ACFEE ACTIVE POWER FILTER

AcFee

有源电力滤波器（V6.0）

操作手册

Operation manual

Lafaelt

莱提电气

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安全须知

■ 安全标识

在本手册中，安全等级有以下三类：

表 1-1　符号、术语及名称的使用

	注释
 注意	如未遵循手册要求，可能会造成损失或者设备故障损坏！
 警告	如未遵循手册要求，可能会造成设备损坏及人员轻伤！
 危险	如未遵循手册要求，可能会造成严重事故及人员重伤或死亡！！！

本手册中凡使用到这 3 类标记，均表示该处是有关安全的重要内容。如果不遵守这些注意事项，可能会造成经济损失，导致轻重伤或死亡、损坏本产品、损坏配套的相关器件、柜体。另外，因贵公司或贵公司客户未遵守本手册的内容而造成的伤害和设备损坏，本公司将不负任何责任。

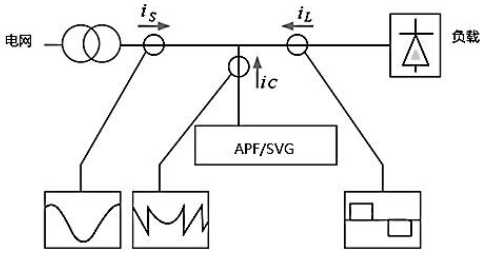
产品简介

首先感谢您购买使用本公司开发生产的 APF 有源滤波器！

我公司竭诚为用户解决电能质量问题，有源滤波器具备综合电能质量治理能力。APF 可同时滤除 2~51 次以内的谐波，滤波能力可高达 97%以上，对阶跃变化的谐波完全补偿时间小于 5ms。APF 可多台同时并联运行，整机效率大于 98%，完全适用于工业、民用领域各种情况，是非线性负载谐波治理与无功补偿的最佳解决方案。

■ 产品原理

1）功能原理



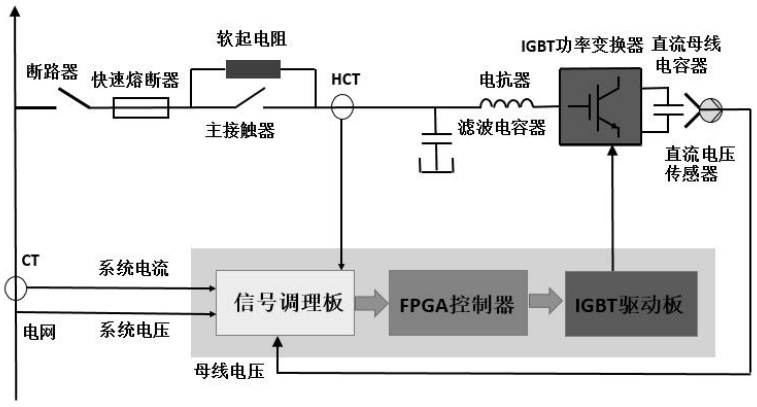
APF 补偿原理图

用户可以通过参数设置，使设备可以同时具备滤除谐波、动态补偿无

功、补偿三相不平衡、补偿电压跌落等功能。

原理名称	原理说明
滤除谐波原理	APF 通过外部电流互感器实时采集电流信号，通过内部检测电路分离出其中的谐波部分，通过 IGBT 功率变换器产生与系统中的谐波大小相等相位相反的补偿电流，实现滤除谐波的功能。 APF 输出补偿电流根据系统的谐波量动态准确变化，因此不会出现过补偿的问题。另外，APF 内部有过载保护功能，当系统的谐波量大于滤波器容量时，装置可以自动限制在 100%额定容量输出，不会发生过载。
补偿无功原理	APF 在 ASVG 模式下运行时根据系统的无功功率，通过 IGBT 功率变换器产生容性或感性的基波电流，实现动态无功补偿的目的，补偿目标值可以通过操作面板设定，不会出现过补偿，并且补偿平滑，不会产生对负载和电网的涌流冲击。
补偿三相不平衡原理	APF 根据系统电流，提取不平衡分量，三相发出与不平衡分量大小相等相位相反的电流，将不平衡部分补偿到零，就能将三相不平衡电流校正成三相平衡电流。

2）控制原理



APF 内部控制原理图

断路器合闸后，为防止上电时电网对直流母线电容器的瞬间冲击，APF 首先通过软启电阻对直流母线的电容器充电。当母线电压 Udc

达到预定值后，主接触器闭合。直流电容作为储能器件，通过 IGBT 逆变器和内部电抗器向外输出补偿电流提供能量。APF 通过外部 CT 实时采集电流信号送至信号调理电路，然后再送至控制器。控制器将采样电流进行分解，提取出各次谐波电流、无功电流、三相不平衡电流，将采集到的要补偿的电流成分和 APF 已发出的补偿电流比较得到差值，作为实时补偿信号输出到驱动电路，触发 IGBT 变换器将补偿电流注入到电网中，实现闭环控制，完成补偿功能。

■ 产品特点

1)模块化设计，任意模块故障不会影响其它模块的正常工作，极大提高了整机设备的可靠性；能实现多台直接并联运行的平滑扩容。多台扩容时采用主从控制方式；多台模块并联时，所有模块能共用一套电流互感器；

2)可同时滤除 2~51 次以下的谐波电流，滤除率不低于 97%；无功补偿可使功率因数达到 1；可校正三相电流不平衡到完全平衡；

3)采用国际知名品牌第七代 IGBT，能自动根据负载的谐波电流调整输出，动态滤波；

4)采用进口国际知名品牌 DSP 控制芯片，运行速度快、可靠性高；

5)采用分层设计，粉尘雨露不会附着在电路板上，适应恶劣工况下的使用；

6)滤波、补偿无功、补偿三相不平衡可单选或多选，并可设置功能的优先次序；

7)采用基于瞬时无功理论的多坐标旋转控制算法，无功及谐波电流完全解耦控制，计算速度快，瞬时响应时间小于 0.1ms,装置补偿全响应时间小于 5ms；

8)输出滤波采用 LC 结构接入电网，自身的高频载波不会回馈到电网，

对配电系统中其他设备没有干扰；

9)具备完整的保护功能，包括过压、过流、过热、短路等完备保护功能，同时具备系统自诊断功能；

10)具有软启动控制回路，避免启动瞬间过大的突入电流，限制该电流在额定范围之间；

11)采用可靠的限流控制环节，当系统中的待补偿电流大于装置的额定容量时，装置能够自动限流在 100%容量输出，维持正常工作；

12)主电路采用三相 H 桥两交错拓扑结构，等效开关频率达到 80K 赫兹，输出波形质量高，开关损耗低；

13)采用高清晰 7 英寸触摸屏（可定制 10 英寸触摸屏），操作方便，屏幕实时显示系统和装置运行参数，具有故障报警及追忆功能，同时可以利用触摸屏双串口功能，将数据上传至 4G 云平台或支持 RS485 的电脑端做远程监控；

14)具备偶次谐波补偿能力以及指定高次谐波的补偿能力；

15)ASVG 模式下可以设定无功优先，谐波优先的工作模式，可以达到补偿无功、补偿谐波自由分配的效果；

■ 初次使用

对于初次使用本产品的用户，应先认真阅读本手册。若对产品功能与安装方面仍有疑问，请咨询本公司技术人员，以获得帮助，对正确使用本产品有利。

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■ 安全事项

安装前	
 危	● 开箱时发现箱内进水或者设备进水、部件缺少或有部件明显损坏时，请不要安装！ ● 装箱单与实物名称以及订购设备名称不符时，请不要安装！

 注	● 搬运模块时，请务必抓牢抱紧壳体。如果搬运过程中造成掉落，有导致受伤的危险，同时可能造成设备损坏。 ● 搬运时应该轻抬轻放，否则有损害设备的危险！ ● 有损伤的或缺件的模块请不要使用，有受伤的危险！ ● 本装置在出厂前已经耐压测试，未和公司技术人员确认，对装置的任何部件都不能进行耐电压试验。并且高压可能会而导致设备绝缘及内部器件的损坏。

安装时	
 危	● 非电气施工专业人员请勿进行安装、维护、检查或部件更换。否则会有触电的危险！ ● 严禁撕毁设备防撕标签，造成损坏，均不属于公司的责任范畴和保修范围。 ● 改造类项目，安装一次线缆时和电流采样二次线时，确保接入系统已断电，并且周边范围内可安全作业。否有触电危险，可能会导致人员伤亡！
 注	● 安装时请轻放模块，并注意不能磕碰模块。如造成损坏，均不属于公司的责任范畴和保修范围。 ● 两个以上模块置于同一个柜子中时，请注意安装位置，保证散热效果。并建议增加风扇等散热措施。 ● 模块安装位置应能保证通风，请勿遮盖模块自带的散热风扇进出风口。 ● 模块安装位置应能保证售后人员进行安全的调试维护。 ● 壁挂式模块安装应尽量在人员走动较少的位置，并需在明显位置做安全危险标识。

上电运行时	
 危	● 上电后不要打开盖板。否则有触电的危险，造成人员伤亡！ ● 严禁带电对设备进行安装、接线！ ● 不要触摸模块的任何一次、二次端子。否则有触电危险，造成人员伤亡！ ● 本设备需本公司指定售后工程师进行调试，其他人员操作需在本公司售后工程师指导下进行，禁止私自操作！否则可能会造成设备损坏，甚至造成人员伤亡！
 注	● 设备运行中时，请勿随意更改设备的出厂参数。否则可能造成设备的损坏！ ● 设备运行中，应避免有东西掉入设备中。否则可能引起设备损坏！ ● 设备上电后，应避免频繁启停设备或者频繁开关设备的上级开关。 ● 调试时，设备出现异常异响或者故障信息，应及时断电，并联系本公司技术人员。

维护保养时	
 危	● 没有经过专业培训的人员请勿对设备实施维修及保养。否则可能会造成人身伤害或设备损坏！ ● 请勿带电对设备进行维修及保养。否则有触电危险！ ● 确认将设备的输入电源断电不低于 10 分钟后，才能对设备实施保养及维修。否则电容上的残余电荷会对人身造成伤害！ ● 在设备上开展维护保养工作之前，请确保设备与所有电源安全断开连接。 ● 更换设备后必须进行参数的设置和检查。 ● 请勿上电运行已经报故障的设备或者损坏的设备，否则会扩大设备的损坏。

■ 特定用途

 注	● 请注意在同一系统中是否有电容电抗等无源器件组成的无功补偿设备，设置不当的话，有源滤波器可能会和这些无源补偿设备发生冲突，或不能充分发挥补偿能力。 ● APF 在用于谐波补偿时，需确保系统中无纯电容补偿设备或呈容性的负载设备，如有则必须采取必要措施（如串联电抗器）使其对所需补偿次数的谐波呈感性特征，避免产生谐振，否则会有 APF 故障损坏或纯电容补偿设备和容性负载设备的损坏的风险； ● APF 工作时，可能干扰其附近的通讯设备，须尽量使通讯、控制传输信号线远离 APF 一次回路，必要时可加装抗干扰 EMI 滤波器，以降低干扰的影响。 ● 海拔高度不超过 1000 米。如超过 1000 米，按照每升高 100 米，设备降额 1%使用。

产品信息

1.1 产品外观说明

■ 模块外形：（200A、150A、100A、75A）

图 1-1 模块外观

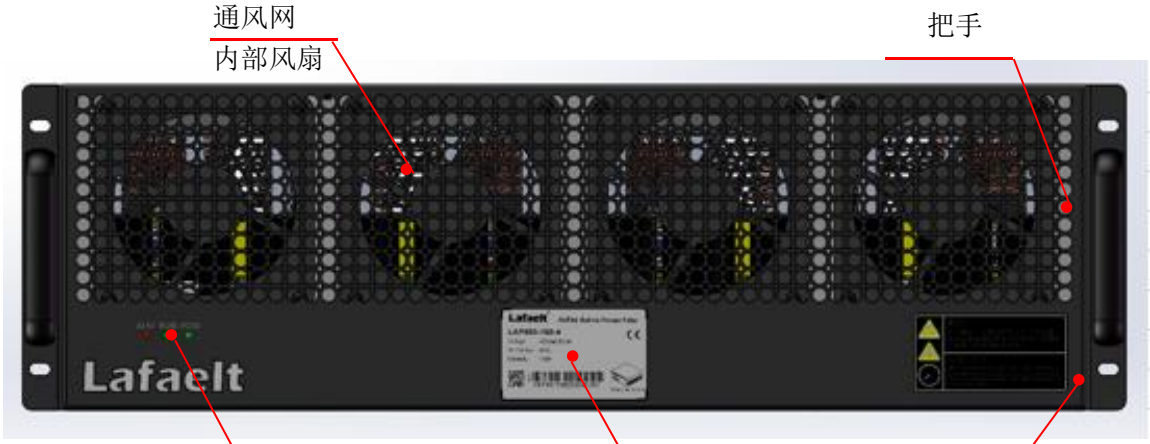


图 1-2 模块正面

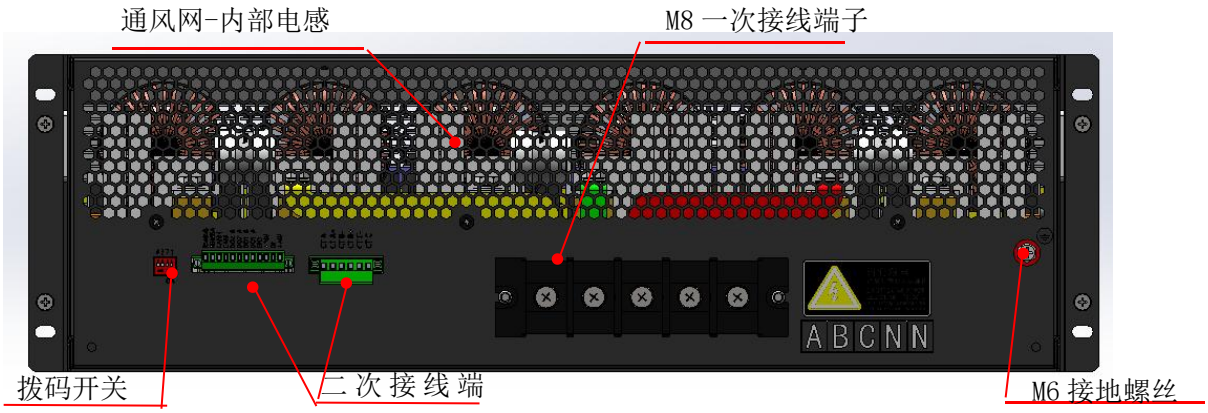


图 1-3 模块背面

■ 模块外形：插拔式（150A、100A、75A）

图 1-4 模块外观（插拔式）

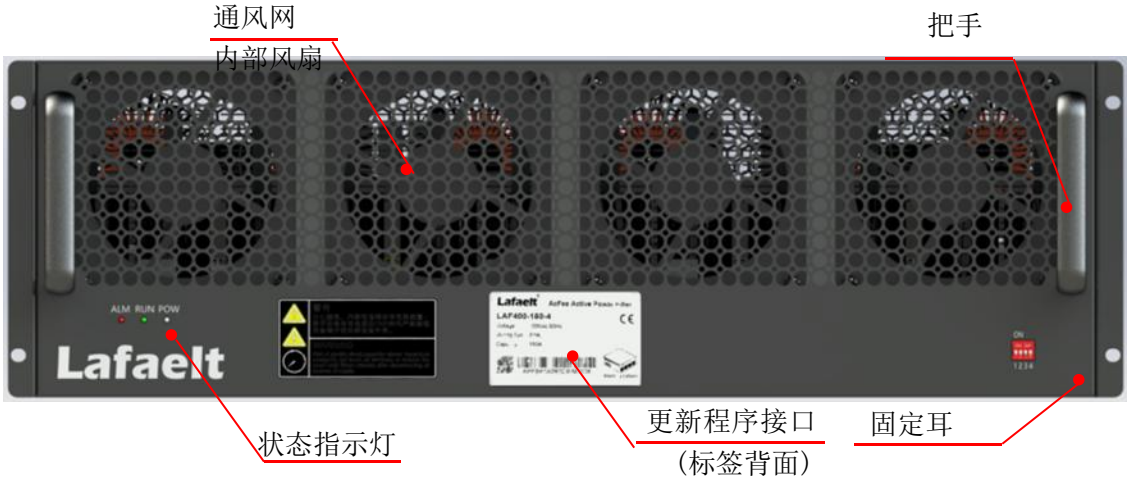


图 1-5 模块正面（插拔式）

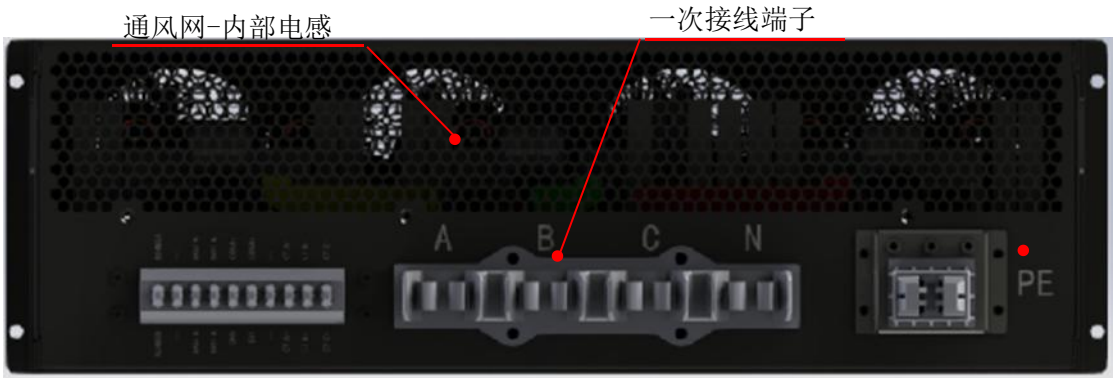


图 1-6 模块背面（插拔式）

1.2 接线端子说明

■ 模块接线端子：（200A、150A、100A、75A）

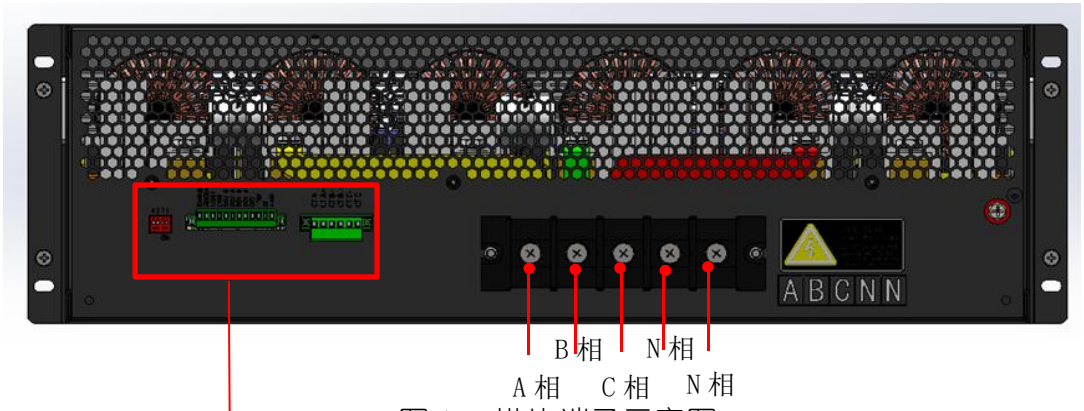


图 1-7 模块端子示意图

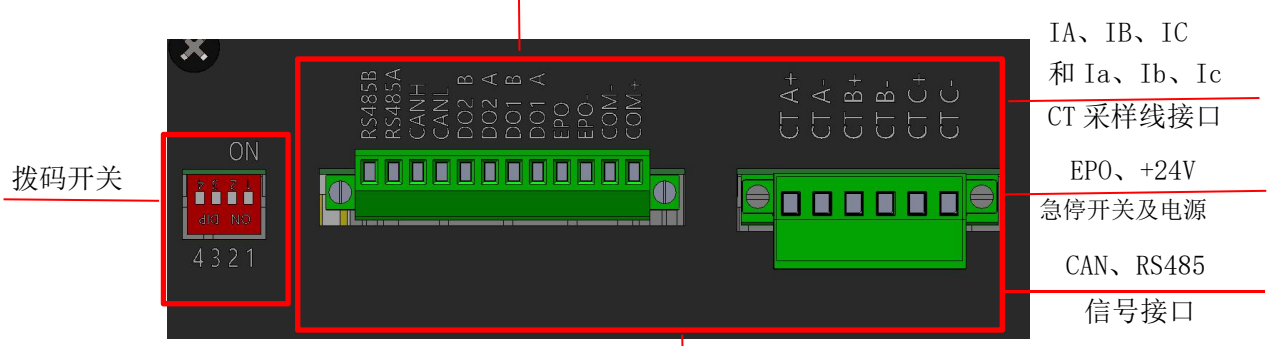


图 1-8 模块端子示意图（插拔式）

拨码开关：因模块本体没有带触摸屏，所以设置模块地址可通过拨码开关进行设置(二进制转十进制)。只有设置正确的模块地址，外置的集中监控触摸屏才能与模块正常通讯；譬如柜内有 2 个模块时，第一个模块可将拨码开关拨到 1 位，第二个模块可将拨码开关拨到 2，需将 1 位复位(按照二进制转十进制方式进行拨码)。拨码开关一共 4 位数，最多并联 15 只模块。

1.3 指示灯状态说明

图 1-9 指示灯状态示意图

状态指示灯：有“ALM（报警）、RUN（运行）、POW（电源）”三种状态指示灯；POW 灯显示模块是否正常上电，如果有一次市电接入，则 POW 灯（绿）点亮；模块上电后，如果模块处于正常运行状态，则 RUN 灯（绿）点亮；如果模块发生报警，则 ALM 灯（红）点亮。

1.4 产品尺寸

■ 模块外形尺寸：机架式（200A、150A、100A、75A）

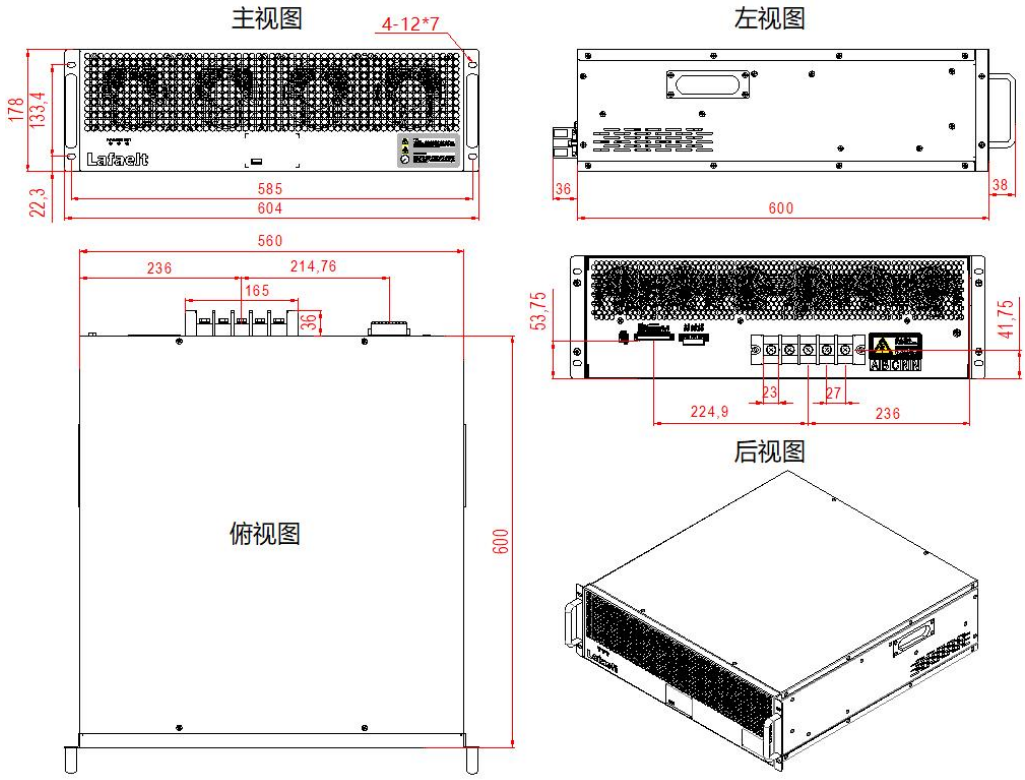


图 1-10 模块尺寸图

模块外形尺寸：插拔式（150A、100A、75A）

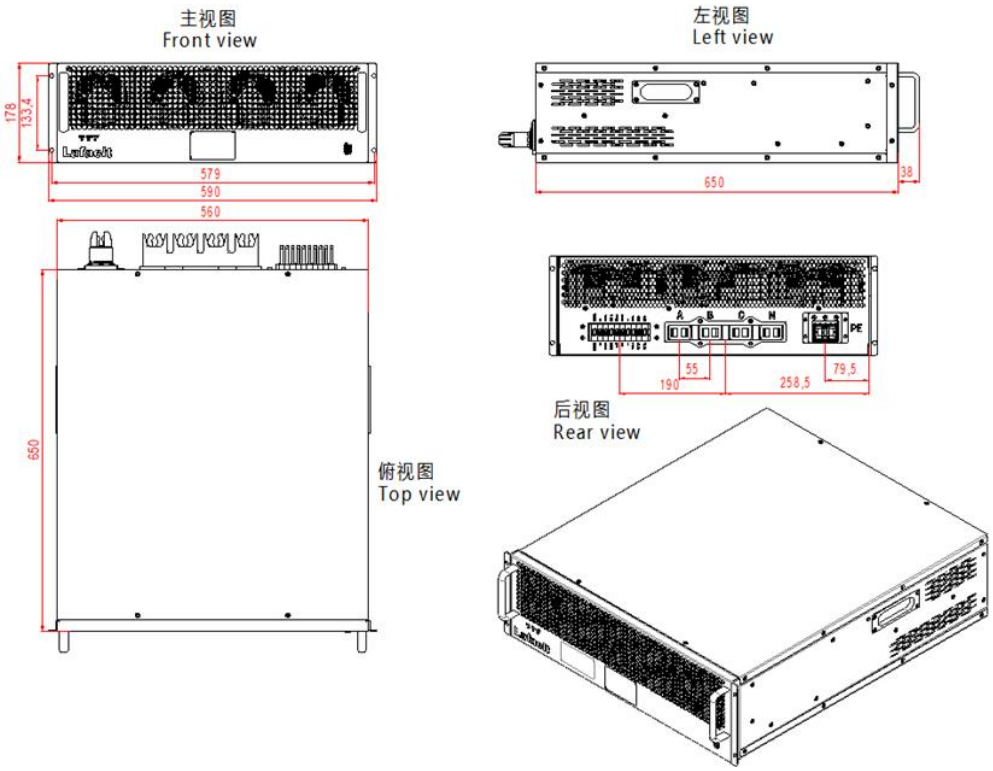


图 1-11 模块尺寸图（插拔式）

系统连接

2.1 系统连接图

■ 单机

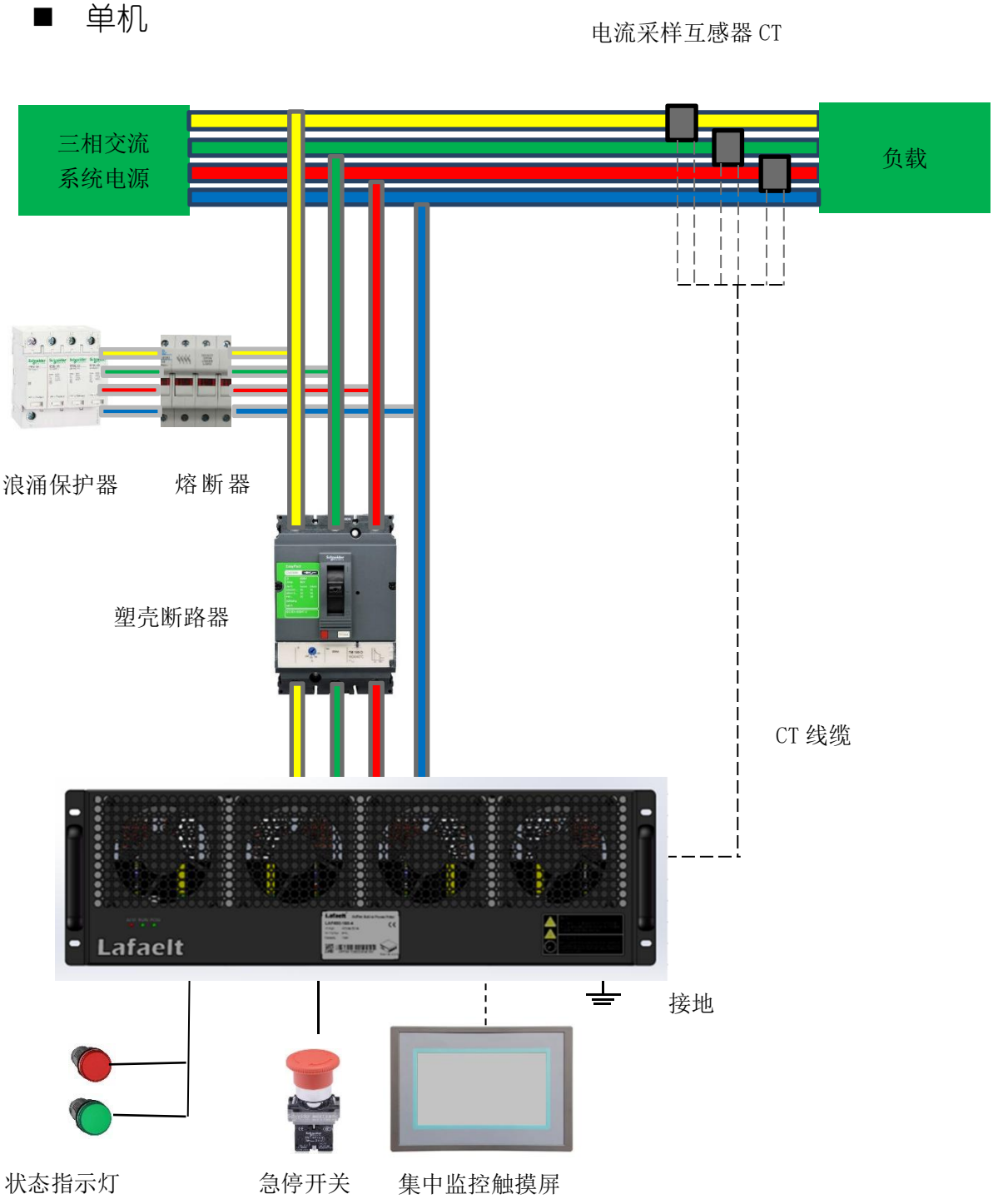


图 2-1 APF 单机系统连接图

■ 多机并联

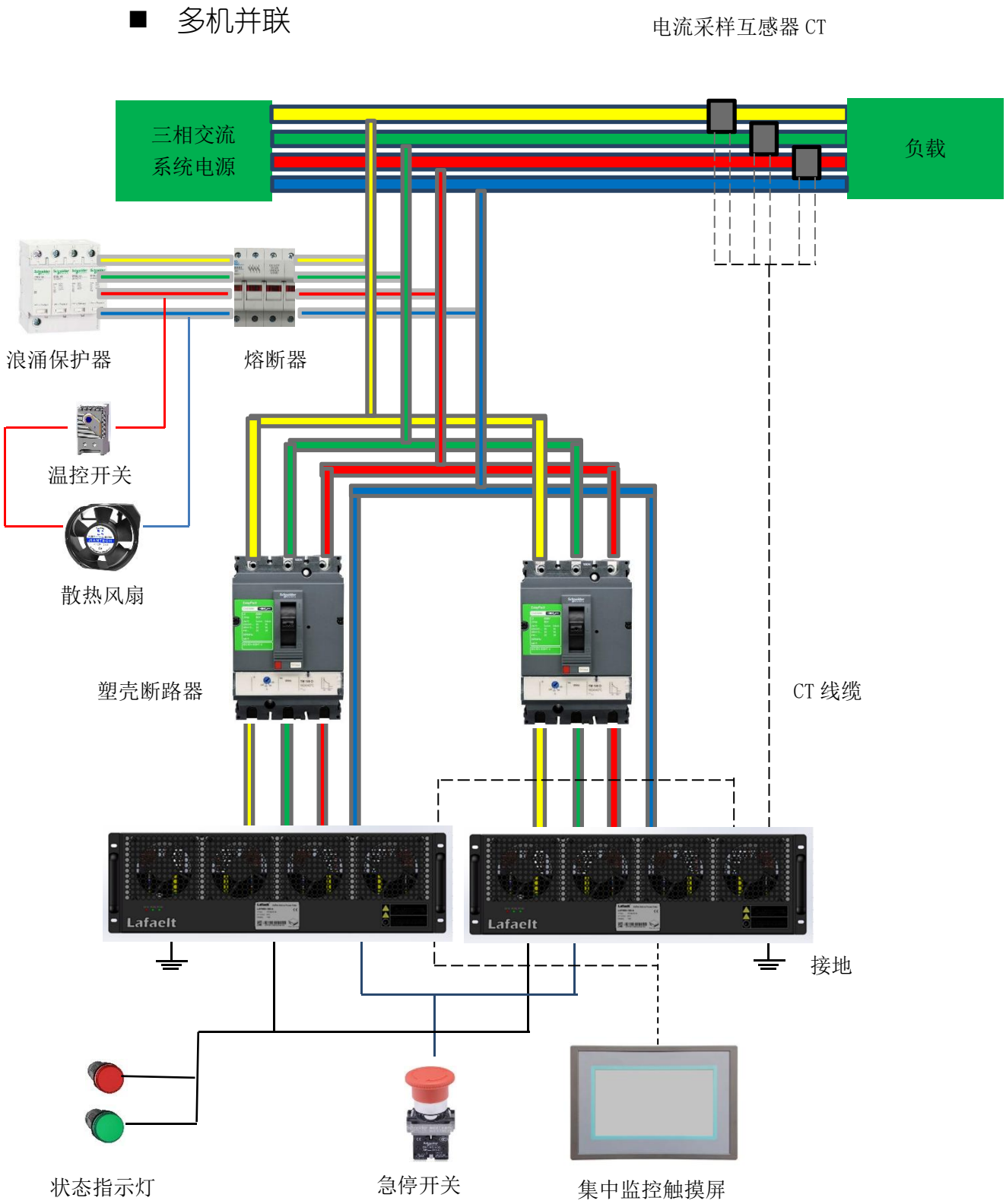


图 2-2 APF 多机并联系统连接图

- 系统连接图只作为常规情况的主要元器件连接参考，部分项目会根据项目情况稍有不同。
- 电流采样互感器的位置不同，电流互感器的二次接线稍有不同。此处不一一赘述详见互感器位置的内容。
- 系统连接图中的二次接线只是简单示意，详细接线参照产品的工程图纸。

2.2 系统构成及配件选型

配件名称	安装位置	功能说明	选型建议
 塑壳断路器 （必须安装）	● 模块的电源输入端 ● 机柜式模块的断路器安装在柜内 ● 壁挂式模块的断路器安装在壁挂模块配套安装的配电箱内	● 控制模块的通断 ● 同时具有过载、短路和欠电压保护功能，能保护线路和模块不受损坏。	● 一般可一个模块配置一个塑壳断路器，也可以多个模块配置一个大的塑壳断路器 ● 塑壳断路器的额定电流建议根据模块额定电流的 1.25~1.5 倍来选择 ● 极数 3P/4P、热磁脱扣 ● 分断能力 35KA 及以上
 浪涌保护器 （选择性安装）	● 模块的电源输入端，塑壳断路器的上口 ● 安装在柜内或者配电箱内	● 为柜体和模块提供安全防护。当电气线路中产生尖峰电流或者电压时，浪涌保护器能在极短的时间内导通分流，从而避免过电压对电气回路中其他设备的造成损害。	● 极数 3P+N ● 最大放电电流 Imax 40kA 及以上

