



PrimaX IR Pro

测量范围为0~100%LEL的点
型可燃气体探测器

用户手册



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申明

制造商：梅思安（中国）安全设备有限公司

苏州工业园区兴浦路瑞恩巷8号

申明产品：PrimaX IR Pro点型可燃气体探测器

产品符合以下国家和国际标准：


企标Q320500INQ01 《点型可燃气体探测器》

GB15322.1-2003 《可燃气体探测器第1部分：测量范围为0~100%LEL的点型可燃气体探测器》

GB3836.1-2010 《爆炸性环境第1部分：设备通用要求》

GB3836.2-2010 《爆炸性环境第2部分：由隔爆外壳“d”保护的设备》

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安全规定

1 安全规定

1.1 正确使用

PrimaX IR Pro气体探测器是一个固定式红外可燃气体探测器，它适合室内和室外使用。例如：离岸工业，石油化工工业，水和污水处理工业。此气体探测器可结合MSA控制器（如MSA Suprema, Gascard XL, 9010/9020, 8020等）一起使用，用于安全或危险用途。

该气体探测器采用红外原理进行监测，发现并提醒用户潜在的碳氢可燃气体危险程度。双光源技术提供了100%光源冗余，增强了气体探测器的可靠性和寿命。此气体探测器具有快速的响应时间，同时提供非常可靠的输出信号。

此气体探测器具有杰出的(4 ~ 20)mA模拟量输出并带HART数字信号。可以连接MSA的控制器，做进一步的应用(安全区域或者危险区域).你可以联系MSA 的代表选择可用的控制器。同时仪表具有Modbus RTU信号输出。

此气体探测器适用气体为甲烷，在出厂前已经在工厂做过标定,并且在标签上注明了其可以检测的气体,标定气体和增益设定信息,使之很容易使用。任何使用者修改工厂设定值应该在仪表标签上做上注明。

此气体探测器是隔爆的，适合安装在危险场合。此探头连接到一个控制系统，其可以给在可燃气体环境中的操作人员提供报警。

使用本产品时必须阅读和遵守本操作手册，特别是安全说明、使用信息以及产品操作部分，必须仔细阅读和切实遵守。此外还需考虑用户所在国的国家安全使用法规。



危险!

本产品保护生命健康，使用、维护或保养不当可能影响设备功能，从而严重危及使用者人身安全。

使用本产品前必须验证产品的可操作性。如果产品未通过功能测试，或产品损坏，或某一部件的保养维修没有完成，或没有使用MSA生产的备用件，则产品不能使用。

代替使用或使用超出本规范范围则属于违规操作，并且未经授权的擅自改装以及由MSA或授权人以外进行的调试工作也属于违规操作。

1.2 责任信息

MSA对产品不当使用或用于非即定用途所导致后果不负责，每个操作员必须自行负责产品的选择和使用。

如产品的使用、维护或保养不遵循本手册说明，则MSA提供的产品责任声明和质量保证等承诺无效。

安全规定

1.3 采取适当的安全预防措施



必须绝对遵守如下安全说明，只有这样才能保证操作员的安全健康以及仪表的正常功能。

- 本手册中描述的设备必须严格按照其标签、警告、指示说明和规定限制范围安装、操作和保养。
- 保护探测器避免剧烈震动
- 不要安装探测器在阳光直射的地方，这样会导致探测器过热，不锈钢的遮阳板可以有效保护PrimaX IR Pro仪表在如此环境中使用。
- 可以用浓度已知且根据设备标定的气体检查设备，这是唯一保证设备整体操作正确的方法，所以标定检查必须是系统常规检测的一部分。仪表标签上注明了工厂使用的标定气体型号和浓度值
- 按本手册规定程序进行保养时，只能使用MSA生产的替换部件。如不这样操作，可能严重损害仪表性能。设备维修或改装如超出保养范围，或由非MSA授权维修人员执行维修或改装，则会导致产品无法达到设计性能。
- 此探测器内部元件不能进行现场维修，请根据质保条款返回MSA进行更换。
- 此探测器不能检测氢气的存在，因此不能被用来检测氢气。
- 此探测器不能被用来检测空气中的乙炔气体，可以联系MSA使用乙炔探头来实现此要求。
- 如果探测器使用在高浓度的溶剂或者粉尘的空气环境中需要经常标定，具体标定和清洁步骤请看第4和第5章。
- 此探测器不得油漆，如果探测器位置处有油漆作业，则必须谨慎操作，确保油漆不会堆积在探测器上，这些油漆积存物会干扰探测器的运行，同时也可能造成误报警。
- 此探测器设计适合的危险区域在说明书的规格章节有定义。
- 大量粉尘堆积会增加探测器的响应时间，故需要定期检查。

1.4 MSA固定仪表质保

质保

参照梅思安公司质量保证声明。

按照梅思安公司的要求，正确地安装、调试和使用本产品，梅思安公司将提供本产品在质保期的相关责任。梅思安公司不承担以下因素引起的产品质保责任：

- 1、由非梅思安公司人员或非经梅思安公司授权人员进行的标定、调试和维护等；
- 2、由于产品不正确地放置、使用、改装；

未经梅思安公司授权，任何人员对本产品所做的确认、陈述或保证，将视为无效条款。

梅思安公司对非自产部件或者附件不承担质保责任；梅思安公司保留将这些部件或者附件制造商提供的质保责任移交给相关采购方的权利。

描述

2 描述

此探测器被设计用来采样其安装位置的碳氢气体，并给用户提提供潜在的危險报警。另外本设备采用了一次成型的金属外壳，和先进的可燃气体传感器，以保证其高温和低温下的可靠性。在线路板和电子元器件方面，全部采用了工业级的符合RoHS的芯片，从根本上保证了其在-40℃~+70℃温度范围内的性能。

此探测器输出带HART的标准(4 ~ 20) mA信号。使用(4 ~ 20) mA的电流环来传输主要的测试信号。同时仪表也使用叠加在模拟量信号上的数字信号来传输仪表信息。此仪表HART协议服从HCF 7.0版规定。市场上可以买到的手操器或者带此应用的PC可以用来与此仪表进行通信。关于HART通信有关的描述文件可以在[www.hartcomm.org]上下载。

2.1用户界面

此探测器提供4位米字型15段的LED数码管进行浓度数据的显示和其他功能的操作。气体浓度值和探测器的基本状态通过PrimaX IR传感器输出的(4 ~ 20)mA信号来实现。其他的状态信息通过HART信号来实现。关于协议的描述可以在和仪表一起的产品CD上的PrimaX IR HART规格参数上找到。可选的标定帽提供了一个LCD显示，使标定变得容易和直观。

2.2遥控器与菜单顺序

2.2.1遥控器



图1 遥控器

遥控器各功能键说明如下：

1: 确认键 (ON) /Confirm (ON)	3: 下移键 (-) /DOWN (-)
2: 退出键 (OFF) /Escape (OFF)	4: 上移键 (+) /UP (+)

描述

4个键用于菜单顺序导航的主要功能：

(1) “+” 或者 “-” 键用于菜单项导航或者数据的增大或者减小。

(2) “ON” 键用于进入M-01, M-02等菜单项的下一层菜单，或者准备修改数据，或者用于保存数据。

(3) “OFF” 键用于退出M-01, M-02等菜单项，或者放弃数据的修改。

2.2.2 菜单项目

菜单项	文字	是否需要密码
M-00	复位继电器	需要
M-01	参数查看	不需要
M-02	参数设置	需要
M-03	设置新密码	需要
M-04	恢复默认设置	需要
M-05	LED 自检	不需要

[M-00]-----复位继电器

当报警继电器设置为“锁定”模式，并且有过报警，当报警消失后，继电器会维持在报警状态，可以使用M-00将继电器恢复为不报警的状态。

[M-01]-----参数查看

(1)在测量模式下，按“+”键选择M-01

(2)按遥控器“ON”键，则显示下一层子菜单项的内容，分别是：

子菜单项显示字符	含义
ALARM_1 = XX	低报警点
ALARM_2 = XX	高报警点
ALARM RELAY1 = DENE/ENER	低报警点继电器激励/非激励选项
ALARM RELAY2 = DENE/ENER	高报警点继电器激励/非激励选项
ALARM RELAY1 = LTCH/UTCH	低报警点继电器锁定/非锁定选项
ALARM RELAY2 = LTCH/UTCH	高报警点继电器锁定/非锁定选项
TEMP = XX	显示探测器所处的环境温度
SLAVE ADDR = XXX	显示探测器Modbus 地址

[M-02]-----参数设置

(1)在测量模式下，按“+”键选择M-02


(2)按遥控器“ON”键，则显示密码输入界面，此时千位会闪烁，表示现在可以更改千位，此时用“+”和“-”键则可以将数据增大或者减小，当更改完毕后再按“ON”键，则千位停止闪烁，

描述

然后百位闪烁，百位更改完毕后则再按“ON”键则十位闪烁，以此类推，当密码输入完毕后，若密码错误，则返回到M-02菜单界面，若密码输入正确，则显示下一层子菜单项的内容，分别是：

子菜单项显示字符	含义
ALARM_L =	低报警点5% ~ (高报警设置点-1%)
ALARM_H =	高报警点(低报警设置点+1%) ~ 99%
ALARM RELAY1 = DENE/ENER	低报警点继电器激励/非激励选项
ALARM RELAY2 = DENE/ ENER	高报警点继电器激励/非激励选项
ALARM RELAY1 = LTCH/UTCH	低报警点继电器锁定/非锁定选项
ALARM RELAY2 = LTCH/UTCH	高报警点继电器锁定/非锁定选项
TEMP SETTING = XX	环境温度设定
SLAVE ADDR = XXX	Modbus地址设定

修改各项参数的内容的方法同修改密码类似，先按下“ON”键则最高位闪烁，然后使用“+”“-”键进行最高位的更改，更改完毕后按“ON”键则进行下一位的更改，当所有的位全部更改完毕后，再按下“ON”键则完成对此数据的更改。在更改过程中按“OFF”键则放弃数据的更改。

	<p>锁定: 就是当检测到气体浓度超过报警点，又回到报警点值以下，继电器输出和LED灯指示的输出还是处于报警状态，需要人工复位</p> <p>非锁定: 就是当检测到气体浓度超过报警点，又回到报警点值以下，继电器输出和LED灯指示会自动恢复到非报警状态</p>
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[M-03]-----密码设置（默认密码是0000）

(1)在测量模式下，按“+”键选择M-03

(2)按遥控器“ON”键，则显示密码输入界面，此时千位会闪烁，表示现在可以更改千位，此时用“+”和“-”键则可以将数据增大或者减小，当更改完毕后再按“ON”键，则千位停止闪烁，然后百位闪烁，百位更改完毕后则再按“ON”键则十位闪烁，以此类推，当密码输入完毕后，若密码错误，则返回到M-03菜单界面，若密码输入正确，则显示“NEW PASSWORD=0000”，进入新密码输入界面。

修改密码，先按下“ON”键则最高位闪烁，然后使用“+”“-”键进行最高位的更改，更改完毕后按“ON”键则进行下一位的更改，当所有的位全部更改完毕后，再按下“ON”键则完成对密码的更改。在更改过程中按“OFF”键则放弃数据的更改。

[M-04]-----恢复出厂设置

(1)在测量模式下，按“+”键选择M-04

(2)按遥控器“ON”键，则显示密码输入界面，此时千位会闪烁，表示现在可以更改千位，此时

描述

用“+”和“-”键则可以将数据增大或者减小，当更改完毕后再按“ON”键，则千位停止闪烁，然后百位闪烁，百位更改完毕后则再按“ON”键则十位闪烁，以此类推，当密码输入完毕后，若密码错误，则返回到M-04菜单界面，若密码输入正确，仪表将重新启动，并且所有的参数恢复为默认设置。

工厂默认模式：

- a)低报警点： 25%
- b)高报警点： 50%
- c)高/低报警继电器: 非激励状态
- d)高/低报警继电器: 非锁定
- e)MODBUS RTU地址： 1
- f)温度偏移量： 0

[M-05]-----LED测试

(1)在测量模式下，按“+”键选择M-05

(2)按遥控器“ON”键，则显示“OFF”并闪烁，此时按一次“+”键则仪表显示LED和指示LED交替闪烁。再次按“+”键，显示回到“OFF”并闪烁。在更改过程中按“OFF”键则放弃数据的更改。

