

015-21001



# GC-400 便携式气相色谱仪 安装使用说明书 (V) 版

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## VOC 专用版

请仔细阅读本说明书，正确使用本产品  
请妥善保管本说明书以备今后使用

上海辉世仪器设备有限公司

中国

上海

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## 1.1 前言

### 请在使用本产品前仔细阅读本说明书。

感谢您购买上海辉世仪器设备有限公司生产的 GC-400 便携式气相色谱仪 VOC 专用型（以下简称本产品）。

本说明书记载了本产品的操作方法（硬件安装及软件分析应用）。请在使用本产品前仔细阅读本说明书并遵照说明书的内容正确使用本产品。

请妥善保管本说明书以备今后参考。

本说明书记载内容以用户拥有 **Windows** 的基本操作知识为前提。

本说明书是中英文双版

### 重要事项

- 如果用户或使用场所发生改变，请将本说明书转交给后续用户。
- 如果本说明书丢失或损坏，请立即与您所在各区域内的经销商或于我公司售后部联系。
- 为确保安全操作，请务必联系本公司专业售后工程师进行安装、调试或维修。

### 声明

- 本说明书内容如有改动恕不另行通知。
- 本说明书内容力求准确，如有错误或遗漏敬请原谅。
- 本说明书版权归上海辉世仪器设备有限公司所有。未经本公司许可不得转载、复制部分或全部内容。

• **Microsoft、Windows 和 Windows 10** 是美国 **Microsoft Corporation** 在美国及其他国家的注册商标。

**Adobe、Adobe 标志和 Adobe Reader** 是美国 **Adobe Systems Incorporated** 在美国及其他国家的注册商标。

在本说明书中记载的其他公司名及产品名是各公司的商标及注册商标。此外本说明书中不对 **TM**、**®** 标记做明确说明。

- **Microsoft® Windows® 10** 操作系统被称作 "**Windows 10**"。
- 本产品备件的供货期为产品停产后七年。其后可能无法提供备件，敬请谅解。但非本公司生产备件的供货期请参照相关厂家规定

## 1.2 保修

本产品的保修内容如下：

### 1. 保修期

本产品的保修期如无特别延保合同，本设备安装之日的 12 个月内或到货后 13 个月内。

### 2. 保修内容

对保修期内因本公司原因造成的故障将免费维修或免费更换零部件（包括软件）。但对个人计算机及其外围设备、零部件等短寿命产品可能无法提供同一型号的产品。

### 3. 责任范围

(1) 任何情况下本公司均不对用户的误工费、间接性损害和衍生性损害负任何责任。也不对因第三方向用户提起的损坏赔偿负任何责任。

(2) 任何情况下本公司的最高赔偿金额均以出厂价格或销售价格为准。

### 4. 责任免除

下列故障不属于保修范围：

- 1) 操作不当。
- 2) 非本公司或本公司指定的其他公司对本产品进行的维修或改装。
- 3) 与非本公司指定的硬件或软件一起使用。
- 4) 因计算机病毒造成的本产品故障和包括基本软件在内的软件及数据损坏。
- 5) 因停电或电压突然降低等电源故障引发的故障和包括基本软件在内的软件及数据损坏。
- 6) 错误关机造成的故障和包括基本软件在内的软件及数据损坏。
- 7) 非产品本身原因造成的故障。
- 8) 因在高温高湿、腐蚀性气体或震动等恶劣环境中使用本产品而造成的故障。
- 9) 因火灾、地震、其他自然灾害、放射性物质和有害物质的污染，以及战争、暴乱和犯罪等不可抗力事故造成的故障。
- 10) 安装后自行拆解或运输产品时造成的故障。
- 11) 消耗品或等同于消耗品的零部件。

### 1.3 警告标识

## 警告标签

本手册常用标签如下所示



**警告**

用于有可能导致死亡或严重受伤的情形。



**小心**

用于有可能导致轻度受伤或仪器损坏的情形。

**注意**

强调提供确保仪器正确使用的附加信息。

## 2.1 产品简介:

**GC-400 型便携式 VOC 分析仪**采用色谱法分离甲烷+FID 检测技术,通过双定量环定量,色谱柱分离技术分离甲烷,实现甲烷、总烃以及非甲烷总烃浓度的现场检测。

### GC-400 型便携式 VOC 总烃分析仪主要特点:

采用色谱柱分离法+FID 检测技术,分离效率高、非甲烷总烃浓度分析周期 60 秒;

甲烷和非甲烷总烃全自动测定:完全自动化的流路设计,单阀双通道进样,双定量环,一次性自动测定甲烷和非甲烷总烃值;

自主开发 win10 操作系统 VOC 专用工作站,测量过程全自动控制;ppm mg/m<sup>3</sup> 单位自动转换无需手动计算。

支持批量数据处理报告;

内置式打印机支持现场打印 数据自动汇总。

载气使用氮气,几乎无氧干扰;如需去除微量氧干扰,软件具有自动扣氧功能;

采用低压型固态氢储罐,安全可靠,便于携带及运输,可按设定流量使用达 9 小时以上;

全程高温伴热,有效解决高温高湿气体场合下样品的冷凝损失问题;

配套伴热管采样枪为聚四氟管路,吸附性小对 VOC 挥发干扰检测影响小;

内置锂电池,可提前预热开机,节省等待预热时间,方便设备转场使用;

内置大容量锂电池加伴热枪可工作 4 小时,选配大电池续航可达 15 小时;

可选配工况枪,蓝牙连接能测量计算包括动压、静压、全压、烟气流速、烟气温度、含湿量、折算浓度、含氧量等参数;

内置打印机,检测数据现场打印,且支持 U 盘导出;

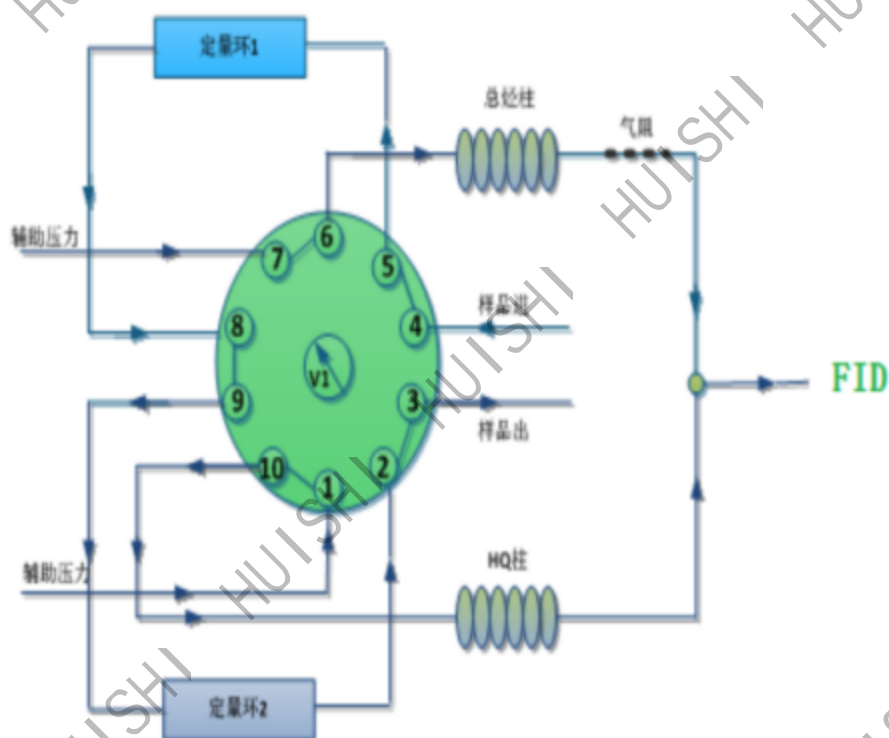
整机不足 15kg,便携小巧,方便现场使用。

### 主要技术参数:

|        |                                            |
|--------|--------------------------------------------|
| 功能     | 分析甲烷;总烃;非甲烷总烃;苯系物等 VOCs (可选配)              |
| 尺寸     | 514 mm ( L ) x 340 mm ( W ) x 150 mm ( H ) |
| 主机重量   | ≤13 Kg                                     |
| 监测器    | FID 检测器;满足 10 <sup>6</sup> 动态线性范围          |
| 检测原理   | GC - FID; 色谱柱分离                            |
| 流量控制精度 | 0.001kpa                                   |
| 分析周期   | NMHC:60s                                   |
| 量程范围   | 0~50000ppm; 可调                             |
| 最小检出限  | ≤ 0.03mg/m <sup>3</sup>                    |
| 重复性    | RSD≤0.5%                                   |
| 准确度    | ≤量程±1 %                                    |
| 操作面板   | 触控                                         |
| 通信     | GPS 定位 (选配)、打印、数据上传、WIFI、蓝牙                |
| 电源     | 内置电源,续航能力大于 4 小时                           |
| 探头温度   | 伴热温度 常温~200℃可调                             |
| 阀箱温度   | 200℃ Max .                                 |
| 环境温度   | -15℃ ~50℃                                  |
| 工作环境   | 5 - 90 % R H                               |

## 2.2 工作原理

GC-400 便携式 VOC 仪由气路系统、样品分离系统，检测器系统、信号处理系统、数据处理系统、电源系统、温度控制单元、显示电路和分析软件组成。样品由载气带入色谱柱分离后经检测器检测含量转换为电信号，经数据采集电路放大整形,进行模拟量向数字量的转换，同时调取内部的校准数据进行运算处理，然后由显示电路把测得的值显示出来并打印。



分析流程图

### 2.3 设备面板功能区域介绍

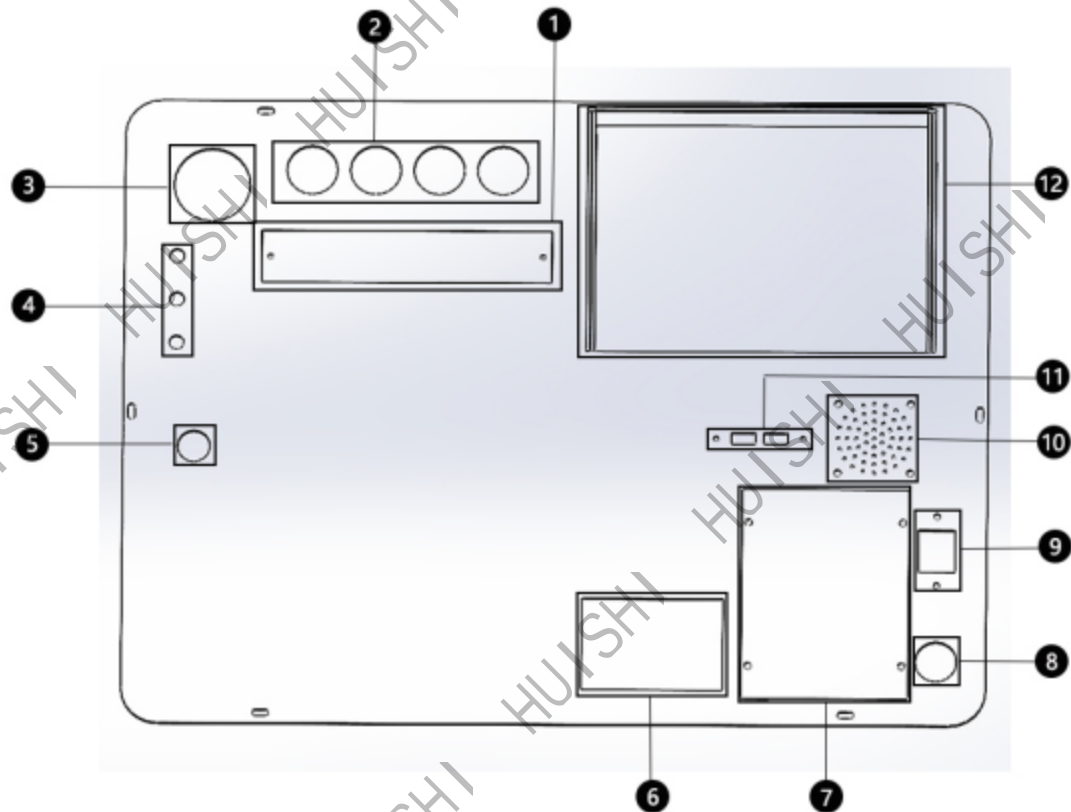


图 1

| 编号 | 说明                      |
|----|-------------------------|
| 1  | 压力调节区域，用于载气 氢气 空气压力流量调整 |
| 2  | 压力显示区                   |
| 3  | 辅助加热区，用于固态储氢气加热         |
| 4  | 气体链接口                   |
| 5  | 采样枪接口，用于采样枪控制及气体采集      |
| 6  | 打印机                     |
| 7  | 电池，用于电池更换及设备检修          |
| 8  | 电源开关                    |
| 9  | 外置电源及充电接口               |
| 10 | 散热风扇                    |
| 11 | USB 接口                  |
| 12 | 显示控制器                   |

### 3.1 使用环境要求

使用本产品时考虑到以下几点确保设备的安全和正确操作。

#### 3.1.1 环境温度和湿度

在如下范围内的温度和湿度操作本产品以获得最佳性能

温度范围: 18℃-28℃

相对湿度范围: 50%-60%

操作温度范围: 5℃-40℃

操作湿度范围: 5%-90%

#### 3.1.2 放置平台要求

将仪器放置在坚固，稳定和平坦的地方

(GC-400 便携式气相色谱仪 VOC 专用版重量大约 13kg 左右)

#### 3.1.3 腐蚀性气体和灰尘

避免暴露在腐蚀性气体和过多的灰尘下以延长设备的使用寿命和维持其最佳的性能。

#### 3.1.4 电磁场和供电装置噪音

此仪器不能在强磁场附近使用。供电装置产生的噪音必须很低或几乎没有。这些因素有可能引起仪器故障。

#### 3.1.5 其他应注意的事项

安装时避免下述条件产生以保持最佳性能:

3.1.5.1) 环境温度波动.

3.1.5.2) 加热或空调改变温度.

3.1.5.3) 直接暴露在阳光中.

3.1.5.4) 强烈震动

### 3.2 移动

小心移动本产品,不要碰撞或震动.

3.2.1重量大约为 13 公斤 (GC-400 V型).

3.2.2必须轻拿轻放.

3.2.3搬运时不准倒置.



## 4 安装

### 4.1.1 供电装置和线路



#### 警告

使用外接电源供电时注意高压电！

- a 在接线板上连接电线之前,关闭接线板上的电源.
- b 供电装置必须带有断路器
- c 不要在电线上放置重物

### 4.1.2 供电装置电压

使用如下所述的电源以维持仪器的最佳性能.

使用电源供电 推荐电压: 锂电池充电器 25.2V 5A

频率 50/60Hz

内置式聚合物锂电池充电电压: 25.2V 5A

频率 50/60Hz

### 4.1.3 供电装置容量

型号: 24V30000

标称电压: DC24V

工作电压: 19.2-25.2V

容量: 30000MA/H

电芯: 聚合物锂电池

尺寸: 147mm\*110mm\*62mm

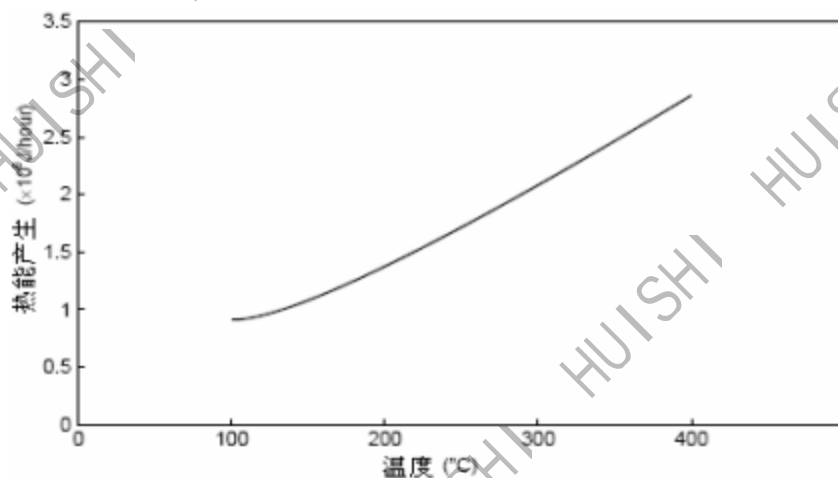
重量: 750g

可持续最大电流: 10A

过流保护值: 50A

注意 供电装置电压有波动或容量不够会影响仪器性能.

热能产生



## 4.2 气体供应安装



### 小心

1. 气体供应压力不可高于下表中所示最大压力。过高的压力会损坏压力控制阀或其他部件。
2. 当和其他仪器共享一个供气装置时，检查包括仪器和气体供应所有装置的使用说明书，
3. 所有装置均在要求的压力范围内工作。

下述所需的气体和纯度值可以保持仪器最佳的性能。

除了 FID 和 TCD 之外的检测器，参看说明书每一检测器的相关内容。

### 4.2.1 气体类型

#### •载气类型

(填充柱 FID 分析)

可以使用氮气或者氦气。氮气在价格上比较便宜。(填充柱 TCD 分析)

使用氮气或者氦气作为载气可以在高灵敏度下分析其他物质。因为氦气是易燃物质，出于安全

性考虑，一般使用氮气。但是，要对氮气和氦气进行分析时，需要使用氮气或氦气作为载气。使用氮气分析空气中的微量组分会很方便，因为氮气作为载气时它的峰不会被检测器检测出来。

(毛细管柱分析)

氦气更适合用于分离。

尽管氮气比氦气更加理想，也可以使用，但是不容易达到最佳分离条件。

#### •尾吹气类型

(毛细管柱 FID)

氮气和氦气均可以使用。氮气灵敏度较高。(毛细管柱 TCD)

对于毛细管 TCD 分析时尾吹气和参照气使用相同的气体。以选择载气相同的方法选择气体类型。

#### 2. 气体纯度

氮气(载气，尾吹气) : 99.995% 或更高

氦气(载气，尾吹气) : 99.995% 或更高

氩气(载气，尾吹气) : 99.995% 或更高

氢气(FID 检测器气体) : 99.995% 或更高

空气(FID 检测器气体) : 干燥的空气(除去油和其他有机成分)

压缩空气(必须使用无油压缩机压缩和经过除湿)

### 4.2.2 气体供应压力

载气 300 - 980kPa (氢气: 300 - 500kPa)

尾吹气 300 - 980kPa

氢气 300 - 500kPa

空气 400 - 500kPa

注意 kPa 和巴的换算关系如下所述

100kPa = 1 bar

kPa 和 kgf/cm<sup>2</sup> 的换算关系如下

1 kPa = 1.02 × 10<sup>-2</sup> kgf/cm<sup>2</sup>

1 kgf/cm<sup>2</sup> = 98.1 kPa kPa 和 psi 的换算关系如下

1 kPa = 1.45 × 10<sup>-1</sup> psi

1 psi = 6.89kPa

### 4.3 高压气罐注意事项



**警告**

**高 压**

气罐处于高压状态下。当对气罐进行操作时，必须严格按照指定的安全措施进行安装以避免事故发生。

通常需要注意的事项如下所述。

参考国家和地方的特殊调整的注意事项。

将气罐垂直放置在平坦的位置，不要倾斜倒立放置。

气罐温度不可以超过 **40°C**。易燃物质必须放置于气罐两米以外。

当使用高压气体和进行日常的泄漏检查时，必须严格保持通风良好。特别是在使用易燃性气体(例如氢气)时，不可在设备五米以内吸烟或点燃明火。必须准备有灭火器。用工具将气罐固定以避免倾斜或翻倒。仅可以使用无油的压力阀。不可使用有油的气管。完成时必须立刻拧紧气罐的主阀门。

#### 4.3.1 对氢气进行操作时注意事项



**警告**

**使用氢气时注意**

如果在通风不好的区域积聚了一定的氢气时会引起爆炸。

1. 正确连接气管。如果进气管连接错误时氢气会释放出来。
2. 当不使用装置时，关闭氢气气罐主阀门。检查主阀门是否泄露。
3. 每次使用装置时，沿着气罐至仪器内部的管路检查气体是否泄露。
4. 要防止氢气泄漏引发的爆炸，使用氢气的地方必须有良好的通风。5 米内禁止使用明火。
5. 完成分析后立刻关闭氢气气罐的主阀门。然后，关闭装置执行正常的关闭程序。