 熔断器 （选择性安装）	● 浪涌保护器输入端。 ● 安装在柜内或者配电箱内。	● 浪涌保护器前安装熔断器的作用多数是当浪涌保护器内部元件出现持续短路故障时，避免出现燃烧等火灾事故；	● 额定电流 32A 及以上 ● 极数 4P
 集中监控触摸屏 （选择性安装）	● 机柜式安装的，可安装在柜体柜门上 ● 壁挂式安装的，可安装在配电箱的箱门上 ● 通讯接于模块的 RS485 □	● 集中监控，更方便的查看和设置参数。	● 我公司配套，也可单独购买
 急停开关 （选择性安装）	● 安装在柜门上或者配电箱的箱门上。 ● 并接于模块的 EPO、+24V □。	● 当柜内或者模块发生异常情况时（冒烟、异响、火光）可立即按下急停开关，让模块停止工作，有效保护模块。	● 按钮释放型 ● 操作部直径 40mm
 温控开关 （选择性安装）	● 安装于柜内端子排 ● 接于风扇的电源输入□	● 通断风扇的电源	● 耐压 250V ● 过载电流 10A ● 常开型，超过 35℃闭合
 风扇 （必须安装）	● 安装柜体后柜门上	● 模块数量≤2 时，建议安装 2 个风扇。 ● 模块数量＞2 时，建议安装 4 个风扇。	● AC220V 50HZ ● 87W 及以上 ● 风量 850CFM ● 运转方向逆时针 ● 建议尺寸 254*254*89

 指示灯 （选择性安装）	● 安装在柜门上 ● 接于继电器的常开常闭触点回路内。	● 显示模块运行/停止、正常/故障状态	● AC220V ● 红色和绿色 ● 扭头直径 22mm
 电流互感器 （必须安装）	● 安装在配电系统主母排上。	● 检测配电系统的负载电流。	● 变比必须/5，100/5-10000/5 间随意选择 ● 精度 0.5 以上 ● 额定负载 2.5VA 以上
其它配件			

一次线缆/铜排

线缆选型：

● 不同容量及电流等级下的 APF 进线电缆选型应遵照电气相关规定，并考虑环境条件进行选择，下表可作为参考：

装置额定电流	35A	50A、75A /50k	100A	150A	200A
ABC 三相电缆	16mm²	25mm²	35mm²	70mm²	95mm²
N 线规格	16mm²*2	25mm²*2	35mm²*2	70mm²*2	95mm²*2

注：APF 以电流为额定值。如果是铝电缆，则对应到相应的铜线载流量规格。

● 线缆通常选用 BVR 多股铜芯聚氯乙烯绝缘软电线。

● 如电流比较大，可根据情况采用两根双并使用；

● 因部分项目存在 3 次谐波，谐波电流会在 N 线上产生叠加，电流达到相线的 3 倍，故 N 线规格必须比相线大一个规格，100A、150A、200A 模块 N 线端子有 2 个，必须要接 2 根 N 线。

铜排选型：

装置额定电流	150A 以下	150A~300A	300A~600A	600A~900A
铜排规格	20*4	30*4	50*5	60*8

–

<table>
<tr><td>其它线缆</td><td>参考选型：

<table>
<tr><th>名称</th><th>规格</th></tr>
<tr><td>浪涌保护器一次线缆</td><td>6㎜²BVR 多股铜芯软线</td></tr>
<tr><td>风扇回路线缆</td><td rowspan="3">1.5㎜²BVR 多股铜芯软线</td></tr>
<tr><td>急停开关回路线缆</td></tr>
<tr><td>指示灯回路线缆</td></tr>
<tr><td>接地线缆</td><td>黄绿色 BVR 多股铜芯软线；
保护接地 PE 线选择建议：当交流相线线径 S≤16㎜² 时选用线径与相线相同;相线线径 16≤S≤35㎜²，保护地线线径选用 16㎜²；相线 S>35㎜²，选用相线线径的一半作为保护地线的线径。</td></tr>
<tr><td>CT 电流互感器采样信号线</td><td>CT 电缆选用 2.5mm2 屏蔽双绞线 RVSP2×2.5（线长 L<15m），或选用 4mm2 屏蔽双绞线 RVSP2×4（线长 15m<L<30m）。</td></tr>
<tr><td>触摸屏通讯线</td><td>电话线，本公司配套提供</td></tr>
</table>
-</td></tr>
</table>

- 以上 APF 系统的主要相关配件如上表所述，可供参考。但不代表所有项目与其完全相同。实际项目上如存在一些特殊或差异，可根据情况进行合理调整。

安装与接线

3.1 安装注意事项

3.1.1 安装环境

安装环境要求	
注 警	1）环境温度：周围环境温度对 APF 的寿命有很大影响，不允许 APF 的运行环境温度超过允许温度范围（-10℃~40℃）。如温度低于-10℃，则需增加合适的加热设备；如温度高于 40℃则需增加空调等降温散热设备。 2）APF 装于阻燃物体的表面，且安装周围要有足够的散热空间，其工作时会产生大量热量。 3）请安装在不易振动的地方。振动不应大于 0.6G。特别注意远离冲床等冲压设备。 4）避免装于避免阳光直射、潮湿、有水珠的地方。 5）避免装于空气中有腐蚀性、易燃性、易爆性气体的场所。 6）避免装在有油污、粉尘的场所。 7）机架式模块安装在机柜内时，柜体需满足相关标准和规定。

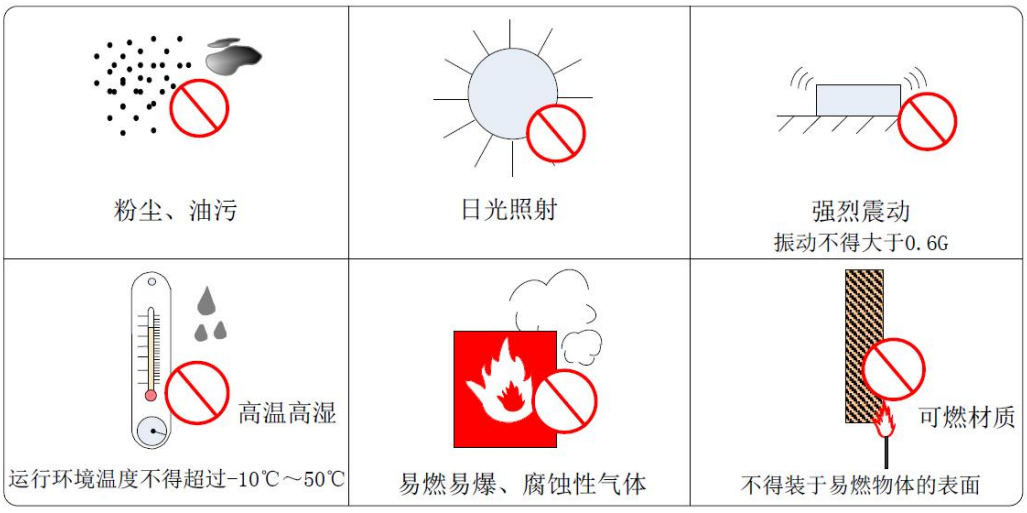


图 3-1 安装环境要求示意图

3.1.2 安装空间与方向

1）安装空间

APF 安装时，要保证进出风口的空间。

安装空间的要求	
注 警	● 严禁遮挡模块出风口 ● 立柜式安装，在机柜的前后出口。至少要预留600mm的进出风空间以及后方维护空间。并保证柜体后门能正常打开和关闭。

■ 柜式安装空间要求

（1）柜式安装时，模块从前方进风，向后方排风。热量从前往后散发。

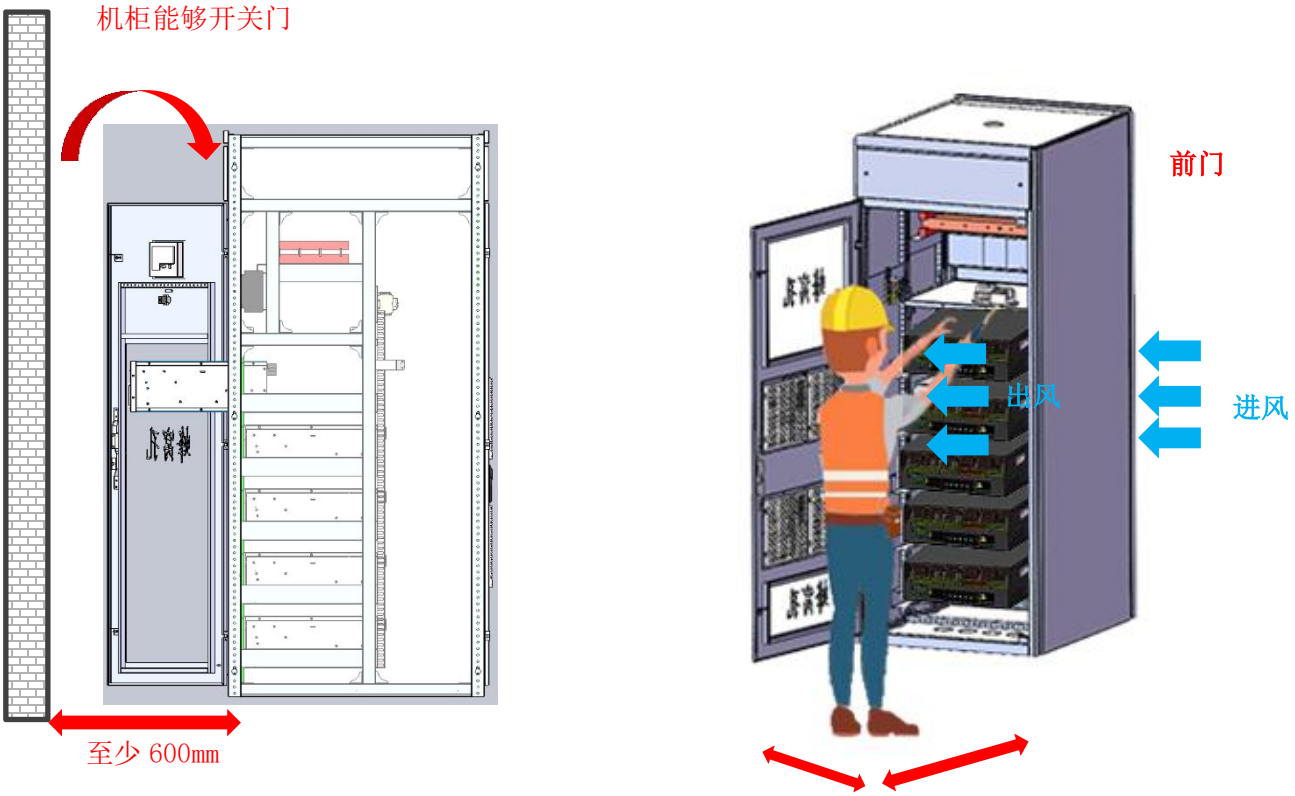


图 3-2 立柜式安装空间要求示意图

（2）安装方向

装置安装时请以水平平放、侧卧进行安装，尽量不要以倒立或者倾斜等其他方向进行安装。

3.2 安装指导

3.2.1 柜式安装

（1）柜体构成

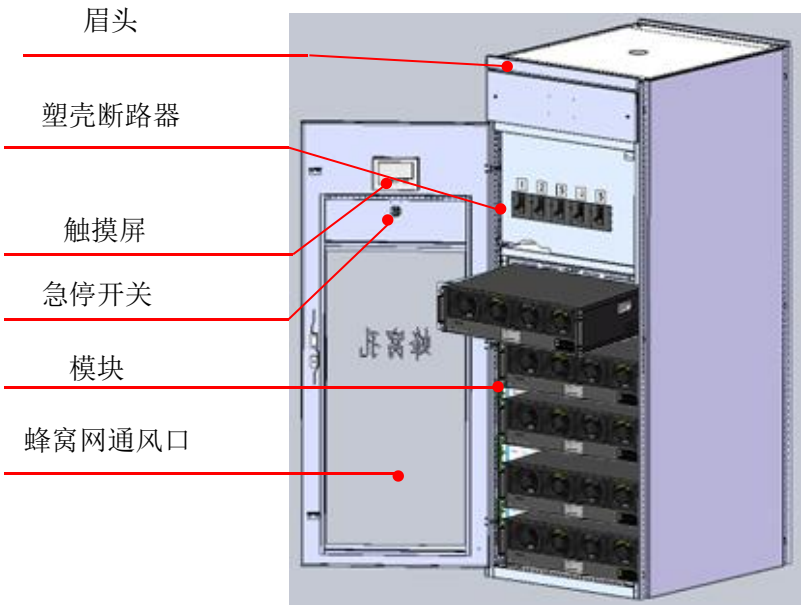


图 3-4 整柜示意图（正面）

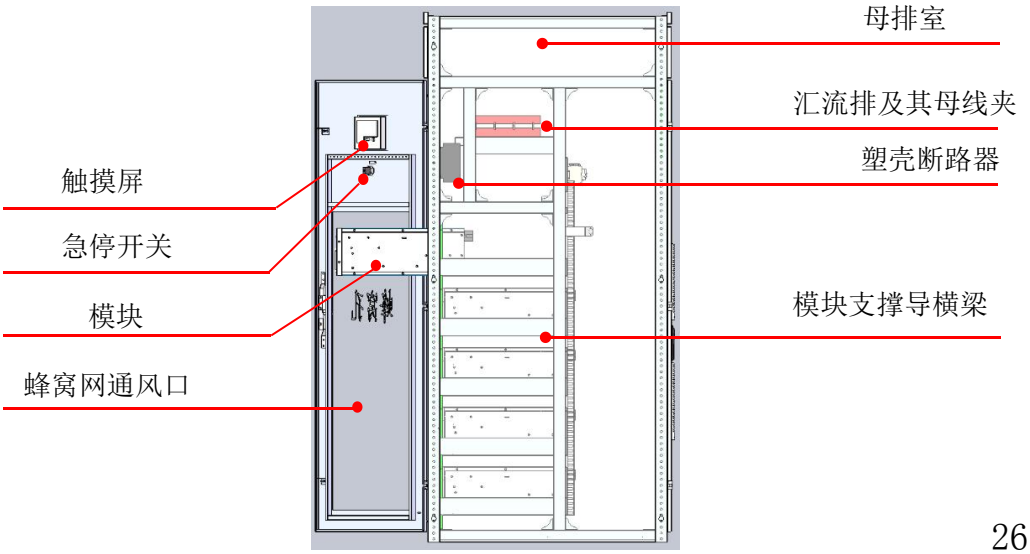


图 3-5 整柜示意图（侧面）

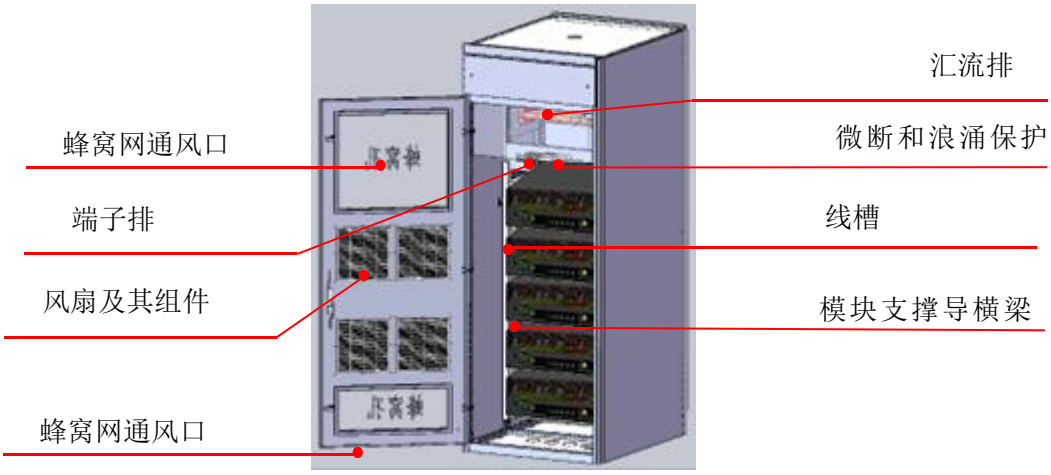


图 3-6 整柜示意图（背面）

设备从上至下分三部分，最顶端为母线室，穿过低压成套设备的系统贯穿母排。第二部分为断路器室，每个模块分配一个断路器，多个断路器通过内部汇流排连接，汇流排与母线室的系统贯穿母排相连。下方为模块室，单柜最多可放 5 个模块。

柜门上可安装触摸屏与急停按钮。如果需要更好的监控模块状态、更方便的操作，可以在柜门上安装 7 寸的外置触摸屏。急停按钮的作用是当柜内出现异响或者冒烟等异常现象，则立即按下急停按钮，使模块处于待机，避免模块运行造成故障的扩散和加重。

模块室的前后门板都需要开蜂窝孔通风散热，风道的方向为前方进风，后方出风。

当柜内模块数量≤2 只时，建议在后门安装 2 只风扇；当模式数量＞2 只时，建议安装 4 只风扇。

- 如第二章系统连接中说明的内容，柜体内有些配件是必须的，有

些配件是选择性安装的。可根据实际项目情况来选择。此处柜体结构及配件选择是由我公司结构工程师和电气工程师进行设计的，只是考虑了常规项目情况，有些部件并没有安装体现，如柜门安装状态指示灯、柜门装电流表等。

- （2）模块的安装固定

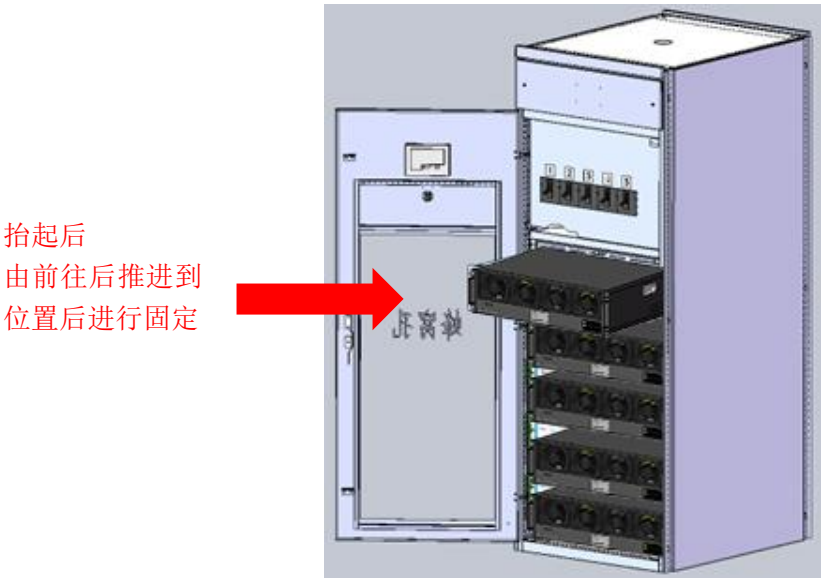


图 3-7 模块安装示意图

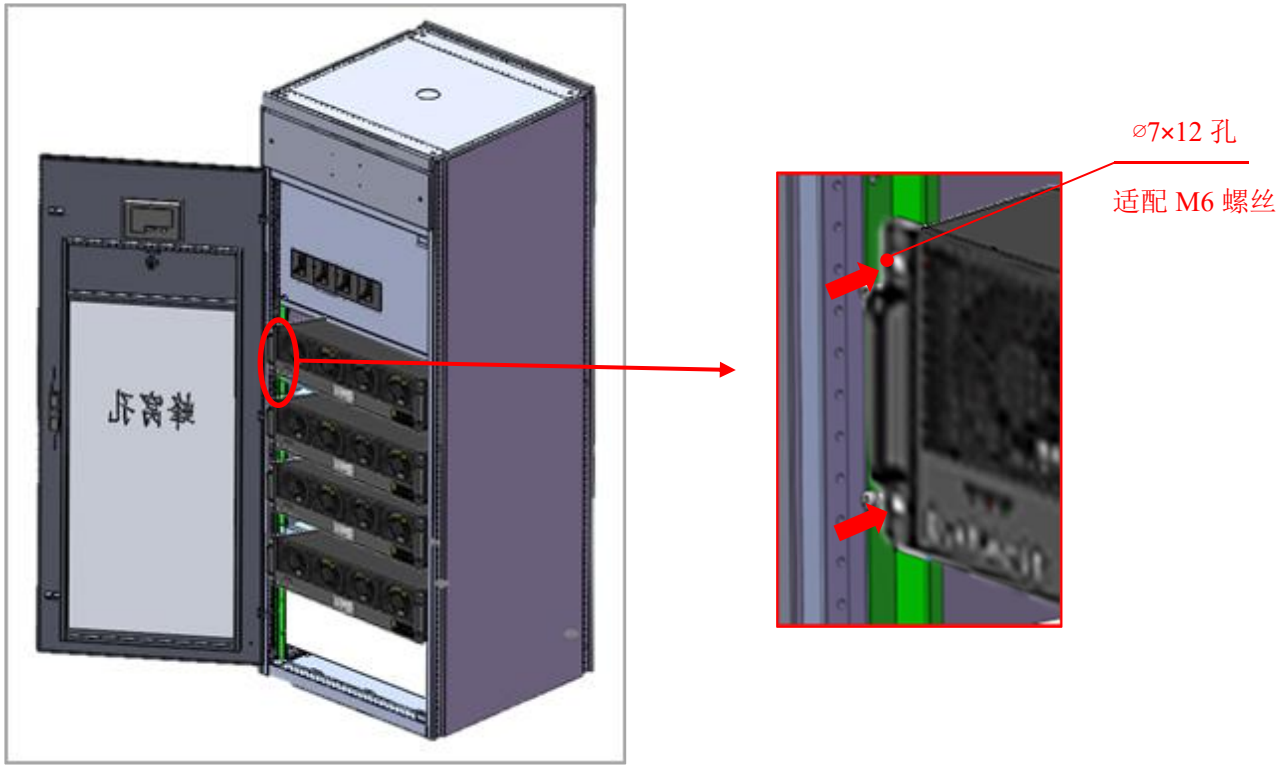
注意	● 模块重量≤38kg，搬运需要借助一定的运输设备来完成，安装时需至少 2 个人员抬起安装。 ● 安装时请轻放模块，并注意不能磕碰模块，尤其模块前面板的触摸屏。如造成损坏，均不属于公司的责任范畴和保修范围。

模块安装于柜内时，单个模块我司将标配俩个安装挂耳将模块前端与柜体固定。此外我司建议在模块的左右两侧安装两个导轨限位横梁来

限位模块。导轨限位横梁后侧设置固定孔，与模块螺栓固定起来。模块后侧左右两边各有一个的固定孔，用 M6 的螺丝进行固定。（安装挂耳由我司提供，导轨限位横梁推荐安装，我司不提供，建议柜体钣金生产时配套。）

- 此处模块的固定和安装方式是由本公司结构工程师进行设计，其安装方便，满足机械强度的要求、并且运输拆卸维护方便。
- 如客户有其它的安装固定方式也可，只要保证机械强度和模块的安装空间散热条件即可。

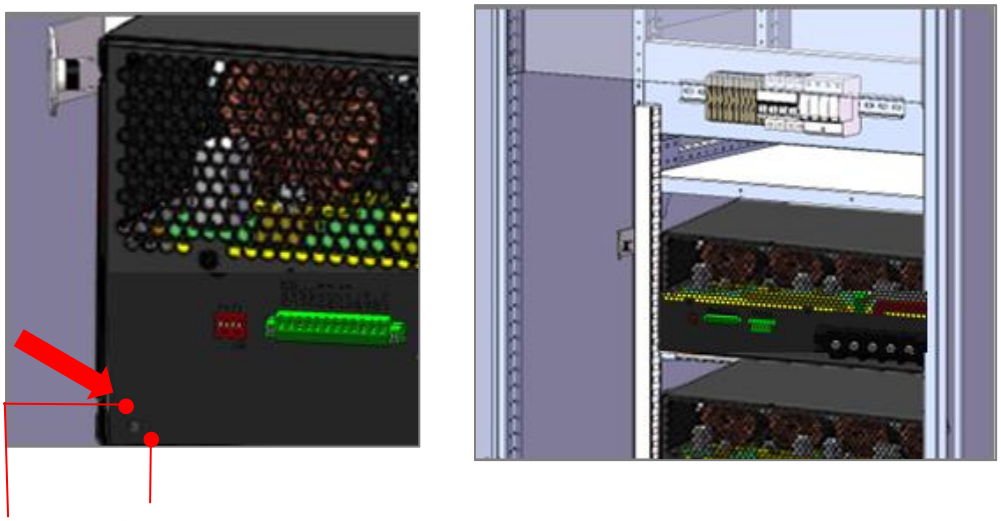
安装挂耳与柜体的固定



注：M6 螺丝需自备。

图 3-8 安装挂耳固定示意图

导轨限位横梁（推荐固定方式，我司不提供，建议柜体钣金生产时配套。）



（相关安装配件非我公司提供）

图 3-9 模块安装固定局部示意图

（3）集中监控触摸屏的安装

机柜安装时，可在柜门上安装 7 寸的外置集中触摸屏来集中监控柜内的所有模块。触摸配套有安装部件进行固定。触摸屏配有 DB9 端口，以及电源端口端子。

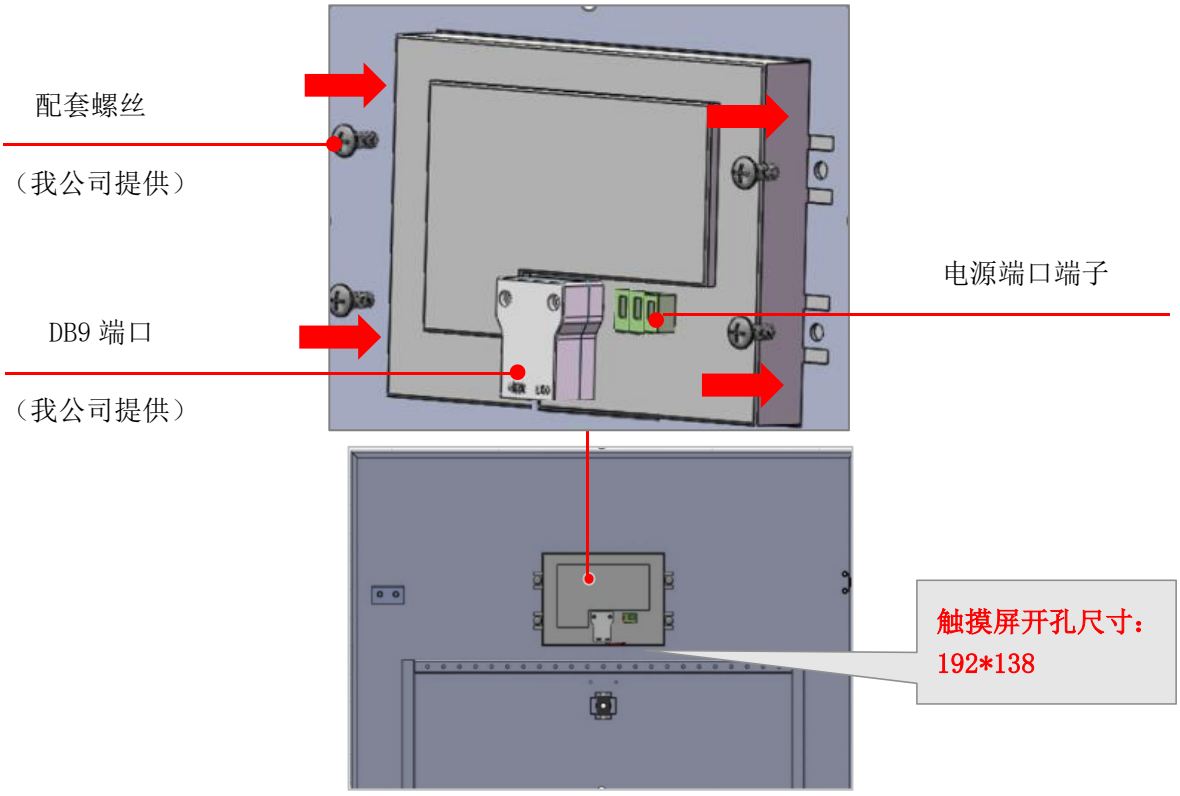


图 3-10 触摸屏安装示意图

3.3 接线

3.3.1 一次接线（1）接

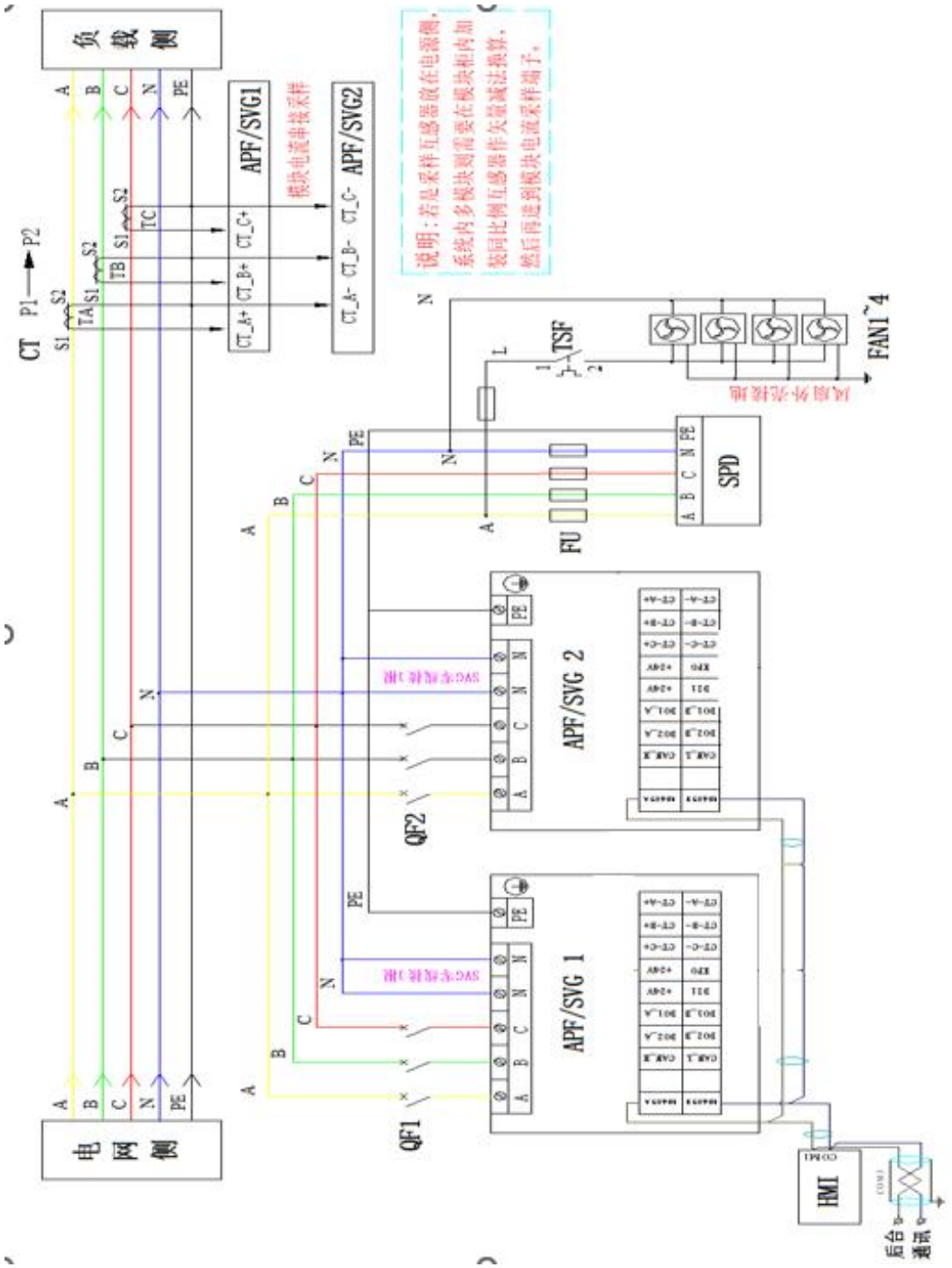


图 3-11 接线示意图

（2）一次线缆/铜排选型

线缆选型：

不同容量及电流等级下的 APF 进线电缆选型应遵照电气相关规定，并考虑环境条件进行选择，下表可作为参考：

装置额定电流	35A	50A、75A /50k	100A	150A	200A
ABC 三相电缆	10mm²	25mm²	35 mm²	70mm²	95mm²
N 线规格	10mm²*2	25mm²*2	35mm²*2	70mm²*2	95mm²*2

注：APF 以电流为额定值。如果是铝电缆，则对应到相应的铜线规格。

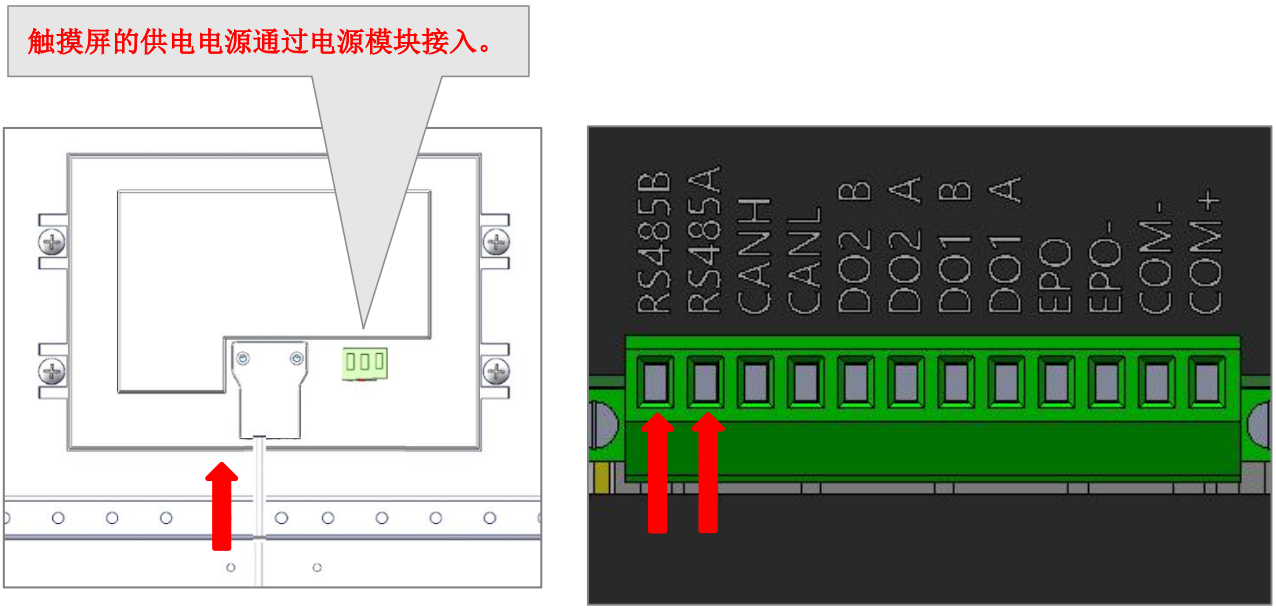
- 线缆通常选用 BVR 多股铜芯聚氯乙烯绝缘软电线。
- 如电流比较大，可根据情况采用两根双并使用；
- 零线（N 线）：一般情况选择与相线一致即可。在三相不平衡或者 3 次谐波较大的场合 N 线建议选大一个规格的线缆，因为此时 N 线处电流较大。如果实际项目中 N 线有准确的电流值，可根据电流选择 N 线规格。
- **接地线缆（PE 线）**：黄绿色 BVR 多股铜芯软线；当交流相线线径 S≤16mm²时选用线径与相线相同;相线线径 16≤S≤35mm² ,保护地线线径选用 16mm²；相线 S>35mm²,选用相线线径的一半作为保护地线的线径。

铜排选型参考：

装置额定电流	150A 以下	150A~300A	300A~600A	600A~900A
铜排规格	20*4	30*4	50*5	60*8

3.3.2 集中监控触摸屏接线

外置集中触摸屏通过模块背面 RS485 口进行连接通讯，固定部件、端口转接模块及通讯线缆是标准配件。通讯线一端插入模块 RS485 口，另一端插入触摸屏背部端口模块上即可。