此探测器应安装在可能有气体泄漏的地方，安装位置由测试气体密度决定。比空气轻的安装在房间的顶部，比空气重的接近地安装。同时考虑空气流动对仪表测试的影响。

在密闭空间进行空气流动的测试有助于探测器安装位置的确认。



在安装前，检查仪表部件是否完整和正确。可以参看发货文件和装箱清单上的标注。

2.3 装箱清单

仪表被运送时应有以下物品：

- PrimaX IR Pro红外探测器
- 防雨罩
- 快速指南
- 合格证书
- 说明书 (CD)
- 安装附件

安装

3 安装

3.1 机械安装

此仪表的尺寸如下图（mm）：

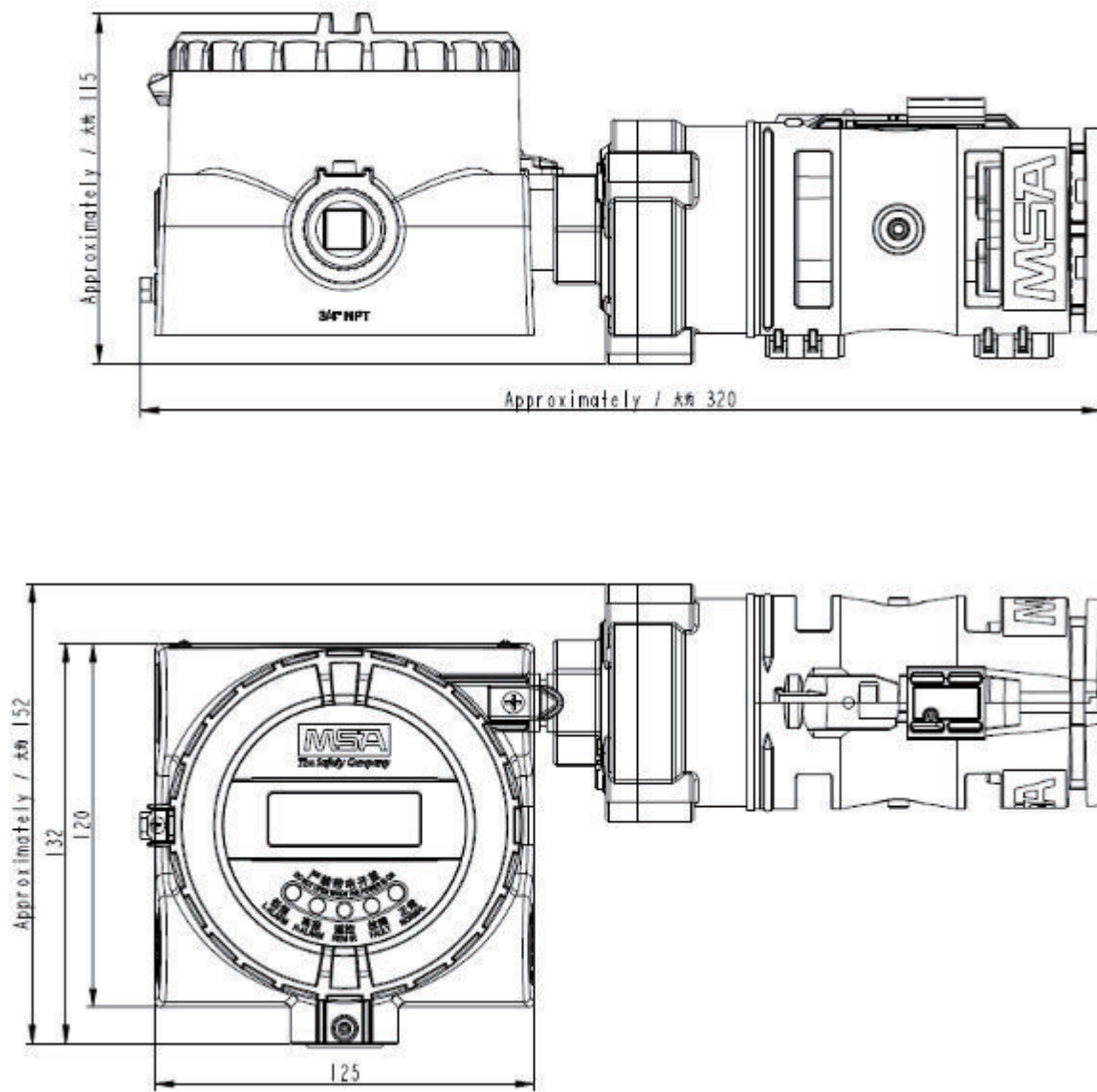


图2 PrimaX IR Pro



注意：MSA推荐水平安装探头。水平安装方式可以防止灰尘和油污在探测器的光学表面堆积。

安装

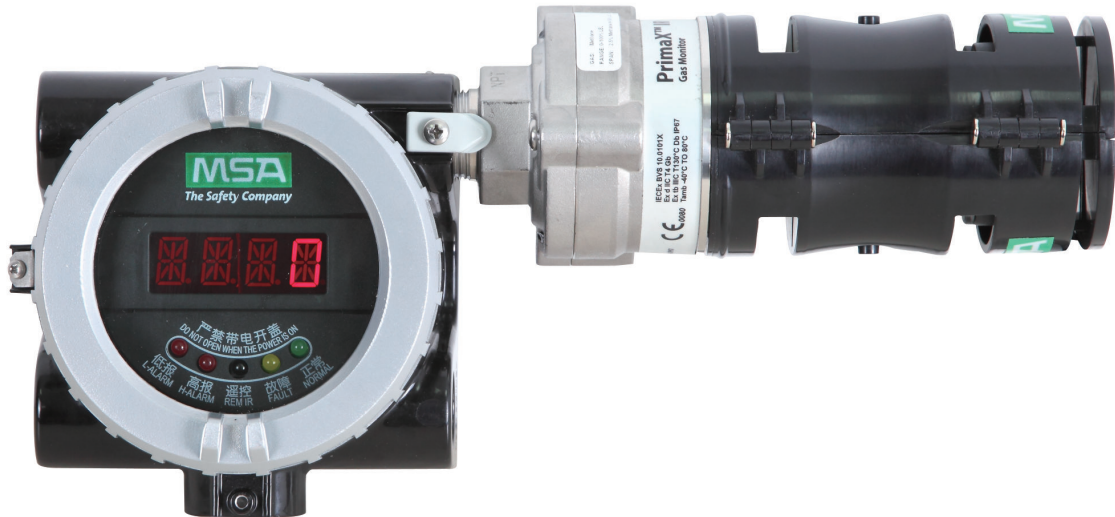


图3 推荐安装方向



注意!

此探测器不得油漆。如果探测器位置处有油漆作业，则必须谨慎操作，确保油漆不会堆积在探测器上，这些油漆积存物会干扰探测器运行。同时也可能造成误报警。



注意!

保护探测器避免剧烈震动。不要安装仪表在阳光直射的地方，这样会导致探测器过热。不锈钢的遮阳板可以有效保护PrimaX IR Pro仪表在这种环境中使用。



注意!

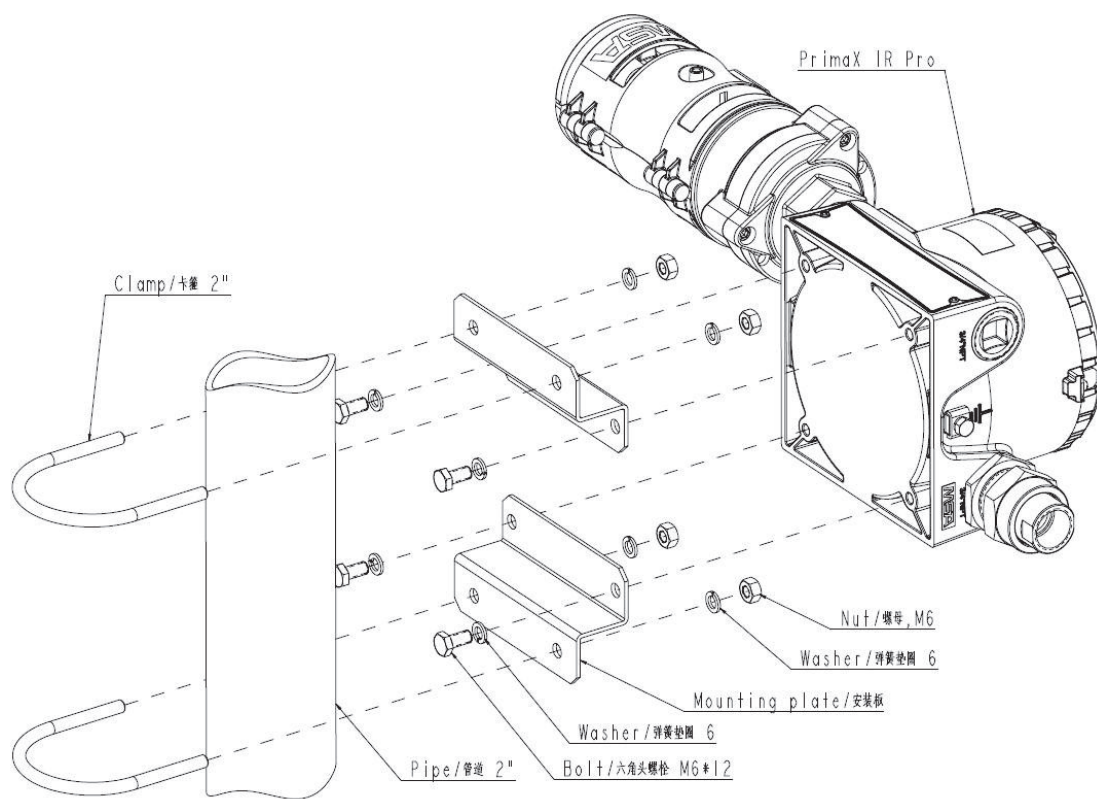
在安装或者拆卸探头期间，不要使用工具或者强力扳支撑反光镜的两个脚。强力扳此脚会永久损坏探测器。

MSA推荐仪表的防雨罩应该一直安装在探头上。假如探测器没有使用防雨罩运行，应该经常检查确保在窗口没有灰尘和油污堆积。

■ 使用36mm的扳手来拧六角螺母安装或者拆卸探头。

- 不要扳探头的两个脚，和外壳一起有两块不锈钢安装板，以确保安装区域有足够的间隙。
- 仪表的最佳安装方向是水平。

安装



Exploded view of PrimaX IR Pro Mounting
PrimaX IR Pro 安装示意图

图4 安装示意图

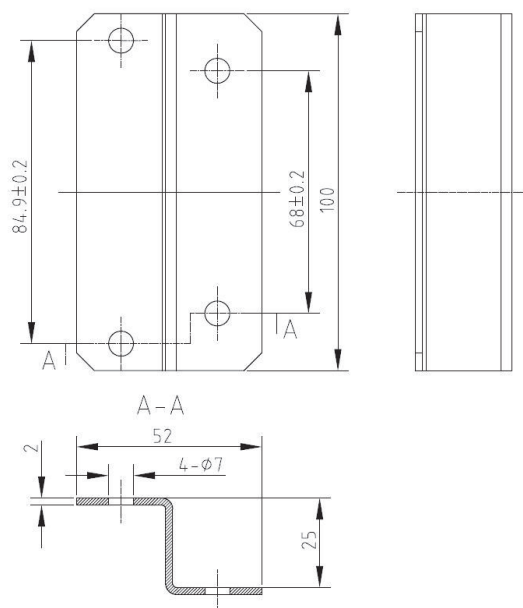


图5 安装板

安装

3.2 电气安装

电气连接介绍



注意!

此仪表必须按照规定进行安装，否则不能保证仪表安全运行。

- 建议检测设备使用屏蔽电缆。
- 始终遵守以下说明的最大电缆长度和横截面
- 水或杂质会通过电缆渗透进入仪表。在危险区域，建议将电缆安装在仪表入口前的回路中，或略微弯折电缆，防止水进入设备。

电线要求

以下表格提供了电缆的型号，长度和线的尺寸。HART信号要求负载在信号线上。好的安装应该防止水和杂物通过线或者导管进入仪表。

注意：下表中的声光报警器特指MSA公司的AF5000，其他公司的声光报警器没有测试过，所以实际数据会跟下表有差异。（接线方式请看图6）

电源电压	导线尺寸	距离(低报继电器有源配置接线)	距离(低报继电器无源配置接线)	信号负载(包括端子)
DC 24V	1.0mm ²	500m(不带声光报警器)	500m(不带声光报警器)	负载 ≤ 250 Ω (带 HART)
		130m(带声光报警器)	300m(带声光报警器)	
DC 24V	1.5mm ²	800m(不带声光报警器)	800m(不带声光报警器)	负载 ≤ 450 Ω (不带 HART)
		180m(带声光报警器)	450m(带声光报警器)	
DC 24V	2.5mm ²	1300m(不带声光报警器)	1300m(不带声光报警器)	
		250m(带声光报警器)	760m(带声光报警器)	

此仪表探头提供了4线供使用。下表对不同颜色线进行了定义：

线颜色	定义	对应线标
红色	24V+	[DC +]
黄色	(4 ~ 20) mA	[4-20]
白色	24V-	[DC -]
黄绿色	大地	

需要一个外部电源。使用一个高质量的电源，使DC电源供应具有低噪声特性。请看以下表格对电源和线的描述：

安装

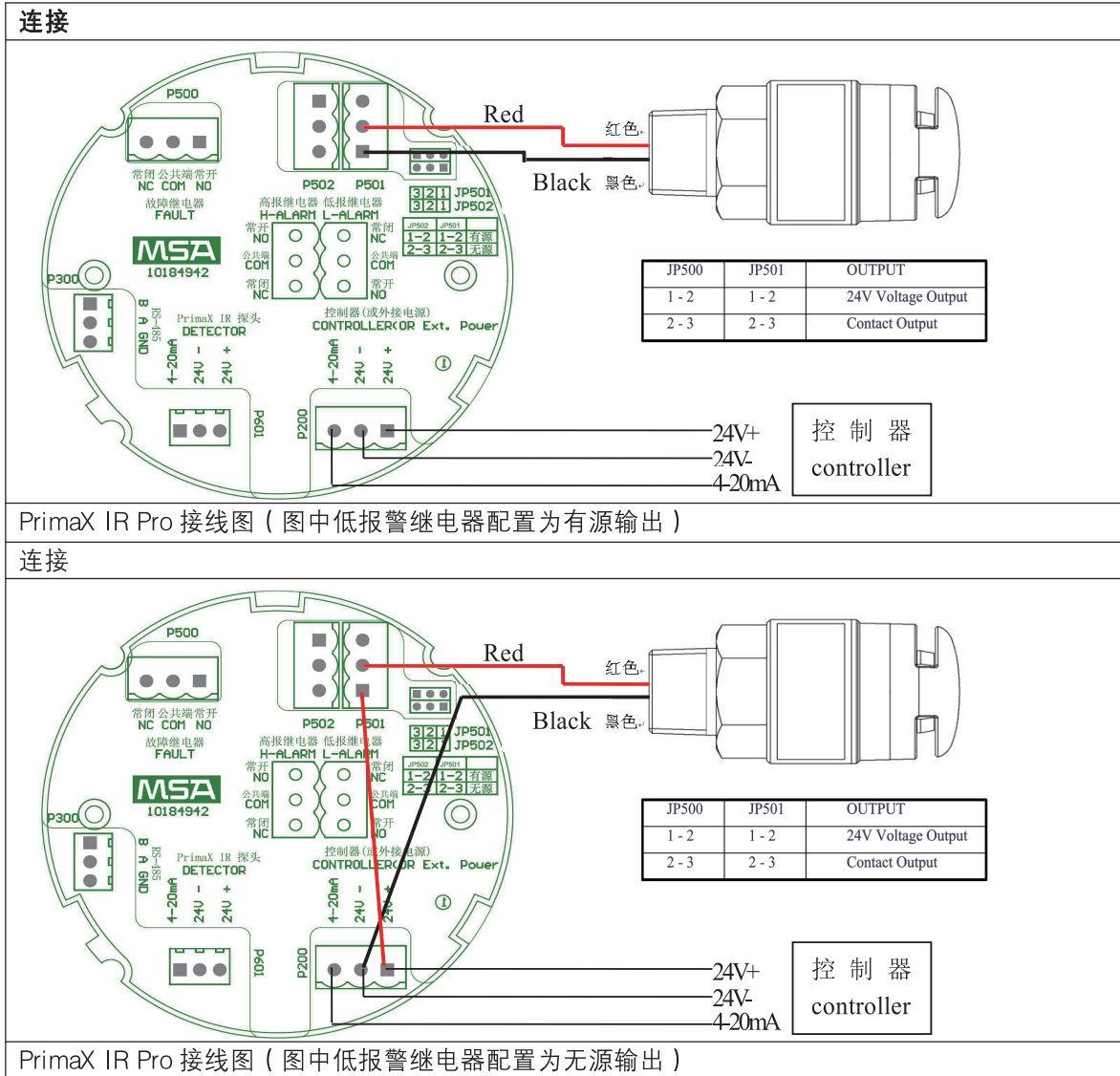


图 6 PrimaX IR Pro接线示意图



注意!