**小 心**

**氢气供应注意事项**

确定流量控制气的供应压力不超过 **500kPa**。

如果供应氢气的流量控制器的压力超过 **500 kPa**，存在危险隐患。大量积聚的氢气有可能引起检测器外的 FID 火苗变大。

氢气比空气轻。如果发生泄漏，如在室内使用本产品会积聚在天花板附近。小心注意通风，使得泄漏的氢气可以顺利排到室外以避免氢气的积聚。

#### 4.4 气路供应管道连接

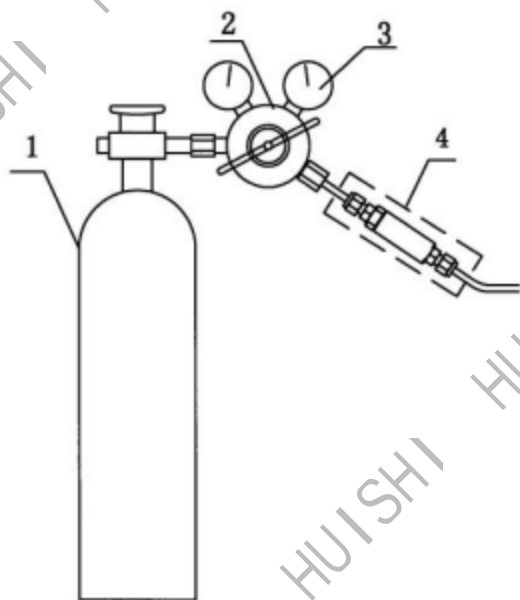
在本产品中有两种类型的链接管（P 型）聚四氟乙烯和（M 型）金属不锈钢或紫铜

##### 4.4.1 气路供应管规格

1 聚四氟乙烯  $\Phi 3\text{mm} \times 2\text{mm} \times 1000\text{mm}$

2 不锈钢  $\Phi 3\text{mm} \times 2\text{mm} \times 1000\text{mm}$

##### 4.4.2 减压阀的安装



1 高压钢瓶 2 减压阀 3 压力表 4 转接头

如采用钢瓶式气源，其减压阀安装步骤如下：

4.4.2.1 将二只氧气减压阀和一只氢气减压阀（如用固态氢无需安装减压阀）的低压出口头分别拧下，接上减压阀接头，旋上低压输出调节杆（不要旋紧）；

4.4.2.2 将减压阀装到钢瓶上，旋紧螺帽后，打开钢瓶高压阀，减压阀高压表应有所指示；

4.4.2.3 关闭钢瓶高压阀后，减压阀高压表指示不应下降，否则就有漏气之处，应予以排除后才能使用。

#### 4.4.3 气罐和便携式气相色谱仪之间管路

##### 气相色谱仪连接管

仪器上面板提供连接外部管的连接口。标签如下所示。

载气输入 CARRIER (“L” 和 “R” 如有指双流路进样的左侧或右侧。)

尾吹气 MAKE UP 如有

氢气输入 HYDROGEN

空气输入 AIR

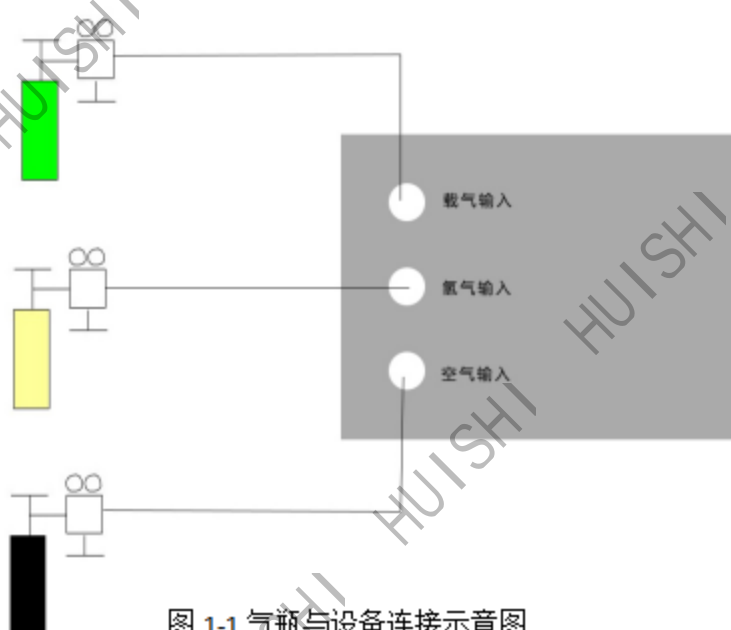


图 1-1 气瓶与设备连接示意图

GC400 便携式气相色谱仪外部气路管道，采用外径 $\Phi 3 \times 0.5$ （壁厚）的聚乙烯管， $\Phi 2 \times 0.5$  不锈钢衬管、O 型圈、硅胶垫圈，M8 $\times 1$  螺纹密封螺母、M8 $\times 1$  螺纹接头来进行连接。

连接方法如图 2-1 所示。

硅胶垫圈

接头 M8 $\times 1$

M8 $\times 1$  密封螺母

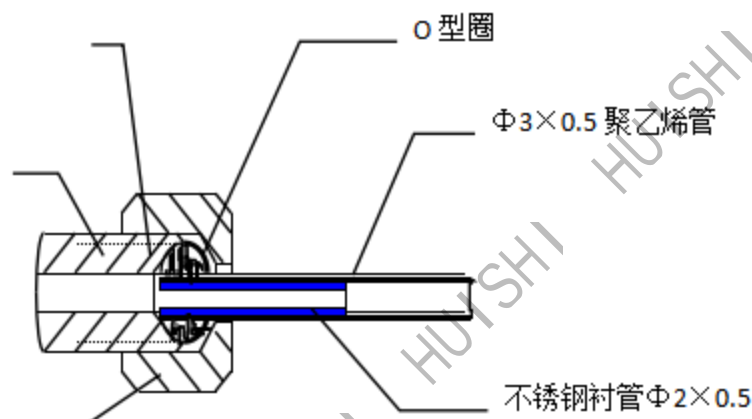


图 2-1 聚乙烯管气路连接示意图

GC400 便携式气相色谱仪的外部气路管道，亦可采用 $\Phi 3 \times 0.5$  外径的不锈钢管或紫铜管、O 型圈、硅胶垫圈，M8 $\times 1$  螺纹密封螺母、M8 $\times 1$  螺纹接头来进行连接。

连接方法如图 2-2 所示。

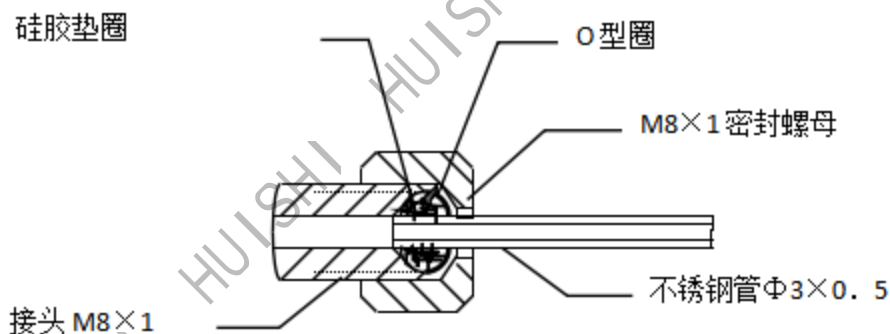


图 2-2 金属管气路管道连接示意图

连接步骤如下所述（以连接气源钢瓶为例）：

1. 截取适当长度的聚乙烯管，并在其两端各插入一根Φ2×0.5的不锈钢衬管。
2. 将 M8×1 密封螺母、磷铜圈和 2 个 O 型圈装入聚乙烯管的一端。
3. 将 M8×1 密封螺母旋在钢瓶接头（M8×1）上，并旋紧，保证密封良好。
4. 将 M8×1 密封螺母、磷铜圈和 2 个 O 型圈装入聚乙烯管的另一端。
5. 将 M8×1 密封螺母旋在净化器的相应接头（M8×1）上，并旋紧，保证密封良好。
6. 其他气路管道的连接步骤与上述步骤相同。
7. 如果使用不锈钢管或紫铜管等金属管气路管道，则Φ2×0.5 不锈钢衬管不必使用，使用卡套接头则直接拧紧即可如使用硅胶垫与上 2.3.4.5 步骤相同。

▲注意：

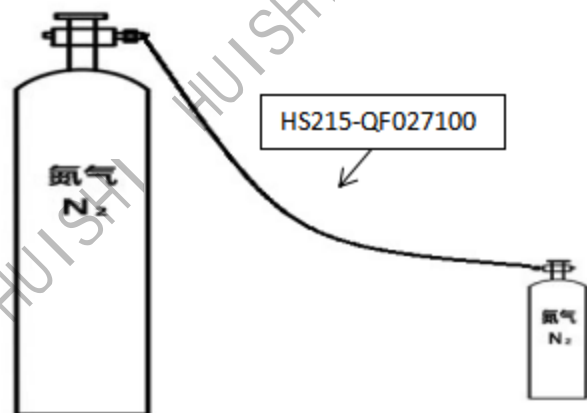
输入到 GC400 便携式气相色谱仪的压力要求：

1. 载气压力必须在 0.343Mpa—0.392Mpa 范围内（相当于 3.5kg/cm<sup>2</sup>—4kg/cm<sup>2</sup>）。
2. 空气压力必须在 0.4Mpa—0.5Mpa 范围内(相当于 3kg/cm<sup>2</sup>—4kg/cm<sup>2</sup>)。
3. 氢气的压力必须在 0.296Mpa—0.392Mpa 范围内(相当于 2kg/cm<sup>2</sup>—4kg/cm<sup>2</sup>)。

## 5 小型气瓶罐的充气及使用方法:

### 5.1 氮气充气方法

使用 QF-2 型气瓶过桥连接器 (HS2155-QF0271000) 首先连接充气钢瓶一端并拧紧, 缓慢打开主阀门让气体缓慢流出排出连接器中空气, 然后连接被充气罐并拧紧后完全打开被充气罐主阀门, 打开充气钢瓶主阀门 2-5 秒后首先关闭被充气罐主阀门后在关闭充气钢瓶阀门。取下过桥连接器充气完成。



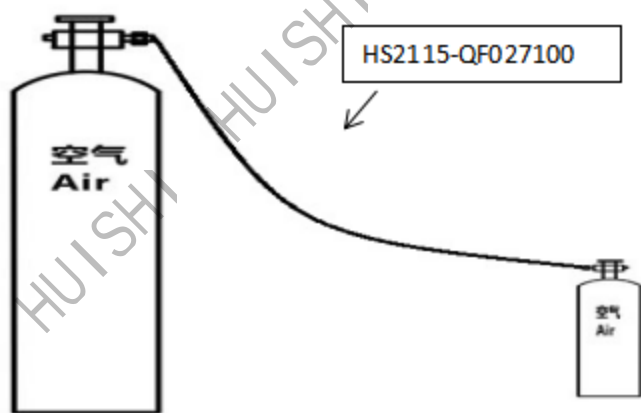
链接示意图

警告! 被充气罐最高耐压 15mpa, 充气钢瓶内压力不要高于 15mpa 以免发生危险.

每 5 年检验一次

### 5.2 空气充气方法

使用 QF-2 型气瓶过桥连接器 (HS2155-QF0271000) 首先连接充气钢瓶一端并拧紧, 缓慢打开主阀门让气体缓慢流出排出连接器中空气, 然后连接被充气罐并拧紧后完全打开被充气罐主阀门, 打开充气钢瓶主阀门 2-5 秒后首先关闭被充气罐主阀门后在关闭充气钢瓶阀门。取下过桥连接器充气完成。



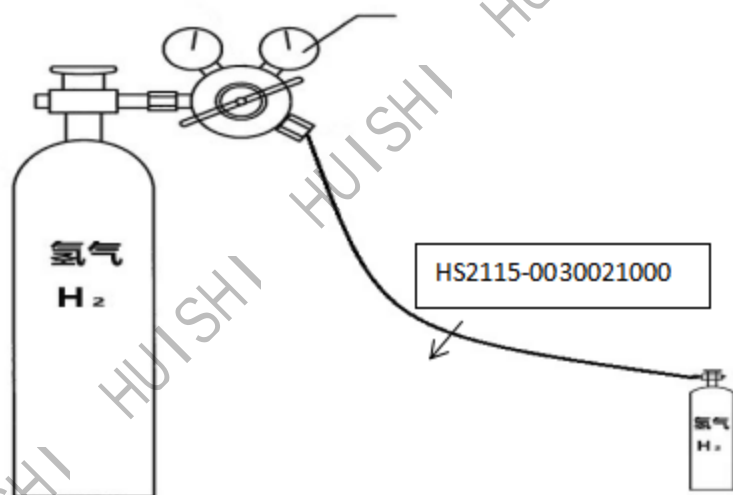
链接示意图

警告! 被充气罐最高耐压 15mpa, 充气钢瓶内压力不要高于 15mpa 以免发生危险.

每 5 年检验一次

## 5.3 金属氢气存储器说明及使用充放气方法

### 5.3.1 金属氢化物储氢外形及链接示意图



### 5.3.2 充气操作过程

本储氢器出厂时一般内部充装了一定量的氢气，初次使用时，需要用真空泵把氢气抽出，或者采用多次吸放氢法将氢气排出。推荐使用Φ3mm 不锈钢管（HS2115-0030021000）连接储氢器阀门和用气设备连接。为了保证用氢纯度，应先紧固储氢器端，打开阀门用氢气吹洗管路后，再紧固用氢设备端。

### 5.3.3 本仪器充氢气的过程如下：

5.3.3.1.氢源：建议氢源的氢纯度：>99.99%。

5.3.3.2.连接：将氢气减压器连接到氢气瓶，用Φ3 不锈钢管连接氢气减压器和金属氢化物储氢器的进出气口。在连接完成前必须用氢气清理管道，以免管道中的空气进入系统。清理管道方法为：拧松金属氢化物储氢器的进出气口卡套，调节氢气减压器的压力为 0.1~0.3MPa，使该气流通过管道排入大气，为将管道清理干净，连续排 5~10 秒，然后紧固卡套，密闭系统。

5.3.3.3.检漏：用肥皂水检查各接口处，确保系统没有漏气。

5.3.3.4.充氢：调节氢气减压器，使氢气压力达到要求值；打开金属氢化物储氢器阀门，开始充氢。由于在充气过程中放热，金属氢化物储氢器的温度将升高，所以建议将金属氢化物储氢器放入水浴中使其冷却。

建议充氢条件：压力 0.4~1.0MPa

时间 50~220min(根据不同型号产品进行调整)

温度 25℃

### 5.3.4、放氢操作过程

5.3.4.1.连接：将金属氢化物储氢器进出气口连接到用气仪器，在连接完成前必须用氢气清理管道，以免管道中的空气进入系统。清理管道方法为：打开金属氢化物储氢器阀门，以适中的流量使氢气流通过管道排入大气，为将管道清理干净，连续排 5~10 秒，然后紧固连接件，密闭系统。

5.3.4.2.检漏：用肥皂水检查各接口处，确保系统没有漏气。

**5.3.4.3.放氢:**打开金属氢化物储氢器阀门即可放氢。金属氢化物储氢器在放氢过程中,内部温度降低,所以产品在使用时,需要配套恒温水浴等供热系统,保证金属氢化物储氢器顺利放氢,亦可适当升温以提高放氢速度。一般情况下,25℃水浴下放氢量仅可达到容量的 40%,35℃水浴下放氢量可达到容量的 80%,建议在 35℃水浴下放氢。客户若对放氢速度和放氢量有更高要求,可适当提高水浴温度,建议水浴温度为 50—60℃,此时的放氢量可达到标称容量。

#### **5.3.5 所需配件**

充氢用减压阀:进口压力 $\geq 15\text{MPa}$ ,出口压力 $\leq 6\text{MPa}$ ;

放氢用减压阀:进口压力 $\geq 3\text{MPa}$ ,出口压力根据需求选择;

连接管路: $\Phi 3$  不锈钢管;

换热装置:水浴箱。



**注意:**定期检测及再生

本产品在长时间运行时,要定期检漏,尤其连接处及管路,防止氢气外泄造成安全隐患;本产品自出厂之日起,要根据使用频率情况,定期测试产品的容量(建议 3 个月~6 个月),若容量降低到额定容量的 80%以下,要进行再生。

再生方法:将储氢器完全放氢后,长时间抽真空,并在加热条件下继续抽真空,将杂质气体、水汽等排出;而后可按照充氢步骤,将储氢器充满氢气。

#### **运输及储存条件**

金属氢化物储氢器在运输及长期储存时,应避免磕碰挤压。

## 6 内置锂电池充放电使用方法及注意事项

### 6.1.1 聚合物锂离子电池充放电注意事项

#### 6.1.1.1. 充电

充电电流及充电电压不得超本电池标定值，如超过规定值可能会对电芯的充放电性能、机械性能及安全性造成损坏，进而可能导致发热及泄漏。

电池充电器必须能恒流恒压充电，建议使用原装充电器；

充电时的单体电池充电电流必须在 25.2V 以下；

充电时温度范围在 0~+45℃；

充电时电压不能超过 26V。

#### 6.1.1.2. 放电

放电电流不得超过以下标准，放电必须在本标准范围内进行。

电池放电电流必须小于 15A；

放电时温度范围在 -20~+60℃；

电池放电终止电压不小于 19.5V。

#### 6.1.1.3. 过放电

需要注意的是，在电芯长期未使用期间，它可能会用其自放电特性而处于某种过放电状态。为防止过放电的发生，电芯应定期充电，将其电压维持在 23.0V 以上。过放电会导致电芯性能、电池功能的丧失。

聚合物锂离子电池贮存

电池长期贮存的环境为：温度 -20~+35℃

相对湿度 45~75%

电池贮存期近一年时要用标准充电方式给电池充电 10%~50%。

聚合物锂离子电池运输

电池应在 10%~50% 的充电状态下运输。

### 6.2 聚合物锂离子电池注意事项：

6.2.1. 为了防止电池可能发生泄漏、发热、爆炸，请注意以下预防措施：

禁止在任何情况下拆卸电芯。

禁止将电池浸入水中或海水中，不能受潮。

禁止在热源旁，如火、加热器等，使用或放置电池。

禁止将电池加热或丢入火中。

禁止直接焊接电池。

禁止在火边或很热的环境中充电。

禁止将电池放入微波炉或高压容器内。

禁止在高温下（如强阳光或很热的汽车中）使用或放置电池，否则会引起过热、起火或者功能衰退、寿命减小。

6.2.2. 聚合物锂离子电池理论上不存在流动的电解液，但万一有电解液泄漏而接触到皮肤、眼睛或身体其它部位，应立即用清水冲洗电解液并就医。

6.2.3. 禁止使用已损坏的电芯（电芯塑料封边损坏，外壳破损，闻到电解液气体，电解液泄漏等）。

如有电解液泄漏或散发电解液气味的电池应远离火源以避免着火或爆炸。



### 7.1 采样枪参数:

功率: 110W

伴热管长度: 1500mm

采样钢管: 50mm

温度范围：室温+6—200℃

A high-pressure hose assembly is shown, consisting of a coiled black hose (2) connected to a long straight section (1) and a metal fitting (3).

