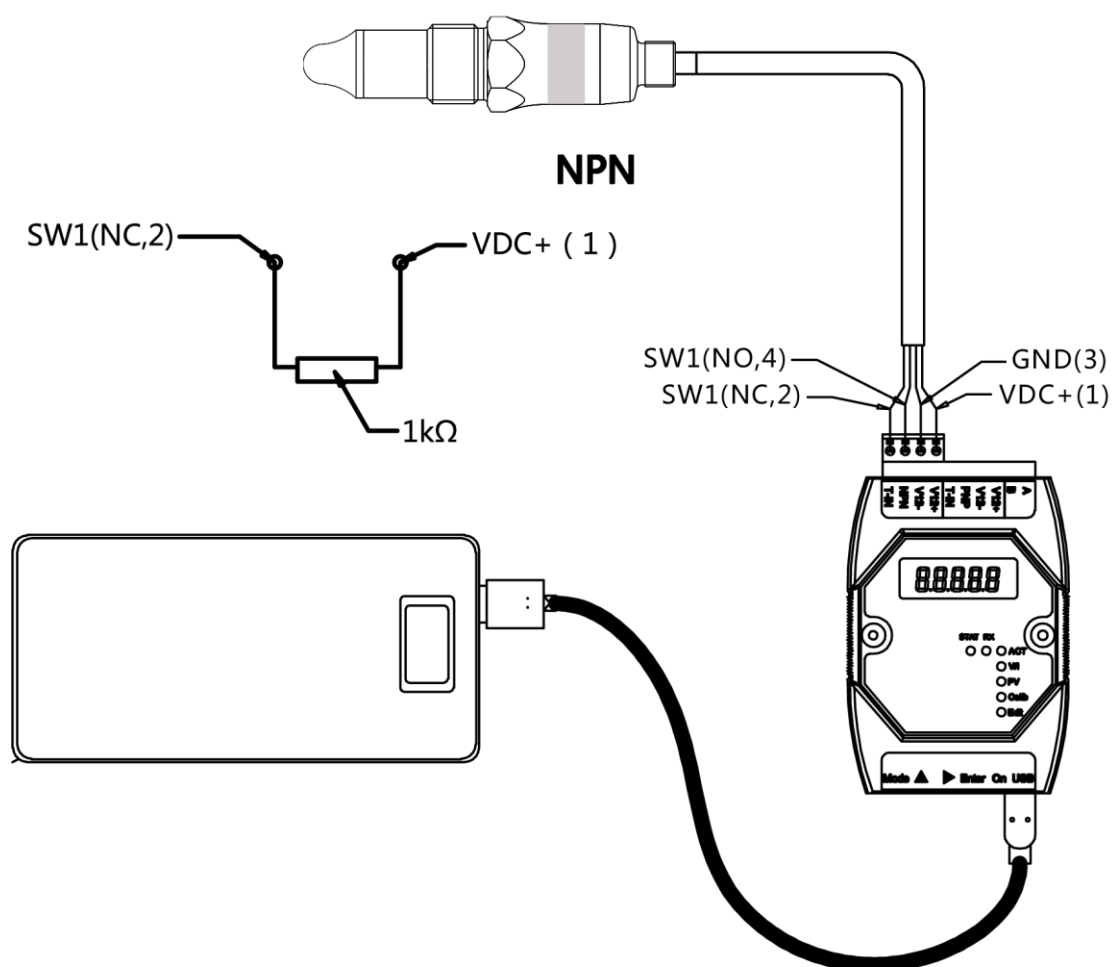


Fig. 4 连接 NPN 型料位开关

NPN 型开关接线顺序

电气连接类型	XR05 端子功能	XR05 线色或端子号	对应 KOMM700 手操器端子号
直接电缆引出	VDC+	白(1)	V12+
	GND	绿(3)	V12-
	SW1(NO)	黄(4)	NPN
	SW1(NC)	棕(2)	T-IN
M12 端子	VDC+	棕(1)	V12+
	GND	蓝(3)	V12-
	SW1(NO)	黑(4)	NPN

	SW1(NC)	白(2)	T-IN
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注意：NPN 型开关与标准型 KOMM700 手操器之间连接时，有一个 1K 欧姆的上拉电阻，在 VDC+和 SW1 (NC) 这两根线之间。专用型手操器（订货编号：KM70-NPN）有内置有 1K 欧姆电阻，因此不需要外接。

6.2 PNP 型开关与手操器接线（有 1k 附加电阻）

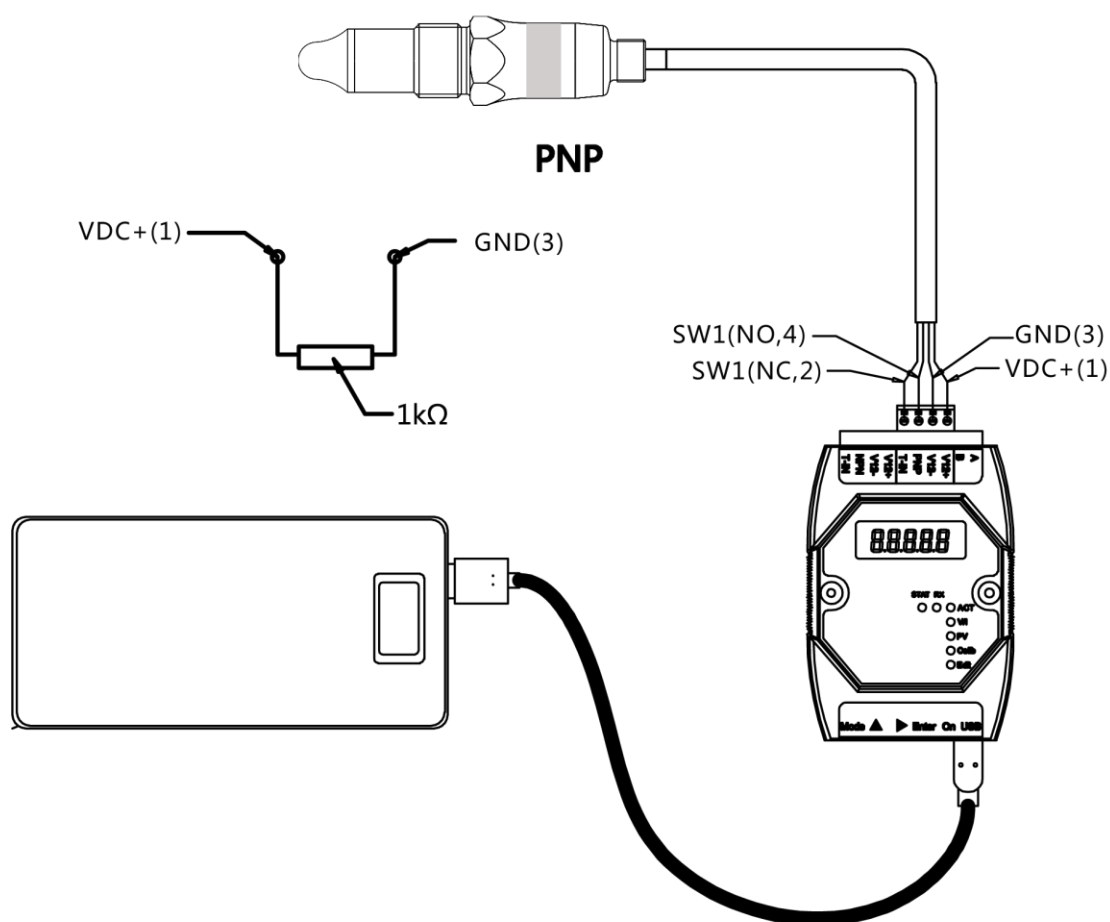


Fig. 5 连接 PNP 型料位开关



注意：PNP 型开关与标准型 KOMM700 手操器之间连接时，有一个 1K 欧姆的附加电阻，在 VDC+和 GND 这两根线之间。专用型手操器（订货编号：KM70-PNP）有内置有 1K 欧姆电阻，因此不需要外接。

PNP 型开关接线顺序

电气连接类型	XR05端子功能	XR05线色或端子号	KOMM700手操器端子号
直接电缆引出	VDC+	白(1)	V12+
	GND	绿(3)	V12-
	SW1(NO)	黄(4)	PNP
	SW1(NC)	棕(2)	T-IN
M12 端子	VDC+	棕(1)	V12+
	GND	蓝(3)	V12-
	SW1(NO)	黑(4)	PNP
	SW1(NC)	白(2)	T-IN

6.3 手操器操作示例

6.3.1 查看料位开关的 P1000 值及其他参数

例 1: 查看微波料位开关的 PV 及其他参数

1. 通电:

- 根据料位开关输出类型(NPN 或 PNP), 将料位开关的 4 根线连接到 KOMM700 手操器的 NPN 端子组(V12+, V12-, NPN, T-IN)或者 PNP 端子组(V12+, V12-, PNP, T-IN)。用 USB 为 KOMM700 手操器供电, 点击 **On** 按键开机。

2. 菜单组 Act 下解锁:

- 启动后, Act 指示灯亮, 表示当前菜单组为 Act, 屏幕显示 *UnLoc* 时, 点击 **Enter** 键, 屏幕显示 *yES* 字符. 并且开始闪烁, 再次点击 **Enter** 键确认, 开始解锁微波料位开关, 解锁时间通常 10 多秒。
- 解锁成功后, KOMM700 手操器的 RX 通信指示灯有周期性闪烁, STAT 指示灯常亮。
- 解锁成功后, KOMM700 手操器自动跳到 PV 菜单组, 显示当前测量值。

3. PV 菜单组下查看参数:

- 点击 **▶** 按键, 切换不同的参数, 其中最重要的几个参数是:
 - ◆ **P1000**: 当前测量值 (范围: 0~1000)
 - 校准后的仪表, 在空气中: P1000≈100。
 - 校准后的仪表, 在水中, P1000≈900。
 - ◆ **AL1**: SW1 开关的报警阈值 (水, 油, 固体粉料的报警阈值不同)
 - ◆ **AH1**: SW1 开关的报警回差
 - ◆ **do**: 输出方式 (0=NPN 或 1=PNP)
 - ◆ **dAmP**: 阻尼: 0~5

6.3.2 修改料位开关报警阈值 AL1

例 2: 修改料位开关的报警阈值 AL1

1. 通电:

- 根据料位开关输出类型(NPN 或 PNP), 将料位开关的 4 根线连接到 KOMM700 手操器的 NPN 端子组(V12+, V12-, NPN, T-IN) 或者 PNP 端子组(V12+, V12-, PNP, T-IN)。用 USB 为 KOMM700 手操器供电, 点击 **On** 按钮开机。

2. Act 菜单组解锁:

- 启动后, Act 指示灯亮, 屏幕显示 *UnLoc* 时, 点击 **Enter** 键, 屏幕显示 *yES* 字符。并且开始闪烁, 再次点击 **Enter** 键确认, 开始解锁微波料位开关, 解锁时间通常 10 多秒。
- 解锁成功后, KOMM700 手操器的 RX 通信指示灯有周期性闪烁, STAT 指示灯常亮。
- 解锁成功后, KOMM700 手操器自动跳到 PV 菜单组, 显示当前测量值。

3. PV 菜单组下查看并修改报警阈值 AL1

- 点击 **▶** 翻动菜单, 一直到屏幕显示 **AL1** 为止。
- 点击 **Enter** 键, KOMM700 手操器自动跳转到 **Edit** 编辑菜单组, 开始编辑修改 **AL1** 参数
 - **AL1** 常见设定阈值:
 - 水: 550
 - 泡沫: 350
 - 导电粘稠介质(例如面酱): 720
 - 油脂: 250
 - 固体颗粒(例如干茶叶): 180
 - 修改完成后, 点击 **Enter** 键, 屏幕显示 *yES* 并闪烁, 提示用户确认, 再次点击 **Enter** 键确认, KOMM700 手操器开始下载参数。
 - 下载通常持续 10 多秒, 下载完成后, RX 通信灯开始闪烁, STAT 灯也会常亮。如果修改成功, 屏幕上会显示 *PASS*。

4. ACT 菜单组下备份:

- 参数不再继续修改时, 应当切换到 Act 菜单组, 执行一次备份命令 **bkup**。

更多操作示例可见 KOMM700 手操器用户使用手册。

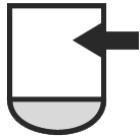

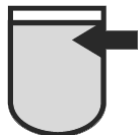

7. 调试

SW1 (NO) 和 SW1 (NC) 输出始终相反。方便用户根据不同应用场合(如上限报警或下限报警等), 通过接线来选择合适的报警输出信号。

7.1 指示灯 (双色)

- 料位开关共有 2 种颜色的 LED 指示灯，分别为蓝色和绿色，提供 2 种显示方式。
- 单色显示方式 (缺省)
 - 不接触物料蓝色 LED 灯熄灭，接触物料时蓝色 LED 灯亮。
 - 绿色 LED 灯不工作，一直熄灭。
- 双色切换显示方式，
 - 探头不接触物料时，绿色 LED 灯亮，蓝色 LED 灯熄灭。
 - 接触物料时，绿色 LED 灯熄灭，蓝色 LED 灯亮。

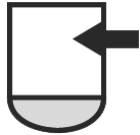

7.2 PNP 报警状态 (线 1 代表 VDC+)



	探头状态	LED 灯	SW1 (NO) (端子 4)	SW1 (NC) (端子 2)	端子 4 电压 (有负载时)	端子 2 电压 (有负载时)
	脱离介质		VDC+ SW1 1 ——— 4(NO)	VDC+ SW1 1 ——— 2(NC)	≈0	≈VDC
	介质覆盖		VDC+ SW1 1 ——— 4(NO)	VDC+ SW1 1 ——— 2(NC)	≈VDC	≈0



提示: PNP 输出模式下, 测量输出电压时, 必须带上负载, 负载最大电流不超过 20mA, 接线图参见 5.3 节。

7.3 NPN 报警状态 (线 3 代表 GND 0V)

	探头状态	LED 灯	SW1 (NO) (端子 4)	SW1 (NC) (端子 2)	端子 4 电压 (有负载时)	端子 2 电压 (有负载时)
	脱离介质		GND SW1 3 ——— 4(NO)	GND SW1 3 ——— 2(NC)	≈VDC	≈0

	介质覆盖		GND 3 — SW1 4(NO)	GND 3 — SW1 2(NC)	≈0	≈VDC
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提示：NPN 输出模式下，测量输出电压时，必须带上负载，负载最大电流不超过 20mA，接线图参见 5.3 节。

7.4 选择合适的报警阈值 AL1

料位开关通过频率扫描，实时监测过程变量 P1000（归一化的谐振频率）的变化，料位开关出厂前经过校准，校准后，探头在空气中时 $p1000 \approx 100$ ，探头在自来水中 $P1000 \approx 900$ 。当前测量值（P1000） \geq 报警阈值参数 AL1 时，指示灯点亮，SW1 激活。

常见介质的建议报警阈值参数 AL1：

介质	实例	建议报警值
水基溶液	自来水，酸，碱溶液	550(出厂缺省)
泡沫	啤酒泡沫	350
粘稠导电介质	面酱	720
油脂	食用油，润滑油	250
含水较低固体颗粒	干茶叶	180
含水较高固体颗粒	米，小麦	250

8. 故障排除

8.1 常见故障列表

故障情况	可能故障原因	处理方法
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LED 灯不亮	1 连接故障 2. 硬件故障 3. 参数错误	1. 检查电源供电电压。 2. 检查接线顺序。 3. 接线与供电都正常时, 用 KOMM700 手操器, 检查料位开关的工作电流是否为 0, 或者超过最大标称电流。 4. 电流正常时, 用 KOMM700 手操器连接料位开关, 执行解锁命令, 查看当前测量值及参数。如果无法通信, 需返厂。 5. 参数不正确时, 可以用 KOMM700 手操器执行 rESto 恢复命令, 恢复以前的备份过的参数。 6. 参数正确时, 检查信号强度 Sig1~6, 拍照或录像记录后, 与厂家技术联系。
LED 灯一直亮	1. 参数错误 2. 硬件故障	1. 用 KOMM700 手操器, 检查料位开关的工作电流是否超过标称的最大电流。 2 电流正常时, 用 KOMM700 手操器连接, 执行 UnLoc 解锁命令, 检查参数。如果无法通信, 需返厂。 3. 如果通信正常, 检查报警阈值 AL1 是否与当前工况适合。 4. 报警阈值不正确时, 可以用手操器执行 rESto 恢复命令, 恢复以前的备份过的参数, 或者重新设定合适的报警阈值。 5. 参数正确时, 检查信号强度 Sig1~6, 拍照或录像记录后, 与制造商联系。

8.2 检查工作电流与压降

用户可以使用 KOMM700 手操器快速的检查工作电流和输出压降指标。 具体步骤如下:

1. 通电:

- 根据料位开关输出类型(NPN 或 PNP), 将料位开关的 4 根线连接到 KOMM700 手操器的 NPN 端子组 (V12+, V12-, NPN, T-IN) 或者 PNP 端子组 (V12+, V12-, PNP, T-IN)。用 USB 为 KOMM700 手操器供电, 点击 **On** 按键开机。


2. V/I 菜单组下检查工作电流

- 点击 **Mode** 键, 进入 V/I 菜单组。
- 点击 **▶** 翻动菜单, 一直到屏幕显示 *mAx.x* 时停止, 此时显示值为当前电流值, 单位 mA。
- 不报警时, 料位开关典型工作电流 8~20mA 之间, 周期性微波扫频时, 最大 30~40mA。
- 报警时工作电流比不报警时, 增大 10~20mA。

3. 检查输出压降前, 必须先先在 Act 菜单组下解锁:

- 点击 **Mode** 键, 直到 Act 指示灯亮, 屏幕显示 *UnLoc* 时, 点击 **Enter** 键, 屏幕显示 *yES* 字符. 并且开始闪烁, 再次点击 **Enter** 键确认, 开始解锁微波料位开关, 解锁时间通常 10 多秒。
- 解锁成功后, KOMM700 手操器自动跳到 PV 菜单组, 显示参数内容。

4. V/I 菜单组下检查输出压降

- 点击 **Mode** 按键，一直到 V/I 指示灯亮。
- 点击  翻动菜单，一直到屏幕显示 **d x.xx** 为止。
- 将探头浸入水中，料位开关处于报警状态，屏幕显示 **d x.xx** 输出压降。
- 实际负载电流约 10mA 时，PNP 输出压降 3V 左右。
- 实际负载电流约 10mA 时，NPN 输出压降通常为 3V 左右。

9. 技术数据

环境条件		特性	
工作温度范围	<ul style="list-style-type: none"> ■ 电缆引出型 -25~70°C ■ M12 连接器型 -40~85°C 	重复性	■ ± 1 mm
储存温度范围	<ul style="list-style-type: none"> ■ 电缆引出型 -25~70°C ■ M12 连接器型 -40~85°C 	回差	■ ± 1 mm
环境湿度	■ <98%RH 冷凝	响应时间	■ 0.2s
防护等级	<ul style="list-style-type: none"> ■ IP67 ■ IP69K (电缆引出型+专用防水电缆) 	阻尼	■ 0~5 s (可调)
电源		输出信号	
供电电压范围	■ 12 ... 30 VDC	输出类型	<ul style="list-style-type: none"> ■ PNP ■ NPN
极性反接保护	■ 有	电流负载	■ 20 mA 最大
电流消耗 (空载)	■ 典型情况 8 mA, 最大 40 mA	短路保护	■ 有
		PNP/NPN 实际输出电压	<ul style="list-style-type: none"> ■ PNP: $(V_S - 1.5) \pm 0.5V$ Rload = 10 kΩ ■ NPN: $1.5 \pm 0.5V$, Rload = 10 kΩ
		泄漏电流	■ 最大 100 μA
		切换逻辑	<ul style="list-style-type: none"> ■ 常开 (NO) ■ 常闭 (NC)

常开(NO): 探头在空气中时, 开关断开。探头被介质覆盖时, 开关闭合 (激活)。

常闭(NC): 探头在空气中时, 开关闭合。探头被介质覆盖时, 开关断开 (激活)。

过程条件

型号	过程持续温度 Tamb < 50 °C 探头尖端浸入过程介 质最深 16mm	过程压力	短时最高过程温度 Tamb < 50 °C 探头尖端浸入过程介 质最深 16mm	短时最大过程压力 t < 1 h
XR05 标准型	-40 ~115°C	-0.1~10Mpa	135°C	-0.1~10Mpa
XR05 散热脖颈	-40~150°C	-0.1~10Mpa	150°C	-0.1~10Mpa

XR06 加长型微波料位开关



UG2020-002-1

使用手册

2020.09.01 Rev. C

1. 标志符号说明

1.1 警告符号



警告：如果用户忽略或者不遵守使用说明，将可能带来安全危险，导致严重伤害。



注意：如果用户忽略或者不遵守使用说明，将可能损坏设备或者造成数据丢失。



ESD：如果用户忽略或者不遵守使用说明，将可能对设备造成 ESD 静电放电损害。

1.2 其他符号



提示

1.3 安全注意事项



注意：本产品仅适用于检测介电常数大于等于 1.5 的固体颗粒，液体及浆料。



注意：不能用于测量对探头材料（PEEK）或者壳体材料有腐蚀性的介质。



警告：用户在安装，配置，调试前必须阅读过并能够正确理解本手册。



警告：用户安装时，只能使用功能正常的仪表。



警告：用户安装时，使用自制或其他厂家的套管，焊接底座等配件，我司不承担由该配件造成的问题责任。



警告：测量高温介质时，产品的外壳温度可能会超过 50℃，此时用户必须采取防护措施，避免可能的烫伤风险。



在有防爆要求的应用中，不能在危险区域用 KOMM700 手操器设置料位开关的参数。

2. 简介

XR06 加长型微波料位开关，适用于卫生、食品及工业应用。具有优秀的抗导电挂料能力，适应多种测量介质，并提供多种过程连接形式和多种输出信号，是传统的机械式、音叉、阻旋开关的理想替代产品。

与本公司其他系列微波料位开关比较，本产品可提供更长探杆长度，因此更适合高温应

用。同时，360° 可见的指示灯和内部接线端子，便于工业现场应用。

2.1 产品结构

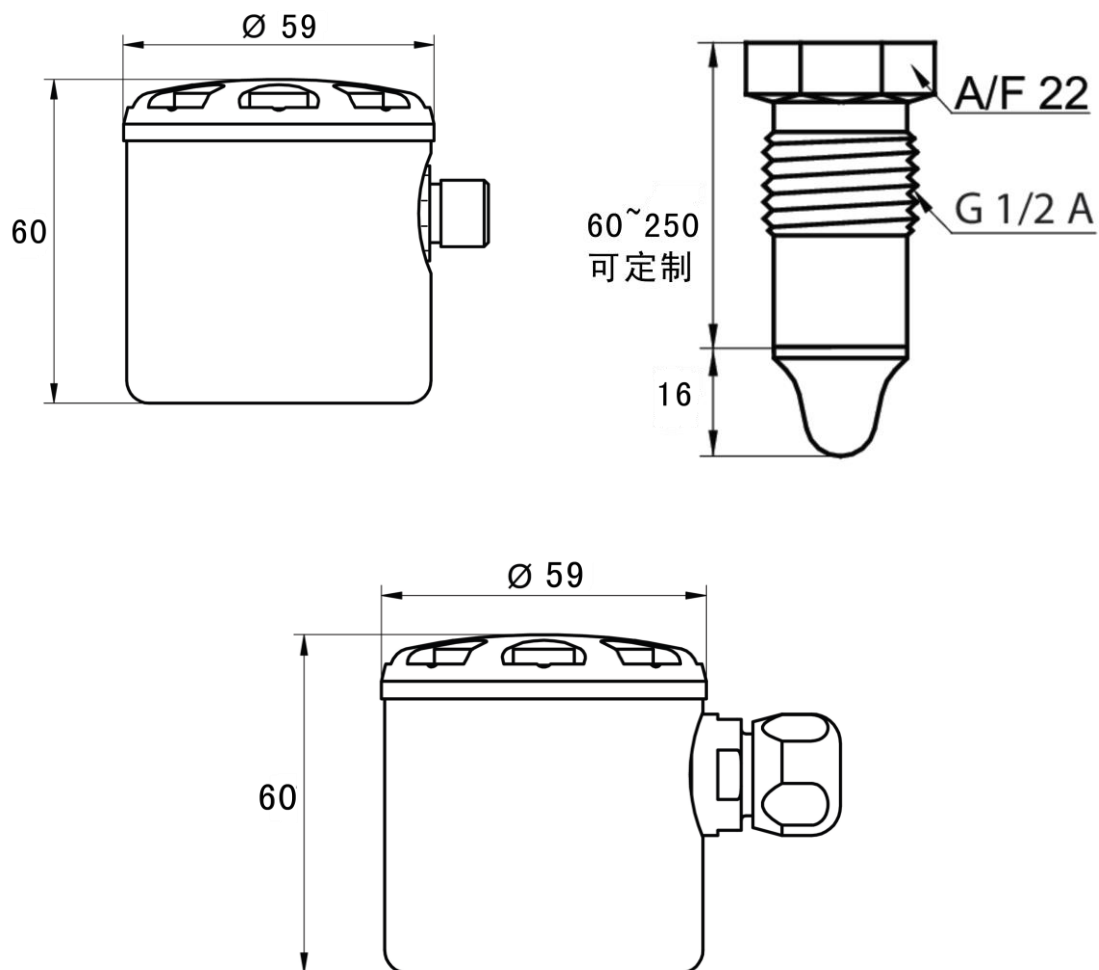


Fig. 1 XR06 结构尺寸

2.2 工作原理

本产品的探头、金属机壳与内部电子单元形成一个高频谐振电路。探头附近形成高频微波电场。当探头被介质覆盖或介质的介电常数改变时，谐振频率将发生较大的变化，内部电子单元通过比较当前谐振频率及用户设定报警阈值，开启或者关闭报警信号。该测量方法可有效的排除粘附性导电挂料的影响。

2.3 特点及应用场合

■应用性广	适用于介电常数 ≥ 1.5 的固体，液体及浆料
■加长探杆	<ul style="list-style-type: none"> ■ 适合有加厚保温层的罐体 ■ 有助于提高抗挂料能力 ■ 适合测量高温介质
■检测稳定	不受泡沫的影响
■抗挂料性	可有效检测粘性导电浆料
■指示明确	报警灯光 360 度可见
■接液材质 PEEK 及不锈钢	适合卫生及工业场合
■使用方便	可现场设定报警点及查看测量值
■适合高温介质	介质最高工作温度 200℃
■常开(NO)常闭(NC)输出	同时提供 NO 和 NC 输出，用户可通过接线选择，方便现场应用

2.4 应用限制

- 不适用于粗糙的介质（如石英砂）和很重的块状材料。
- 不适用于对探头及接液部分有腐蚀性的介质（如：臭氧化水）。
- 探头不能受紫外线辐射。

3. 铭牌及存储运输

3.1 铭牌

TYPE	选型编号
IN	输入电压和最大功耗电流 12 ~ 30V, 40mA
OUT	PNP、NPN, 最大外部负载 20mA
TAMP	-40℃ < 环境温度 < 85℃
SN	序列号
DATE	制造日期

3.2 储存和运输

储存条件:

储存温度: $-40\sim 85^{\circ}\text{C}$
使用原包装。

运输至测量点:

使用原包装将设备运输到测量点。

4. 安装

4.1 安装位置

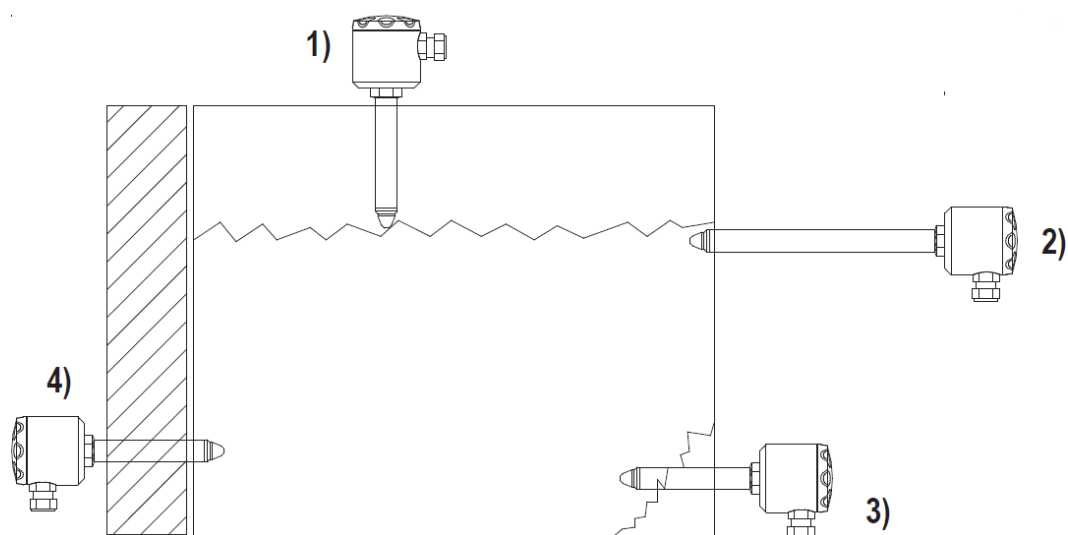


Fig.2 安装位置图

可以将料位开关安装在容器的任何部位。

1. 料位上限
2. 探杆在罐外，有助于散热，适用于高温介质测量
3. 料位下限（防止堆积物料影响）
4. 适用于罐壁较厚，有保温隔层的容器

4.2 常温介质安装注意事项



危险介质可导致伤害风险

- ▶ 穿戴针对危险介质（例如，各种酸、碱性溶液等）的防护装备。
- ▶ 安装前清空容器和管道。
- ▶ 料位开关旋紧时，力矩为 15~20 Nm。
- ▶ M12 连接器的螺丝，只能用手旋紧，不得使用扳手等工具，最大力矩 0.6 Nm。
- ▶ 工业型场合直接安装时，要求使用 PTFE 胶带缠绕螺纹。
- ▶ 卫生型场合安装时，不能使用 PTFE 胶带缠绕螺纹。

4.3 高温介质安装注意事项

除常温介质注意事项之外，还需要注意：



提示：说明书标称的最高工作温度，要求只有 PEEK 探头部分与介质接触。参见安装位置图 Fig.2 的第 2 种安装形式。安装位置不恰当会导致料位开关的实际最高工作温度低于标称值。

4.3.1 适用温度范围

探杆长度	环境温度	介质最高长期工作温度
标准型	-40~60℃	95℃
	-40~40℃	115℃
加长型，探杆露在罐外部分（散热）长度 100mm	-40~60℃	155℃
	-40~40℃	175℃
加长型，探杆露在罐外部分（散热）长度 250mm	-40~60℃	195℃
	-40~40℃	200℃

4.4 安装后检查

- ▶ 设备是否完好无损(目视检查)。
- ▶ 卫生型场合，要检查安装护套的泄放孔，方向是否朝下，是否有泄漏。
- ▶ 检查 M12 连接器的插头，是否旋紧。

5. 电气连接

5.1 内部等效电路

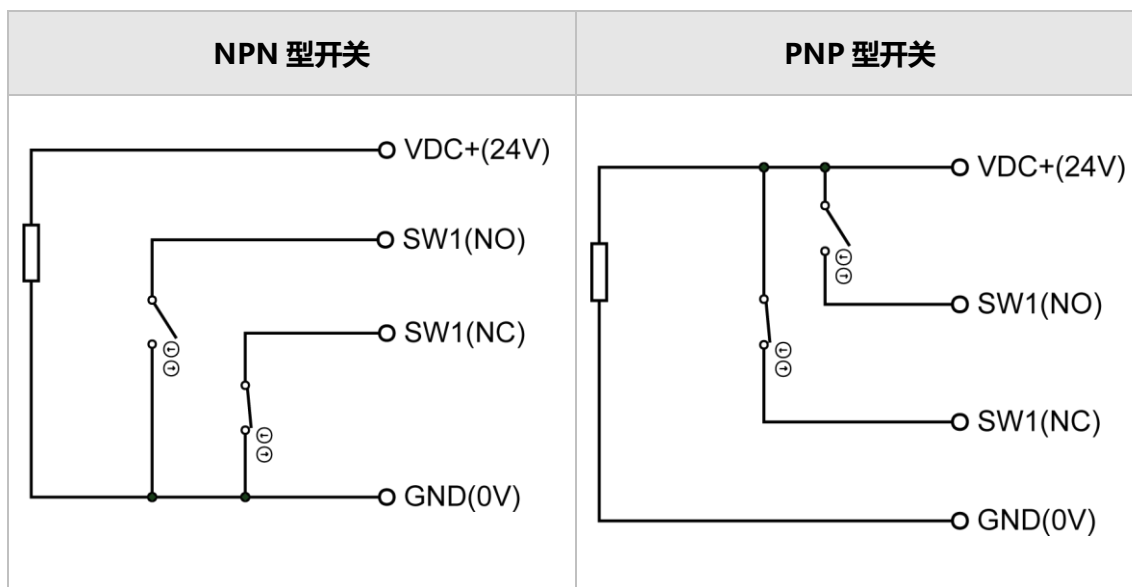


Fig. 3 XR06 开关等效电路

电路符号	含义	M12 连接器 端子号	M12 插头电缆 连线颜色	壳体内部 端子号
VDC+	直流电源+	1	棕	+
GND	直流电源-	3	蓝	-
SW1 (NO)	常开输出	4	黑	NO
SW1 (NC)	常闭输出	2	白	NC

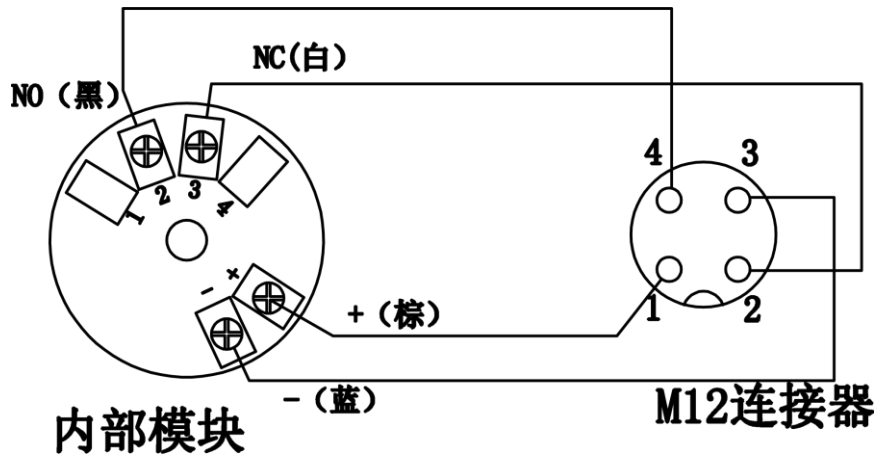
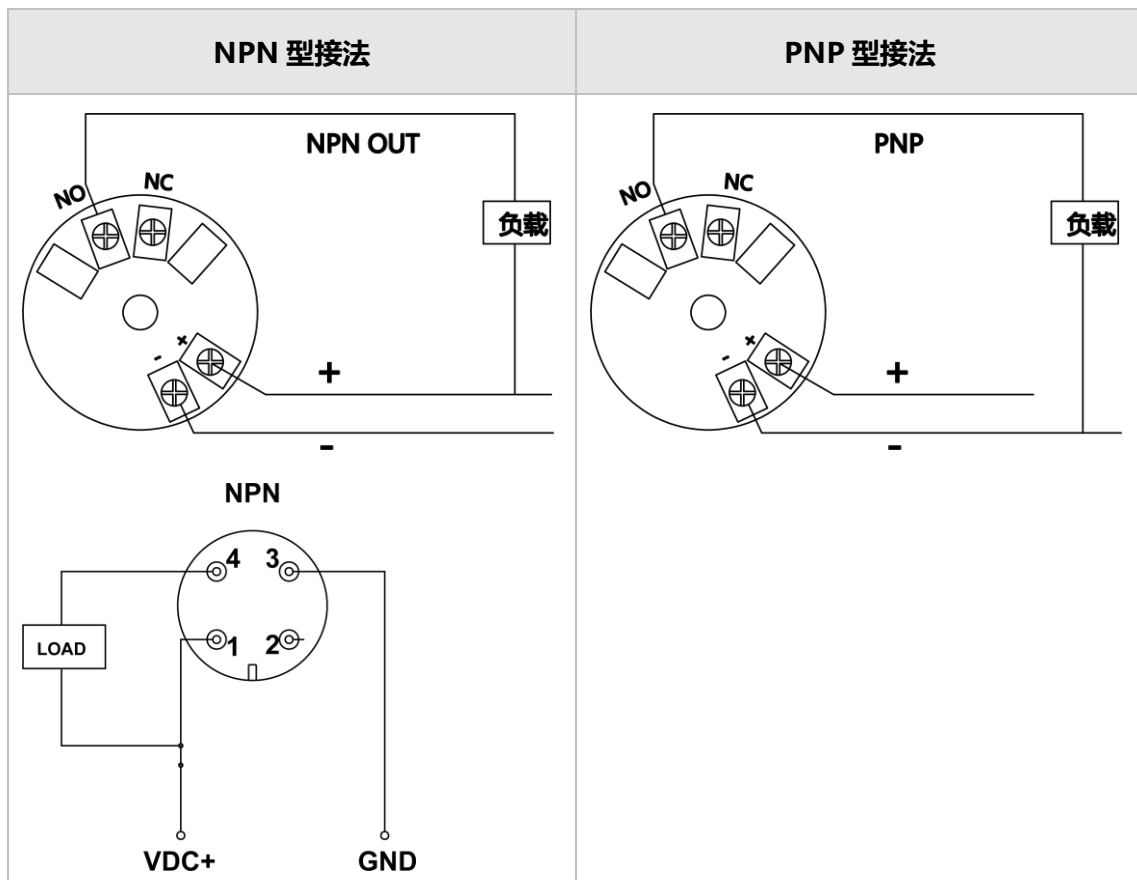
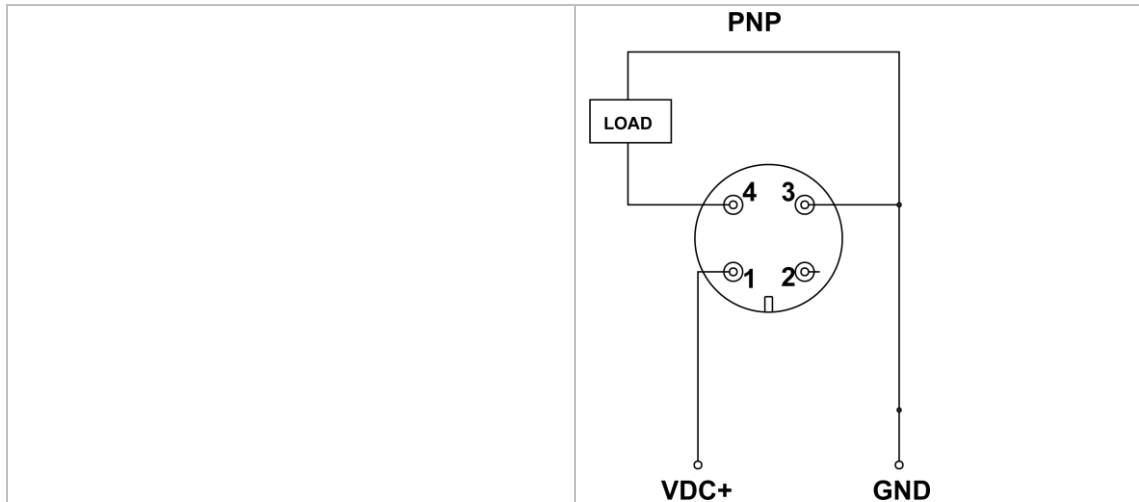


Fig. 4 内部端子和 M12 连接器之间连接

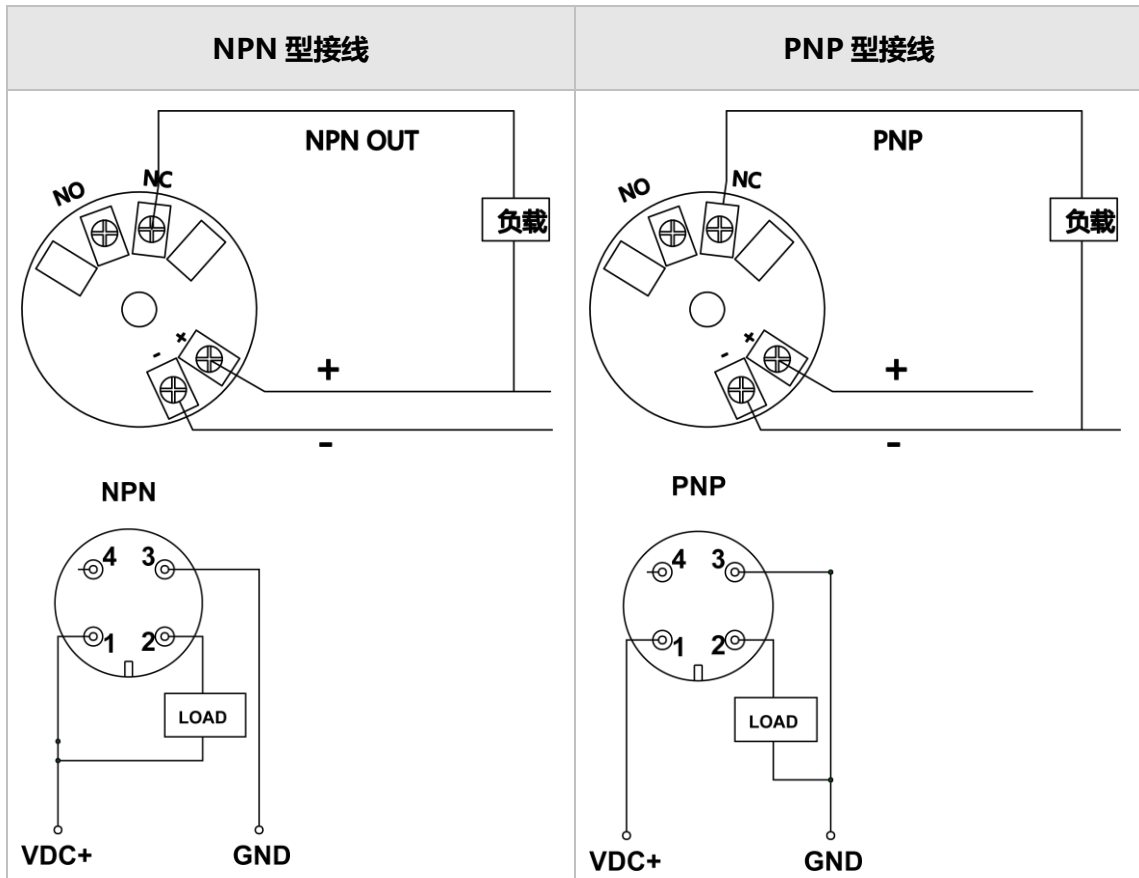
5.2 接线图

5.2.1 常开 (NO) 接法





5.2.2 常闭 (NC) 接线



5.3 连接后检查

- ▶ 设备或电缆是否完好无损(目视检查)?
- ▶ 电缆是否符合要求?
- ▶ 电缆是否已经完全消除应力?
- ▶ 供电电压是否与铭牌参数一致?
- ▶ 连接器插头是否旋紧?

6. 配置

- ▶ 手操器由 5V USB 供电，内部升压后，手操器可以为料位开关提供 12V 直流供电。
- ▶ 手操器内置蜂鸣器，当接收到料位开关的报警信号后，蜂鸣器响。

6.1 NPN 型开关与手操器接线（需上拉电阻）

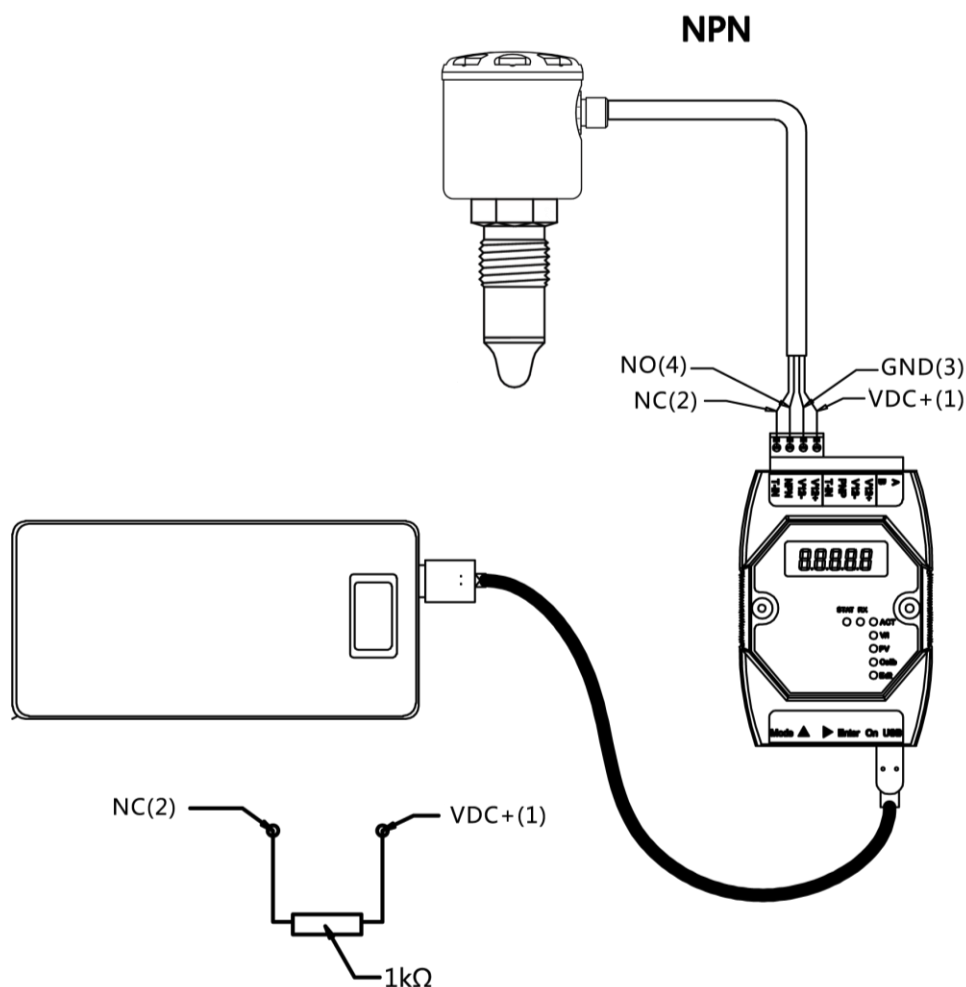


Fig. 4 连接 NPN 型料位开关



注意：NPN 型开关与标准型 KOMM700 手操器之间连接时，有一个 1K 欧姆的上拉电阻，在 VDC+ 和 NC 这两根线之间。专用型手操器（订货编号：KM70-NPN）有内置有 1K 欧姆电阻，因此不需要外接。

输出类型	XR06 M12 端子号及线色	XR06 内部端子号	KOMM700 手操器对应端子号
NPN	1 (棕)	+	V12+

	3 (蓝)	-	V12-
	4 (黑)	NO	NPN
	2 (白)	NC	T-IN

6.2 PNP 型开关与手操器接线

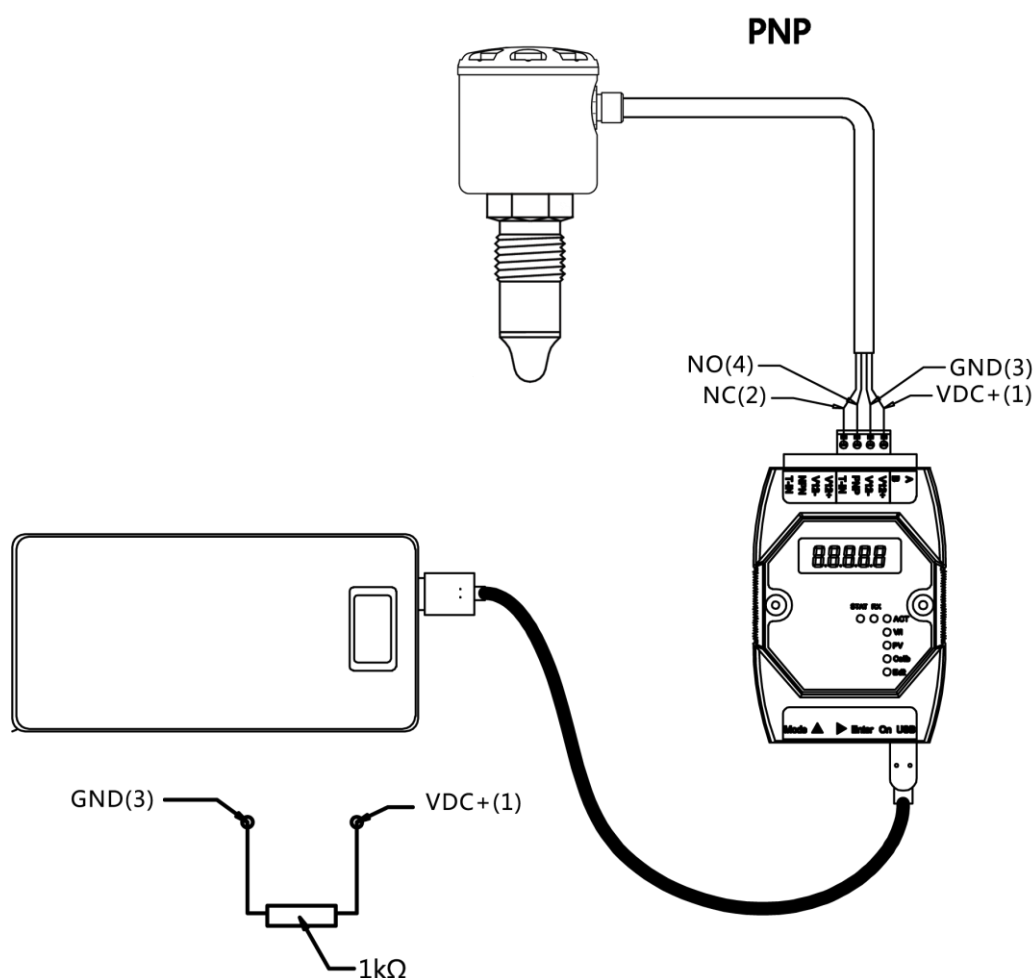


Fig. 5 连接 PNP 型料位开关



注意：PNP 型开关与通用型 KOMM700 手操器之间连接时，有一个 1K 欧姆的附加电阻，在 VDC+ 和 GND 这两根线之间。专用型手操器（订货编号：KM70-PNP）有内置有 1K 欧姆电阻，因此不需要外接。

输出类型	XR06	XR06	KOMM700
	M12 端子号及线色	内部端子号	手操器对应端子号
PNP	1 (棕)	+	V12+
	3 (蓝)	-	V12-
	4 (黑)	NO	PNP
	2 (白)	NC	T-IN

6.3 手操器操作说明

6.3.1 查看料位开关的 P1000 值及其他参数

示例：查看微波料位开关的 PV 及其他参数

1. 通电：

- 根据料位开关输出类型(NPN 或 PNP)，将料位开关的 4 根线连接到 KOMM700 手操器的 NPN 端子组 (V12+, V12-, NPN, T-IN) 或者 PNP 端子组 (V12+, V12-, PNP, T-IN)。用 USB 为 KOMM700 手操器供电，点击 **On** 按钮开机。

2. Act 菜单组下解锁：

- 启动后，Act 指示灯亮，屏幕显示 *UnLoc* 时，点击 **Enter** 键，屏幕显示 *yES* 字符。并且开始闪烁，再次点击 **Enter** 键确认，开始解锁料位开关，解锁时间通常 10 多秒。
- 解锁成功后，KOMM700 手操器的 RX 通信指示灯有周期性闪烁，STAT 指示灯常亮。
- 解锁成功后，KOMM700 手操器自动跳到 PV 菜单组，显示参数内容。

3. PV 菜单组下查看参数：

- 点击 **▶** 按钮，切换不同的参数，其中最重要的几个参数是：
 - ◆ **P1000**：当前测量值（范围：0~1000）
 - 校准后的仪表，在空气中：P1000≈100
 - 校准后的仪表，在水中，P1000≈900
 - ◆ **AL1**：SW1 开关的报警点（水，油，固体粉料的报警值不同）
 - ◆ **AH1**：SW1 开关的报警回差
 - ◆ **do**：输出方式（0=NPN 或 1=PNP）
 - ◆ **dAmP**：阻尼：0~5

6.3.2 修改料位开关报警阈值 AL1

示例：修改料位开关的报警阈值 **AL1**


1. 通电：

- 根据料位开关输出类型(NPN 或 PNP)，将料位开关的 4 根线连接到 KOMM700 手操器 NPN 端子组 (V12+, V12-, NPN, T-IN) 或者 PNP 端子组 (V12+, V12-, PNP, T-IN)。用 USB 为 KOMM700 手操器供电，点击 **On** 按钮开机。

2. Act 菜单组下解锁:

- 启动后, Act 指示灯亮, 屏幕显示 *UnLoc* 时, 点击 **Enter** 键, 屏幕显示 *yES* 字符. 并且开始闪烁, 再次点击 **Enter** 键确认, 开始解锁微波料位开关, 解锁时间通常 10 多秒。
- 解锁成功后, KOMM700 手操器的 RX 通信指示灯有周期性闪烁, STAT 指示灯常亮。
- 解锁成功后, KOMM700 手操器自动跳到 PV 菜单组, 显示参数内容。

3. PV 菜单组下查看并修改报警阈值 AL1

- 点击  翻动菜单, 一直到屏幕显示 AL1 为止。
- 点击 **Enter** 键, KOMM700 手操器自动跳转到 Edit 编辑菜单组, 开始编辑修改 AL1 参数
- AL1 参数通常需要根据实际测量情况设定。
 - 举例: 探头在空气中为 100, 在被测介质中为 900
 - AL1 可以选择两者的中间值 (50%点), 本例中为: 500
 - 如果介质为容易粘附的导电介质, 则可以选择 75~80%点, 例如 720。
- 修改完成后, 点击 **Enter** 键, 屏幕闪烁 *yES*, 提示用户确认, 再次点击 **Enter** 键后, KOMM700 手操器开始下载参数。
- 下载通常持续 10 多秒, 下载完成后, RX 通信灯开始闪烁, STAT 灯也会常亮。如果修改成功, 屏幕上会显示 *PASS*。

4. ACT 菜单组下备份:

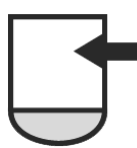

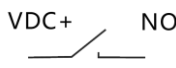
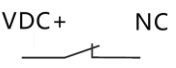
- 参数不再继续修改时, 应当切换到 Act 菜单组, 执行一次备份命令 **bkup**。



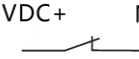
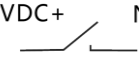
更多操作示例可见 KOMM700 手操器用户使用手册。

7. 调试

NO (M12 连接器 4 脚) 和 NC (M12 连接器 2 脚) 端子输出始终相反。方便用户根据不同应用场合 (如上限报警, 下限报警) 通过接线选择合适的报警输出信号。

7.1 PNP 报警状态



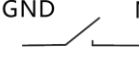
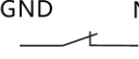


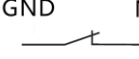
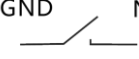
	探头状态	LED 灯	NO (M12 端子 4)	NC (M12 端子 2)	NO 电压 (有负载时)	NC 电压 (有负载时)
	脱离介质				0	≈VDC

	介质覆盖		VDC+ NO 	VDC+ NC 	≈VDC	0
---	------	---	--	--	------	---



PNP 输出模式下，测量输出电压时，必须带上一个最大电流不超过 20mA 的负载（如 24V 继电器，蜂鸣器，指示灯等）。见 5.2 节接线图。

7.2 NPN 报警状态

	探头状态	LED 灯	NO (M12 端子 4)	NC (M12 端子 2)	NO 电压 (有负载时)	NC 电压 (有负载时)
	脱离介质		GND NO 	GND NC 	≈VDC	0
	介质覆盖		GND NO 	GND NC 	0	≈VDC