在接线前，请断掉或者隔离所有电源连接到仪表。否则有触电危险发生。

电源要求		
输入电压 [探头部位]	正常	最大
20 V DC	250 mA	430 mA
24 V DC	200 mA	310 mA
31 V DC	150 mA	250 mA

外部控制器

此探测器可以连接任何能接收(4~20)mA模拟量信号的控制器。在MSA网站 www.MSAafety.com 查找适合的控制器。

HART信号的输出是给数字控制系统使用的，其协议兼容HCF 7.0版及以下版本。

启用和标定

4 启用和标定

4.1 初始启用

探测器在工厂已经做过标定，已经可以使用。仪表提供(4 ~ 20) mA信号输出，以便连接控制器进行数据收集。HART信号叠加在(4 ~ 20) mA输出信号上，探头信息可以被控制系统按照HART R7.0格式进行读取。

在探测器运行期间，故障代码输出提供以下信息：

A.主板故障

故障代码	含义
E-07	开机flash自检故障
E-08	开机RAM自检故障
E-09	Flash CRC校验错误
E-10	看门狗故障
E-11	ADC采样数值异常
E-12	温度传感器故障
E-13	继电器检测故障
E-14	任务测试故障
E-15	继电器SPI通信故障
E-16	Flash写故障
E-17	外部参考电源故障
E-18	定期Flash检测故障
E-19	定期RAM检测故障
E-20	外部ADC12钳位在高位故障
E-21	内部ADC10钳位在高位故障
E-22	定期PC指针检测故障
E-23	定期堆栈检测故障
E-24	定期通用寄存器检测故障
E-25	定期特殊功能寄存器检测故障
E-26	定期电压检测故障
E-27	中断故障
E-28	RAM软失效故障

B.探头故障：

故障代码	(4 ~ 20)mA电流值	含义
E-52	0	探头故障，或者探头接线错误
	2.0	检测到有问题，可由HART读取
	2.5	光路被阻挡
	3.0	启动或者探头正在标定
	3.5	清洁模式
E-53	20 ~ 20.5	超量程

启用和标定

标定概述


按照当地的法规，标定必须定期进行。

仪表在工厂已经被标定。但是我们推荐在仪表安装后再进行一次标定。新探头需要多次标定直到标定记录证明探头已经稳定。标定频率可以根据安全官员或者工厂管理者制定的时间表进行。

信号

(4 ~ 20)mA模拟量信号在探测器上电1分钟之内可以输出。但是探测器标定需要等待上电至少60分钟，直到温度稳定才能进行。

 在试运行期间也要定期进行标定。以确保探头在最佳状态下运行。

 建议在标定开始前需要连接好所有的标定附件，以便在图11所示的标定流程图中的合适的时间内可以通入测试气体。

虽然探测器已经在出厂前已经标定，但是探测器装到最终目的环境最好做一次标定。

任何型号的气体探测器，真实的检查执行需要直接通检测气体到探头。新探头需要多次标定直到标定记录证明探头已经稳定。标定频率可以根据安全官员或者工厂管理者制定的时间表进行。

标定气体按照第4.3章说明的进行选择

- (1) 在尝试进行标定前，阅读所有的标定命令。
- (2) 确定和熟悉所有的标定部件。

预先连接好标定附件可以使标定更容易进行。



注意！

不按照以上说明正确标定会导致标定失败。

4.2 PrimaX IR Pro的标定

探测器标定可以使用可选的标定帽在探头上进行或者通过电脑使用HART协议进行。

标定方法


 MSA 推荐使用的标定气体值是量程的中间值。



图7 MSA HART标定帽(使用计算机进行标定时使用)

启用和标定

虽然全标定（零点和增益标定都执行）和只进行零点标定在此探测器都可以执行。但是有时候零点标定就足够了。通常，任何探头性能的退化都和零点漂移有关，进而将影响到探头的灵敏度性能。完成零点标定后再使用HART 标定帽进行增益的检测，以确保仪表正常运行。对于增益检测，通入一个已知浓度的气体，来验证测量到的响应是不是在可接受的范围内。假如增益检测不成功，执行一次零点和增益标定。

使用标定帽标定步骤（在整个标定过程中，仪表LED显示E-52）

- (1) 取掉探测器上的防雨罩
- (2) 标定帽带一个卡口，使之可以扣接到仪表上。以下这个图片就是卡口的位置图



图8 PrimaX IR Pro标定帽

(3)假如用户可以确保环境中没有可燃气，则此时环境气可以作为探测器的零点标定气。图11是标定流程图。

(4) 安装标定帽。紧紧的按住标定帽确保其正好固定。

- 标定将自动开始，当标定帽完全固定好在探测器上时。
- 通常条件下，在电源稳定接通后会显示所有图标。

(5) 标定帽显示的是零点气瓶图标并且在闪烁，表示探测器正在零点标定。

- 最初的30秒是给用户给探头通气体的时间。在这期间，用户可以移除标定帽来终止标定
- 30秒过后，探测器会开始进行零点标定调节。零点标定指示通过一个白的气瓶图标和文字"ZERO"。
- 最初30秒过后移除标定帽会导致标定失败，这将中止当前的标定，仪表将继续使用前一次的标定设置参数。

(6) 当标定帽气瓶图标闪烁的时候，通零点标定气，采用气体流量是1.5升/分钟。零点气可以使用环境气或者标定箱里的零气瓶，在第4.3章节里有说明。



图9 零点标定气瓶图标

启用和标定

(7) 当零点标定成功，标定帽标记符号“√”将会出现。假如只是执行零点标定，就可以移除标定帽了。在零点标定成功后，增益标定在零点图标“√”出现后30秒内自动开始。

(8) 假如零点标定失败，标定帽显示屏将显示“X”大约2分钟，然后将断电。

➤ 假如零点标定失败，移除标定帽再安装上，再做一次零点标定。假如多次标定失败，请联系MSA的服务中心。

(9) 当标定帽显示增益气体图标时，通入增益气体，通过标定帽接口

➤ 在标定图标闪烁后，必须在30秒内通入气体，不然将出现标定错误。最初这30秒是给用户通入标定气体的时间。在这期间，用户可以通过移除标定帽来中止标定过程。

➤ 显示屏以更快的闪烁频率来指示标定正在进行。



图10 增益标定图标

(10) 当增益标定成功，则标记“√”将显现。假如增益标定失败则“X”将出现2分钟，然后仪表断电。

➤ 查看第5章，了解标定失败后接下来应该做什么。

(11) 当标定完成后，停止通气并移除标定帽。重新装上防雨罩在探头上。在其从探头移除后标定帽将自动断电。(4 ~ 20) mA输出被限定在3mA 2分钟，以减少在标定过程中出现误报警的几率。

➤ 在标定过程结束后，有2分钟的过程，这个仪表将不能检测现场环境中任何气体。

■ 在标定过程中仪表可以通过HART来显示气体值（在HART通信协议参数里查看标定信号的使能/不使能）

➤ 当标定帽移除以后，仪表有2分钟的时间进行标定残留气体扩散，此时仪表LED依然显示E-52。然后仪表将检测环境中目标气体的浓度。

其中第11步可以参考以下图片：

启用和标定

当零点或者增益标定失败，此仪表将返回到前一次成功标定的设置。

假如标定帽在标定结束后在探头上保留超过15分钟，则(4 ~ 20)mA信号输出故障信号。

标定帽的电池是不可更换的，当标定帽的电池耗尽，请向梅思安公司重新订购此标定帽。

⚠ 注意!

在仪表完成零点或者增益标定后,标定帽必须被移除，否则探头将不能正常运行。

HART 标定步骤

此仪表可以使用带HART通信协议的控制器进行标定，例如艾默生的375或者475手操器（图12）。确保HART手操器和仪表能正常通信。这个手操器必须能使用HART R7.0版。手操器可以从得到HART授权的供应商那里购买到。在产品CD里有PrimaX IR的标定描述。也可以登陆MSA的网站www.MSAafety.com上查看PrimaX IR HART的规格书



图12

当导管连接到HART标定帽上，运行HART远程标定时，需使用1.5升/分钟的恒流阀，参考图13:



图13 HART 标定设置

启用和标定

4.3 标定工具

此仪表推荐使用标定气体如下表所示。

气体型号	标定气	气瓶P/N	标定值
甲烷	2.5%甲烷	10028032	50% LEL
零气	99.9% 氮气	3290005	0% LEL

维护

5 维护

5.1 概述



危险!

在对仪表进行维护前，关断电源，确保安全后再重新启动。

此仪表内部没有可以在现场进行维修的部件。不要尝试去打开仪表的外壳，为了能在恶劣环境中使用本设备，在出厂前探头外壳已经被封死。假如在第5.2和5.3章里不能找到要解决的方法，请联系MSA相关人员。

5.2 故障说明

(4 ~ 20)mA信号输出提供了一些有限的诊断信息。其他的故障解除步骤参看下表

总的故障指南

指示	采取措施
探头IR光源没有闪烁	核实探头和主板接线是不是按照说明进行的，然后重新上电。
探头IR光源闪烁，但是没有(4 ~ 20)mA信号	核实探头和主板接线是不是按照说明进行的，然后重新上电。
故障电流输出	检查电源然后重新启动。 确认标定帽没有一直留在探头上。
光路遮挡故障电流输出	确认光路没有遮挡，或者执行清洁步骤。
在现场没有可检测气体时出现高的读数	按照清洁步骤进行对视窗和镜片的清洁。 通零气，看读数是否会下降到零。假如没有，则进行零点和增益标定。
在开机和预热后，4mA不稳定	确认直流供电电压在(20 ~ 31)VDC范围内。假如电源供电在(20 ~ 31) VDC范围内，检查电源线是不是有干扰，如果有的话则在此线上加一个外部滤波器。
当有气体输入时，输出电流没有改变	确保气路没有堵塞。观察进气口和恒流阀。确认不是标定模式，或者是任何第4.1定义的mA信号输出值。确认仪表不是处在固定电流的模式（通过HART通信）
标定帽，增益标定失败	拔掉标定帽，重新标定一次，确保零点标定成功。假如零点标定是“√”，增益标定失败，则确认标定气和流量是否正确。另外确认标定气是否在30s内到达标定帽内部。检测O型圈是否完整，确保探头和标定帽良好密闭。检测标定帽是否损坏。
在开启时，标定帽所有图标快速闪烁	标定帽电池即将耗完。标定帽将继续工作，直到电池耗尽。
已知浓度气体响应错误	标定。如果标定失败，则断电后再次通电。核实标定气体流量以及气瓶的正确性。确认防雨罩或者流量帽没有堵塞。根据第3.2核实线载。核实环境温度适合仪表运行。
一个光源没有闪光	PrimaX IR 设计成可以只使用一个光源来满足所有规格要求。光源的状态可以通过HART通讯来得到。详细描述看HART说明书。执行一次标准标定。无进一步的要求。

5.3 HART 提供的故障信息

HART 数字信号可以提供一些额外的仪表状态信息，包括故障说明、标定和遮挡状态。

所有定义PrimaX IR 状态字节可以在产品CD的HART规格里找到。使用HART协议可以提供额外的故障信息。

5.4 清洁

灰尘、油膜、水、或者水滴到镜片上留下的残渣都会对仪表造成不良影响。防雨罩设计来是为了防止灰尘和液体进入光学监视系统。

(1) 移除防雨罩或者流量帽，见图14



图14 移除流量帽

(2) 放一个不透明的物体（一张纸，两个手指等）在光源窗口和反光镜之间，以遮挡光路2到3秒钟（图15）

- 假如不透明物体留在光路的时间长于10秒，一个遮挡故障电流信号将产生并输出。
- 整个清洁模式需要耗时2分钟。



图15 光路遮挡

维护

注意：探头在清洁模式下将不能响应目标气体

- 在这期间，模拟电流输出将设置成清洁模式值。
- 如果监视HART信号，清洁状态位将被设置。

虽然视窗都是由坚固的材料组成不容易破坏，但是当我们做清理时也不能过分用力。在清洁时，我们推荐使用棉签来清除在视窗上的物体。

(3) 使用一个干棉签或者是带蒸馏水的去擦拭窗口和清除脏污。

(4) 进一步清洁，干的棉签擦去所有的残留水

(5) 使用带异丙醇的棉签擦除厚重的堆积物，液体或者油膜。再一次使用带蒸馏水的棉签对视窗进行擦洗。然后用一个棉签擦干视窗。

(6) 避免使用过量的水或者酒精在清洁过程中，并且检查视窗确保整个表面都是干净的。

当清洁的所有过程完成，确保没有任何东西遗留在光路中。

当清洁模式结束，仪表返回正常运行。注意残留的清洁液会导致输出信号偏高，直到其完全干涸。

(7) 检查防雨罩是否有堵塞，然后在探头上装上防雨罩。

➤ 清洁完视窗，最好采用零点气和标定气检查探头的反应。

警告!

不要在探头分析区域安装任何外物（除了每次清洁过程），否则红外光线将被部分遮挡，这将导致探头产生不正确的读数。为了功能正常，所有物体都将移除探头的分析区域。

危险!

假如使用水或者异丙醇清洁探头视窗，任何清洁过程中产生的残留物都必须在仪表返回正常测试状态前完全消除。使用零气检查探头的响应是检查是否有残留物的最好方法。再标零或者标定探头时确保仪表读数稳定。

5.5 防雨罩清洁

定期取下防护罩用水冲刷或者采用高压气体清洁是很好的维护方法。清洁后安装好防雨罩，保护镜片和视窗不被损坏，并对防止杂物堆积在光学系统表面有帮助。

维护



图16 防雨罩的清洁

5.6 标定帽清洁

在特别恶劣或者有溶剂的环境中，且不能执行标定时，需对光敏元件进行必要的清洁。

- 使用一个干净的干的棉签，粘上异丙醇到光源探头轻轻擦拭，如图17所示



注意!

一定不要将标定帽放入水中，或者破坏标定帽



图17 标定帽清洁

技术参数

6 技术参数

适用气体	甲烷	
量程	(0~100)% LEL	
报警设定值(默认)	低报: 25%LEL; 高报: 50%LEL	
报警继电器	低/高报警继电器 (激励/非激励可选); 故障继电器 (激励输出)	额定负载: 2 A at 30 VAC; 0.5 A at 30 VAC (有源低报输出)
使用电源	(20 ~ 31)VDC	
功耗	< 7W	
信号输出	(4 ~ 20)mA; HART; Modbus RTU	三线制
温度范围	仪表	(-40 ~ +70) °C
	标定帽	(-30 ~ +60) °C
漂移	零漂	< ± 1%LEL/ 3个月
	增益漂移	< ± 2%LEL/ 3个月
精度	± 5 % LEL (0 ~ 50%LEL: ± 3%LEL)	
响应时间	T90 带防雨罩	< 20秒
干扰信号	<1% FS	
湿度	(15 ~ 95)% RH, 无凝露	
IP	IP67	
探头寿命	见1.4节	
SIL 认证	SIL2 详细描述请看附录A	

附件

7 附件

以下是PrimaX IR Pro使用的可销售备件清单：

料号	描述
10111874	PrimaX IR 标定帽
10122228	HART标定帽,PrimaX IR
10116419	Insect screen/远程标定插件
10154839	PrimaXIR/PrimaX IR Pro 防虫罩
10119193	PrimaX IR 探头, 甲烷型 (5.0%) , NPT
10187245	电子模块组件,PrimaX IR Pro,SIL,备件
10187244	电子模块组件,PrimaX IR Pro,H,SIL,备件 (带HART输出口)
10113663	PrimaX IR环境防护罩组件
10111458	带有连接电缆的外螺纹直插头
10114373	PrimaX IR管道安装附件
10153762	遮阳罩,PrimaX IR Pro, 碳钢, RAL7035
10155916	遮阳罩, PrimaXIR Pro,sus304
10180277	遥控器,红外,本安型,中国

附录A

附录A

满足SIL要求的条件

本仪表是严格按照IEC 61508, EN 50271标准要求设计，并通过了TÜV莱茵SIL2的认证

以下是本仪表关于SIL的参数.