1 采样端链接手柄 2 伴热软管 3 进样端链接手柄

Diagram illustrating the components of a pneumatic cylinder, numbered 1 through 13:

1. Piston rod end cap
2. Piston rod seal
3. Piston rod seal
4. Piston rod seal
5. Piston rod
6. Piston rod end cap
7. Piston rod seal
8. Piston rod seal
9. Piston rod seal
10. Piston rod seal
11. Piston rod seal
12. Piston rod seal
13. Piston rod seal

1 金属过滤器 2 1/4 前密封圈 3 1/4 后密封垫圈 4 M12\*1.25 不锈钢螺帽  
5 惰性不锈钢管 5 M12\*1 不锈钢螺帽 7 1/4 后密封垫圈 8 1/4 前密封圈  
9 钢管接头 10 密封 O 型圈 11 微孔滤膜 12 网板 13 采样端手柄

#### 7.4 采样枪的连接示意图



采样枪进样端接头红色圆点对准采样枪接口底座红色卡槽出垂直插入当听到啪的声响链接到位即可。

#### 7.5 采样枪的拔出

握住采样枪进样端接头红点上部（示意图圈出部分）垂直向上拉起即可拔出。



## 8 软件操作说明

### 安装

本节讲述软件的安装。本设备出厂时已预装正版 HSNMHC400 专用分析软件，如操作系统，软件，数据损坏需要重新安装请按照以下步骤安装。

#### 8.1 安装方法

本节讲述软件的安装操作。

从安装到使用软件分为以下 2 个步骤。

##### 8.1.1 安装

##### 8.1.2 序列号注册

#### 8.2 安装前

在安装软件之前，请检查以下内容：

运行本软件的操作系统为 Windows10。请确认 PC 的操作系统。

准备注册号串码（在 U 盘或者说明书内）。

##### 8.2.1

插入软件 U 盘找到（HSNMHC400 软件安装包）压缩文件

| 名称                                                                                                | 修改日期             | 类型           | 大小       |
|---------------------------------------------------------------------------------------------------|------------------|--------------|----------|
|  HSNMHC400软件安装包 | 2021/10/12 12:24 | 360压缩 ZIP 文件 | 2,633 KB |

本软件为绿色软件无需安装解压即可使用，解压后找到 HSNMHC400.exe 可执行文件创建桌面快捷方式即可。

| 名称                           | 修改日期             | 类型        | 大小       |
|------------------------------|------------------|-----------|----------|
| ConfigFiles                  | 2021/10/12 13:10 | 文件夹       |          |
| DB                           | 2021/10/12 13:10 | 文件夹       |          |
| Log                          | 2021/10/12 13:10 | 文件夹       |          |
| x64                          | 2021/10/12 13:10 | 文件夹       |          |
| x86                          | 2021/10/12 13:10 | 文件夹       |          |
| 原始图片                         | 2021/10/12 13:10 | 文件夹       |          |
| HSNMHC400                    | 2021/10/10 18:29 | 应用程序      | 413 KB   |
| System.Data.SQLite.dll       | 2018/10/19 10:28 | 应用程序扩展    | 349 KB   |
| System.Data.SQLite           | 2018/10/19 10:28 | XML 文档    | 1,043 KB |
| Yj.Sp.BaseBusiness.dll       | 2021/10/10 18:29 | 应用程序扩展    | 24 KB    |
| Yj.Sp.BaseBusiness.pdb       | 2021/10/10 18:29 | PDB 文件    | 64 KB    |
| Yj.Sp.Business.dll           | 2021/10/10 18:29 | 应用程序扩展    | 7 KB     |
| Yj.Sp.Business.pdb           | 2021/10/10 18:29 | PDB 文件    | 14 KB    |
| Yj.Sp.Calculation.dll        | 2021/10/10 18:29 | 应用程序扩展    | 20 KB    |
| Yj.Sp.Calculation.pdb        | 2021/10/10 18:29 | PDB 文件    | 42 KB    |
| Yj.Sp.Comm.dll               | 2021/10/10 18:29 | 应用程序扩展    | 11 KB    |
| Yj.Sp.Comm.pdb               | 2021/10/10 18:29 | PDB 文件    | 32 KB    |
| Yj.Sp.Database.dll           | 2021/10/10 18:29 | 应用程序扩展    | 16 KB    |
| Yj.Sp.Database.pdb           | 2021/10/10 18:29 | PDB 文件    | 26 KB    |
| Yj.Sp.Framework.dll          | 2021/10/10 18:29 | 应用程序扩展    | 83 KB    |
| Yj.Sp.Framework.pdb          | 2021/10/10 18:29 | PDB 文件    | 148 KB   |
| Yj.Sp.HsUL.exe.config        | 2021/10/7 20:11  | CONFIG 文件 | 4 KB     |
| Yj.Sp.HsUL.pdb               | 2021/10/10 18:29 | PDB 文件    | 366 KB   |
| Yj.Sp.HsUL.vshost            | 2021/10/10 18:29 | 应用程序      | 23 KB    |
| Yj.Sp.HsUL.vshost.exe.config | 2021/10/10 18:22 | CONFIG 文件 | 4 KB     |

### 8.2.2 软件注册

首次运行本软件需要注册码注册后方可操作



双击 HSNMHC400 软件快捷图标

第一次运行需要输入注册码：在本说明书及软件 U 盘上可以查询，或质询安装售后工程师索取。

本设备的注册码为：

软件注册

生成码：BFEBFBFF000906EA

注册码：

第一次使用软件，请输入注册码！

确定

取消

## 8.2 软件操作方法

### 8.2.1 软件连接

手动编辑电脑 IP 地址为 192.168.1.100 号段

编辑 IP 设置

手动

IPv4

☒ 开

IP 地址

192.168.1.100

子网前缀长度

8

网关

首选 DNS

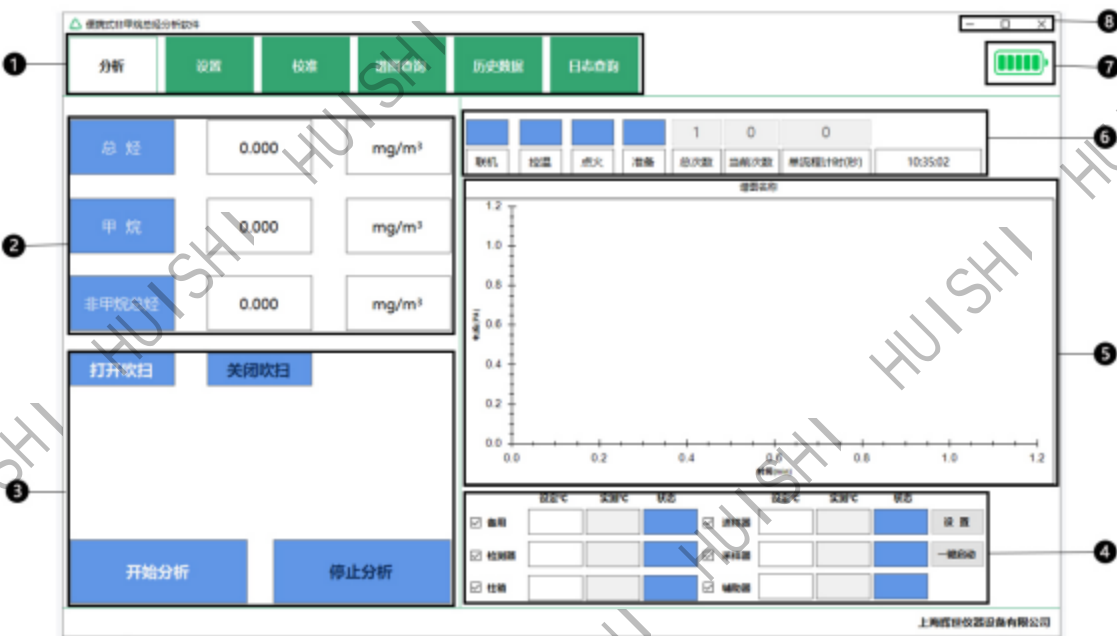
备用 DNS

IPv6

☐ 关

保存 取消

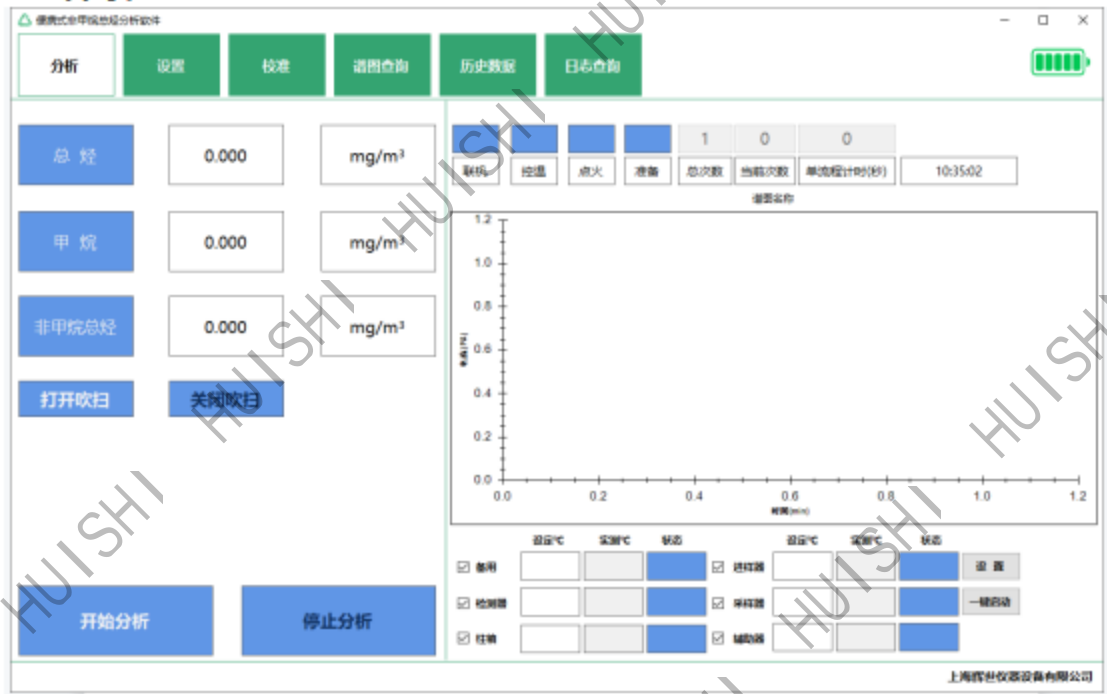
8.3 软件界面介绍:



| 编号 | 说 明                                      |
|----|------------------------------------------|
| 1  | (功能工具栏) 显示: 分析, 设置, 校准, 谱图查询, 历史数据, 日志查询 |
| 2  | 实时分析数据显示区域                               |
| 3  | 运行控制区域                                   |
| 4  | 温度设置控制区                                  |
| 5  | 实时信号显示区域                                 |
| 6  | 运行状态指示区域                                 |
| 7  | 电池电量显示区域                                 |
| 8  | 退出软件                                     |

9 软件操作功能介绍

9.1 分析



9.1.1 点击 **关闭吹扫** 按键可吹扫采样枪及采样管路里残留污染物点击即可关闭吹扫功能。

9.1.2 点击 **开始分析** 或 **停止分析** 点击【开始分析】，设备执行分析程序，程序结束后自行停止，也可点击【停止分析】提前终止分析程序

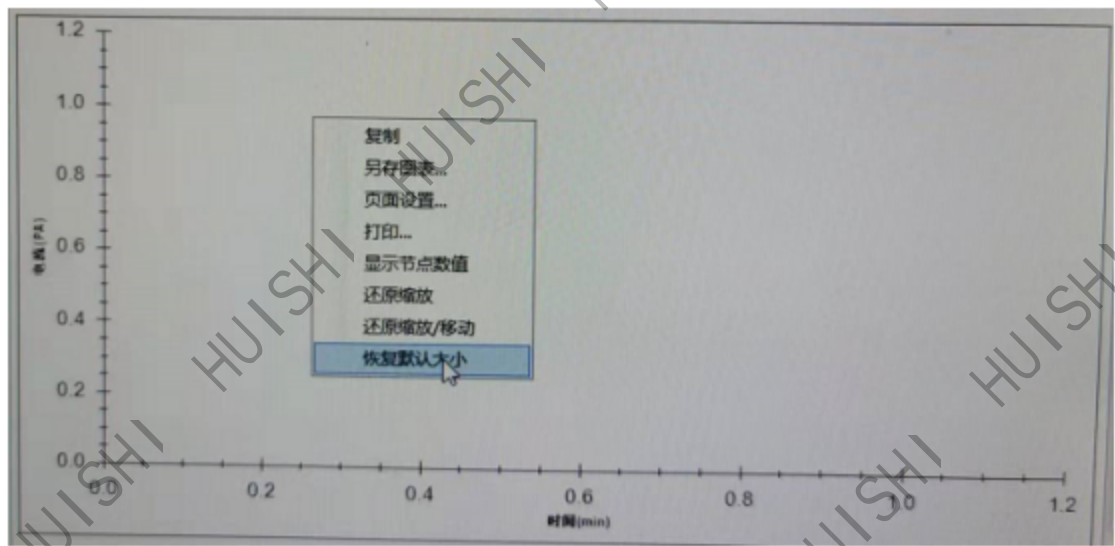
9.1.3 温度设置

输入设定温度勾选需要加热的部件后点【设置】键即可把参数下载至设备点【一键启动】即可执行加热操作。

|                                         | 设定℃ | 实测℃ | 状态 |                                         | 设定℃ | 实测℃ | 状态 |      |
|-----------------------------------------|-----|-----|----|-----------------------------------------|-----|-----|----|------|
| <input checked="" type="checkbox"/> 备用  |     |     |    | <input checked="" type="checkbox"/> 进样器 |     |     |    | 设置   |
| <input checked="" type="checkbox"/> 检测器 |     |     |    | <input checked="" type="checkbox"/> 采样器 |     |     |    | 一键启动 |
| <input checked="" type="checkbox"/> 柱箱  |     |     |    | <input checked="" type="checkbox"/> 辅助器 |     |     |    |      |

9.1.4 谱图调整

谱图显示区域内按住鼠标左键移动鼠标可以移动图谱位置，左键圈住要放大区域即可放大，点击鼠标右键点击【恢复默认大小】即可恢复原始状态



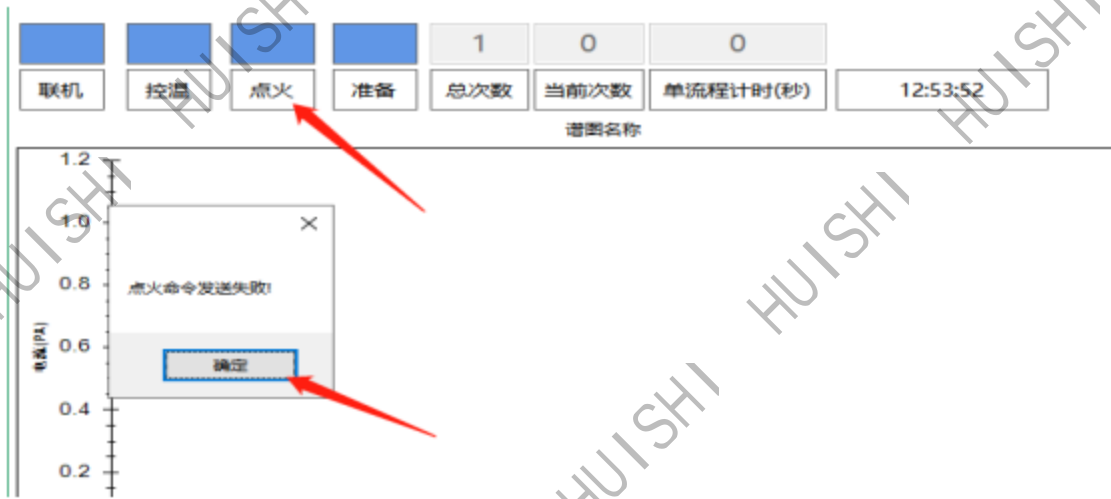
9.1.5 状态指示栏

初始状态为蓝色，绿色为准备好状态，即达到仪器设定参数值。

- 【总次数】表示为本次分析总的分析次数
- 【当前次数】表示当前执行次数
- 【单流程计时】表示单次循环的分析总时间
- 【时间】显示当前时间

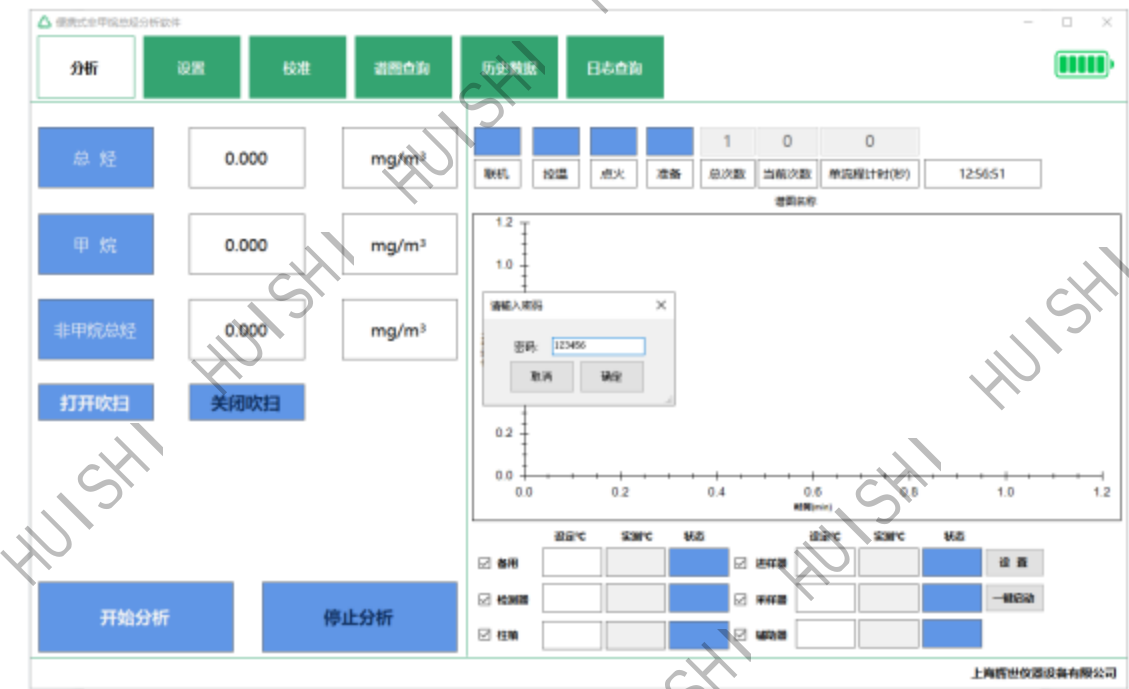


9.1.6 点火本设备默认控温绿色后 10 分钟自动点火，如需手动点火点击【点火】按键【确定】



9.2 设置

点【设置】输入初始密码 123456【确认】即可进入设置界面



9.2.1 温度设置

设备出厂已做温度校准参数，如需校准按以下步骤：  
准备校准后的水银温度计，插入要校准温度的部件待数据稳定后读取水银温度计温度值，填入【真实温度】栏，  
设置温度填入【设置温度】栏后点击【下载温度校准参数】即可。



### 9.2.2 检测器

【点火】等同于分析界面中点火功能，手动点火开关。

【着火阈值】此参数是判断设备是否点火成功数值。当基线高于设定值认为点火成功。如低于设定值及判断为灭火。

【点火状态】灭火为 OFF 着火 NO

【点火次数】当设备判定为灭火状态是执行的自动点火的次数，最高 5 次

【放大倍数】检测器灵敏度调节

【相位】调节出峰方向

【设置】所有参数更改后需要点击设置键确认



### 9.2.3 事件设置

【采样】开 采样的开始时间，一般为 00:01 开始

【采样】关 采样的结束时间，00:20 结束

【分析】开 分析的开始时间，一般 00:21 开始

【分析】关 分析的结束时间，甲烷出完后的时间。

设置后点【下载事件参数】

循环参数设置

【流程循环次数】一个分析流程的样品分析个数。

【单次分析时间】单个流程的分析总时间包含采样和分析时间。

【单次延迟时间】一般设置为采样关的时间一致即可

【保存】参数设定后点击保存按键

| 设置  | 分析 | 检测器   | 事件设置  | 系统设置  |       |
|-----|----|-------|-------|-------|-------|
| 采样  | 开  | 00:00 | 00:00 | 00:00 | 00:00 |
| 不循环 | 关  | 00:00 | 00:00 | 00:00 | 00:00 |
| 分析  | 开  | 00:00 | 00:00 | 00:00 | 00:00 |
| 不循环 | 关  | 00:00 | 00:00 | 00:00 | 00:00 |
| 备用  | 开  | 00:00 | 00:00 | 00:00 | 00:00 |
| 不循环 | 关  | 00:00 | 00:00 | 00:00 | 00:00 |
| 备用  | 开  | 00:00 | 00:00 | 00:00 | 00:00 |
| 不循环 | 关  | 00:00 | 00:00 | 00:00 | 00:00 |
| 备用  | 开  | 00:00 | 00:00 | 00:00 | 00:00 |
| 不循环 | 关  | 00:00 | 00:00 | 00:00 | 00:00 |
| 备用  | 开  | 00:00 | 00:00 | 00:00 | 00:00 |
| 不循环 | 关  | 00:00 | 00:00 | 00:00 | 00:00 |

循环参数设置

流程循环次数(次): 1

单次分析时间(秒): 120

单次延迟时间(秒): 10

保存

全部填入0

下载事件参数

读取事件参数

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## 9.2.4 系统设置

谱图文件名设置

☒ 自动方式-日期+时间

☐ 手动方式-前缀+日期+时间

☐ 手动方式-前缀+计数

文件前缀: 1

保存

电压校准

100%电量对应的AD值: 4096

0%电量对应的AD值: 2560

保存

通讯口设置

IP地址: 192.168.1.150 端口: 8888 选择 删除

192.168.0.102  
192.168.0.100  
192.168.0.100

设置

单位选择: mg/m³

保存

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**【谱图文件名设置】** 这三项是用于实验结束后文件的保存方式进行控制选择。  
 第一项表示文件以实验时的日期和时间做为后缀保存文件名，并且采用自动保存；  
 第二项方式是以你输入的文件名为前缀加实验时的日期和时间做为后缀保存文件名，并且采用自动保存；  
 第三种方式是以你输入的文件名为前缀，以 000n++计数为后缀的文件保存方式，每保存一个文件系统计数自动加一。  
 文件的保存方式点选后点击**【保存】**按键

#### 谱图文件名设置

☒ 自动方式-日期+时间

☐ 自动方式-前缀+日期+时间

☐ 自动方式-前缀+计数

文件前缀:

保 存

【设置】单位转换，ppm 和 mg/m<sup>3</sup> 单位可自动转换 设置后点击【保存】按钮

单位选择:

|                   |   |
|-------------------|---|
| mg/m <sup>3</sup> | ▼ |
| PPM               |   |
| mg/m <sup>3</sup> |   |

【电量校准】内置式锂电池电力显示校准设置后点击【保存】按钮

#### 电量校准

100%电量对应的AD值

0%电量对应的AD值

保 存

【通讯 IP 设置】同步本地电脑 IP 地址段，wifi 链接设置

通讯IP设置

IP地址 192.168.1.150 端口 8888 连接 刷新

192.168.0.105  
192.168.0.108  
192.168.0.100

### 9.3 校准

便携式气相色谱分析仪

分析 设置 校准 谱图查询 历史数据 日志查询

最小半峰宽(秒): 0 最小峰高: 0 窗口采样点数: 10  
最大半峰宽(秒): 1000 平滑次数: 30  
斜率: 1 去掉最小值(个): 1  
最小峰面积: 2 去掉最大值(个): 1 综合滤波法