触摸屏端接线　　（通讯线我公司配套提供）　　模块端接线

图 3-12 集中监控触摸屏通讯线接线示意图

3.3.3 CT 接线

（1）CT 位置与方向

APF 并联安装在系统中，电流互感器 CT 可任意装在电网侧或者负载

侧，在监控触摸屏上可根据安装情况设置 CT 位置为电网侧或负载侧。

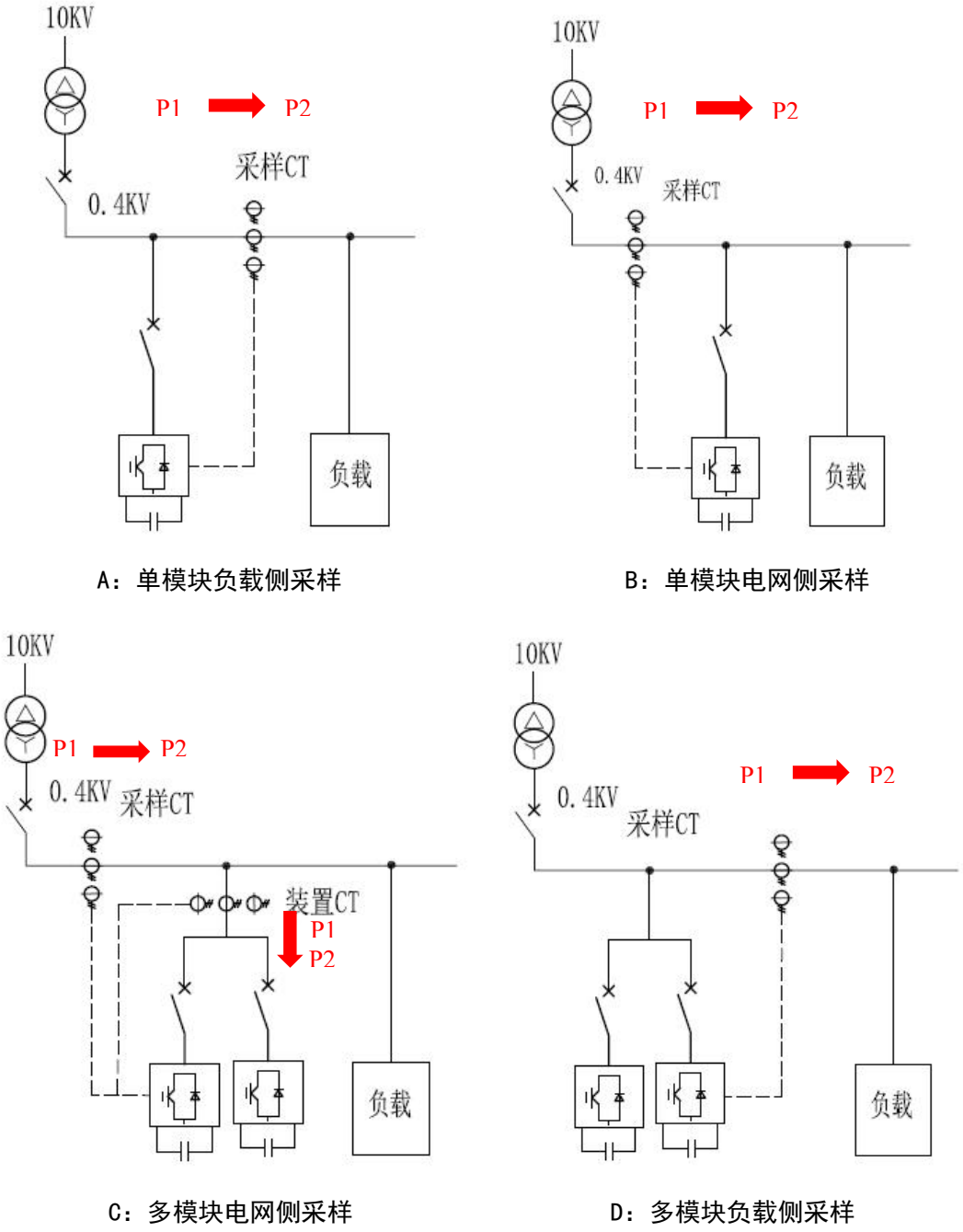


图 3-13 CT 采样方案示意图

■ 单模块

APF 单模块接入系统中时，CT 位置可安装在电网侧或者负载侧。如图 A、B 所示。

■ 多模块

多模块并机接入系统中时，采样电网侧和采样负载侧则不同，采样负载侧接线更方便。

负载侧采样：多模块并机采样负载侧，只需要一套 CT 即可。如图 D 所示。

电网侧采样：多模块并机采样电网侧时，需要在 APF 柜内增加装置 CT 来采样模块自身输出的电流，然后用电网 CT 信号与装置 CT 信号反并联相减得到负载侧电流信号，作为最终采样信号输入到模块内，模块与模块之间采样信号串接。如图 C 所示。

■ APF 与电容补偿混合使用

APF 与电容电抗补偿设备共同使用时，原则是 APF 主进线点比电容器更靠近负载，原因是 APF 补偿谐波，这样 APF 接入点向电网侧方向，流过的是补偿谐波后的电流，基本上以基波为主，有利于提高电容器的使用寿命。CT 位置可以放在电网侧也可以放在负载侧。

 **注意 警告**	● APF 在用于谐波补偿时，不能与纯电容一起使用，必须串联电抗器，使其对所需补偿次数的谐波呈感性特征，避免产生谐振，否则可能会导致 APF 故障损坏或纯电容补偿设备损坏；

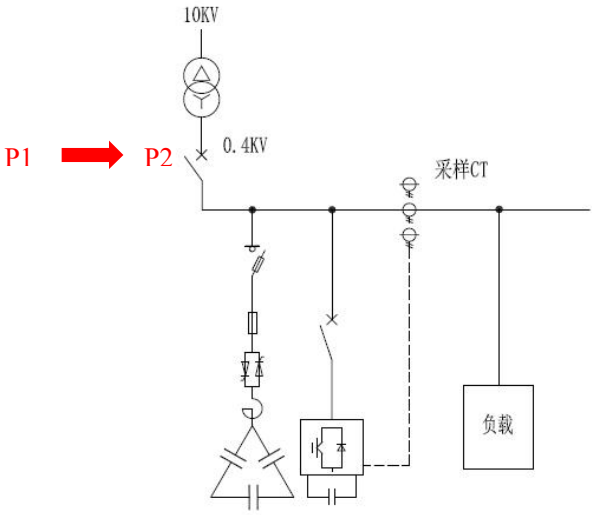


图 3-14 APF CT 采样位置示意图

CT 的安装方向：P1 朝向电网，P2 朝向负载。

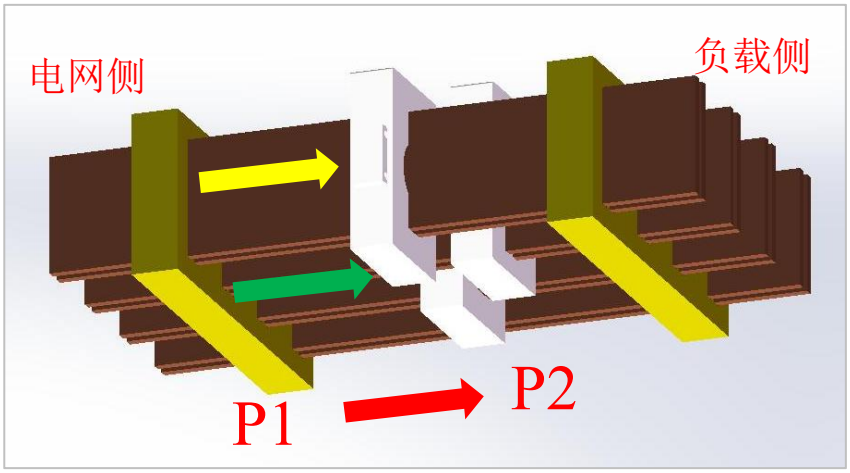
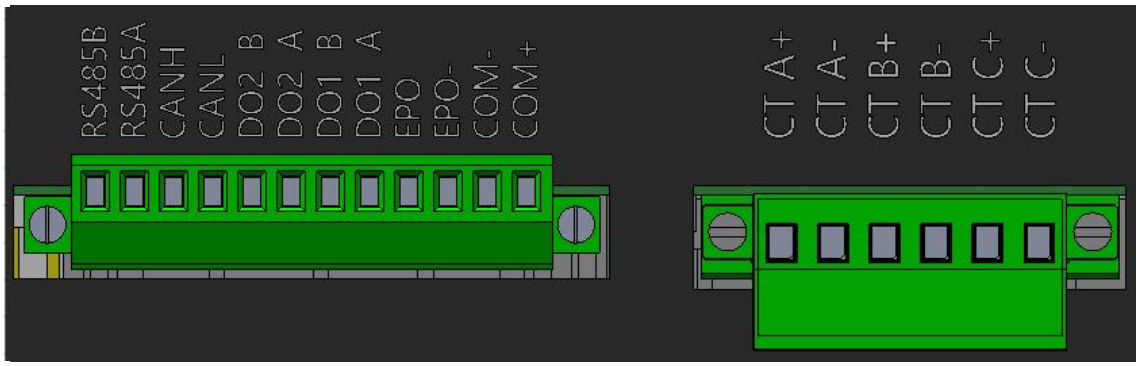


图 3-16 电流互感器 P1P2 方向示意图

- 若 CT 电流的流向为从 P1→P2,则 S1 为 +，S2 为 -；反之 S1 为 -，S2 为+。

（2）接线

注意 警告	**若电流互感器连接不正确，可能因开路导致电击致命！** ● 采样CT安装及接线时参考接线图纸，如有疑惑请及时联系本公司技术。 ● APF的CT安装接线必须由经过培训的合格工程师依据“电工法则”进行，严禁其他人员违规进行安装，本手册只介绍安装的基本内容，具体安装细节请参考电工规范。 ● 在安装电流互感器原边前，先用分离短路端子将二次侧短路，否则开路状态下的电流互感器在二次侧会产生高压。 ● 确保电流互感器处于短路状态，直至APF的CT连接端子都接好。 ● 在将电流互感器与 APF 分离前，用可分离短路端子将其短路。



二次信号线接口说明

序号	丝印	名称描述	备注	序号	丝印	名称描述	备注
1	RS485B	485B 信号		11	COM-	GND	
2	RS485A	485A 信号		12	COM+	24V 电源	
3	CAN_H	CAN_H 信号					
4	CAN_L	CAN_L 信号		序号	丝印	名称描述	备注
5	DO2_B	输出 2_B		1	CT_A+	互感器 A 相_+	
6	DO2_A	输出 2_A		2	CT_A-	互感器 A 相_-	
7	DO1_B	输出 1_B		3	CT_B+	互感器 B 相_+	
8	DO1_A	输出 1_A		4	CT_B-	互感器 B 相_-	

9	EPO	急停		5	CT_C+	互感器 C 相_+	
10	EPO-	GND		6	CT_C-	互感器 C 相_-	

图 3-17 模块二次端子及 CT 线缆接入示意图

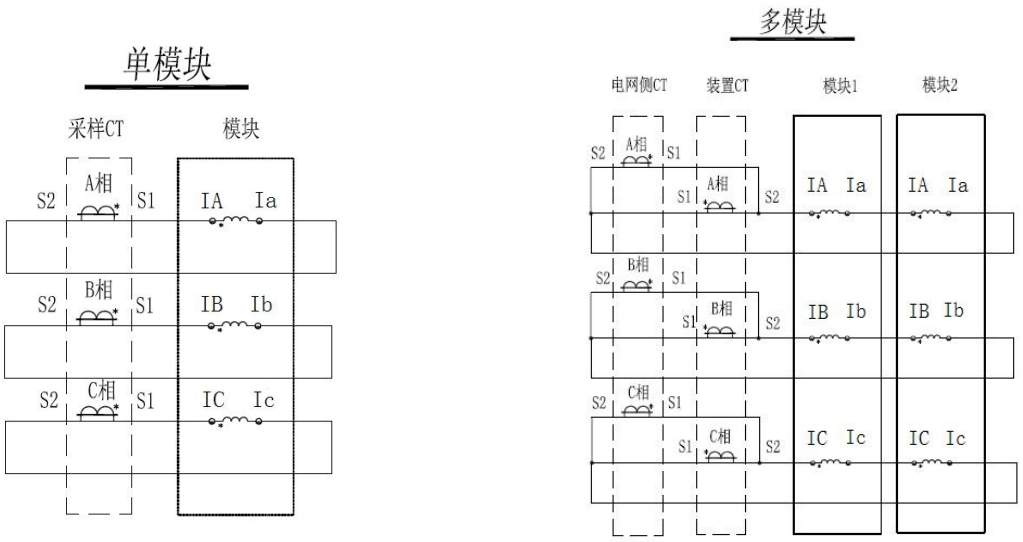


图 3-18 典型 CT 接线示意图

电网侧采样：多模块并机采样电网侧时，需要在 APF 柜内增加装置 CT 来采样模块自身输出的电流，然后用电网 CT 信号与装置 CT 信号反并联相减得到负载侧电流信号，作为最终采样信号输入到模块内，模块与模块之间采样信号串接。如图 3-18 所示。

CT 电缆选用 2.5mm2 屏蔽双绞线 RVSP2×2.5（线长 L<15m），或选用 4mm2 屏蔽双绞线 RVSP2×4（线长 15m<L<30m）。

3.3.4 急停开关接线

APF 立柜安装时，一般会在柜体柜门上安装 1 个急停开关。当柜内或者模块发生异常情况时（冒烟、异响、火光）可按下急停开关，让模块立即停止工作，有效保护模块。

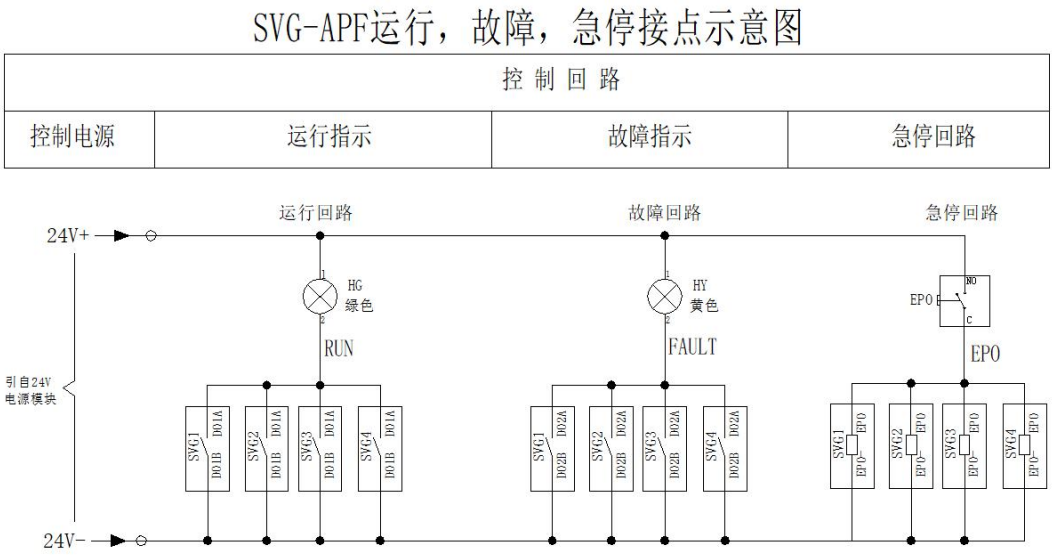


图 3-19 急停开关接线示意图

多模块并机时：各模块 EPO、EPO-并接到急停开关上，接常开信号。

主辅柜时：主辅柜各接一个急停开关。主柜急停与辅柜急停串联起来，再与各模块并接。当主辅柜任意一个柜子，按下急停开关时，所有模块立即停机。

注意	• 急停开关非强制要求安装，如果不安装，则EPO、COM+□不接线。

开关机操作指南

4.1 开机步骤

4.1.1 检查接线

（1）检查母排与断路器，断路器与设备之间的接线有无明显的相序接错问题。如发现问题需及时更改。

（2）检查设备的母线是否接紧，有无松动现象，要确保线接紧。

（3）使用万用表检测设备 A.B.C.N.PE 两两之间有无短路现象。

（4）检查 CT 接线是否有误，端子排两端接线是否对应，如不对应则务必要整改。

4.1.2 检查通讯

（1）当确保上述流程没有问题，断开急停开关，合上断路器。

（2）检查模块正面通讯状态指示灯是否正常点亮并闪烁，如果不闪烁或者不亮，则表示通讯有问题。如果触摸屏上主界面模块显示红色，则需查看每个模块的地址拨码开关是否设置正确，如果都设置成 1 肯定通讯不上的，应该将柜内模块的地址拨码开关，模块从上到下依次按照 1、2、3、4 进行设置。如果仍然通讯有问题，则需联系厂家沟通解决。

（3）进入参数设置界面，需要输入密码进行登录，其余界面无需登录。

（4）进入设置界面进行参数设置。在这个界面里用户设置相关参数，如：启动模式、工作模、CT 变比、CT 位置、功率因数等。

4.1.4 检查参数

查看页面的参数显示是否与系统中的实际参数显示一致。如果功率因数，有功无功那显示不对（比如功率因数很低，有功无功某一相或两相为负值），则可能是 CT 接线有问题，需及时与厂家联系解决。

 警告	● 执行APF开机步骤时，APF输出端子将带电。 ● 如有负载与APF输出端子相连接，请向用户确认给负载供电是否安全。如果负载尚未准备好接受供电，勿必将负

4.2 关机步骤

关机方式是直接断开 APF 上级的断路器，设备处于断电状态；关机状态下，APF 封锁 IGBT 触发脉冲，设备处于非补偿模状态。需特别指出，APF 断电后请勿即刻拆卸模块，须待模块内部电容器完全放电后方可进行操作，放电时间约 10 分钟。

 警告	● 为防止人身伤害，关机后如要做维修或开启机箱的操作，请先用万用表测量输入端处的电压，确保没有市电接入情况下再进行相关操作！ ● 模块拆卸需在断电后 10 分钟方可操作（模块内部储能电容放电约 10 分钟）。