NPN 输出模式下，测量输出电压时，必须带上一个最大电流不超过 20mA 的负载（如 24V 继电器，蜂鸣器，指示灯等），见 5.2 节接线图。

7.3 选择合适的报警阈值参数 AL1

料位开关通过频率扫描，随时监测过程变量 P1000（归一化的谐振频率）的变化，料位开关出厂前经过校准，校准后，探头在空气中时 P1000≈100，探头在自来水中 P1000≈900。当前测量值（P1000）≥报警阈值参数 AL1 时，指示灯亮，开关激活。

举例：

1. 假设当前料位开关已经安装在现场罐上。
2. 探头未被介质覆盖时，P1000 值为 150，
3. 探头被介质全部覆盖时，P1000 值为 950.
4. 假设介质不产生挂料情况，则报警点可设定为 60%处。
5. 具体公式：AL1= 150+ (950-150)*60%
6. AL1=630
7. 假设介质容易产生挂料，则报警点建议设定 75%~80%间。

8. 具体公式: $AL1 = 150 + (950 - 150) * 75\%$
9. $AL1 = 750$

8. 故障排除

8.1 常见故障列表

故障情况	可能故障原因	处理方法
LED 灯不亮	<ol style="list-style-type: none"> 1 连接故障 2. 硬件故障 3. 参数错误 	<ol style="list-style-type: none"> 1. 检查电源供电电压。 2. 检查接线顺序。 3. 接线与供电都正常时, 用 KOMM700 手操器, 检查料位开关的工作电流是否为 0, 或者超过最大标称电流。 4. 用手操器连接料位开关, 解锁后查看当前测量值及参数。如果无法通信, 建议返厂维修。 5. 如果参数不正确, 可以用 KOMM700 手操器执行 rESto 恢复命令, 恢复以前的备份过的参数。 6. 参数正确时, 检查信号强度 Sig1~6, 记录或拍照录像后与厂家联系。
LED 灯一直亮	<ol style="list-style-type: none"> 1. 参数错误 2. 硬件故障 	<ol style="list-style-type: none"> 1. 用 KOMM700 手操器, 检查料位开关的工作电流是否超过标称的最大电流。 2. 电流正常时, 用 KOMM700 手操器连接并检查参数。如果无法通信连接, 建议返厂维修。 3. 如果通信正常, 检查仪表报警阈值 AL1 是否设置的过低, 导致一直报警。 4. 参数不正确时, 可以用手操器执行 rESto 恢复命令, 恢复以前的备份过的参数, 或者重新设定报警阈值 AL1。 5. 参数正确时, 检查信号强度 Sig1~6, 记录或拍照录像后, 与厂家联系。

8.2 检查工作电流与压降

用户可以使用 KOMM700 手操器快速的检查工作电流和输出压降指标。 具体步骤如下:

1. 通电:

- 根据料位开关输出类型(NPN 或 PNP), 将料位开关的 4 根线连接到 KOMM700 手操器 NPN 端子组 (V12+, V12-, NPN, T-IN) 或者 PNP 端子组 (V12+, V12-, PNP,

T-IN)。用 USB 为 KOMM700 手操器供电，点击 **On** 按键开机。

2. V/I 菜单组下检查工作电流

- 点击 **Mode** 键，进入 V/I 菜单组。
- 点击 **▶** 翻动菜单，屏幕显示 *mAxx.x* 时停止，这里就是当前电流功耗。
- 不报警时，料位开关典型工作电流 8~20mA 之间，周期性微波扫频时，最大 30~40mA。
- 报警时电流比不报警时，增大 10~20mA。

3. Act 菜单组下解锁：

- 点击 **Mode** 键，直到 Act 指示灯亮，屏幕显示 *UnLoc* 时，点击 **Enter** 键，屏幕显示 *yES* 字符，并且开始闪烁，再次点击 **Enter** 键确认，开始解锁微波料位开关，解锁时间通常 10 多秒。
- 解锁成功后，KOMM700 手操器自动跳到 PV 菜单组，显示参数内容。

4. V/I 菜单组下检查输出压降

- 点击 **Mode** 键，一直翻动到 V/I 菜单组。
- 点击 **▶** 翻动菜单，一直到屏幕显示 *d x.xx* 为止。
- 将料位开关探头浸入水中，料位开关处于报警状态，观察 *d x.xx* 数值，这就是输出压降。
- 负载电流约 10mA，PNP 输出压降通常 3V 左右或更低。
- 负载电流约 10mA，NPN 输出压降通常 3V 左右或更低。

9. 技术指标

环境条件		特征	
工作温度范围	■ -40 ... -85 °C	重复性	■ ± 1 mm
储存温度范围	■ -40 ... -85 °C	回差	■ ± 1 mm
环境湿度	■ <98%RH 冷凝	响应时间	■ 0.2s
防护等级	■ IP67	阻尼	■ 0 ~5 s (可调)
电源		输出信号	
供电电压范围	■ 12 ... 30 V DC	输出类型	■ PNP ■ NPN
极性反接保护	■ 有	电流负载	■ 20 mA 最大
电流消耗 (空载)	■ 典型情况 8 mA, 最大 40 mA	短路保护	■ 有
电源中断时间	■ 1ms	PNP/NPP 实际输出电压	■ PNP: (VS- 1.5)±0.5V Rload = 10 kΩ ■ NPN:1.5±0.5V , Rload = 10 kΩ
		泄漏电流	■ 最大 100 μA
		切换逻辑	■ 常开 (NO) ■ 常闭 (NC)

常开 (NO) : 探头在空气中时, 开关断开。探头被介质覆盖时, 开关闭合 (激活)。

常闭 (NC) : 探头在空气中时, 开关闭合。探头被介质覆盖时, 开关断开 (激活)。

过程条件

探杆结构	过程持续温度 (Tamb < 40 °C) 探头仅 PEEK 部分 接触介质	过程压力	短时最高过程温度 Tamb < 40 °C 探头仅 PEEK 部分接 触介质	短时最大过程压力 t < 1 h
标准型	-40 ~115°C	-0.1~10Mpa	140°C	-0.1~10Mpa

探杆露出 罐外长度 100mm	-40~175°C	-0.1~10Mpa	150°C	-0.1~10Mpa
探杆露出 罐外长度 250mm	-40~200°C	-0.1~10Mpa	200°C	-0.1~10Mpa

XR07 双输出型微波料位开关



UG2020-003-1

使用手册

2020.09.01 Rev. C

1. 标志符号说明

1.1 警告符号



警告：如果用户忽略或者不遵守使用说明，将可能带来安全危险，导致严重伤害。



注意：如果用户忽略或者不遵守使用说明，将可能损坏设备或者造成数据丢失。



ESD：如果用户忽略或者不遵守使用说明，将可能对设备造成 ESD 静电放电损害。

1.2 其他符号



提示

1.3 安全注意事项



注意：本产品仅适用于检测介电常数大于等于 1.5 的固体颗粒、液体及浆料。



注意：不能用于测量对探头材料（PEEK）或者壳体材料有腐蚀性的介质。



警告：用户在安装，配置，调试前必须经过培训，阅读过并能够正确理解本手册。



警告：用户安装时，只能使用功能正常的仪表



警告：用户安装时，使用自制或其他厂家的套管，焊接底座等配件，我司不承担由该配件造成的问题责任。



警告：测量介质温度较高时，本产品的外壳温度可能会超过 50°C，此时用户必须采取防护措施，避免可能的烫伤风险。



在防爆应用中，不能用 KOMM700 手操器在危险区域设置料位开关的参数。

2. 简介

XR07 双输出型微波料位开关，适用于卫生、食品及工业应用。具有优秀的抗导电挂料能力，适应多种测量介质，并提供多种过程连接形式和多种输出信号，是传统的机械式、音叉、阻旋开关的理想替代产品。

与本公司其他系列微波料位开关比较，本产品的显著特点是：提供双路独立输出，因此可用于分层介质检测。同时，本产品提供了串口数据上传以及 PWM 数据上功能，更加适用于复杂以及对要求严格控制品质的应用。

2.1 产品结构

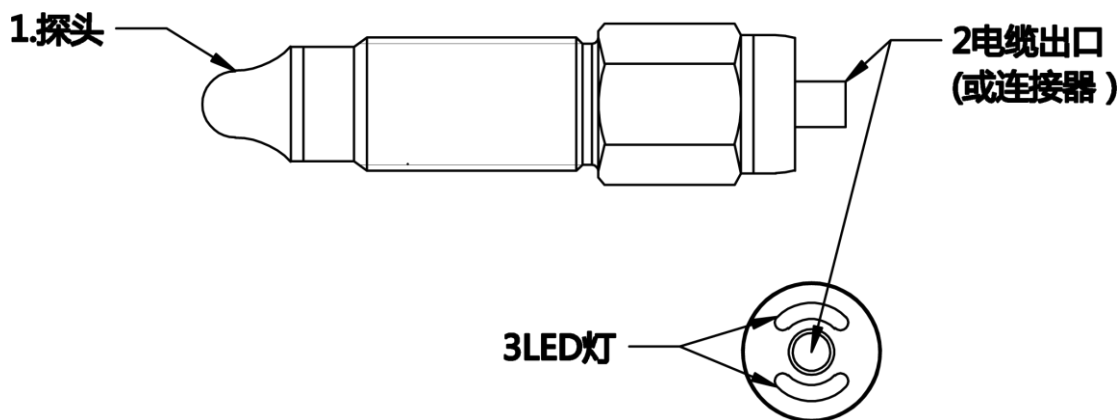


Fig. 1 XR07 结构图

2.2 工作原理

本产品的探头、金属外壳及内部电子单元形成一个高频谐振电路。探头附近形成高频微波电场。探头被介质覆盖或介质的介电常数改变时，谐振频率将发生较大的变化，内部电子单元通过比较当前谐振频率及用户设定报警阈值，开启或者关闭报警信号。该测量方法

可有效的排除粘附性导电挂料的影响。

2.3 特点及应用场合

■应用性广	适用于介电常数 ≥ 1.5 的固体、液体及浆料
■2路独立报警	可检测分层介质，如啤酒和泡沫，油和水等。
■抗挂料性	多种探头结构，有效检测粘附性导电浆料
■结构紧凑	适合狭小空间安装
■接液材质 PEEK 及不锈钢	适合卫生及工业应用
■使用方便	可使用手操器现场设定报警点及查看测量值
■数据上传	提供 1 路 24V 串口数据上传
■PWM 输出	可利用 PWM 输出过程变量
■常开(NO)常闭(NC)输出	第一路报警 NO 输出，第二路报警 NC 输出，输出方式不可改变

2.4 应用限制

- 不适用于粗糙的介质（如石英砂）和很重的块状材料。
- 不适用于对探头及接液部分有腐蚀性的介质（如：臭氧化水）。
- 探头不能受紫外线辐射。

3. 铭牌及运输存储

3.1 铭牌

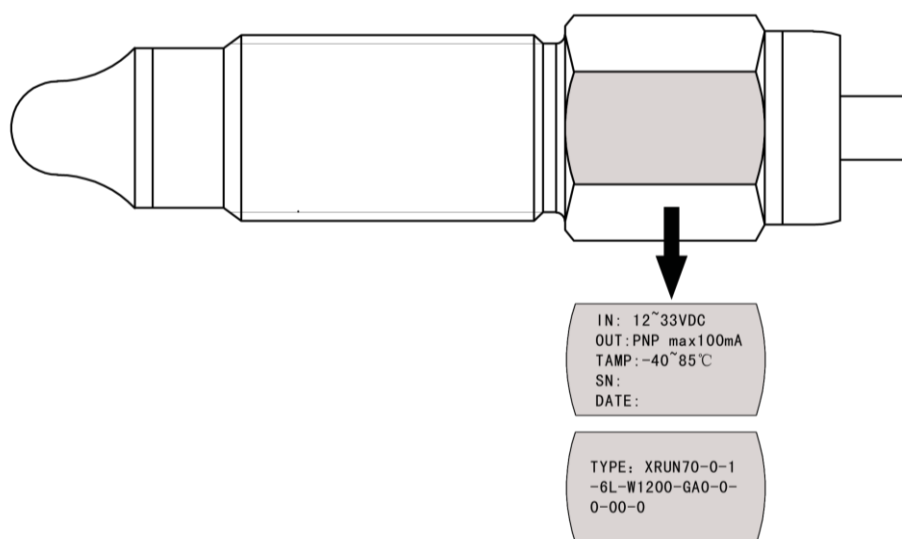


Fig. 2 铭牌示意图

TYPE	选型编号
IN	输入电压和最大功耗电流 12 ~ 33V, 40mA
OUT	PNP、NPN, 最大外部负载 100mA
TAMP	-40°C < 环境温度 < 85°C
SN	序列号
DATE	制造日期

3.2 储存和运输

储存条件:

储存温度: -40~85°C
 使用原包装。

运输至测量点:

使用原包装将设备运输到测量点。

4. 安装

4.1 安装位置

测量设备可以安装在管道或罐体中的任意位置处。使用套筒扳手可以将测量设备安装在难于操作的测量点。

- 料位上限
- 料位下限
- 干运行保护

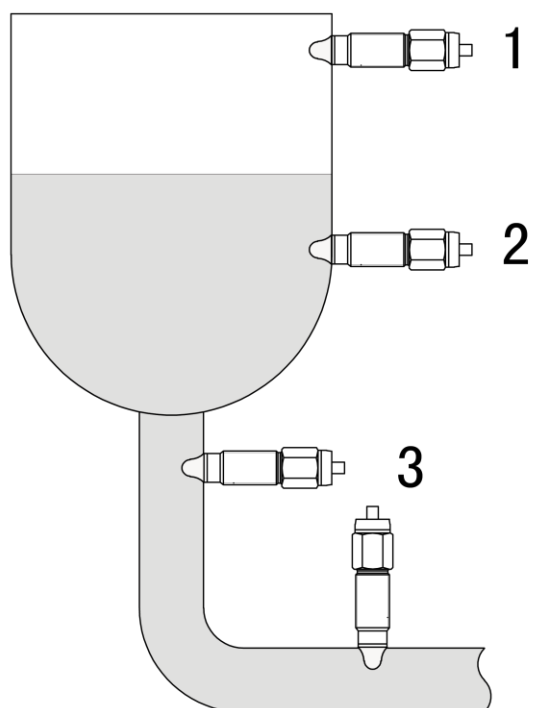


Fig.3 安装位置图

4.2 工业型场合安装




危险介质可导致伤害风险

- ▶ 穿戴针对危险介质（例如，各种酸、碱性溶液等）的防护装备。
- ▶ 安装前清空容器和管道。

4.2.1 直接安装

具体步骤如下：

1. 安装前和安装时，确保容器和管道内没有介质。
2.  必须用 PTFE 胶带缠绕在料位开关的螺纹上。
3. 用扳手（22AF）将料位开关旋进安装孔（G1/2）。
4. 旋紧力矩 30 Nm。

4.2.2 使用不锈钢过程连接器安装



注意：使用不锈钢过程连接器时，可以利用密封垫圈或者连接器的锥面密封，PTFE 胶带不是必须的。

具体步骤如下：

1. 安装前和安装时，确保容器和管道内没有介质。
2. 首先在现场容器或管道上安装不锈钢过程连接器。
3. 将料位开关旋进过程连接器。
4. 旋紧力矩 15~20 Nm。

4.2.3 使用塑料（如 PTFE）过程连接器安装



注意：使用塑料过程连接器时，可以利用密封垫圈或者锥面密封，PTFE 胶带不是必须的。

具体步骤如下：

1. 安装前和安装时，确保容器和管道内没有介质。
2. 首先在现场容器或管道上安装过程连接器。
3. 根据过程连接器的密封性，决定是否使用 PTFE 胶带。
4. 将料位开关旋进过程连接器。
5. 旋紧力矩 15~20 Nm。
6. 接地处理：料位开关金属外壳与金属罐壁（Frame Ground）之间，应当通过导线或者金属夹连接。

4.3 卫生型场合安装



危险介质可导致伤害风险

- ▶ 卫生型场合安装只能使用焊接套管（不锈钢）。
- ▶ 卫生型场合不能使用 PTFE 胶带，或者其他弹性体密封。
- ▶ 必须由在卫生领域接受过培训的焊工完成焊接工作。

4.3.1 焊接套管安装

具体步骤如下：

1. 安装前和安装时，确保容器和管道内没有介质。
2. 焊入式套管或接合器以卫生的方式进行安装且内部齐平。
3. 焊缝打磨至 $Ra < 0.8 \mu m$ 。
4. 泄漏口指向下方。
5. 旋紧料位开关。
6. 旋紧力矩 10~15 Nm。

4.4 安装后检查

- ▶ 设备是否完好无损（目视检查）？
- ▶ 是否采取充足的防护措施防止设备直接日晒雨淋？
- ▶ 设备是否正确固定？

5. 电气连接



本产品电气接口分为：**电缆直接引出型**、**M12 四芯连接器**两种。两种接口使用的线色不同，安装时需注意。

5.1 工作模式

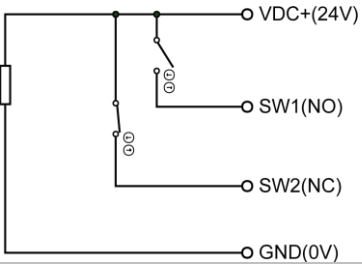
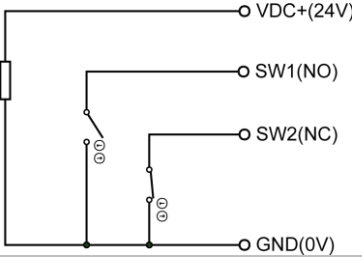
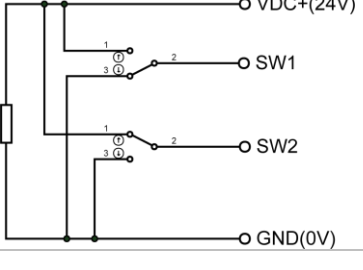
设定参数	功能	说明
mode = 0	单路报警模式（缺省）	当测量值 $P1000 \geq AL1$ 时，SW1（常开），SW2（常闭）同时激活，此时 SW1 导通，SW2 断开，两者输出永远相反。本模式与 XR05 兼容。
mode=1	双路报警模式（NO+NC）	$P1000 \geq AL1$ 时 SW1（常开）导通（激活状态） $P1000 \geq AL2$ 时 SW2（常闭）断开（激活状态）
mode = 2	双路报警模式（NO+NO）	$P1000 \geq AL1$ 时 SW1（常开）导通（激活状态） $P1000 \geq AL2$ 时 SW2（常开）导通（激活状态）
mode = 3	串行数据上传	$P1000 \geq AL1$ 时 SW1（常开）导通（激活状态） SW2 线上传输 9600bps，8N1 格式的串口数据 高电平 24V 代表 1，低电平 0V 代表 0
mode = 4	PWM 输出	$P1000 \geq AL1$ 时 SW1（常开）导通（激活状态） SW2 线采用 PWM 脉冲宽度调制上传 P1000 数据

5.2 端子含义，编号及对应颜色

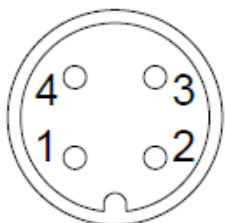
电路符号	含义	M12 端子号 及连线颜色	电缆直接引出型 连线颜色
VDC+	直流电源+	棕 1	白
SW2	第二路开关量输出	白 2	棕
GND	直流电源-	蓝 3	绿
SW1	第一路开关量输出	黑 4	黄

5.3 电缆直接引出型等效电路（Mode=0 或 1）

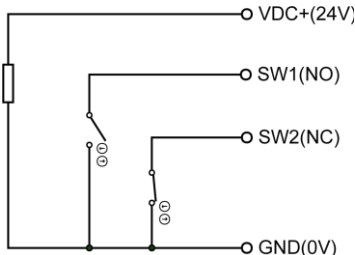
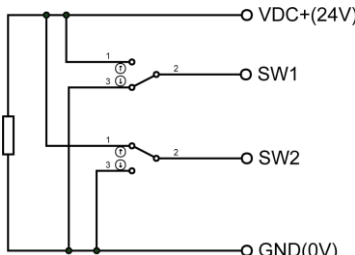
输出类型	料位开关内部等效电路	引脚功能（颜色或线号）
------	------------	-------------

PNP		VDC+ 白 1 SW1 (NO) 黄 4 SW2 (NC) 棕 2 GND (0V) 绿 3
NPN		VDC+ 白 1 SW1 (NO) 黄 4 SW2 (NC) 棕 2 GND (0V) 绿 3
数字输出 推挽式		VDC+ 白 1 SW1 黄 4 SW2 棕 2 GND (0V) 绿 3

5.4 M12 连接器型等效电路 (Mode=0 或 1)



输出类型	料位开关内部等效电路	功能 M12 端子号 电缆颜色
PNP		VDC+ 1 棕 SW1 (NO) 4 黑 SW2 (NC) 2 白 GND (0V) 3 蓝

NPN		<table border="0"> <tr> <td>VDC+</td> <td>1</td> <td>棕</td> </tr> <tr> <td>SW1 (NO)</td> <td>4</td> <td>黑</td> </tr> <tr> <td>SW2 (NC)</td> <td>2</td> <td>白</td> </tr> <tr> <td>GND (0V)</td> <td>3</td> <td>蓝</td> </tr> </table>	VDC+	1	棕	SW1 (NO)	4	黑	SW2 (NC)	2	白	GND (0V)	3	蓝
VDC+	1	棕												
SW1 (NO)	4	黑												
SW2 (NC)	2	白												
GND (0V)	3	蓝												
数字输出 推挽式		<table border="0"> <tr> <td>VDC+</td> <td>1</td> <td>棕</td> </tr> <tr> <td>SW1</td> <td>4</td> <td>黑</td> </tr> <tr> <td>SW2</td> <td>2</td> <td>白</td> </tr> <tr> <td>GND (0V)</td> <td>3</td> <td>蓝</td> </tr> </table>	VDC+	1	棕	SW1	4	黑	SW2	2	白	GND (0V)	3	蓝
VDC+	1	棕												
SW1	4	黑												
SW2	2	白												
GND (0V)	3	蓝												

5.5 连接后检查

- ▶ 设备或电缆是否完好无损(目视检查)?
- ▶ 电缆是否符合要求?
- ▶ 电缆是否已经完全消除应力?
- ▶ 供电电压是否与铭牌参数一致?
- ▶ 连接器插头是否旋紧?

6. 配置

- ▶ 手操器由 5V USB 供电，同时手操器为料位开关提供 12V 直流供电。
- ▶ 当接收到料位开关的报警信号后，手操器内置的蜂鸣器响。

6.1 NPN 开关与手操器接线

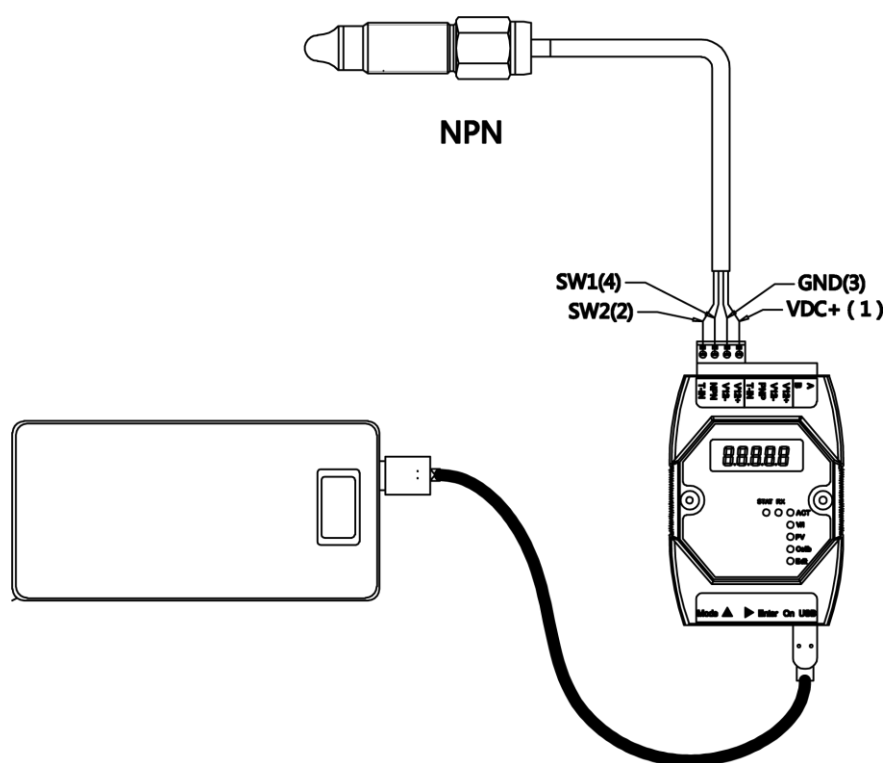


Fig. 4 连接 NPN 型料位开关

NPN 型开关接线顺序

电气连接类型	电路符号	XR07 线色或端子号	KOMM700 手操器端子号
直接电缆引出 (白绿黄棕)	VDC+	白(1)	V12+
	GND	绿(3)	V12-
	SW1	黄(4)	NPN
	SW2	棕(2)	T-IN

M12 端子 (棕蓝黑白)	VDC+	棕(1)	V12+
	GND	蓝(3)	V12-
	SW1	黑(4)	NPN
	SW2	白(2)	T-IN

6.2 PNP 开关与手操器接线

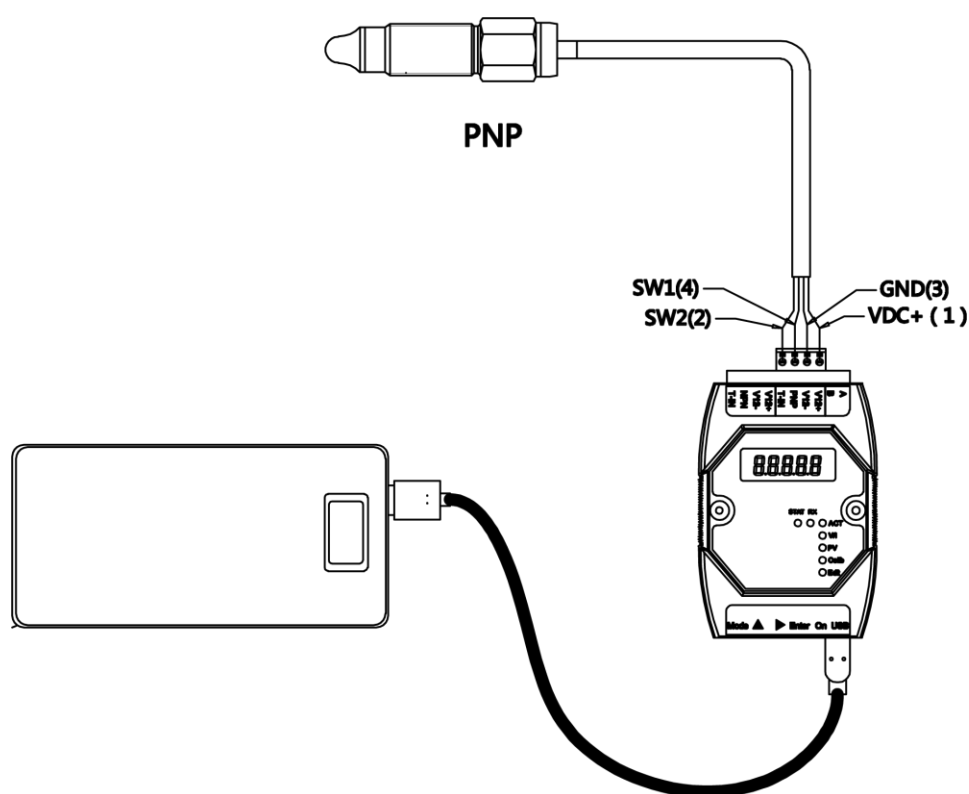


Fig. 5 连接 PNP 型料位开关

PNP 型开关接线顺序

电气连接类型	电路符号	XR07 线色 或端子号	KOMM700 端子号
直接电缆 引出	VDC+	白(1)	V12+
	GND	绿(3)	V12-
	SW1	黄(4)	PNP
	SW2	棕(2)	T-IN
M12 端子	VDC+	棕(1)	V12+
	GND	蓝(3)	V12-