安全功能相关参数：

类型	B
架构	1oo1
故障冗余度 HFT	0
安全失效分数 (SFF)	97%
诊断覆盖率 DC	94%
安全失效率 λS	2114.16fit
不可检测危险失效率 λDU	112.33fit
危险失效率 λD	1773.32fit
可检测危险失效率 λDD	1660.99fit
PFD, PFH	请看下表
平均修复时间MTTR	72 小时
检测间隔时间TI	看下表
环境温度	40°C
硬件版本	1.0
软件版本	0.01

	PFD1001	PFD1001% SIL2	PFH1001	PFH1001% SIL2
16周 TI	$2.76.2 \times 10^{-4}$	2.76%	1.12×10^{-7}	11.2%
52周 TI	$6.17.2 \times 10^{-4}$	6.17%	1.12×10^{-7}	11.2%

架构和 SIL等级

下表是安全架构和SIL对应模式

LDM =低要求模式

HDM = 高要求和连续模式

	SIL1		SIL2	
	LDM	HDM	LDM	HDM
架构 1oo1	X	X	X	X

附录A

安全使用通用要求:

- 必须按照说明书的要求进行使用仪表。对于标定和维护，一定要按照当地法规进行。
- 当仪表出现问题，一定要在72小时内进行维修
- HART和Modbus协议不能传输和安全功能相关的数据
- 连接的控制器监控4 ~ 20mA信号电流时，必须能监控小于4mA和大于20mA的值。
- 系统必须能进行功能和标定检查
- 在标定时一定要进行目测
- 每年要进行系统检查
- 标定和校准是功能和标定检查的一部分
- 测试气体必须是能监测的气体。测试气体浓度必须是测量量程的中间值
- 零气是不带碳氢可燃气体的干净空气或者是人造空气
- 以下条件必须进行标定:
- 零点值漂移 > +/-5 % LEL
- 灵敏度值漂移 > +/-20 % 真实值
- 假如标定检查值在允许误差范围内，标定周期可以延长一倍
- 最长标定周期是52周。如果探头在运行中灵敏度只有初始值的一半，必须被更换
- 每年要进行继电器输出功能测试。并且继电器的触点输出要检查
- 客户需要在继电器输出回路上加一个0.5A的保险丝

SIL 2配置要求

- 如果仪表使用在高要求和连续模式，探头只能是1oo2的架构
4 ~ 20 mA输出偏差能被监控。

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
PrimaX IR Pro 型测量范围为 0~100% LEL 的点型可燃气体探测器	×	○	○	○	○	○

本表格依据SJ/T 11364的规定编制。

○：表示该有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下。

×：表示该有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。

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1. Safety Regulations

1.1. Correct Use

The PrimaX IR Pro Gas Monitor - referred to hereafter as device - is a fixed infrared combustible gas detector. It is suitable for outdoor and indoor applications, e.g. offshore industry, chemical and petrochemical industry, water and sewage industry.

The device utilises infrared technology to monitor, detect and alert users to potentially dangerous levels of combustible hydrocarbon gas. Dual source technology offers 100% redundancy on the optical source to maximize reliability and lifetime. This device allows for extremely fast response time whilst providing an extremely stable output signal.

The device is a stand-alone unit with a 4 to 20 mA output with HART [Highway Addressable Remote Transducer] digital information encoded on the analogue output. The signal of the transmitter can be used in combination with MSA control units for further actions in safety or non-safety applications. Contact your MSA representative for available controllers.

The device is shipped factory-calibrated and is labelled with target gas, calibration gas and span setting information for ease of use. Any user changes to the factory assigned values should be noted on the device labels.

The device is explosion-proof and suitable for installation in hazardous locations. This sensor is intended for integration with a control system that can alert operations personnel to the presence of combustible gas.

It is imperative that this operating manual be read and observed when using the product. In particular, the safety instructions, as well as the information for the use and operation of the product, must be carefully read and observed. Furthermore, the national regulations applicable in the user's country must be taken into account for a safe use.



Danger!

This product is supporting life and health. Inappropriate use, maintenance or servicing may affect the function of the device and thereby seriously compromise the user's life.

Before use the product operability must be verified. The product must not be used if the function test is unsuccessful, it is damaged, a competent servicing/maintenance has not been made, genuine MSA spare parts have not been used.

Alternative use, or use outside this specification will be considered as non-compliance. This also applies especially to unauthorised alterations to the apparatus and to commissioning work that has not been carried out by MSA or authorised persons.

1.2. Liability Information

MSA accepts no liability in cases where the product has been used inappropriately or not as intended. The selection and use of the product are the exclusive responsibility of the individual operator.

Product liability claims, warranties also as guarantees made by MSA with respect to the product are voided, if it is not used, serviced or maintained in accordance with the instructions in this manual.

1.3. Safety and Precautionary Measures to be Adopted



Attention!

The following safety instructions must be observed implicitly. Only in this way can the safety and health of the individual operators, and the correct functioning of the device, be guaranteed.

- The device described in this manual must be installed, operated and maintained in strict accordance with the labels, cautions, instructions, and within the limitations stated.
- Protect the device from extreme vibration.
- Do not mount the device in direct sunlight, since this may cause it to overheat. A stainless steel sunshield is available for the PrimaX IR Pro Gas Monitor to protect it from extreme environments.
- The only absolute method to ensure proper overall operation of the device is to check it with a known concentration of the gas for which it has been calibrated. Consequently, calibration checks must be included as part of the routine inspection of the system. The device is labelled with the type and value of the factory calibration gas.
- Use only genuine MSA replacement parts when performing any maintenance procedures provided in this manual. Failure to do so may seriously impair device performance. Repair or alteration of the device, beyond the scope of these maintenance instructions or by anyone other than an authorised MSA service provider, could cause the product to fail to perform as designed.
- There are NO field-repairable internal components for this device. Return to MSA for warranty replacement per the Warranty section.
- This device does NOT detect the presence of hydrogen gas and must never be used to monitor for hydrogen gas.
- The standard device must never be used in atmospheres containing acetylene gas. Contact MSA regarding available acetylene sensors.
- Calibrate frequently if used in atmospheres exposed to high levels of solvents or dust. See chapters 5 and 6 for calibration and cleaning procedures.
- Do not paint the device. If painting is done in an area where the device is located, exercise caution to ensure paint is not deposited on the device. Such paint deposits could interfere with the device operation. Solvents in the paint may also cause an alarm condition to occur.

- The device is designed for applications in hazardous areas under environmental conditions defined in the Specifications section of this manual.
- The response time of the device can be increased by significant dust deposits. Checks for dust deposits must be done at regular intervals.

1.4. MSA Permanent Instrument Warranty

Warranty

Refer to the declaration of MSA warranty.

This warranty is applicable provided the product is installed, maintained and used in accordance with MSA's instructions and/or recommendations. MSA makes no warranty concerning the liability caused by below factors:

- Calibration, debugging or maintenance made by non MSA personnel or the personnel is nonauthorized by MSA.
- Product is incorrectly placed, used or modified.

Any confirmation, statement or warranty made without MSA's authorization is treated as invalid clause.

MSA makes no warranty concerning components or accessories not manufactured by MSA, but will pass onto the Purchaser all warranties of manufacturers of such components.

2. Description

The device is designed to sample the environment at the installed location and alert the user to potentially dangerous levels of hydrocarbon gas. The device is shipped factory calibrated and is labelled with target gas, calibration gas and span setting information.

The output of the device is a standard 4 ~ 20 mA with HART. The 4 ~ 20 mA signal communicates the primary measured value using the 4 ~ 20 mA current loop. Additional device information is communicated using a digital signal that is superimposed on the analogue signal. The device is compliant with HART Communications Foundation [HCF] Revision 7.0 format. Commercially available hand-held communicator devices or PC applications can be used to communicate with the device using the Device Description [DD] file that is available from the HART Communications Foundation website [www.hartcomm.org].

2.1. User Interface

This device is equipped with a junction box with IR sensor, display and relay output. The display consists of four digits LED with 15 segments to display gas concentration and function or error code.

The gas level and basic device status are available via the 4 ~ 20 mA output signal. Other detailed device status is available via the HART signal. Details about this interface can be found in the PrimaX IR HART Specification [www.MSAafety.com].

The optional calibration cap provides an LCD display for easy and intuitive calibration of the device. The proper usage of this calibration cap is described in chapter 4.3.1.

The device should be installed where gas leaks are anticipated. The installation position depends on the gas density, either in the upper area of the room beneath the ceiling for gases lighter than air, or close to the ground for gases heavier than air. Also consider how air movement may affect the ability of the device to detect gas. Testing for ventilation patterns may be helpful in establishing locations for the device in enclosed areas.



Before beginning the installation, check that the delivered components are complete and correct, referring to the shipping documents and the label on the shipment carton.

Device LED and Display



Fig. 1 Device

- 1 Display
- 2 **red LED**: indicates low explosive limit alarm
- 3 **red LED**: indicates high explosive limit alarm
- 4 **IR**: Remote controller LED
- 5 **yellow LED**: indicate fault alarm
- 6 **green LED**: indicates normal condition

2.2. Package Contents

The device will be delivered with the following items in the shipping carton:

- PrimaX IR sensor [316 Stainless Steel]
- Environmental guard
- Quick Start Guide
- Qualified product card (include CCCF label)
- This instruction manual, HART specification and installation drawing
- Mounting kit

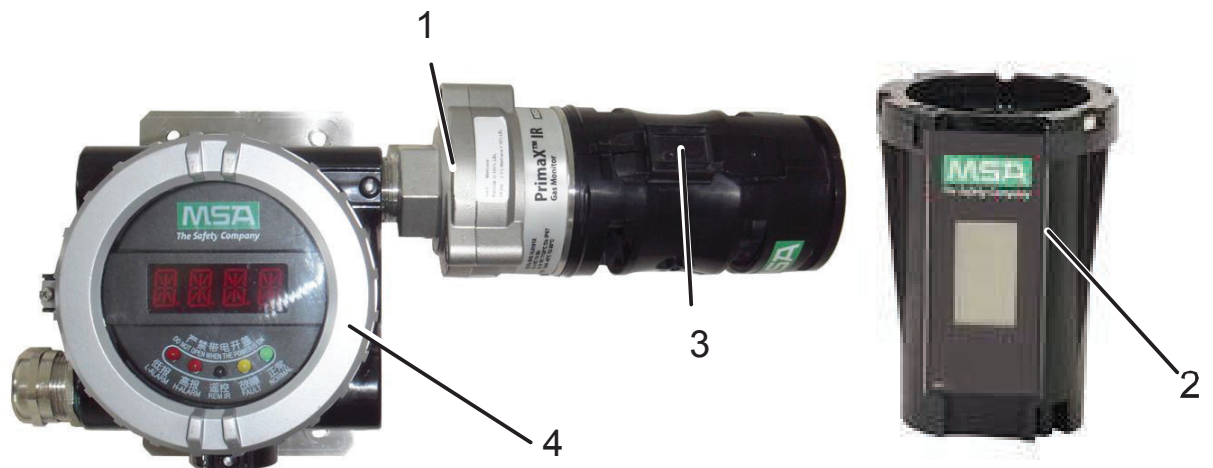


Fig. 2 Overview of Prima X IR parts

- | | | | |
|---|--|---|---------------------|
| 1 | PrimaX IR sensor [316 stainless steel] | 3 | Environmental guard |
| 2 | Calibration cap [optional] | 4 | Aluminium housing |

Accessories to be used with this product may be packaged separately. Check the enclosed shipping papers to identify all PrimaX IR accessories that have been ordered.

Accessories available for the PrimaX IR Gas Monitor include:

- Optional calibration cap for calibration operations
- Optional tether strap for environmental guard

The complete list of accessories is provided in chapter 8.

The device will be labelled with the information shown below:

- Target gas, calibration gas and span value
- Serial number and date of manufacture
- Area classification markings



Fig. 3 Label

3. Installation

3.1. Mechanical Installation

The device's dimensions are shown below [mm]:

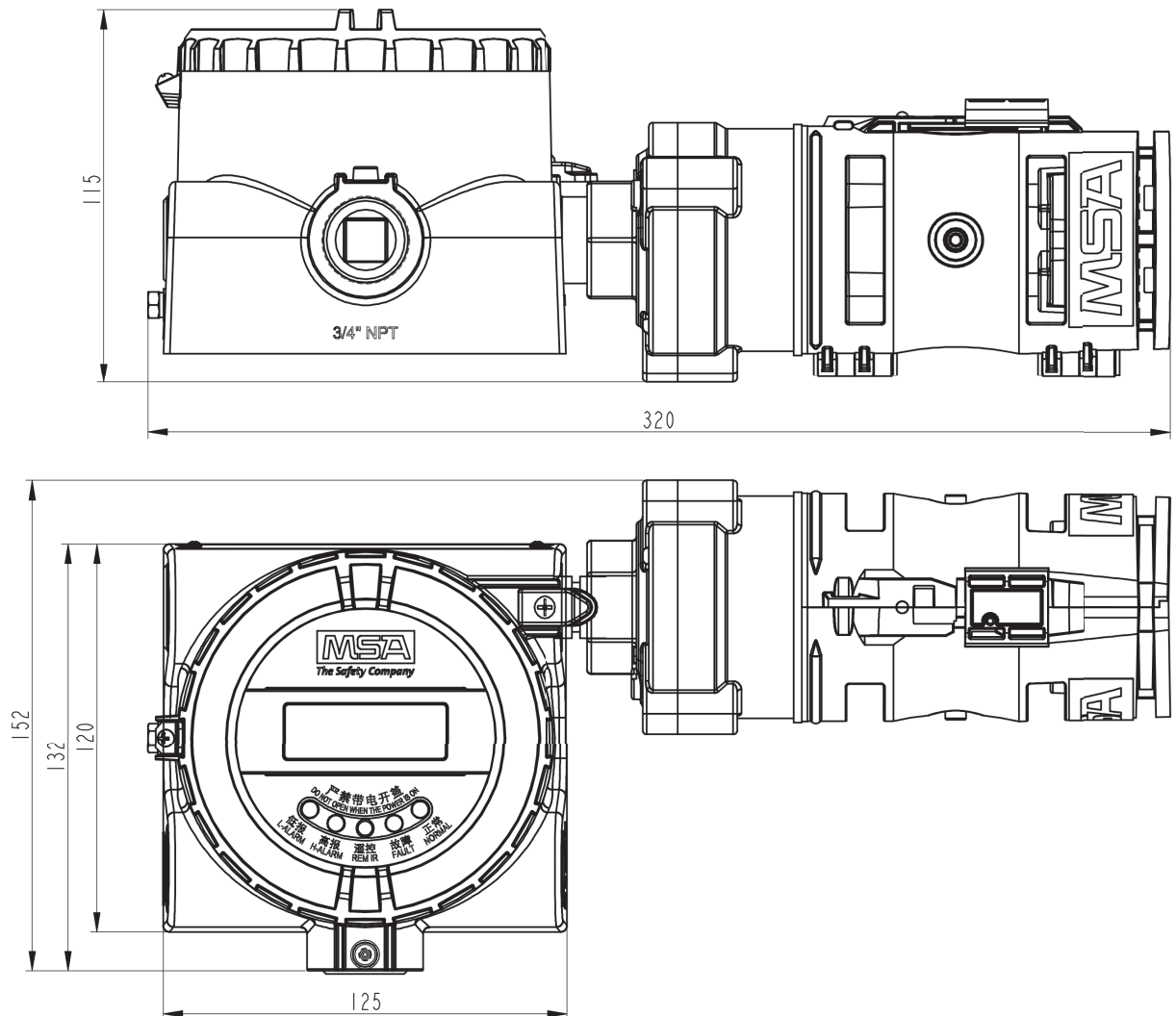


Fig. 4 PrimaX IR Pro



MSA recommends mounting the sensor horizontally. Horizontal mounting will help prevent the build-up of particulate or liquid matter on the monitor's optical surfaces.