4.3 自动启动

系统停电或电压、频率异常， APF 会自动关机，停止输出补偿电流。满足以下条件后，无需操作 APF 将自动重新启动进行补偿。

- 市电恢复正常
- APF 掉电前处于开机状态
- 自动启动延时 20s 后

如 APF 未处于开机状态，用户可通过触摸屏控制面板手动启动 APF。

7 寸大屏操作指南

当模块放在机柜内时，通常可在柜体前门板安装一个外置触摸屏，方便用户设置、查看参数。外置触摸屏为 7 寸大屏。下面是关于触摸屏的操作方法介绍。

5.1 主界面

装置通电后，屏幕处于启动状态，启动过程约持续几秒。启动成功后，若系统正常，则显示主界面如图 5.1 所示。

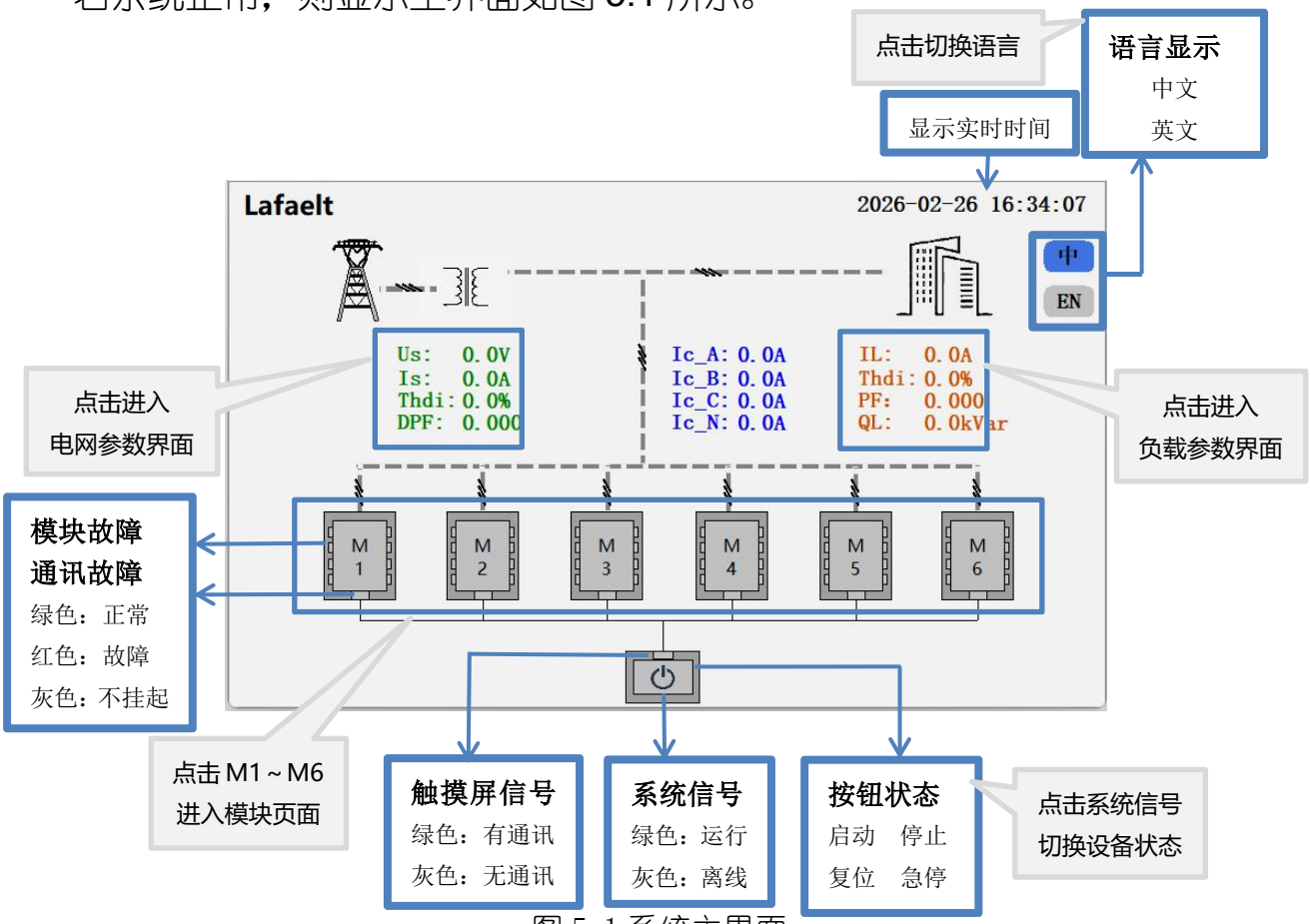


图 5.1 系统主界面

注：按钮状态———启动状态下，隐藏启动和复位按钮，显示停止和急停按钮。

停止：封锁输出。

急停：封锁输出，跳脱主回路断路器。

5.2 电网参数界面

点击导航栏的“电网”按钮，则进入电网参数界面：

图 5.2 电网参数 1 界面

图 5.3 电网参数 2 界面

51 次电网谐波电流，如图 5.4，5.5，5.6，5.7 所示：

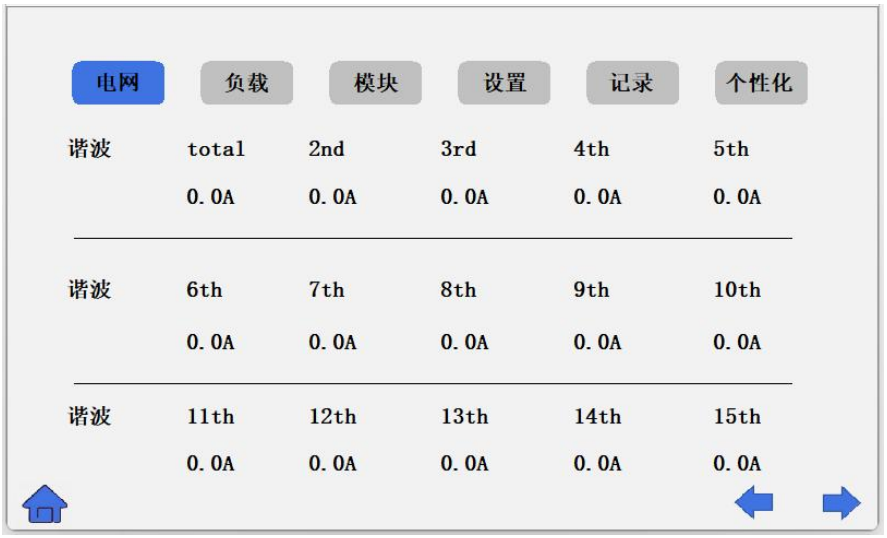


图 5.4 电网谐波 1 界面

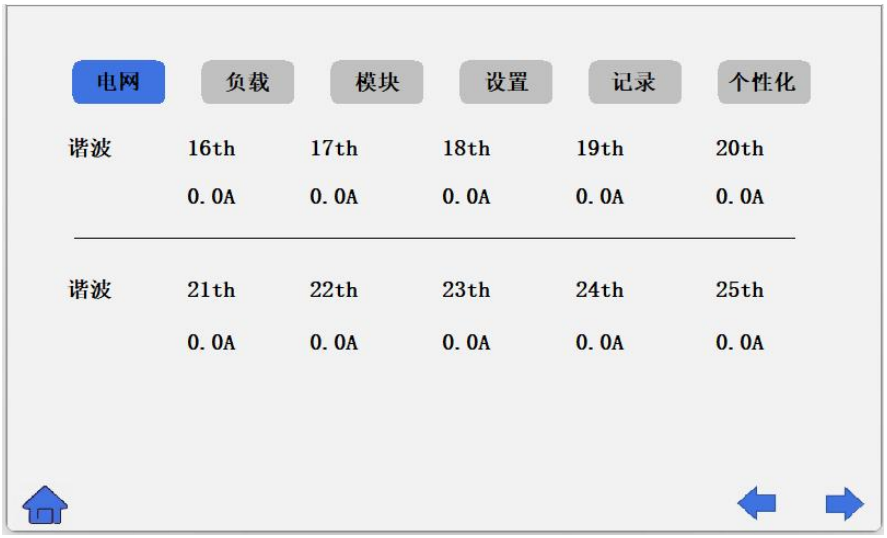


图 5.5 电网谐波 2 界面

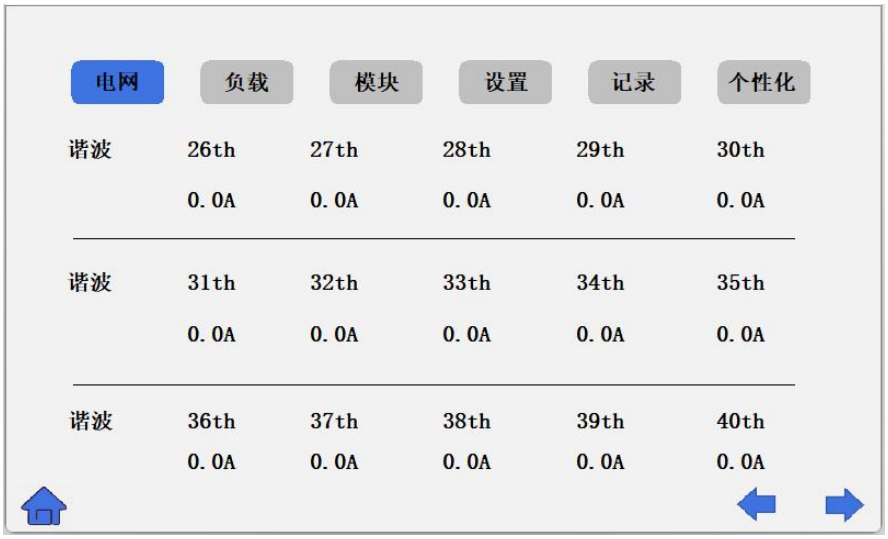


图 5.6 电网谐波 3 界面

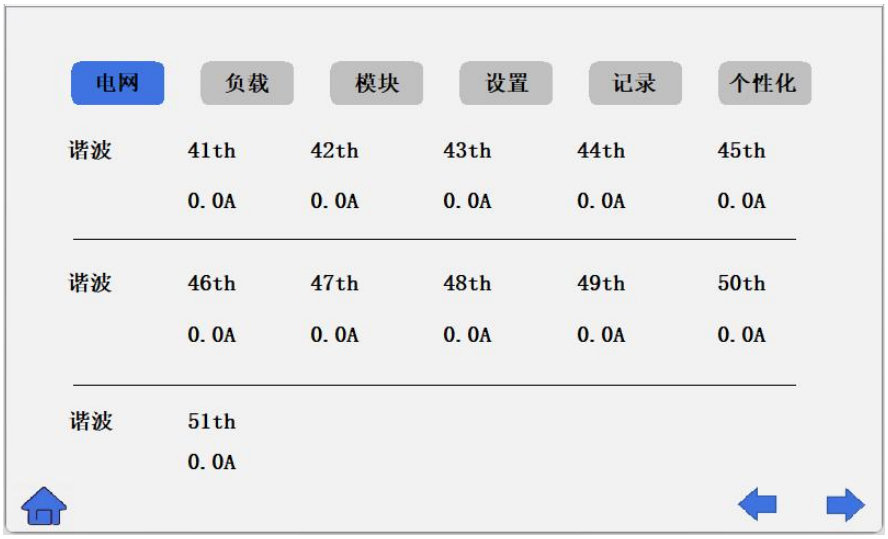


图 5.7 电网谐波 4 界面

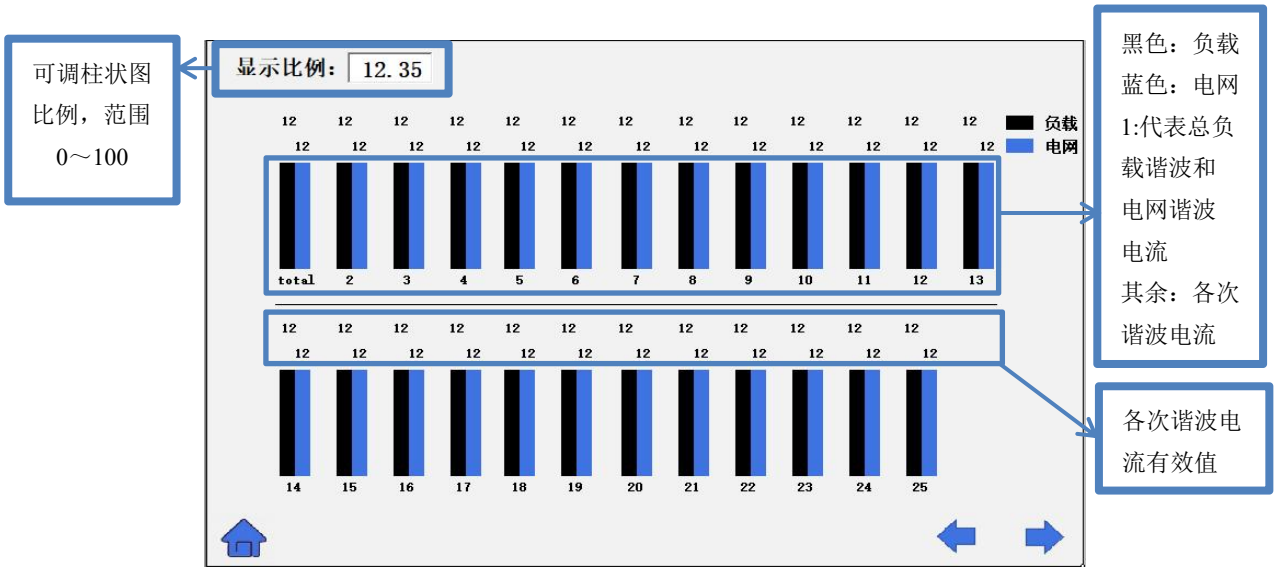


图 5.8 柱状图 1

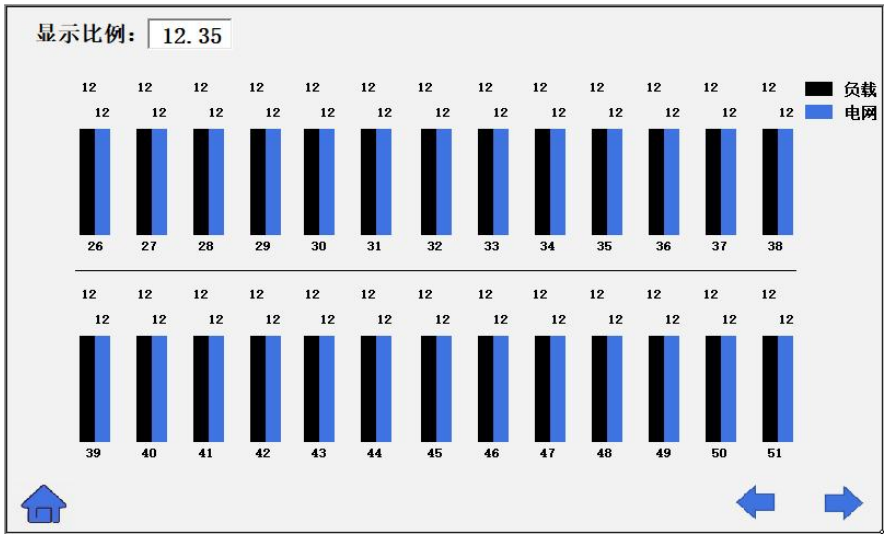


图 5.9 柱状图 2

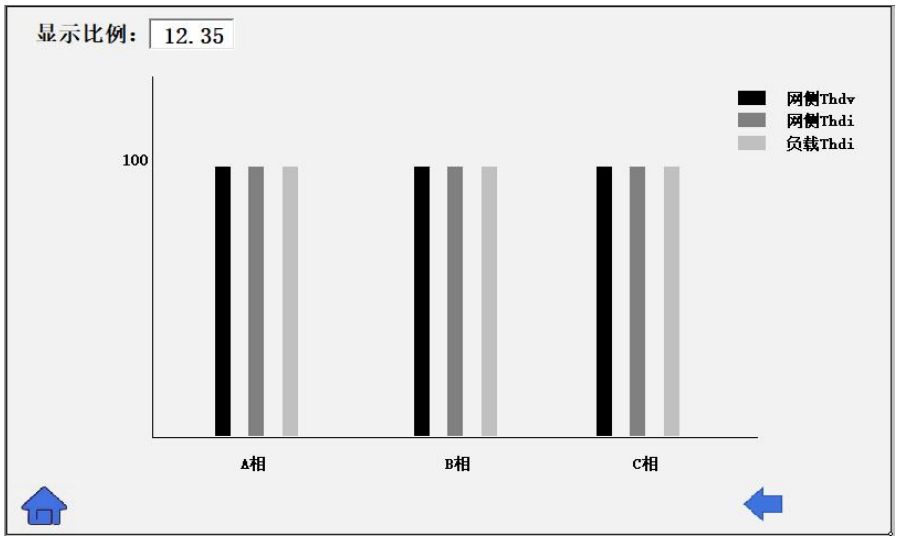


图 5.10 Thd 柱状图

5.3 负载参数界面

点击导航栏的“负载”按钮，则进入负载参数界面：

图 5.11 负载参数界面

51 次负载谐波电流，如图 5.12，5.13，5.14，5.15 所示：

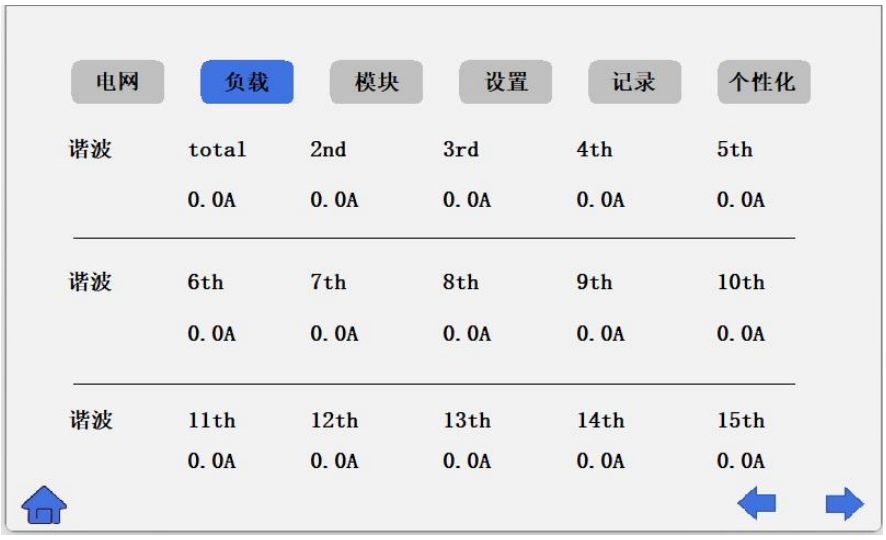


图 5.12 负载谐波 1 界面

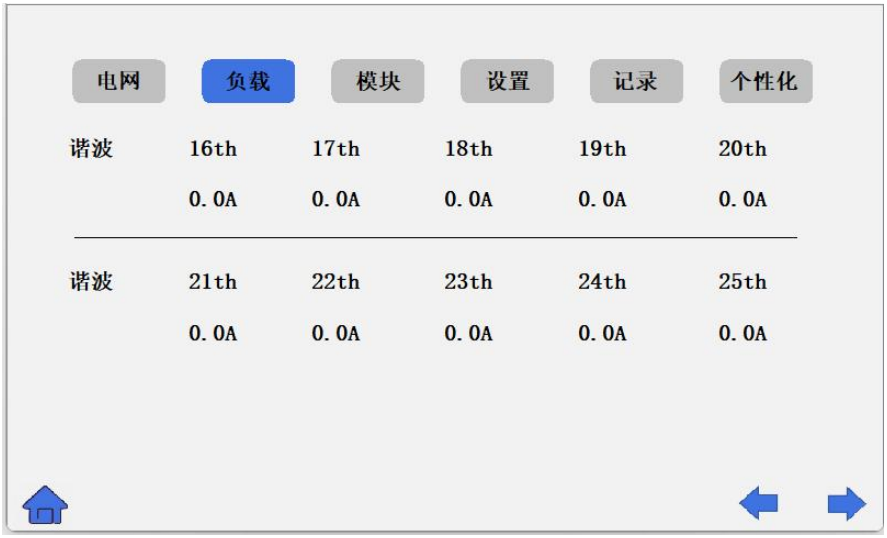


图 5.13 负载谐波 2 界面

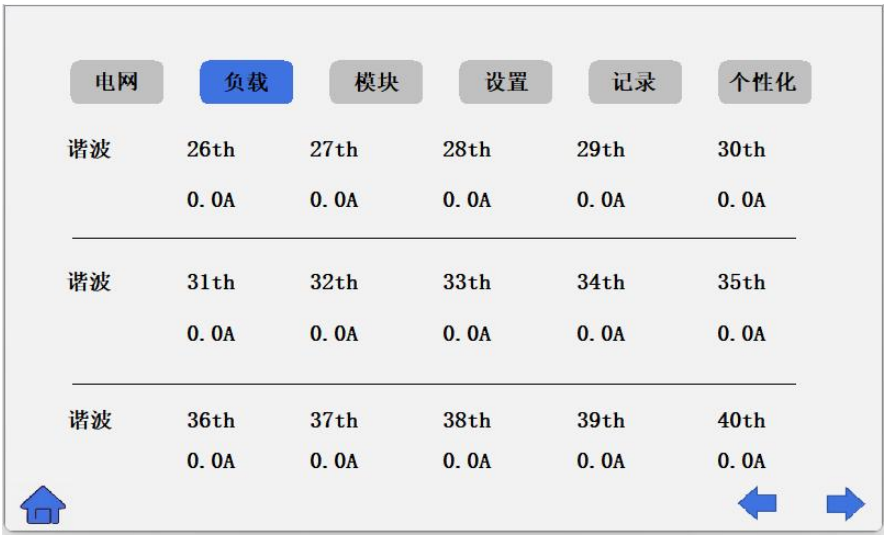


图 5.14 负载谐波 3 界面

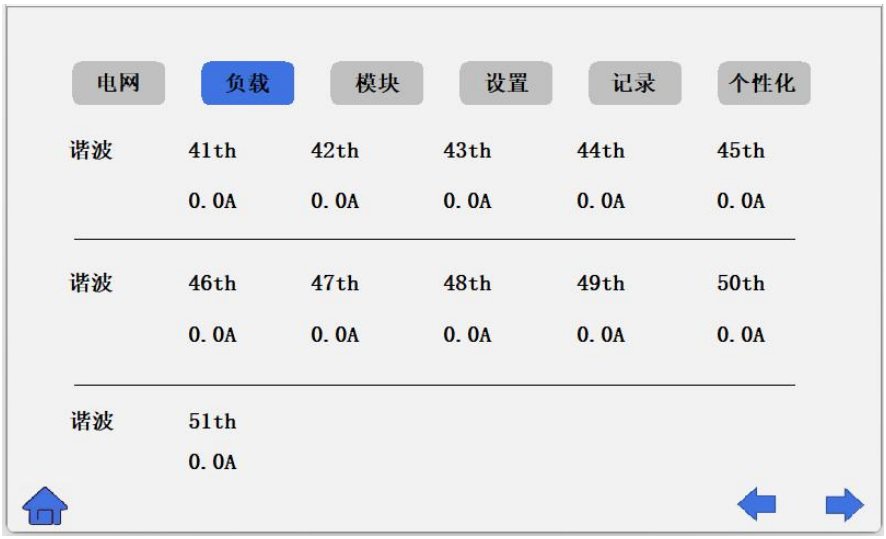


图 5.15 负载谐波 4 界面

5.4 模块参数界面

点击导航栏的“模块”按钮，则进入模块参数界面：

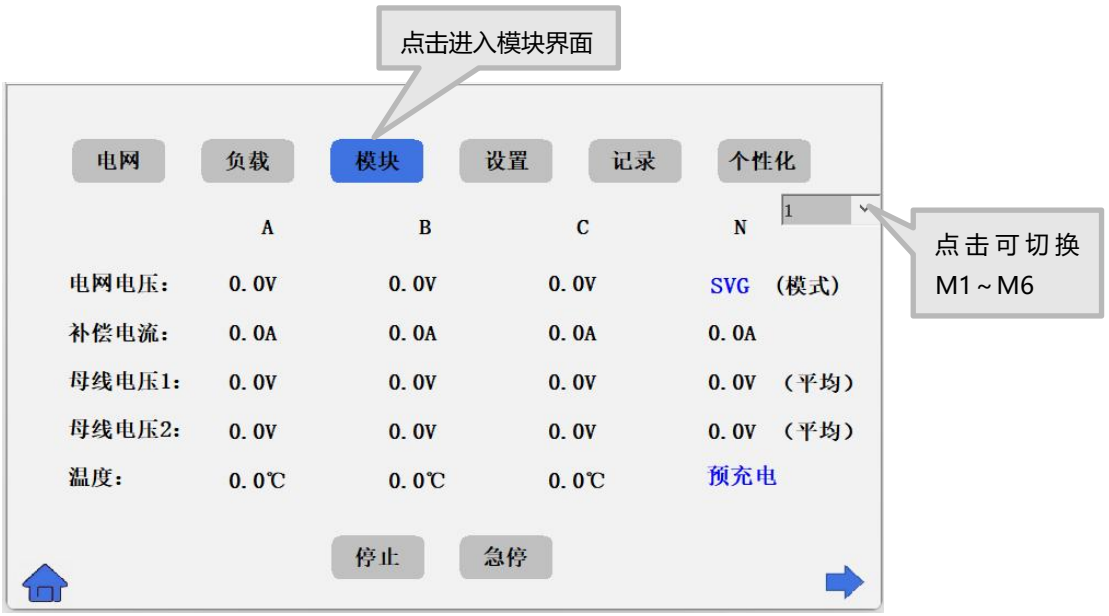


图 5.16 模块参数 1 界面

注：“设备”状态共有五个状态显示：预充电、待机、启动、停止、故障。

“单模块按钮”状态———启动状态下，隐藏启动和复位按钮，显示停止和急停按钮。

停止：封锁输出。

急停：封锁输出，跳脱主回路断路器。

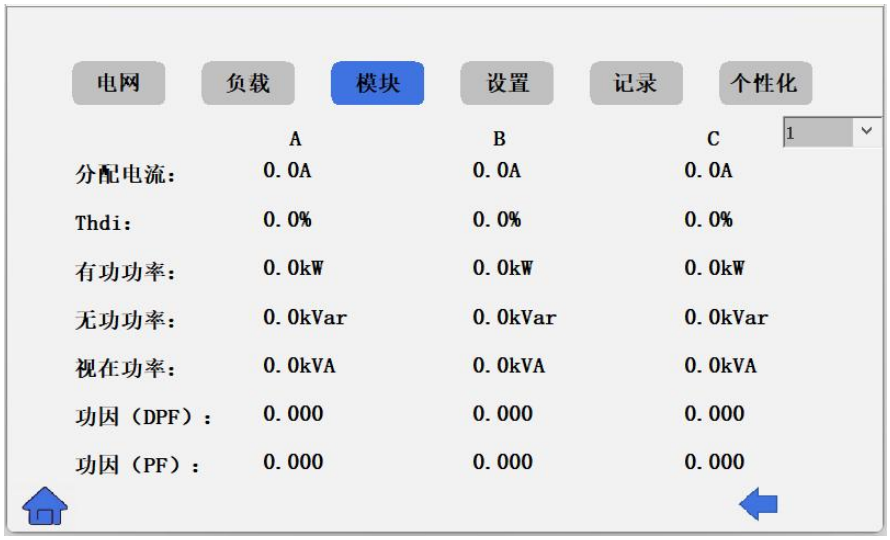


图 5.17 模块参数 2 界面

5.5 设置参数界面

点击导航栏的“设置”按钮，弹出用户登录，输入用户密码：1234。进入设置界面来修改参数：

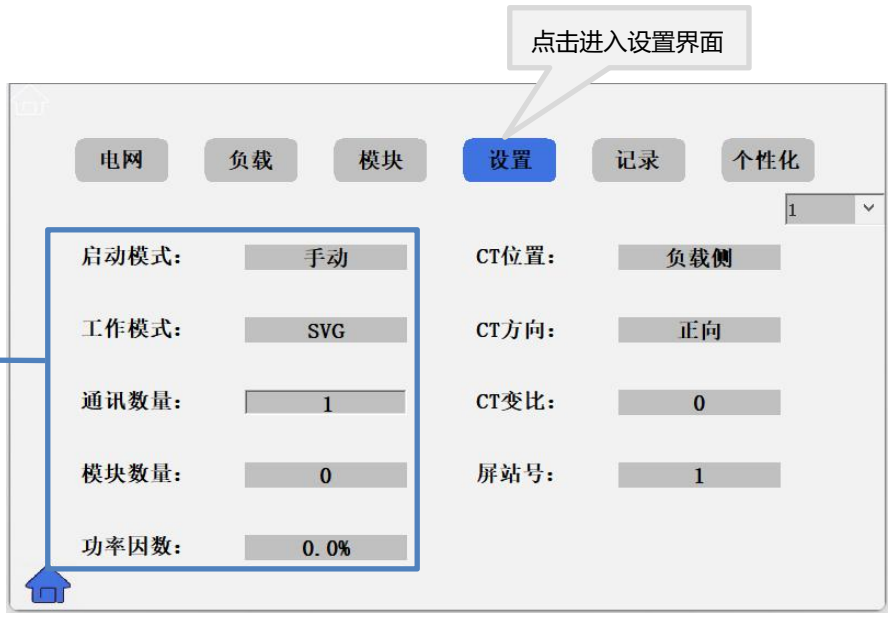
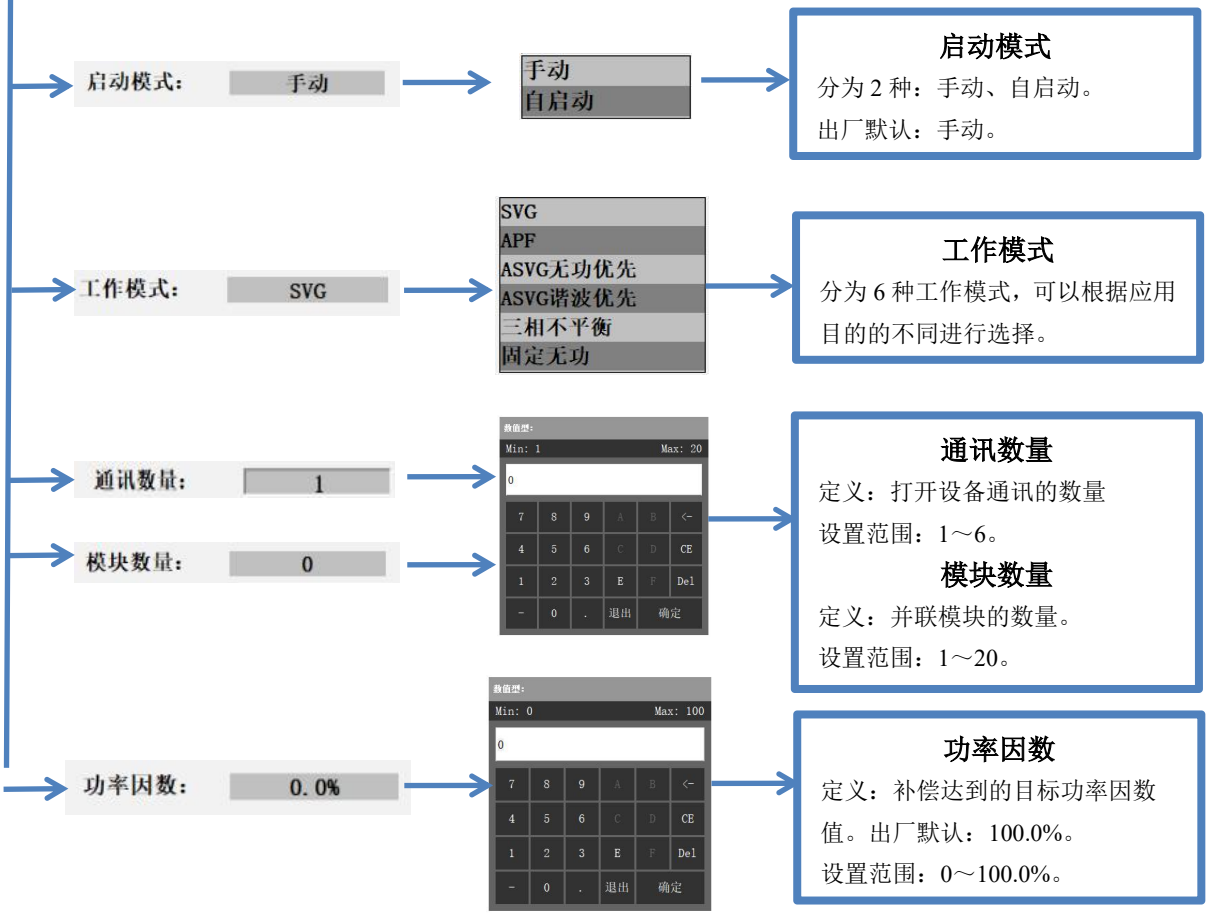
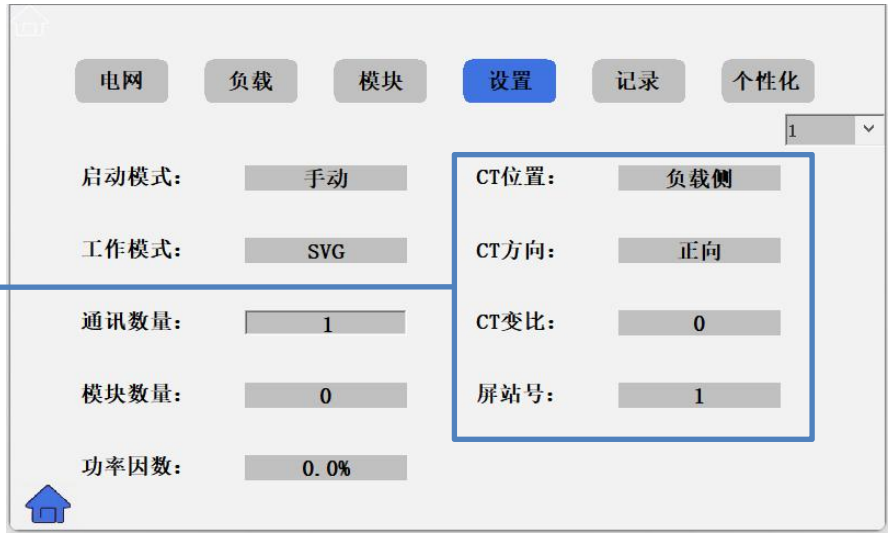
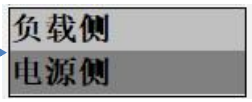

点击进入设置界面
电网
负载
模块
设置
记录
个性化
1
启动模式：
手动
工作模式：
SVG
通讯数量：
1
模块数量：
0
功率因数：
0.0%
CT位置：
负载侧
CT方向：
正向
CT变比：
0
屏站号：
1

图 5.18 设置界面


启动模式：
手动
手动
自启动
启动模式
分为 2 种：手动、自启动。
出厂默认：手动。
工作模式：
SVG
SVG
APF
ASVG无功优先
ASVG谐波优先
三相不平衡
固定无功
工作模式
分为 6 种工作模式，可以根据应用目的的不同进行选择。
通讯数量：
1
模块数量：
0
Min: 1
Max: 20
Min: 0
Max: 100
通讯数量
定义：打开设备通讯的数量
设置范围：1～6。
模块数量
定义：并联模块的数量。
设置范围：1～20。
功率因数：
0.0%
功率因数
定义：补偿达到的目标功率因数值。出厂默认：100.0%。
设置范围：0～100.0%。





CT 位置

负载侧：CT 安装在接入点前侧。

电源测：CT 安装在接入点后侧。

CT 方向

正向：电源指向负载。

反向：负载指向电源。

CT 变比

定义：CT 的一次、二次侧额定电流大小。出厂默认：200。

设置范围：0～10000。

屏站号

通过关联屏站号，来检测设备运行情况。设置范围：0～255。

5.6 实时记录界面

点击导航栏的“记录”按钮，则进入实时记录界面：

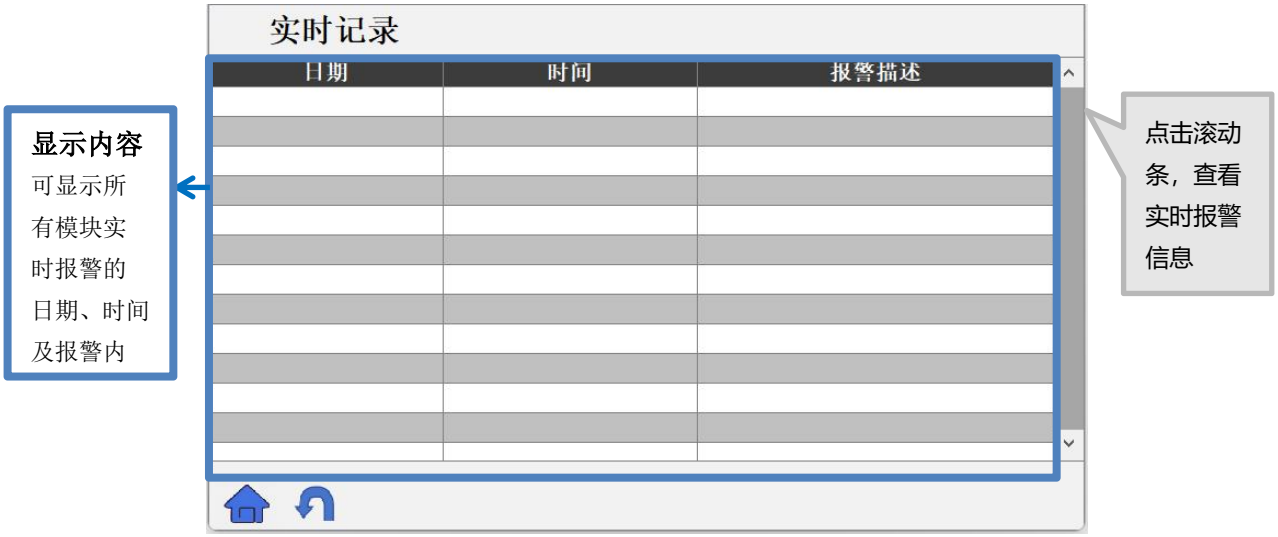


图 5.19 实时记录界面

5.7 个性化界面

点击导航栏的“个性化”按钮，则进入个性化界面：

图 5.20 个性化界面

本界面可查看软件版本号和设备信息，特殊寄存器 1—8 可查看故障代码。

 **注意**	● 若在运行过程中发生故障导致设备自动关机，则待故障消失后设备可自动重新开机。 ● 若装置上电后直接断电，则当前状态会存储下来，下次来电后自动开启运行时，会自动读取断电前的参数设置。
 **警告**	● 为保证设备安全，防止非法操作，对于普通用户在“设置”参数时需要登录，密码为 1234，而调试人员可以在“调试参数”按钮中登录。 ● 技术员密码和管理员密码为非公开密码，需要本公司授权后才能获取。严禁现场调试人员私自将技术员密码或者管理员密码告知普通用户或者其他非专业人员，防止操作不当，导致设备故障、损坏。

维护与保养

为保证装置安全、可靠运行，本公司建议对装置定期进行维护：常规建议环每12个月清理灰尘一次，每4—5年更换散热风扇，对直流电容器每8年更换一次。特殊环境可根据运行情况，缩短维护周期。对设备进行全面维护的步骤如下：

第一步：检查环境温度/湿度。

在APF运行时，测试环境温度和湿度，确保在设备允许范围之内。若超出设备允许范围，必须降额使用。

第二步：关机

- 停止设备运行，拆掉动力线。
- 等待至少10分钟，模块内直流侧电容完全放电。
- 打开设备柜门。

第三步：清洁设备

- 目检设备内部元件、电缆有无异常（例如变形或变色等）。
- 将设备内的杂物/灰尘清扫干净，尤其注意冷却风扇周围以及进出风口。
- 确保没有无异物掉落在设备内。
- 使用软刷将电路板上的灰尘拭去。

第四步：检查断路器

- 检查断路器是否有老化，破损的部位。

第五步：检查机械/电气连接

- 检查电气连接是否牢固，更换被氧化的插针/接头。

- 检查所有机械连接是否紧固，重新紧固有松动的地方。

第六步：其他异常

- 如果有其他异常，进行相应维修。

第一步：重启设备

- 将一次线线重新接好。
- 恢复所有连接。
- 启动设备。
- 确认设备状态。

如果设备存在异常情况，或者处于报警状态，应该及时联系本公司！

附表 1 APF 技术规格表

类别	项目	指标										
名称	产品名称	**APF**										
规格	电压等级	220V			400V					480V	690V/800V	
	模块规格	75A	100A	150A	50A	75A	100A	150A	200A	150A	75A	100A
	模块尺寸	W560*H178*D600										
输入	工作电压	220V、400V、480V、690V、800V（-40%～+20%）										
	工作频率	50/60Hz（-10% ~ +10%）										
	电流互感器	100:5 ~ 10000:5										
功能	补偿谐波	2-51 次										
	谐波滤除率	97%										
	补偿无功	-1~+1 可调（设备容量范围内）										
	补偿三相不平衡	100%不平衡完全补偿										
通讯协议	通讯方式	RS485、Modbus 协议										
	通讯接口	RS485										
	上位机软件	有，所有参数可通过上位机设置										
	故障报警	有，可记录无限条报警信息										
	监控	支持各模块独立监控/整机集中监控										
技术指标	全响应时间	≤5ms										
	有功损耗	≤2%，≤1.5%(碳化硅)										
	散热方式	智能风冷										
	噪声	≤60dB										
	保护功能	过压、欠压、过热、过流、短路等二十余种保护										
	CT 安装位置	负载侧/电网侧 可选										
机械特性	模块重量	≤37kg										
	颜色	磨砂黑										
环境要求	工作温度	-10℃~+40℃										
	海拔	<5000 米（1000 米以上，每增加 100 米容量降低 1%）										
	相对湿度	<95%，无凝露										
	防护等级	模块 IP20										
	抗污染等级	2 级（可定制 3 级）										

附表 2 APF 详细菜单描述

界面	名称		释义
主界面	电网	Us	电网侧电压
		Is	电网侧电流
		Thdi	电网侧电流畸变率
		DPF	电网侧基波功率因数
	补偿电流	Ic_A	A 相补偿电流
		Ic_B	B 相补偿电流
		Ic_C	C 相补偿电流
		Ic_N	N 相补偿电流
	负载	IL	负载侧电流
		Thdi	负载侧电流畸变率
		PF	负载侧功率因数
		QL	负载侧无功功率
电网	电压		三相相电压
	电流		电网侧三相电流有效值
	Thdu		三相电压畸变率
	Thdi		电网侧三相电流畸变率
	功因（DPF）		电网侧基波功率因数
	有功功率		电网侧 A、B、C 相有功功率
	无功功率		电网侧 A、B、C 相无功功率
	视在功率		电网侧 A、B、C 相视在功率
	功因（PF）		电网侧功率因数
	频率		电压频率
负载	电流		负载侧三相电流有效值
	Thdi		负载侧三相电流畸变率
	有功功率		负载侧 A、B、C 相有功功率
	无功功率		负载侧 A、B、C 相无功功率
	视在功率		负载侧 A、B、C 相视在功率
	功因（DPF）		负载侧基波功率因数
	功因（PF）		负载侧功率因数
	电网电压		三相相电压
	补偿电流		三相补偿电流有效值

模块	母线电压 1	三相母线电压 1 有效值
	母线电压 2	三相母线电压 2 有效值
	温度	PCB_NTC 温度、散热器_NTC 温度 1、散热器_NTC 温度 2
	分配电流	模块侧三相电流有效值
	Thdi	模块侧三相电流畸变率
	有功功率	模块侧 A、B、C 相有功功率
	无功功率	模块侧 A、B、C 相无功功率
	视在功率	模块侧 A、B、C 相视在功率
	功因（DPF）	模块侧基波功率因数
	功因（PF）	模块侧功率因数
设置	启动模式	分为 2 种：手动、自启动。出厂默认：手动。
	工作模式	分为 6 种工作模式，可以根据应用目的的不同进行选择。
	通讯数量	定义：打开设备通讯的数量。设置范围：1-6。
	模块数量	定义：并联模块的数量。设置范围：1-20。
	功率因数	定义：补偿达到的目标功率因数值。出厂默认：100.0%。
	CT 位置	负载侧：CT 安装在接入点前侧。电源测：CT 安装在接入点后侧。
	CT 方向	正向：电源指向负载。反向：负载指向电源。
	CT 变比	定义：CT 的一次、二次侧额定电流大小。出厂默认：200。 设置范围：0-10000。
	屏站号	通过关联屏站号，来检测设备运行情况。设置范围：0-255。
记录	实时记录	当前报警时间、日期及报警信息
个性化	上位软件	触摸屏程序版本号
	控制软件	软件程序版本号
	特殊寄存器	显示设备故障字

附表 3 APF 状态及故障信息表

名称		含义
状态	预充电	“预充电”表示模块上电后不控整流充电状态。
	待机	“待机”表示预充电完成，限流电阻旁路，继电器吸合，模块属于待机状态。
	运行	“运行模式”表示模块处于运行状态，可以正常补偿。
	正常封锁	“正常封锁”表示模块 IGBT 关断，且没有故障。
	故障封锁	“故障封锁”表示模块 IGBT 关断，系统存在二级或三级故障。
系统 1 级故障	DSP-EEPROM 通信故障	DSP 与 EEPROM 通信发生错误时，则会发出“DSP-EEPROM 通信故障”警告。
	电网电压低报警	电网电压过低，低于设定保护值时，则会发出“电网电压低报警”警告。
	母线电压高报警	母线电压过高，超过设定保护值时，则会发出“母线电压高报警”警告。
	环温过温报警	模块内部环境温度超过设定的保护值，则会发出“环温过高报警”警告。
	散热器过温报警	散热器温度超过设定的保护值，则会发出“散热器过高报警”警告。
	支路 1 过流报警	IGBT 支路 1 桥臂电流超过设定的保护值时，则会发出“支路 1 过流报警”警告。
	支路 2 过流报警	IGBT 支路 2 桥臂电流超过设定的保护值时，则会发出“支路 2 过流报警”警告。
	调节器积分限幅	调节器积分发生错误时，则会发出“调节器积分限幅”警告。
	调节器输出限幅	调节器输出发生错误时，则会发出“调节器输出限幅”警告。
	R 调节器输出限幅	R 调节器输出发生错误时，则会发出“R 调节器输出限幅”警告。
系统 2 级故障	急停	IGBT 封锁，电流过大时；网压过高，超出设置范围时；按下柜门或触摸屏急停按钮时，则会发出“急停”警告。（状态字 3 级故障会置 1，跳脱主回路断路器）
	AD 参考基准错误	模拟电路采样未调试成功，则会发出“AD 参考基准错误”警告。
	缺相	网压缺相时，则会发出“缺相”警告。
	硬件过流	通过硬件电路判断过流时，则会发出“硬件过流”警告。
	硬件驱动电源	通过硬件电路判断驱动电源不正确时，则会发出“硬件驱动电源”警告。
	电压相序不匹配	A、B、C 相的电压相位关系不匹配时，则会发出“电压相序不匹配”警告。
	负载电流相序不匹配	A、B、C 相的电流相位关系不匹配时，则会发出“负载电流相序不匹配”警告。
	电网电压高	电网电压过高，超过设定保护值时，则会发出“电网电压高”警告。（状态字 3 级故障会置 1，跳脱主回路断路器）
	电网电压低故障	电网电压过低，低于设定保护值时，则会发出“电网电压低故障”警告。
	网侧失电	电网没有电时，则会发出“电网电压低”警告。
	网侧锁相失败	锁相环调节器发生错误时，则会发出“网侧锁相失败”警告。

	电网频率错误	电网频率发生错误时，则会发出“电网频率错误”警告。
	硬件母线电压过高	通过硬件判断母线电压过高时，超过设定保护值时，则会发出“硬件母线电压过高”警告。
	母线电压相差过大	通过软件判断母线电压相差过大时，则会发出“母线电压相差过大”警告。
	启动母线电压过低	从预充电完成到待机状态的启动母线电压，低于设定保护值时，则会发出“启动母线电压过低”警告。
	输出峰值过流	输出最大值电流超过设定保护值时，则会发出“输出峰值过流”警告。
	输出过流故障	输出有效值电流超过设定保护值时，则会发出“输出过流故障”警告。
	零线过流故障	零序电流有效值超过设定保护值时，则会发出“零线过流故障”警告。
	风机故障	检测到风机的输入输出发生错误时，则会发出“风机故障”警告。
	PCB 温度过高	模块内部环境温度超过设定的保护值，则会发出“PCB 温度过高”警告。
	散热器温度过高	散热器温度超过设定的保护值，则会发出“散热器过高”警告。
	预充电时逆变电流过高	未启动时逆变电流超过设定保护值时，则会发出“预充电时逆变电流过高”警告。（状态字 3 级故障会置 1，跳脱主回路断路器）
	IGBT 封锁时逆变电流过高	运行过程中逆变电流超过设定保护值时，则会发出“IGBT 封锁时逆变电流过高”警告。（状态字 3 级故障会置 1，跳脱主回路断路器）
	Udc_A1 过压	A1 相直流母线电压过高，超过设定的保护值，则会发出“Udc_A1 过压”警告。
	Udc_B1 过压	B1 相直流母线电压过高，超过设定的保护值，则会发出“Udc_B1 过压”警告。
	Udc_C1 过压	C1 相直流母线电压过高，超过设定的保护值，则会发出“Udc_C1 过压”警告。
	Udc_A2 过压	A2 相直流母线电压过高，超过设定的保护值，则会发出“Udc_A2 过压”警告。
	Udc_B2 过压	B2 相直流母线电压过高，超过设定的保护值，则会发出“Udc_B2 过压”警告。
	Udc_C2 过压	C2 相直流母线电压过高，超过设定的保护值，则会发出“Udc_C2 过压”警告。
算法故障字	NCAP_A1 调节器	NCAP_A1 调节器算法错误时，则会发出“NCAP_A1 调节器”警告。
	NCAP_B1 调节器	NCAP_B1 调节器算法错误时，则会发出“NCAP_B1 调节器”警告。
	ID 调节器	ID 调节器算法错误时，则会发出“ID 调节器”警告。
	IQ 调节器	IQ 调节器算法错误时，则会发出“IQ 调节器”警告。
	IO 调节器	IO 调节器算法错误时，则会发出“IO 调节器”警告。
	Udc 调节器	Udc 调节器算法错误时，则会发出“Udc 调节器”警告。
	谐波调节器	谐波调节器算法错误时，则会发出“谐波调节器”警告。
	CPU2 谐波调节器	CPU2 谐波调节器算法错误时，则会发出“CPU2 谐波调节器”警告。

附表 4 APF 通讯数据点表

1. 通讯协议 RS485 MODBUS RTU,通讯波特率 9600bps， 数据位 8 位，无校验位， 停止位 1 位。

2. 通过触摸屏参数屏站号修改 Modbus 协议站号地址。

2. 接线为： 远程监控用的工控机等各类上位机设备的 RS485 通讯线信号正(+)接预留后台 485 通讯的棕色线， 上位机设备的 RS485 信号负(-)接预留后台 485 通讯的蓝色线。

3. 访问屏内各模块的地址和数据表如下：

项次	内容描述	单位	范围	备注	读写	数据地址	
						10 进制	16 进制
1	网侧 Thdv_A	%	-100~100	实际值=通信值	R	0	0
2	网侧 Thdv_B	%	-100~100	实际值=通信值	R	1	1
3	网侧 Thdv_C	%	-100~100	实际值=通信值	R	2	2
4	网侧 DPF_A	%	-100~100	实际值=通信值	R	3	3
5	网侧 DPF_B	%	-100~100	实际值=通信值	R	4	4
6	网侧 DPF_C	%	-100~100	实际值=通信值	R	5	5
7	网侧有功功率_A	kW	-32767~+32767	实际值=通信值/10	R	6	6
8	网侧有功功率_B	kW	-32767~+32767	实际值=通信值/10	R	7	7
9	网侧有功功率_C	kW	-32767~+32767	实际值=通信值/10	R	8	8
10	网侧无功功率_A	kVar	-32767~+32767	实际值=通信值/10	R	9	9
11	网侧无功功率_B	kVar	-32767~+32767	实际值=通信值/10	R	10	A
12	网侧无功功率_C	kVar	-32767~+32767	实际值=通信值/10	R	11	B
13	网侧视在功率_A	kVA	-32767~+32767	实际值=通信值/10	R	12	C
14	网侧视在功率_B	kVA	-32767~+32767	实际值=通信值/10	R	13	D
15	网侧视在功率_C	kVA	-32767~+32767	实际值=通信值/10	R	14	E
16	网侧总谐波电流	A	0~65535	实际值=通信值/10	R	15	F
17	电网频率	Hz	0~65535	实际值=通信值	R	16	10
18	负载电流_A	A	0~65535	实际值=通信值/10	R	17	11
19	负载电流_B	A	0~65535	实际值=通信值/10	R	18	12
20	负载电流_C	A	0~65535	实际值=通信值/10	R	19	13
21	负载 Thdi_A	%	-100~+100	实际值=通信值	R	20	14
22	负载 Thdi_B	%	-100~+100	实际值=通信值	R	21	15
23	负载 Thdi_C	%	-100~+100	实际值=通信值	R	22	16
24	负载 DPF_A	%	-100~+100	实际值=通信值	R	23	17
25	负载 DPF_B	%	-100~+100	实际值=通信值	R	24	18
26	负载 DPF_C	%	-100~+100	实际值=通信值	R	25	19
27	负载 PF_A	%	-100~+100	实际值=通信值	R	26	1A
28	负载 PF_B	%	-100~+100	实际值=通信值	R	27	1B
29	负载 PF_C	%	-100~+100	实际值=通信值	R	28	1C
30	负载有功功率_A	kW	-32767~+32767	实际值=通信值/10	R	29	1D
31	负载有功功率_B	kW	-32767~+32767	实际值=通信值/10	R	30	1E