	SW1	黑(4)	PNP
	SW2	白(2)	T-IN



注意：XR07 微波料位开关和标准型 KOMM700 手操器之间连接时，不需要附加电阻。

6.3 手操器操作说明

6.3.1 查看料位开关的 P1000 值及参数

示例：查看微波料位开关的 P1000 及当前工作模式

1. 通电：

- 根据料位开关输出类型(NPN 或 PNP)，将料位开关的 4 根线连接到 KOMM700 手操器的 NPN 端子组 (V12+, V12-, NPN, T-IN) 或者 PNP 端子组 (V12+, V12-, PNP, T-IN)。用 USB 为 KOMM700 手操器供电，点击 **On** 按键开机。

2. Act 菜单组下解锁：

- 启动后，Act 指示灯亮，屏幕显示 *UnLoc* 时，点击 **Enter** 键，屏幕显示 *yES* 字符。并且开始闪烁，再次点击 **Enter** 键确认，开始解锁微波料位开关，解锁时间通常 10 多秒。
- 解锁成功后，KOMM700 手操器的 RX 通信指示灯有周期性闪烁，STAT 指示灯常亮。
- 解锁成功后，KOMM700 手操器自动跳到 PV 菜单组，显示参数内容。

3. PV 菜单组下查看参数：

- 点击 **▶** 按键，切换不同的参数，其中最重要的几个参数是：
 - ◆ **CodE**：当前工作模式指示
 - 700 当前单点报警 modE=0
 - 701 当前双点报警 (NO+NC) modE=1
 - 702 当前双点报警 (NO+NO) modE=2
 - 703 当前数据上传模式 modE=3
 - 704 当前 PWM 输出模式 modE=4
 - ◆ **P1000**：当前测量值（范围：0~1000）
 - 校准后的仪表，在空气中：P1000≈100。
 - 校准后的仪表，在水中，P1000≈900。
 - ◆ **AL1**：SW1 开关的报警阈值（水，油，固体粉料的报警值不同）
 - ◆ **AH1**：SW1 开关的报警回差
 - ◆ **do**：输出方式（0=NPN 或 1=PNP）
 - ◆ **dLy**：报警延时：0~10
 - ◆ **dAmP**：阻尼：0~5

6.3.2 修改料位开关报警阈值 AL1

示例：修改料位开关的报警阈值 **AL1**

1. 通电：

- 根据料位开关输出类型(NPN 或 PNP)，将料位开关的 4 根线连接到 KOMM700 手操器的 NPN 端子组 (V12+, V12-, NPN, T-IN) 或者 PNP 端子组 (V12+, V12-, PNP, T-IN)。用 USB 为 KOMM700 手操器供电，点击 **On** 按键开机。

2. Act 菜单组下解锁：

- 启动后，Act 指示灯亮，屏幕显示 *UnLoc* 时，点击 **Enter** 键，屏幕显示 *yES* 字符。并且开始闪烁，再次点击 **Enter** 键确认，开始解锁微波料位开关，解锁时间通常 10 多秒。
- 解锁成功后，KOMM700 手操器的 RX 通信指示灯有周期性闪烁，STAT 指示灯常亮。
- 解锁成功后，KOMM700 手操器自动跳到 PV 菜单组，显示参数内容。

3. PV 菜单组下查看并修改报警阈值 **AL1**

- 点击 **▶** 翻动菜单，一直到屏幕显示 **AL1** 为止。
- 点击 **Enter** 键，KOMM700 手操器自动跳转到 **Edit** 编辑菜单组，开始编辑修改 **AL1** 参数
 - **AL1** 常见设定值：
 - 水： 550
 - 泡沫： 350
 - 导电粘稠介质（例如面酱）： 720
 - 油脂： 250
 - 固体颗粒（例如干茶叶）： 180
- 修改完成后，点击 **Enter** 键，屏幕闪烁 *yES*，提示用户确认，再次点击 **Enter** 键后，KOMM700 手操器开始下载参数。
- 下载通常持续 10 多秒，下载完成后，RX 通信灯开始闪烁，STAT 灯也会常亮。如果修改成功，屏幕上会显示 *PASS*。

4. ACT 菜单组下备份：

- 参数不再继续修改时，应当切换到 Act 菜单组，执行一次备份命令 **bkup**。

6.3.3 修改料位开关工作模式

示例：修改料位开关的工作模式参数 **modE**

1. 通电：

- 根据料位开关输出类型(NPN 或 PNP)，将料位开关的 4 根线连接到 KOMM700 手操器的 NPN 端子组 (V12+, V12-, NPN, T-IN) 或者 PNP 端子组 (V12+, V12-, PNP, T-IN)。用 USB 为 KOMM700 手操器供电，点击 **On** 按键开机。

2. Act 菜单组下解锁：

- 启动后，Act 指示灯亮，屏幕显示 *UnLoc* 时，点击 **Enter** 键，屏幕显示 *yES* 字符。并且开始闪烁，再次点击 **Enter** 键确认，开始解锁微波料位开关，解锁时间通常 10 多秒。
- 解锁成功后，KOMM700 手操器的 RX 通信指示灯有周期性闪烁，STAT 指示灯常亮。
- 解锁成功后，KOMM700 手操器自动跳到 PV 菜单组，显示参数内容。

3. 打开高级隐藏菜单:

- 在 Act 菜单组, 点击 翻动菜单, 一直到屏幕显示 Loc (密码锁) 为止。
- 点击 Enter 键, 开始编辑, 将 Loc (密码锁) 更改为 132, 再次点击 Enter 键保存。

4. 在 Edit 菜单组修改 modE 参数

- 首先点击 Mode 按钮, 一直到 Edit 指示灯亮起。
- 点击 翻动菜单, 一直到屏幕显示 modE (工作模式) 为止。
- 点击 Enter 按钮, 开始编辑修改 modE 参数, 修改完成后, 再次点击 Enter 按钮保存。
 - 0: 单点报警 (SW1=NO, SW2=NC)
 - 1: 双点报警 (SW1=NO, SW2=NC)
 - 2: 双点报警 (SW1=NO, SW2=NO)
 - 3: 数据上传 (SW1=NO, SW2 传输数据)
 - 4: PWM 输出 (SW1=NO, SW2 输出 PWM 信号)

5. Edit 菜单组下, 使用 d-Adv 命令下载

- 修改完成后, 点击 翻动菜单, 一直到屏幕显示 d-Adv 为止, d-Adv 是专用于下载高级功能参数的命令。
- 点击 Enter 键, 屏幕提示 yES, 再次点击 Enter 键, KOMM700 手操器开始下载
- 下载通常持续 10 多秒, 下载完成后, RX 通信灯开始闪烁, STAT 灯也会常亮。如果修改成功, 屏幕上会显示 PASS。

6. ACT 菜单组下备份:

- 参数不再继续修改时, 应当切换到 Act 菜单组, 执行一次备份命令 bkup。

6.3.4 修改第二路报警阈值

示例: 修改料位开关的第二路阈值参数 AL2



备注: 第二路阈值参数菜单 AL2 缺省情况下被隐藏, 用户必须首先将料位开关的工作模式改为 1 (双路报警 NO+NC) 后, 才可以查看修改 AL2 菜单。

1. 通电:

- 根据料位开关输出类型(NPN 或 PNP), 将料位开关的 4 根线连接到 KOMM700 手操器的 NPN 端子组 (V12+, V12-, NPN, T-IN) 或者 PNP 端子组 (V12+, V12-, PNP, T-IN)。用 USB 为 KOMM700 手操器供电, 点击 On 按钮开机。

2. Act 菜单组下解锁:

- 启动后, Act 指示灯亮, 屏幕显示 UnLoc 时, 点击 Enter 键, 屏幕显示 yES 字符. 并且开始闪烁, 再次点击 Enter 键确认, 开始解锁微波料位开关, 解锁时间通常 10 多秒。
- 解锁成功后, KOMM700 手操器的 RX 通信指示灯有周期性闪烁, STAT 指示灯常亮。
- 解锁成功后, KOMM700 手操器自动跳到 PV 菜单组, 显示参数内容。

3. 打开高级隐藏菜单:

- 在 Act 菜单组, 点击 翻动菜单, 一直到屏幕显示 Loc (密码锁) 为止。
- 点击 Enter 键, 开始编辑, 将 Loc (密码锁) 更改为 132, 再次点击 Enter 键保存。

4. 在 Edit 菜单组修改 modE 参数

- 首先点击 **Mode** 按键，一直到 Edit 指示灯亮起。
- 点击 **▶** 翻动菜单，一直到屏幕显示 **modE** (工作模式) 为止。
- 点击 **Enter** 按键，开始编辑 **modE** 参数，更改为 1 后，再次点击 **Enter** 按键保存。

5. Edit 菜单组下, 使用 **d-Adv** 命令下载

- 修改完成后，点击 **▶** 翻动菜单，一直到屏幕显示 **d-Adv** 为止，**d-Adv** 是专用于下载高级功能参数的命令。
- 点击 **Enter** 键，屏幕提示 **yES**，再次点击 **Enter** 键，KOMM700 手操器开始下载
- 下载通常持续 10 多秒，下载完成后，RX 通信灯开始闪烁，STAT 灯也会常亮。如果修改成功，屏幕上会显示 **PASS**。

6. 回到 PV 菜单组编辑 AL2:

- 点击 **Mode** 键，直到 PV 指示灯亮起。
- 点击 **▶** 翻动菜单，一直到屏幕显示 **AL2** (第二路报警阈值) 为止。
- 点击 **Enter** 按键，开始编辑 **AL2** 参数。
 - 常见 AL2 推荐值
 - 水: 550
 - 导电粘稠介质 (如番茄酱): 720
- 修改完成后，点击 **Enter** 键，屏幕闪烁 **yES**，提示用户确认，再次点击 **Enter** 键后，KOMM700 手操器开始下载参数。
- 下载通常持续 10 多秒，下载完成后，RX 通信灯开始闪烁，STAT 灯也会常亮。如果修改成功，屏幕上会显示 **PASS**。

7. ACT 菜单组下备份:

- 参数不再继续修改时，应当切换到 **Act** 菜单组，执行一次备份命令 **bkup**。



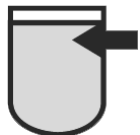

更多操作示例可见 KOMM700 手操器用户使用手册。

7. 单路报警调试 (缺省模式)

缺省情况下，参数 **modE=0**，表示料位开关工作在单路报警输出模式，测量值大于报警点参数 AL1 时，SW1 (NO)，SW2 (NC) 同时激活。现场情况需要常开输出时，选择 SW1 (NO) 作为输出，需要常闭输出时，选择 SW2 (NC) 作为输出。

7.1 PNP 单点报警状态 (端子 1 代表 VDC+)

探头 状态	LED 灯	SW1 (线 4)	SW2 (线 2)	线 4 电压 (有负载时)	线 2 电压 (有负载时)
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	脱离 介质		VDC+ SW1 1 ——— 4	VDC+ SW2 1 ——— 2	0	≈VDC
	介质 覆盖		VDC+ SW1 1 ——— 4	VDC+ SW2 1 ——— 2	≈VDC	0



PNP 输出模式下，测量 SW1，SW2 输出电压时，**必须连接上负载**，最大负载电流不超过 100mA，见 Fig.6。

PNP

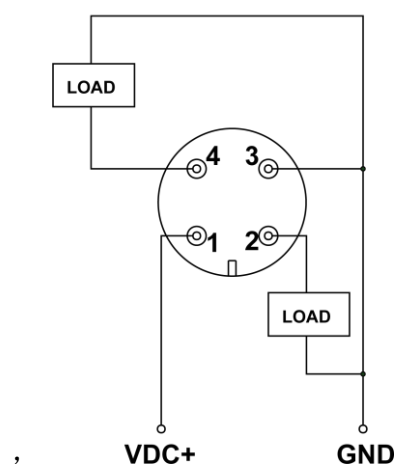






Fig. 6 PNP 输出测试电路

7.2 NPN 单点报警状态 (线 3 代表 GND 0V)

探头 状态	LED 灯	SW1 (线 4)	SW2 (线 2)	线 4 电压 (有负载)	线 2 电压 (有负载)	
	脱离 介质		GND SW1 3 ——— 4	GND SW2 3 ——— 2	≈VDC	0
	介质 覆盖		GND SW1 3 ——— 4	GND SW2 3 ——— 2	0	≈VDC



NPN 输出模式下，测量 SW1，SW2 输出电压时，**必须连接上负载**，最大负载电流不超过 100mA，见 Fig.7。

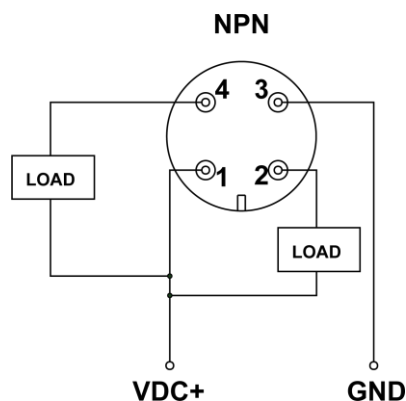


Fig. 7 NPN 输出测试电路

7.3 选择合适的报警阈值参数 AL1

缺省单点报警工作模式下，料位开关通过频率扫描，随时监测过程变量 P1000（谐振频率）的变化，料位开关出厂前经过校准，校准后，探头在空气中时 $p1000 \approx 100$ ，探头在自来水中 $P1000 \approx 900$ 。当前测量值 P1000 大于报警阈值 AL1 时，指示灯亮，SW1 (NO)，SW2 (NC) 处于激活状态。

常见介质的建议报警阈值参数 AL1：

介质	实例	建议报警阈值
水基溶液	自来水， 酸，碱溶液	550(出厂缺省)
泡沫	啤酒泡沫	350
粘稠导电介质	番茄酱	720
油脂	食用油，润滑油	250
含水较低固体颗粒	干茶叶	180
含水较高固体颗粒	米，小麦	250


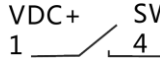
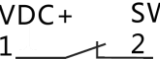

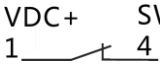
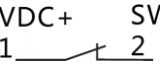

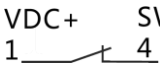
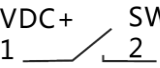
8. 双路报警调试

参数 $modE=1$ 或 2 时，料位开关工作在双路报警输出模式下。主要用于检测分层的介质，例如泡沫和啤酒，油和水，提供 SW1 (NO)，SW2 (NC) 两路不同的报警输出。SW1 (NO) 用于检测上层介质（如油，泡沫），SW2 用于检测下层介质（如水）。

- $modE=1$ 时
 - $P1000 \geq AL1$ 时，SW1 (NO) 导通，报警激活。
 - $P1000 \geq AL2$ 时，SW2 (NC) 断开，报警激活。
- $modE=2$ 时
 - $P1000 \geq AL1$ 时，SW1 (NO) 导通，报警激活。

- $P1000 \geq AL2$ 时， SW2 (NO) 导通，报警激活。


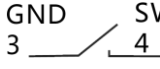
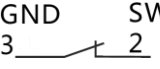

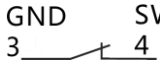
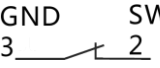
8.1 PNP 双路报警用于介质分层检测 (modE=1)



	探头状态	LED 灯	SW1 (线 4)	SW2 (线 2)	SW1 电压 (有负载时)	SW2 电压 (有负载时)
	脱离介质	●			0	\approx VDC
	上层覆盖	● 闪烁			\approx VDC	\approx VDC
	下层覆盖	● 闪烁			\approx VDC	0



PNP 输出模式下，测量 SW1，SW2 输出电压时，必须带上负载（如：24V 继电器，蜂鸣器，指示灯），最大负载电流不超过 100mA，接线图参见第 7 章 Fig.6。

8.2 NPN 双路报警用于介质分层检测 (参数 modE=1)

	探头状态	LED 灯	SW1 (线 4)	SW2 (线 2)	SW1 电压 (有负载时)	SW2 电压 (有负载时)
	脱离介质	●			\approx VDC	0
	上层覆盖	● 闪烁			0	0

	下层 覆盖		GND 3 ——— SW1 4	GND 3 ——— SW2 2	0	≈VDC
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NPN 输出模式下，测量 SW1，SW2 输出电压时，必须带上负载（如：24V 继电器，蜂鸣器，指示灯），最大负载电流建议不超过 100mA，接线图见第 7 章 Fig. 7.

9. 故障排除

9.1 常见故障列表

故障情况	可能故障原因	处理方法
LED 灯不亮	1 连接故障 2. 硬件故障 3. 参数错误	1. 检查电源供电电压。 2. 检查接线顺序。 3. 接线与供电都正常时，用 KOMM700 手操器，检查料位开关的工作电流是否为 0，或者超过最大标称电流。 4. 电流正常时，用 KOMM700 手操器连接料位开关，解锁后查看当前测量值及参数。如无法通信连接，建议返厂维修。 5. 参数不正确时，可以用 KOMM700 手操器执行 rESto 恢复命令，恢复以前的备份过的参数。 6. 参数正确时，检查信号强度 Sig1~6，记录或拍照录像后，与厂家联系。
LED 灯一直亮	1. 参数错误 2. 硬件故障	1、用 KOMM700 手操器，检查料位开关的工作电流是否超过标称的最大电流。 2. 电流正常时，用 KOMM700 手操器连接并检查参数。如果手操器无法连接，料位开关需返厂。 3. 通信正常，检查仪表参数报警阈值 AL1 是否过低。 4. 参数不正确时，可以用 KOMM700 手操器执行 rESto 恢复命令，恢复以前的备份过的参数，或者重设阈值 AL1。 5. 参数均正确时，检查信号强度 Sig1~6，记录或拍照录像后与厂家联系。

9.2 检查工作电流与压降

用户可以使用 KOMM700 手操器快速的检查工作电流和输出压降指标。具体步骤如下：

1. 通电:

- 根据料位开关输出类型(NPN 或 PNP), 将料位开关的 4 根线连接到 KOMM700 手操器的NPN 端子组(V12+, V12-, NPN, T-IN)或者PNP 端子组(V12+, V12-, PNP, T-IN)。用 USB 为 KOMM700 手操器供电, 点击 **On** 按键开机。

2. V/I 菜单组下检查工作电流

- 点击 **Mode** 键, 翻动菜单组到 V/I 指示灯亮, 当前为 V/I 菜单组。
- 点击 **▶** 翻动菜单, 屏幕显示 *mAxx.x* 时停止, 这里就是当前电流功耗。
- 不报警时, 料位开关典型工作电流 10~20mA 之间, 周期性微波扫频时, 最大 30~40mA。
- 报警时电流比不报警时, 增大 10~20mA。

3. Act 菜单组下解锁 (测量压降时, 必须解锁):

- 点击 **Mode** 键, 切换当前菜单组, 直到 Act 指示灯亮, 屏幕显示 *UnLoc* 时, 点击 **Enter** 键, 屏幕显示 *yES* 字符. 并且开始闪烁, 再次点击 **Enter** 键确认, 开始解锁微波料位开关, 解锁时间通常 10 多秒。
- 解锁成功后, KOMM700 手操器自动跳到 PV 菜单组, 显示参数内容。

4. V/I 菜单组下检查输出压降

- 点击 **Mode** 按键, 切换当前菜单组, 一直到 V/I 指示灯亮。
- 点击 **▶** 翻动菜单, 一直到屏幕显示 *d x.xx* 为止。
- 将料位开关探头浸入水中, 料位开关处于报警状态, *d x.xx* 数值就是输出压降。
- 负载电流 10mA 时, PNP 输出压降通常为 1.3V 左右。
- 负载电流 10mA 时, NPN 输出压降通常为 0.8V 左右。

10. 配置示例

示例 1: 只检测啤酒 (有泡沫时)

步骤如下:

1. 用 KOMM700 手操器连接料位开关, 解锁并观察测量值。
2. 假设探头全部浸没在啤酒中时, **P1000** (过程变量值) 为 950。
3. 假设探头浸没在泡沫中, 不碰到啤酒液面时, **P1000** 为 350~500 之间波动。
4. 如果只检测啤酒, 则将报警点设定到 **P1000** (泡沫最大波动值) 和 **P1000** (啤酒) 之间的中点, 等于 $(950+500) / 2 = 725$
5. 使用 KOMM700 手操器, 将 **AL1** 参数改为 725。并将参数下载到料位开关。
6. 下载完成后, 此时探头碰到泡沫, SW1 (NO) 无输出, 碰到啤酒液面时 SW1 (NO) 才被激活。
7. 最后使用 **bkup** 命令, 备份参数。

示例 2: 检测啤酒泡沫

1. 如果需要检测泡沫, 只需要将报警点参数 **AL1** 设定为泡沫的最小波动值, 或者更小, 本例中为 350。
2. 修改完成后, 下载参数到料位开关。此时, 探头被泡沫或者啤酒覆盖时, 料位开关的 SW1 (NO) 都会被激活, 输出报警信号。

3. 最后使用 **bkup** 命令，备份参数。

11. 技术指标

环境条件		特征	
工作温度范围	<ul style="list-style-type: none"> ■ 电缆引出型 -25~70°C ■ M12 连接器型 -40~85°C 	重复性	■ ± 1 mm
储存温度范围	<ul style="list-style-type: none"> ■ 电缆引出型 -25~70°C ■ M12 连接器型 -40~85°C 	回差	■ ± 1 mm
环境湿度	■ <98%RH, 冷凝	响应时间	■ 缺省 0.2s (出厂前可设定, 最小 0.1s)
防护等级	■ IP67	阻尼	■ 0~5 s (可调)
电源		输出信号	
供电电压范围	■ 12 ... 33 V DC	输出类型	<ul style="list-style-type: none"> ■ PNP ■ NPN ■ 数字式推挽输出
极性反接保护	■ 有	电流负载	■ 100 mA 最大
电流消耗 (空载)	■ 典型情况 12 mA, 最大 40 mA	短路保护	■ 有
电源中断时间	<ul style="list-style-type: none"> ■ 10ms (标准型) ■ 30ms (定制型) 	PNP/NPP 实际输出电压	<ul style="list-style-type: none"> ■ PNP: VDC- 0.5V Rload = 10 kΩ ■ NPN: 0.4V, Rload = 10 kΩ
		PNP 泄漏电流	■ 最大 100 μA
		NPN 泄漏电流	■ 50~600uA
		切换逻辑	<ul style="list-style-type: none"> ■ 常开 (NO) ■ 常闭 (NC)

常开 (NO) : 探头在空气中时, 开关断开。探头被介质覆盖时, 开关闭合 (激活)。

常闭 (NC) : 探头在空气中时, 开关闭合。探头被介质覆盖时, 开关断开 (激活)。



因为硬件电路原因, 在料位开关输出关断 (Off) 状态时, XR07 PNP 和 NPN 输出型的泄漏电流不同。

过程条件

型号	过程持续温度 Tamb < 50 °C 探头尖端浸入过程介 质最深 16mm	过程压力	短时最高过程温度 Tamb < 50 °C 探头尖端浸入过程介 质最深 16mm	短时最大过程压力 t < 1 h
XR07	-40 ~115°C	-0.1~10Mpa	135°C	-0.1~10Mpa

XR05 universal microwave level switch



UG2020-001-1

User manual
2020.09.01 Rev. D

1. Symbols

description

1.1 Warning symbols



Warning: if the user ignored or did not follow the instructions, it might lead to safety hazards, or serious injury.



Caution: if the user ignored or did not follow the instructions, it might damage the device or cause data loss.



ESD: if the user ignored or did not follow the instructions, ESD damage might be caused to the device.

1.2 Other symbols



Note

1.3 Safety instructions



Caution: this product is only applicable to the detection of solids, liquids or slurries with dielectric constant greater than or equal to 1.5.



Caution: this product cannot be used to measure media that are corrosive to the probe material (PEEK) or housing material.



Warning: users must have read and understood this manual before installation, configuration and commissioning.



Warning: user can only use undamaged product during installation.



Warning: when users use self-made or other manufacturer's weld-in sleeve and other accessories, we will not be responsible for the damage caused by these accessories.



Warning: In hot media applications, the housing temperature of this product may exceed 50 °C. Users must take precautions to avoid risk of burns.



Warning: KOMM700 communicator should not be used in hazardous area for explosion proof applications.

2. Introduction

XR05 universal level switch is suitable for hygienic, food and industrial applications. It has excellent resistance to conductive sticking media, works in a variety of process media, and provides a variety of process connection forms and a variety of output signals. This product is an ideal substitute for traditional mechanical, tuning fork and rotary paddle level switches.

2.1 Product structure

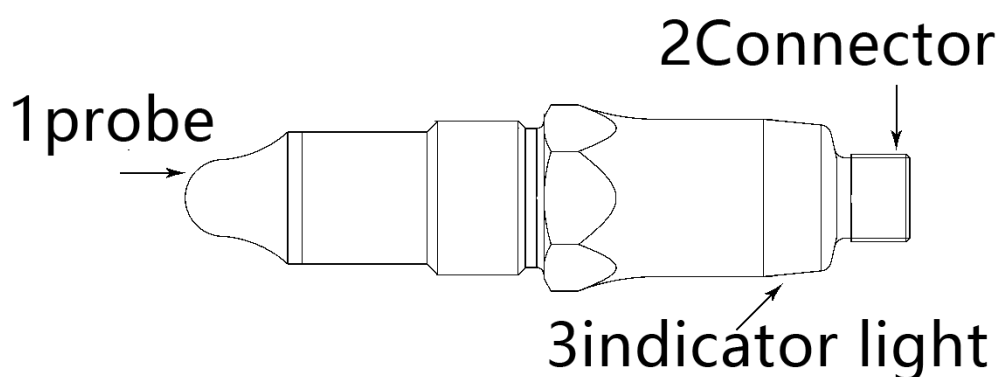


Fig. 1 XR05 structure

2.2 Working principle

The probe, metal housing and internal electronic unit form a high frequency resonant circuit. High frequency microwave electric field is formed near the probe. When the probe is covered by the medium or the dielectric constant of the medium changes, the resonance frequency will change greatly. The internal electronic unit turns on or turns off the alarm signal by comparing the current resonant frequency with the threshold set by the user. This measurement method can effectively eliminate the influence of conductive coating.

2.3 Features and applications

■ Wide application	Suitable for solids, liquids and slurries.
■ Reliability	Not affected by bubbles
■ Anti coating property	Adhesive and conductive slurry can be detected effectively
■ Compact structure	Suitable for installation in tight spaces
■ Material of wetted parts: PEEK and stainless steel	Suitable for hygienic and industrial applications
■ Easy to use	Threshold can be set with communicator
■ operating temperature range	Standard type 115 °C, Heat neck type 150 °C
■ Normally open (NO) Normally closed (NC)	NO and NC outputs are provided at the same time for the field applications

2.4 Application restrictions

- Not suitable for abrasive media (such as quartz sand) and heavy bulk materials.
- Not suitable for the medium corrosive to the probe and the wetted part (such as ozonised water).
- The probe should not be exposed to ultraviolet radiation.

3. Nameplate, storage and

transport

3.1 Name plate

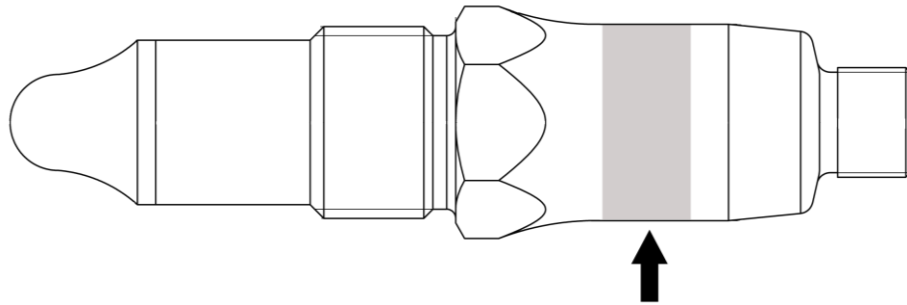


Fig. 2 nameplate

TYPE	Order code
IN	Power supply voltage and maximum power consumption current 12 ~ 30V, 40mA
OUT	PNP, NPN, maximum external load 20mA
TAMP	-40°C < Ambient temperature < 85 °C
SN	Serial number
DATE	Date of manufacture

3.2 Storage and transport

Storage conditions:

Storage temperature: - 40 ~ 85 °C

Use the original packaging.