手动选择 自动选择  
☐ 单点 ☐ 低中浓度峰面积界限: 100  
☒ 低浓度 ☐ 中浓度 中高浓度峰面积界限: 200  
☐ 高浓度

保存校准参数

谱图计算 结果信息 单点曲线 低浓度曲线 中浓度曲线 高浓度曲线

谱图文件: 打开 打开参考数据 关闭参考数据 开始寻峰

1.2  
1.0  
0.8  
0.6  
0.4  
0.2  
0.0  
0.0 0.2 0.4 0.6 0.8 1.0 1.2  
时间(min)

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### 9.3.1 色谱峰处理参数

最小半峰宽(秒):       最小峰高:       窗口采样点数:   
 最大半峰宽(秒):       平滑次数:   
 斜率:       去掉最小值(个):   
 最小峰面积:       去掉最大值(个):       ☒ 综合滤波法

| 参数       | 范围        | 功能说明                                                        |
|----------|-----------|-------------------------------------------------------------|
| 最小半峰宽    | 0-50      | 删除峰宽比设置值小或大的峰,过程如同筛子以最小有效峰的半高处的宽度为依据来设置,最小半峰宽,可从谱图显示处估计该设置值 |
| 最大半峰宽    | 1000以上    |                                                             |
| 斜率       | 0-99999.9 | 峰检测灵敏度,用于确定峰的起点与终点                                          |
| 最小面积     | 0-99999.9 | 删除面积(峰高)比设定值小的峰,用于删除分析过程中面积                                 |
| 最小峰高     | 0-99999.9 | 峰高相对于较小的不相关峰(如基线噪声)                                         |
| 平滑次数     | 0-30      |                                                             |
| 去掉最(小)大值 | 0-99.9    | 去掉一个最小含量或者最大含量值                                             |
| 窗口采样点数   | 0-30      |                                                             |

### 9.3.2 校准曲线手动自动选择

☒ 手动选择      ☐ 自动选择

☒ 单点  
☐ 低浓度  
☐ 中浓度  
☐ 高浓度

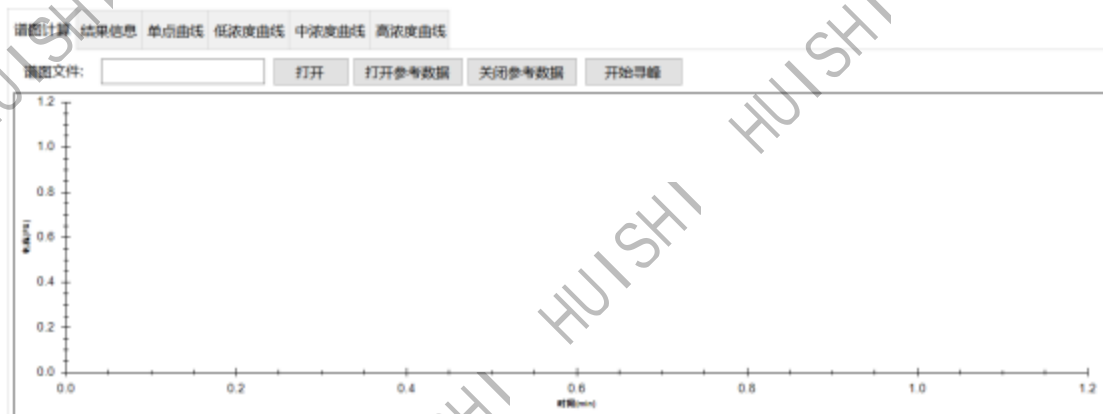
低中浓度峰面积界限:   
 中高浓度峰面积界限:

【手动选择】：单点 低浓度 中浓度 高浓度四项可选，根据样品试剂大概浓度点选响应曲线后点击【保存校准参数】

【自动选择】：点选后设置低中，中高浓度峰面积界限参数，比如中低浓度设置 100，中高浓度设置 200 者表示当总烃面积小于 100 时自动选择低浓度标曲 100-200 之间自动选择中浓度标曲，高于 200 时选择高浓度标曲。

### 9.3.3 标准曲线的制作

#### 9.3.3.1 选择【谱图计算】



9.3.3.2 【打开】谱图文件，选择相应浓度标准谱图文件

谱图文件:

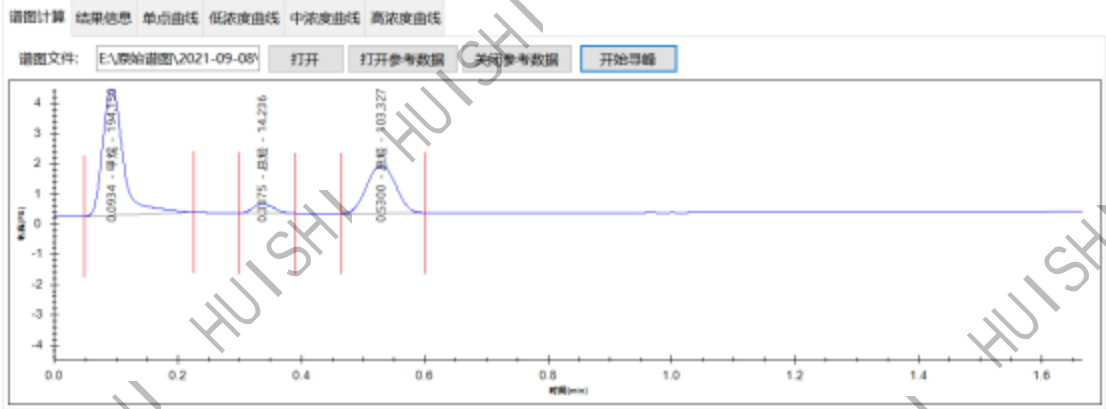
打开

打开参考数据

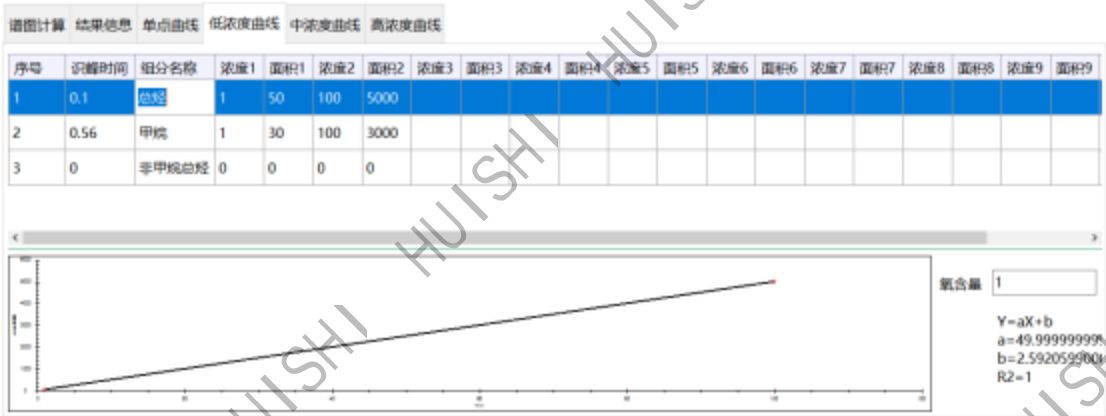
关闭参考数据

开始寻峰

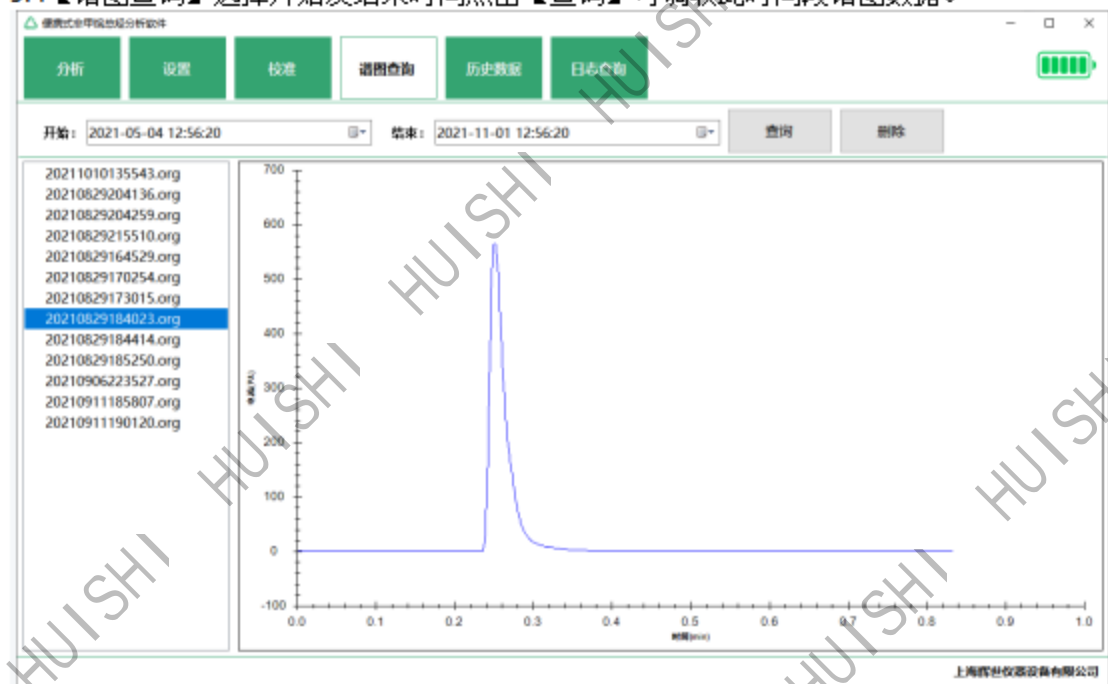
9.3.3.3 点击【开始寻峰】调整积分参数中采样点数，和平滑次数参数寻至总烃及甲烷峰时间及面积出现为止。



9.3.3.4 校准以低浓度曲线为例，中高浓度曲线制作方法一样不在赘述。选择【低浓度曲线】在【谱图计算】栏查询总烃出峰时间及面积在【序号】1【识峰时间】栏输入总烃的时间，【组分名称】输入名称【浓度1】输入对应标气标气浓度值，【面积1】输入峰面积。在【序号】2【识峰时间】栏输入甲烷的时间，【组分名称】输入名称【浓度1】输入对应标气标气浓度值，【面积1】输入峰面积。以此类推重复 1-3 步骤调取不同标气浓度值文件进行标曲的制作最多 10 个点,选取标气浓度文件应遵循从低到高的原则。



9.4【谱图查询】选择开始及结束时间点击【查询】可调取此时间段谱图数据。



9.5【历史数据】仪器型号，仪器编号，测量地点，测量时间。根据实际情况填写后勾选点【保存数据】

9.5.1【创建时间】选择创建时间的起始及结束时间点击【查询】即可统计此时间段总烃，甲烷及非甲烷总烃浓度平均值。如某项数据错误选择后点击【删除数据】即可删除。

蓝牙连接智能烟枪后即可勾选需要打印的工况数据如：环境温度，压力等

历史数据界面显示：

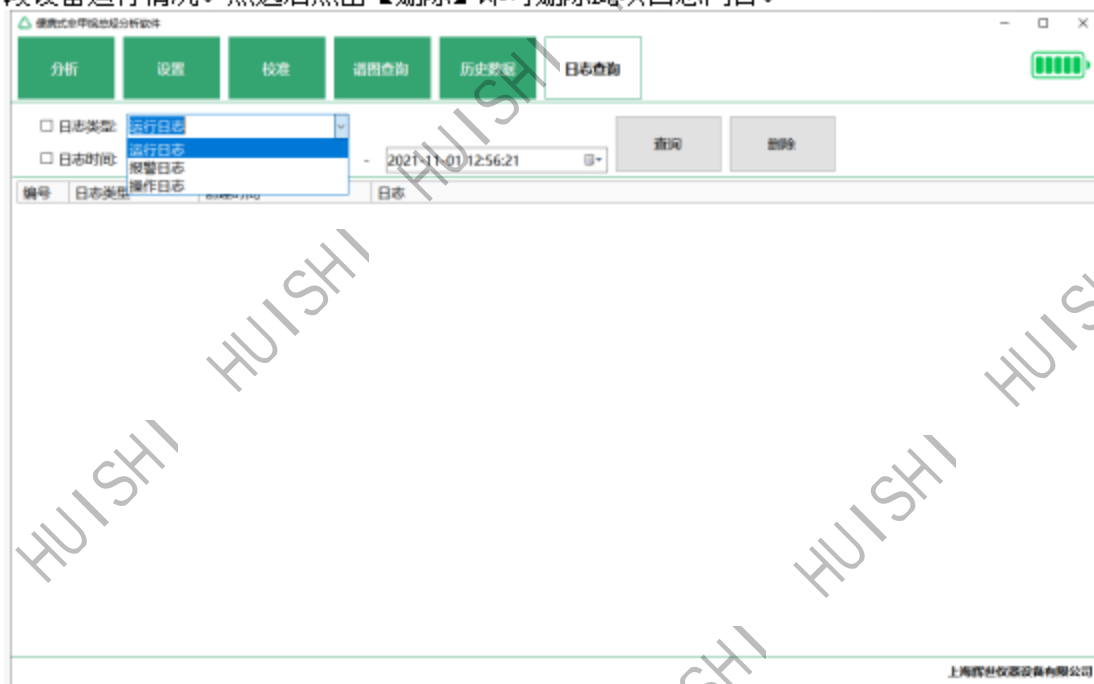
- 仪器型号：0
- 仪器编号：0
- 测量地点：0
- 测量时间：2021-11-01 12:56:21
- 创建时间：2021-10-01 12:56:21 - 2021-11-01 12:56:21
- 查询按钮
- 删除数据按钮
- 历史数据表：
 

| ID  | 谱图名称           | 创建时间             | 总烃浓度         | 甲烷浓度        | 非甲烷总烃浓度      | 浓度单位  |
|-----|----------------|------------------|--------------|-------------|--------------|-------|
| 1   | 20210911185... | 2021/9/11 19:... | 19.20791368  | 54.51004636 | -35.73783268 | mg_m3 |
| 2   | 20210911190... | 2021/9/11 19:... | 144.80372775 | 0           | 144.26802775 | mg_m3 |
| 平均值 |                |                  | 82.06        | 27.26       | 54.27        |       |
- 右侧参数选择：
  - ☐ 催化率: 0
  - ☐ 环境湿度: 0
  - ☐ 工况风量: 0
  - ☐ 含湿度: 0
  - ☐ 计压: 0
  - ☐ 计温: 0
  - ☐ 燃气温度: 0
  - ☐ 工况流量: 0
  - ☐ 全压kpa: 0
  - ☐ 压力: 0
  - ☐ 静压: 0
  - ☐ 含氧量: 0
  - ☐ 枪管温度: 0
  - ☐ 标况风量: 0
  - ☐ 流速: 0
  - ☐ 动压: 0
- 底部按钮：保存数据、导出数据、打印

9.5.2 【打印】点选需要打印的参数数据后点击【打印】点击  内置式打印机即可打印当前数据



9.6 【日志查询】分为 运行日志 报警日志 操作日志，选取日志时间起始结束时间段，点击【查询】可查询此时间段设备运行情况。点选后点击【删除】即可删除此项日志内容。



## 10 分析故障判断及处理方法

| 故障现象         | 故障判断                                                                                                                                                                                                                                                                                                            | 检查方法及修复                                                                                                                                                                                                                                                                                                       |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 没有色谱峰        | <ol style="list-style-type: none"> <li>1. 放大器电源断开。</li> <li>2. 离子线断。</li> <li>3. 没有载气流过。</li> <li>4. 积分仪/色谱工作站信号线接触不良。</li> <li>5. 积分仪/色谱工作站故障</li> <li>6. 进样器温度太低,样品没有汽化。</li> <li>7. 微量注射器堵塞。</li> <li>8. 进样器硅胶垫漏气。</li> <li>9. 色谱柱安装连接不规范。</li> <li>10. 火未点着 (FID)。</li> <li>11. FID 极化电压未接或接触不良。</li> </ol> | <ol style="list-style-type: none"> <li>1. 检查放大器, 保险丝。</li> <li>2. 检查离子线。</li> <li>3. 检查流路是否阻塞, 气源是否用完。</li> <li>4. 检查积分仪/色谱工作站接线。</li> <li>5. 排除积分仪/色谱工作站故障。</li> <li>6. 增加进样器温度。</li> <li>7. 更换注射器。</li> <li>8. 更换进样器硅胶垫。</li> <li>9. 重新安装、拧紧色谱柱。</li> <li>10. 重新点火。</li> <li>11. 接上极化电压, 排除接触不良。</li> </ol> |
| 保留时间正常但灵敏度下降 | <ol style="list-style-type: none"> <li>1. 衰减太大</li> <li>2. 没有足够样品量</li> <li>3. 样品进样过程中的损耗</li> <li>4. 注射器漏或堵</li> <li>5. 载气漏气</li> <li>6. 氢气和空气流量选择不当 (FID)</li> <li>7. 极化电压不正常 (FID)</li> </ol>                                                                                                                | <ol style="list-style-type: none"> <li>1. 降低衰减, 增加量程范围</li> <li>2. 增加进样量</li> <li>3. 保证样品全部进入系统</li> <li>4. 更换注射器</li> <li>5. 查漏并排除漏气</li> <li>6. 调整氢气和空气流量</li> <li>7. 检查并排除极化电压故障</li> </ol>                                                                                                                |
| 拖尾峰          | <ol style="list-style-type: none"> <li>1. 进样温度太低</li> <li>2. 进样器汽化管污染或进样垫残留</li> <li>3. 色谱柱温度太低</li> <li>4. 进样技术太差</li> <li>5. 色谱柱选择不当</li> </ol>                                                                                                                                                               | <ol style="list-style-type: none"> <li>1. 重新调节进样器温度</li> <li>2. 清洗进样器或清除进样垫的残留</li> <li>3. 升高色谱柱温度</li> <li>4. 改进进样技术</li> <li>5. 选择适当的色谱柱</li> </ol>                                                                                                                                                         |
| 伸舌峰          | <ol style="list-style-type: none"> <li>1. 样品量太大色谱柱过载</li> <li>2. 样品凝聚在系统中</li> </ol>                                                                                                                                                                                                                            | <ol style="list-style-type: none"> <li>1. 降低样品量</li> <li>2. 升高温度老化系统</li> </ol>                                                                                                                                                                                                                               |
| 色谱峰分离不好      | <ol style="list-style-type: none"> <li>1. 色谱柱温度太高</li> <li>2. 色谱柱太短</li> <li>3. 载气流速太高</li> <li>4. 色谱柱选择不当</li> </ol>                                                                                                                                                                                           | <ol style="list-style-type: none"> <li>1. 降低柱温</li> <li>2. 选择较长的色谱柱</li> <li>3. 降低载气流速</li> <li>4. 选择适当的色谱柱</li> </ol>                                                                                                                                                                                        |
| 平顶峰          | <ol style="list-style-type: none"> <li>1. 放大器饱和</li> <li>2. 积分仪/色谱工作站故障</li> </ol>                                                                                                                                                                                                                              | <ol style="list-style-type: none"> <li>1. 降低进样量或降低放大器灵敏度</li> <li>2. 排除积分仪/色谱工作站故障</li> </ol>                                                                                                                                                                                                                 |
| 基线有不规则波动     | <ol style="list-style-type: none"> <li>1. 仪器接地不好</li> <li>2. 检测器污染</li> <li>3. 气流选择不当</li> <li>4. 放大器不好</li> </ol>                                                                                                                                                                                              | <ol style="list-style-type: none"> <li>1. 改善接地</li> <li>2. 清洗检测器</li> <li>3. 选择合适气流量</li> <li>4. 检查放大器</li> </ol>                                                                                                                                                                                             |

|                |                                                            |                                                               |
|----------------|------------------------------------------------------------|---------------------------------------------------------------|
|                |                                                            |                                                               |
| <b>基线噪声大</b>   | 1. 色谱柱污染<br>2. 气体不纯<br>3. 接地不良<br>4. 检测器污染<br>5. 检测器电缆接触不良 | 1. 更换色谱柱<br>2. 净化气体使达到要求<br>3. 改善接地<br>4. 清洗检测器<br>5. 更换或修复电缆 |
| <b>基线单方向漂移</b> | 1. 载气逐渐有完<br>2. 系统漏气                                       | 1. 更换气瓶<br>2. 探漏                                              |

## 1.1 preface

**Please read this instruction manual carefully before using this product.**

Thank you for purchasing the GC-400 portable gas chromatograph VOC special model (this product) from Shanghai Huixian Instruments Co., Ltd.

This manual describes the operation method of this product (hardware installation and software analysis application). Please read this instruction carefully and use the product correctly before using this product.

Please keep this instruction manual properly for future reference.

The content recorded in this manual is based that the user has the basic operation knowledge of Windows.

This manual is a double edition in Chinese and English

## material particulars

- If the user or place changes, please transfer this instruction to subsequent users.
- If this manual is lost or damaged, please contact your dealer in each area or at our after-sales department immediately.
- To ensure safe operation, please contact the professional after-sales engineer of the company for installation, commissioning or maintenance.

## statement

This instruction manual is subject to changes without notice.