32	负载有功功率_C	kW	-32767~+32767	实际值=通信值/10	R	31	1F
33	负载无功功率_A	kVar	-32767~+32767	实际值=通信值/10	R	32	20
34	负载无功功率_B	kVar	-32767~+32767	实际值=通信值/10	R	33	21
35	负载无功功率_C	kVar	-32767~+32767	实际值=通信值/10	R	34	22
36	负载视在功率_A	kVA	-32767~+32767	实际值=通信值/10	R	35	23
37	负载视在功率_B	kVA	-32767~+32767	实际值=通信值/10	R	36	24
38	负载视在功率_C	kVA	-32767~+32767	实际值=通信值/10	R	37	25
39	负载侧总谐波电流	A	0~65535	实际值=通信值/10	R	38	26
40	命令字	bit	均为脉冲信号，且不低于 4s 的脉冲宽度	0：启动 1：停止 2：复位	W	39	27
41	一键启停使能位	bit		0：单独启停 1：一键启停	W	40	28
42	通讯状态		模块通讯状态	0:通讯正常 1：通讯故障	R	41	29
43	模块 1_工作模式	bit	运行模式	0:SVG 1:APF 2:SAPF 3:ASVG	R	47	2F
44	模块 1_系统状态字	bit	当前状态机	0：预充电 1：待机 2：运行　3：停止	R	48	30
45	模块 1_散热器_NTC 温度 1	℃	-2000~+2000	实际值=通信值	R	49	31
46	模块 1_散热器_NTC 温度 2	℃	-2000~+2000	实际值=通信值	R	50	32
47	模块 1_网侧电压_A	V	0~65535	实际值=通信值/10	R	51	33
48	模块 1_网侧电压_B	V	0~65535	实际值=通信值/10	R	52	34
49	模块 1_网侧电压_C	V	0~65535	实际值=通信值/10	R	53	35
50	模块 1_网侧电流_A	A	0~65535	实际值=通信值/10	R	54	36
51	模块 1_网侧电流_B	A	0~65535	实际值=通信值/10	R	55	37
52	模块 1_网侧电流_C	A	0~65535	实际值=通信值/10	R	56	38
53	模块 1_装置电流_A	A	0~65535	实际值=通信值/10	R	57	39
54	模块 1_装置电流_B	A	0~65535	实际值=通信值/10	R	58	3A
55	模块 1_装置电流_C	A	0~65535	实际值=通信值/10	R	59	3B
56	模块 1_网侧 PF_A	%	-100~100	实际值=通信值	R	60	3C
57	模块 1_网侧 PF_B	%	-100~100	实际值=通信值	R	61	3D
58	模块 1_网侧 PF_C	%	-100~100	实际值=通信值	R	62	3E
59	模块 1_网侧 Thdi_A	%	-100~100	实际值=通信值	R	63	3F
60	模块 1_网侧 Thdi_B	%	-100~100	实际值=通信值	R	64	40
61	模块 1_网侧 Thdi_C	%	-100~100	实际值=通信值	R	65	41
62	模块 1_不平衡度_A	%	0~65535	实际值=通信值	R	66	42
63	模块 1_不平衡度_B	%	0~65535	实际值=通信值	R	67	43
64	模块 1_不平衡度_C	%	0~65535	实际值=通信值	R	68	44
65	模块 1_总母线电压	V	0~65535	实际值=通信值	R	69	45

66	模块 1_平均母线电压 1	V	0~65535	实际值=通信值	R	70	46
67	模块 1_平均母线电压 2	V	0~65535	实际值=通信值	R	71	47
68	模块 1_CT 系数		-30000~+30000	实际值=通信值	R	72	48
69	模块 1_CT 系数		-30000~+30000	实际值=通信值	R	73	49
70	模块 1_CT 系数		-30000~+30000	实际值=通信值	R	74	4A
71	模块 1_模组数量		0~65535	实际值=通信值	R	75	4B
72	模块 1_无功设定	%	-100~100	实际值=通信值	R	76	4C
73	模块 1_系统状态字 1		0~65535	实际值=通信值	R	77	4D
74	模块 1_系统 1 级故障字		0~65535	实际值=通信值	R	78	4E
75	模块 1_系统 2 级故障字 1		0~65535	实际值=通信值	R	79	4F
76	模块 1_系统 2 级故障字 2		0~65535	实际值=通信值	R	80	50
77	模块 1_负载分配比例	%	-100~+100	实际值=通信值	R	81	51
78	模块 1_PCB_NTC 温度	℃	-2000~+2000	实际值=通信值	R	82	52
79	模块 1_命令字	bit	均为脉冲信号，且不低于 2s 的脉冲宽度	0：启动 1：停止 2：复位	W	83	53
80	模块 1_启动模式	bit	投切状态	0:手动；2：自动	R	84	54
81	模块 2_工作模式	bit	运行模式	0:SVG 1:APF 2:SAPF 3:ASVG	R	147	93
82	模块 2_系统状态字	bit	当前状态机	0：预充电 1：待机 2：运行 3：停止	R	148	94
83	模块 2_散热器_NTC 温度 1	℃	-2000~+2000	实际值=通信值	R	149	95
84	模块 2_散热器_NTC 温度 2	℃	-2000~+2000	实际值=通信值	R	150	96
85	模块 2_网侧电压_A	V	0~65535	实际值=通信值/10	R	151	97
86	模块 2_网侧电压_B	V	0~65535	实际值=通信值/10	R	152	98
87	模块 2_网侧电压_C	V	0~65535	实际值=通信值/10	R	153	99
88	模块 2_网侧电流_A	A	0~65535	实际值=通信值/10	R	154	9A
89	模块 2_网侧电流_B	A	0~65535	实际值=通信值/10	R	155	9B
90	模块 2_网侧电流_C	A	0~65535	实际值=通信值/10	R	156	9C
91	模块 2_装置电流_A	A	0~65535	实际值=通信值/10	R	157	9D
92	模块 2_装置电流_B	A	0~65535	实际值=通信值/10	R	158	9E
93	模块 2_装置电流_C	A	0~65535	实际值=通信值/10	R	159	9F
94	模块 2_网侧 PF_A	%	-100~100	实际值=通信值	R	160	A0
95	模块 2_网侧 PF_B	%	-100~100	实际值=通信值	R	161	A1
96	模块 2_网侧 PF_C	%	-100~100	实际值=通信值	R	162	A2
97	模块 2_网侧 Thdi_A	%	-100~100	实际值=通信值	R	163	A3
98	模块 2_网侧 Thdi_B	%	-100~100	实际值=通信值	R	164	A4

99	模块 2_网侧 Thdi_C	%	-100~100	实际值=通信值	R	165	A5
100	模块 2_不平衡度_A	%	0~65535	实际值=通信值	R	166	A6
101	模块 2_不平衡度_B	%	0~65535	实际值=通信值	R	167	A7
102	模块 2_不平衡度_C	%	0~65535	实际值=通信值	R	168	A8
103	模块 2_总母线电压	V	0~65535	实际值=通信值	R	169	A9
104	模块 2_平均母线电压 1	V	0~65535	实际值=通信值	R	170	AA
105	模块 2_平均母线电压 2	V	0~65535	实际值=通信值	R	171	AB
106	模块 2_CT 系数		-30000~+30000	实际值=通信值	R	172	AC
107	模块 2_CT 系数		-30000~+30000	实际值=通信值	R	173	AD
108	模块 2_CT 系数		-30000~+30000	实际值=通信值	R	174	AE
109	模块 2_模组数量		0~65535	实际值=通信值	R	175	AF
110	模块 2_无功设定	%	-100~100	实际值=通信值	R	176	B0
111	模块 2_系统状态字 1		0~65535	实际值=通信值	R	177	B1
112	模块 2_系统 1 级故障字		0~65535	实际值=通信值	R	178	B2
113	模块 2_系统 2 级故障字 1		0~65535	实际值=通信值	R	179	B3
114	模块 2_系统 2 级故障字 2		0~65535	实际值=通信值	R	180	B4
115	模块 2_负载分配比例	%	-100~+100	实际值=通信值	R	181	B5
116	模块 2_PCB_NTC 温度	℃	-2000~+2000	实际值=通信值	R	182	B6
117	模块 2_命令字	bit	均为脉冲信号，且不低于 2s 的脉冲宽度	0：启动 1：停止 2：复位	W	183	B7
118	模块 2_启动模式	bit	投切状态	0:手动；2：自动	R	184	B8
119	模块 3_工作模式	bit	运行模式	0:SVG 1:APF 2:SAPF 3:ASVG	R	247	F7
120	模块 3_系统状态字	bit	当前状态机	0：预充电 1：待机 2：运行 3：停止	R	248	F8
121	模块 3_散热器_NTC 温度 1	℃	-2000~+2000	实际值=通信值	R	249	F9
122	模块 3_散热器_NTC 温度 2	℃	-2000~+2000	实际值=通信值	R	250	FA
123	模块 3_网侧电压_A	V	0~65535	实际值=通信值/10	R	251	FB
124	模块 3_网侧电压_B	V	0~65535	实际值=通信值/10	R	252	FC
125	模块 3_网侧电压_C	V	0~65535	实际值=通信值/10	R	253	FD
126	模块 3_网侧电流_A	A	0~65535	实际值=通信值/10	R	254	FE
127	模块 3_网侧电流_B	A	0~65535	实际值=通信值/10	R	255	FF
128	模块 3_网侧电流_C	A	0~65535	实际值=通信值/10	R	256	100
129	模块 3_装置电流_A	A	0~65535	实际值=通信值/10	R	257	101
130	模块 3_装置电流_B	A	0~65535	实际值=通信值/10	R	258	102
131	模块 3_装置电流_C	A	0~65535	实际值=通信值/10	R	259	103
132	模块 3_网侧 PF_A	%	-100~100	实际值=通信值	R	260	104

133	模块 3_网侧 PF_B	%	-100~100	实际值=通信值	R	261	105
134	模块 3_网侧 PF_C	%	-100~100	实际值=通信值	R	262	106
135	模块 3_网侧 Thdi_A	%	-100~100	实际值=通信值	R	263	107
136	模块 3_网侧 Thdi_B	%	-100~100	实际值=通信值	R	264	108
137	模块 3_网侧 Thdi_C	%	-100~100	实际值=通信值	R	265	109
138	模块 3_不平衡度_A	%	0~65535	实际值=通信值	R	266	10A
139	模块 3_不平衡度_B	%	0~65535	实际值=通信值	R	267	10B
140	模块 3_不平衡度_C	%	0~65535	实际值=通信值	R	268	10C
141	模块 3_总母线电压	V	0~65535	实际值=通信值	R	269	10D
142	模块 3_平均母线电压 1	V	0~65535	实际值=通信值	R	270	10E
143	模块 3_平均母线电压 2	V	0~65535	实际值=通信值	R	271	10F
144	模块 3_CT 系数		-30000~+30000	实际值=通信值	R	272	110
145	模块 3_CT 系数		-30000~+30000	实际值=通信值	R	273	111
146	模块 3_CT 系数		-30000~+30000	实际值=通信值	R	274	112
147	模块 3_模组数量		0~65535	实际值=通信值	R	275	113
148	模块 3_无功设定	%	-100~100	实际值=通信值	R	276	114
149	模块 3_系统状态字 1		0~65535	实际值=通信值	R	277	115
150	模块 3_系统 1 级故障字		0~65535	实际值=通信值	R	278	116
151	模块 3_系统 2 级故障字 1		0~65535	实际值=通信值	R	279	117
152	模块 3_系统 2 级故障字 2		0~65535	实际值=通信值	R	280	118
153	模块 3_负载分配比例	%	-100~+100	实际值=通信值	R	281	119
154	模块 3_PCB_NTC 温度	℃	-2000~+2000	实际值=通信值	R	282	11A
155	模块 3_命令字	bit	均为脉冲信号，且不低于 2s 的脉冲宽度	0：启动 1：停止 2：复位	W	283	11B
156	模块 3_启动模式	bit	投切状态	0:手动；2：自动	R	284	11C
157	模块 4_工作模式	bit	运行模式	0:SVG 1:APF 2:SAPF 3:ASVG	R	347	15B
158	模块 4_系统状态字	bit	当前状态机	0：预充电 1：待机 2：运行 3：停止	R	348	15C
159	模块 4_散热器_NTC 温度 1	℃	-2000~+2000	实际值=通信值	R	349	15D
160	模块 4_散热器_NTC 温度 2	℃	-2000~+2000	实际值=通信值	R	350	15E
161	模块 4_网侧电压_A	V	0~65535	实际值=通信值/10	R	351	15F
162	模块 4_网侧电压_B	V	0~65535	实际值=通信值/10	R	352	160
163	模块 4_网侧电压_C	V	0~65535	实际值=通信值/10	R	353	161
164	模块 4_网侧电流_A	A	0~65535	实际值=通信值/10	R	354	162
165	模块 4_网侧电流_B	A	0~65535	实际值=通信值/10	R	355	163
166	模块 4_网侧电流_C	A	0~65535	实际值=通信值/10	R	356	164

167	模块 4_装置电流_A	A	0~65535	实际值=通信值/10	R	357	165
168	模块 4_装置电流_B	A	0~65535	实际值=通信值/10	R	358	166
169	模块 4_装置电流_C	A	0~65535	实际值=通信值/10	R	359	167
170	模块 4_网侧 PF_A	%	-100~100	实际值=通信值	R	360	168
171	模块 4_网侧 PF_B	%	-100~100	实际值=通信值	R	361	169
172	模块 4_网侧 PF_C	%	-100~100	实际值=通信值	R	362	16A
173	模块 4_网侧 Thdi_A	%	-100~100	实际值=通信值	R	363	16B
174	模块 4_网侧 Thdi_B	%	-100~100	实际值=通信值	R	364	16C
175	模块 4_网侧 Thdi_C	%	-100~100	实际值=通信值	R	365	16D
176	模块 4_不平衡度_A	%	0~65535	实际值=通信值	R	366	16E
177	模块 4_不平衡度_B	%	0~65535	实际值=通信值	R	367	16F
178	模块 4_不平衡度_C	%	0~65535	实际值=通信值	R	368	170
179	模块 4_总母线电压	V	0~65535	实际值=通信值	R	369	171
180	模块 4_平均母线电压 1	V	0~65535	实际值=通信值	R	370	172
181	模块 4_平均母线电压 2	V	0~65535	实际值=通信值	R	371	173
182	模块 4_CT 系数		-30000~+30000	实际值=通信值	R	372	174
183	模块 4_CT 系数		-30000~+30000	实际值=通信值	R	373	175
184	模块 4_CT 系数		-30000~+30000	实际值=通信值	R	374	176
185	模块 4_模组数量		0~65535	实际值=通信值	R	375	177
186	模块 4_无功设定	%	-100~100	实际值=通信值	R	376	178
187	模块 4_系统状态字 1		0~65535	实际值=通信值	R	377	179
188	模块 4_系统 1 级故障字		0~65535	实际值=通信值	R	378	17A
189	模块 4_系统 2 级故障字 1		0~65535	实际值=通信值	R	379	17B
190	模块 4_系统 2 级故障字 2		0~65535	实际值=通信值	R	380	17C
191	模块 4_负载分配比例	%	-100~+100	实际值=通信值	R	381	17D
192	模块 4_PCB_NTC 温度	℃	-2000~+2000	实际值=通信值	R	382	17E
193	模块 4_命令字	bit	均为脉冲信号，且不低于 2s 的脉冲宽度	0：启动 1：停止 2：复位	W	383	17F
194	模块 4_启动模式	bit	投切状态	0:手动；2：自动	R	384	180
195	模块 5_工作模式	bit	运行模式	0:SVG 1:APF 2:SAPF 3:ASVG	R	447	1BF
196	模块 5_系统状态字	bit	当前状态机	0：预充电 1：待机 2：运行 3：停止	R	448	1C0
198	模块 5_散热器_NTC 温度 1	℃	-2000~+2000	实际值=通信值	R	449	1C1
199	模块 5_散热器_NTC 温度 2	℃	-2000~+2000	实际值=通信值	R	450	1C2
200	模块 5_网侧电压_A	V	0~65535	实际值=通信值/10	R	451	1C3
201	模块 5_网侧电压_B	V	0~65535	实际值=通信值/10	R	452	1C4

202	模块 5_网侧电压_C	V	0~65535	实际值=通信值/10	R	453	1C5
203	模块 5_网侧电流_A	A	0~65535	实际值=通信值/10	R	454	1C6
204	模块 5_网侧电流_B	A	0~65535	实际值=通信值/10	R	455	1C7
205	模块 5_网侧电流_C	A	0~65535	实际值=通信值/10	R	456	1C8
206	模块 5_装置电流_A	A	0~65535	实际值=通信值/10	R	457	1C9
207	模块 5_装置电流_B	A	0~65535	实际值=通信值/10	R	458	1CA
208	模块 5_装置电流_C	A	0~65535	实际值=通信值/10	R	459	1CB
209	模块 5_网侧 PF_A	%	-100~100	实际值=通信值	R	460	1CC
210	模块 5_网侧 PF_B	%	-100~100	实际值=通信值	R	461	1CD
211	模块 5_网侧 PF_C	%	-100~100	实际值=通信值	R	462	1CE
212	模块 5_网侧 Thdi_A	%	-100~100	实际值=通信值	R	463	1CF
213	模块 5_网侧 Thdi_B	%	-100~100	实际值=通信值	R	464	1D0
214	模块 5_网侧 Thdi_C	%	-100~100	实际值=通信值	R	465	1D1
215	模块 5_不平衡度_A	%	0~65535	实际值=通信值	R	466	1D2
216	模块 5_不平衡度_B	%	0~65535	实际值=通信值	R	467	1D3
217	模块 5_不平衡度_C	%	0~65535	实际值=通信值	R	468	1D4
218	模块 5_总母线电压	V	0~65535	实际值=通信值	R	469	1D5
219	模块 5_平均母线电压 1	V	0~65535	实际值=通信值	R	470	1D6
220	模块 5_平均母线电压 2	V	0~65535	实际值=通信值	R	471	1D7
221	模块 5_CT 系数		-30000~+30000	实际值=通信值	R	472	1D8
222	模块 5_CT 系数		-30000~+30000	实际值=通信值	R	473	1D9
223	模块 5_CT 系数		-30000~+30000	实际值=通信值	R	474	1DA
224	模块 5_模组数量		0~65535	实际值=通信值	R	475	1DB
225	模块 5_无功设定	%	-100~100	实际值=通信值	R	476	1DC
226	模块 5_系统状态字 1		0~65535	实际值=通信值	R	477	1DD
227	模块 5_系统 1 级故障字		0~65535	实际值=通信值	R	478	1DE
228	模块 5_系统 2 级故障字 1		0~65535	实际值=通信值	R	479	1DF
229	模块 5_系统 2 级故障字 2		0~65535	实际值=通信值	R	480	1E0
230	模块 5_负载分配比例	%	-100~+100	实际值=通信值	R	481	1E1
231	模块 5_PCB_NTC 温度	℃	-2000~+2000	实际值=通信值	R	482	1E2
232	模块 5_命令字	bit	均为脉冲信号，且不低于 2s 的脉冲宽度	0：启动 1：停止 2：复位	W	483	1E3
233	模块 5_启动模式	bit	投切状态	0:手动；2：自动	R	484	1E4
234	模块 6_工作模式	bit	运行模式	0:SVG 1:APF 2:SAPF 3:ASVG	R	547	223
235	模块 6_系统状态字	bit	当前状态机	0：预充电 1：待机 2：运行 3：停止	R	548	224
236	模块 6_散热器_NTC 温	℃	-2000~+2000	实际值=通信值	R	549	225

	度 1						
237	模块 6_散热器_NTC 温度 2	℃	-2000~+2000	实际值=通信值	R	550	226
238	模块 6_网侧电压_A	V	0~65535	实际值=通信值/10	R	551	227
239	模块 6_网侧电压_B	V	0~65535	实际值=通信值/10	R	552	228
240	模块 6_网侧电压_C	V	0~65535	实际值=通信值/10	R	553	229
241	模块 6_网侧电流_A	A	0~65535	实际值=通信值/10	R	554	22A
242	模块 6_网侧电流_B	A	0~65535	实际值=通信值/10	R	555	22B
243	模块 6_网侧电流_C	A	0~65535	实际值=通信值/10	R	556	22C
244	模块 6_装置电流_A	A	0~65535	实际值=通信值/10	R	557	22D
245	模块 6_装置电流_B	A	0~65535	实际值=通信值/10	R	558	22E
246	模块 6_装置电流_C	A	0~65535	实际值=通信值/10	R	559	22F
247	模块 6_网侧 PF_A	%	-100~100	实际值=通信值	R	560	230
248	模块 6_网侧 PF_B	%	-100~100	实际值=通信值	R	561	231
249	模块 6_网侧 PF_C	%	-100~100	实际值=通信值	R	562	232
250	模块 6_网侧 Thdi_A	%	-100~100	实际值=通信值	R	563	233
251	模块 6_网侧 Thdi_B	%	-100~100	实际值=通信值	R	564	234
252	模块 6_网侧 Thdi_C	%	-100~100	实际值=通信值	R	565	235
253	模块 6_不平衡度_A	%	0~65535	实际值=通信值	R	566	236
254	模块 6_不平衡度_B	%	0~65535	实际值=通信值	R	567	237
255	模块 6_不平衡度_C	%	0~65535	实际值=通信值	R	568	238
256	模块 6_总母线电压	V	0~65535	实际值=通信值	R	569	239
257	模块 6_平均母线电压 1	V	0~65535	实际值=通信值	R	570	23A
258	模块 6_平均母线电压 2	V	0~65535	实际值=通信值	R	571	23B
259	模块 6_CT 系数		-30000~+30000	实际值=通信值	R	572	23C
260	模块 6_CT 系数		-30000~+30000	实际值=通信值	R	573	23D
261	模块 6_CT 系数		-30000~+30000	实际值=通信值	R	574	23E
262	模块 6_模组数量		0~65535	实际值=通信值	R	575	23F
263	模块 6_无功设定	%	-100~100	实际值=通信值	R	576	240
264	模块 6_系统状态字 1		0~65535	实际值=通信值	R	577	241
265	模块 6_系统 1 级故障字		0~65535	实际值=通信值	R	578	242
266	模块 6_系统 2 级故障字 1		0~65535	实际值=通信值	R	579	243
267	模块 6_系统 2 级故障字 2		0~65535	实际值=通信值	R	580	244
268	模块 6_负载分配比例	%	-100~+100	实际值=通信值	R	581	245
269	模块 6_PCB_NTC 温度	℃	-2000~+2000	实际值=通信值	R	582	246
270	模块 6_命令字	bit	均为脉冲信号，且不低于 2s 的脉冲宽度	0：启动 1：停止 2：复位	W	583	247
271	模块 6_启动模式	bit	投切状态	0:手动；2：自动	R	584	248

附表 5 APF 状态字及故障字

bit位 / 名称	系统状态字 1	系统 1 级故障字	系统 2 级故障字 1	系统 2 级故障字 2
bit0	预充电状态	IIC 通信故障	急停	启动母线电压过低
bit1	预充电完成	电网电压低报警	AD 参考基准错误	输出峰值过流_软件
bit2	待机	母线电压高报警	缺相	输出过流
bit3	运行	环温过温报警	硬件过流	零线过流故障
bit4	停止	散热器过温报警	硬件驱动电源	风机故障
bit5	IGBT 封锁	支路 1 过流报警	硬件 IGBT 短路	PCB 温度过高
bit6	IGBT 故障封锁	调节器积分限幅	电压相序不匹配	散热器温度过高
bit7	1 级故障	调节器输出限幅	负载电流相序不匹配	预充电时逆变电流过高
bit8	2 级故障	R 调节器输出限幅	电网电压高	IGBT 封锁时逆变电流高
bit9	3 级故障	支路 2 过流报警	电网电压低	Udc_A1 过压
bit10	测试运行	保留	网侧失电	Udc_B1 过压
bit11	自启动完成		网侧锁相失败	Udc_C1 过压
bit12	系统容性切换		电网频率	Udc_A2 过压
bit13	心跳信号		硬件母线电压过高	Udc_B2 过压
bit14	继电器状态		内核通信故障	Udc_C2 过压
bit15	Udc 给定完成		母线电压相差过大	保留

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ACFEE ACTIVE POWER FILTER

AcFee APF （V6.0）

Operation manual

Lafaelt

LAFAELT ELECTRIC

Introduction

Thank you for purchasing our APF active power filter!

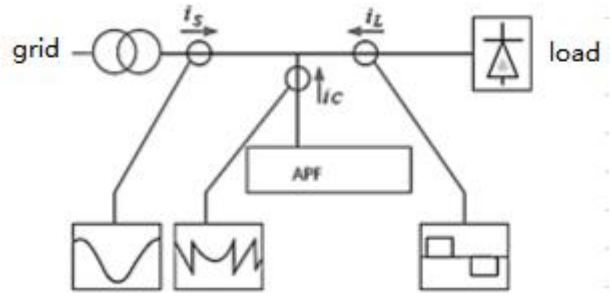
We are dedicated to solving power quality problems for our customers. Our active power filter offers comprehensive power quality management capabilities. The APF can simultaneously filter harmonics from the 2nd to the 51st order, achieving a filtering efficiency exceeding 97%. It fully compensates for step-change harmonics in less than 5ms. Multiple APFs can operate in parallel, achieving an overall efficiency exceeding 98%. They are ideal for a variety of industrial and residential applications, providing an optimal solution for harmonic control and reactive power compensation for nonlinear loads.

Product appearance

Overview

❑ Product Principle

1） Functional Principle



APF Compensation Principle Diagram

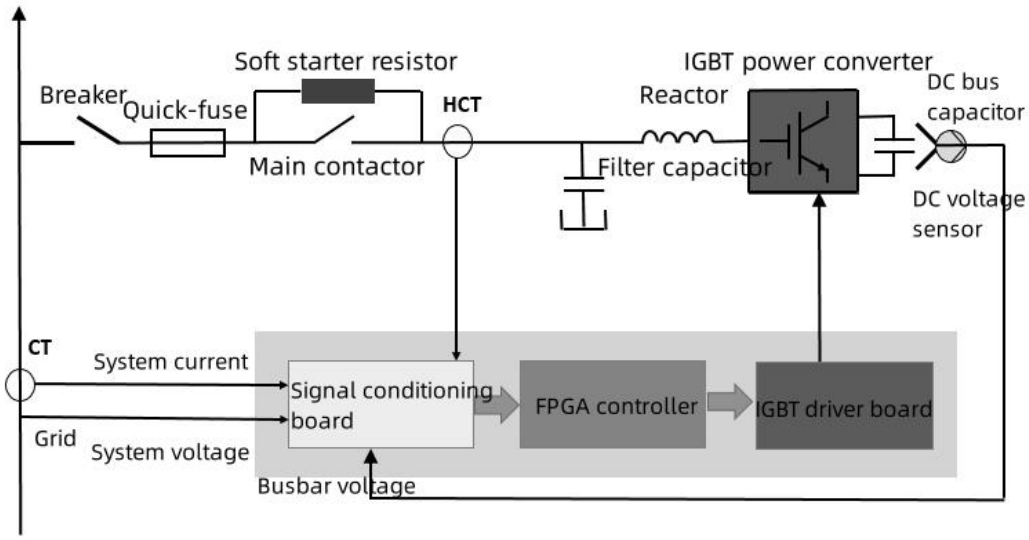
By setting parameters, users can enable the device to simultaneously have functions such as filtering harmonics, dynamically compensating reactive power, compensating for three-phase imbalance, and compensating for voltage drops.

APF Functional principle

Principle Name	Principle Description
Harmonic Filtering Principle	The APF collects current signals in real-time through an external current transformer, separates the harmonic through its internal detection circuit, and generates a compensation current that is equal in magnitude but opposite in phase to the harmonics in the system through an IGBT power converter, thereby achieving the function of harmonic filtering. The compensation current output by the APF dynamically and accurately adjusts according to the harmonic content of the system, thus avoiding the problem of over-compensation. In addition, the APF is equipped with an internal overload protection function. When the harmonic content of the system exceeds the filter capacity, the device can automatically limit its output to 100% of the rated capacity, preventing overload.
Reactive Power Compensation Principle	When the APF operates in ASVG mode, it generates capacitive or inductive fundamental current through the IGBT power converter based on the reactive power of the system, so as to achieve the purpose of dynamic reactive power compensation. The compensation target value can be set via the operation panel, with no over-compensation occurring, and the compensation is smooth, without inrush current impact on the load and the power grid.

Three-Phase Imbalance Compensation Principle	The APF extracts the unbalanced components based on the system current. The three phases generate currents that are equal in magnitude and opposite in phase to these unbalanced components, compensating the unbalanced part to zero, thereby correcting the three-phase unbalanced current into a three-phase balanced current.

2） Control principle



APF Internal Control Principle Diagram

After the circuit breaker is closed, to prevent the instantaneous impact of the power grid on the DC bus capacitor when power is applied, the APF first charges the DC bus capacitor through the soft-start resistor. When the bus voltage Udc reaches the preset value, the main contactor closes. The DC capacitors, acting as energy storage devices, output compensation currents through the IGBT inverter and internal reactors to provide energy.

The APF collects current signals in real time through an external CT, sends them to the signal conditioning circuit, and then to the controller. The controller decomposes the sampled current, extracts harmonic currents of all orders, reactive current, and three-phase unbalanced current. It compares the collected current components to be compensated with the compensation current already generated by the APF to obtain a difference, which is output as a real-time compensation signal to the drive circuit. This triggers the IGBT converter to inject the compensation current into the power grid, realizing closed-loop control and completing the compensation function.

- **Product Features**

1) Modular design: any module failure will not affect the normal operation of other modules, greatly improving the reliability of the entire equipment; it can achieve smooth expansion by directly connecting multiple units in parallel. Master-slave control is used for multiple unit expansion; when multiple modules are connected in parallel, all modules can share a set of current transformers

2) It can filter out harmonic currents of 2nd to 51st order at the same time, with a filtering rate of no less than 97%; reactive power compensation can make the power factor reach 1. It can correct the imbalance of three-phase current to complete balance

3) Adopting the seventh generation IGBT of internationally renowned brands, it can automatically adjust the output according to the harmonic current of the load and perform dynamic filtering.

4) Adopts imported DSP control chips from internationally renowned brands, featuring fast operating speed and high reliability.

5) The layered design prevents dust,dew and rain from adhering to the circuit board, making it suitable for use in harsh working conditions.

6) Filtering, reactive power compensation, and three-phase imbalance compensation can be selected individually or in multiple options, and the priority of the functions can be set

7) Adopting multi-coordinate rotation control algorithm based on instantaneous reactive power theory, reactive power and harmonic current are completely decoupled and controlled, with fast calculation speed, instantaneous response time less than 0.1ms, and full compensation response time of the device less than 5ms

8) The output filter adopts LC structure to connect to the power grid. Its own high-frequency carrier will not be fed back to the power grid, and there will be no interference to other equipment in the power distribution system

9) It has complete protection functions, including overvoltage, overcurrent, overheating, short circuit and other complete protection functions, and also has system self-diagnosis function

10) Equipped with a soft start control circuit to avoid excessive inrush current at the start moment and limit the current within the rated range

11) With a reliable current limiting control mechanism, when the current to be compensated in the system is greater than the rated capacity of the device, the device can automatically limit the current to 100% capacity output to maintain normal operation

12) The main circuit adopts a three-phase H-bridge two-interleaved topology,

with an equivalent switching frequency reaching 80K Hz, featuring high output waveform quality and low switching loss;

13) Adopts a high-definition 7-inch touch screen (10-inch touch screen customizable), which is easy to operate. The screen displays the operating parameters of the system and the device in real time, and is equipped with fault alarm and recall functions. Meanwhile, by utilizing the dual serial port function of the touch screen, data can be uploaded to the 4G cloud platform or a computer that supports RS485 for remote monitorin

14) Capable of compensating even-order harmonics and specified high-order harmonics

15) In ASVG mode, operating modes of reactive power priority and harmonic priority can be set, which can achieve the effect of free allocation between reactive power compensation and harmonic compensation

- **First Use**

Users who use this product for the first time should first read this manual carefully. If you still have questions about the function and installation of this product, please consult our technicians for assistance, which is beneficial for the correct use of this product.

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About the Manual

Thank you for purchasing our APF active power filter. This manual explains how to use this product correctly. Please read this manual carefully before use (installation, wiring, operation, maintenance, and inspection). Please also understand the safety precautions before using this product.

<table>
<tr><td rowspan="3">  </td><td>● This manual is delivered with the product
● This manual applies to APF200A,150A,100A
● This manual also applies to APF 690V 100A,75A</td></tr>
<tr><td>● This manual introduces the functional features and usage of APF, including product selection, parameter setting, operation and debugging, maintenance and inspection, etc. Please read this manual carefully before use. Equipment manufacturers should send this manual to the end user along with the equipment for subsequent reference.</td></tr>
<tr><td>● The illustrations in this manual are only for explaining how to install and use the product, and may be different from the product you ordered.
● Our company is committed to continuous improvement of products and upgrading of product functions. The information provided is subject to change without prior notice.
● If you have any questions during use, please contact our regional agents or directly contact our sales and technical personnel.</td></tr>
</table>

Safety instructions

❑ Safety signs

In this manual, the safety levels are divided into the following three categories

Table 1-1 Usage of Symbols, Terms and Names

	Notes
 Notice	Failure to follow the manual requirements may cause losses or equipment malfunction and damage!
 Warning	Failure to follow the manual requirements may result in equipment damage and minor injuries to personnel!
 Danger	Failure to follow the manual requirements may result in serious accidents and serious injuries or death!!! !

These three symbols used throughout this manual indicates that the relevant content is important for safety. Failure to comply with these precautions may result in economic losses, minor or serious injuries, or even death, as well as damage to this product, relevant supporting components, and cabinets. Additionally, our company shall not be held liable for any injuries or equipment damage caused by your company or your customers' failure to comply with this manual.

❑ Safety Notes

Before installation	
 Danger	● If you find water in the box or the device, or if parts are missing or obviously damaged when unpacking, please do not install it! ● If the packing list does not match the name of the actual product and the name of the ordered equipment, please do not install it!

 Notice	● When transporting the module, be sure to hold the housing tightly. If it falls during transport, there is a risk of injury and possible damage to the device. ● When transporting, lift and place with care, otherwise there is a risk of damaging the equipment! ● Do not use a damaged or missing module, as there is a risk of injury! ● This device has undergone a withstand voltage test before leaving the factory. Do not perform withstand voltage tests on any component of the device without confirmation with our technical staff. High voltage may damage the insulation and internal components of the device.

During installation	
 Dange	● Non-electrical construction professionals are prohibited from installing, maintaining, inspecting or replacing parts. Otherwise, there is a risk of electric shock! ● It is strictly forbidden to tear off the anti-tear label of the equipment. Any damage caused is not within the scope of the company's responsibility and warranty. ● For renovation projects, when installing primary cables and current sampling secondary cables, ensure that the access system is powered off and that the surrounding area is safe for operation. Otherwise, there is a risk of electric shock, which could result in personal injury or death!
 Notice	● Please handle the module gently during installation and be careful not to bump or knock it. Any damage caused thereby shall not fall within the company's liability scope or warranty scope ● When placing two or more modules in the same cabinet, pay attention to the installation position to ensure effective heat dissipation. It is recommended to add cooling measures such as fans. ● The module installation location should ensure ventilation. Do not cover the module's built-in cooling fan inlet and outlet. ● The module installation location should ensure safe debugging and maintenance by after-sales personnel. ● Wall-mounted modules should be installed in locations with less traffic as much as possible, and safety hazard signs should be placed in obvious locations.

During power-on operation	
 Danger	● Do not open the cover after power is turned on. Otherwise, there is a risk of electric shock, resulting in casualties! ● It is strictly forbidden to install or wire the equipment while it is energized! ● Do not touch any primary or secondary terminals of the module. Otherwise, there is a risk of electric shock, resulting in casualties! ● This equipment needs to be debugged by our company's designated after-sales engineers. Other personnel must operate it under the guidance of our after-sales engineers. Unauthorized operation is prohibited! Otherwise, it may cause equipment damage or even casualties!
 Notice	● When the device is running, please do not change the factory parameters of the device at will. Otherwise, it may cause damage to the device! ● When the device is running, avoid dropping objects into the device. Otherwise, the device may be damaged! ● After the device is powered on, avoid frequently starting and stopping the device or frequently turning on and off the upper switch of the device. ● During debugging, if the equipment makes abnormal noises or generates fault information, you should immediately turn off the power and contact our technical staff.
During maintenance	
 Danger	● Personnel without professional training are not allowed to repair or maintain the equipment. Otherwise, personal injury or equipment damage may occur! ● Do not repair or maintain the device while it is powered on. Otherwise, there is a risk of electric shock! ● Ensure that the input power supply of the equipment has been disconnected for no less than 10 minutes before carrying out maintenance and repair on the equipment. Otherwise, residual charges on the capacitors may cause personal injury! ● Before performing maintenance work on the device, ensure that the device is safely disconnected from all power sources. ● Parameters must be set and checked after replacing the device. ● Do not power on a device that has reported a fault or is damaged, otherwise it will cause further damage to the device.

❑ Specific purpose

 Notice	● Please pay attention to whether there are reactive compensation devices composed of passive components such as capacitors and reactor in the same system. If the settings are improper, the active filter may conflict with these passive compensation devices or fail to fully exert its compensation capabilities. ● When using APF for harmonic compensation, ensure that there are no purely capacitive compensation devices or capacitive load devices in the system. If there are any, necessary measures (such as series reactors) must be taken to make the harmonics of the required compensation order inductive to avoid resonance. Otherwise, there is a risk of damage to the APF or to the purely capacitive compensation devices and capacitive load devices. ● When the APF is working, it may interfere with nearby communication equipment. The communication and control transmission signal lines must be kept as far away from the APF primary circuit as possible. If necessary, an anti-interference EMI filter can be installed to reduce the impact of interference. ● The altitude should not exceed 1000 meters. If it exceeds 1000 meters, the equipment rating will be derated by 1% for every 100 meters increase in altitude.