Transport to measuring point:

Transport the product to the measuring point in its original packaging.

4. Installation

4.1 Installation location

The level switch can be installed anywhere in the storage tank, pipe or silo. Using a socket wrench, users can install the level switch in the location that is hard to operate.

The level switch can be installed for:

1. High limit of level
2. Low limit of level
3. Dry run protection

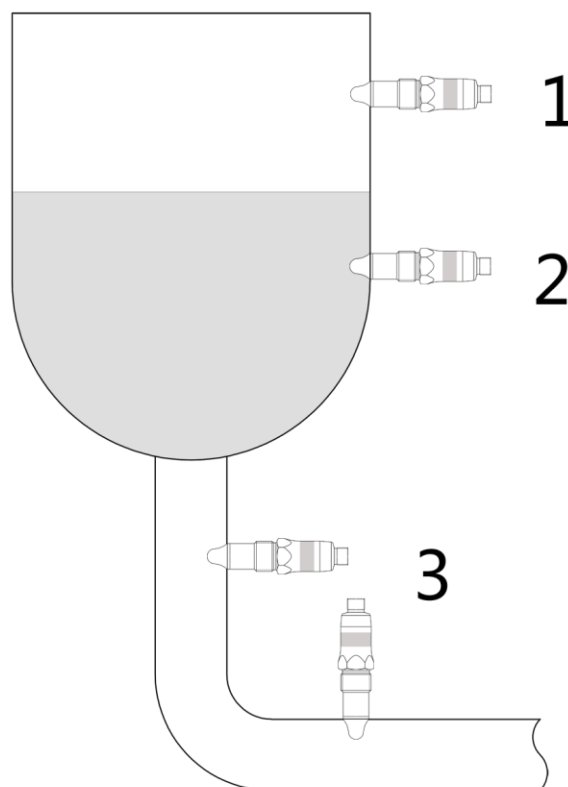


Fig.3 installation location

4.2 Installation for industrial applications



Risk of injury may be caused by hazardous media.

- ▶ Wear protective equipment for hazardous media.
- ▶ Clear storage tanks and pipes before installation.

4.2.1 Direct installation

The specific steps are as follows:

1. Before and during installation, make sure that there is no medium in the storage tank and pipe.



2. Caution: PTFE tape must be wrapped around the thread of level switch.
3. Screw the level switch into the mounting hole with a wrench (22AF).
4. The tightening torque is 30 Nm.

4.2.2 Installation with stainless steel weld-in sleeve



Note: when weld-in sleeve is used, PTFE tape is not required.

The specific steps are as follows:

1. Before and during installation, make sure that there is no medium in the storage tank and pipe.
2. First install the weld-in sleeve on the field storage tank or pipe.
3. Screw in the level switch.
4. The tightening torque is 15 ~ 20 Nm.

4.2.3 Installation using plastic (e.g. PTFE) adapter



Note: when using plastic process adapter, PTFE tape is not required.

The specific steps are as follows:

1. Before and during installation, make sure that there is no medium in the storage tank or pipe.
2. First install the adapter on the storage tank or pipe.
3. Screw in the level switch.
4. The tightening torque is 15 ~ 20 Nm.
5. Grounding: the metal housing of the level switch should be connected to the frame ground through wires.

4.3 Installation for hygienic applications



Risk of injury may be caused by hazardous media.

- ▶ Only use weld-in sleeve (stainless steel) for hygienic installation.
- ▶ Do not use PTFE tape or other elastomers for hygienic applications.

- ▶ Welding must be performed by welders trained in the field of hygienic.

4.3.1 Weld-in sleeve installation

The specific steps are as follows:

1. Before and during installation, make sure that there is no medium in the storage tank and pipe.
2. Weld-in sleeves or adapters are installed in a hygienic manner and flush inside.
3. Weld seams are smoothed out to $RA < 0.8 \mu m$.
4. Drain hole points down.
5. Tighten the level switch.
6. The tightening torque is 10-15 Nm.

4.4 Inspection after installation

- ▶ Is the level switch not damaged (visual inspection)?
- ▶ Is the level switch properly protected from direct sunlight and rain?
- ▶ Is the level switch properly secured against shock?

5. Electrical connectio

n



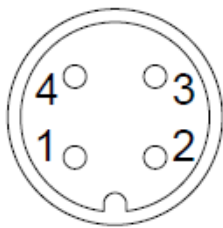
Caution: XR05 electrical interface is divided into two types: cable-outlet type and M12 4-Pin connector. The two kinds of interfaces use different wire colors, which should be noted during installation.

5.1 Equivalent circuit of cable outlet type

Type of output	Equivalent circuit	Function (wire color or number)												
NPN		<table> <tr> <td>VDC+</td> <td>White</td> <td>1</td> </tr> <tr> <td>SW1 (NO)</td> <td>Yellow</td> <td>4</td> </tr> <tr> <td>SW1 (NC)</td> <td>Brown</td> <td>2</td> </tr> <tr> <td>GND (0V)</td> <td>Green</td> <td>3</td> </tr> </table>	VDC+	White	1	SW1 (NO)	Yellow	4	SW1 (NC)	Brown	2	GND (0V)	Green	3
VDC+	White	1												
SW1 (NO)	Yellow	4												
SW1 (NC)	Brown	2												
GND (0V)	Green	3												

PNP		<table border="0"> <tr> <td>VDC+</td> <td>White</td> <td>1</td> </tr> <tr> <td>SW1 (NO)</td> <td>Yellow</td> <td>4</td> </tr> <tr> <td>SW1 (NC)</td> <td>Brown</td> <td>2</td> </tr> <tr> <td>GND (0V)</td> <td>Green</td> <td>3</td> </tr> </table>	VDC+	White	1	SW1 (NO)	Yellow	4	SW1 (NC)	Brown	2	GND (0V)	Green	3
VDC+	White	1												
SW1 (NO)	Yellow	4												
SW1 (NC)	Brown	2												
GND (0V)	Green	3												

5.2 Equivalent circuit of M12 connector type

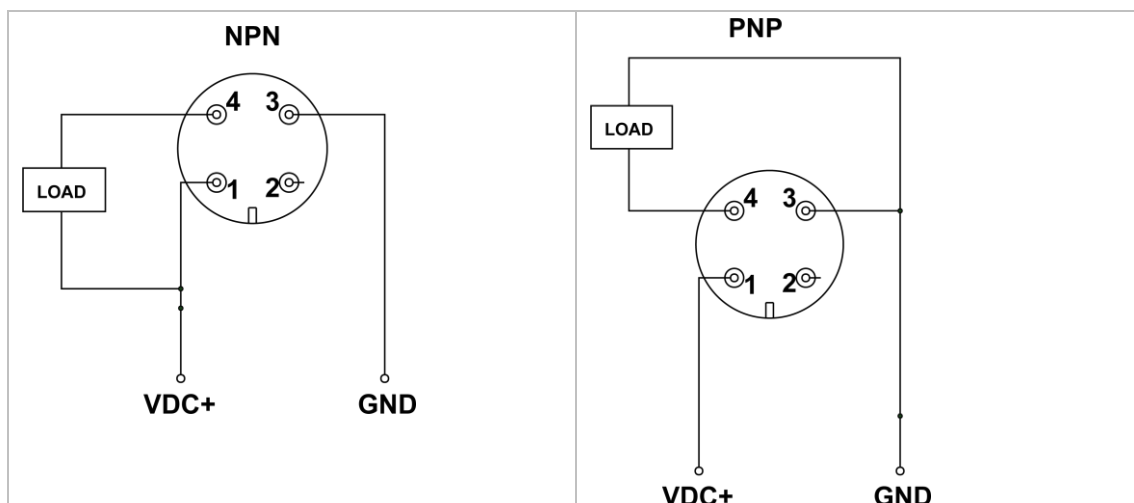


Type of output	Equivalent circuit	Function/M12 pin number/wire color												
NPN		<table border="0"> <tr> <td>VDC+</td> <td>1</td> <td>Brown</td> </tr> <tr> <td>SW1 (NO)</td> <td>4</td> <td>Black</td> </tr> <tr> <td>SW1 (NC)</td> <td>2</td> <td>White</td> </tr> <tr> <td>GND (0V)</td> <td>3</td> <td>Blue</td> </tr> </table>	VDC+	1	Brown	SW1 (NO)	4	Black	SW1 (NC)	2	White	GND (0V)	3	Blue
VDC+	1	Brown												
SW1 (NO)	4	Black												
SW1 (NC)	2	White												
GND (0V)	3	Blue												
PNP		<table border="0"> <tr> <td>VDC+</td> <td>1</td> <td>Brown</td> </tr> <tr> <td>SW1 (NO)</td> <td>4</td> <td>Black</td> </tr> <tr> <td>SW1 (NC)</td> <td>2</td> <td>White</td> </tr> <tr> <td>GND (0V)</td> <td>3</td> <td>Blue</td> </tr> </table>	VDC+	1	Brown	SW1 (NO)	4	Black	SW1 (NC)	2	White	GND (0V)	3	Blue
VDC+	1	Brown												
SW1 (NO)	4	Black												
SW1 (NC)	2	White												
GND (0V)	3	Blue												

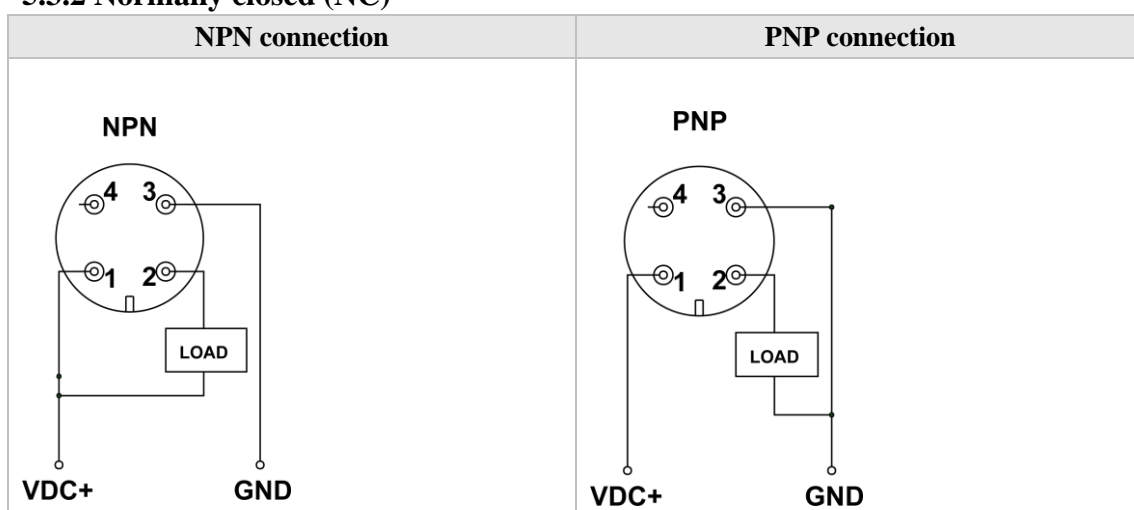
5.3 Wiring diagram

5.3.1 Normally open (NO)

NPN connection	PNP connection



5.3.2 Normally closed (NC)



5.4 Inspection after connection

- ▶ Is the level switch not damaged (visual inspection)?
- ▶ Does the cable meet the requirements?
- ▶ Has the cable been completely stress relieved?
- ▶ Whether the power supply voltage is consistent with the name plate?
- ▶ Is the connector plug tightened?

6. Configuration

- ▶ Powered by 5V USB, the communicator provides 12V DC power supply for the level switch.
- ▶ When the alarm signal of the level switch is detected, the built-in buzzer of communicator will sound.

6.1 Connect NPN switch to communicator

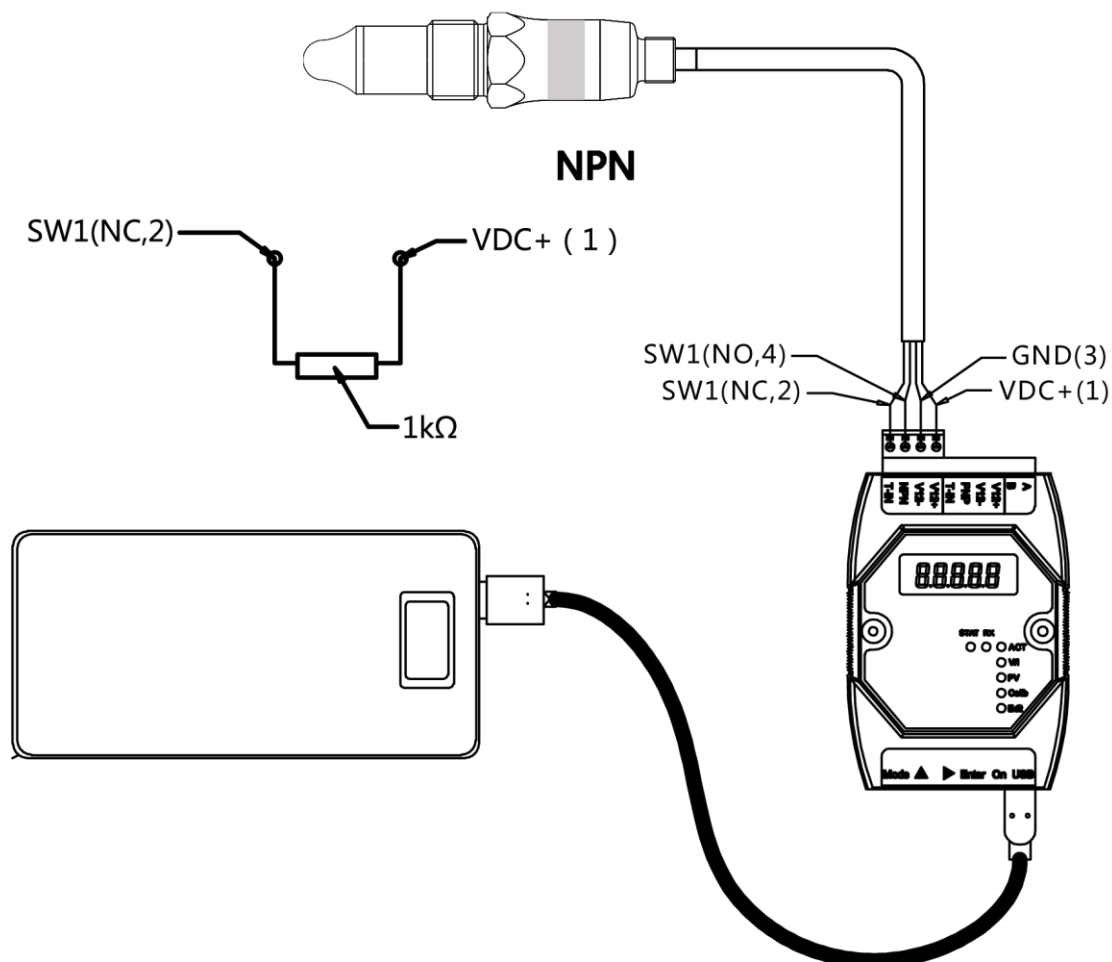


Fig. 4 Connect NPN level switch to the communicator

NPN level switch wiring table

Electrical connection type	XR05 function	XR05 Wire color or pin number	KOMM700 Communicator terminal
Cable Outlet	VDC+	White (1)	V12+
	GND	Green (3)	V12-
	SW1(NO)	Yellow (4)	NPN
	SW1(NC)	Brown (2)	T-IN
M12 4pin	VDC+	Brown (1)	V12+
	GND	Blue (3)	V12-
	SW1(NO)	Black (4)	NPN
	SW1(NC)	White (2)	T-IN



Note: For XR05 NPN level switch, a 1K ohm pull-up resistor between the VDC + and SW1 (NC) wires is needed for communication. In dedicated communicator (order code:

KOMM700-NPN), there is a built-in 1K ohm resistor. In this case, no external resistor is required. The standard communicator does not have this resistor; therefore users must add the external pull-up resistor manually.

6.2 Connect PNP switch to communicator

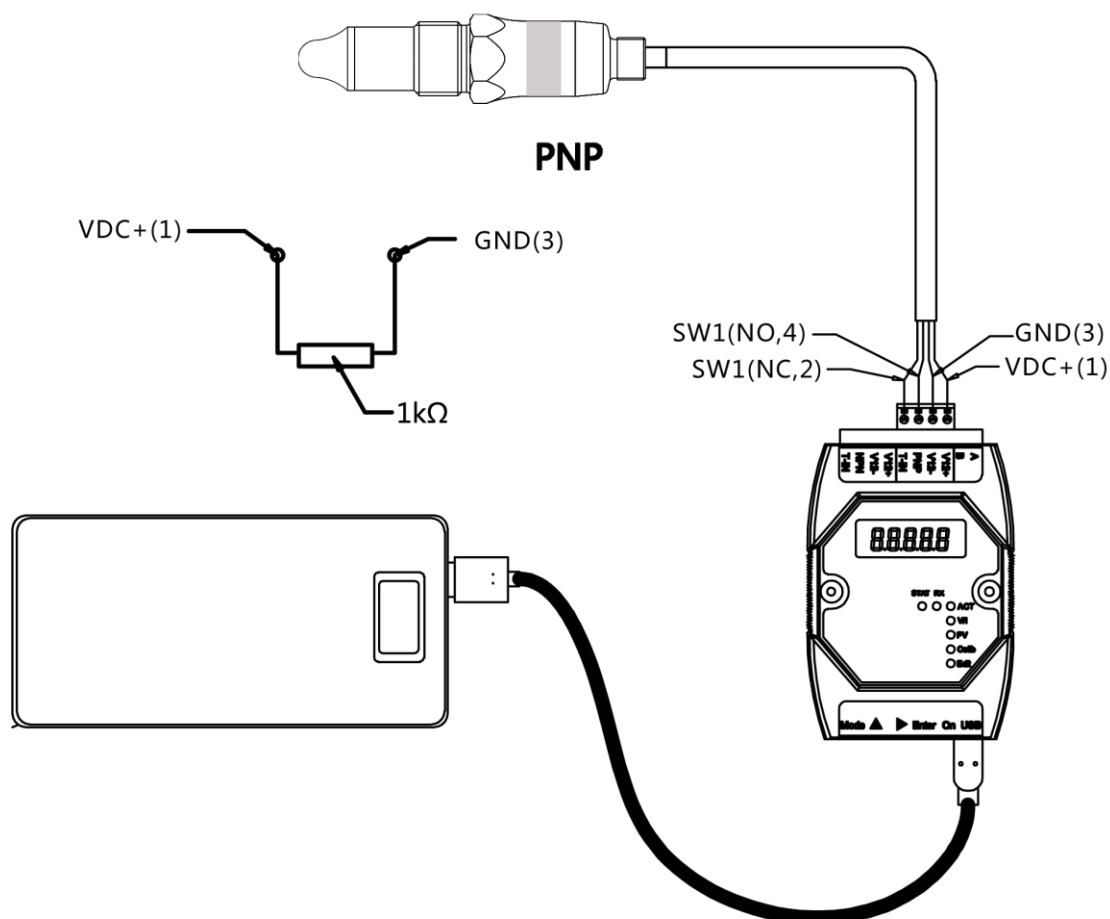


Fig. 5 Connect PNP level switch to the communicator

Wiring table of PNP switch

Electrical connection type	XR05 function	XR05 Wire color or M12 pin number	KOMM700 Communicator terminal number
Cable outlet	VDC+	White (1)	V12+
	GND	Green (3)	V12-
	SW1(NO)	Yellow (4)	PNP
	SW1(NC)	Brown (2)	T-IN
M12	VDC+	Brown (1)	V12+
	GND	Blue (3)	V12-
	SW1(NO)	Black (4)	PNP
	SW1(NC)	White (2)	T-IN



Note: For XR05 PNP level switch, a 1K ohm resistor between the VDC + and GND wires is needed for communication. In dedicated communicator (order code: KOMM700-PNP), there is a built-in 1K ohm resistor. In this case, no external resistor is required. The standard communicator does not have this resistor; therefore users must add the external resistor manually.

6.3 Examples of configuration

6.3.1 View PV value and other parameters of level switch

Example 1: view PV and other parameters of microwave level switch

1. Power on:

- According to the output type of level switch (NPN or PNP), connect the four wires of level switch to the NPN terminal group (**V12 +**, **V12 -**, **NPN**, **T-IN**) or the PNP terminal group (**V12 +**, **V12 -**, **PNP**, **T-IN**) of KOMM700 communicator. Use USB to power the KOMM700 communicator and click the button **ON** to power on.

2. Unlock in Act menu group:

- After startup, the **Act** indicator light is on. When the screen displays **UnLoc**, click the button **Enter**, and the screen displays **yES**, and starts to blink. Click the button **Enter** again to confirm to start unlocking the microwave level switch. The unlocking time is usually more than 10 seconds.
- After successful unlocking, the **RX** communication indicator of KOMM700 communicator flashes periodically, and the **STAT** indicator is always on.
- After successful unlocking, KOMM700 communicator will automatically jump to **PV** menu group and display parameter contents.

3. View parameters in PV menu group:

Click the button **▶** to view different parameters. The most important parameters are:

P1000: current PV (range: 0 ~ 1000)

After calibration, P1000 \approx 100 when probe is in air.

After calibration, P1000 \approx 900 when probe is in tap water.

AL1: Alarm threshold of SW1 (water, oil and solid powder have different AL1 values)

AH1: Alarm hysteresis of SW1

do: Output type (0 = NPN, 1 = PNP)

dAmP: Damping: 0 ~ 5

6.3.2 Modify alarm threshold AL1 of level switch

Example 2: modify alarm threshold **AL1** of level switch

1. Power on:

- According to the output type of level switch (NPN or PNP), connect the four wires of level switch to the NPN terminal group (**V12 +**, **V12 -**, **NPN**, **T-IN**) or the PNP terminal group (**V12 +**, **V12 -**, **PNP**, **T-IN**) of KOMM700 communicator. Use USB to power the KOMM700 communicator and click the button **ON** to power on.
2. **Unlock in Act menu group:**
- After startup, the **Act** indicator light is on. When the screen displays **UnLoc**, click the button **Enter**, and the screen displays **yES**, and starts to blink. Click the button **Enter** again to confirm to start unlocking the microwave level switch. The unlocking time is usually more than 10 seconds.
 - After successful unlocking, the **RX** communication indicator of KOMM700 communicator flashes periodically, and the **Stat** indicator is always on.
 - After successful unlocking, KOMM700 communicator will automatically jump to **PV** mode and display parameter contents.
3. **PV menu group:** View and modify alarm point **AL1**
- Click the button **▶** to scroll through the menu until **AL1** is displayed on the screen.
- Click the button **Enter**, KOMM700 communicator will automatically jump to **Edit** menu group and start editing and modifying **AL1** parameters
- Recommended **AL1** value for different applications
- Water: 550
- Foam: 350
- Conductive viscous medium (e.g. ketchup): 720
- Oil: 250
- Solid particles (e.g. dried tea): 180
- After the modification is over, click the button **Enter** to start. The screen will display **yES** and prompt the user to confirm. After clicking the button **Enter** again, KOMM700 communicator starts to download parameters.
- The download usually takes more than 10 seconds. After the download is completed, the **RX** communication light starts to flash, and the **Stat** light will be on. If the modification is successful, **PASS** will be displayed on the screen.
4. **Backup in Act menu group:**
- When no further parameter modification is required, you should switch to **Act** menu group and execute a backup command **bkup**.

More operation examples can be found in the KOMM700 communicator user manual.

7.

Commissioning

SW1 (NO) and SW1 (NC) outputs are always opposite. It is convenient for users to select the

appropriate alarm output signal according to different applications.

7.1 Indicator light (bi-color)

The level switch has a blue and a green LED indicator lights. It works in one of the following two kinds of display modes.

- Monochrome display mode (default)

The blue LED is off when probe is not covered by medium, and the blue LED is on when probe is covered by medium. The green LED does not work and is always off.
- Bi-color switching display mode,

When the probe is not covered by medium, the green LED is on and the blue LED is off. When the probe is covered by medium, the green LED is off and the blue LED is on.



Note: customers could specify the required display mode in the order.

7.2 PNP alarm status (Line 1 = VDC +)

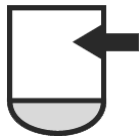

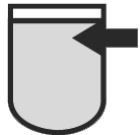

	Probe status	LED lamp	SW1 (NO) (Pin 4)	SW1 (NC) (Pin 2)	Pin/Line 4 voltage	Pin/Line 2 voltage
	Not covered				≈0	≈VDC
	Covered				≈VDC	≈0



For PNP output type, when measuring the output voltage, the load must be connected. The maximum load current should not exceed 20mA. Refer to section 5.3 for wiring diagram.

7.3 NPN alarm status (line 3 represents GND 0V)

Probe	LED	SW1 (NO)	SW1 (NC)	Pin/Line 4	Pin/Line 2
-------	-----	----------	----------	------------	------------

	status	lamp	(Pin 4)	(Pin 2)	voltage	voltage
	Not covered		GND SW1 3 ——— 4(NO)	GND SW1 3 ——— 2(NC)	≈VDC	≈0
	Covered		GND SW1 3 ——— 4(NO)	GND SW1 3 ——— 2(NC)	≈0	≈VDC



For NPN output type, when measuring the output voltage, the load must be connected. The maximum load current should not exceed 20mA. See section 5.3 for wiring diagram.

7.4 Select the appropriate threshold AL1

Through frequency sweeping, the level switch monitors the change of P1000 (normalized resonance frequency) in real time. The level switch is calibrated before delivery. After calibration, when the probe is in air, $P1000 \approx 100$, when the probe is in tap water, $P1000 \approx 900$. When the current measured value ($P1000$) \geq threshold **AL1**, the indicator light is on and SW1 is activated.

Recommended threshold AL1 for common applications

medium	example	Recommended threshold AL1
Water based solution	Tap water, acid, alkali solution	550 (factory default)
Foam	Beer-froth	350
Viscous conductive medium	Ketchup	720
Oil	Edible oil, lubricating oil	250
Solid particles with low water content	Dried tea	180
Solid particles with high water content	Rice, wheat	250

8.**Troubleshooting****8.1 List of common issues**

Issues	Possible cause	Solutions
The LED is always off	<ol style="list-style-type: none"> 1. Connection failure 2. Hardware failure 3. Parameter error 	<ol style="list-style-type: none"> 1. Check the power supply voltage 2. Check the wiring sequence 3. When the wiring and power supply are correct, use KOMM700 communicator to check whether the supply current of level switch is 0 or exceeds the maximum nominal current. 4. When the supply current is correct, connect the level switch to KOMM700 communicator, execute the unlocking command, and check the supply current and other parameters. If the level cannot communicate, return it to the manufacturer. 5. When the parameters are incorrect, you can use KOMM700 communicator to execute the rESto command to restore to previous data. 6. When the parameters are correct, check the signal strength sig1 ~ 6, and contact the manufacturer after taking photos or video recording.
The LED is always on	<ol style="list-style-type: none"> 1. Parameter error 2. Hardware failure 	<ol style="list-style-type: none"> 1. Use KOMM700 communicator to check whether the supply current of level switch exceeds the nominal maximum current. 2. When the current is correct, connect the level switch to KOMM700 communicator, execute the UnLoc command, and check the parameters. If the level switch cannot communicate, return it to the manufacturer. 3. If the communication works, check whether the threshold parameter is suitable for the current application. 4. When some parameters are incorrect, you can use communicator to execute the rESto command to restore to previous data or modify parameter directly. 5. When the parameters are correct, check the signal strength sig1 ~ 6, and contact the manufacturer after taking photos or video recording.

8.2 Check the supply current and output voltage drop

Users can use KOMM700 communicator to quickly check the supply current and output voltage drop. The specific steps are as follows:

1. Power on:

- According to the output type of level switch (NPN or PNP), connect the four wires of level switch to the NPN terminal group (**V12 +, V12 -, NPN, T-IN**) or the PNP terminal group (**V12 +, V12 -, PNP, T-IN**) of KOMM700 communicator. Use USB to power the KOMM700 communicator and click on the button **ON** to power on.