This manual strives to be accurate, please have any mistakes or omissions, please forgive.

The copyright of this manual belongs to Shanghai Huixian Instrument and Equipment Co., Ltd. Part or all shall not be reproduced without the permission of the Company.

Microsoft, Windows and Windows 10 are registered trademarks of American Microsoft Corporation in the United States and other countries.

The Adobe, Adobe logo and Adobe Reader are registered trademarks of American Adobe Systems Incorporated in the United States and other countries.

Other company names and product names recorded in this instruction are the trademarks and registered trademarks of each Company. In addition, the TM, markers are not clearly specified in this specification.

**The Microsoft Windows 10 operating system is called the "Windows 10".**

The supply period of spare parts of this product is seven years after the production stop. Please understand that spare parts may not be available later. However, the supply period of spare parts please refer to the provisions of relevant manufacturers

## 1.2 guarantee

The warranty content of this product is as follows:

### 1. defects liability period

No special extended warranty contract for this product is provided within 12 months of the date of equipment installation or within 13 months after arrival.

### 2. warranty content

Failure caused by the Company will be repaired or replaced with parts (including software) during the warranty. However, the same model may not be available for short-lived products such as personal computers, their peripherals and components.

### 3. scope cover

- (1) In no event shall the Company be liable to any user for missed work costs, indirect damages and derivative damages. Nor is it liable for damages brought to the third user.
- (2) The maximum amount of the Company shall be limited to the factory price or sales price.

### 4. waiver

The following faults are not under the warranty:

- 1) misoperation.

Repair or modification of this product by 2) not Company or other companies designated by the Company.

- 3) is used with non-hardware or software designated by the company.

4) This product failure due to computer viruses and software and data damage including basic software.

5) faults caused by power failure such as power failure or sudden voltage reduction and software and data damage including basic software.

Failure caused by 6) error shutdown and software and data damage, including basic software.

- 7) is not due to the product itself.

8) fault caused by the use of this product in harsh environments such as high temperature and humidity, corrosive gas or vibration.

9) has faults caused by fires, earthquakes, other natural disasters, contamination of radioactive and harmful substances, as well as irresistible accidents such as war, riots and crime.

Failure caused by 10) when dismantling or transporting products after installation.

11) consumables or equivalent components.

### 1.3 Warning ID

## 警告标签

Common labels in this



**warn**

For situations that can cause death or serious



**take**

For situations that may cause mild injury or



**pay**

Provide additional information to ensure

## 2.1 Product Introduction:

**Type GC-400 portable VOC analyzer adopts the separation of methane + FID detection technology by double quantitative cycle quantification and column separation of methane, total hydrocarbon and non-methane total hydrocarbon concentration.**

### **Main characteristics of type GC-400 portable VOC total hydrocarbon analyzer:**

Using the chromatographic column separation method + FID detection technique, the high separation efficiency, non-methane total hydrocarbon concentration analysis period was 60 seconds;

Automatic determination of methane and non-methane total hydrocarbon: fully automatic flow path design, single valve and double channel sample inlet, double quantitative ring, and automatic determination of methane and non-methane total hydrocarbon values at one time;

V O C special station of win10 operating system, automatic control of measurement process; automatic conversion of ppm mg/m<sup>3</sup> unit without manual calculation.

Support for bulk data processing reports;

Built-in printers support automatic summary of data from field printing.

The carrier uses nitrogen with little oxygen interference; and the software has automatic oxygen deduction function;

Using low-pressure solid-state hydrogen storage bottle, safe and reliable, easy to carry and transport, can be used according to the set flow of more than 9 hours;

The whole high temperature heat companion, effectively solve the problem of condensation loss of samples under high temperature and high humidity gas occasions;

The supporting heat companion pipe sampling gun is a polytetrafluoride pipeline, with little adsorption impact on VOC volatilization interference detection;

Built-in lithium battery, can be preheated up in advance, save waiting time, to facilitate the use of equipment transfer;

Built-in large-capacity lithium battery and thermal companion gun can work for 4 hours, and choose with a large battery life of up to 15 hours;

Optional working condition gun, Bluetooth connection measurement and calculation includes dynamic pressure, static pressure, full pressure, flue gas flow rate, flue gas temperature, moisture content, conversion concentration, oxygen content and other parameters;

Built-in printer, detection data field printing, and support U disk export;

The whole machine is less than 15kg, portable and small, convenient for on-site use.

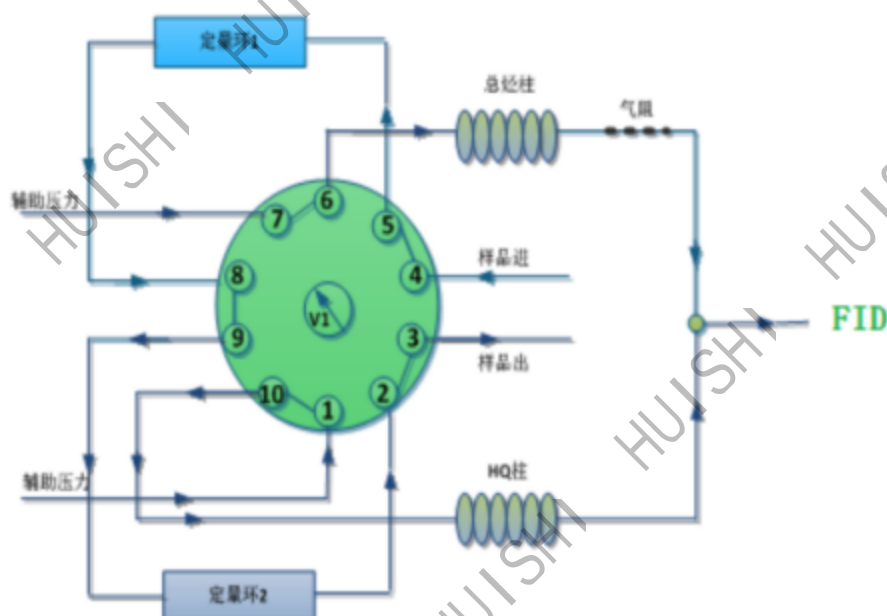
### **Main technical parameters:**

|                          |                                                                                                                        |
|--------------------------|------------------------------------------------------------------------------------------------------------------------|
| function                 | Analysis of methane; total hydrocarbon; non-methane total hydrocarbon; benzene series and other V O C s (are optional) |
| size                     | 514 mm ( L ) x 340 mm ( W ) x 150 mm ( H )                                                                             |
| Host weight              | ≤13 K g                                                                                                                |
| monitor                  | FID detector; meet 10 <sup>6</sup> Dynamic linear range                                                                |
| Principle of detection   | GC-FID; chromatcolumn separation                                                                                       |
| Traffic control accuracy | 0.001kpa                                                                                                               |
| Analysis cycle           | NMHC:60s                                                                                                               |
| range ability            | 0 ~ 50,000 p p m; Adjustable                                                                                           |
| Minimum detection limit  | ≤ 0.03mg/m <sup>3</sup>                                                                                                |

|                       |                                                                      |
|-----------------------|----------------------------------------------------------------------|
| repetitiveness        | $RSD \leq 0.5\%$                                                     |
| accuracy              | $\leq \text{range} \pm 1\%$                                          |
| operation panel       | <b>touch control</b>                                                 |
| communication         | GPS positioning (optional), printing, data upload, WIFI, Bluetooth   |
| source                | Built-in power supply, with a battery life of more than 4 hours      |
| Probe temperature     | The constant temperature of $\sim 200^{\circ}\text{C}$ is adjustable |
| Valve box temperature | $200^{\circ}\text{C}$ Max .                                          |
| ambient temperature   | $-15^{\circ}\text{C} \sim 50^{\circ}\text{C}$                        |
| work environment      | 5 - 90 % R H                                                         |

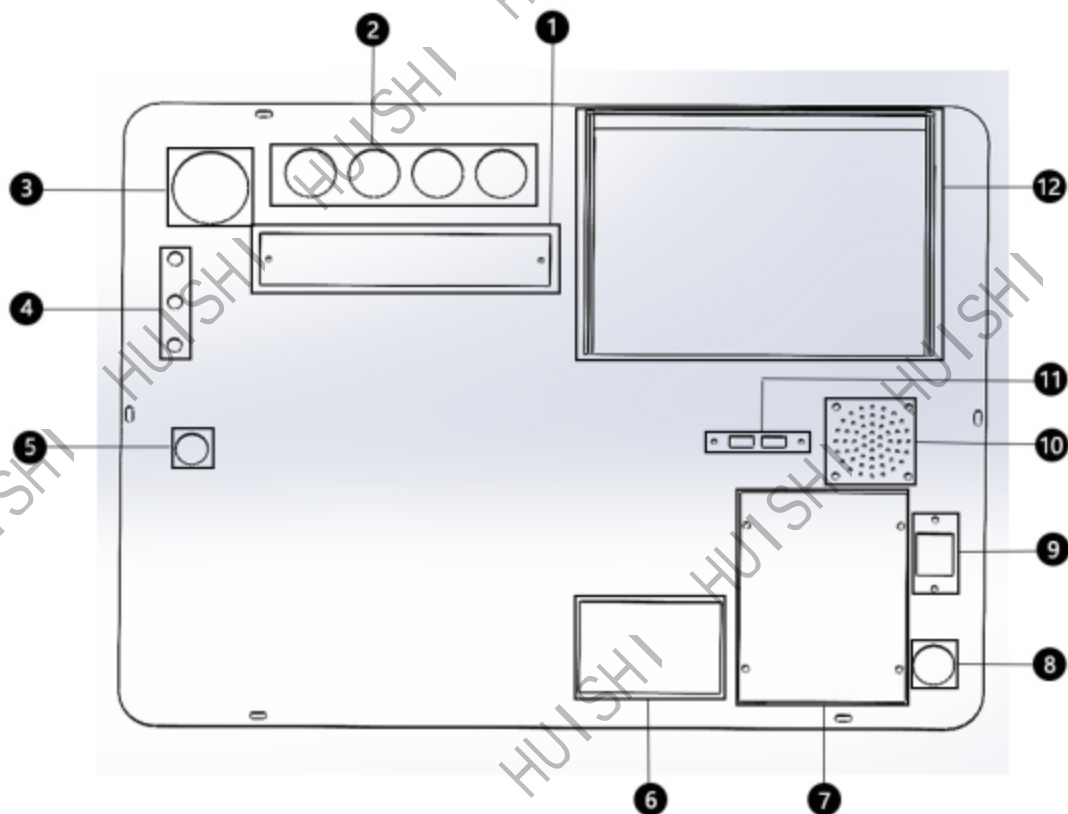
## 2.2 operational principle

The GC-400 portable VOC instrument is composed of gas circuit system, sample separation system, detector system, signal processing system, data processing system, power supply system, temperature control unit, display circuit, and analysis software. The samples are separated from the gas belt into the chromatography column and then converted to electrical signal by the detector. It is amplified and plastic by the data acquisition circuit, transforms analog amount to digital amount, and the internal calibration data is transferred for calculation and processing, and then the measured value is displayed and printed by the display circuit.



Analyze the flow chart

## 2.3 Introduction of functional area of equipment panel



graph 1

| number | explain                                                                             |
|--------|-------------------------------------------------------------------------------------|
| 1      | Pressure adjustment area for carrying gas and hydrogen air pressure flow adjustment |
| 2      | Pressure display area                                                               |
| 3      | Auxiliary heating area, used for solid-state hydrogen storage gas heating           |
| 4      | Gas link mouth                                                                      |
| 5      | Sampling gun interface for sampling gun control and gas collection                  |
| 6      | printer                                                                             |
| 7      | Battery, used for battery replacement and equipment maintenance                     |
| 8      | mains switch                                                                        |
| 9      | External power supply and charging interface                                        |
| 10     | radiator fan                                                                        |
| 11     | USB joggle                                                                          |
| 12     | display control unit                                                                |

### **3.1 Use environment requirements**

Consider the following points to ensure the safe and correct operation of the equipment.

#### **3.1.1 ambient temperature and humidity**

Operating this product for optimal performance at the temperature and humidity in the following range

temperature range: 18℃-28℃

Relative humidity range: 50%-60%

operating temperature range: 5℃-40℃

Operating humidity range: 5%-90%

#### **3.1.2 placement platform requirements**

Place the instrument in firm, stable, and flat places

(GC-400 Portable Gas chromatograph VOC weighs about 13kg)

#### **3.1.3 corrosive gas and dust**

Avoid exposure to corrosive gases and excessive dust to extend the service life of the equipment and maintain its optimal performance.

#### **3.1.4 电 magnetic field and power supply device noise**

This instrument cannot be used near a strong magnetic field. The noise generated by the power supply device must be very low or minimal. These factors have the potential to cause an instrument failure.

#### **3.1.5 other considerations for 3.1.5**

Avoid the following conditions to maintain optimal performance:

3.1.5.1) ambient temperature fluctuations.

3.1.5.2) heating or air conditioning changes the temperature.

The 3.1.5.3) is directly exposed to sunlight.

The 3.1.5.4) will vibrate strongly

### 3.2 shift

Be careful to move this product without collision or vibration.

3.2.1. weighs approximately 13 kg (type GC-400 V).

3.2.2. must be lightly.

3.2.3. shall not be inverted when handling.



## 4 install

### 4.1.1 electrical device and lines



**Warn**

**Pay attention to the high-voltage power when using the external power supply!**

A Turn off the power supply on the wiring board before connecting the wire to the wiring board.

The b power supply device must have a circuit breaker

C Do not place heavy objects on the wire

### 4.1.2 electric device voltage

Use the power supply as described below to maintain the optimal performance of the instrument.

Recommended voltage using power supply: lithium battery charger 25.2V 5A

Frequency of 50/ 60Hz

Built-in polymer lithium battery charging voltage: 25.2V 5A

Frequency of 50/ 60Hz

### 4.1.3 electric capacity

Model number: 24V30000

Nominal voltage: DC24V

Operating voltage: 19.2-25.2V

capacity: 30000MA/H

Cell: lithium polymer battery

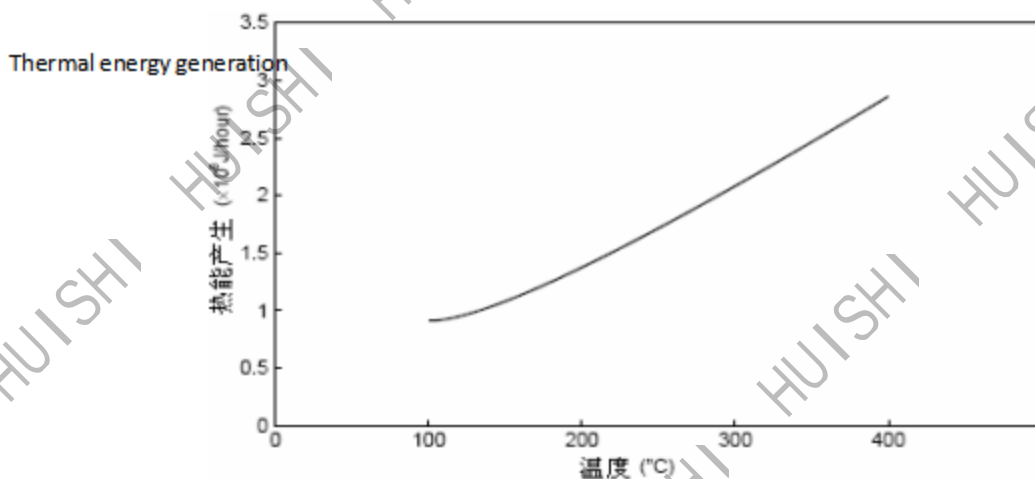
Size: 147mm\*110mm\*62mm

weight: 750g

Sustainable maximum current: 10A

Overcurrent protection value: 50A

pay attention to Voltage fluctuation of power supply device fluctuates or insufficient capacity will affect instrument performance.



## 4.2 Gas supply and installation

**take care**



4. No gas supply pressure above the maximum pressure shown in the table below will damage the pressure control valve or other components.
5. When sharing with other instruments-one gas supply device, check the operating instructions for all devices including instruments and gas supply,
6. All devices operate within the required pressure range.

The gas and purity values required below can maintain the optimal performance of the instrument.  
FID and TCD except the FID-detector.

### 4.2.1 body type

Type of adenyated gas

(FI filled column D analysis)

Helium or nitrogen can be used. Nitrogen is cheaper in price. (Filled column TCD analysis)

Other substances can be analyzed as carriers using helium or hydrogen at high sensitivity. Because hydrogen is flammable substances, out of safety

Sexual consideration, -like the use of helium gas. However, for the analysis of helium and hydrogen, nitrogen and argon is required as a carrier. It would be convenient to analyze trace fractions in the air using nitrogen, because its nitrogen peak is not detected by the detector when loaded as the gas.

(Capillary column analysis)

Helium gas is more well suited for separation.

Although nitrogen is more ideal than helium, optimal separation conditions are not easily achieved.

Type of caudal blow

(Capillary Column FID)

Both helium and nitrogen can be used. Nitrogen sensitivity is high. (Capillary Column TCD)

The same gas was used for tail blowing and reference gas for capillary TCD analysis. Select the gas type with the same method for carrying the gas.

2. gas purity

Helium gas (gas carrier, tail blowing) : 99.995% or higher

Nitrogen (gas load, tail blowing) : 99.995% or higher

Argon (gas load, tail blowing) : 99.995% or higher

Hydrogen gas (FID detector gas) : 99.995% or higher

Air (FID detector gas) : Dry air (remove oil and other organic ingredients)

Compressed air (which must be compressed and dehumidified with an oil-free compressor)

### 4.2.2 body supply pressure

carrier gas 300-980kPa (hydrogen: 300-500kPa)

Tail blow 300-980kPa

hydrogen 300 - 500kPa

air 400 - 500kPa

Note that the conversion relationship between kPa and Ba is described below

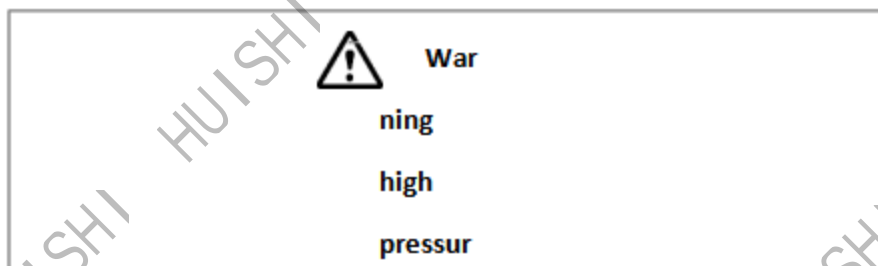
100kPa = 1 bar

The conversion relationship between kPa and kgf/cm<sup>2</sup> is as follows

1 kPa = 1.02 × 10<sup>-2</sup> kgf/cm<sup>2</sup>

The conversion relation of 1 kgf/cm<sup>2</sup> = 98.1 kPa kPa and psi is as follows  
1 kPa = 1.45 × 10<sup>-1</sup> psi  
1 psi = 6.89 kPa

#### 4.3 Notes for high-pressure gas tank



Common considerations are described below.

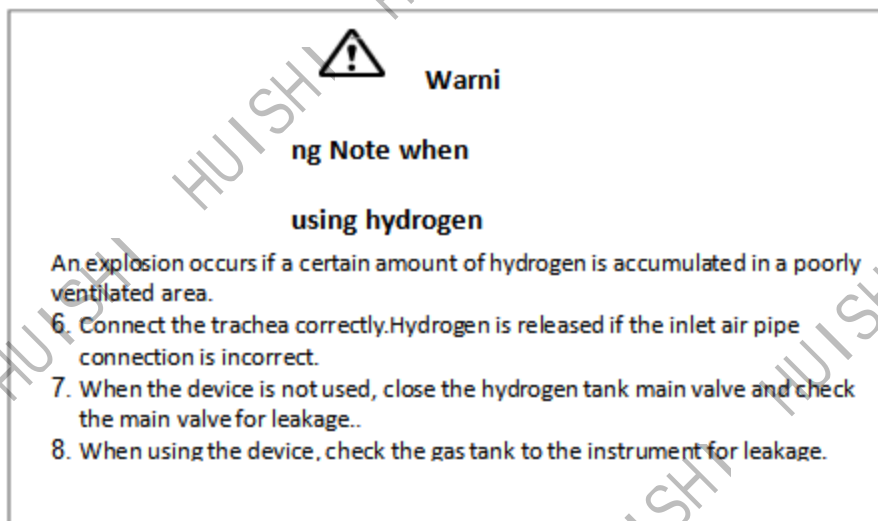
Reference to national and local special adjustments.

Place the tank vertically in a flat position, not upside down.

The air tank temperature can not exceed 40 ° C. Flammable substances must be placed two meters outside the air tank.

When using high pressure gas and daily leakage inspection, good ventilation must be strictly maintained, especially when using flammable gas (such as hydrogen), equipment must not smoke or ignite open fire must be fire extinguisher equipped with fire extinguisher tools to fix the gas tank to avoid tipping or overturning the pressure valve can only use oil, the main valve of the gas tank must be tightened immediately.