Chapter 1 Product information

1.1 Product appearance description

■Module Appearance: (200A, 150A, 100A, 75A)

Figure 1-1 Module Appearance

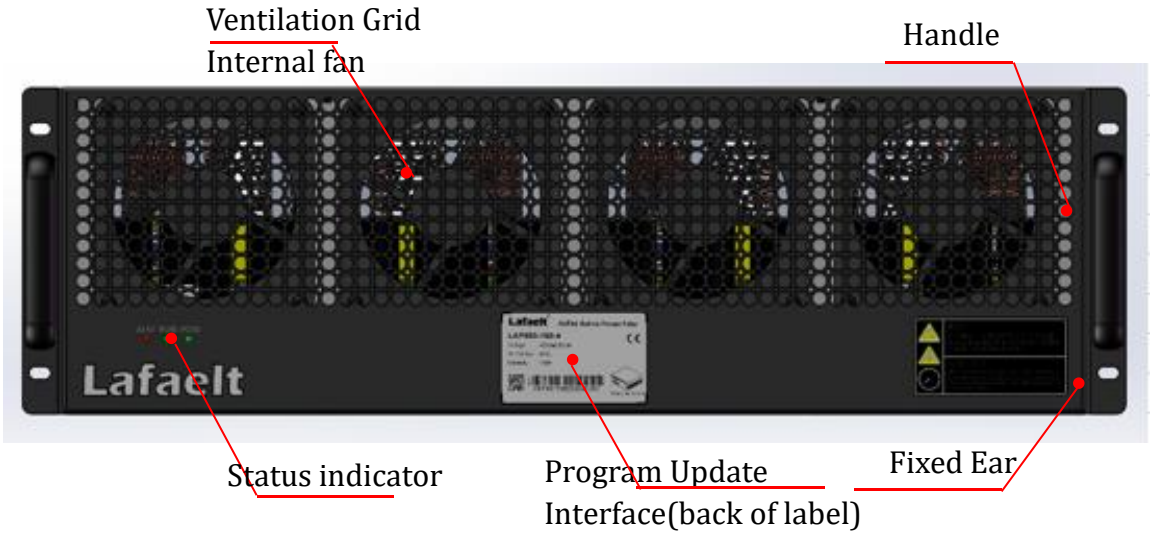


Figure 1-2 Front view of the module

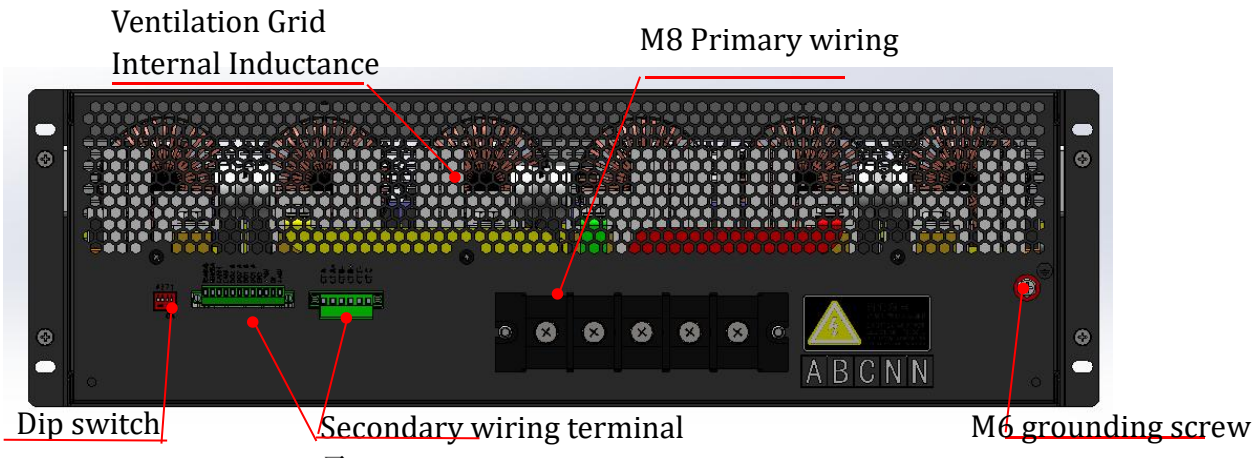


Figure 1-3 Module Back

■Module Appearance: Plug-in Type(200A,150A, 100A, 75A)

Figure 1-4 Module Appearance (Plug-in Type)

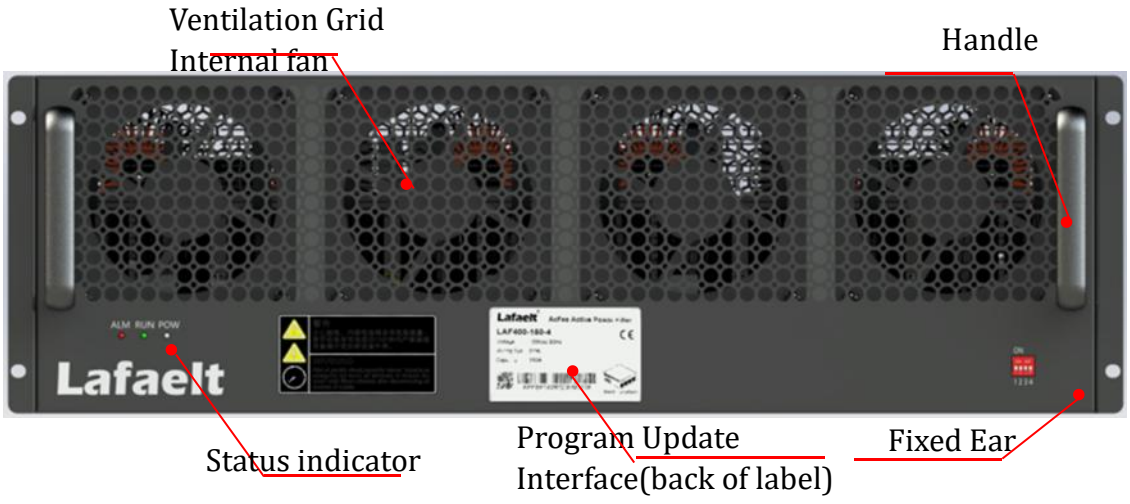


Figure 1-5 Module Front (Plug-in Type)

Ventilation Grid
Internal Inductance

Primary wiring

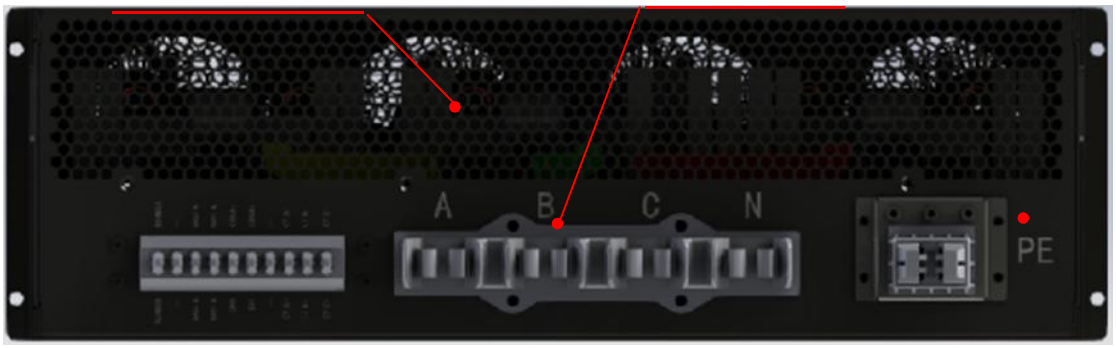


Figure 1-6 Module Back (Plug-in Type)

1.2 Wiring terminal description

■Module terminal blocks: (200A, 150A, 100A)

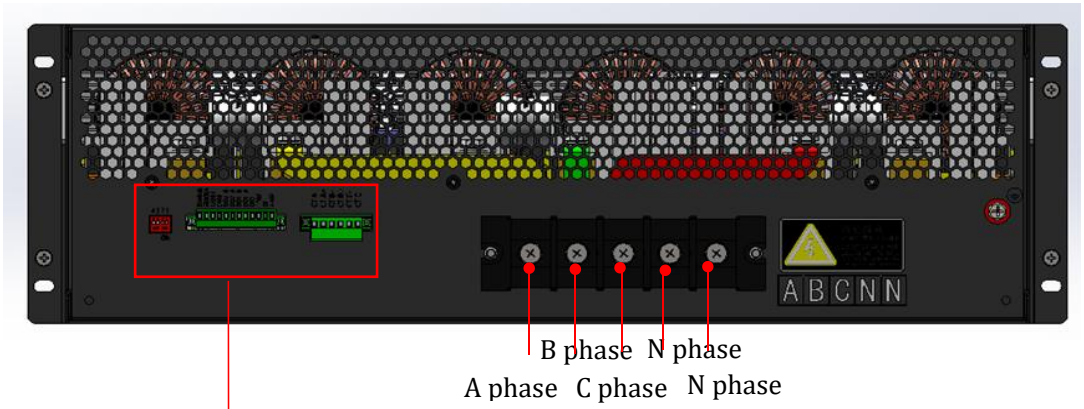


Figure 1-7 Module Terminal Diagram

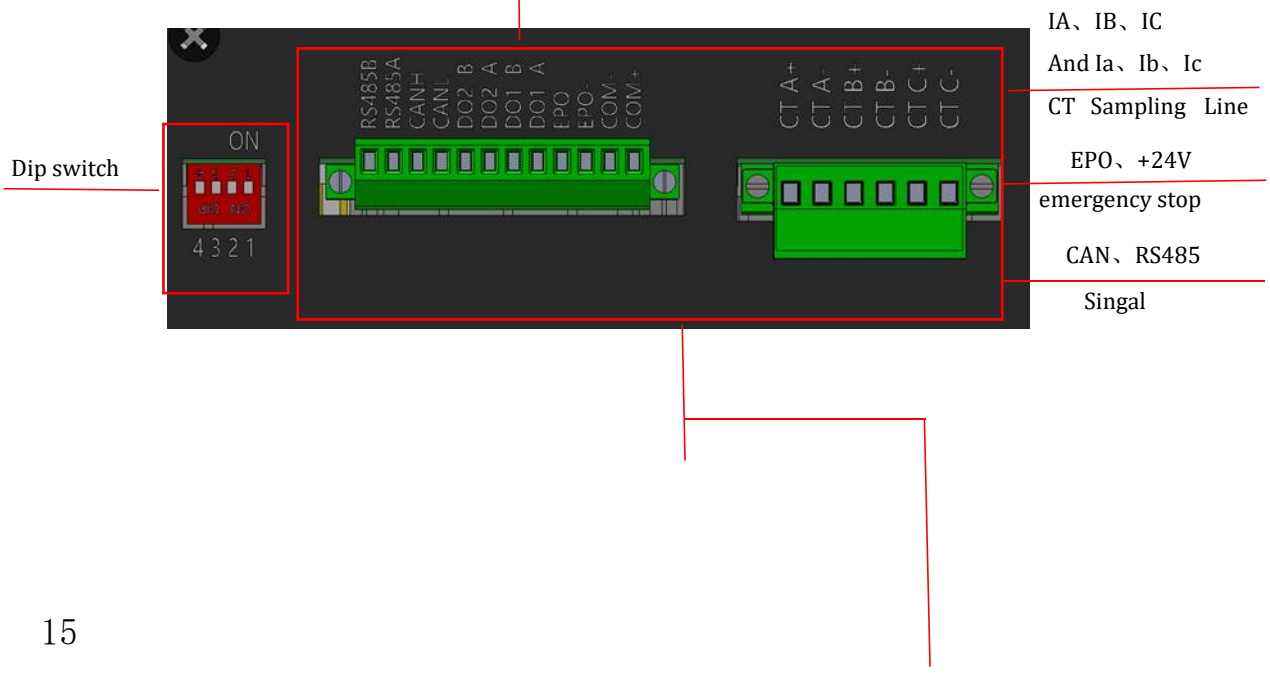


Figure 1-8 Module Terminal Diagram (Plug-in Type)

DIP Switch: Since the module itself is not equipped with a touch screen, the module address can be set via the DIP switch (converting binary to decimal). Only when the correct module address is set can the external centralized monitoring touch screen communicate normally with the module. For example, if there are 2 modules in the cabinet, the first module can have the DIP switch set to position 1, and the second module can be set to position 2, with position 1 needing to be reset (tconverting binary to decimal). The DIP switch has a total of 4 digits, allowing up to 15 modules to be connected in parallel.

1.3 Indicator Light Status Description

Figure 1-9 Indicator status diagram

Status indicator: There are three status indicators: ALM (alarm), RUN (operation), and POW (power supply); the POW indicator shows whether the module is powered on normally. If the mains power is connected once, the POW indicator (green) will be on; after the module is powered on, if the module is in normal operation, the RUN indicator (green) will be on; if the module alarms, the ALM indicator (red) will be on.

1.4 Product Dimension

- **Module Dimension：rack-mounted(200A、150A、100A、75A)**

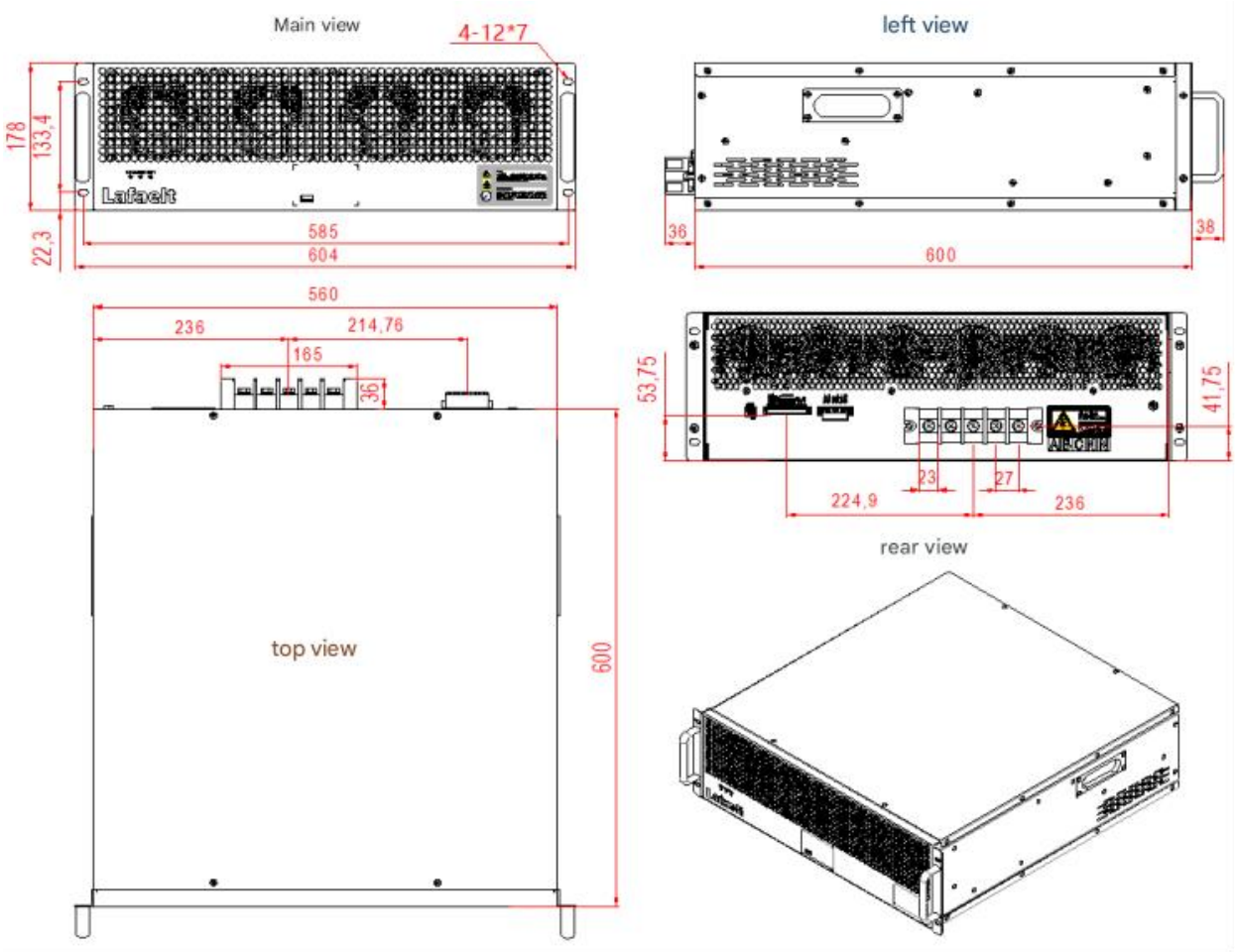


Figure 1-10 Module dimensions

■ **Module dimensions: plug-in (150A, 100A、75A)**

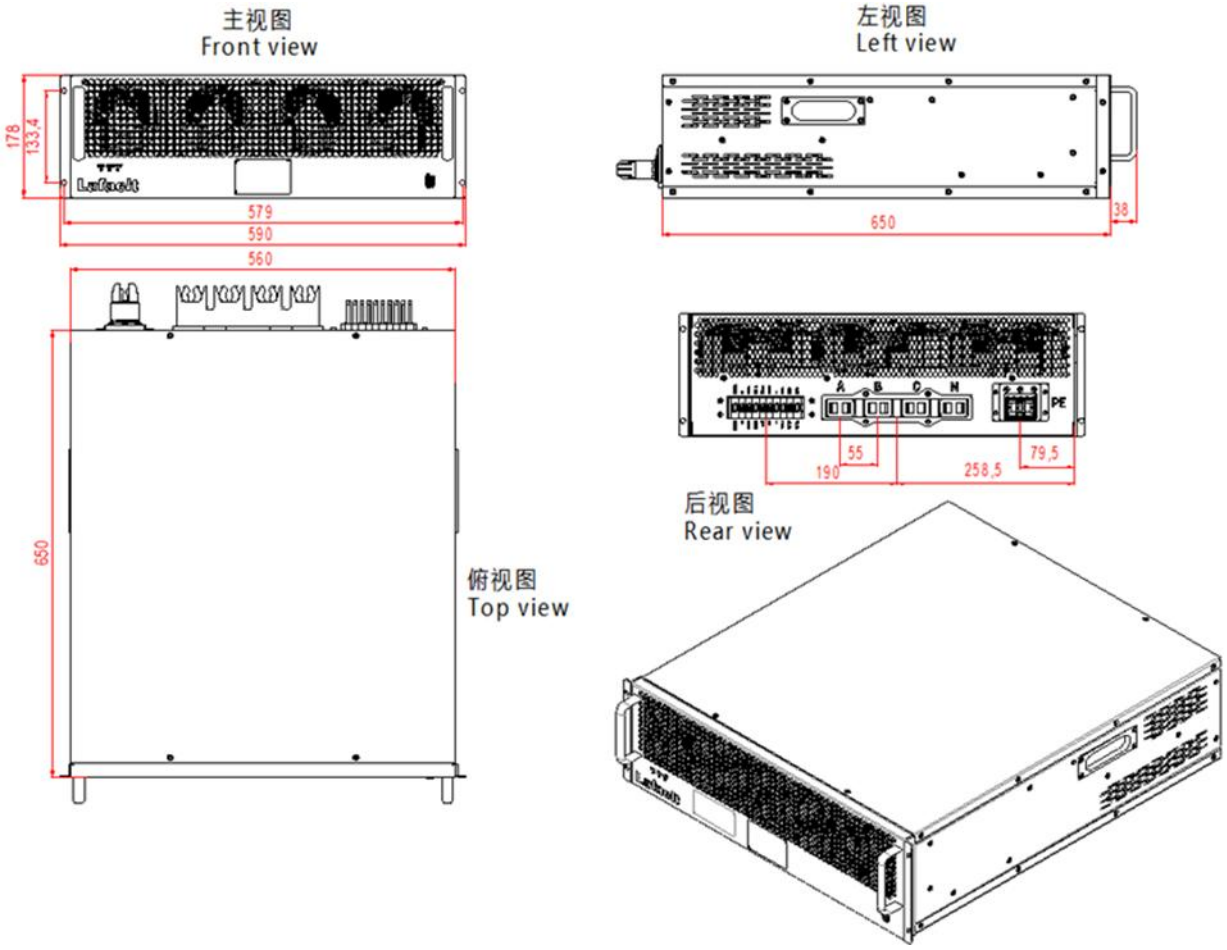


Figure 1-11 Module dimensions (plug-in type)

Chapter 2 System Connection

2.1 System Connection Diagram

■ **Single Machine**

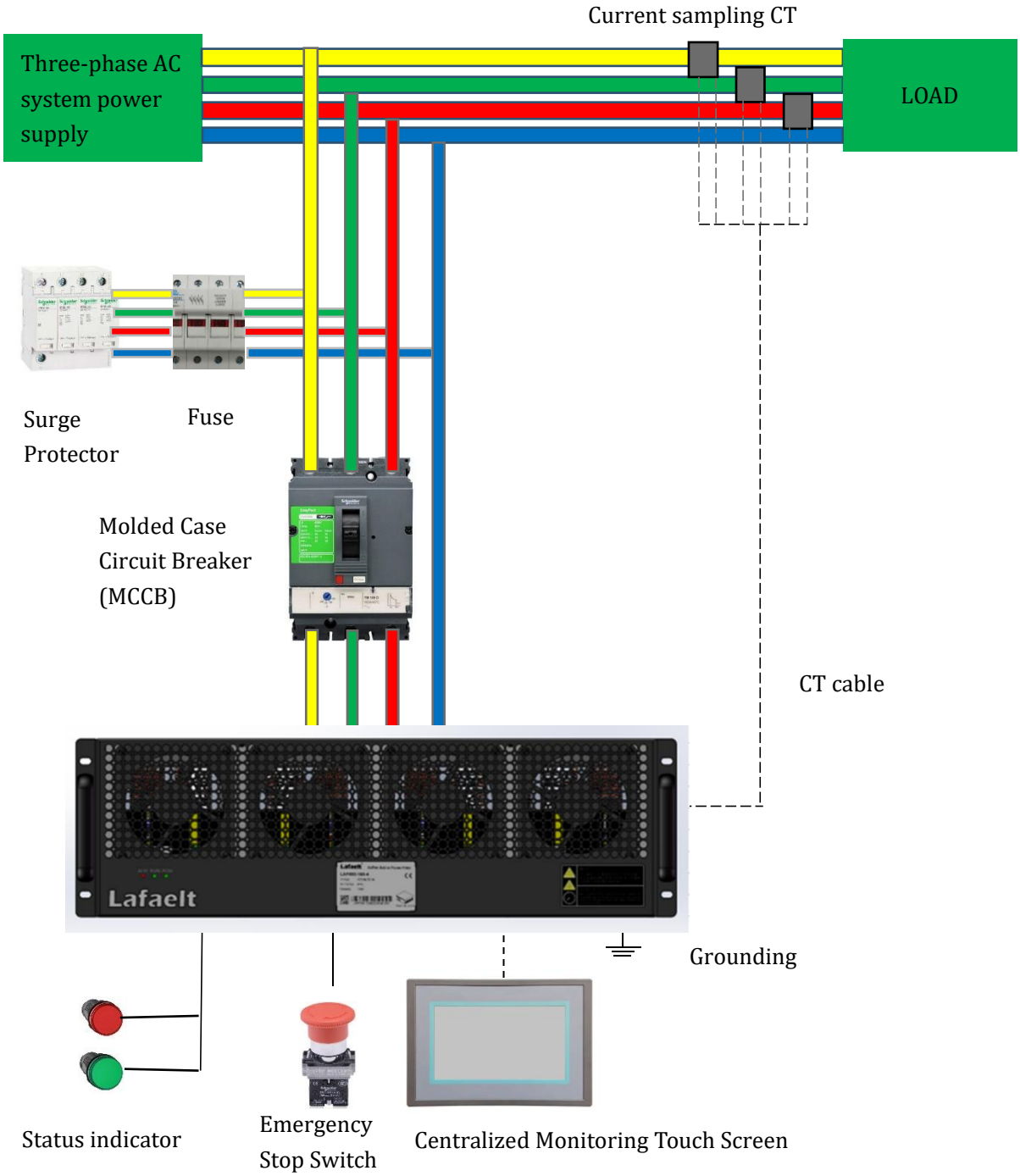


Figure 2-1 APF stand-alone system connection diagram

■ **Multi-machine parallel connection**

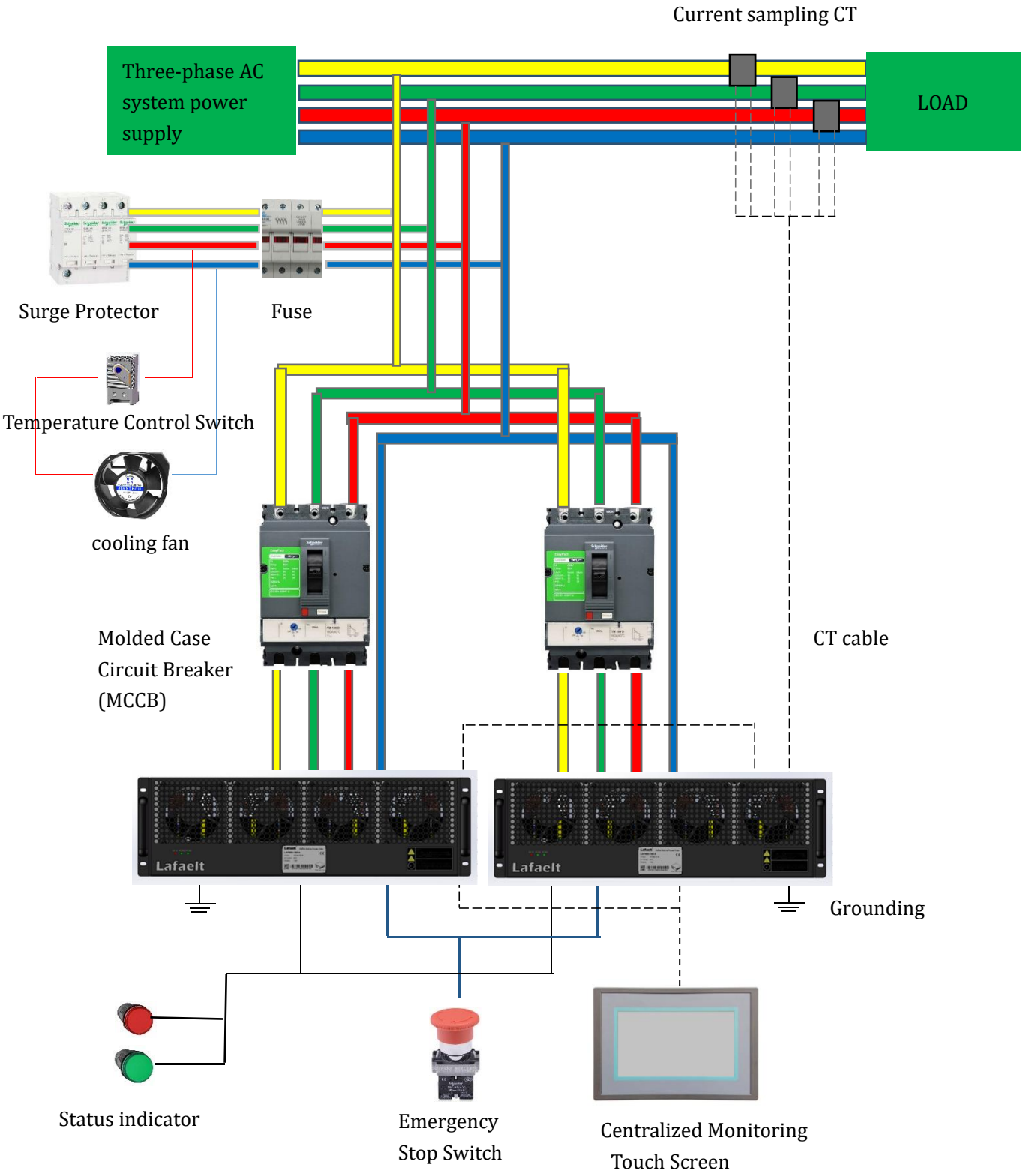


Figure 2-2 APF multi-machine parallel system connection diagram

- The system connection diagram is only used as a reference for the

connection of main components under normal circumstances. Specific projects may vary slightly based on project requirements.

- The wiring of current transformer (CT) secondary circuits varies slightly depending on the installation location of the current sampling CT. For specific configurations, refer to the corresponding CT location section (not detailed here).
- The secondary wiring shown in the system connection diagrams is a schematic representation only; for detailed wiring, refer to the product's execution drawings provided by the manufacturer.

2.2 System Configuration and Components Selection

Component	Installation Location	Function Description	Selection Guidelines
 Molded Case Circuit Breaker (MCCB) (must be installed)	● Power input terminal of the module ● For cabinet-mounted modules: Circuit breakers are installed inside the cabinet ● For wall-mounted modules: Circuit breakers are installed in the distribution box provided with the wall-mounted module	● Switching control of the module ● Provides protection against overload, short-circuit, and undervoltage conditions, preventing damage to both wiring and the module.	● Typically, one module can be equipped with one molded case circuit breaker (MCCB), or multiple modules may share a larger MCCB. ● The rated current of the MCCB is recommended to be 1.25~1.5 times the rated current of the module. ● Pole configuration: 3P/4PThermal-magnetic trip ● Breaking capacity: ≥35kA
 Surge protector (Optional)	● At the power input terminal of the module, the line-side terminals of the molded case circuit breaker (MCCB) ● Be installed inside the cabinet or distribution box	● Provides safety protection for cabinets and modules. When a peak current or voltage occurs in the electrical circuit, the surge protector can conduct and shunt in a very short time, thereby preventing overvoltage from damaging other devices in the electrical circuit.	● Pole configuration: 3P+N ● Maximum discharge current (Imax): ≥40kA

 Fuse (Optional)	● Input terminal of Surge Protector ● Be installed inside the cabinet or distribution box.	● The purpose of installing a fuse before a surge protector is mostly to avoid fire accidents such as combustion when a continuous short circuit fault occurs in the internal components of the surge protector	● Rated current: 32A and above ● Pole configuration: 4P
 Centralized Monitoring Touch Screen (Optional)	● Cabinet-mounted type, can be installed on the cabinet door ● Wall-mounted installation, can be installed on the door of ● Communication is connected to the RS485 port of the module	● Centralized monitoring, more convenient to view and set parameters.	● Provided as part of our company's system package, or available for separate purchase.
 Emergency Stop Switch (Optional)	● Installed on the cabinet door or the door of the distribution box. ● Connect to the module's EPO and +24V terminals.	● When an abnormal situation occurs inside the cabinet or with the module (such as smoke, abnormal noise, or fire), the emergency stop switch can be pressed immediately to stop the module from operating, thereby effectively protecting the module.	● Button release type ● Operating part diameter: 40mm
 Temperature Control Switch (Optional)	● Installed on the terminal block inside the cabinet ● Connected to the power input port of the fan	● Switch the fan on and off	● Withstand voltage 250V ● Overload current 10A ● Normally open, closes above 35°C

 Fan (must be installed)	● Install on the rear door of the cabinet	● If the number of modules is ≤ 2, it is recommended to install two fans. ● If the number of modules is greater than 2, it is recommended to install four fans.	● AC220V 50HZ ● 87W and above ● Air volume: 850CFM ● Operation direction: counterclockwise ● Recommended size: 254×254×89
 Indicator light (Optional)	● Installed on the cabinet door ● Connected to the circuit of the relay's normally open and normally closed contacts.	● Display module running/stop, normal/fault status	● AC220V ● Red and Green ● Knob diameter: 22mm
 Current transformer (must be installed)	● Installed on the main busbar of the power distribution system	● Detect the load current of the power distribution system.	● Transformation ratio must be /5, selectable between 100/5 and 10000/5 ● Accuracy 0.5 or higher ● Rated load 2.5VA or higher
Other components			
Primary cable/copper busbar	Cable Selection： ● Under different capacity and current levels, the selection of APF incoming cables shall comply with relevant electrical regulations, and environmental conditions shall be considered in the selection. The following table can be used as a reference： Note: APF is rated by current. For aluminum cables, they correspond to the corresponding current-carrying capacity specifications of copper cables.		

Device rated current	35A	50A、75A /50k	100A	150A	200A
ABC three-phase cable	16㎜²	25㎜²	35㎜²	70㎜²	95㎜²
N wire specification	16㎜²*2	25㎜²*2	35㎜²*2	70㎜²*2	95㎜²*2

- Cables are typically BVR multi-strand copper-core PVC-insulated flexible wires.
- For high currents, two double-strand wires may be used.
- Since 3rd harmonics exist in some projects, harmonic currents will superimpose on the N wire, and the current can reach 3 times that of the phase wire. Therefore, the specification of the N wire must be one grade larger than that of the phase wire. For 100A, 150A, and 200A modules, there are 2 N wire terminals, and 2 N wires must be connected.

Copper busbar selection：

Device rated current	Below 150A	150A~300A	300A~600A	600A~900A
Copper busbar specifications	20*4	30*4	50*5	60*8

<table>
<tr><td>Other cables</td><td>Reference Model selection：
<table>
<tr><th>Name</th><th>Specifications</th></tr>
<tr><td>Surge protector primary cable</td><td>6mm²BVR multi-strand copper core flexible wire</td></tr>
<tr><td>Fan circuit cable</td><td rowspan="3">1.5mm² BVR multi-strand copper core flexible wire</td></tr>
<tr><td>Emergency stop switch circuit cable</td></tr>
<tr><td>Indicator light circuit cable</td></tr>
<tr><td>Grounding cable</td><td>Yellow-green BVR multi-strand copper core flexible cable.
Suggestions for selecting protective grounding PE wire: When the cross-sectional area of AC phase wire S ≤ 16mm², select the same cross-sectional area as the phase wire; when the phase wire cross-sectional area 16 ≤ S ≤ 35mm², select 16mm² for the protective grounding wire; when the phase wire S > 35mm², select half of the phase wire's cross-sectional area as the cross-sectional area of the protective grounding wire.</td></tr>
<tr><td>CT current transformer sampling signal line</td><td>For CT cables, select 2.5mm² shielded twisted pair RVSP2×2.5 (cable length L<15m), or 4mm² shielded twisted pair RVSP2×4 (cable length 15m<L<30m).。</td></tr>
<tr><td>Touch screen communication cable</td><td>Telephone line， provided as a complete set by our company</td></tr>
</table></td></tr>
</table>

- The table above lists the main components of the APF system for reference only. However, this does not guarantee that all components will be identical. If there are any special or discrepant features in your project, reasonable adjustments may be made based on the specific circumstances.

Chapter 3 Installation and Wiring

3.1 Installation Precautions

3.1.1 Installation Environment

Installation environment requirements	
 Notice Warnin g	1） Ambient temperature: The ambient temperature has a significant impact on the service life of the APF. The operating ambient temperature of the APF is not allowed to exceed the allowable range (-10℃~40℃). If the temperature is lower than -10℃, appropriate heating equipment should be added; if the temperature is higher than 40℃, cooling and heat dissipation equipment such as air conditioners should be added. 2） The APF should be installed on the surface of flame-retardant objects, and there must be sufficient heat dissipation space around the installation, as it will generate a large amount of heat during operation. 3） Please install it in a location not prone to vibration. Vibration should not exceed 0.6G. Special attention should be paid to keeping it away from stamping equipment such as punch presses. 4）Avoid installation in locations exposed to direct sunlight, damp environments, or places with water droplets. 5）Avoid installation in places where there are corrosive, flammable, or explosive gases in the air. 6）Avoid installation in locations with oil stains or dust. 7） When rack-mounted modules are installed in a cabinet, the cabinet must comply with relevant standards and regulations.