2. Check the supply current in V/I menu group:

- Click the button **Mode** to enter V/I menu group.
- Click the button **▶** to scroll through the menu until the screen displays *mAxx.x*, and the displayed value is the supply current in mA.
- When alarm is off, the typical supply current of level switch is between 8 ~ 20mA, and the peak current is 30 ~ 40mA under periodic microwave frequency sweeping. When the alarm is on, the supply current increases by 10 ~ 20mA.

3. Before checking the output voltage drop, it is necessary to unlock in Act menu group:

- Click the button **Mode** until the **Act** indicator light is on and the screen displays *UnLoc*, then click the button **Enter**, and the screen will display *yES* character, and the screen will start to blink. Click the button **Enter** again to confirm and start to unlock the level switch. The unlocking time is usually more than 10 seconds.
- After successful unlocking, KOMM700 communicator will automatically jump to PV menu group and display parameter contents.

4. Check the output voltage drop in V/I menu group:

- Click the button **Mode** until the **V/I** indicator light is on.
- Click the button **▶** to scroll through the menu until *d x.xx* is displayed on the screen
- Immerse the probe of level switch into water and keep the level switch in alarm state. View the value of *d x.xx*, which is the output voltage drop.
- When the actual load current is about 10mA, the output voltage drop of PNP is about 3V.
- When the actual load current is about 10mA, the output voltage drop of NPN is usually about 3V.

9 Technical data

Environment conditions		Features	
Operating temperature	<ul style="list-style-type: none"> ■ Cable outlet type -25~70°C ■ M12 connector type -40~85°C 	Repeatability	■ ± 1 mm
Storage temperature	<ul style="list-style-type: none"> ■ Cable outlet type -25~70°C ■ M12 connector type -40~85°C 	Return difference	■ ± 1 mm
Ambient humidity	■ < 98% RH	response time	■ 0.2s
Protection level	<ul style="list-style-type: none"> ■ IP67 ■ IP69K (cable outlet type + special waterproof cable) 	damping	■ 0 ~ 5 s (adjustable)
Power Supply		output signal	
Supply voltage	■ 12 ... 30 VDC	type of output	<ul style="list-style-type: none"> ■ PNP ■ NPN
Polarity reversal protection	■ Yes	Current load	■ 20 mA maximum
Current consumption (no load)	■ Typical 8mA, maximum 40mA	Short circuit protection	■ Yes
		Actual output voltage	<ul style="list-style-type: none"> ■ PNP: $(V_s - 1.5) \pm 0.5V$ Rload = 10 kΩ ■ NPN: $1.5 \pm 0.5V$, Rload = 10 kΩ
		leakage current	■ maximum 100 μ a
		Switching logic	<ul style="list-style-type: none"> ■ normally open (NO) ■ normally closed (NC)

Normally open (NO): When the probe is in air, the switch is off. When the probe is covered by medium, the switch is on (activated).

Normally closed (NC): When the probe is in air, the switch is on. When the probe is covered by medium, the switch is off (activated).

Process conditions:

model	Continuous process temperature Tamb < 50 °C The maximum immersion depth of probe tip is 16mm	Process pressure	Short time maximum process temperature Tamb < 50 °C The maximum immersion depth of probe tip is 16mm	Short time maximum process pressure t < 1 h
XR05 Standard type	-40 ~115°C	-0.1~10Mpa	135°C	-0.1~10Mpa
XR05 Cooling neck	-40~150°C	-0.1~10Mpa	150°C	-0.1~10Mpa

XR06 lengthened microwave level switch



UG2020-002-1

User manual
2020.09.01 Rev. C

1. Symbols

description

1.1 Warning symbols



Warning: if the user ignored or did not follow the instructions, it might lead to safety hazards, or serious injury.



Caution: if the user ignored or did not follow the instructions, it might damage the device or cause data loss.



ESD: if the user ignored or did not follow the instructions, ESD damage might be caused to the device.

1.2 Other symbols



Note

1.3 Safety instructions



Caution: this product is only applicable to the detection of solids, liquids or slurries with dielectric constant greater than or equal to 1.5.



Caution: this product cannot be used to measure media that are corrosive to the probe material (PEEK) or housing material.



Warning: users must have read and understood this manual before installation, configuration and commissioning.



Warning: user can only use undamaged product during installation.



Warning: when users use self-made or other manufacturer's weld-in sleeve and other

accessories, we will not be responsible for the damage caused by these accessories.



Warning: In hot media applications, the housing temperature of this product may exceed 50 °C. Users must take precautions to avoid risk of burns.



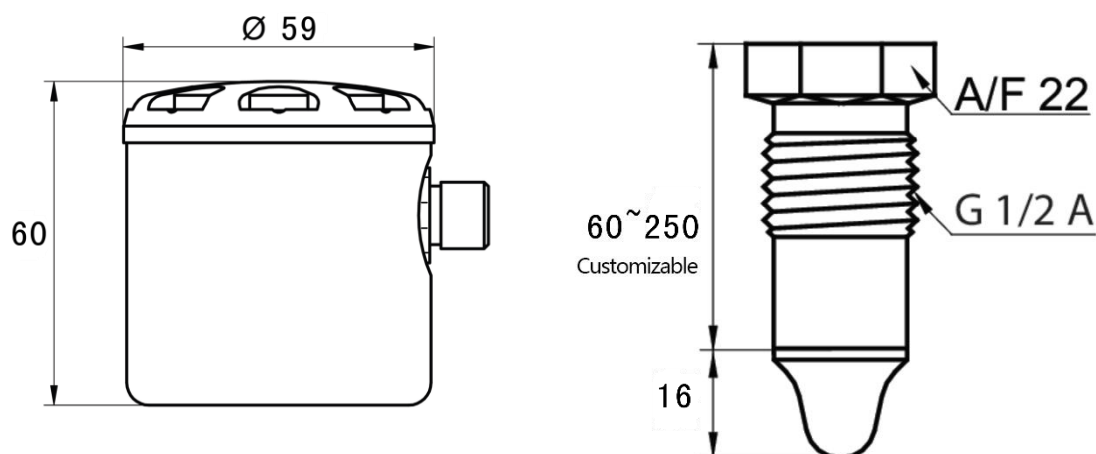
Warning: KOMM700 communicator should not be used in hazardous area for explosive-proof applications.

2. Introduction

XR06 extended microwave level switch is suitable for hygienic, food and industrial applications. It has excellent resistance to conductive sticking media, adapts to a variety of process media, and provides a variety of process connections and a variety of output signals. It is an ideal substitute for traditional mechanical, tuning fork and rotary paddle switches.

Compared with other series of our microwave level switches, this product can provide longer probe rod length, so that it is more suitable for high temperature applications. The 360° visible indicator light and its internal wiring terminals facilitate industrial field applications.

2.1 Product dimension



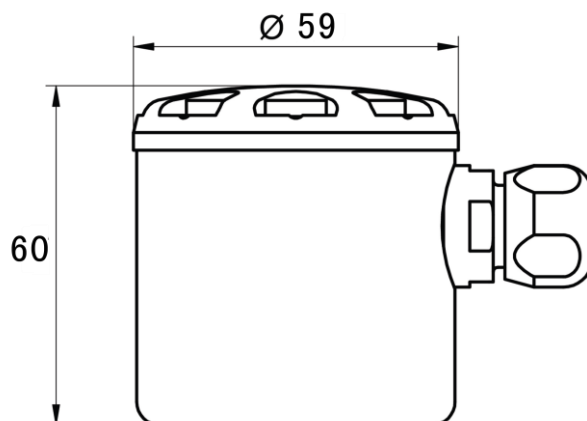


Fig. 1 XR06 dimension

2.2 Working principle

The probe, metal housing and internal electronic unit form a high frequency resonant circuit. High frequency microwave electric field is formed near the probe. When the probe is covered by the medium or the dielectric constant of the medium changes, the resonance frequency will change greatly. The internal electronic unit turns on or turns off the alarm signal by comparing the current resonant frequency with the threshold set by the user. This measurement method can effectively eliminate the influence of adhesive conductive coating.

2.3 Features and applications

■ Wide application	Suitable for solid and liquid with dielectric constant ≥ 1.5
■ Extended probe rod	<ul style="list-style-type: none"> ● Suitable for storage tank with thick insulation layer ● It helps to improve the anti-coating ability ● Suitable for measuring high temperature medium
■ Reliability	Not affected by bubbles
■ Anti-coating property	Adhesive and conductive slurry can be detected effectively
■ Clear instructions	The alarm light is visible from 360 degrees
■ Material of wetted part: PEEK and stainless steel	Suitable for hygienic and industrial applications
■ Easy to use	Threshold can be set with communicator
■ Suitable for high temperature medium	The maximum working temperature of medium is 200 °C
■ Normally open (NO) Normally closed (NC) output	NO and NC output are provided at the same time for field applications

2.4 Application restrictions

- Not suitable for abrasive media (such as quartz sand) and heavy bulk materials.
- Not suitable for the medium corrosive to the probe and the wetted part (such as ozonised water).
- The probe should not be exposed to ultraviolet radiation.

3. Nameplate, storage and

transport

3.1 Name plate

TYPE	Order code
IN	Power supply voltage and maximum power consumption current 12 ~ 30V, 40mA
OUT	PNP, NPN, maximum 20mA
TAMP	-40°C < ambient temperature < 85 °C
SN	Serial number
DATE	Date of manufacture

3.2 Storage and transport

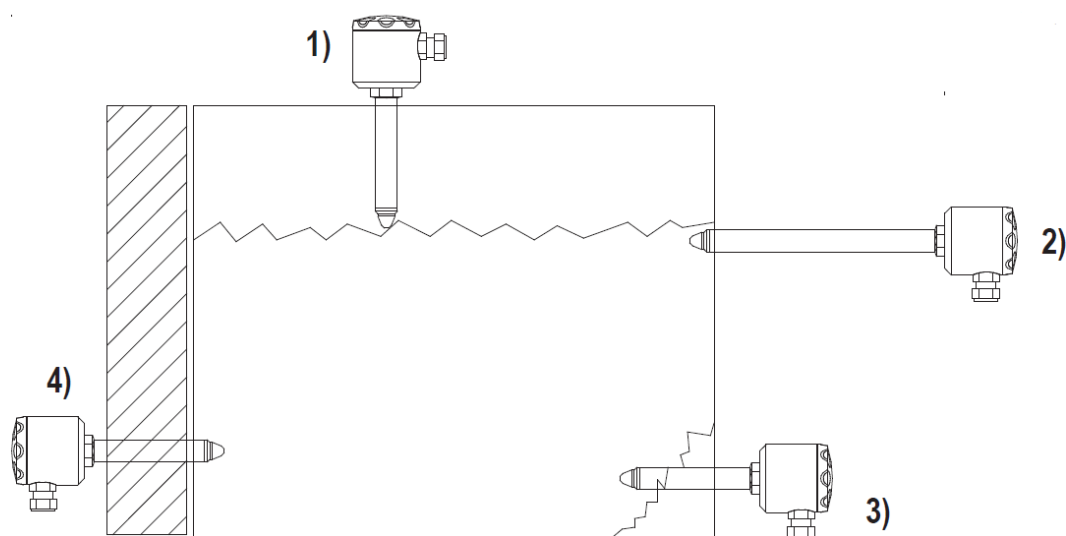
Storage conditions:

Storage temperature: - 40 ~ 85 °C

Use the original packaging.

Transport to measuring point:

Transport the product to the measuring point in its original packaging.

4.**Installation****4.1 Installation location****Fig.2 installation location**

The level switch can be installed in any part of the storage tank.

1. Upper limit of level
2. The probe rod is located outside the tank for heat dissipation and is suitable for high temperature medium measurement
3. Long probe rod helps to avoid the influence of accumulated medium.
4. Suitable for storage tanks with thick wall and insulation layer.

4.2 Safety instructions for normal temperature medium applications

Risk of injury may be caused by hazardous media.

- ▶ Wear protective equipment against hazardous media such as acids, alkaline solutions, etc.
- ▶ Clear storage tanks and pipes before installation.
- ▶ When the level switch is tightened, the torque is 15 ~ 20 Nm.

- ▶ The thread of M12 connector can only be tightened by hand. Spanner and other tools are not allowed for M12 connector, and the maximum torque is 0.6Nm.
- ▶ For direct installation in industrial application, PTFE tape should be wrapped around the thread.
- ▶ For installation in hygienic application, PTFE tape should not be used for the thread.

4.3 Safety instructions for high temperature medium applications



In addition to precautions for the normal temperature medium applications, it should be noted that the nominal maximum operating temperature requires that only the PEEK tip is in contact with the medium. Refer to the second installation form in Fig. 2 for high temperature application. Improper installation depth may cause the actual maximum working temperature to be lower than the nominal value.

4.3.1 Probe rod length and working temperature range

Probe rod length	Ambient temperature	Maximum long term working temperature of medium
Standard type	-40~60°C	95°C
	-40~40°C	115°C
The length of the probe rod exposed outside the tank (for heat dissipation) is 100 mm	-40~60°C	155°C
	-40~40°C	175°C
The length of the probe rod exposed outside the tank (for heat dissipation) is 250mm	-40~60°C	195°C
	-40~40°C	200°C

4.4 Inspection after installation

- ▶ Whether the equipment is intact (visual inspection).
- ▶ In hygienic applications check whether the drain hole of the installation adapter is downward.
- ▶ Check whether the plug of the M12 connector is tightened.

5. Electrical

connection

5.1 Equivalent circuit

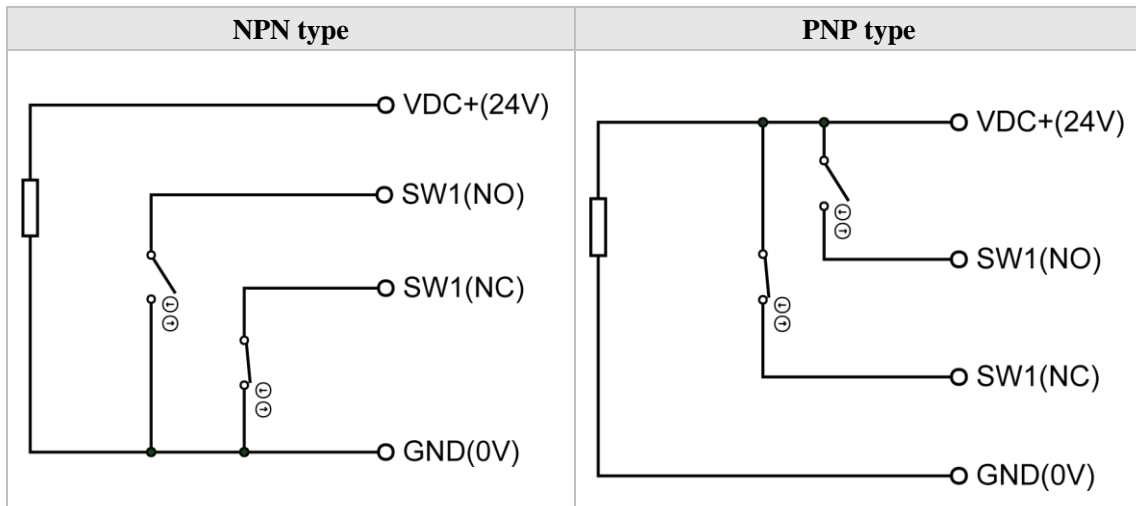


Fig. 3 XR06 equivalent circuit

Circuit symbol	Function	M12 Pin number	M12 cable wire color	Internal Terminal
VDC+	DC power supply+	1	Brown	+
GND	DC power supply-	3	blue	-
SW1 (NO)	Normally open output	4	black	NO
SW1 (NC)	Normally closed output	2	white	NC

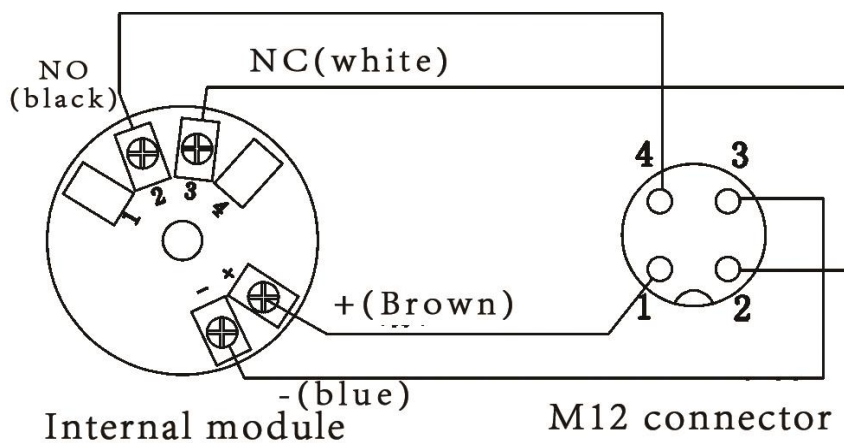
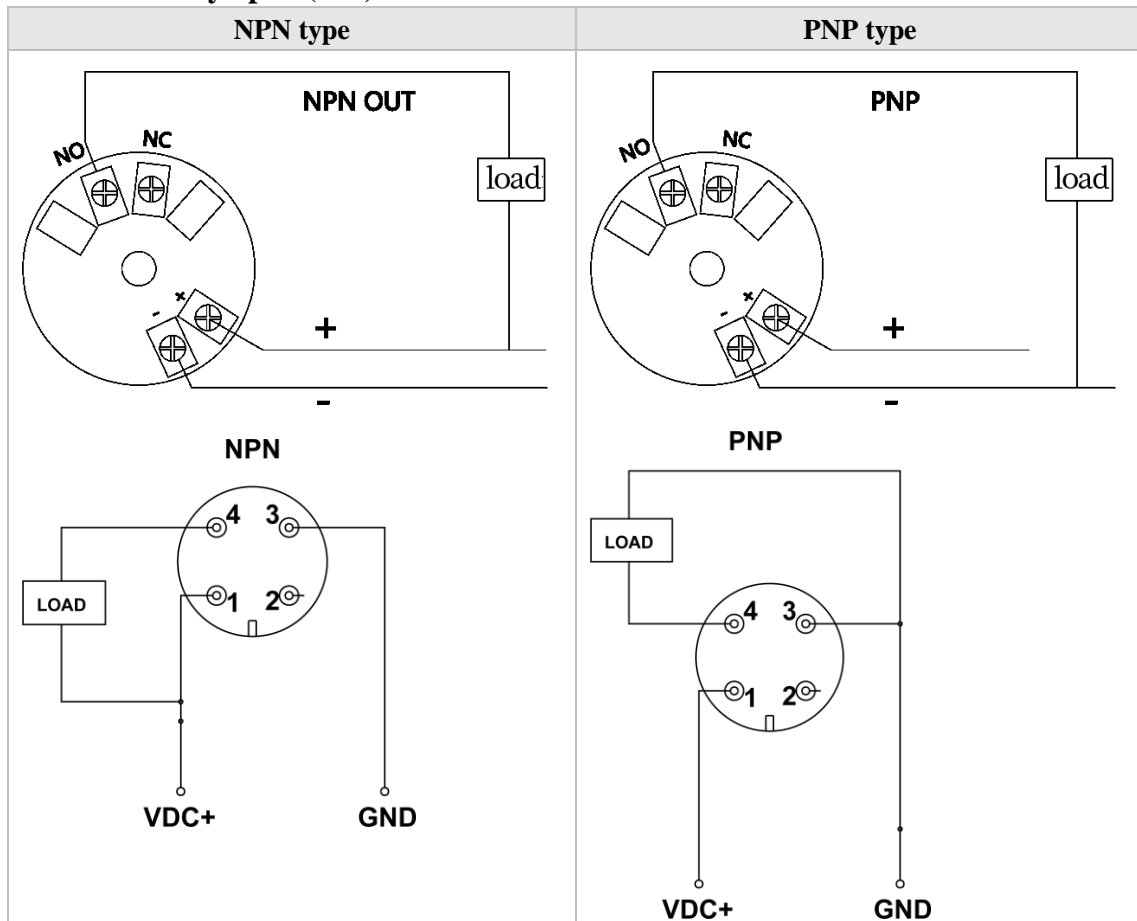


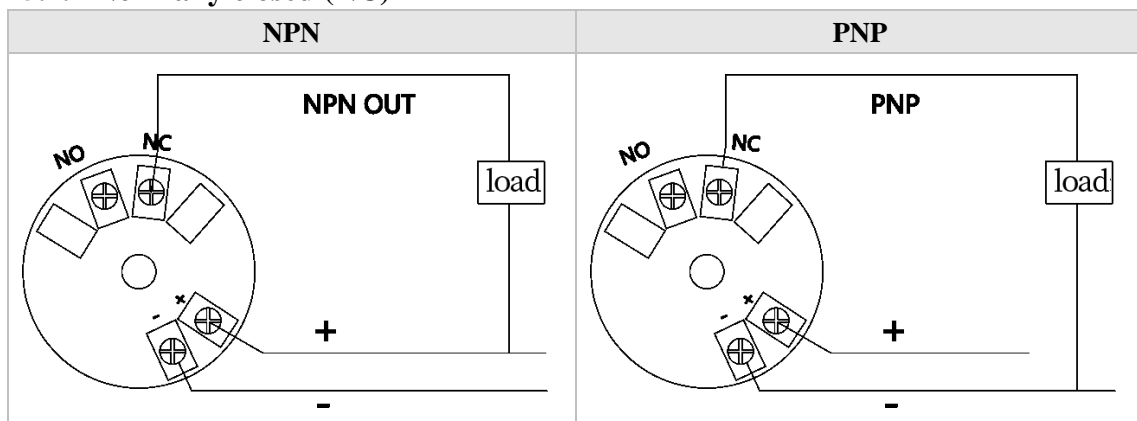
Fig. 4 internal connection between internal terminal and M12 connector

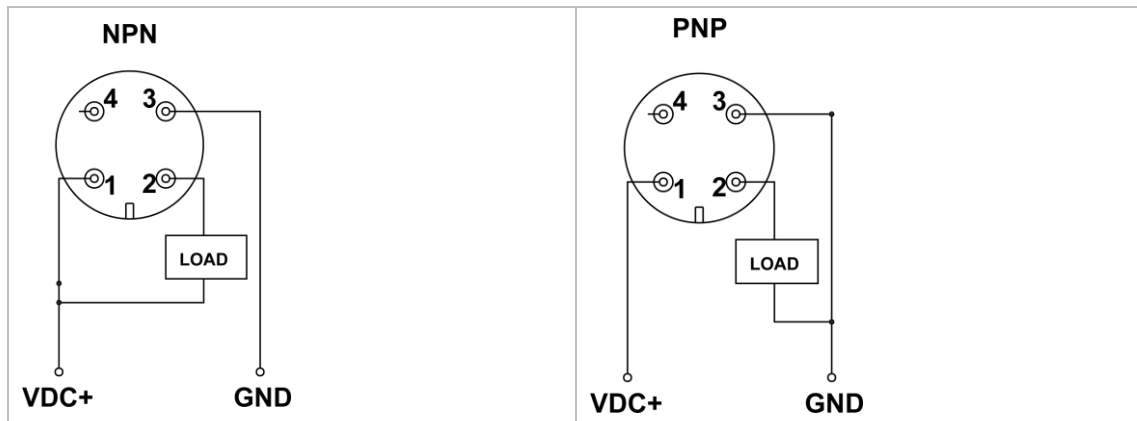
5.2 Wiring diagram

5.2.1 Normally open (NO)



5.2.2 Normally closed (NC)





5.3 Inspection after wiring

- ▶ Is the equipment or cable undamaged (visual inspection)?
- ▶ Does the cable meet the requirements?
- ▶ Has the cable been completely stress relieved?
- ▶ Whether the power supply voltage is consistent with the parameters on the name plate?
- ▶ Is the connector plug tightened?

6. Configuration

- ▶ Powered by 5V USB, the communicator provides 12V DC power supply for the level switch.
- ▶ When the alarm signal of the level switch is detected, the built-in buzzer of communicator will sound.

6.1 Connect NPN switch to communicator

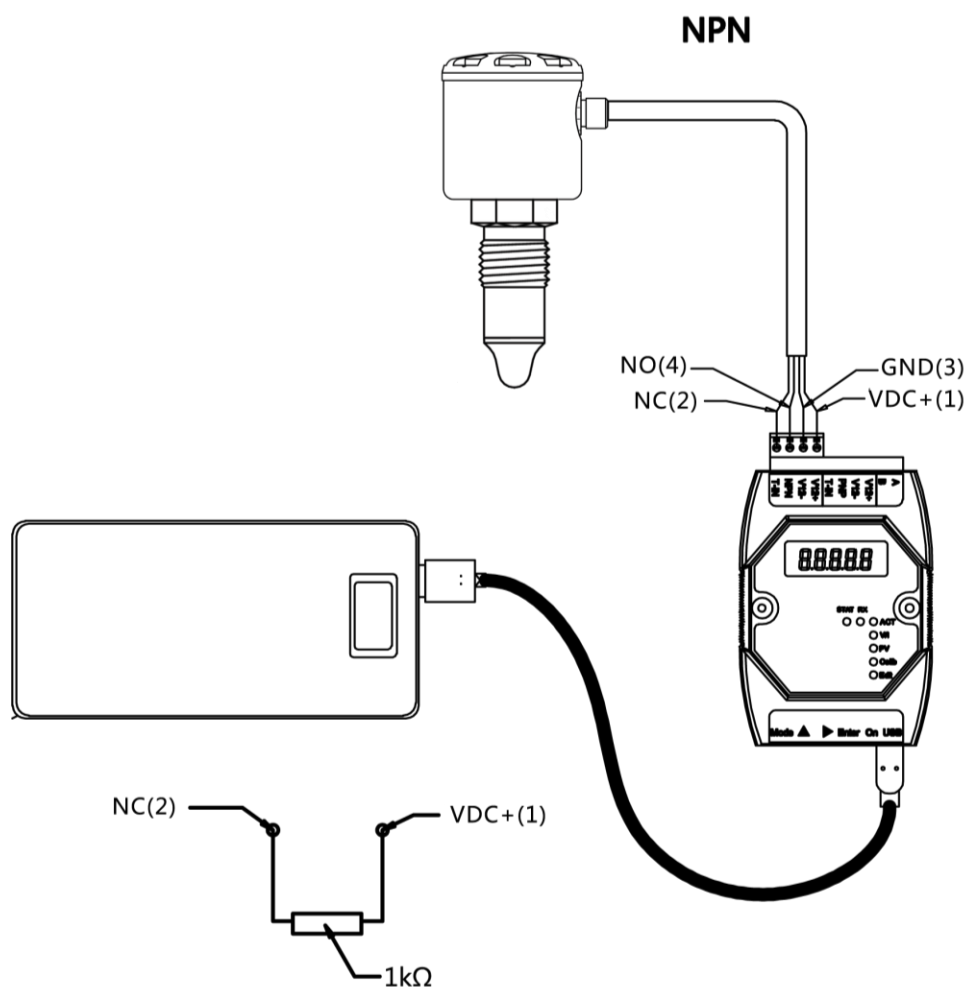


Fig. 4 Connect NPN level switch to communicator

Type of output	XR06 M12 Pin number and wire color	XR06 Internal terminal	KOMM700 terminal number of communicator
NPN	1(brown)	+	V12+
	3(blue)	-	V12-
	4(black)	NO	NPN
	2(white)	NC	T-IN



Note: For XR06 NPN level switch, a 1K ohm resistor between the VDC + and NC wires is needed for communication. In dedicated communicator (order code: KOMM700-NPN), there is a built-in 1K ohm resistor. In this case, no external resistor is required. The standard communicator does not have this resistor; therefore users must add the external pull-up resistor

manually.