#### 4.3.1 hydrogen



#### 4.4 Connect of gas road supply pipeline

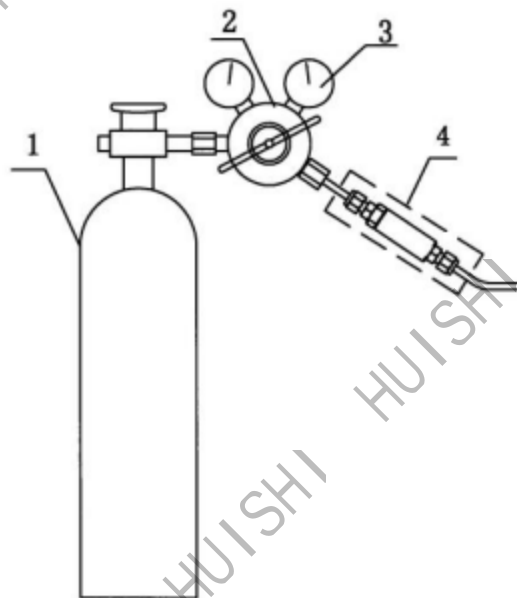
There are two types of link tubes (type P) PTFE and (type M) metal stainless steel or purple copper in this product

##### 4.4.1 气 Road supply pipe specification

1 PTFE  $\Phi 3\text{mm} \times 2\text{mm} \times 1000\text{mm}$

2 Stainless steel  $\Phi 3\text{mm} \times 2\text{mm} \times 1000\text{mm}$

##### Installation of the 4.4.2 减 pressure valve



1 High pressure cylinder 2 pressure gauge 4 rotary connector

If the cylinder-type gas source is used, the pressure reduction valve installation steps are as follows:

- 4.4.2.1 shall respectively unscrew the low pressure outlet heads of two oxygen pressure reduction valves and one hydrogen pressure reduction valve (such as using solid state hydrogen without installing the pressure reduction valve), connect to the pressure reduction valve connector, and turn on the low pressure output control rod (do not tighten);
- 4.4.2.2. Install the pressure relief valve on the cylinder, tighten the screw cap, open the cylinder high pressure valve, the high pressure gauge of the pressure relief valve shall be indicated;
- 4.4.2.3. After closing the cylinder high pressure valve, the high pressure gauge of the pressure reduction valve should not drop, otherwise there is air leakage, should be discharged Only can be use.

## Pipe line between

### 4.4.3 tank and portable PLC

Gas chromatograph connecting pipe

The upper panel of the instrument provides connections to the external pipe. The label are shown below.

Air load, input CARRIER ("L" and "R" refer to the left or right of the two-stream feed.)

make up gas MAKE UP if available

Hydrogen, input HYDROGEN

Air, input AIR

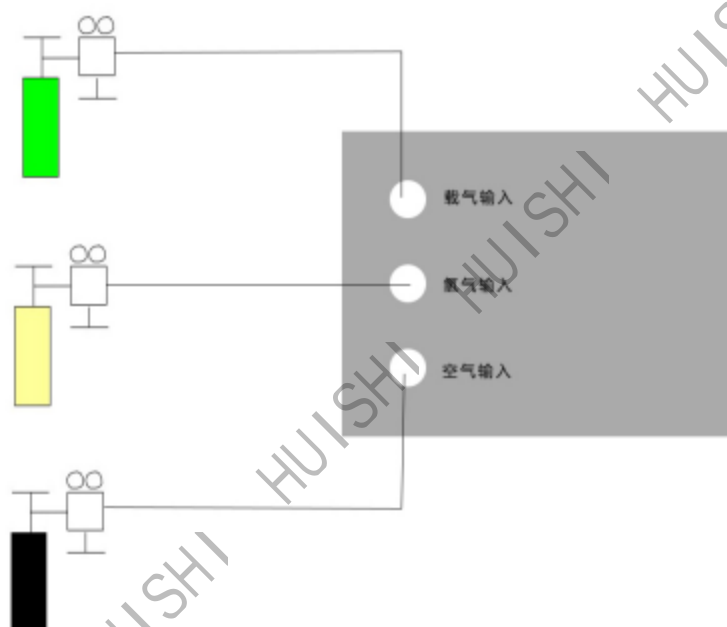


Fig. 1-1 Schematic diagram of the connection between gas cylinder and equipment

GC 400 Portable gas chromatograph external gas pipeline, using polyethylene pipe with outer diameter 30.5 (wall thickness), 20.5 stainless steel liner, O ring, silicone gasket, M81 threaded sealing nut, M81 threaded joint for connection.

The connection method is shown in Figures 2-1.

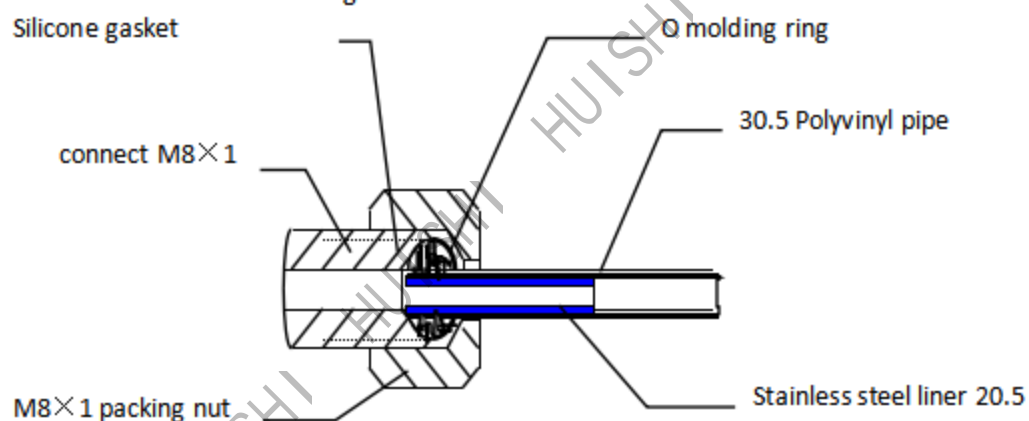


Fig. 2-1 Schematic diagram of polyethylene pipe gas road connection

The external gas pipeline for the GC 400 portable gas chromatograph can also be connected with a 30.5 outer diameter stainless steel pipe or purple copper pipe, O-ring, silicone gasket, M81 threaded sealing nut, M81 threaded connector.

The connection method is shown in Figures 2-2.

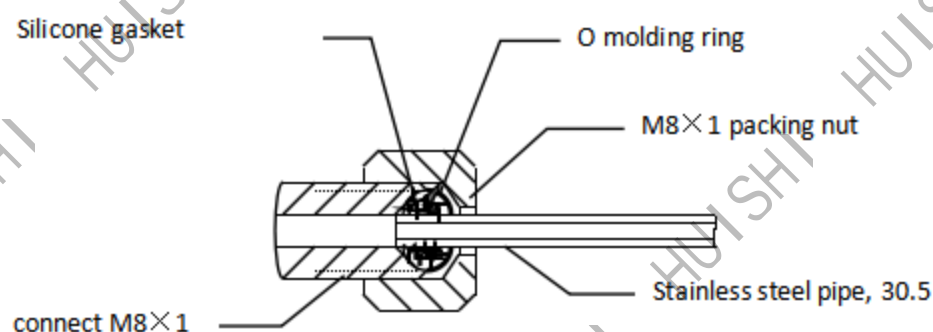


Fig. 2-2 Schematic diagram of metal pipe gas pipeline connection

The connection step are described as follows (take connecting gas source cylinder as an example):

8. Cut off a polyethylene tube of the appropriate length and insert a 20.5 stainless steel liner at each end.
9. Install the M81 sealing nut, phosphocopper rings and 2 O rings into one end of the polyethylene tube.
10. Spin the M81 sealing nut on the cylinder connector (M81) and tighten to ensure a good seal.
11. Install the M81 sealing nut, phosphocopper rings and 2 O rings into the other end of the polyethylene tube.
12. Spin the M81 sealing nut on the corresponding connector (M81) of the purifier, and tighten it to ensure a good seal.
13. The connection steps for other gas pipelines are the same as those described above.
14. If metal pipes such as stainless steel or purple copper pipes are used, the 20.5 stainless steel liner need not be used, and tighten the same as using silicone pad as step 2.3.4.5.

▲ pay attention to:

Enter the pressure requirements to the GC 400 portable gas chromatograph:

4. The gas carrying pressure must be in the 0.343Mpa — 0.392Mpa range (equivalent to 3.5kg / cm<sup>2</sup>—4kg/cm<sup>2</sup>) 。
5. The air pressure must be in the 0.4Mpa — 0.5Mpa range (equivalent to 3kg /

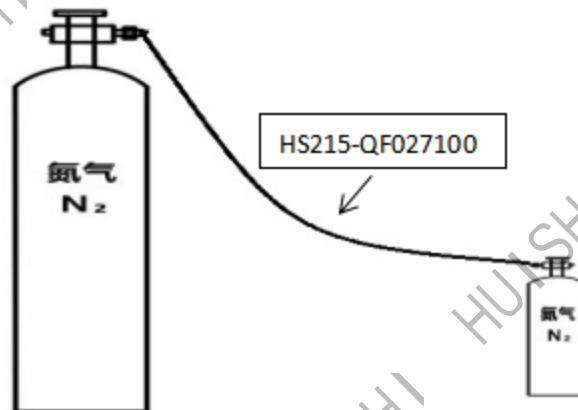
cm<sup>2</sup>—4kg/cm<sup>2</sup>).

6. The pressure of hydrogen must be in the 0.296Mpa —0.392Mpa range (equivalent to 2kg / cm<sup>2</sup>—4kg/cm<sup>2</sup>).

## 5 Inflation and use methods of small gas bottle tanks:

### 5.1 Nitrogen inflation method

Use the QF-2 gas cylinder bridge connector (HS2155-QF0271000) to first connect one end of the inflatable cylinder and tighten, slowly open the main valve slowly to flow out of air from the connector, then connect the inflatable tank and tighten and fully open the main valve of the inflatable cylinder, first close the main valve for 2-5 seconds. Remove the bridge connector to air.



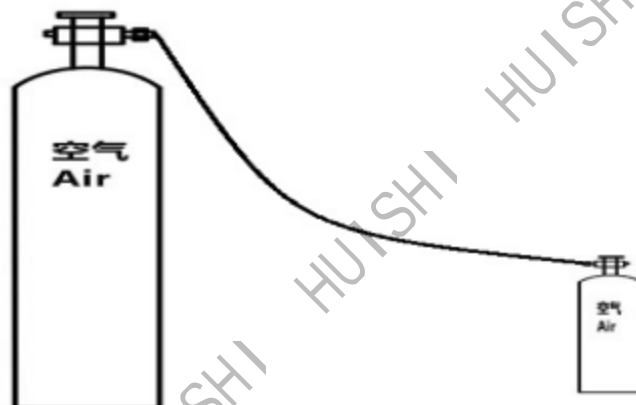
Link Schematic

warn!The maximum pressure resistance of the inflatable tank is 15mpa, and the internal pressure of the inflatable cylinder should not be higher than 15mpa to avoid danger.

It was tested every 5 years

### 5.2 Air inflation method

Use the QF-2 gas cylinder bridge connector (HS2155-QF0271000) to first connect one end of the inflatable cylinder and tighten, slowly open the main valve slowly to flow out of air from the connector, then connect the inflatable tank and tighten and fully open the main valve of the inflatable cylinder, first close the main valve for 2-5 seconds. Remove the bridge connector to air.



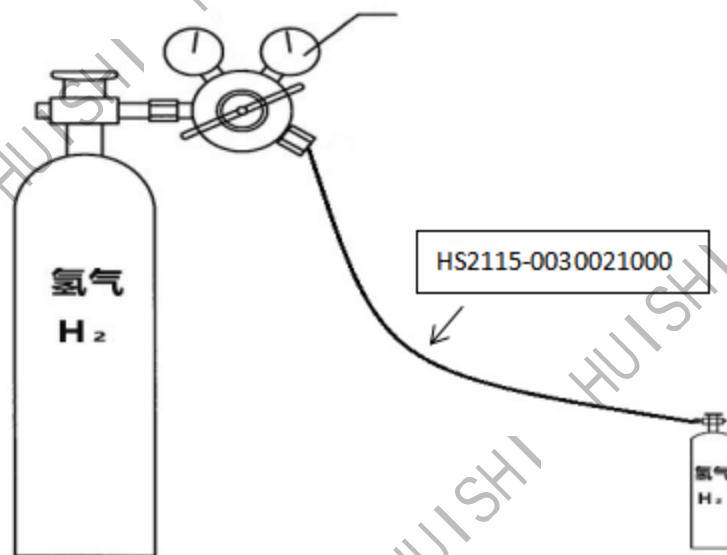
#### Link Schematic

warn!The maximum pressure resistance of the inflatable tank is 15mpa, and the internal pressure of the inflatable cylinder should not be higher than 15mpa to avoid danger.

It was tested every 5 years

### 5.3 Description of metal hydrogen storage and use of charging and discharge method

Schematic diagram of the shape and link of hydrogen storage of 5.3.1 metal hydride



#### 5.3.2 充 gas operation process

The hydrogen reservoir is generally filled with a certain amount of argon inside the factory. When first use, argon needs to be pumped out by vacuum pump, or by multiple hydrogen discharge method. A 3mm stainless steel pipe (HS2115-0030021000) is recommended to connect hydrogen storage valves and gas equipment. In order to ensure the purity of hydrogen use, the hydrogen storage device end should be tightened first, open the valve to wash the pipeline, and then tighten the hydrogen equipment end.

**The hydrogen filling process of the 5.3.3 本 instrument is as follows:**

5.3.3.1. hydrogen source: Recommended hydrogen purity of the hydrogen source: > 99.99%.

5.3.3.2. connection: Connect the hydrogen reducer to the hydrogen bottle; connect the hydrogen reducer to the metal hydrogen reservoir with 3 stainless steel pipe. The pipe must be cleaned with hydrogen before the connection to prevent air from the pipe from entering the system. The pipeline cleaning method is: loosen the inlet and outlet trap of the metal hydrogen storage device, adjust the pressure of the hydrogen reducer to 0.1~0.3MPa, let the airflow through the pipeline into the air, to clean the pipeline, row continuously for 5~10 seconds, and then tighten the sleeve and seal the system.

5.3.3.3. leakage detection: Check the interface with soapy water to ensure no air leakage.

5.3.3.4. hydrogen charge: adjust the hydrogen pressure reducer to make the hydrogen pressure reach the required value: open the metal hydride hydrogen storage valve, and start the hydrogen charge. Since the temperature of the metal hydride hydrogen reservoir will increase during

inflation, it is recommended to put the metal hydride hydrogen reservoir in a water bath to cool it.

Recommended hydrogen filling conditions: pressure 0.4~1.0MPa

Time 50~220min (adjusted to different models)

temperature 25℃

#### **5.3.4, hydrogenation operation process**

5.3.4.1. connection: Connect the metal hydroxide hydrogen reservoir to the gas instrument, and the pipe must be cleaned with hydrogen before the connection is completed

Way to prevent the air in the pipe from entering the system. The cleaning method of the pipeline is: open the metal hydroxide hydrogen reservoir valve and make the hydrogen flow through the pipeline into the atmosphere with moderate flow. In order to clean the pipeline, row it continuously for 5~10 seconds, and then tighten the connector and seal the system.

5.3.4.2. leakage detection: Check the interface with soapy water to ensure no air leakage.

5.3.4.3. hydrogen discharge: open the metal hydroxide hydrogen reservoir valve to allow for hydrogen discharge. In the process of hydrogenation of metal hydroxide hydrogen storage, the internal temperature is reduced, so the product needs to support a heating system, such as constant temperature and water bath, to ensure the smooth hydrogen discharge of metal hydroxide hydrogen storage, and can also heat up appropriately to improve the speed of hydrogen discharge. In general, 25℃ of water bath can delegate hydrogen can only reach 40% of the capacity, and 35℃ of water bath can reach 80% of the capacity, it is recommended to lower hydrogen in 35℃ of water bath. If the customer has higher requirements for hydrogen discharge speed and hydrogen discharge amount, the water bath temperature can be raised appropriately. The recommended water bath temperature is 50-60℃, and the hydrogen discharge amount can reach the nominal capacity.

#### **5.3.5 所 requires accessories**

Pressure relief valve for hydrogen charge: inlet pressure 15MPa, outlet pressure 6MPa;

Pressure relief valve for hydrogen discharge: inlet pressure of 3MPa, outlet pressure selected as required;

Connecting line: 3 Stainless steel pipe;

Heat exchanger device: water bath box.



Note: Regular testing and regeneration

When the product runs for a long time, leakage regularly, especially the connection and pipeline, to prevent hydrogen leakage; the capacity of the product (3 to 6 months), if the capacity is reduced to less than 80% of the rated capacity, regenerated.

Regeneration method: After the hydrogen reservoir is completely discharged, vacuum for a long time, and continue to vacuum under heating conditions, discharge impurities, water vapor, etc.: and then the hydrogen reservoir can be filled with hydrogen according to the hydrogen filling step.

#### **Transportation and storage conditions**

The metal hydrogen storage shall avoid extrusion during transportation and long-term storage.

## **6 Built-in lithium battery charging and discharge use methods and**

### **precautions**

#### **Note for 6.1.1 聚 compound lithium ion battery**

##### **6.1.1. charge**

Charging current and charging voltage shall not exceed the calibration value of the battery. If it exceeds the specified value, it may cause damage to the charging and discharge performance, mechanical performance and safety of the cell, and entry may lead to heat and leakage.

Battery charger must be capable of constant current and constant pressure charging, and the original charger is recommended;

The charging current of the single battery must be below 25.2V;

The temperature range is from 0 to + 45 °C when charging;

The voltage cannot exceed 26 V when charging.

##### **6.1.2. discharge**

The discharge current shall not exceed the following standards, and the discharge must be conducted within the scope of this standard.

The battery discharge current must be less than 15A;

The temperature range at discharge is from -20 to + 60 °C;

Battery discharge termination voltage shall not be less than 19.5V.

##### **6.1.3. over-discharge**

It should be noted that during the cell is not in use, it may use its self-discharge properties in some over-discharge state. To prevent overdischarge, the cell should be charged regularly to maintain its voltage above 23.0V. Excessive discharge can lead to the loss of cell performance and battery function.

#### **Polymer lithium-ion battery storage**

The long-term storage environment of the battery is: temperature -20~ + 35 °C

Relative humidity is 45 to 75%

During the battery storage period of nearly 1 year, the battery should be charged by 10% to 10% 50%.

#### **Polymer lithium-ion battery transport**

The battery shall be transported in a 10% to 50% charging state.

### **6.2 Polymer lithium-ion battery precautions:**

**6.2.1.** To prevent possible battery leakage, heat, or explosion, note the following precautions:

Do not removal the removed under any circumstances.

Do not immerse batteries in water or sea water.

Do not use or place batteries next to heat sources, such as fires, heaters, etc.

Do not heat or drop the battery into the fire.

Direct welding of batteries is prohibited.

No charging in a fire or hot environment.

Do not place the battery in a microwave or high pressure container.

Use or place batteries in high temperatures (e. g., strong sunlight or hot cars), otherwise it will cause overheating, fire, or function decline, and life to be reduced.

The 6.2.2. polymer lithium-ion battery does not theoretically have a flowing electrolyte, but in case of electrolyte leakage and contact with the skin, eyes or other parts of the body, it should immediately flush the electrolyte with clear water and seek medical treatment.

6.2.3. prohibit the use of damaged cells (cell plastic seal damage, damaged shell, smell of electrolyte gas, electrolyte leakage, etc.).

Batteries with electrolyte leakage or electrolyte odor should be kept away from the source of fire to avoid fire or explosion.



## 7 Installation method and precautions of heat companion sampling gun

### 7.1 Sampling gun parameters:

voltage:24V

power:110W

Length of heat pipe: 1500mm

Sampling steel pipe: 50mm

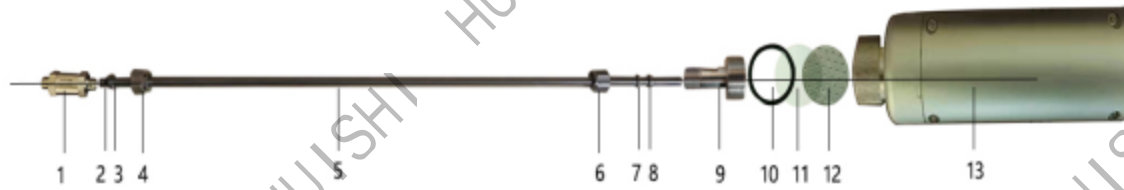
Temperature range: room temperature + 6- -200℃

### 7.2 Schematic diagram of the sampling gun



**1 Sampling end link handle 2 companion hot hose 3 inlet sample end link handle**

### 7.3 Schematic diagram of the installation link handle at the sampling end



- 1 Metal Filter 2 1 / 4 front sealing ring 3 1 / 4 rear seal gasket 4 M12\*1.25 stainless steel cap  
5 Inert stainless steel pipe 6 M12 \* 1 stainless steel cap 7 1 / 4 rear sealing gasket 8 1 / 4 front sealing ring  
9 Steel pipe link head 10 seals the O-ring 11 microhole filter film 12 mesh plate 13 sampling end handle

### 7.4 Schematic diagram of the links to the sampling gun



The sampling gun into the sample end of the joint red dot aligned with the sampling gun interface base red card slot inserted vertically when the sound sound link is in place.