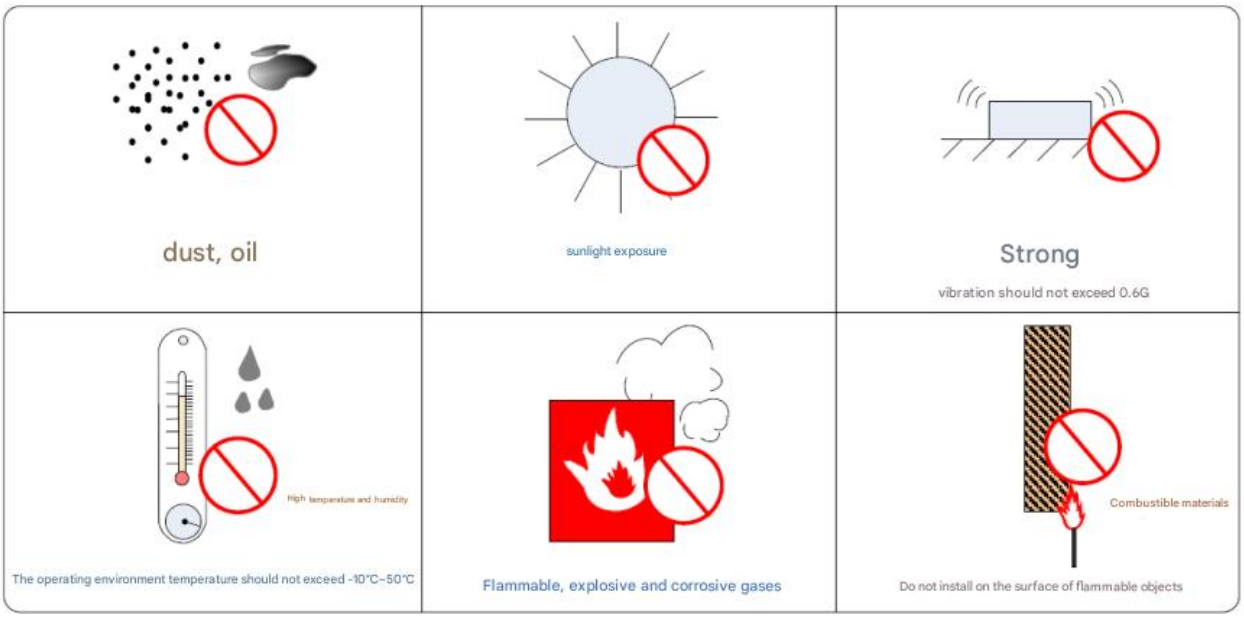


Figure 3-1 Installation environment requirements

3.1.2 Installation Space and Direction

1）Installation Space

When installing the APF, ensure adequate space for the air inlet and outlet.

Installation space requirements	
Notice Warning	● Strictly prohibit blocking the module's air outlets. ● For vertical cabinet installation, at least 600mm of space for air intake and exhaust, as well as rear maintenance space, must be reserved at the front and rear outlets of the cabinet. Additionally, ensure that the rear door of the cabinet can be opened and closed properly.

■ Space Requirements for Cabinet-Type Installation

（1）In cabinet-mounted installations, the module takes in air from the front and exhausts it to the rear, with heat dissipating from front to back.

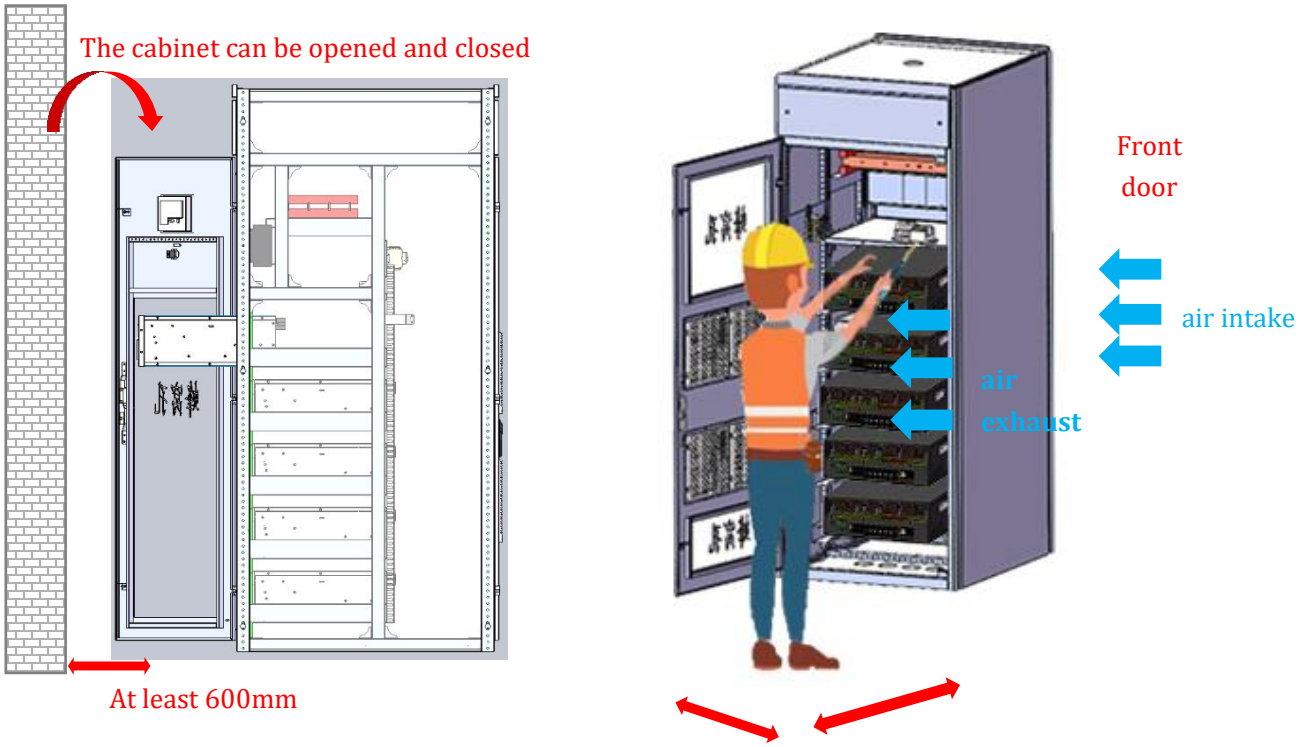


Figure 3-2 Schematic diagram of space requirements for vertical cabinet installation

（2）Installation direction

When installing the device, please place it horizontally or on its side. Try not to install it in an inverted or tilted position.

3.2 Installation Instruction

3.2.1 Cabinet-type Installation

（1）Cabinet Structure

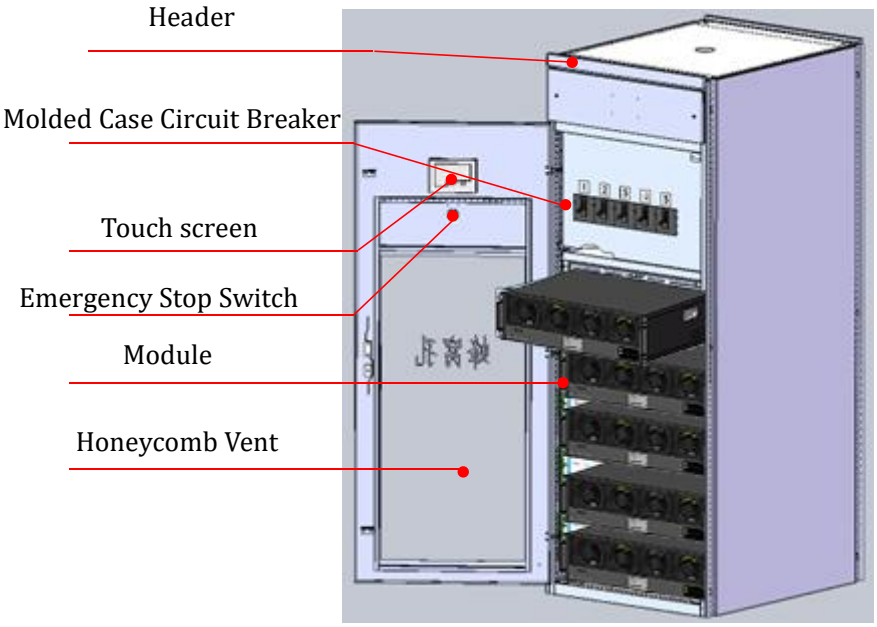


Figure 3-4 Schematic diagram of the entire cabinet (front)

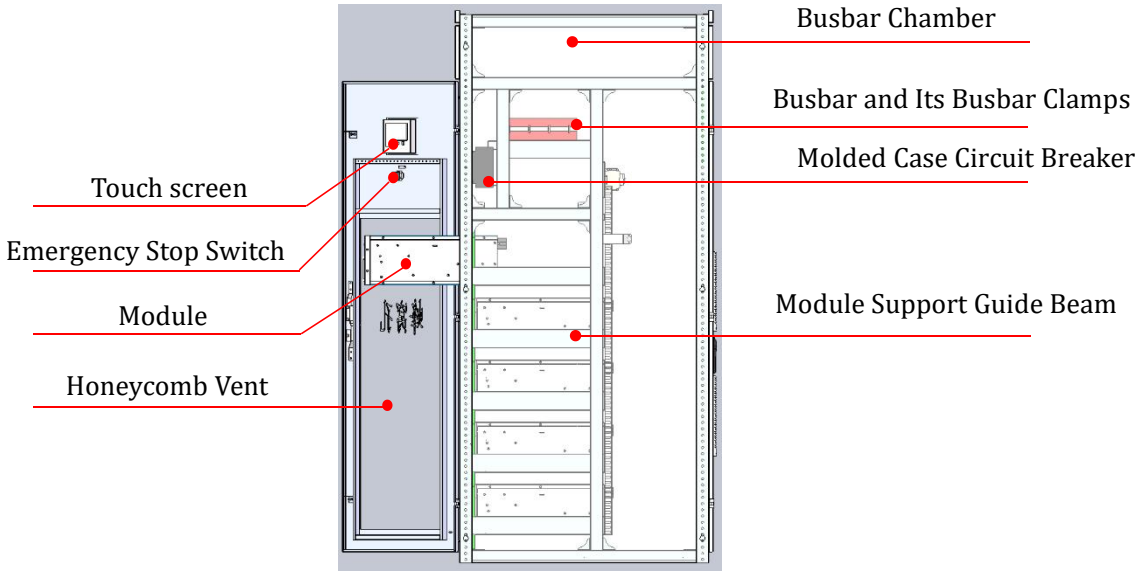


Figure 3-5 Schematic diagram of the entire cabinet (side view)

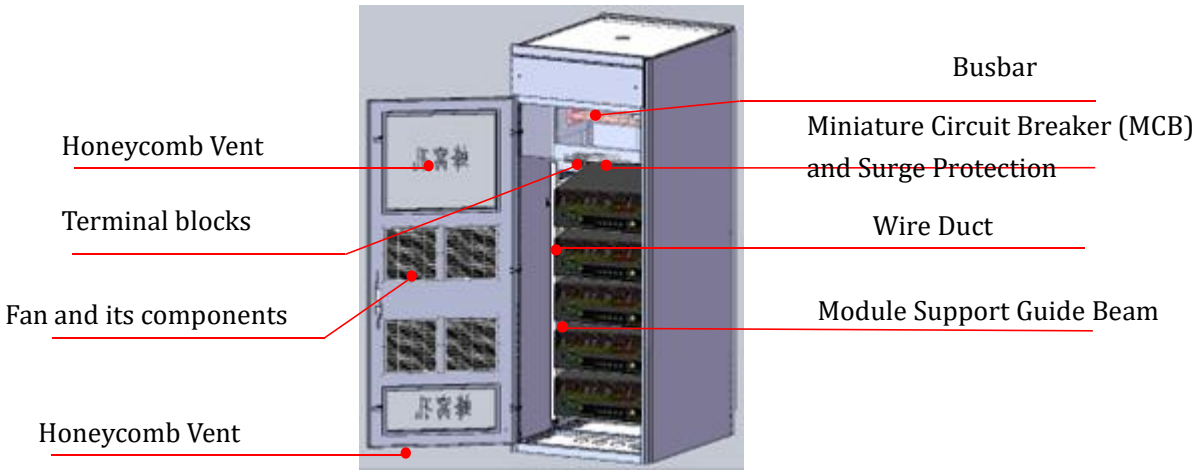


Figure 3-6 Schematic diagram of the entire cabinet (back)

The equipment is divided into three parts from top to bottom. The top is the busbar chamber, which passes through the system of the low-voltage complete equipment. The second part is the circuit breaker compartment, where each module is assigned a circuit breaker, multiple circuit breakers are connected via an internal busbar, which connects to the system busbars in the busbar compartment. The lower part is the module compartment, and a single cabinet can hold up to 5 modules.

A touch screen and an emergency stop button can be installed on the cabinet door. For better monitoring of module status and more convenient operation, a 7-inch external touch screen can be mounted on the cabinet door. The function of the emergency stop button is: when abnormal phenomena such as abnormal noise or smoke occur inside the cabinet, press the emergency stop button immediately to put the modules in standby mode, thus preventing the spread and aggravation of faults caused by module operation.

The front and rear doors of the module compartment should have honeycomb holes for ventilation and heat dissipation, with air flowing in from the front and out from the rear.

If there are ≤ 2 modules in the cabinet, it is recommended to install two fans on the rear door. If there are > 2 modules, it is recommended to install

four fans.

NOTE

- As specified in Chapter 2 System Connection, some components inside the cabinet are mandatory, while others are optional for installation. The selection can be made based on actual project conditions. The cabinet structure and accessory selection here are designed by our company's structural engineers and electrical engineers, which only take into account the circumstances of conventional projects. Some components are not shown as installed, such as status indicators mounted on the cabinet door, ammeters installed on the cabinet door, etc.

（2）Installation and fixing of modules

After lifting, push it from front to back into position and then secure it.

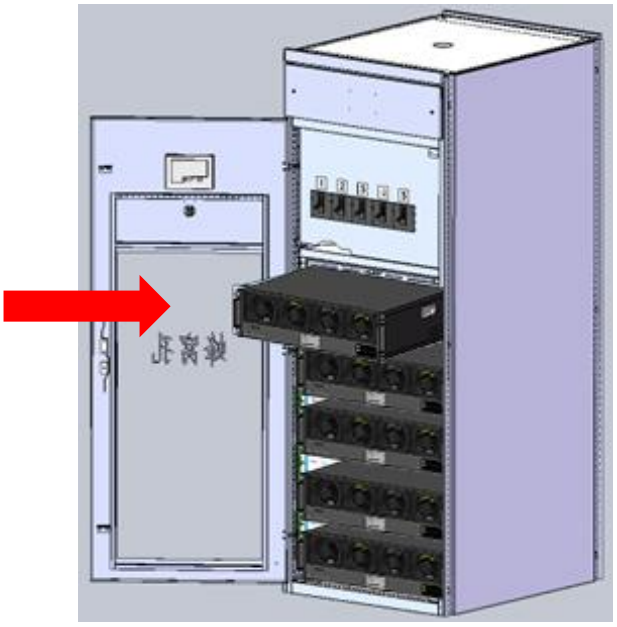


Figure 3-7 Module installation diagram

Notice	● The module weighs ≤ 38kg and requires transport equipment. Lift and installation requires at least two people. ● Please handle the module gently during installation and avoid bumping or knocking it, especially the touchscreen on the front panel. Any damage will be void our liability and warranty.

When installing the module in the cabinet, we provide two standard

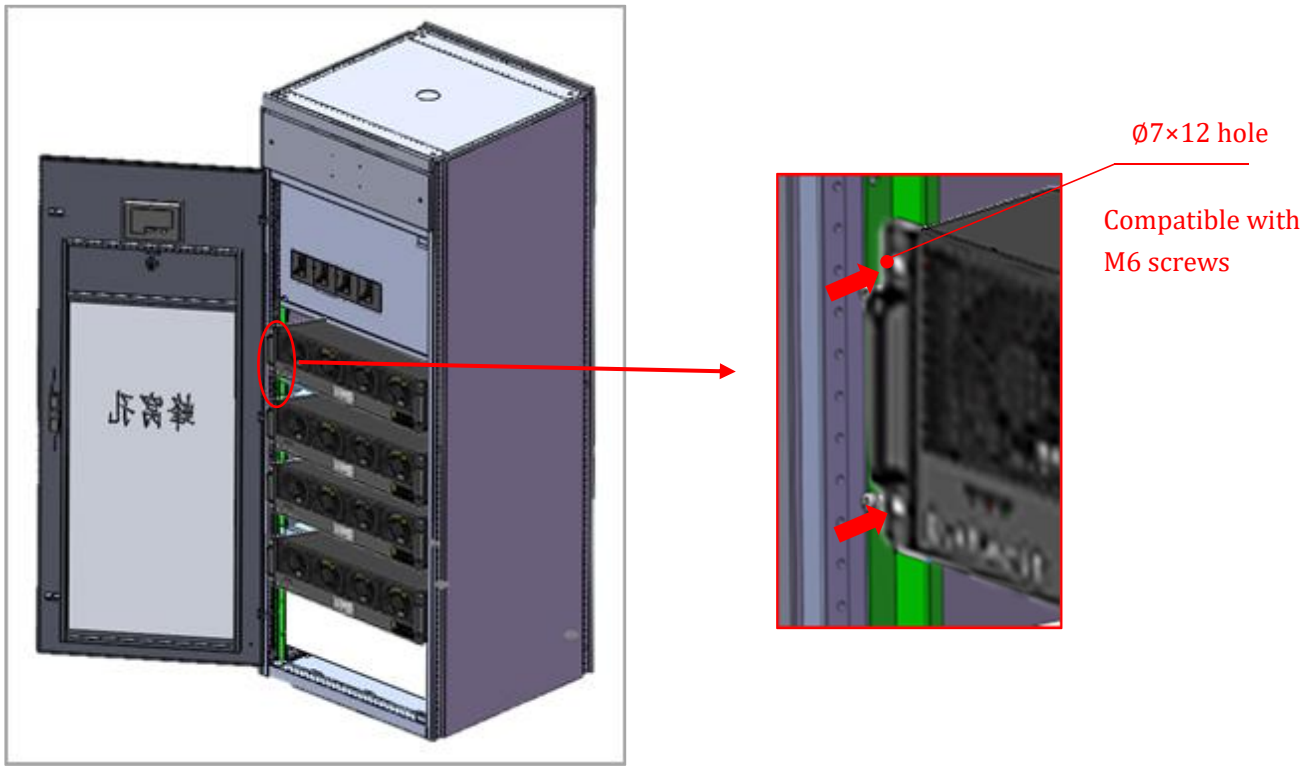
mounting brackets for each module to secure the front end to the cabinet. We also recommend installing two guide rail limit beams on the left and right sides of the module to stabilize the module. The rear side of the guide rail limit beams has fixing holes for bolting to the module. There are two fixing holes on each side of the rear of the module for securing with M6 screws.

(The mounting brackets are provided by our company. The guide rail limit beams are recommended for installation, but are not provided by our company. We recommend that they be included during cabinet sheet metal production.)

NOTE

- The module mounting and installation method here was designed by our structural engineers. It is easy to install, meets mechanical strength requirements, and is convenient for transportation, disassembly, and maintenance.
- Other mounting methods are also acceptable, as long as they ensure mechanical strength and heat dissipation within the module's installation space.

Install the mounting bracket and fix them to the cabinet



Note: M6 screws should be provided by the user.

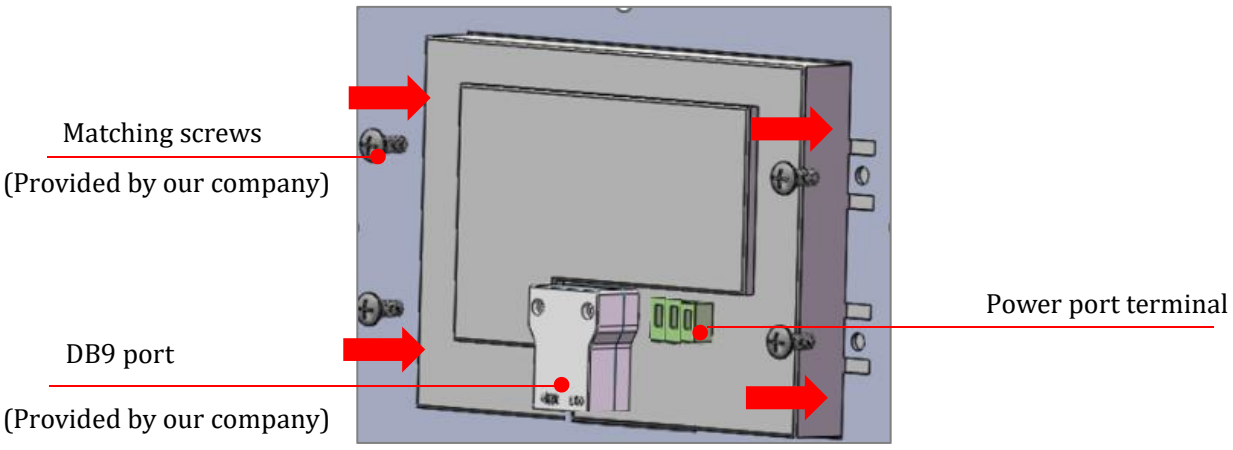
Figure 3-8 Installing the mounting bracket

Guide Rail Limiting Crossbeam(Recommended fixing method. Not provided by our company. It's recommended to integrate during cabinet sheet metal production.)

Figure 3-9 Schematic diagram of module installation and fixation

(3) Installation of Centralized Monitoring Touchscreen

When installing the cabinet, a 7-inch external centralized touch screen can be installed on the cabinet door to centrally monitor all modules within the cabinet. The touch screen comes with mounting hardware for securement. The touch screen is equipped with a DB9 port and power port terminals.



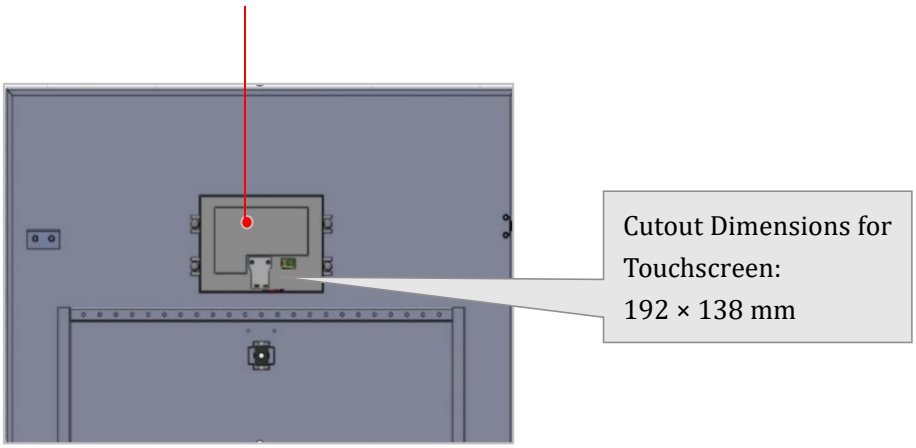


Figure 3-10 Touch screen installation diagram

3.3 Wiring

3.3.1Primary wiring

（1）Wiring Diagram

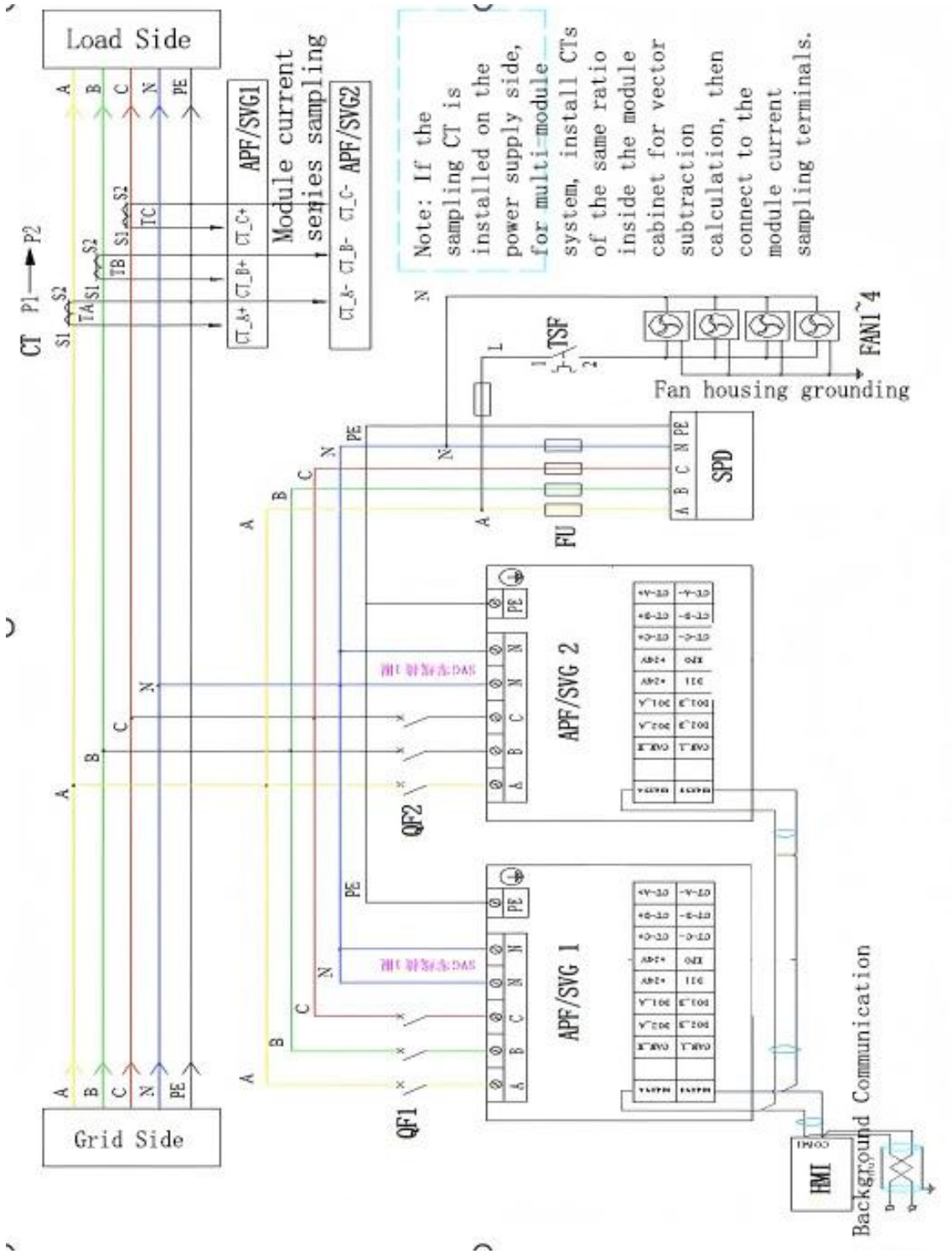


Figure 3-11 Wiring diagram

（2）Primary cable/copper busbar selection

Cable selection:

- The selection of APF incoming cables with different capacities and current levels should comply with relevant electrical regulations and take environmental conditions into consideration. The following table can be used as a reference:

Device rated current	35A	50A、75A /50k	100A	150A	200A
ABC three-phase cable	16㎜²	25㎜²	35㎜²	70㎜²	95㎜²
N wire specifications	16㎜²*2	25㎜²*2	35㎜²*2	70㎜²*2	95㎜²*2

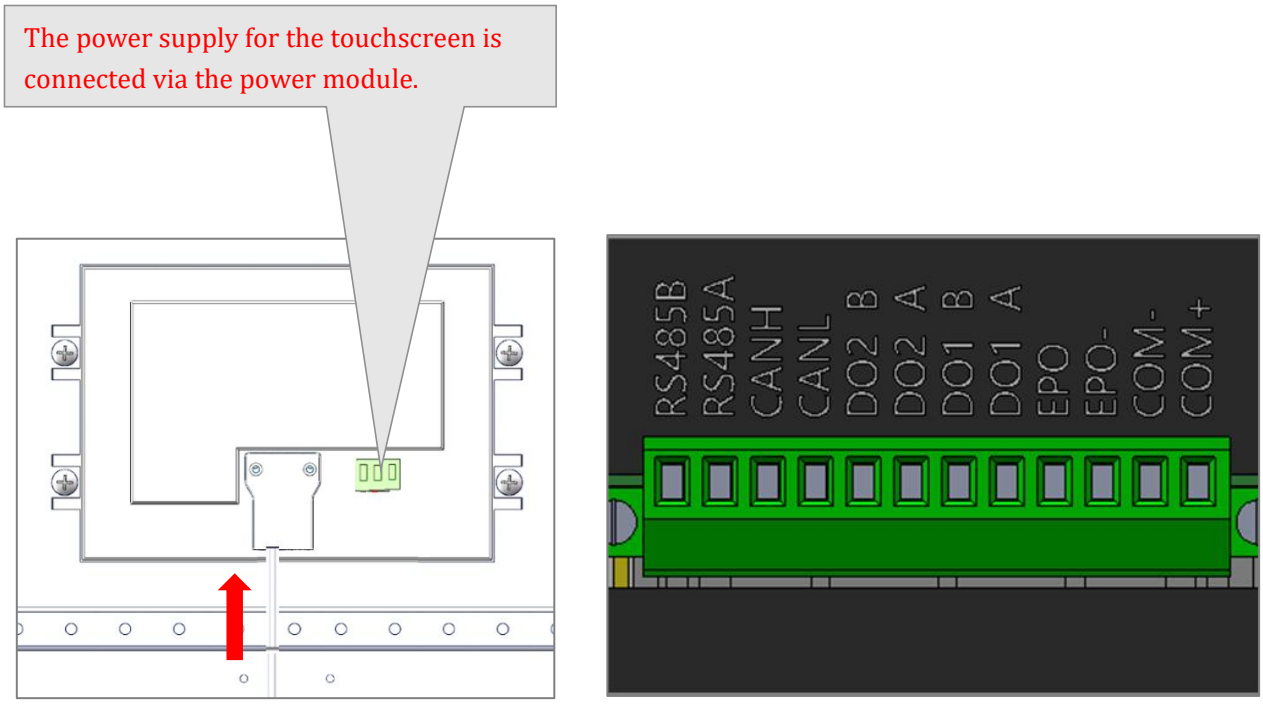
Note: APF is rated based on current. For aluminum cables, the corresponding copper wire specifications apply.

- Cables are usually BVR multi-strand copper-core PVC-insulated flexible wires.
- For high currents, two pairs of wires may be used.
- Neutral (N) Wire: Generally, it can be selected to be consistent with the phase wire. In situations with three-phase imbalance or significant third harmonics, it is recommended to use a larger gauge for the N wire, as the current at the N wire is relatively large at this time. If there is an accurate current value for the N wire in the actual project, the specification of the N wire can be selected according to the current.
- Grounding (PE) Wire:Yellow-green BVR multi-strand copper-core flexible wire. When the AC phase wire cross-sectional area S is ≤ 16 mm^2, the wire cross-sectional area is the same as that of the phase wire; when the phase wire cross-sectional area is 16 ≤ S ≤ 35 mm^2, use a 16 mm^2 protective ground wire. When the phase wire cross-sectional area is greater than 35 mm^2, use half the phase wire cross-sectional area as the protective ground wire.
- Copper busbar selection reference：

Device rated current	below150A	150A~300A	300A~600A	600A~900A
Copper busbar specifications	20*4	30*4	50*5	60*8

3.3.2 Centralized Monitoring Touchscreen Wiring

The external centralized touchscreen connects to the RS485 port on the back of the module. The mounting bracket, port adapter module, and communication cable are standard accessories. Insert one end of the communication cable into the RS485 port on the module and the other end into the port module on the back of the touchscreen.



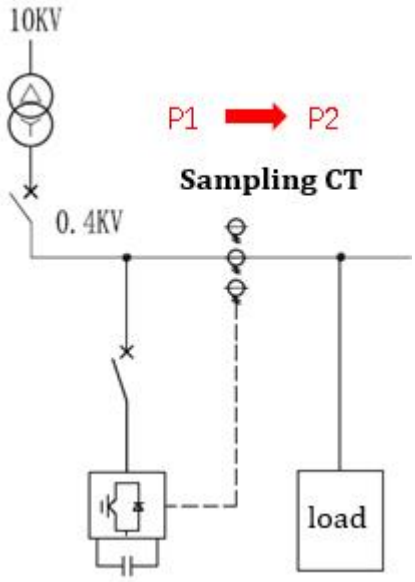
Touch screen terminal wiring (Communication cables are provided by our company) Module terminal wiring

Figure 3-12 Wiring Diagram for Centralized Monitoring Touchscreen Communication Cable

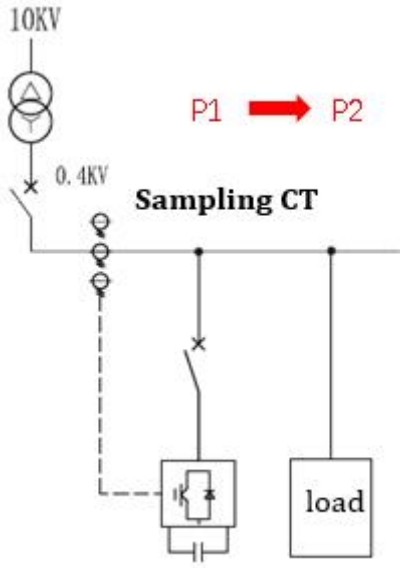
3.3.3 CT Wiring

（1）CT Position and Direction

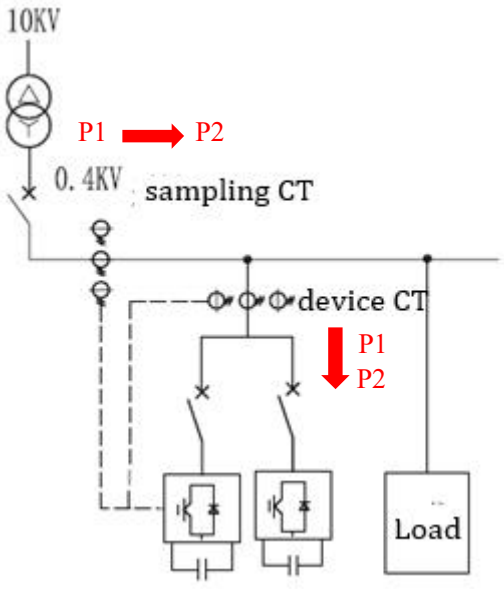
APFs are installed in parallel in the system. The current transformer (CT) can be installed on the grid side or the load side. The CT position (grid side or load side) can be set on the monitoring touchscreen according to the actual installation.



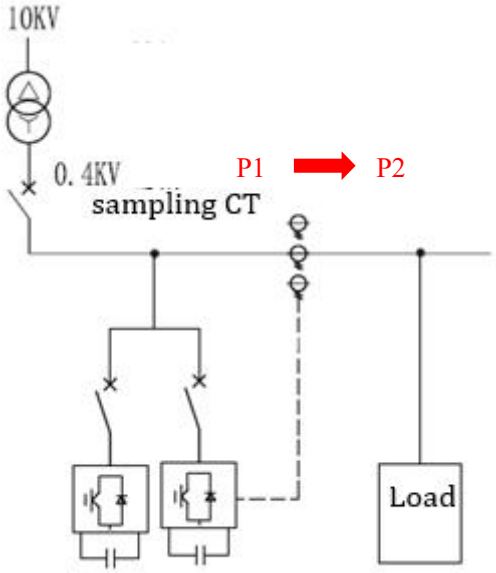
A：Single Module Load-Side Sampling



B：Single Module Grid-Side Sampling



C：Multi-module grid-side sampling



D：Multi-module load-side sampling

Figure 3-13 Schematic diagram of CT sampling scheme

■ Single Module

When a single APF module is connected to the system, the CT can be installed on either the grid side or the load side, as shown in Figures A and B.

■Multi-module

When multiple modules are connected to the system in parallel, the sampling grid side and the sampling load side are different, and the sampling

load side wiring is more convenient.

Load-Side Sampling: When sampling the load side for multiple parallel-connected modules, only one set of CTs is required, as shown in Figure D.

Grid-Side Sampling: When sampling the grid side for multiple parallel-connected modules, it is necessary to add a CT device in the APF cabinet to sample the output current of the modules themselves. Then, the grid CT signal and the CT device signal are subtracted in anti-parallel to obtain the load-side current signal, which is input into the modules as the final sampling signal. The sampling signals between modules are connected in series, as shown in Figure C.

■Mixed Use of APF and Capacitor Compensation

When APF and capacitor-reactor compensation device are used together, the principle is that the main incoming line connection of APF should be closer to the load than the capacitor. This is because the APF compensates for harmonics.This way, the APF connection point faces the grid, and the current flowing through it is harmonically compensated, primarily consisting of the fundamental wave, which helps extend the life of the capacitors. The CT can be placed on either the grid or the load side.