6.2 Connect PNP switch to communicator

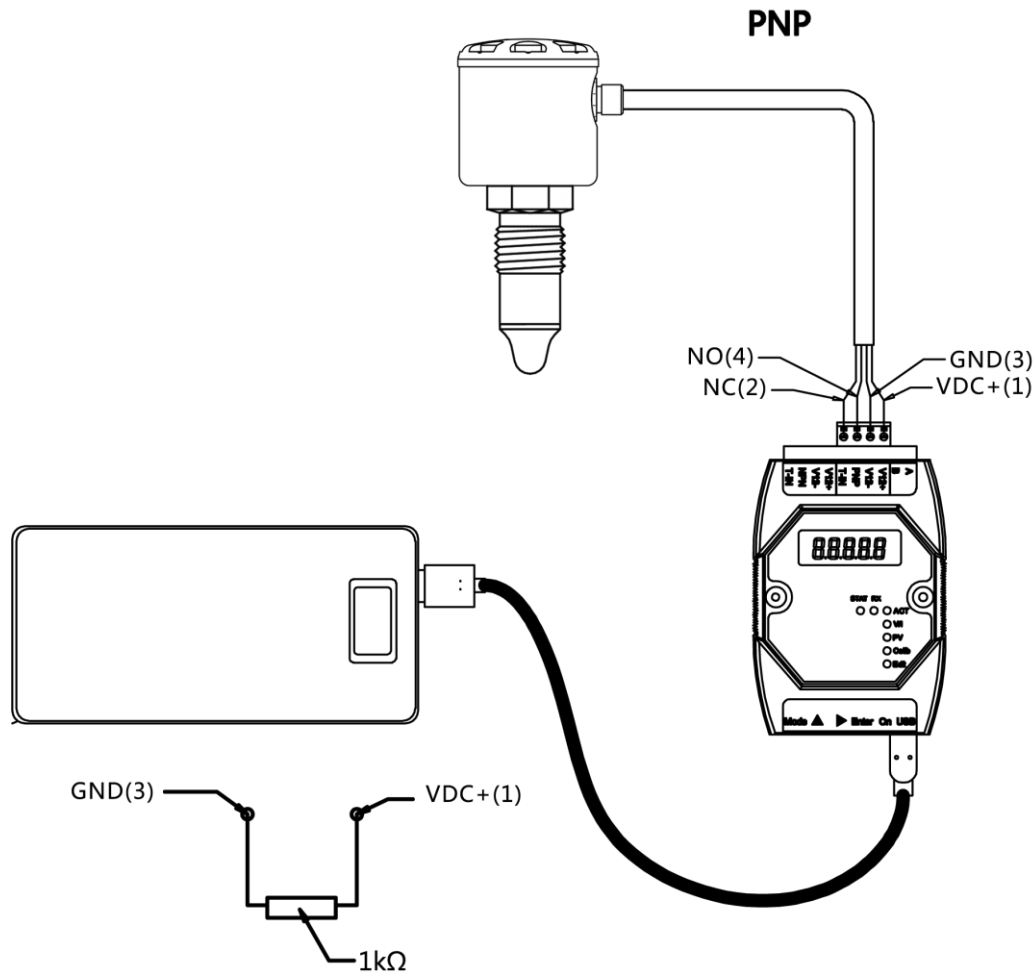


Fig. 5 Connect PNP level switch to communicator

Type of output	XR06 M12 Pin number and wire color	XR06 Internal terminal	KOMM700 terminal of communicator
PNP	1(brown)	+	V12+
	3(blue)	-	V12-
	4(black)	NO	PNP
	2(white)	NC	T-IN



Note: For XR06 PNP level switch, a 1K ohm resistor between the VDC + and GND wires is needed for communication. In dedicated communicator (order code: KOMM700-PNP), there is a built-in 1K ohm resistor. In this case, no external resistor is required. The standard communicator does not have this resistor; therefore users must add the external resistor manually.

6.3 Examples of configuration

6.3.1 View P1000 value and other parameters of level switch

Example 1: view P1000 and other parameters of microwave level switch

1. Power on:

- According to the output type of level switch (NPN or PNP), connect the four wires of level switch to the NPN terminal group (**V12 +, V12 -, NPN, T-IN**) or the PNP terminal group (**V12 +, V12 -, PNP, T-IN**) of KOMM700 communicator. Use USB to power the KOMM700 communicator and click the button **ON** to power on.

2. Unlock in Act menu group:

- After startup, the **Act** indicator light is on. When the screen displays **UnLoc**, click the button **Enter**, and the screen displays **yES**, and starts to blink. Click the button **Enter** again to confirm to start unlocking the microwave level switch. The unlocking time is usually more than 10 seconds.
- After successful unlocking, the **RX** communication indicator of KOMM700 communicator flashes periodically, and the **STAT** indicator is always on.
- After successful unlocking, KOMM700 communicator will automatically jump to **PV** menu group and display parameter contents.

3. View parameters in PV menu group:

Click the button **▶** to view different parameters. The most important parameters are:

P1000: current PV (range: 0 ~ 1000)

After calibration, $P1000 \approx 100$, when probe is in air.

After calibration, $P1000 \approx 900$, when probe is in tap water.

AL1: Alarm threshold of SW1 (water, oil and solid powder have different AL1 values)

AH1: Alarm hysteresis of SW1

do: Output type (0 = NPN, 1 = PNP)

dAmP: Damping: 0 ~ 5


6.3.2 Modify alarm threshold **AL1** of level switch

Example 2: modify alarm threshold **AL1** of level switch

1. Power on:

- According to the output type of level switch (NPN or PNP), connect the four wires of level switch to the NPN terminal group (**V12 +, V12 -, NPN, T-IN**) or the PNP terminal group (**V12 +, V12 -, PNP, T-IN**) of KOMM700 communicator. Use USB to power the KOMM700 communicator and click the button **ON** to power on.

2. Unlock in Act menu group:

- After startup, the **Act** indicator light is on. When the screen displays *UnLoc*, click the button **Enter**. The screen displays *yES*, and starts to blink. Click the button **Enter** again to confirm to start unlocking the microwave level switch. The unlocking time is usually more than 10 seconds.
 - After successful unlocking, the **RX** communication indicator of KOMM700 communicator flashes periodically, and the **STAT** indicator is always on.
 - After successful unlocking, KOMM700 communicator will automatically jump to **PV** menu group and display parameter contents.
3. **PV menu group:** View and modify alarm point **AL1**
- Click the button  to scroll through the menu until **AL1** is displayed on the screen.
 - Click the button **Enter**, KOMM700 communicator will automatically jump to the **Edit** menu group and start editing and modifying **AL1** parameters
 - ◆ Recommended **AL1** value for different applications
 - ◆ Water: 550
 - ◆ Foam: 350
 - ◆ Conductive viscous medium (e.g. ketchup): 720
 - ◆ Oil: 250
 - ◆ Solid particles (e.g. dried tea): 180
 - After the modification is over, click the button **Enter** to start downloading. The screen will display *yES* at first and prompt the user to confirm. After clicking the button **Enter** again, KOMM700 communicator starts to download parameters.
 - The download usually takes more than 10 seconds. After the download is completed, the **RX** communication light starts to flash, and the **STAT** light will be on. If the modification is successful, *PASS* will be displayed on the screen.
4. **Backup in Act menu group:**
- When further parameter modification is not required, you should switch to **Act** menu group and execute a backup command **bkup**.

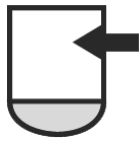

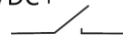
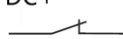


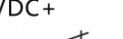
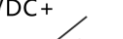
More configuration examples can be found in the KOMM700 communicator user manual.

7.

Commissioning

NO (pin 4 in M12 connector) and NC (pin 2 in M12 connector) are always opposite. It is convenient for users to select the appropriate alarm output signal according to different applications.

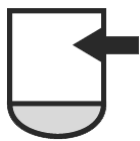

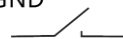





7.1 PNP alarm status

	Probe status	LED lamp	NO (Pin 4 of M12)	NC (Pin 2 of M12)	NO voltage (with load)	NC voltage (with load)
	Not covered		VDC+ NO 	VDC+ NC 	0	≈VDC
	Covered		VDC+ NO 	VDC+ NC 	≈VDC	0



For PNP output type, when measuring the output voltage, the load must be connected. The maximum load current should not exceed 20mA. Refer to section 5.3 for wiring diagram.

7.2 NPN alarm status

	Probe status	LED lamp	NO (Pin 4 of M12)	NC (Pin 2 of M12)	NO voltage (with load)	NC voltage (with load)
	Not covered		GND NO 	GND NC 	≈VDC	0
	Covered		GND NO 	GND NC 	0	≈VDC



For NPN output type, when measuring the output voltage, the load must be connected. The maximum load current should not exceed 20mA. See section 5.3 for wiring diagram.

7.3 Select the appropriate threshold AL1

Through frequency sweeping, the level switch monitors the change of P1000 (normalized resonance frequency) in real time. The level switch is calibrated before delivery. After calibration, when the probe is in air, $P1000 \approx 100$, when the probe is in tap water, $P1000 \approx 900$. When the current measured value ($P1000$) $\geq A11$, the indicator light is on and SW1 is activated.

Recommended threshold AL1 for common applications

Medium	Example	Recommended threshold AL1
Water based solution	Tap water, acid, alkali solution	550 (factory default)
Foam	Beer-froth	350
Viscous conductive medium	Ketchup	720
Oil	Edible oil, lubricating oil	250
Solid particles with low water content	Dried tea	180
Solid particles with high water content	Rice, wheat	250

8. Troubleshooting

8.1 List of common issues

Issues	Possible cause	Solutions
The LED is always off	<ol style="list-style-type: none"> 1. Connection failure 2. Hardware failure 3. Parameter error 	<ol style="list-style-type: none"> 1. Check the power supply voltage 2. Check the wiring sequence 3. When the wiring and power supply are correct, use KOMM700 communicator to check whether the supply current of level switch is 0 or exceeds the maximum nominal current. 4. When the supply current is correct, connect the level switch to KOMM700 communicator, execute the unlocking command, and check the supply current and other parameters. If the level cannot communicate, return it to the manufacturer. 5. When some parameters are incorrect, you can use KOMM700 communicator to execute the rESto command to restore to previous data. 6. When the parameters are correct, check the signal strength sig1 ~ 6, and contact the manufacturer after taking photos or video recording.
The LED is always on	<ol style="list-style-type: none"> 1. Parameter error 2. Hardware failure 	<ol style="list-style-type: none"> 1. Use KOMM700 communicator to check whether the supply current of level switch exceeds the nominal maximum current. 2. When the current is normal, connect the level switch to KOMM700 communicator, execute the UnLoc command, and check the parameters. If the level switch cannot communicate,

	<p>return it to the manufacturer.</p> <p>3. If the communication works, check whether the threshold parameter is suitable for the current application.</p> <p>4. When some parameters are incorrect, you can use communicator to execute the rESto command to restore to previous data or modify parameter directly.</p> <p>5. When the parameters are correct, check the signal strength sig1 ~ 6, and contact the manufacturer after taking photos or video recording.</p>
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8.2 Check the supply current and output voltage drop

Users can use KOMM700 communicator to quickly check the supply current and output voltage drop. The specific steps are as follows:

1. Power on:

- According to the output type of level switch (NPN or PNP), connect the four wires of level switch to the NPN terminal group (**V12 +, V12 -, NPN, T-IN**) or the PNP terminal group (**V12 +, V12 -, PNP, T-IN**) of KOMM700 communicator. Use USB to power the KOMM700 communicator and click on the button **ON** to power on.

2. Check the supply current in V/I menu group:

- Click the button **Mode** to enter V/I menu group.
- Click the button **▶** to scroll through the menu until the screen displays *mAx.x*, and the display value is the supply current in mA.
- When alarm is off, the typical supply current of level switch is between 8 ~ 20mA, and the peak current is 30 ~ 40mA under periodic microwave frequency sweeping. When the alarm is on, the supply current increases by 10 ~ 20mA.

3. Before checking the output voltage drop, it is necessary to unlock in Act menu group:

- Click the button **Mode** until the **Act** indicator light is on and the screen displays *UnLoc*, then click the button **Enter**. The screen will display *yES* character, and *l* start to blink. Click the button **Enter** again to confirm and start to unlock the level switch. The unlocking time is usually more than 10 seconds.
- After successful unlocking, KOMM700 communicator will automatically jump to PV menu group and display parameter contents.

4. Check the output voltage drop in V/I menu group:

- Click the button **Mode** until the **V/I** indicator light is on.
- Click the button **▶** to scroll through the menu until *d x.xx* is displayed on the screen
- Put the probe of level switch into water and keep the level switch in alarm state. View the value of *d x.xx*, which is the output voltage drop.
- When the actual load current is about 10mA, the output voltage drop of PNP is about 3V.
- When the actual load current is about 10mA, the output voltage drop of NPN is usually about 3V.

9. Technical data

Environment conditions		Features	
Operating temperature	■ -40 ... -85 °C	Repeatability	■ ± 1 mm
Storage temperature	■ -40 ... -85 °C	Return difference	■ ± 1 mm
Ambient humidity	■ < 98% RH	response time	■ 0.2s
Protection level	■ IP67	damping	■ 0 ~ 5 s (adjustable)
Power Supply		output signal	
Supply voltage range	■ 12 ... 30 VDC	Type of output	■ PNP ■ NPN
Polarity reversal protection	■ Yes	Current load	■ 20 mA maximum
Current consumption (no load)	■ typical 8 mA, maximum 40 mA	Short circuit protection	■ Yes
Power interruption time	■ 1ms	PNP/NPP output voltage	■ PNP: (VS- 1.5)±0.5V Rload = 10 kΩ ■ NPN: 1.5±0.5V , Rload = 10 kΩ
		leakage current	■ maximum 100 μA
		Switching logic	■ normally open (NO) ■ normally closed (NC)

Normally open (NO): When the probe tip is in air, the switch is off. When the probe tip is covered by medium, the switch is on (activated).

Normally closed (NC): When the probe tip is in air, the switch is on. When the probe tip is covered by medium, the switch is off (activated).

Process conditions

Probe structure	Continuous process temperature Tamb < 40 °C	Process pressure	Short time maximum process temperature Tamb < 40 °C	Short time maximum process pressure t < 1 h
Standard type	-40 ~115°C	-0.1~10Mpa	140°C	-0.1~10Mpa
Length 100 mm	-40~175°C	-0.1~10Mpa	150°C	-0.1~10Mpa
Length 250mm	-40~200°C	-0.1~10Mpa	200°C	-0.1~10Mpa

XR07 dual output microwave level switch



UG2020-003-1

User manual
2020.09.01 Rev. C

1. Symbols

description

1.1 Warning symbols



Warning: if the user ignored or did not follow the instructions, it might lead to safety hazards, or serious injury.



Caution: if the user ignored or did not follow the instructions, it might damage the device or cause data loss.



ESD: if the user ignored or did not follow the instructions, ESD damage might be caused to the device.

1.2 Other symbols



Note

1.3 Safety instructions



Caution: this product is only applicable to the detection of solids, liquids or slurries with dielectric constant greater than or equal to 1.5.



Caution: this product cannot be used to measure media that are corrosive to the probe material (PEEK) or housing material.



Warning: users must have read and understood this manual before installation, configuration and commissioning.



Warning: user can only use undamaged product during installation.



Warning: when users use self-made or other manufacturer's weld-in sleeve and other

accessories, we will not be responsible for the damage caused by these accessories.



Warning: in hot media applications, the housing temperature of this product may exceed 50 °C. Users must take precautions to avoid risk of burns.



Warning: KOMM700 communicator should not be used in hazardous area for explosion proof applications.

2. Introduction

XR07 dual output microwave level switch is suitable for hygienic, food and industrial applications. It has excellent resistance to conductive sticking material, adapts to a variety of process media, and provides a variety of process connection forms and a variety of output signals. It is an ideal substitute for traditional mechanical, tuning fork and rotary paddle switches.

Compared with other series of microwave level switches, the remarkable feature of this product is that it can provide dual independent output. It can be used for layered medium detection. Besides, the product provides serial data upload and PWM data function, which make it suitable for complicated control applications.

2.1 Product structure

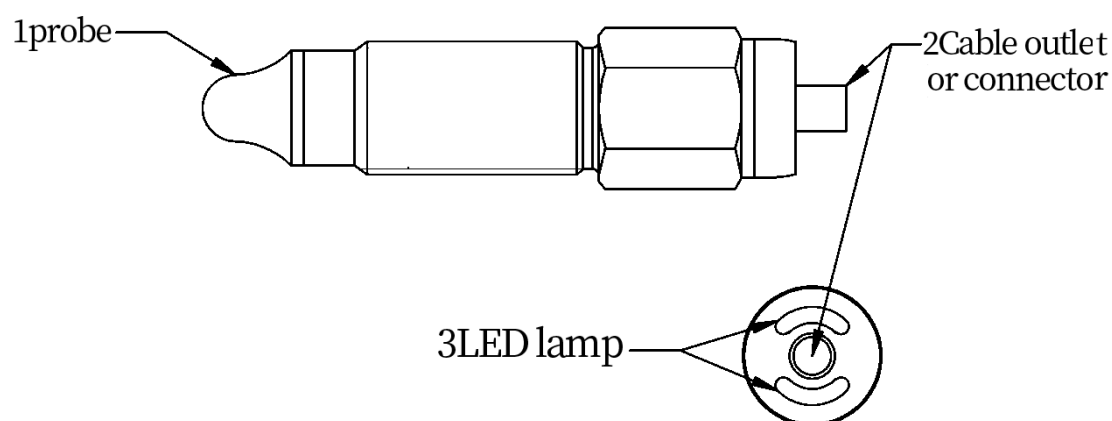


Fig. 1 XR07 structure

2.2 Working principle

The probe, metal housing and internal electronic unit form a high frequency resonant circuit. High frequency microwave electric field is formed near the probe. When the probe is covered by the medium or the dielectric constant of the medium changes, the resonance frequency will change greatly. The internal electronic unit turns on or turns off the alarm signal by comparing the current resonant frequency with the threshold set by the user. This measurement method can effectively eliminate the influence of adhesive conductive coating.

2.3 Features and applications

■ Wide application	Suitable for solid and liquid with dielectric constant ≥ 1.5
■ Dual alarm output	It can detect layered media, such as beer and foam, oil and water.
■ Anti-coating property	Suitable for detection of adhesive and conductive slurry
■ Compact size	Suitable for installation in tight spaces
■ Material of wetted part: PEEK and stainless steel	Suitable for hygienic and industrial applications
■ Easy to use	Alarm threshold can be set with communicator
■ Data upload	Serial data upload is provided on a 24V output line
■ PWM output	PWM output is provided for uploading process variable
■ Normally open (NO) Normally closed (NC)	NO and NC are provided at the same time.

2.4 Application restrictions

- Not suitable for abrasive media (such as quartz sand) and heavy bulk materials.
- Not suitable for the medium corrosive to the probe and the wetted part.
- The probe should not be exposed to ultraviolet radiation.

3. Nameplate, storage and

transport

3.1 Name plate

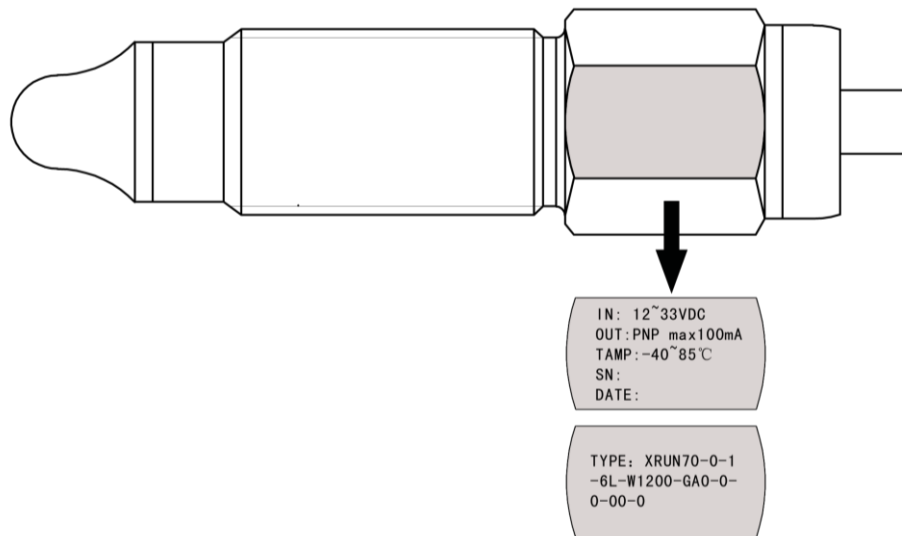


Fig. 2 nameplate

TYPE	Order code
IN	Power supply voltage and maximum power consumption current 12 ~ 33V, 40mA
OUT	PNP, NPN, maximum external load 100mA
TAMP	-40°C < ambient temperature < 85 °C
SN	Serial number
DATE	Date of manufacture

3.2 Storage and transport

Storage conditions:

Storage temperature: - 40 ~ 85 °C

Use the original packaging.

Transport to measuring point:

Transport the product to the measuring point in its original packaging.

4. Installation

4.1 Installation location

The level switch can be installed anywhere in the storage tank, pipe or silo. Using a socket wrench, users can install the level switch in the location which is hard to operate.

The level switch can be installed for:

1. Upper limit of material level
2. Lower limit of material level
3. Dry run protection

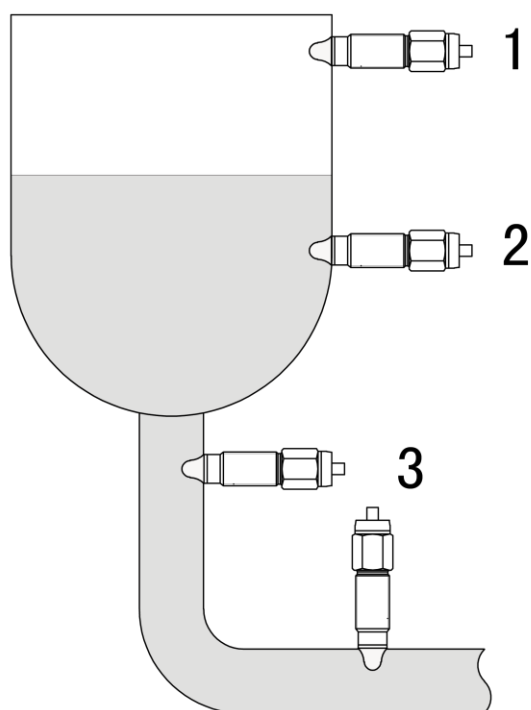


Fig.3 installation location

4.2 Installation for industrial applications



Risk of injury may be caused by hazardous media

- ▶ Wear protective equipment against hazardous media (e.g. various acids, alkaline solutions, etc.).
- ▶ Clear storage tanks and pipes before installation.

4.2.1 Direct installation

The specific steps are as follows:

1. Before and during installation, make sure that there is no medium in the storage tank and pipe.



2. Caution: PTFE tape must be wrapped around the thread of level switch.

3. Screw the level switch into the mounting hole with a wrench (22AF).

4. The tightening torque is 30 Nm.

4.2.2 Installation with stainless steel weld-in sleeve



Note: when weld-in sleeve is used, PTFE tape is not required.

The specific steps are as follows:

1. Before and during installation, make sure that there is no medium in the storage tank and pipe.

2. First install the weld-in sleeve on the field storage tank or pipe.

3. Screw in the level switch.

4. The tightening torque is 15 ~ 20 Nm.

4.2.3 Installation using plastic (e.g. PTFE) adapter



Note: when using plastic process adapter, PTFE tape is not required.

The specific steps are as follows:

1. Before and during installation, make sure that there is no medium in the storage tank or pipe.

2. First install the adapter on the storage tank or pipe.

3. Screw in the level switch.

4. The tightening torque is 15 ~ 20 Nm.

5. Grounding: the metal housing of the level switch should be connected to the frame ground through wires.

4.3 Installation for hygienic applications



Risk of injury may be caused by hazardous media

- ▶ Only use weld-in sleeve (stainless steel) for hygienic installation.
- ▶ Do not use PTFE tape or other elastomers for hygienic applications.

▶ Welding must be performed by welders trained in the field of hygiene.

4.3.1 Weld-in sleeve installation

The specific steps are as follows:

1. Before and during installation, make sure that there is no medium in the storage tank and pipe.
2. Weld-in sleeves or adapters are installed in a hygienic manner and flush inside.
3. Weld seams are smoothed out to $RA < 0.8 \mu m$.
4. Drain hole points down.
5. Tighten the level switch.
6. The tightening torque is 10-15 Nm.

4.4 Inspection after installation

- ▶ Is the level switch not damaged (visual inspection)?
- ▶ Are adequate precautions taken to prevent level switch from direct sunlight and rain?
- ▶ Is the level switch properly secured against shock?

5. Electrical connection



Caution: XR07 electrical interface is divided into two types: cable-outlet type and M12 4-Pin connector. The two kinds of interfaces use different wire colors, which should be noted during installation.

5.1 Working modes

Parameter	Function	Description
mode = 0	Single alarm output (default)	When $P1000 \geq AL1$, SW1 (NO) and SW2 (NC) are activated simultaneously, SW1 is turned on, SW2 is turned off. SW1 and SW2 are always opposite.
mode=1	Dual alarm output for layered media	When $P1000 \geq AL1$, SW1 (NO) is on (activated). When $P1000 \geq AL2$, SW2 (NC) is off (activated)
mode = 2	Dual alarm output for layered media	When $P1000 \geq AL1$, SW1 (NO) is on (activated) When $P1000 \geq AL2$, SW2 (NO) is on (activated)
mode = 3	Data upload	When $P1000 \geq AL1$, SW1 (NO) is on (activated) SW2 is used for 9600bps, 8N1 Serial communication
mode = 4	PWM output	When $P1000 \geq AL1$, SW1 (NO) is on (activated)

	SW2 is used for transmitting P1000 through PWM signal
--	---

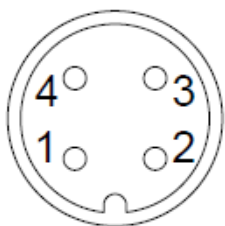
5.2 M12 type and cable outlet type have different wire colors

Circuit symbol	Function	M12 pin number and wire color	Cable outlet wire color
VDC+	DC power supply+	Brown1	White
SW2	Second switch output	White2	Brown
GND	DC power supply-	Blue3	green
SW1	First switch output	Black4	yellow

5.3 Equivalent circuit of cable-outlet type (Mode=0 or 1)

Type of output	Equivalent circuit	Function (wire color or label)												
PNP		<table> <tr> <td>VDC+</td> <td>White</td> <td>1</td> </tr> <tr> <td>SW1 (NO)</td> <td>Yellow</td> <td>4</td> </tr> <tr> <td>SW2 (NC)</td> <td>Brown</td> <td>2</td> </tr> <tr> <td>GND (0V)</td> <td>Green</td> <td>3</td> </tr> </table>	VDC+	White	1	SW1 (NO)	Yellow	4	SW2 (NC)	Brown	2	GND (0V)	Green	3
VDC+	White	1												
SW1 (NO)	Yellow	4												
SW2 (NC)	Brown	2												
GND (0V)	Green	3												
NPN		<table> <tr> <td>VDC+</td> <td>White</td> <td>1</td> </tr> <tr> <td>SW1 (NO)</td> <td>Yellow</td> <td>4</td> </tr> <tr> <td>SW2 (NC)</td> <td>Brown</td> <td>2</td> </tr> <tr> <td>GND (0V)</td> <td>Green</td> <td>3</td> </tr> </table>	VDC+	White	1	SW1 (NO)	Yellow	4	SW2 (NC)	Brown	2	GND (0V)	Green	3
VDC+	White	1												
SW1 (NO)	Yellow	4												
SW2 (NC)	Brown	2												
GND (0V)	Green	3												
Digital output push-pull		<table> <tr> <td>VDC+</td> <td>White</td> <td>1</td> </tr> <tr> <td>SW1</td> <td>Yellow</td> <td>4</td> </tr> <tr> <td>SW2</td> <td>Brown</td> <td>2</td> </tr> <tr> <td>GND (0V)</td> <td>Green</td> <td>3</td> </tr> </table>	VDC+	White	1	SW1	Yellow	4	SW2	Brown	2	GND (0V)	Green	3
VDC+	White	1												
SW1	Yellow	4												
SW2	Brown	2												
GND (0V)	Green	3												

5.4 Equivalent circuit of M12 connector type (Mode=0 or 1)



Type of output	Equivalent circuit	Function/M12 pin number/wire color
PNP		VDC+ 1 Brown SW1 (NO) 4 Black SW2 (NC) 2 White GND (0V) 3 Blue
NPN		VDC+ 1 Brown SW1 (NO) 4 Black SW2 (NC) 2 White GND (0V) 3 Blue
Digital output push-pull		VDC+ 1 Brown SW1 4 Black SW2 2 White GND (0V) 3 Blue

5.5 Inspection after wiring

- ▶ Is the level switch not damaged (visual inspection)?
- ▶ Does the cable meet the requirements?
- ▶ Has the cable been completely stress relieved?
- ▶ Whether the power supply voltage is consistent with the name plate?
- ▶ Is the connector plug tightened?