### 7.5 Pull of sampling gun

Hold the upper part of the red point of the link head of the sampling gun and pull up vertically to pull out.



## 8 Software operation instructions

### install

This section describes the installation of the software. The legitimate HSNMHC400 special analysis software, such as operating system, software, data damage needs to be reinstalled, please follow the following steps to install.

#### 8.1 8 method of erection

This section describes the installation of the software.

There are 2 steps to use the software from installation to use:

##### 8.1.1 install

The 8.1.2 序 column number registers

### 8.2 Before installation

Before installing the software, check the following:

The operating system running this software is Windows 10. Please confirm the operating system of the PC.

Prepare the registration number serial code (in the U disk or instructions).

#### 8.2.1

Insert the software U disk to find the (HSNMHC400 software installation package) compressed file

| 名称                                                                                                 | 修改日期             | 类型           | 大小       |
|----------------------------------------------------------------------------------------------------|------------------|--------------|----------|
|  HSNMHC400软件安装包 | 2021/10/12 12:24 | 360压缩 ZIP 文件 | 2,633 KB |

This software is green software without installing decompression, after decompression can find the HSNMHC400.exe executable to create a desktop shortcut.

| 名称                           | 修改日期             | 类型        | 大小       |
|------------------------------|------------------|-----------|----------|
| ConfigFiles                  | 2021/10/12 13:10 | 文件夹       |          |
| DB                           | 2021/10/12 13:10 | 文件夹       |          |
| Log                          | 2021/10/12 13:10 | 文件夹       |          |
| x64                          | 2021/10/12 13:10 | 文件夹       |          |
| x86                          | 2021/10/12 13:10 | 文件夹       |          |
| 原始图像                         | 2021/10/12 13:10 | 文件夹       |          |
| HSNMHC400                    | 2021/10/10 18:29 | 应用程序      | 413 KB   |
| System.Data.SQLite.dll       | 2018/10/19 10:28 | 应用程序扩展    | 349 KB   |
| System.Data.SQLite           | 2018/10/19 10:28 | XML 文档    | 1,043 KB |
| Yj.Sp.BaseBusiness.dll       | 2021/10/10 18:29 | 应用程序扩展    | 24 KB    |
| Yj.Sp.BaseBusiness.pdb       | 2021/10/10 18:29 | PDB 文件    | 64 KB    |
| Yj.Sp.Business.dll           | 2021/10/10 18:29 | 应用程序扩展    | 7 KB     |
| Yj.Sp.Business.pdb           | 2021/10/10 18:29 | PDB 文件    | 14 KB    |
| Yj.Sp.Calculation.dll        | 2021/10/10 18:29 | 应用程序扩展    | 20 KB    |
| Yj.Sp.Calculation.pdb        | 2021/10/10 18:29 | PDB 文件    | 42 KB    |
| Yj.Sp.Comm.dll               | 2021/10/10 18:29 | 应用程序扩展    | 11 KB    |
| Yj.Sp.Comm.pdb               | 2021/10/10 18:29 | PDB 文件    | 32 KB    |
| Yj.Sp.Database.dll           | 2021/10/10 18:29 | 应用程序扩展    | 16 KB    |
| Yj.Sp.Database.pdb           | 2021/10/10 18:29 | PDB 文件    | 26 KB    |
| Yj.Sp.Framework.dll          | 2021/10/10 18:29 | 应用程序扩展    | 83 KB    |
| Yj.Sp.Framework.pdb          | 2021/10/10 18:29 | PDB 文件    | 148 KB   |
| Yj.Sp.HsUI.exe.config        | 2021/10/7 20:11  | CONFIG 文件 | 4 KB     |
| Yj.Sp.HsUI.pdb               | 2021/10/10 18:29 | PDB 文件    | 366 KB   |
| Yj.Sp.HsUI.vshost            | 2021/10/10 18:29 | 应用程序      | 23 KB    |
| Yj.Sp.HsUI.vshost.exe.config | 2021/10/10 18:22 | CONFIG 文件 | 4 KB     |

### 8.2.2 软件 Part registration

The first operation of the software requires registration code registration before operation



Double-click on the HSNMHC400 software shortcut icon

The first operation needs to input the registration code: in this manual and software U disk, or ask the installation after-sales engineer.

The registration code

软件注册

|      |                      |
|------|----------------------|
| 生成码: | BFEBFBFF000906EA     |
| 注册码: | <input type="text"/> |

第一次使用软件, 请输入注册码!

确定 取消

Enter the registration code to determine it.

## 8.2 Software operation method

### A 8.2.1 软件-pi连接

Manual editing of the computer IP address is segment 192.168.1.100

编辑 IP 设置

手动

IPv4

☒ 开

IP 地址

192.168.1.100

子网前缀长度

1

网关

首选 DNS

备用 DNS

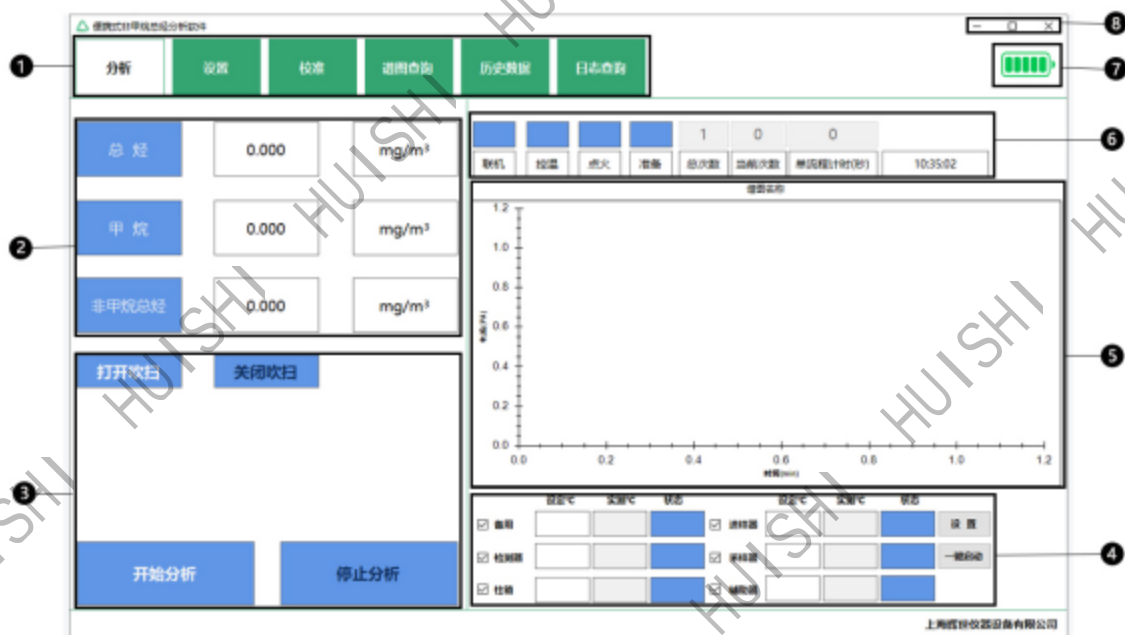
IPv6

☐ 关

保存 取消



### 8.3 Software interface introduction:



| number | explain                                                                                                    |
|--------|------------------------------------------------------------------------------------------------------------|
| 1      | (Function toolbar) Display: analysis, setting, calibration, spectral map query, historical data, log query |
| 2      | Real-time analysis of the data display regions                                                             |
| 3      | Run the control area                                                                                       |
| 4      | Temperature setting control zone                                                                           |
| 5      | Real-time signal display area                                                                              |
| 6      | Operating status indication area                                                                           |
| 7      | Battery power display area                                                                                 |
| 8      | Exit software                                                                                              |

9 Software operation function introduction

9.1 analyse



9.1.1 click the **关闭吹扫** button to sweep the sampling gun and residual pollutants in the sampling pipe  
**打开吹扫** to turn off the purpower  
Can.



9.1.2 click [Start Analysis], the device performs the analysis program, stop by itself after the program, or click [Stop Analysis] to terminate the analysis program in advance

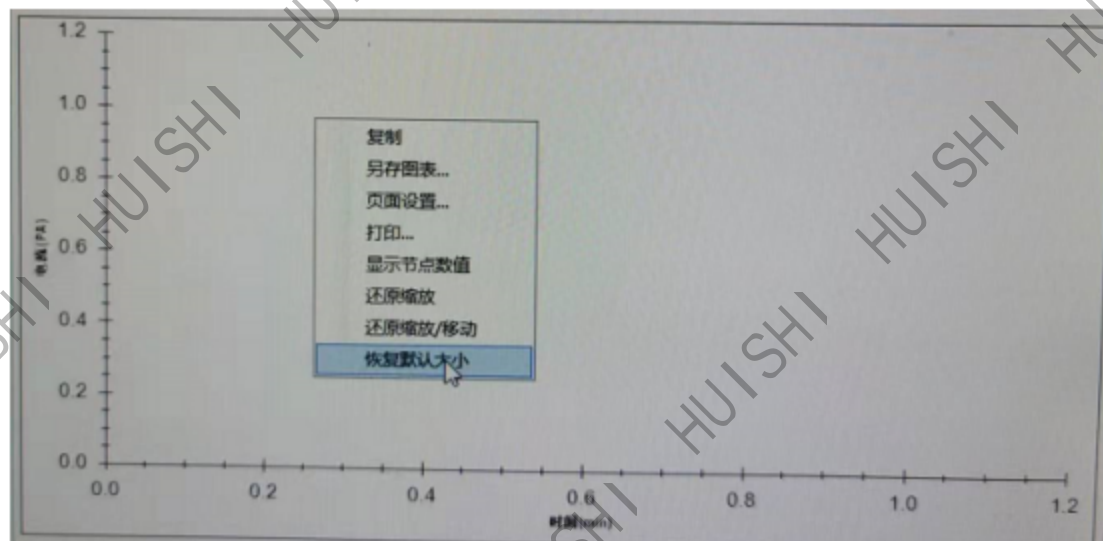
The 9.1.3 temperature setting

Enter the setting temperature to check the heating part rear point [set] key to download the parameters to the equipment point [one key start] to perform the heating operation.



#### 9.1.4 figure adjustment

Press the left mouse button in the map display area, move the mouse can move the map position, the left key circle to enlarge the area to zoom in, click the mouse right click [restore the default size] to restore the original state



#### The 9.1.5 status indicator bar

The initial state is blue and green is ready, reaching the instrument setting parameter value.

[Total number] is expressed as the total number of analysis for this analysis

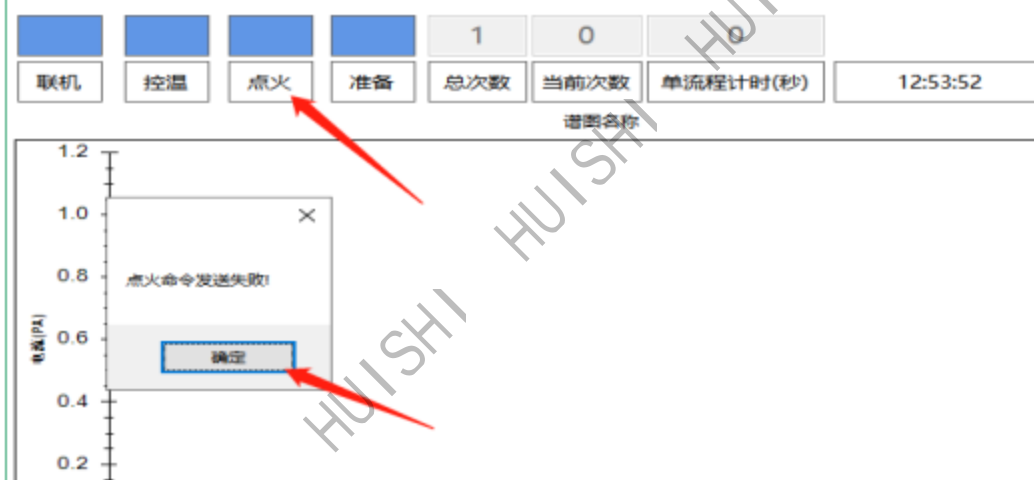
[Current times] represents the current number of execution

[Single-process timing] represents the total analysis time of a single cycle

[Time] Display the current time

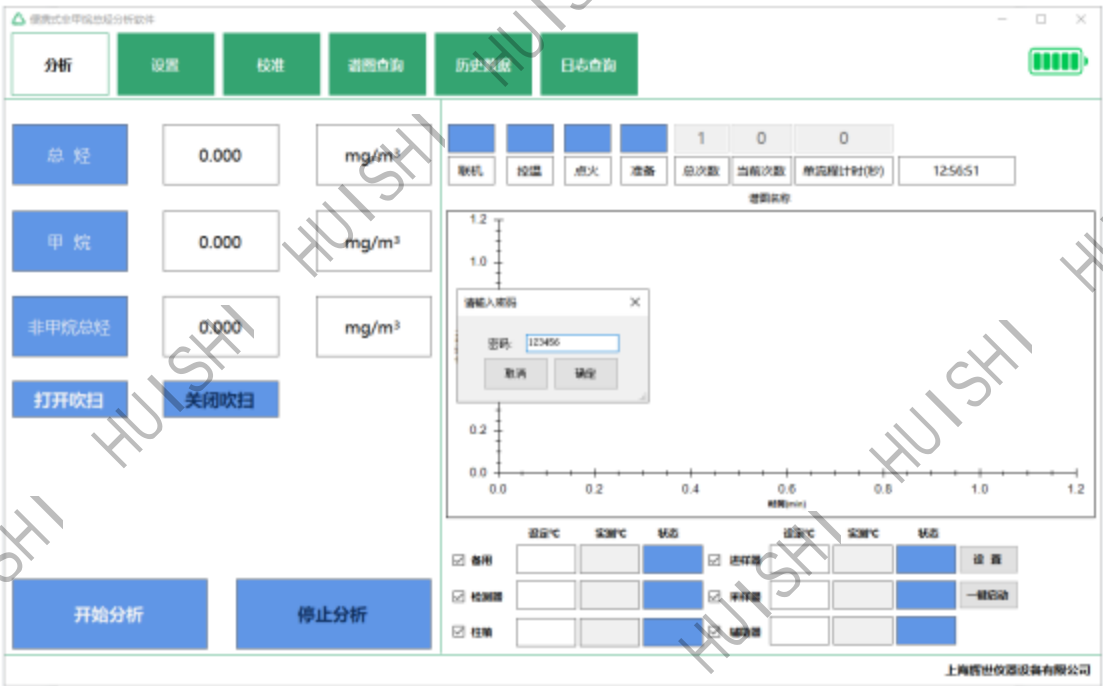


9.1.6 点 ignition automatically 10 minutes after default temperature control green. If manual ignition, click [Ignition] button [OK]



9.2 set up

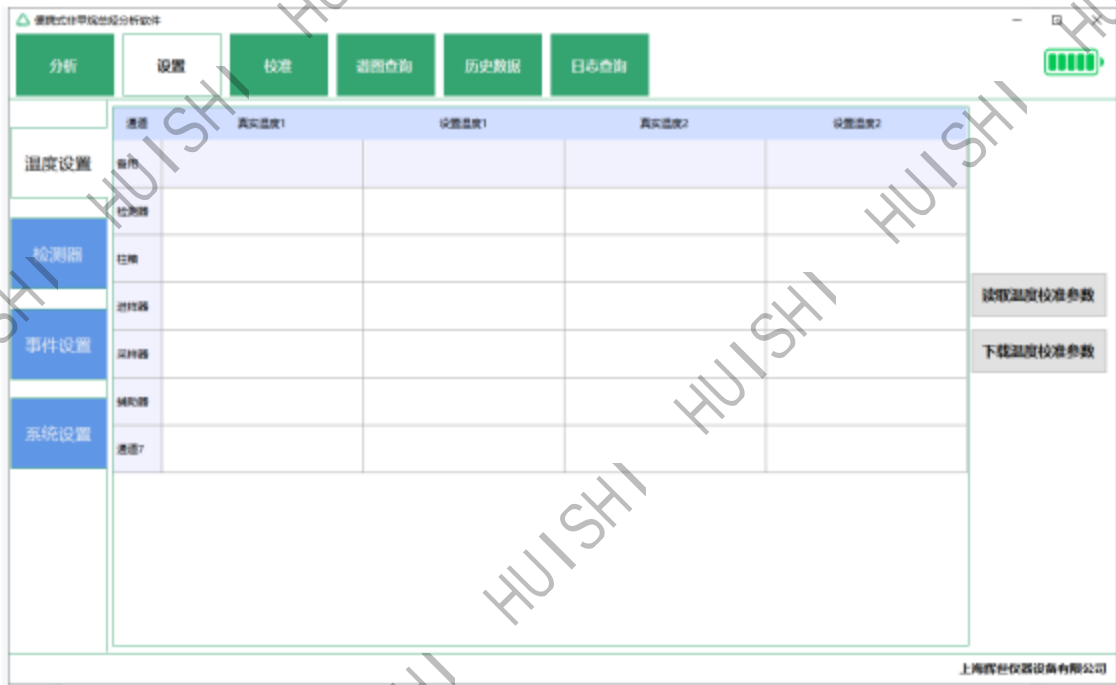
Point [Settings] enter the initial password 123456 [confirm] to enter the setting interface



9.2.1degree setting

Temperature calibration parameters, follow the steps:

Prepare the calibrated mercury thermometer, insert the parts to calibrate the temperature, read the mercury thermometer temperature value after the data stabilizes, fill in the [real temperature] column, set the temperature, fill in the [set temperature] column, and click [Download the temperature calibration parameters].



### 9.2.2 detector

[Ignition] is equivalent to the ignition function in the analysis interface, and the manual ignition switch.

[Fire threshold] This parameter is to determine the ignition success value of the device. The ignition is considered successful when the baseline is above the set point. If lower than the setting value and judged as fire extinguishing.

[Ignition status] Fire extinguishing is OFF fire NO

[Ignition times] When the equipment determines that the fire extinguishing state is the number of automatic ignition performed, the maximum is 5 times

[Amplification] Sensor sensitivity adjustment

[Phase] Adjust the peak direction

[Settings] All parameters change and need to click the Settings key to confirm

### 9.2.3part settings

[Sampling] The start time of the mining sample is generally 00:01

[Sampling] End time of off sampling, 00:20

[Analysis] The start time of the open analysis, which generally starts at 00:21

[Analysis] End time of turn-off analysis, time after methane production.

Set the breakpoint [Download the event parameter]

Cycle parameter settings

[Number of process cycles] Number of samples analyzed for an analysis process.

[Single analysis time] The total analysis time for a single process includes the sampling and analysis time.

[Single delay time] Generally set to the same time of the sampling pass

[Save] Click the Save key after the parameter setting

| 采样  | 分析    | 延迟    | 循环    |
|-----|-------|-------|-------|
| 开   | 00:00 | 00:00 | 00:00 |
| 不循环 | 关     | 00:00 | 00:00 |
| 分析  | 开     | 00:00 | 00:00 |
| 不循环 | 关     | 00:00 | 00:00 |
| 备用  | 开     | 00:00 | 00:00 |
| 不循环 | 关     | 00:00 | 00:00 |
| 备用  | 开     | 00:00 | 00:00 |
| 不循环 | 关     | 00:00 | 00:00 |
| 备用  | 开     | 00:00 | 00:00 |
| 不循环 | 关     | 00:00 | 00:00 |
| 备用  | 开     | 00:00 | 00:00 |
| 不循环 | 关     | 00:00 | 00:00 |

循环参数设置

循环次数(次)

单次分析时间(秒)

单次延迟时间(秒)

保存

全部填入0

下载事件参数

读取事件参数

### 9.2.4 unified setup

设置

采样方式: ☐ 日期+时间 ☐ 日期+计数

文件前缀:

保存

校准

100%电量对应的AO值:

0%电量对应的AO值:

保存

网络IP设置

IP地址:  端口:  连接

192.168.0.105  
192.168.0.106  
192.168.0.100

设置

单位选择:  保存

[Map file name setting] These three items are used for the control selection of the file after the end of the experiment.