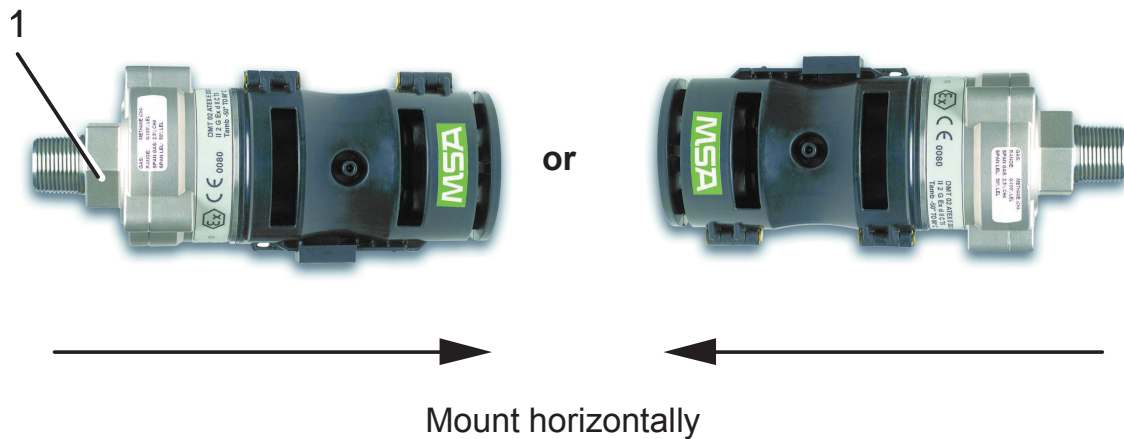


Fig. 5 Recommended mounting orientation

1 Hex nut size: 36mm - Metric



Attention!

Do not paint the device. If painting is done in an area where a sensor is located, exercise caution to ensure paint is not deposited on the sensor. Such paint deposits could interfere with the device operation. Solvents in the paint may also cause an alarm condition to occur.



Attention!

Protect the device from extreme vibration. Do not mount the sensing head in direct sunlight, since this may cause the sensor to overheat. A stainless steel sunshield is available for the device to protect it from extreme environments.

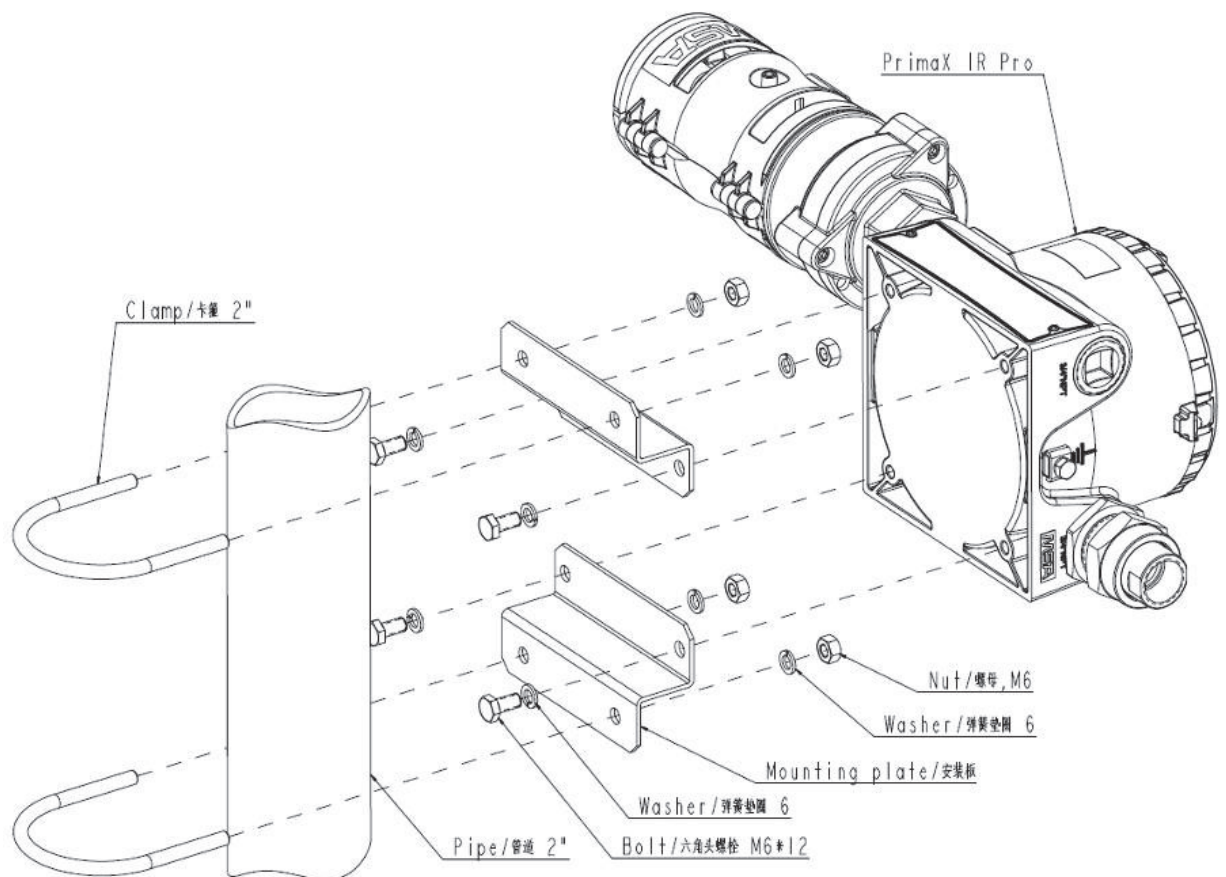


Attention!

During sensor installation or removal, do not use any tools or apply excessive force to the two legs that support the unit's reflectors. Applying force to the legs can permanently damage the monitor.

MSA recommends that the device's environmental guard should be installed on the unit at all times. If the device is to be operated without the guard, frequent checks must be made to ensure particulate or liquid matter has not collected on the windows.

- Use a 36 mm wrench on the hex nut in the sensor neck to install or remove the sensor.
 - ▷ Do not apply torque to the two sensor legs.



Exploded view of PrimaX IR Pro Mounting
PrimaX IR Pro 安装示意图

Fig. 6

PrimaX IR Pro Instructions:

Powder-coated aluminium .

A stainless steel mounting plate is included with PrimaX IR Pro house to ensure that there is sufficient clearance from the installed surface [→ fig. 6].

- (1) Install the mounting bracket and PrimaX IR using the bracket holes as the drilling template.

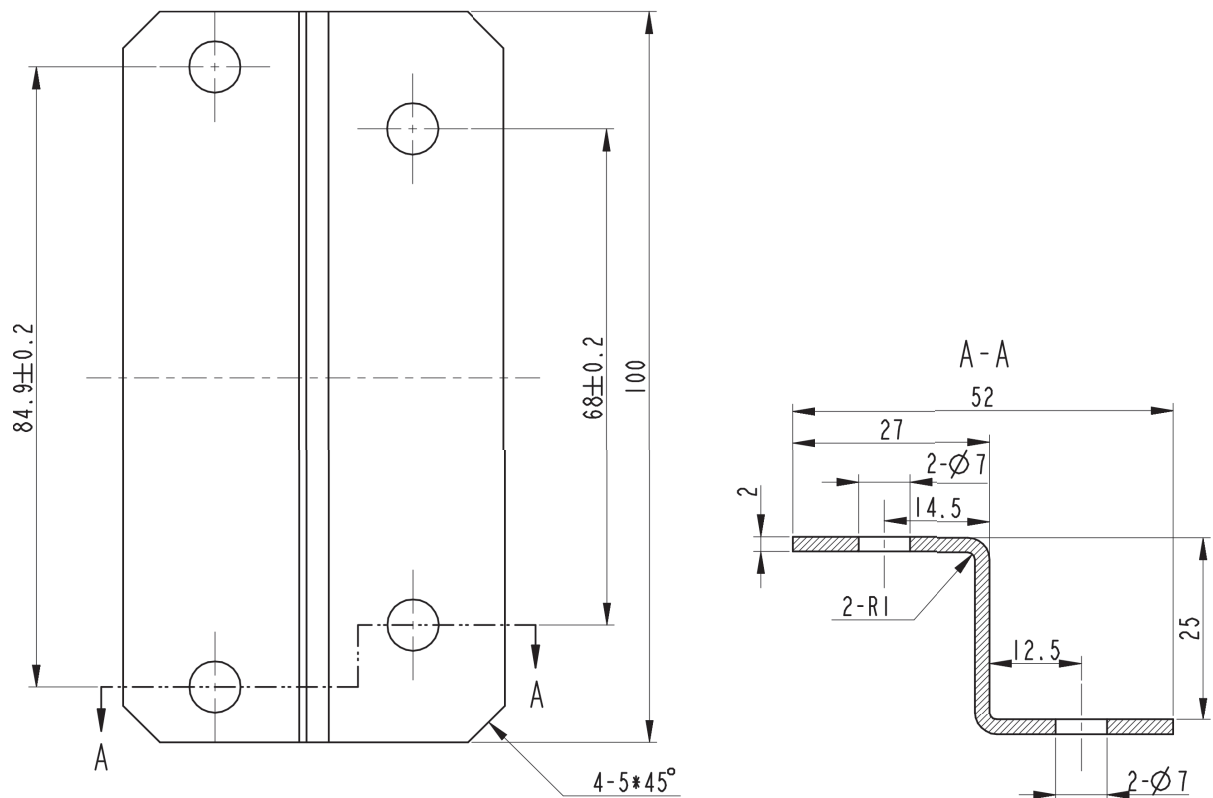


Fig. 7 *Mounting bracket for PrimaX IR Pro*

(2) The PrimaX IR Pro orientation for the device is horizontal.

3.2. Electrical Installation

Instructions for Electrical Connection



Attention!

The device must be installed only in compliance with the applicable regulations, otherwise the safe operation of the device is not guaranteed.

- Shielded cable for measuring devices is recommended.
- Always observe maximum cable lengths and cross-sections shown below.
- Water or impurities can penetrate the device through the cable. In hazardous areas, it is recommended to install the cable in a loop just before entry into the device or to slightly bend it to prevent water from entering.

Wiring Requirements

The following table provides typical cable lengths and wire sizes for installation. The HART signal requires a load across the signal.

Power	Wire size	Distance	Signal Load
DC 24V	1.0mm ²	500m(without audible and visual alarm)	Signal Load ≤ 250 Ω (with HART)
		130m(with audible and visual alarm AF5000)	Signal Load ≤ 450 Ω (without HART)
DC 24V	1.5mm ²	800m(without audible and visual alarm)	Signal Load ≤ 50 Ω (with HART)
		180m(with audible and visual alarm AF5000)	Signal Load ≤ 450 Ω (without HART)
DC 24V	2.5mm ²	1300m(without audible and visual alarm)	Signal Load ≤ 50 Ω (with HART)
		250m(with audible and visual alarm AF5000)	Signal Load ≤ 450 Ω (without HART)

Proper installation should prevent water and dirt from entering the unit via the wires or conduit.

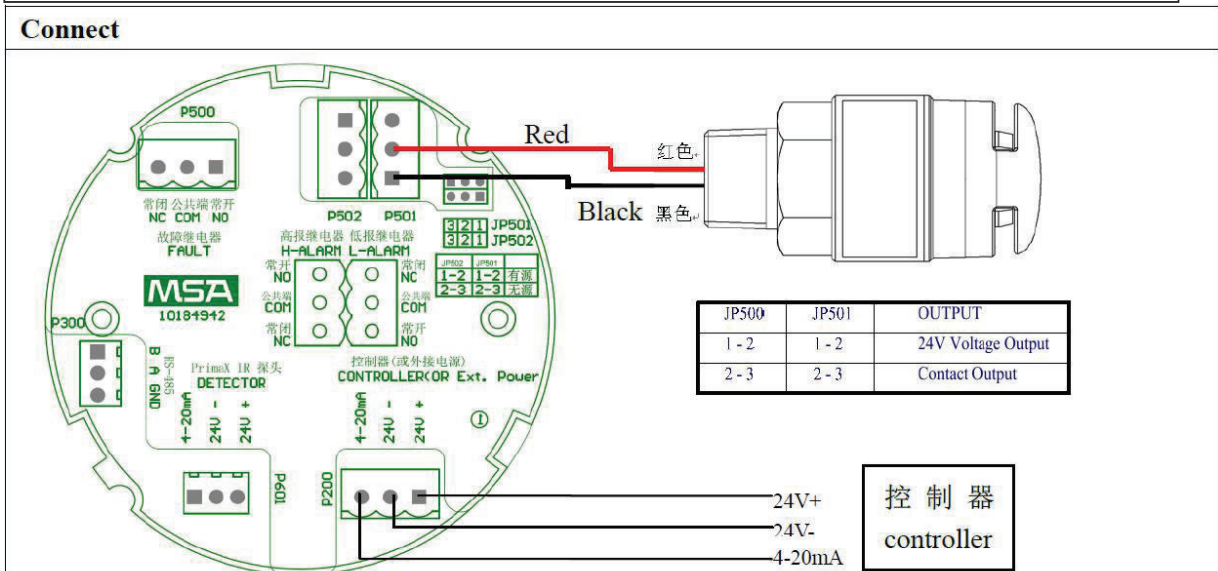
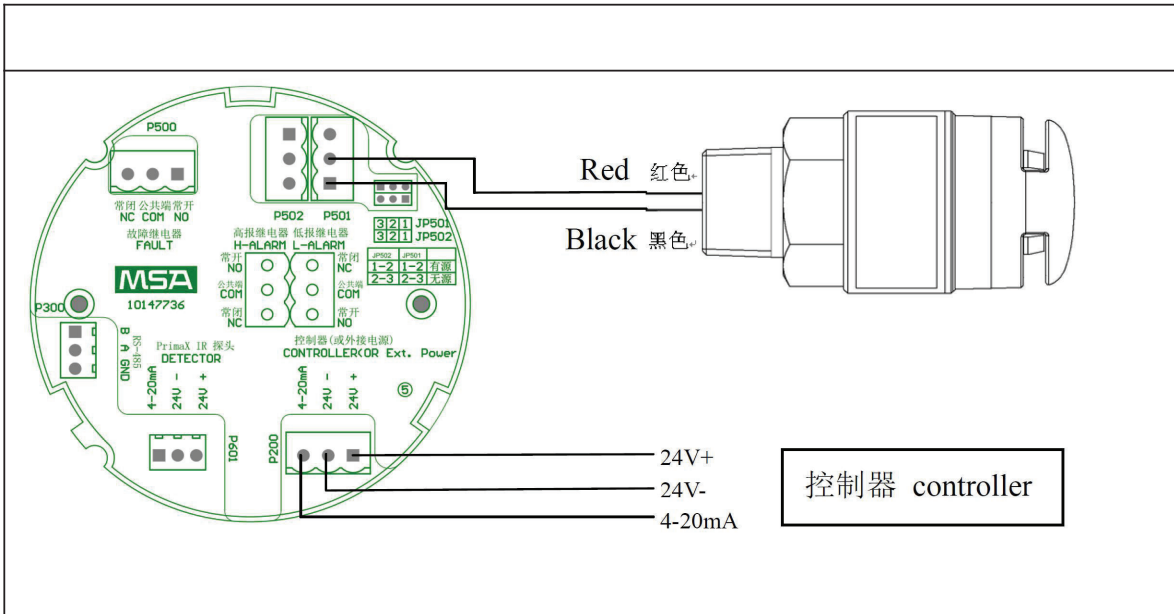
The device sensor is provided with 4 wires for use. The table below shows the wire colour definitions:

Wiring Colour Definitions for sensor

Wire colour	Definition
-------------	------------

Red	24 VDC [DC +]
Yellow	4 ~ 20 mA Source [SIG]
White	0 VDC [DC -]
Green/Yellow	Earth Ground

An external power source is required. Use a high quality, DC power supply with low noise characteristics. See the diagram below for power supply and wiring details:



PrimaX IR Pro 接线图（图中低报警继电器配置为有源输出）

PrimaX IR Pro wiring diagram (Low gas alarm relay output configure active output)

Fig. 8 PrimaX IR Pro wiring diagram (connect audio alarm for low alarm)



Attention!

Before wiring the device, disconnect or isolate all power connected to the device; otherwise electric shock could occur.

Input voltage [at sensor]	Power requirements	
	Nominal	Maximum
19V DC	250 mA	430 mA
24 V DC	200 mA	310 mA
32 V DC	150 mA	250 mA

External Controllers

The device can be connected to any device capable of accepting a 4 - 20 mA sourcing analogue signal. Ensure that your controller can read all signals. Check the MSA website www.MSAsafety.com for available controllers.

The HART output is intended to be used with digital control systems that are compatible with HCF Revision 7.0 protocol.

4. Remote Controller and Menu Sequence

4.1. Remote controller

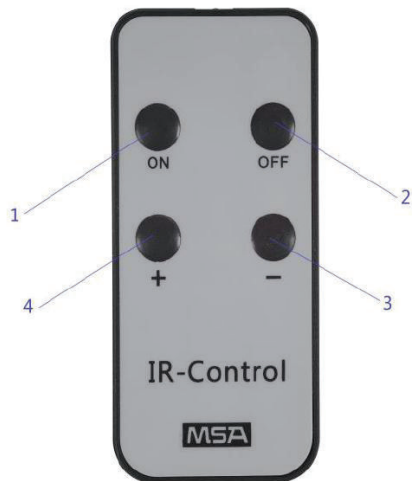


Fig. 9 Remote Controller

- | | | | |
|---|---------------------------------------|---|--|
| 1 | ON: Enter one menu item/Save | 3 | -: Down roll menu item/Decrease value |
| 2 | OFF: Exit/Abandon modification | 4 | +: Up roll menu item/Increase value |

Buttons

The main function of the 4 buttons used for navigation of the menu sequence:

- “+” or “-” is used for navigation of the menu or increasing or decreasing data.
- “ON” is used to enter the submenu of menu items M-01, M-02, etc, or ready to modify data, or to save data.
- “OFF” is used to exit menu items M-01, M-02, etc, or to abandon modification of the data.

4.2. Menu item

Menu item	Function	Password need
M-00	Reset relay	Yes
M-01	Parameter viewing	No
M-02	Parameter setting	Yes
M-03	New password setup	Yes
M-04	Load default	Yes
M-05	LED test	No



In the description of the following menu function, “Measure mode” means concentration display mode.

[M-01] - Parameter browse

(1) Switch to the measure mode.

(2) Press button “+” to select M-01.

(3) Press button “ON”.

▷ The display shows the next submenu.

Display contents of the submenu item	Meaning
ALARM_1=XX	Low alarm point
ALARM_2=XX	High alarm point
ALARM RELAY2 = DENE/ ENER	Low Alarm relay energized / de-energized
ALARM RELAY2 = DENE/ ENER	High Alarm relay energized / de-energized
ALARM RELAY1 = LTCH/UTCH	Low Alarm relay latch / un-latch
ALARM RELAY2 =	High Alarm relay latch / un-latch

LTCH/UTCH

TEMP = XX

Display the current temperature of PCBA

SLAVE ADDR = XXX

Display the Modbus address

[M-02] - Parameter setting

- (1) Press button “+” to select M-02 in the measure mode.
- (2) Press button “ON” on the remote controller to enter the submenu.
- (3) Enter password:
 - ▷ The password has four digits.
 - ▷ The first of the four digits starts blinking.
- (4) To change the value, press button “+” or “-” to increase or decrease data.
- (5) Press button “ON” after changing value to save data.
 - ▷ The first of the four digit stops blinking.
 - ▷ The second digit starts blinking.
- (6) Repeat procedure for all left digits.



If the password is correct, the displays shows the next submenu.
If the password is wrong, the display returns to the menu M-02.

Display character of the submenu item

Meaning

ALARM_L= XX

Low alarm point 5% ~ (configured high alarm threshold-1%)

ALARM_H= XX

High alarm point (configured low alarm threshold+1%) ~ 99%

ALARM RELAY2 = DENE/
ENER

Low Alarm relay energized / de-energized

ALARM RELAY2 = DENE/
ENER

High Alarm relay energized / de-energized

ALARM RELAY1 =
LTCH/UTCH

Low Alarm relay latch / un-latch

ALARM RELAY2 =
LTCH/UTCH

High Alarm relay latch / un-latch

TEMP SETTING = XX

Temperature sensor calibration

SLAVE ADDR = XX

Modbus address setting



lock: even if gas concentration become normal the alarm signal is still valid
unlock: if gas concentration become normal the alarm signal will be deleted

Changing parameters is similar to the password input:

(1) Press button “ON”.

▷ The highest digit starts blinking.

(2) To change the value, press button “+” or “-” to increase or decrease data.

(3) Press button “ON” after changing value to save data.

(4) Repeat procedure for all left digits.

[M-03] – new password setting (default value is 0000)

(1) Press button “+” to select M-03 in the measure mode.

(2) Press button “ON” on the remote controller to enter the submenu.

(3) Enter password:

▷ The password has four digits.

▷ The first of the four digits starts blinking.

(4) To change the value, press button “+” or “-” to increase or decrease data.

(5) Press button “ON” after changing value to save data.

▷ The first of the four digit stops blinking.

▷ The second digit starts blinking.

(6) Repeat procedure for all left digits.



If the password is correct, the displays shows the next submenu.
If the password is wrong, the display returns to the menu M-03.

Display character of the submenu item	Meaning
NEW PASSWORD	Input new password

Changing parameters is similar to the password input:

(1) Press button “ON”.

▷ The highest digit starts blinking.

(2) To change the value, press button “+” or “-” to increase or decrease data.

(3) Press button “ON” after changing value to save data.

(4) Repeat procedure for all left digits.

[M-04] – Load default

- (1) Press button “+” to select M-04 in the measure mode.
- (2) Press button “ON” on the remote controller to enter the submenu.
- (3) Enter password:
 - ▷ The password has four digits.
 - ▷ The first of the four digits starts blinking.
- (4) To change the value, press button “+” or “-” to increase or decrease data.
- (5) Press button “ON” after changing value to save data.
 - ▷ The first of the four digit stops blinking.
 - ▷ The second digit starts blinking.
- (6) Repeat procedure for all left digits.



If the password is correct, the detector will restart. .
If the password is wrong, the display returns to the menu M-04.

factory default mode:

- a) Low alarm: 25%
- b) High alarm: 50%
- c) High/low alarm relay: de-energized state (relay contact is opened)
- d) Unlock
- e) MODBUS RTU address 1
- f) Temperature offset value is 0

[M-05] –LED test

- (1) Press button “+” to select M-05 in the measure mode.
- (2) Press button “ON” on the remote controller to enter the submenu. Then detector display “OFF”
- (3) Press button “+” one time, the all LED will flash. Press button “+” again, detector display “OFF” ,the LED stop flash.



Press the Button “OFF” to cancel the input during the process.

5. Start-up and Calibration

5.1. Remote Controller and Menu Sequence

Initial Startup

The device is factory-calibrated and ready for use. The device provides a 4 - 20 mA output signal that can be used in conjunction with data acquisition controllers. The digital HART signal that is superimposed on the 4 - 20 mA output can be read by control systems that are in compliance with HART Revision 7.0 format.

During device operation, the fault information shown below:

Fault code	(4 ~ 20)mA	Meaning
E-07	---	Pwer on flash self check fault
E-08	---	Pwer on RAM self check fault
E-09	---	Information flash CRC fault
E-10	---	Watchdog fault
E-11	---	ADC10 & ADC12 mismatch fault
E-12	---	Temperature sensor fault
E-13	---	Relay check fault
E-14	---	Task check fault
E-15	---	Relay SPI check fault
E-16	---	Information flash write fault
E-17	---	External reference check fault
E-18	---	Periodic flash check fault
E-19	---	Periodic RAM check fault
E-20	---	ADC12 stuck at high fault
E-21	---	ADC10 stuck at high fault
E-22	---	Periodic PC check fault
E-23	---	Periodic stack check fault
E-24	---	Periodic general purpose register check fault
E-26	---	Periodic SFR check fault
E-27	---	Periodic voltage check fault
E-28	---	Interrupt fault
E-52	0	Sensor failure. Communications not available to sensor
	2.0	Problem detected. Status available via HART interface
	2.5	Light path is blocked
	3.0	Unit power was recently applied or calibration in process with Cal SignalEnabled
	3.5	Defined in chapter 5
E-53	20 ~ 20.5	>100% LEL gas is detected by the device

*Output levels are customer configurable between 2.0 – 3.5 mA via the HART interface.

See the Hart Specification on the product CD for more information.

Calibrations

General

The calibration must be done at regular intervals in accordance with applicable national and regional regulations.

The device is calibrated at the factory. Nevertheless, it is recommended to recalibrate the device after installation. New sensors should be calibrated more often until the calibration records prove sensor stability. The calibration frequency can then be reduced to the schedule set by the safety officer or plant manager.

Signal

The 4 - 20 analogue signal is available within 1 minute of power-on but the device should be powered for at least 60 minutes before attempting calibration to allow for temperature stabilization.



Carry out the calibration during commissioning as well as at regular intervals. This ensures optimum operation of the sensor.



It is recommended that all calibration components are connected before starting a calibration as it is necessary to apply test gas at the appropriate time as shown in fig. 15.

Although the device is factory-calibrated, it is good practice to calibrate the unit once it is installed in its final environmental destination.

As with any type of gas monitor, the only true check of its performance is to apply gas directly to the sensor. New sensors should be calibrated more often until the calibration records prove sensor stability. The calibration frequency can then be reduced to the schedule set by the safety officer or plant manager.

Span gas selections are shown in chapter 5.3.

- (1) Read all calibration instructions before attempting an actual calibration.
- (2) Identify and become familiar with all of the calibration components.
 - ▷ Prior connection of the calibration components will make it easier to calibrate the unit.



Attention!

Failure to follow the above can result in inaccurate calibration.

5.2. PrimaX IR Calibration

The device can be calibrated using either the optional calibration cap locally at the sensor, or using the HART digital interface.



MSA recommends using a calibration gas value in the middle of the measuring range for optimum calibration.

Calibration methods



Fig. 10 MSA Calibration Cap



Fig. 11 HART Hand-held



Fig. 12 HART control system

Although both a full calibration [zero and span] and zero only calibration can be performed on the device, a zero only calibration may be sufficient to properly calibrate the monitor. Normally, any degradation of the sensor's performance is associated with slight drifts in zero that, in turn, will adversely affect its span performance. After completing the zero calibration, perform a span check to ensure proper operation. For a span check, apply a gas of known concentration and verify that the measured response is within acceptable limits. If the span check is unsuccessful, perform a full zero and span calibration.

Alternate Span Gas Settings

To achieve the most accurate calibration it is always best to use the gas of interest and calibrate at the operating temperature. If the target span gas is not available, an alternative span gas can be used with the values show in the table below. The sensor label will identify the span gas and value used by the factory for calibration. Use of a reference gas for calibration may decrease accuracy.

The user may change the gas monitor's span value, gas name and gas curve through use of the PrimaX IR Link software found on the product CD. Please refer to the PrimaX IR HART Specification and the PrimaX IR Link Help Guide on the product CD.

Calibration Settings

Target Gas	100% LEL = x%volume	Span Gas	Span Value (LEL)	Gas Curve Number	
Methane	ATEX	4,40%	2.5%v Methane	57%	1
Propane	ATEX	1,70%	0.6%v Propane	35%	2
Ethylene	ATEX	2,30%	0.1%v Propane	55%	3
Methane	N.A.	5,00%	2.5%v Methane	50%	1
Propane	N.A.	2,10%	0.6%v Propane	29%	2
Ethylene	N.A.	2,70%	0.1%v Propane	48%	3
Toluene	ATEX	1,00%	0.1%v Propane	31%	3
Xylene	ATEX	0,90%	0.1%v Propane	25%	3
Toluene	ATEX	1,10%	0.1%v Propane	27%	3
Butane	ATEX	1,40%	0.6%v Propane	35%	5
Heptane	ATEX	0,85%	0.6%v Propane	45%	4
Hexane	ATEX	1,00%	0.6%v Propane	41%	4
Pentane	ATEX	1,10%	0.6%v Propane	41%	5
Butane	N.A.	1,90%	0.6%v Propane	26%	5
Heptane	N.A.	1,00%	0.6%v Propane	41%	4
Hexane	N.A.	1,20%	0.6%v Propane	35%	4
Pentane	N.A.	1,50%	0.6%v Propane	29%	5
Ethanol	ATEX	3,10%	0.6%v Propane	34%	2
Naptha	ATEX & N.A.	0,90%	0.6%v Propane	56%	2
Methanol	ATEX & N.A.	6,00%	0.6%v Propane	19%	2
Acetone	ATEX & N.A.	2,50%	0.1%v Propane	22%	2
Ethanol	N.A.	3,30%	0.6%v Propane	32%	2
DiEthyl Ether	N.A.	1,90%	0.6%v Propane	38%	2
Ethyl Acetate	ATEX & N.A.	2,00%	0.6%v Propane	63%	2
DiEthyl Ether	ATEX	1,70%	0.6%v Propane	43%	2

Calibration Cap Procedure

- (1) Remove the environmental guard from the device.
- (2) The calibration cap is equipped with a slot for an optional tether retention system. The figure below shows the location of the tether slot.