6. Configuration

- ▶ Powered by 5V USB, the communicator provides 12V DC power supply for the level switch.
- ▶ When the alarm signal of the level switch is detected, the built-in buzzer of communicator will sound.

6.1 Connect NPN switch to communicator

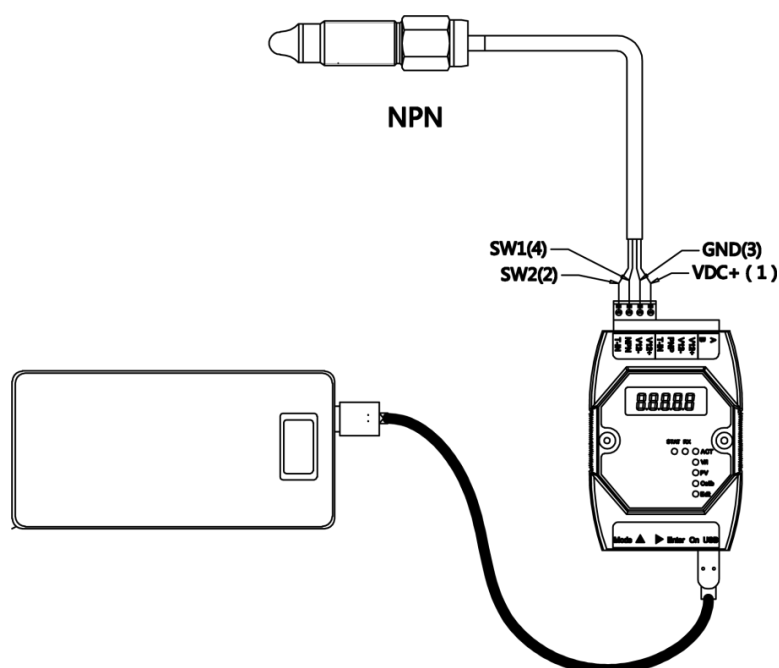


Fig. 4 Connect NPN level switch to communicator

Wiring table of NPN switch

Electrical connection type	Circuit symbol	XR07 Wire color or pin number	KOMM700 Communicator terminal
Cable Outlet	VDC+	White (1)	V12+
	GND	Green (3)	V12-
	SW1	Yellow (4)	NPN
	SW2	Brown (2)	T-IN
M12 4pin	VDC+	Brown (1)	V12+
	GND	Blue (3)	V12-
	SW1	Black (4)	NPN
	SW2	White (2)	T-IN

6.2 Connect PNP switch to communicator

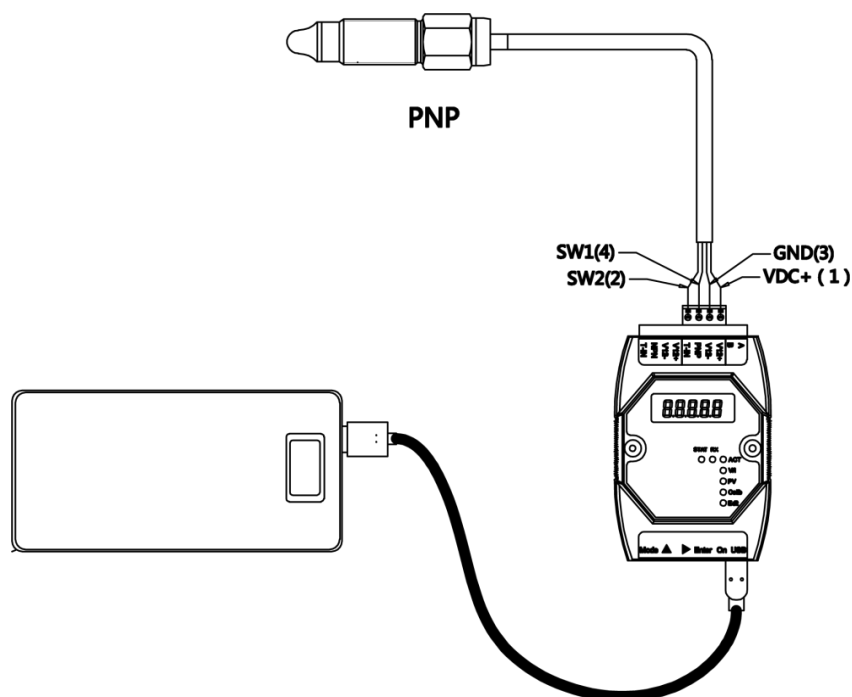


Fig. 5 Connect PNP level switch to communicator

Wiring table of PNP switch

Electrical connection type	Circuit symbol	XR07 line color or terminal number	KOMM700 Communicator terminal
Cable outlet	VDC+	White (1)	V12+
	GND	Green (3)	V12-
	SW1	Yellow (4)	PNP
	SW2	Brown (2)	T-IN
M12 4-Pin	VDC+	Brown (1)	V12+
	GND	Blue (3)	V12-
	SW1	Black (4)	PNP
	SW2	White (2)	T-IN



Note: XR07 level switch does not need extra resistor for communication with standard KOMM700 communicator.

6.3 Examples of configuration operation

6.3.1 View P1000 value and the current working mode of level switch

Example 1: view P1000 and the current working mode of microwave level switch

1. Power on:

- According to the output type of level switch (NPN or PNP), connect the four wires of level switch to the NPN terminal group (**V12 +, V12 -, NPN, T-IN**) or the PNP terminal group (**V12 +, V12 -, PNP, T-IN**) of KOMM700 communicator. Use USB to power the KOMM700 communicator and click the button **ON** to power on.

2. Unlock in Act menu group:

- After startup, the **Act** indicator light is on. When the screen displays **UnLoc**, click the button **Enter**. The screen displays **yES**, and starts to blink. Click the button **Enter** again to confirm to start unlocking the microwave level switch. The unlocking time is usually more than 10 seconds.
- After successful unlocking, the **RX** communication indicator of KOMM700 communicator flashes periodically, and the **STAT** indicator is always on.
- After successful unlocking, KOMM700 communicator will automatically jump to **PV** menu group and display parameter contents.

3. View parameters in PV menu group:

Click the button **▶** to view different parameters. The most important parameters are:

CodE: current working mode:

700 means modE= 0 (single alarm output)

701 means modE= 1 (dual alarm output SW1=NO, SW2=NC)

702 means modE= 2 (dual alarm output SW1=NO, SW2=NO)

703 means modE= 3 (single alarm output with data uploading)

704 means modE= 4 (single alarm output with PWM output)

P1000: current PV (range: 0 ~ 1000)

After calibration, P1000 \approx 100, when probe is in air.

After calibration, P1000 \approx 900, when probe is in tap water.

AL1: Alarm threshold of SW1 (water, oil and solid powder have different AL1 value)

AH1: Alarm hysteresis of SW1

do: Output type (0 = NPN, 1 = PNP)

dLy: Alarm delay (0~10)

dAmP: Damping: 0 ~ 5

6.3.2 Modify alarm threshold **AL1** of level switch

Example 2: modify alarm threshold **AL1** of level switch

1. Power on:

- According to the output type of level switch (NPN or PNP), connect the four wires of

level switch to the NPN terminal group (**V12 +, V12 -, NPN, T-IN**) or the PNP terminal group (**V12 +, V12 -, PNP, T-IN**) of KOMM700 communicator. Use USB to power the KOMM700 communicator and click the button **ON** to power on.

2. Unlock in Act menu group:

- After startup, the **Act** indicator light is on. When the screen displays **UnLoc**, click the button **Enter**, and the screen displays **yES**, and starts to blink. Click the button **Enter** again to confirm to start unlocking the microwave level switch. The unlocking time is usually more than 10 seconds.
- After successful unlocking, the **RX** communication indicator of KOMM700 communicator flashes periodically, and the **STAT** indicator is always on.
- After successful unlocking, KOMM700 communicator will automatically jump to **PV** menu group and display parameter contents.

3. PV menu group: View and modify alarm threshold **AL1**

- Click the button **▶** to scroll through the menu until **AL1** is displayed on the screen.
- Click the button **Enter**, KOMM700 communicator will automatically jump to **Edit** menu group and start editing and modifying **AL1** parameters
 - ◆ Recommended **AL1** value for different applications
 - ◆ Water: 550
 - ◆ Foam: 350
 - ◆ Conductive viscous medium (e.g. ketchup): 720
 - ◆ Oil: 250
 - ◆ Solid powder (e.g. dried tea): 180
- After the modification is over, click the button **Enter** to start downloading. The screen will display **yES** and prompt the user to confirm. After clicking the button **Enter** again, KOMM700 communicator starts to download parameters.
- The download usually takes more than 10 seconds. After the download is completed, the **RX** communication light starts to flash, and the **STAT** light will be on. If the modification is successful, **PASS** will be displayed on the screen.

4. Backup in Act menu group:

- When no further configuration is required, you should switch to **Act** menu group and execute a backup command **bkup**.

6.3.3 Modify the working mode of level switch

Example 3: modify the working mode of level switch (parameter **modeE**).

1. Power on:

- According to the output type of level switch (NPN or PNP), connect the four wires of level switch to the NPN terminal group (**V12 +, V12 -, NPN, T-IN**) or the PNP terminal group (**V12 +, V12 -, PNP, T-IN**) of KOMM700 communicator. Use USB to power the KOMM700 communicator and click the button **ON** to power on.




2. Unlock in Act menu group:

- After startup, the **Act** indicator light is on. When the screen displays **UnLoc**, click the button **Enter**, and the screen displays **yES**, and starts to blink. Click the button **Enter**





again to confirm to start unlocking the microwave level switch. The unlocking time is usually more than 10 seconds.

- After successful unlocking, the **RX** communication indicator of KOMM700 communicator flashes periodically, and the **STAT** indicator is always on.
- After successful unlocking, KOMM700 communicator will automatically jump to **PV** menu group and display parameter contents.




3. Enable high-level submenu of communicator:

- In Act menu group (the Act indicator light is on), click the button  to scroll through the menu until **Loc** (the password) is displayed on the screen.
- Click the button  and begin to edit. Change the password to 132 and click the button  again to save.

4. Change the parameter **mode** in Edit menu group:

- Click the button  until the indicator light **Edit** is turned on.
- Click the button  to scroll through the menu until **mode** is displayed on the screen.
- Click the button  and begin to edit. Change the working mode to desired value and click the button  again to save it.
 - ◆ 0: single alarm output (SW1=NO, SW2=NC)
 - ◆ 1: dual alarm output (SW1=NO, SW2=NC)
 - ◆ 2: dual alarm output (SW1=NO, SW2=NO)
 - ◆ 3: single alarm with data upload (SW1=NO, SW2=Data)
 - ◆ 4: single alarm with PWM output(SW1=NO, SW2= PWM)

5. Download in Edit menu group:

- After the modification is over, click the button  to scroll through current menu group until **d-Adv** is displayed on the screen. **d-Adv** is the command for downloading high-level parameters.
- Click the button , the screen will display **yES** and prompt the user to confirm. Click the button  again, KOMM700 communicator starts to download parameters.
- The download usually takes more than 10 seconds. After the download is completed, the **RX** communication light starts to flash, and the **STAT** light will be on. If the modification is successful, **PASS** will be displayed on the screen.

6. Backup in Act menu group:

- When no further configuration is required, users should switch to **Act** menu group and execute a backup command **bkup**.

6.3.4 Modify alarm threshold **AL2** of level switch

Example 3: modify alarm threshold **AL2** of level switch



Note: the submenu for **AL2** is hidden in default. To edit **AL2**, the working mode of level switch must be set to 1 at first.

1. Power on:

- According to the output type of level switch (NPN or PNP), connect the four wires of level switch to the NPN terminal group (**V12 +**, **V12 -**, **NPN**, **T-IN**) or the PNP terminal

group (**V12 +**, **V12 -**, **PNP**, **T-IN**) of KOMM700 communicator. Use USB to power the KOMM700 communicator and click the button **ON** to power on.

2. Unlock in Act menu group:

- After startup, the **Act** indicator light is on. When the screen displays **UnLoc**, click the button **Enter**, and the screen displays **yES**, and starts to blink. Click the button **Enter** again to confirm to start unlocking the microwave level switch. The unlocking time is usually more than 10 seconds.
- After successful unlocking, the **RX** communication indicator of KOMM700 communicator flashes periodically, and the **STAT** indicator is always on.
- After successful unlocking, KOMM700 communicator will automatically jump to **PV** menu group and display parameter contents.

3. Enable high-level submenu of communicator:

- In Act menu group (the Act indicator light is on), click the button **▶** to scroll through the menu until **Loc** (the password) is displayed on the screen.
- Click the button **Enter** and begin to edit. Change the password to 132 and click the button **Enter** again to save.

4. Change the parameter **modE** to 1 in Edit menu group:

- Click the button **Mode** until the indicator light **Edit** is turned on.
- Click the button **▶** to scroll through the menu until **modE** is displayed on the screen.
- Click the button **Enter** and begin to edit. Change the working mode to 1 and click the button **Enter** again to save it.
- Click the button **Enter** again to save.

5. Download in Edit menu group:

- After the modification is over, click the button **▶** to scroll through current menu group until **d-Adv** is displayed on the screen. **d-Adv** is the command for downloading high-level parameters.
- Click the button **Enter**, the screen will display **yES** and prompt the user to confirm. Click the button **Enter** again, KOMM700 communicator starts to download parameters.
- The download usually takes more than 10 seconds. After the download is completed, the **RX** communication light starts to flash, and the **STAT** light will be on. If the modification is successful, **PASS** will be displayed on the screen.

6. PV menu group: View and modify alarm threshold **AL2**

- Click the button **Mode** until the indicator light PV is turned on.
- Click the button **▶** to scroll through the menu until **AL2** is displayed on the screen.
- Click the button **Enter**, KOMM700 communicator will automatically jump to **Edit** menu group and start editing and modifying **AL2** parameters
 - ◆ Recommended **AL2** value for different applications
 - ◆ Water: 550
 - ◆ Conductive viscous medium (e.g. ketchup): 720
- After the modification is over, click the button **Enter** to start downloading. The screen will display **yES** and prompt the user to confirm. After clicking the button **Enter** again, KOMM700 communicator starts to download parameters.
- The download usually takes more than 10 seconds. After the download is completed, the

RX communication light starts to flash, and the **STAT** light will be on. If the modification is successful, **PASS** will be displayed on the screen.

7. Backup in Act menu group:

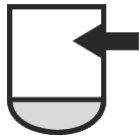

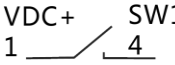
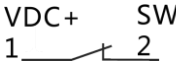


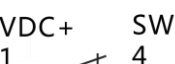
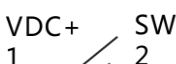
- When no further configuration is required, you should switch to **Act** menu group and execute a backup command **bkup**.

More configuration examples can be found in the KOMM700 communicator user manual.

7. Commissioning: single alarm output

In default case, parameter mode is 0 which means that the level switch works in single alarm output mode. In this mode, when P1000 is greater than the alarm threshold **AL1**, SW1 (normally open) and SW2 (normally closed) are activated simultaneously. Users can select SW1 or SW2 as alarm output according to the field application.

7.1 PNP single alarm status (mode = 0 SW1=NO, SW2=NC)

	Probe status	LED lamp	SW1 (line 4)	SW2 (line 2)	Line 4 voltage	Line 2 voltage
	Not covered				0	≈VDC
	Covered				≈VDC	0



For PNP output type, when measuring the output voltage, the load must be connected. The maximum load current should not exceed 100mA. Refer to Fig.6 for wiring diagram.

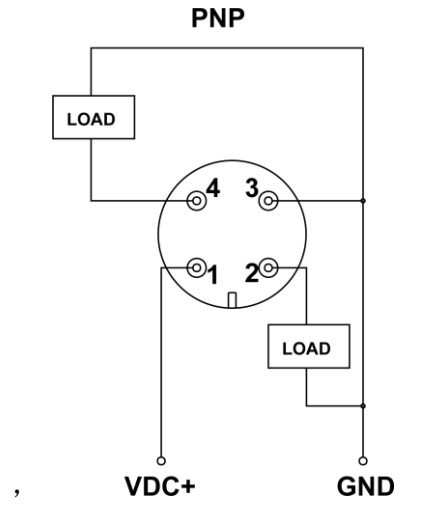


Fig. 6 PNP output test circuit

7.2 NPN single point alarm status (mode=0, SW1=NO, SW2=NC)

	Probe status	LED lamp	SW1 (line 4)	SW2 (line 2)	Line 4 voltage (with load)	Line 2 voltage (with load)
	Not covered		GND SW1 3 ——— 4	GND SW2 3 ——— 2	≈VDC	0
	Covered		GND SW1 3 ——— 4	GND SW2 3 ——— 2	0	≈VDC



For NPN output type, when measuring the output voltage, the load must be connected. The maximum load current should not exceed 100mA. See Fig.7 for wiring diagram.

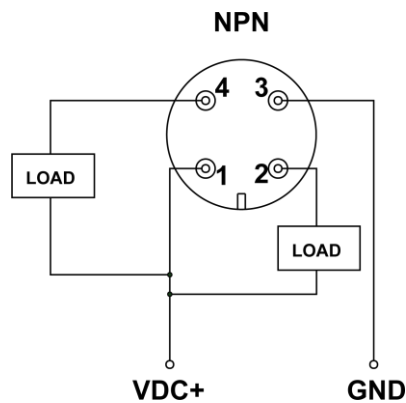


Fig. 7 NPN output test circuit

7.3 Select the appropriate alarm threshold AL1

Through frequency sweeping, the level switch monitors the change of P1000 (normalized resonance frequency) in real time. The level switch is calibrated before delivery. After calibration, when the probe is in air, $P1000 \approx 100$, when the probe is in tap water, $P1000 \approx 900$. When the current measured value ($P1000$) \geq **AL1**, the indicator light is on, SW1(NO) and SW2(NC) are activated. SW1 (NO) is turned off when activated, and SW2 (NC) is turned on when activated,

Recommended threshold AL1 for common applications

Medium	Example	AL1
Water based solution	Tap water, acid, alkali solution	550 (factory default)
Foam	Beer-froth	350
Viscous conductive medium	Ketchup	720
Oil	Edible oil, lubricating oil	250
Solid particles with low water content	Dried tea	180
Solid particles with high water content	Rice, wheat	250

8. Commissioning: dual output



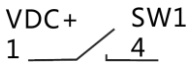
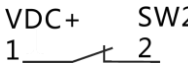


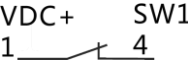
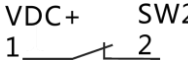


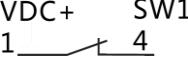
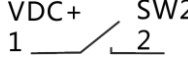
mode

When parameter **mode** = 1 or 2, the level switch works in the dual alarm output mode. This mode is used for detecting layered media, such as foam and beer, oil and water. SW1 (NO) is utilized to detect the upper media (such as oil, foam) and is determined by the threshold **AL1**. SW2 is utilized to detect lower media (such as water) and is determined by the threshold **AL2**.

- **mode=1**
 - If $P1000 \geq AL1$, SW1 (NO) is on (activated).
 - If $P1000 \geq AL2$, SW2 (NC) is off (activated).
- **mode=2**
 - If $P1000 \geq AL1$, SW1 (NO) is on (activated).

- If $P1000 \geq AL2$, SW2 (NO) is on (activated).



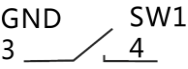
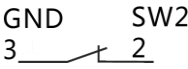


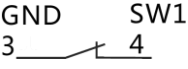
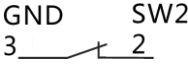
8.1 PNP dual output (mode=1, SW1=NO, SW2=NC)



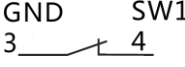
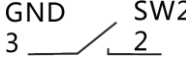
	Probe status	LED lamp	SW1 (line 4)	SW2 (line 2)	SW1 voltage	SW2 voltage
	Not covered				0	\approx VDC
	Covered by upper layer	 Rapid flash			\approx VDC	\approx VDC
	Covered by lower layer	 Rapid flash			\approx VDC	0



For PNP output type, when measuring the output voltage, the load must be connected. The maximum load current should not exceed 100mA. See Fig.6 for wiring diagram.

8.2 NPN dual output (mode=1, SW1=NO, SW2=NC)

	Probe status	LED lamp	SW1 (line 4)	SW2 (line 2)	SW1 voltage	SW2 voltage
	Not covered				\approx VDC	0
	Covered by upper layer	 Rapid flash			0	0

	Covered by lower layer				0	≈VDC
---	------------------------------	---	---	--	---	------



For NPN output type, when measuring the output voltage, the load must be connected. The maximum load current should not exceed 100mA. See Fig.7 for wiring diagram.

9. Trouble shooting

9.1 List of common issues

Issues	Possible cause	Solutions
The LED is always off	<ol style="list-style-type: none"> 1. Connection failure 2. Hardware failure 3. Parameter error 	<ol style="list-style-type: none"> 1. Check the power supply voltage 2. Check the wiring sequence 3. When the wiring and power supply are correct, use KOMM700 communicator to check whether the supply current of level switch is 0 or exceeds the maximum nominal current. 4. When the supply current is correct, connect the level switch to KOMM700 communicator, execute the UnLoc command, and check the supply current and other parameters. If the level cannot communicate, return it to the manufacturer. 5. When some parameters are incorrect, you can use KOMM700 communicator to execute the rESto command to restore to previous data. 6. When the parameters are correct, check the signal strength sig1 ~ 6, and contact the manufacturer after taking photos or video recording.
The LED is always on	<ol style="list-style-type: none"> 1. Parameter error 2. Hardware failure 	<ol style="list-style-type: none"> 1. Use KOMM700 communicator to check whether the supply current of level switch exceeds the nominal maximum current. 2. When the current is normal, connect the level switch to KOMM700 communicator, execute the UnLoc command, and check the parameters. If the level switch cannot communicate, return it to the manufacturer. 3. If the communication works, check whether the threshold parameter is suitable for the current application. 4. When some parameters are incorrect, you can use communicator to execute the rESto command to restore to

		<p>previous data or modify parameter directly.</p> <p>5. When the parameters are correct, check the signal strength sig1 ~ 6, and contact the manufacturer after taking photos or video recording.</p>
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9.2 Check the supply current and output voltage drop

Users can check the supply current and output voltage drop quickly with KOMM700 communicator. The specific steps are as follows:

1. Power on:

- According to the output type of level switch (NPN or PNP), connect the four wires of level switch to the NPN terminal group (**V12 +, V12 -, NPN, T-IN**) or the PNP terminal group (**V12 +, V12 -, PNP, T-IN**) of KOMM700 communicator. Use USB to power the KOMM700 communicator and click on the button **ON** to power on.

2. Check the supply current in V/I menu group:

- Click the button **Mode** to enter V/I menu group.
- Click the button **▶** to scroll through the menu until the screen displays *mAx.x*, and the display value is the supply current in mA.
- When alarm is off, the typical supply current of level switch is between 8 ~ 20mA, and the peak current is 30 ~ 40mA under periodic microwave frequency sweeping. When the alarm is on, the supply current increases by 10 ~ 20mA.

3. Before checking the output voltage drop, it is necessary to unlock in Act menu group:

- Click the button **Mode** until the **Act** indicator light is on and the screen displays *UnLoc*, then click the button **Enter**, and the screen will display *yES* character, and the screen will start to flash. Click the button **Enter** again to confirm and start to unlock the level switch. The unlocking time is usually more than 10 seconds.
- After successful unlocking, KOMM700 communicator will automatically jump to PV menu group and display parameter contents.

4. Check the output voltage drop in V/I menu group:

- Click the button **Mode** until the V/I indicator light is on.
- Click the button **▶** to scroll through the menu until *d x.xx* is displayed on the screen
- Immerse the probe of level switch into water and keep the level switch in alarm state. View the value of *d x.xx*, which is the output voltage drop.
- When the load current is 10mA, the output voltage drop of PNP is usually about 1.3V.
- When the load current is 10mA, the output voltage drop of NPN is usually about 0.8V.

10. Configuration

examples

Example 1: detect beer only (with foam)

1. Connect the level switch to KOMM700 communicator, unlock the level switch and check its P1000 value.
2. Given that P1000 (process variable) was 950 when the probe was completely immersed in beer;
3. Given that when the probe was immersed in the foam and was not covered by beer, the P1000 fluctuated between 350~500;
4. If user wish to detect beer only, the alarm threshold should be set to the middle point between P1000 (bubble maximum fluctuation) and P1000 (beer), i.e., $(950+500) / 2 = 725$.
5. Using KOMM700 communicator, change **AL1** to 725, and download **AL1** to the level switch.
6. Use the **bkuP** command to back up all parameters.
7. After download and backup, the level switch's SW1 (NO) output will not be activated when its probe tip is covered by the foam. Only when the probe tip is covered by beer, the SW1 (NO) output will be activated.

Example 2: detect foam as well as beer

1. If user wishes to detect foam as well as beer, the alarm threshold AL1 should be set to the minimum fluctuation value of foam or even lower, i.e., 350.
2. After **AL1** is set to 350 and is downloaded to level switch, the level switch's SW1 (NO) output will be activated when the probe tip is covered by foam as well as beer.
3. Use the **bkuP** command to back up all parameters.

11. Technical data

Environment conditions		Features	
Operating temperature	<ul style="list-style-type: none"> ■ cable outlet type -25~70°C ■ M12 connector type -40~85°C 	Repeatability	■ ± 1 mm
Storage temperature	<ul style="list-style-type: none"> ■ cable outlet type -25~70°C 	Hysteresis	■ ± 1 mm
		Response time	■ default 0.2S (adjustable, minimum 0.1s)

	<ul style="list-style-type: none"> ■ M12 connector type -40~85°C 	Damping	<ul style="list-style-type: none"> ■ 0 ~ 5 s (adjustable)
Ambient humidity	<ul style="list-style-type: none"> ■ < 98% RH 		
Protection level	<ul style="list-style-type: none"> ■ IP67 		

Power Supply

Supply voltage range	<ul style="list-style-type: none"> ■ 12 ... 33 V DC
Polarity reversal protection	<ul style="list-style-type: none"> ■ Yes
Current consumption (no load)	<ul style="list-style-type: none"> ■ typical 12 mA maximum 40 mA
Power interruption time	<ul style="list-style-type: none"> ■ 10ms (standard type) ■ 30ms (customized)

Output signal

Type of output	<ul style="list-style-type: none"> ■ PNP ■ NPN ■ Digital push pull ■ 100 mA maximum
Current load	<ul style="list-style-type: none"> ■ 100 mA maximum
Short circuit protection	<ul style="list-style-type: none"> ■ Yes
PNP/NPP	<ul style="list-style-type: none"> ■ PNP: VDC- 0.5V
Actual output voltage	<ul style="list-style-type: none"> Rload = 10 kΩ ■ NPN: 0.4V , Rload = 10 kΩ
NPN leakage current	<ul style="list-style-type: none"> ■ maximum 100 μ a
PNP leakage current	<ul style="list-style-type: none"> ■ 50~600 μ a
Switching logic	<ul style="list-style-type: none"> ■ normally open (NO) ■ normally closed (NC)

Normally open (NO): When the probe is in air, the switch is off. When the probe is covered by medium, the switch is on (activated).

Normally closed (NC): When the probe is in air, the switch is on. When the probe is covered by medium, the switch is off (activated).



For XR07 PNP and NPN level switches, the off state leakage currents are different due to hardware pulldown circuit.

Process conditions

Model	Continuous process temperature Tamb < 50 ° C The maximum immersion depth of probe tip is 16mm	Process pressure	Short time maximum process temperature Tamb < 50 ° C The maximum immersion depth of probe tip is 16mm	Short time maximum process pressure t < 1 h
XR07	-40 ~115°C	-0.1~10Mpa	135°C	-0.1~10Mpa

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