The first item indicates that the file is kept at the date and time of the experiment and is saved automatically;

The second way is to save the file name you entered as the date and time of the experiment, and use automatic saving;

The third way is to save the file that you typed as the previous file name, with 000n ++ count, and automatically add one for each saved file system count

Click the file and click [Save] key

谱图文件名设置

☒ 自动方式-日期+时间

☐ 自动方式-前缀+日期+时间

☐ 自动方式-前缀+计数

文件前缀:

保 存

[Settings] Unit conversion, ppm and mg/m<sup>3</sup> units can automatically convert the settings and click the [Save] button

设置

单位选择:

PPM

mg/m<sup>3</sup>

[Power calibration] Built-in lithium battery power display calibration setting, click [Save] button

电量校准

100%电量对应的AD值

0%电量对应的AD值

保 存

[Communication IP settings] Synchronize the local computer IP address segment, wifi link settings

#### 通讯IP设置

IP地址  端口

192.168.0.105  
192.168.0.108  
192.168.0.100

### 9.3 calibration

便携式气相色谱分析仪

分析 设置 校准 谱图查询 历史数据 日志查询

最小半峰宽(秒):  最小峰高:  谱图采样点数:  ☒ 手动选择 ☐ 自动选择

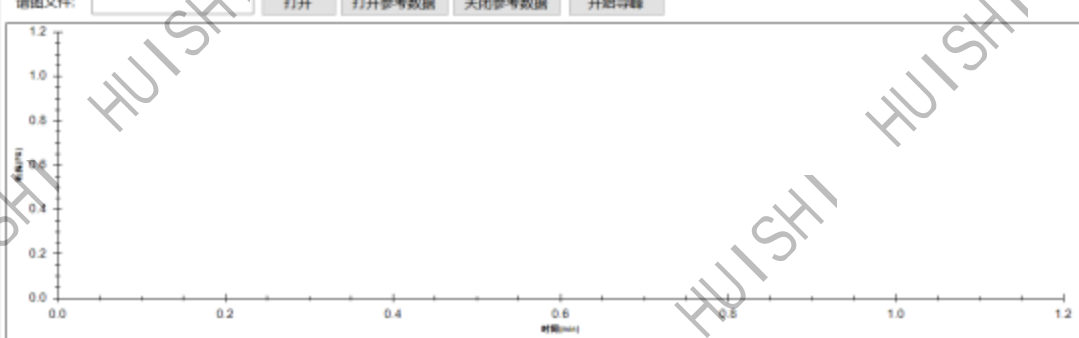
最大半峰宽(秒):  平滑次数:  ☐ 单点 ☒ 低浓度 ☐ 中浓度 ☐ 高浓度

斜率:  去掉最小值(个):  低中浓度峰面积界限:  中高浓度峰面积界限:

最小峰面积:  去掉最大值(个):  ☒ 综合速率法

谱图计算 结果信息 单点曲线 低浓度曲线 中浓度曲线 高浓度曲线

谱图文件:



上海世仪器设备有限公司

### 9.3.1 spectral peak processing parameters

最小半峰宽(秒):       最小峰高:       窗口采样点数:   
 最大半峰宽(秒):       平滑次数:   
 斜率:       去掉最小值(个):   
 最小峰面积:       去掉最大值(个):       ☒ 综合滤波法

| parameter                          | scope          | function declaration                                                                                                                                                                                                       |
|------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Minimum half peak width            | 0-50           | Removing peaks with small or large peak width ratio set values is like the screen based on the half height width of the minimum effective peak. The minimum half peak width can be estimated from the spectrograph display |
| Maximum half peak                  | 1000 more than |                                                                                                                                                                                                                            |
| gradient                           | 0-99999.9      | Peak detection sensitivity, used to determine the beginning and end point of the peak                                                                                                                                      |
| minimal area                       | 0-99999.9      | Peaks with the area (peak height) smaller than the set point were used to remove area peak height relative to smaller unrelated peaks (e. g., baseline noise) during the analysis                                          |
| The minimum peak is high           | 0-99999.9      |                                                                                                                                                                                                                            |
| The number of smooth               | 0-30           |                                                                                                                                                                                                                            |
| Remove the maximum (minimum) value | 0-99.9         | Remove a minimum content or maximum content value                                                                                                                                                                          |
| Number of window sampling points   | 0-30           |                                                                                                                                                                                                                            |

The 9.3.2 校准 quasi-curves are manually selected automatically

☒ 手动选择      ☐ 自动选择

☒ 单点  
☐ 低浓度  
☐ 中浓度  
☐ 高浓度

低中浓度峰面积界限:   
 中高浓度峰面积界限:

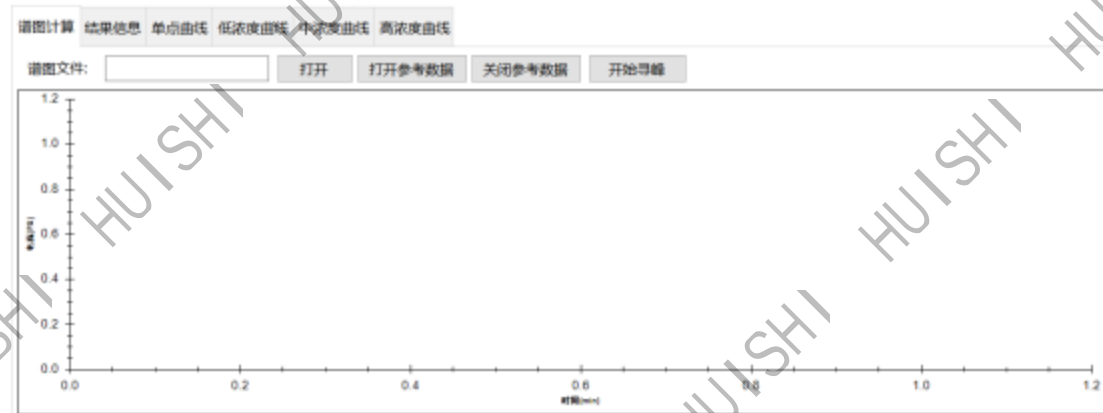
[Manual selection]: Four optional high concentration in the low concentration of a single point.

Select the response curve according to the approximate concentration point of the sample reagent and click [Save the calibration parameters]

[Automatic selection]: After point selection, set low and medium, high concentration peak area boundary parameters, such as medium and low concentration setting 100, medium and high concentration setting 200 indicate that the low concentration calibration 100-200 when the total hydrocarbon area is less than 100, and the high concentration calibration is higher than 200. Production of the

### 9.3.3quasi-curves

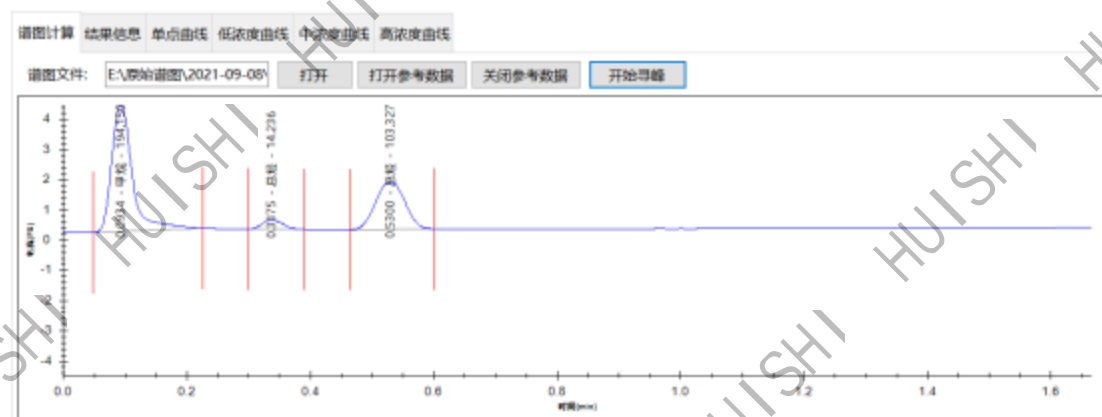
#### 9.3.3.1 selection [spectral calculation]



#### 9.3.3.2 [Open] spectral map file and select the corresponding concentration standard spectral

谱图文件:  打开 打开参考数据 关闭参考数据 开始寻峰

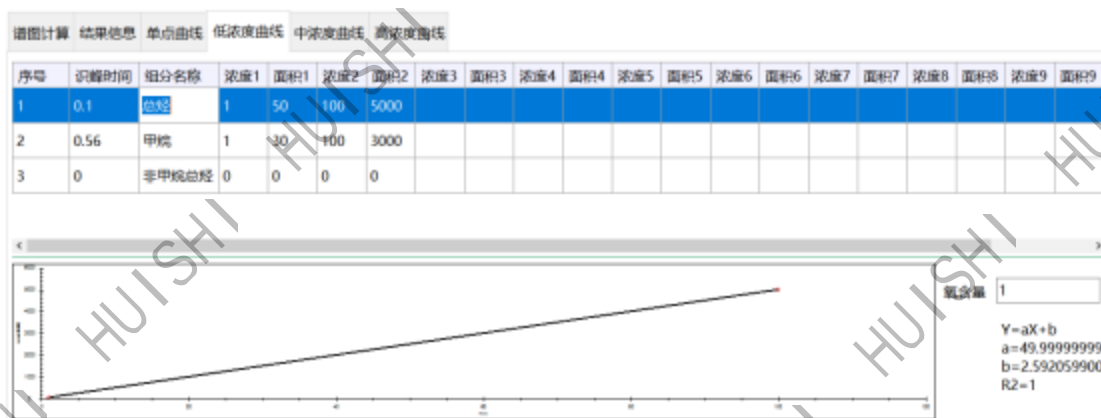
9.3.3.3 Click [Start peak search] to adjust the number of sampling points in the integral parameters, and the smoothing number parameters until the total hydrocarbon and methane peak time and area appear.



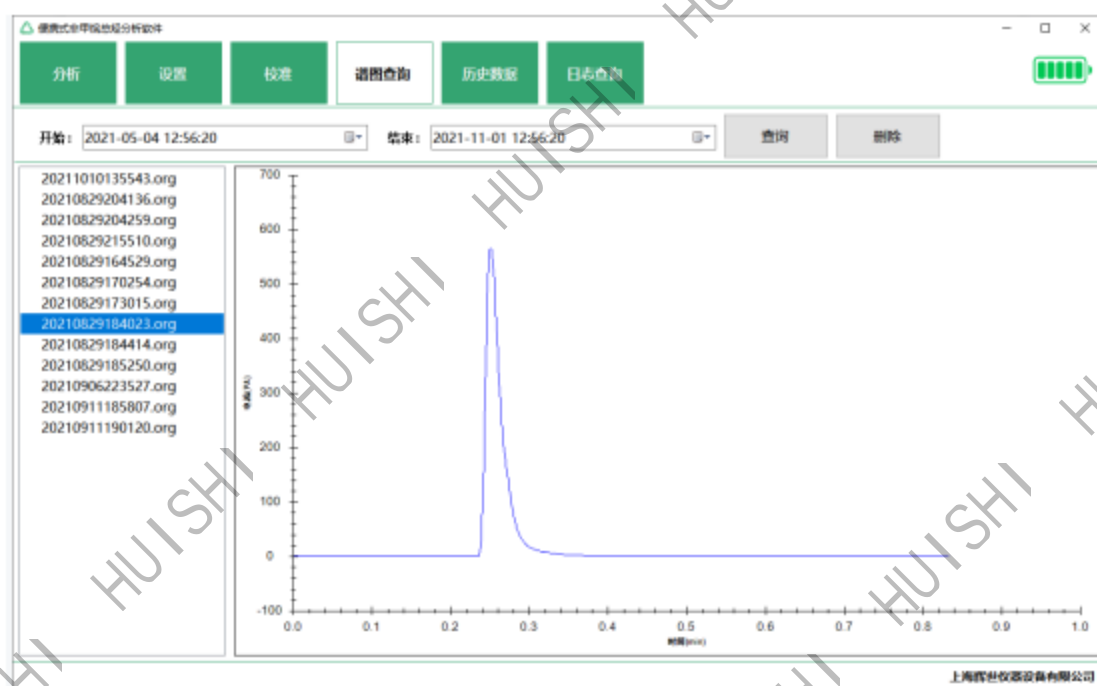
9.3.3.4 calibration in the low concentration curve, the medium to high concentration curve production method is not repeated.

Select [low concentration curve] to query the time of total hydrocarbon peak time and area in [spectral chart calculation] in [serial number] 1 [peak recognition time] column, [component name] enter name [concentration 1] enter the corresponding standard gas concentration value, and [area 1] enter peak area. Enter the time of methane in the column [No.] 2 [peak recognition

time], [component name] enter the name [concentration 1] enter the corresponding standard gas concentration value, and [area 1] input the peak area. So on, repeat 1-3 steps to retrieve different gas concentration files for calibration for a maximum of 10 points. The gas concentration document shall be selected following the principle from low to high.



9.4 [Map query] Select start and end time Click [Query] to retrieve map data for this time period.



9.5 [Historical data] Instrument model, instrument number, measurement place, measurement time. Check the point according to the actual situation [Save data]

9.5.1[creation time] Select the start and end time of the creation time. Click [Query] to count the average value of the total hydrocarbon, methane and non-methane total hydrocarbon concentrations during this time period. If a data is wrongly selected, click [Delete data] to delete it.

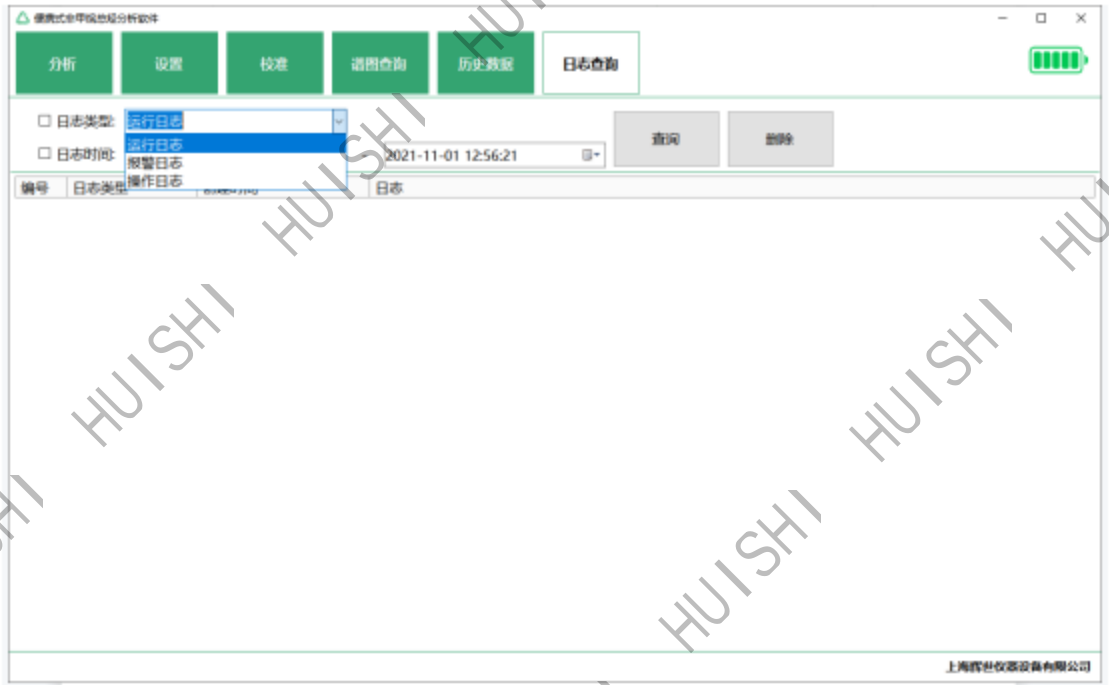
After connecting the intelligent smoke gun, Bluetooth can check the working condition data to be printed, such as: ambient temperature, pressure, etc

| ID | 谱图名称           | 创建时间             | 总烃浓度         | 甲烷浓度        | 非甲烷总烃浓度      | 浓度单位  |
|----|----------------|------------------|--------------|-------------|--------------|-------|
| 1  | 20210911185... | 2021/9/11 19:... | 19.30791368  | 54.51004636 | 35.73783268  | mg_m3 |
| 2  | 20210911190... | 2021/9/11 19:... | 144.80372775 | 0           | 144.26802775 | mg_m3 |
|    | 平均值            |                  | 82.06        | 27.26       | 54.27        |       |

9.5.2[Print] Click the parameter data to print and click [Print] Click the built-in printer to print the current data

| ID | 谱图名称           | 创建时间             | 总烃浓度         | 甲烷浓度        | 非甲烷总烃浓度      | 浓度单位  |
|----|----------------|------------------|--------------|-------------|--------------|-------|
| 1  | 20210911185... | 2021/9/11 19:... | 19.30791368  | 54.51004636 | 35.73783268  | mg_m3 |
| 2  | 20210911190... | 2021/9/11 19:... | 144.80372775 | 0           | 144.26802775 | mg_m3 |
|    | 平均值            |                  | 82.06        | 27.26       | 54.27        |       |

9.6 [Log query] is divided into operation log alarm log operation log, select the start and end time of log time, and click [query] to query the equipment operation of this time period.Click [Delete] to delete this log content.



## 10 Analyze the fault judgment and treatment methods

| fault phenomenon                                             | Troubleshooting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Inspection method and repair                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>There is no spectral peak</b>                             | 12. The amplifier power supply is disconnected.<br>13. The ion line is broken.<br>14. No air no not over.<br>15. Poor contact with the integrator / chromatographic workstation signal line.<br>16. Integrator / chromatograph workstation failure<br>17. The sample inlet temperature was too low so that the sample was not vaporized.<br>18. Microinjectors were blocked.<br>19. Air leakage of silicone pad of sample inlet.<br>20. The chromatcolumn installation connection is not standard.<br>21. The fire is not lit (FID).<br>22. The FID polarization voltage is unconnected or poorly contacted. | 12. Check the amplifier, the fuse.<br>13. Check the ion line.<br>14. Check that the flow path is blocked and that the gas supply is exhausted.<br>15. Check the integrator / chromatographic workstation wiring.<br>16. Trouthe integrator / chromatograph workstation.<br>17. Increase the sample inlet temperature.<br>18. Replace the syringe.<br>19. Replace the sampler silicone pad.<br>20. Reinstall and tighten the chromatcolumn.<br>21. re-light.<br>22. Connect the polarized voltage to exclude poor contact. |
| <b>The tention time was normal but sensitivity decreased</b> | 8. The decay is too large<br>9. Not a sufficient sample size<br>10. Loss during sample entry<br>11. Injector leakage or blockage<br>12. Air leakage<br>13. Improper selection of Hydrogen and Air Flow (FID)<br>14. Unnormal polarization voltage (FID)                                                                                                                                                                                                                                                                                                                                                      | 8. Reduce the attenuation and increase the scale range<br>9. Increase sample intake<br>10. Ensure that all the samples go into the system<br>11. Replace the syringe<br>12. Detect the air leakage and eliminate the air leakage<br>13. Adjust the hydrogen gas and the air flow rate<br>14. Check and troubleshoot the polarization voltage fault                                                                                                                                                                        |
| <b>tailing peak</b>                                          | 5. The intake temperature is too low<br>6. Vaporization pipe pollution of sample inlet or residual sample inlet pad                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 6. Readjust the sample inlet temperature<br>7. Clean the inlet or remove the                                                                                                                                                                                                                                                                                                                                                                                                                                              |

|                                                         |                                                                                                                                                                                                  |                                                                                                                                                                                             |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                         | <p>7. The chromatcolumn temperature is too low</p> <p>8. The feeding technique is too poor</p> <p>The 5. chromatcolumn was improperly selected</p>                                               | <p>residue from the inlet pad</p> <p>8. Increase the chromatcolumn temperature</p> <p>9. Improve the sample entry technology</p> <p>10. Select the appropriate chromatcolumn</p>            |
| <b>Extend the tongue peak</b>                           | <p>3. The sample size was too large for the chromatcolumn overload</p> <p>4. Samples are condensed in the system</p>                                                                             | <p>3. Reduce sample size</p> <p>4. Increase the temperature and aging system</p>                                                                                                            |
| <b>Chmatographic peaks were not separated</b>           | <p>4. The chromatcolumn temperature is too high</p> <p>5. The chromatography column is too short</p> <p>6. The gas flow rate is too high</p> <p>The 4. chromatcolumn was improperly selected</p> | <p>5. Reduce column temperature</p> <p>6. Select longer chromatcolumns</p> <p>7. Reduce the gas flow rate</p> <p>8. Select the appropriate chromatcolumn</p>                                |
| <b>flat peak</b>                                        | <p>3. The amplifier is saturated</p> <p>4. Integrator / chromatograph workstation failure</p>                                                                                                    | <p>3. Reduce the sample size or reduce the amplifier sensitivity</p> <p>4. Trouthe integrator / chromatograph workstation</p>                                                               |
| <b>There are irregular fluctuations at the baseline</b> | <p>5. The instrument is not down to earth</p> <p>6. Detector contamination</p> <p>7. The airflow selection is improper</p> <p>8. The amplifier is not good</p>                                   | <p>5. Improve grounding</p> <p>6. Clean the detector</p> <p>7. Select the appropriate gas flow rate</p> <p>8. Check the amplifier</p>                                                       |
| <b>The baseline noise was large</b>                     | <p>6. Chromatic column pollution</p> <p>7. The gas is not pure</p> <p>8. bad earth</p> <p>9. Detector contamination</p> <p>10. Poor detector cable contact</p>                                   | <p>6. Replace the color column</p> <p>7. Purification of the gas meets the requirements</p> <p>8. Improve grounding</p> <p>9. Clean the detector</p> <p>10. Replace or repair the cable</p> |
| <b>Baseline single-direct ional drift</b>               | <p>3. The gas is gradually over</p> <p>4. System air leakage</p>                                                                                                                                 | <p>3. Replace the cylinder</p> <p>4. leak detection</p>                                                                                                                                     |

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