Fig. 13 Calibration cap

1 Tether slot

- (3) If the user can confirm that the ambient air is free of combustible gas, ambient air can be used in place of the zero gas cylinder. See fig. 15 for a visual representation of the calibration process.
- (4) Install the calibration cap. Press firmly to ensure cap is properly seated.
 - ▷ The calibration process will start automatically when the cap is fully seated on the sensor housing.
 - ▷ Under normal conditions, the display will show all icons steady at power-up.
- (5) The calibration cap display indicates the zero gas cylinder symbol and flashes, indicating that the device is in Zero Calibration mode.
 - ▷ The initial 30 seconds is intended to give the user time to apply gas to the sensor. During this time, the user can abort the process by removing the calibration cap.
 - ▷ After the initial 30 seconds, the device will start the Zero calibration adjustment. The Zero Calibration is indicated by the white cylinder [→ fig. 13] and the word "Zero".
 - ▷ Removal of the calibration cap after the initial 30 seconds will result in a calibration fault. This will abort the present calibration and the device will continue to operate with the previous calibration settings.
- (6) Apply zero gas to the calibration port at an approximate flow rate of 1.5 LPM while the cylinder symbol is flashing. Zero gas can be supplied as

ambient air or from the zero gas cylinder in the calibration kit as noted in chapter 5.3.



Fig. 14 Zero Gas Cylinder Symbol

- (7) When the Zero calibration is successful, the tick symbol “✓” will appear. If only performing a Zero calibration, remove the calibration cap. Following a successful zero, the span process will automatically begin within 30 seconds following the zero symbol “✓”.
- (8) If the Zero calibration fails, the display will show an X for approximately 2 minutes, and will then power down.
- ▷ If the Zero calibration fails, remove the calibration cap and reinstall to start another zero attempt. If multiple failures occur, contact an authorized MSA service centre.
- (9) When the display flashes the span gas symbol, apply the span gas through the calibration cap port [→ figure 12].
- ▷ The unit must see gas within 30 seconds after the span symbol starts to flash or a calibration fault may occur. The initial 30 seconds are intended to give the user time to apply gas to the sensor. During this time, the user can abort the Span process by removing the calibration cap.
 - ▷ The display will then flash at a faster rate to indicate active calibration by the sensor.



Fig. 15 Span Gas Cylinder Symbol

- (10) When the Span calibration is successful, the tick symbol “✓” will appear. If the Span calibration fails, an X will be displayed for approximately 2 minutes, and the device will then power down.
- ▷ See chapter 6 for subsequent action upon calibration failure.

- (11) When calibration is complete, stop the gas flow and remove the calibration cap. Reconnect the environmental guard or flow cap to the sensor. The calibration cap will automatically power down once removed from the sensor. The 4 ~ 20 mA is held at the sensor calibration level for two minutes to reduce the chance of a nuisance alarm upon completion of a calibration procedure.
- ▷ During calibration and this 2 minute period, the unit will not be detecting any gas in the ambient area.
 - Alternately, the device can be commanded via HART to track the gas level during calibration [see the Calibration Signal Enable/Disable command in the HART Specification].
 - ▷ Once the calibration cap is removed it can take up to two minutes for gas to diffuse and the device to read normal ambient levels.

When a Zero or Span calibration failure occurs, the device reverts back to its previous successful calibration settings.

If the calibration cap is left on for more than 15 minutes after calibration concludes, the 4 to 20 mA signal indicates Fault status.

When the calibration cap battery is nearing the end of its useful life, the LCD will display all the icons in a series of rapid flashes at power-up before it starts the normal calibration cycle. The battery is non-serviceable and the calibration cap would need to be replaced once the battery is depleted.



Attention!

The calibration cap must be removed from the device after completing the Zeroing and/or Spanning procedure; otherwise, the sensor cannot perform properly.

HART Calibration Procedure

The device can be calibrated using a HART compatible communications interface with Device Description capability [DD], such as the Emerson 375 or 475 Field Communicator [→ fig. 10]. Ensure that the HART hand-held communicator is compatible with the area classification. This hand-held HART communicator must be HART revision 7.0 compliant and can be obtained from a HART authorised supplier. See the PrimaX IR HART specification found on the MSA website at www.MSAafety.com.

Calibration can also be performed via the HART interface with optional screen inserts in the Environmental Guard. As shown in figure 16, the environmental guard can be fitted with these screens that will allow the calibration gas to be retained in the enclosure long enough for a valid zero and/or span reading to be obtained under still-air conditions.



Attention!

Use of these inserts will increase the sensor response time by up to 100% to ambient gas conditions. Ensure that the operational conditions are appropriate for use of these screens.

When supplying tubing to the environmental guard to allow remote HART calibration, gas should be delivered to both ports of the environmental guard from a 1.5 l/min regulator as shown in figure 17:



Fig. 17 HART calibration set-up

1 Screens

When used under windy conditions, a rubber calibration cover must be used over the environmental guard while applying the zero and span gas. See figure 17 for a picture of this cover.



Fig. 18 HART Calibration Cover



Attention!

Ensure that the calibration cover is removed after calibration is complete. This cover is intended to block the flow of ambient air into the sensor during calibration, and in normal operation must ALWAYS be removed.

For applications where access to the HART signal is needed in hazardous areas, MSA provides the HART Module as shown in Fig. 18.



Fig. 19 HART module

The explosion-proof port allows access via a HART hand-held controller using the cable shown above [part number 10081441].

5.3. Calibration Kits

Calibration kits are available for the device. The recommended calibration kits are shown in the following table.

GAS TYPE	CAL CYLINDER	CYLINDER P/N	SPAN VALUE	CAL KIT #
Methane	2.5% Methane	10028032	57% LEL (LEL= 4.4%vol)	40
Propane	0.6% Propane	10028034	35% LEL (LEL= 1.7%vol)	40
Zero Gas	100% Nitrogen	10028030	0% LEL	40

See the PrimaX IR Pro section of www.MSAafety.com for additional PrimaX IR Pro calibration gases.

6. Maintenance

6.1. General



Danger!

Before working on the device, turn off the power and secure against restart.

There are NO field repairable internal components for this device. Do not attempt to open the enclosure of the device, it is factory sealed for protection from hazardous environments. If the troubleshooting guides in chapters 6.2 and 6.3 do not alleviate the problem, contact your MSA representative.

6.2. Troubleshooting

The 4 ~ 20 mA output provides a limited set of information for diagnostic purposes. Additional troubleshooting steps are outlined below.

General Troubleshooting Guide

Indication	Action
Sensor IR source does not flash	Verify sensor and facility wiring according to the installation section and then reapply power
Sensor IR source is flashing but no 4 ~ 20mA signal.	Verify sensor and facility wiring according to the installation section and then reapply power.
FAULT mA output	Check power supply and restart. Check to ensure that the calibration cap was not left on the sensor for an extended time.
OBSCURATION mA output	Verify optical path is not obscured or perform the cleaning procedure below.
Elevated gas reading when no gas is expected to be present	Clean the optical window and mirror using the cleaning procedure below. Apply zero gas to see if reading drops to zero. If it does not, then perform Zero and Span calibration.
Unstable 4 mA signal after power on and warm up	Verify DC voltage supply is between 20 – 31 VDC. Total voltage, including any AC components, must be less than 31 VDC. If power supply is within 20-31 VDC, check for noise on the input power line. Use of an external filter may be required in this case.

mA output current does not change when gas is applied	<p>Verify that gas flow path is unobstructed. Visually inspect the gas inlets and the regulator.</p> <p>Verify that you are not in calibration mode or any of the defined mA output levels shown in chapter 5.1.</p> <p>Verify that the device is not in Fixed Current Mode [Commanded via HART].</p>
Calibration cap span fails.	<p>Pull the cap off and evacuate gas from the calibration cap. Retry the calibration procedure and verify the Zero calibration was successful. If Zero calibration returns “✓” and the Span calibration fails, verify adequate span gas and flow. Verify that the Span gas is applied within the 30 second window.</p> <p>Check the o-ring integrity to ensure a good seal between the sensor and the calibration cap.</p> <p>Check the cap for damage.</p>
Calibration cap rapidly flashes all icons during startup	<p>The calibration cap battery is nearing the end of its useful life. The calibration cap will continue to operate until the battery is consumed.</p>
Known gas concentration response is incorrect	<p>Calibrate. If calibration fails, remove power and reapply.</p> <p>Verify span gas flow rate and cylinder accuracy. Verify environmental guard and/or flow cap are not obstructed.</p> <p>Verify line load is according to electrical installation chapter 3.2.</p> <p>Verify ambient temperature range is appropriate for the device rating.</p>
One source not flashing	<p>The PrimaX IR is designed to meet all specifications with only one source. Source status is available through HART communication. See HART manual for details. Perform standard calibration.</p> <p>No further action required.</p>

6.3. HART Information for Troubleshooting

The HART digital signal can provide additional information on the unit's health and status. Some of the information includes specific fault, calibration and obscuration status.

All available status bytes are defined in the PrimaX IR HART Specification found on the product CD. Refer to this document for complete HART command and status definitions. Use the HART digital interface to query the unit to provide additional troubleshooting information.

6.4. Cleaning

The presence of particulate matter, oil films, liquid water, or the residue from water drops on the device optics can adversely affect its performance. The environmental guard is designed to prevent solids or liquids from reaching the monitor's optical system. Heating elements are also incorporated into the unit to prevent water condensation. Under severe conditions, however, some material may collect on these surfaces and it may be necessary to occasionally check and clean the windows.

(1) Remove the environmental or flow cap.

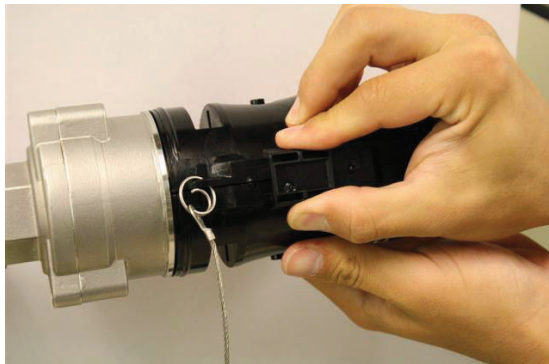


Fig. 20 Remove Environmental Guard

(2) Place an opaque object [piece of paper, two fingers, etc.] between the light source window and the mirror to completely obscure the light path for two to three seconds [→ fig. 20].

- ▷ If the opaque object is left in the light path for longer than 10 seconds, an Obscuration fault will be set on the mA output [→ chapter 5.1].
- ▷ The device enters the Cleaning Mode for 5 minutes.



Fig. 21 Light path obscuration



The sensor will not respond to the presence of gas in cleaning mode.

- The analogue current output will be set to the the Cleaning Mode value [→ chapter 5.1] during this time.
- If monitoring the HART signal, the Cleaning Status bit will be set.

Although both windows are made of a highly durable material that is not easily scratched, avoid excessive pressure when cleaning them. Clean, cotton tipped applicators are recommended to remove material collected on the windows.

- (3) Use a dry applicator or one moistened with distilled water to wipe the window and remove dust.
- (4) Use an additional clean, dry applicator to remove any residual water.
- (5) Use an applicator moistened with isopropyl alcohol to remove heavy deposits of solids, liquids or oil films. Clean the window again with a second applicator moistened with distilled water; then, dry the window with a final applicator.
- (6) Avoid using excessive amounts of water or alcohol in the cleaning procedure, and inspect the window to ensure that the entire surface is clean.



When the cleaning process is complete, be sure to remove all objects from the light path.

When exiting the Cleaning Mode, the unit returns to normal operation. Note that residual cleaning fluids may result in an elevated signal until completely dry.

(7) Inspect the environmental guard for any blockages, then replace the environmental guard on sensor.

- ▷ After cleaning the windows, it is advisable to check the sensor's response to both zero and calibration gas.



Warning!

Do not place foreign objects in the sensor's analytical region [except per the Cleaning Procedure above]; otherwise, the infrared beam can be partially blocked, causing the sensor to generate false readings. All objects must be removed from the sensor's analytical region for it to function properly.



Danger!

If water or isopropyl alcohol is used to clean the sensor's windows, any residue from the cleaning procedure must be completely dissipated before returning the unit to service. Checking the sensor's response to zero gas is the best way to purge residual cleaning materials from the sensor. Ensure that the sensor's reading is stable before zeroing or calibrating the sensor [→ chapter 5].

6.5. Environmental Guard Cleaning

It is good maintenance practice to occasionally clean the environmental guard by removing it and rinsing it with water, or using compressed air to clean it [→ fig.21]. Always reinstall the environmental guard for normal operations to provide protection against damage to the mirror and windows, and to help prevent dust from accumulating on the optical surfaces.



Fig. 22 Environmental Guard Cleaning

6.6. Calibration Cap Cleaning Procedure

In general, the calibration cap should not require any maintenance. However, if it is used in extremely dirty or solvent based environments, it may be necessary to clean the light sensor if the calibration cap performance is not adequate.

- Use a clean, dry applicator and isopropyl alcohol to gently swab the light sensor, as shown in figure 22.



Attention!

Never immerse the calibration cap in water or damage will occur.



Fig. 23 Calibration cap diode cleaning

7. Technical Data

Measuring Range		0-100% LEL
Power Input		20 – 31 VDC
Power Consumption		< 6.0 W
Signal Output	4 ~ 20 mA	3-wire current source
Temperature Range	Sensor	-40 to +70°C
	Calibration Cap	-30 to +60 °C
Drift	Zero Drift	< 1%LEL/ 3 months
	Gain Drift	< 2%LEL/ 3 months
Accuracy	≤ 50% LEL	+/- 3 % LEL
	> 50% LEL	+/- 5 % LEL
Response Time	t50 with Environmental Guard	< 10 sec
	t90 with Environmental Guard	< 20 sec
Noise		<1% FS
Humidity		15 to 95% RH, non-condensing
Sensor Life	☒ chapter 1.4	
In-Rush Current		< 350 mA
Physical Characteristics	Length	203 mm
	Weight	3.5 kg
	Material type	316 Stainless Steel
Ingress Protection		IP67 [3rd party certified]

7.1. Certification and Approval

Check with your MSA representative to verify availability or check the product approval label for details on your model:

Dekra EXAM	II 2G EEx d IIC T4
CE	Low Voltage Directive, EMC Directive, ATEX
Calibration Cap, Intrinsic Safety	ATEX, IEC, cCSAus

8. Accessories

The following accessories are available for the device:

Description	Part No.	
Calibration cap	10111874	Figure 2
Insect screen/Remote calibration inserts	10116419	Chapter 8.5
Sun shield	10113481	Chapter 8.2
Calibration cover	10122228	Figure 17
HART hand-held communicator cable	10081441	Figure 18
Flow cap	10113100	Chapter 8.1
3-way pushbutton valve	635729	Chapter 8.1
Sensor O-ring	10105967	
Environmental guard	10113663	Figure 2
Stainless steel tether	10114097	Figure 2
Duct mount flange	10114373	Chapter 8.3

8.1. Flow Cap



Fig. 24 Flow cap

The flow cap is for use with a sampling system. It is available in 316 stainless steel and is secured to the sensor in place of the environmental guard with two screws.

A 3-way pushbutton valve is available for ease of calibration when using the flow cap. The sample flow and the calibration gas can both be plumbed to this valve, and the operator holds down the pushbutton to switch the flow to the calibration gas.



Using the flow through adapter can extend the response time, depending on the gas flow rate and system design.

8.2. Sunshield

The sunshield is a 316 stainless steel plate that protects the sensor from direct sunlight and from excessive temperature rise.



Fig. 25 Sun shield

8.3. Duct Mount Flange

Gas monitoring in air ducts can be performed by means of this duct mount flange. Install the sensor in a location that is convenient for maintenance, where it will be exposed to a representative sample and is not subject to extremes of flow, turbulence, temperature and particulate.

When installing, the direction of flow inside the duct must be as shown in Fig. 25. Calibration of the device mounted in an air duct must be done with the HART interface. Once calibration has been initiated, apply the calibration gasses via the gas calibration port. Ensure that the duct is free of all gases to which the sensor will respond and the duct flow rate is below 1 m/s. If hydrocarbon combustible gas is present in the duct, the sensor must be removed from the duct during calibration. The sensor can be removed from the duct mount bracket via four screws.

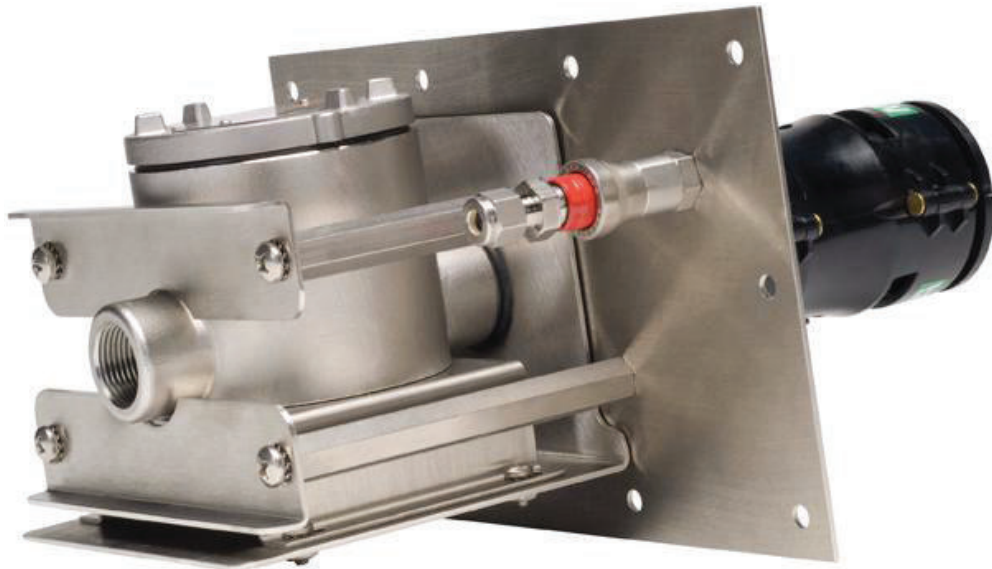


Fig. 26 Duct mount

1 Flow

2 Gas calibration port

8.4. HART Module

The HART Module is a 316 Stainless Steel enclosure that provides a hazardous area approved HART port for access to the HART signal. The PrimaX IR Pro can be mounted to this module using an available port and all applicable facility wiring rules from Section apply to wiring the HART Module.



Fig. 27 HART module

An optional cable is available from MSA to connect to the XP HART port from a hand-held controller.

8.5. Insect Guard/Remote Calibration Inserts

For applications where HART is being used for calibration and the sensor is located in a remote location where use of the calibration cover is not practical, optional screen inserts are available. These inserts snap into the environmental guard [→ fig. 28] and permit a very slow diffusion of gas through the tight mesh screens. This allows enough zero and span gas to be retained in the environmental guard for the calibration procedure to be accurate for still air applications.



Attention!

Use of these inserts will increase the sensor response time to ambient gas conditions. Ensure that the operational conditions are appropriate for use of these screens.

These screens can be used as an insect guard.



Fig. 28 Remote cal/ Insect screen inserts

9. Approvals

9.1 Marking, Certificates and Approvals According to the Directive 94/9/EC ATEX

Prima X IR Pro

Manufacturer: MSA (China) Safety Equipment Co.,Ltd

Product: PrimaX IR Pro

Type of protection EN 60079-0 :2009, EN 60079-1 :2007
IEC 60079-31 :2008

Measuring function
for explosion protection : no

Gas: see manual

Marking: PrimaX IR Pro



II 2 G Ex d IIC T4 Gb

II 2 D Ex tb IIIC T130°C Db IP67

-40°C ≤ Ta ≤ +70°C

EC-Type Examination Certificate: BVS 10 ATEX E 157 X

Quality Assurance Notification : 0080

Year of Manufacture: : see Label

Serial Nr.: : see Label

EMC Conformance according
to the Directive 2004/108/EC EN 50 270 :2007 Type 2
EC 61 000 - 6 - 4: 2007

Special conditions for safe use:

- For dust applications the installation conditions according to EN 61241-14 has to be considered. Take precaution to avoid electrostatic discharge with respect to the instrument label.
- Maintenance or repair for protection "d" equipment is only allowed by the manufacturer.
- The gas monitor PrimaX IR Pro is equipped with a tapered NPT ¾" thread or a metric M25 x 1,5 thread for mounting to a connection enclosure of protection type increased safety "e" or protection type flameproof enclosure "d".

- When mounting the gas monitor to an enclosure of protection type flameproof enclosure "d" the reference pressure of the separate enclosure for the connection must not exceed 10,5 bar. The test of the mechanical strength of the separate enclosure for the connection and the test of the connecting thread with respect to explosion hazards must be ensured within the framework of the type test of the electrical apparatus, that is attached to the gas monitor PrimaX IR Pro. The threaded hole to which the gas monitor is attached to must meet the requirements of section 5.3 [Table 3/4] of EN 60079-1.
- NPT 3/4" fixture has to be sealed with 2 layer PTFE sealing tape or according to the instructions of the manufacturer of the enclosure with NPT thread; when removed, new PTFE sealing has to be used after reinstalling .
- When mounting the gas monitor to protection "e" [increased safety] enclosures, the mechanical resistance and the IP protection [IP6X] of the mounted enclosure has to be ensured by the type test of the electrical apparatus being mounted to the gas monitor. After mounting of the gas monitor onto a protection "e" enclosure, the clearances and creepage distances must meet the requirements of 4.3 [Table 1] of EN 60079-7. The non-shielded cables of the gas monitor must be routed and connected so as to be mechanically protected and corresponding to the temperature resistance of the cables as per 4.2, 4.5.1 and 4.8 of EN 60079-7.
- The PrimaX IR Pro gas monitor must be screwed into the housing wall such that it is secured against self-loosening. The specified minimum thread depth of the add-on housing has to be observed.
- The PrimaX IR Pro gas monitor and enclosure must both be earth grounded.

9.2 Marking, Certificates and Approvals According to IECEx PrimaX IR Pro

Manufacturer: MSA (China) Safety Equipment Co., Ltd.
No. 8 Rui En Lane, Xingpu Road,
Suzhou Industrial Park, Jiangsu, China

Product: PrimaX IR Pro

Type of protection IEC 60079-0: 2007, IEC 60079-1: 2007
IEC 60079-31 :2008

Measuring function
for explosion protection : no

Gas: see manual

Marking: PrimaX IR
Pro



Ex d IIC T4 Gb
Ex tb IIIC T130°C Db IP67
-50°C Ta +80°C

EC-Type Examination
Certificate:

IECEX BVS ??

Quality Assurance Notification : 0080

Year of Manufacture: : see Label


Serial Nr.: : see Label

EMC Conformance according
to the Directive 2004/108/EC EN 50 270 :2007 Type 2
IEC 61 000 - 6 - 4 :2007

Special conditions for safe use:

- For dust applications the installation conditions according to EN 61241-14 has to be considered. Take precaution to avoid electrostatic discharge with respect to the instrument label.
- Maintenance or repair for protection "d" equipment is only allowed by the manufacturer.
- The gas monitor PrimaX IR Pro is equipped with a tapered NPT $\frac{3}{4}$ " thread or a metric M25 x 1,5 thread for mounting to a connection enclosure of protection type increased safety "e" or protection type flameproof enclosure "d".
- In case of mounting the gas monitor to an enclosure of protection type flameproof enclosure "d" the reference pressure of the separate enclosure for the connection must not exceed 10,5 bar. The test of the mechanical strength of the separate enclosure for the connection and the test of the connecting thread with respect to explosion hazards must be ensured within the framework of the type test of the electrical apparatus, that is attached to the gas monitor PrimaX IR Pro. The threaded hole to which the gas monitor is attached to must meet the requirements of section 5.3 [Table 3/4] of EN 60079-1.
- NPT $\frac{3}{4}$ " fixture has to be sealed with 2 layer PTFE sealing tape or according to the instructions of the manufacturer of the enclosure with NPT thread; when removed, new PTFE sealing has to be used after reinstalling .
- When mounting the gas monitor to protection "e" [increased safety] enclosures, the mechanical resistance and the IP protection [IP6X] of the mounted enclosure has to be ensured by the type test of the electrical apparatus being mounted to the gas monitor. After mounting of the gas monitor onto a protection "e" enclosure, the clearances and creepage distances must meet the requirements of 4.3 [Table 1] of EN 60079-7. The non-shielded cables of the gas monitor must be routed and connected so as to be mechanically protected and corresponding to the temperature resistance of the cables as per 4.2, 4.5.1 and 4.8 of EN 60079-7.
- The PrimaX IR Pro gas monitor must be screwed into the housing wall such that it is secured against self-loosening. The specified minimum thread depth of the add-on housing has to be observed.
- The PrimaX IR Pro gas monitor and enclosure must both be earth grounded.

PrimaX IR Pro Calibration Cap

Manufacturer:	Mine Safety Appliances Company 1000 Cranberry Woods Drive Cranberry Township, PA 16066 USA
Product:	PrimaX IR Calibration Cap
Type of protection	EN 60079-0 :2006, EN 60079-11 :2007
Marking:	 II 2 G Ex ia IIC T4 -30°C ≤ Ta ≤ +60°C
EC-Type Examination Certificate:	LCIE 10 ATEX 3090
Battery	Panasonic BR 1632A
Quality Assurance Notification :	0080
Year of Manufacture: :	see Label
Serial Nr.: :	see Label
EMC Conformance according to the Directive 2004/108/EC	EN 61000 - 6 - 3 :2007

9.3 Special conditions for the safe use according to SIL applications

The PrimaX IR Pro Gas Monitor has been subjected to rigorous reliability and functional safety assessments, which have culminated in the gas monitor being certified to IEC 61508, EN 50271 by TÜV Rheinland Industrie Service GmbH. The tables below list the SIL parameters for this device.

Safety relevant parameters for the PrimaX IR Pro Gas Monitor:

Type	B
Structure	1001
HFT	0
Safe Failure Fraction (SFF)	97%
DC	94%
λ_S (Detected safe failure rate)	2114.16fit
λ_{DU} (Undetected dangerous failure rate)	112.33fit
λ_D (Dangerous failure rate)	1773.32fit
λ_{DD} (Detected dangerous failure rate)	1660.99fit
PFD, PFH	See table
MTTR	72 hr
TI (Test Interval)	See table
Ambient Temperature	40°C
Hardware version	1.0
Software version	0.01

	PFD1001	PFD1001 % SIL2	PFH1001	PFH1001 % SIL2
16week TI	2.76.2x10 ⁻⁴	2.76%	1.12x10 ⁻⁷	11.2%
52week TI	6.17.2x10 ⁻⁴	6.17%	1.12x10 ⁻⁷	11.2%

Possible structures and acquirable SILs

The following table shows which structure has to be selected to fulfill the requirements of a specific SIL.

LDM = Low Demand Mode

HDM = High Demand or Continuous Mode

	SIL1		SIL2		SIL3	
	LDM	HDM	LDM	HDM	LDM	HDM
Structure 1001	X	X	X	X	X	X

Depending on the selected configuration and the sensor version, the

following safety-relevant parameters have to be considered while implementing the safety loop:

General conditions for safe use:

- The application advice and the limitations of the manual have to be considered. For calibration and maintenance, the regional and national regulations have to be considered.
- A defective device has to be repaired within 72 hours.
- The HART® and Modbus interface cannot be used for the transmission of safety related data.
- The connected controller has to monitor the 4 ~ 20 mA signal current for values below 4mA and above 20 mA.
- A functional check/calibration check has to be done for the complete system.
- A visual check has to be done together with the calibration.
- A system check has to be done every year.
- Calibration and adjustment are part of the function/calibration check.
- The test gas must be the gas to be monitored. The concentration of the test gas has to be in the middle of the measurement range.
- For zero gas, clean air free of hydrocarbon combustible gas or synthetic air has to be used.
- An adjustment has to be done under the following conditions:
 - ◆ difference at zero > +/-5 % LEL
 - ◆ difference at sensitivity > +/-20 % of the rated value
- If the calibration is inside of the valid tolerance, the calibration interval can be doubled.
- The maximum of the calibration interval is 52 weeks. -The gas monitor has to be replaced if the sensor sensitivity during the operation is reduced to less than 50% of the initial sensitivity.
- Checking the relay output function is accomplished by proven test every 1 year. And contact welding should be check by the proven test
- The customer should connect a 0.5A fuse in the relay out loop.

Special conditions for SIL 2

- The use of the device in a High Demand or Continuous Mode is allowed only in a 1oo2 –structure (for PrimaX IR sensor).

The 4 ~ 20 mA output of the device must be monitored regarding deviations.



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传真: 0512-62952853

中国营销总部
电话: 021-62375878
传真: 021-62375876

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