Notice Waring	● When APF is used for harmonic compensation, it cannot be used with pure capacitors. A reactor must be connected in series to ensure the compensation circuit exhibits inductive reactance at targeted harmonic frequencies, thereby preventing resonance.Otherwise, it may cause APF failure or damage to the pure capacitor compensation equipment.

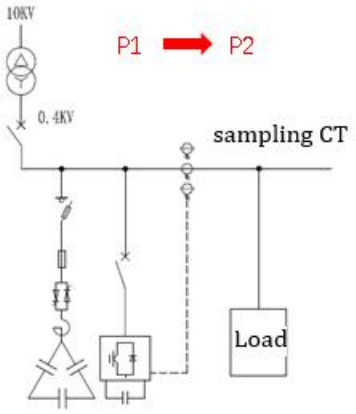


Figure 3-14 Schematic diagram of APF CT sampling position

CT installation direction: P1 towards the grid, P2 towards the load.

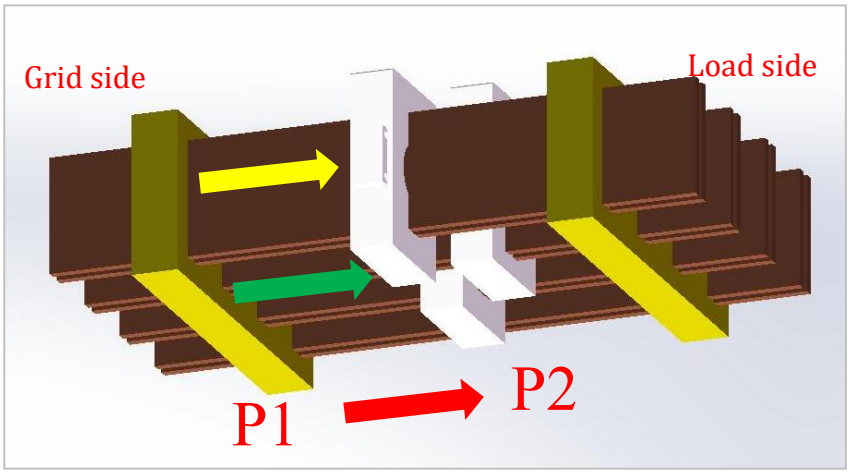
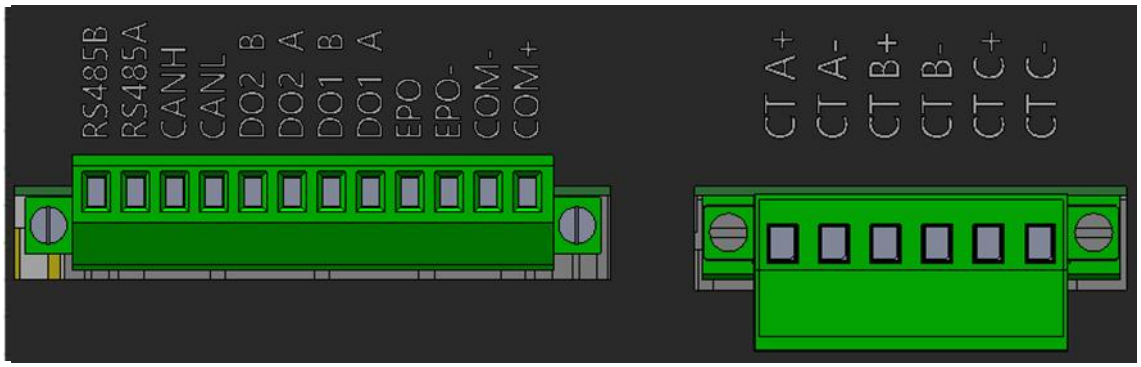


Figure 3-16 Schematic diagram of the P1 P2 direction of the current transformer

NOTE ● If the CT current flows from P1 to P2, then S1 is positive (+) and S2 is negative (-); otherwise, S1 is negative (-) and S2 is positive (+).

（2）Wiring

Notice Warning	**Improper current transformer connection can result in fatal electric shock due to an open circuit!** ● Refer to the wiring diagram when installing and wiring the sampling CT. If you have any questions, please contact our technical support staff immediately. ● The installation and wiring of the APF CT must be performed by a trained and qualified engineer in accordance with the "Electrical Code." Unauthorized installation by other personnel is strictly prohibited. This manual only covers basic installation information. Please refer to the Electrical Code for specific installation details. ● Before installing the primary side of the current transformer, short-circuit the secondary side with a disconnect shorting terminal first. Otherwise, the current transformer in an open-circuit state will generate high voltage on the secondary side. ● Ensure that the current transformer is short-circuited until all APF CT terminals are connected. ● Before disconnecting the current transformer from the APF, short-circuit it with the disconnect shorting terminal.



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Description of Secondary Signal Wire Interface							
No.	Silk Screen	Name & Description	Remarks	No.	Silk Screen	Name & Description	Remarks
1	RS485B	485B Signal		11	COM-	GND	
2	RS485A	485A Signal		12	COM+	24V Power Supply	
3	CAN_H	CAN_H Signal					
4	CAN_L	CAN_L Signal		No.	Silk Screen	Name & Description	Remarks
5	DO2_B	Output 2_B		1	CT_A+	Current Transformer Phase A+	
6	DO2_A	Output 2_A		2	CT_A-	Current Transformer Phase A-	
7	DO1_B	Output 1_B		3	CT_B+	Current Transformer Phase B+	
8	DO1_A	Output 1_A		4	CT_B-	Current Transformer Phase B-	
9	EPO	Emergency Stop		5	CT_C+	Current Transformer Phase C+	
10	EPO-	GND		6	CT_C-	Current Transformer Phase C-	

Figure 3-17 Module secondary terminals and CT cable connection diagram 2

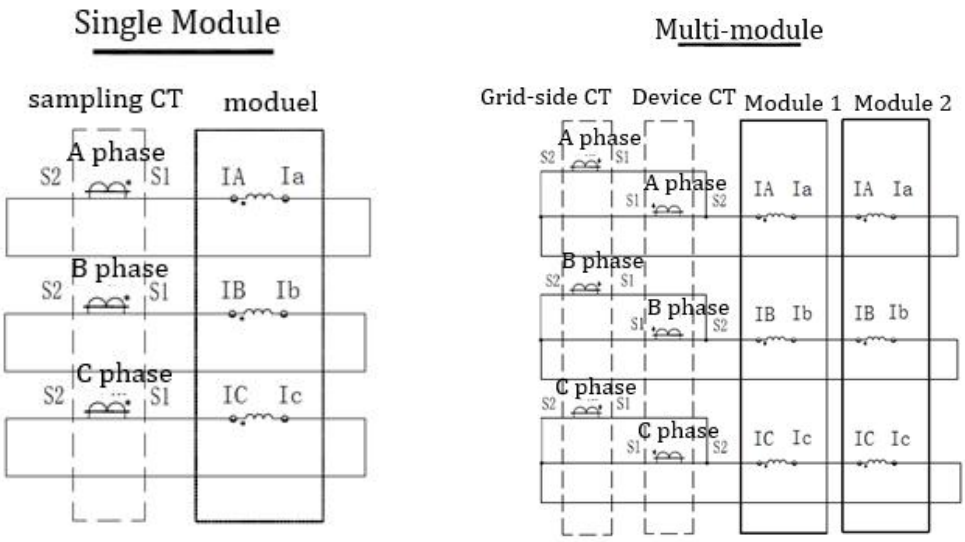


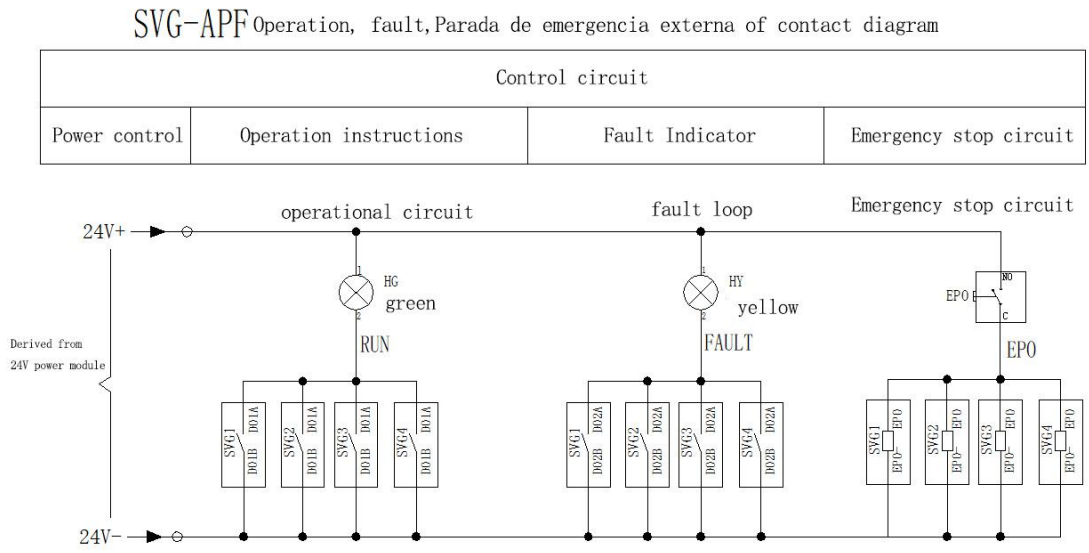
Figure 3-18 Typical CT wiring diagram

Grid-side sampling: When multiple modules are connected in parallel for grid-side sampling, a CT device must be added to the APF cabinet to sample the module's output current. Then, the grid CT signal and the device CT signal are connected in anti - parallel and subtracted to obtain the load - side current signal, which is then input into the module as the final sampling signal. The sampling signals between modules are connected in series. As shown in Figure 3 - 18.

The CT cable should be a 2.5mm^2 shielded twisted pair RVSP 2×2.5 (cable length L < 15m) or a 4mm^2 shielded twisted pair RVSP 2×4 (cable length 15m < L < 30m).

3.3.4 Emergency Stop Switch Wiring

When installing an APF cabinet, an emergency stop switch is typically installed on the cabinet door. If an abnormality (smoke, unusual noise, or fire) occurs inside the cabinet or within a module, pressing the emergency stop switch immediately stops the module, effectively protecting it.



For multi-module parallel operation: Connect the EPO+ and EPO- terminals of each module to the emergency stop switch (using a normally open signal).

Figure 3-19 Emergency stop switch wiring diagram

For parallel operation of multiple modules: Connect the EPO and COM+ pins of each module to an emergency stop switch, connected to a normally open signal.

For primary/auxiliary cabinet: Connect an emergency stop switch to each of the primary and auxiliary cabinet. The emergency stop of the primary cabinet and that of the auxiliary cabinet are connected in series, and then connected in parallel with each module. When the emergency stop switch in either primary or auxiliary cabinet is pressed, all modules will immediately shut down.

Notice	● The emergency stop switch is not mandatory for installation. If not installed, the EPO and COM+ ports should remain unconnected.

Chapter 4 Start-up and Shutdown Operation Guide

4.1 Startup steps

4.1.1 Wiring Inspection

(1) Check the wiring between the busbar and the circuit breaker, and between the circuit breaker and the equipment for obvious phase sequence errors. If any problems are found, correct them immediately.

(2) Check whether the equipment's busbars are tightly connected and free from looseness; ensure all connections are secure.

(3) Use a multimeter to check for short circuits between each pair of the equipment's A, B, C, N, and PE terminals.

(4) Check whether the CT wiring is correct and whether the wiring at both ends of the terminal block corresponds. If not, make sure to correct them.

4.1.2 Communication Inspection

(1) After confirming that the above procedures are correct, disconnect the emergency stop switch and close the circuit breaker.

(2) Check whether the communication status indicator on the front of the module is lit and flashing normally. If it does not flash or is not lit, it indicates a communication problem. If the module on the main interface of the touch screen is displayed in red, check whether the address DIP switch of each module is set correctly. If all are set to 1, communication will definitely fail. The address DIP switches of the modules in the cabinet should be set as 1, 2, 3, 4 in sequence from top to bottom. If the communication problem persists, contact the manufacturer for resolution.

(3) To enter the parameter setting interface, you need to enter a password to log in; no login is required for other interfaces.

(4) Enter the setting interface to configure parameters. In this interface, users can set relevant parameters such as: startup mode, operating mode, CT transformation ratio, CT position, power factor, etc.

4.1.3 Parameter Check

Check whether the parameter display on the interface is consistent with the actual parameter display in the system. If the power factor, active power, or reactive power displays incorrectly (e.g., extremely low power factor, or negative values for active/reactive power in one or two phases), it may indicate a problem with the CT wiring. Please contact the manufacturer promptly for resolution.

 Warning	● During APF start-up, APF output terminals become energized. ● If a load is connected to the APF output terminal, please confirm with the user whether it is safe to power the load. If the load is not ready to receive power, ensure the load is safely isolated from the APF output terminals.

4.2 Shutdown steps

Shutdown is performed by directly disconnecting the circuit breaker upstream of the APF, de-energizing the device. In this state, the APF blocks the IGBT trigger pulses, placing the device in non-compensation mode. Importantly, do not disassemble the module immediately after the APF is powered off. Wait until the internal capacitors are fully discharged, which takes approximately 10 minutes.

 Warning	● To prevent personal injury, if you attempt to perform maintenance or open the chassis after shutting down the unit, first use a multimeter to measure the voltage at the input terminals to ensure there is no mains power before proceeding. ● Module disassembly can only be performed 10 minutes after power-off (the energy storage capacitors inside the module require approximately 10 minutes to discharge).

4.3 Automatic Startup

If the system loses power or experiences voltage or frequency abnormalities, the APF will automatically shut down and stop outputting compensation current. If the following conditions are met, the APF will automatically restart and begin compensation without any further action.

- Mains power returns to normal
- The APF was in the power-on state before power failure
- After a 20-second delay for automatic startup

If the APF is not in the power-on state, the user can manually start the APF via the touch screen control panel.

Chapter 5 7-inch HMI Operation Guide

When modules are installed in a cabinet, an external touch screen is usually mounted on the front door of the cabinet to facilitate parameter setting and viewing for users.The external touch screen is a 7-inch screen. The following describes how to operate the touch screen.

5.1 Main Interface

After the device is powered on, the screen will be in the startup state, and the startup process will last for several seconds. After the startup is successful, if the system is normal, the main interface will be displayed as shown in Figure 5.1.

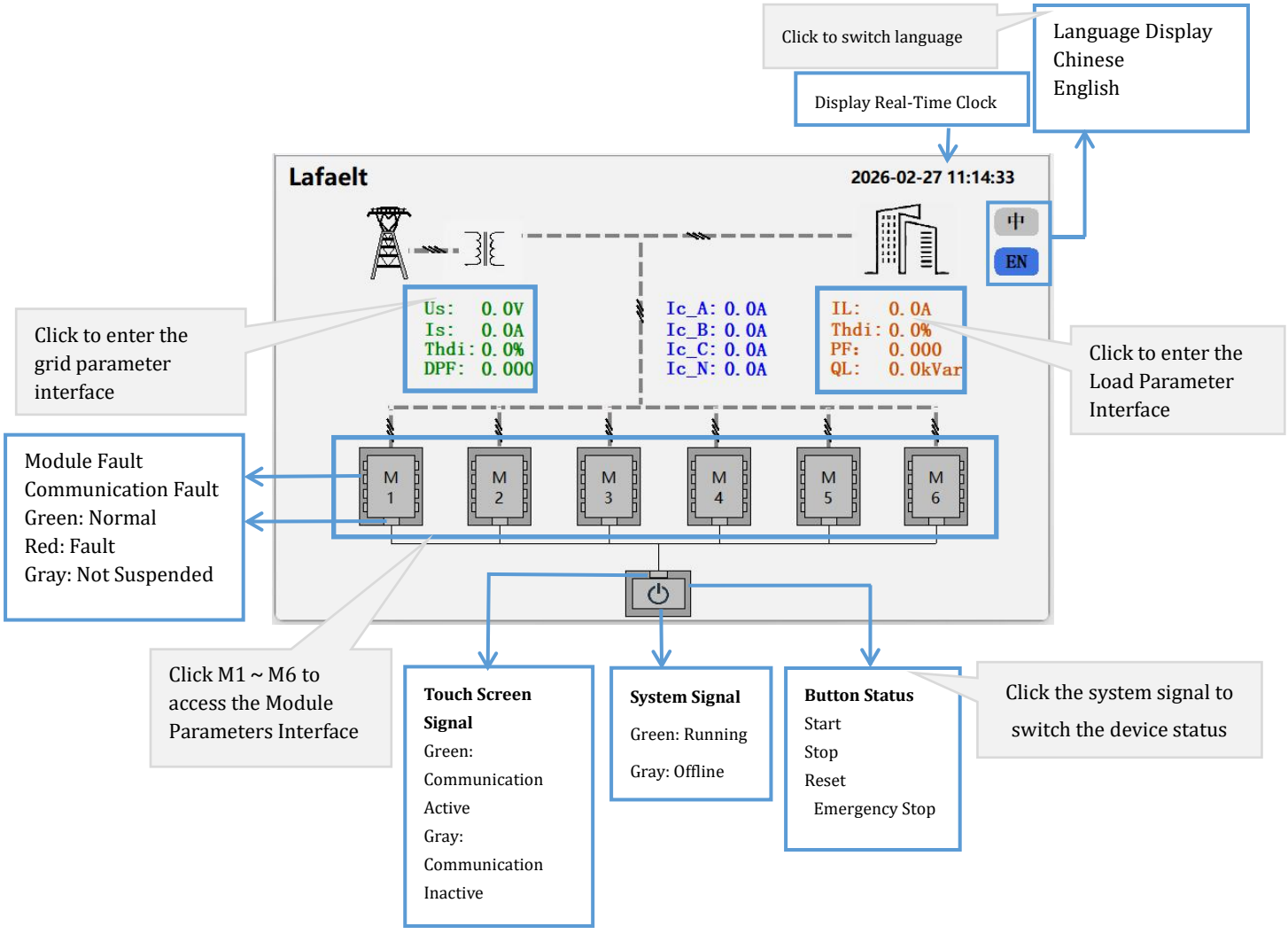


Figure 5.1 System Main Interface

Note: Button Status--During operation:

Hide Start & Reset buttons;

Display Stop & Emergency Stop buttons.

Stop: Blocks output.

Emergency Stop: Blocks output *and* trips the main circuit breaker.

5.2 Grid Parameters Interface

Click the "Grid" button in the navigation bar to enter the grid parameters interface:

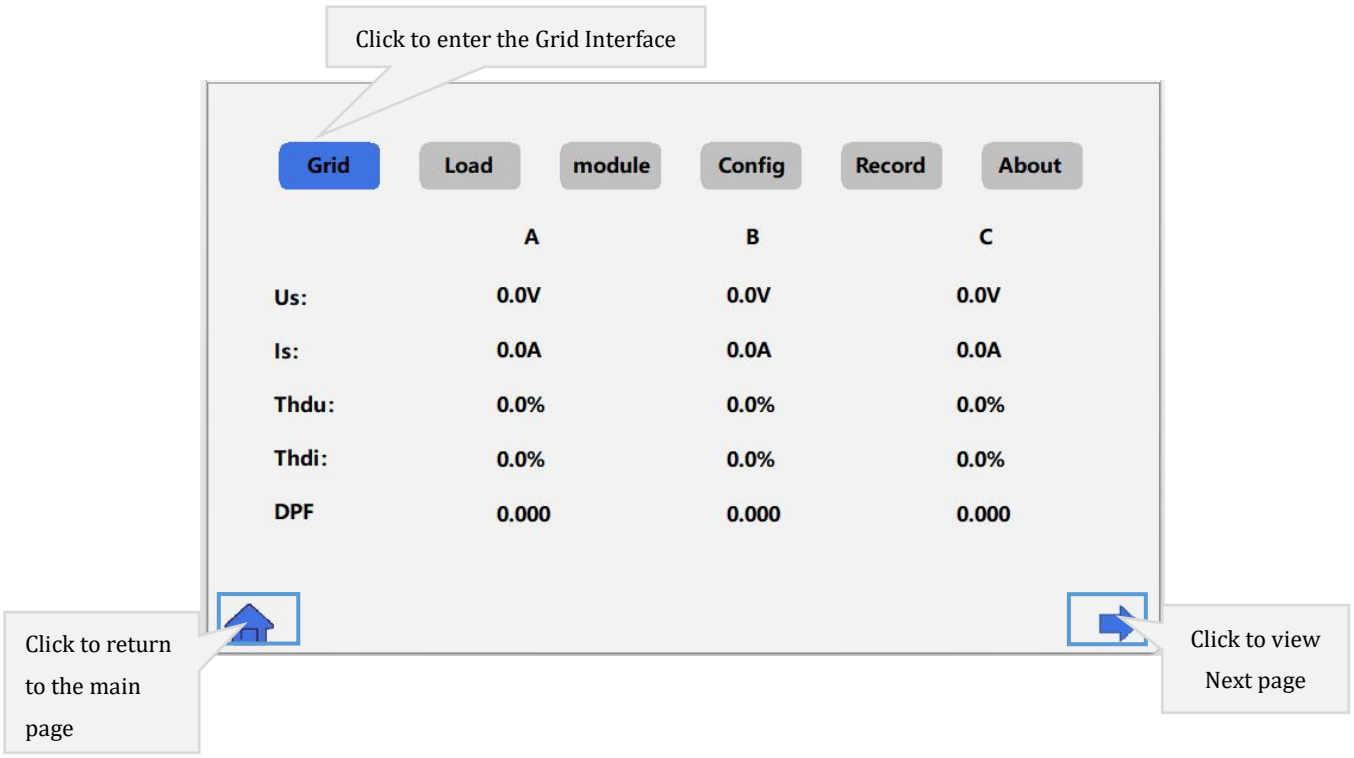


Figure 5.2 Grid Parameter 1 Interface

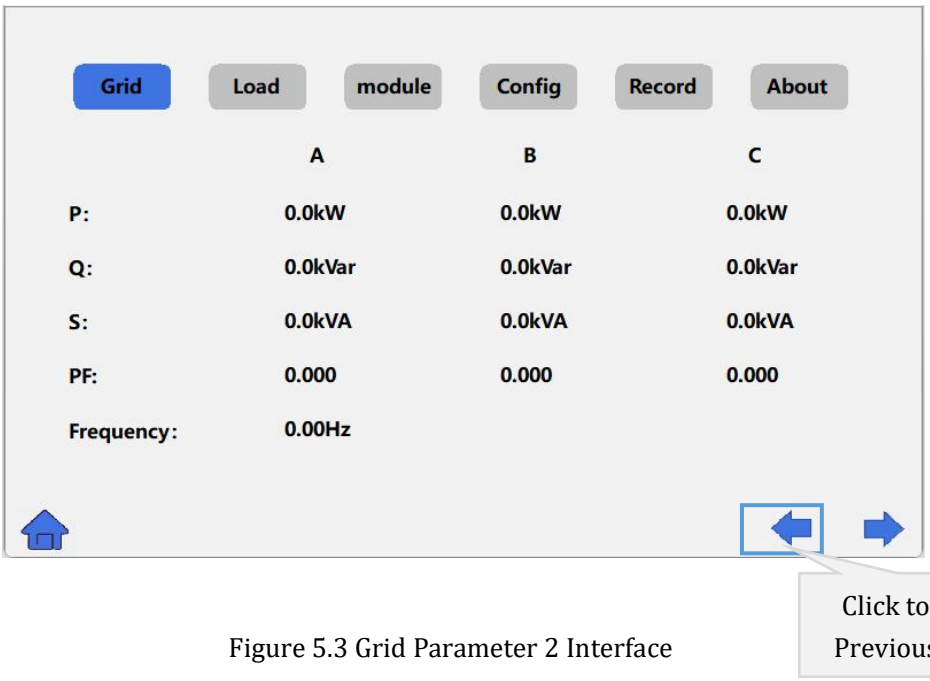


Figure 5.3 Grid Parameter 2 Interface

The 51th harmonic current of the power grid is shown in Figures 5.4，5.5，5.6 and 5.7:

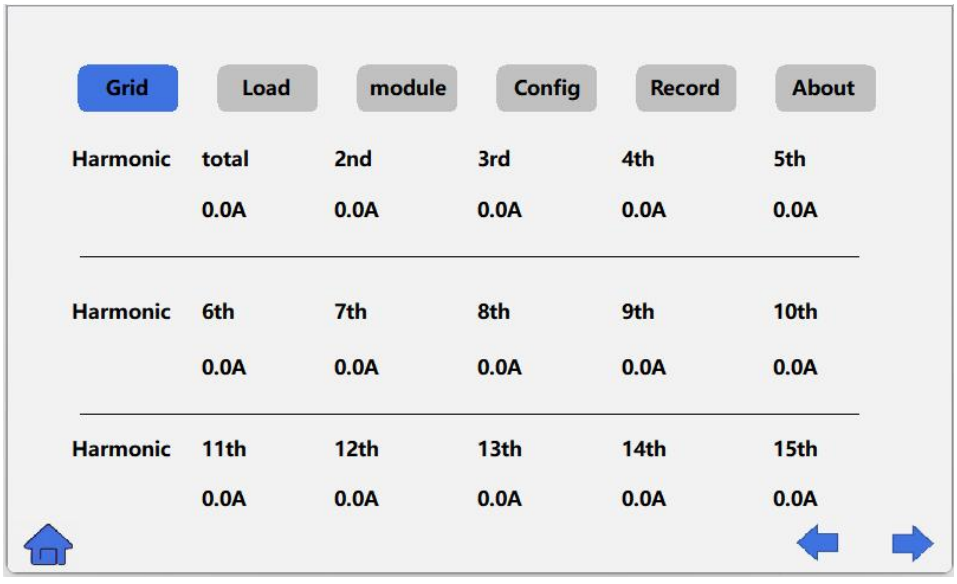


Figure 5.4 Power Grid Harmonic 1 Interface

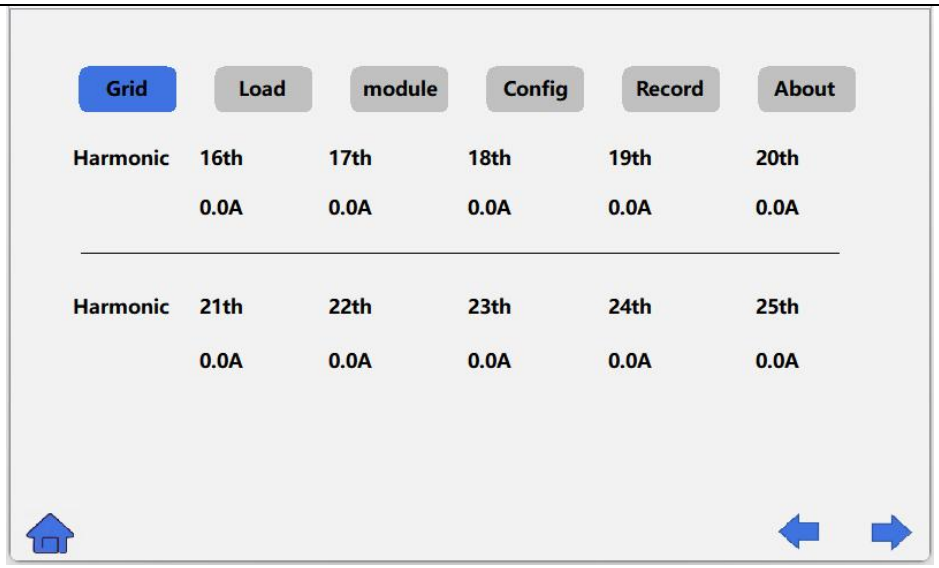


Figure 5.5 Grid Harmonics 2 Interface

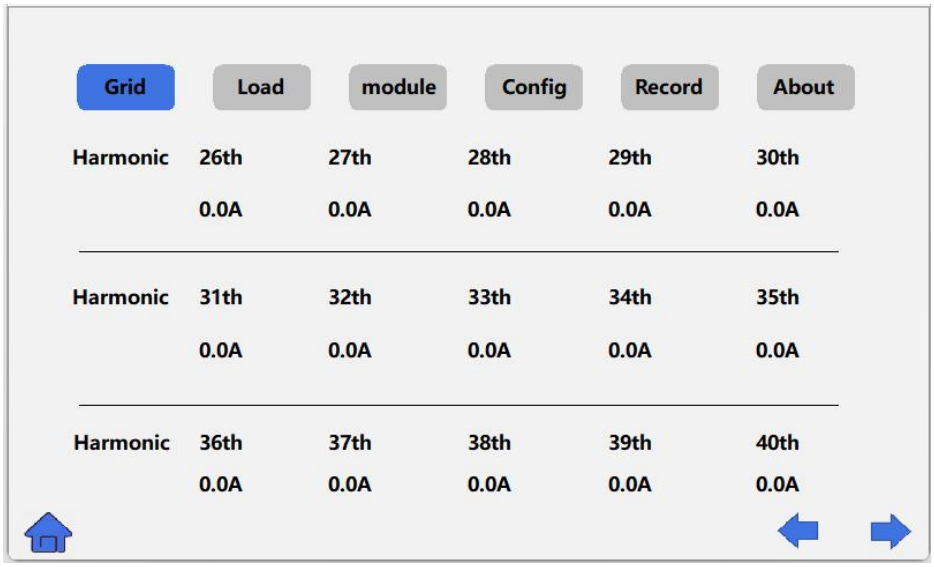


Figure 5.6 Grid Harmonics 3 Interface

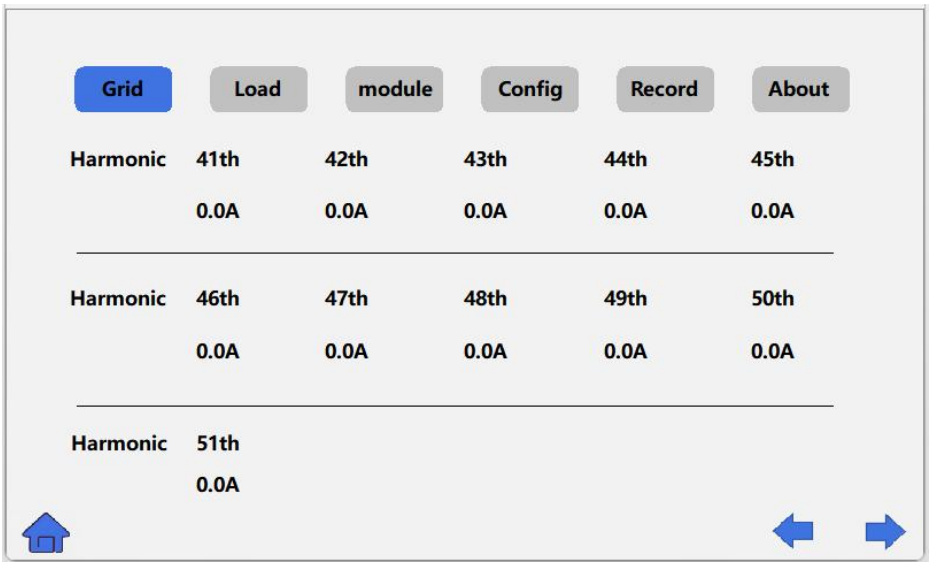


Figure5.7 Grid Harmonics 4 Interface

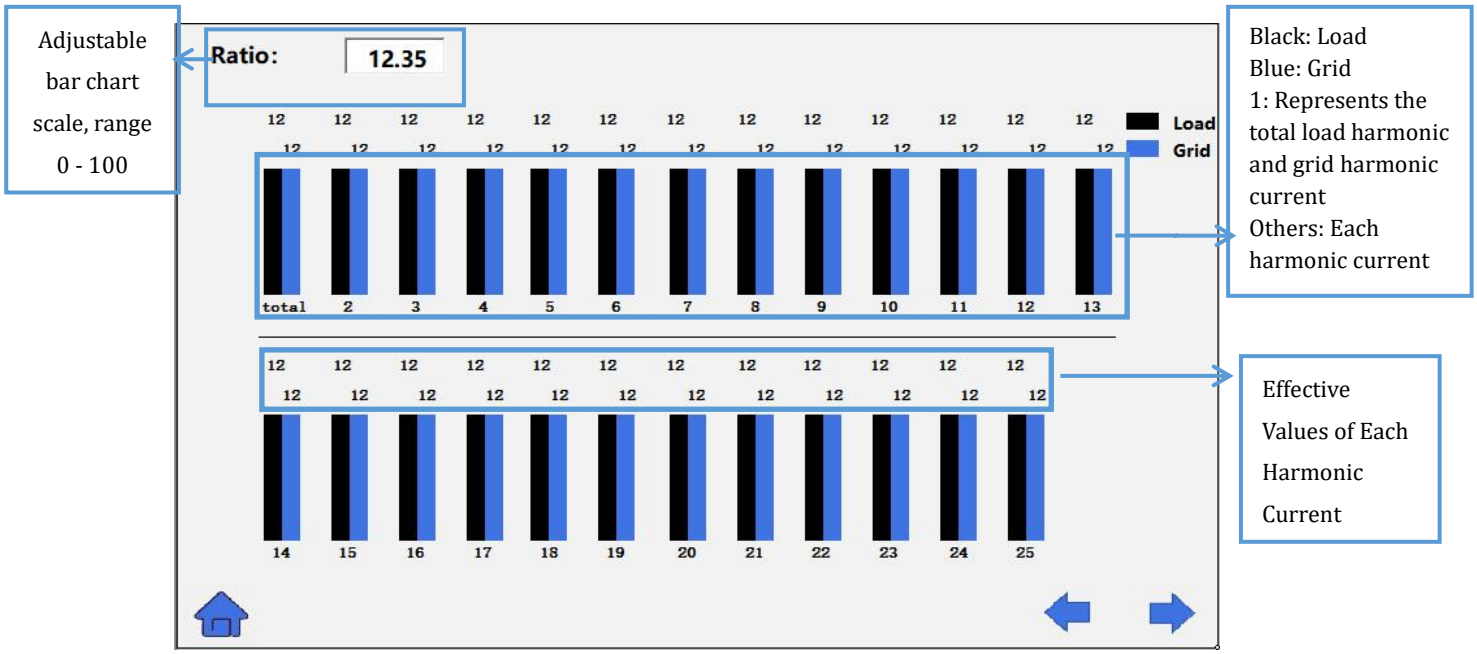


Figure 5.8 Bar Chart1

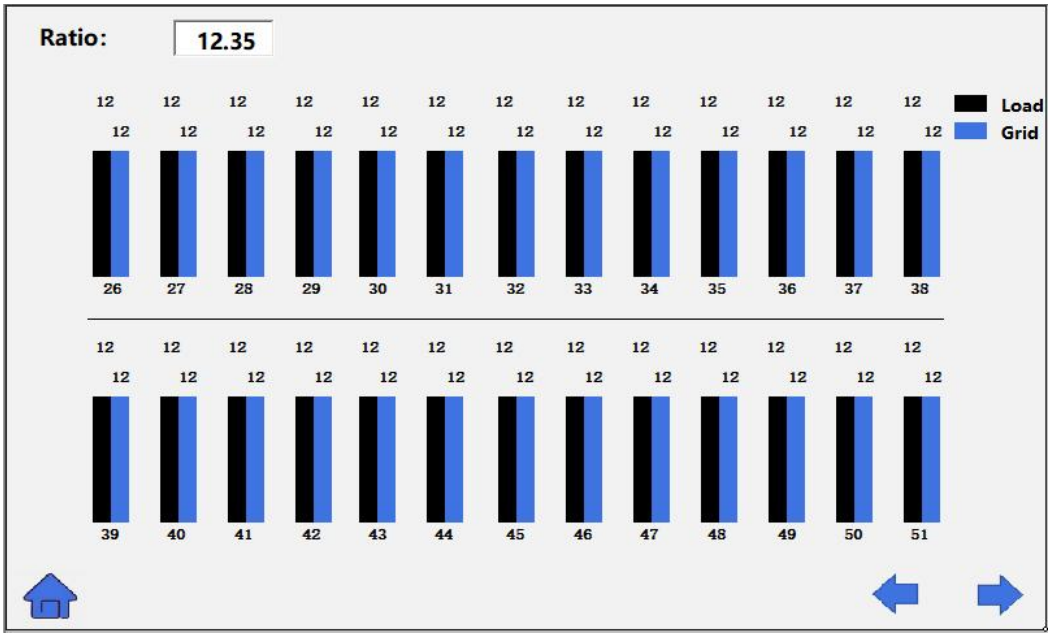


Figure 5.9 Bar Chart2

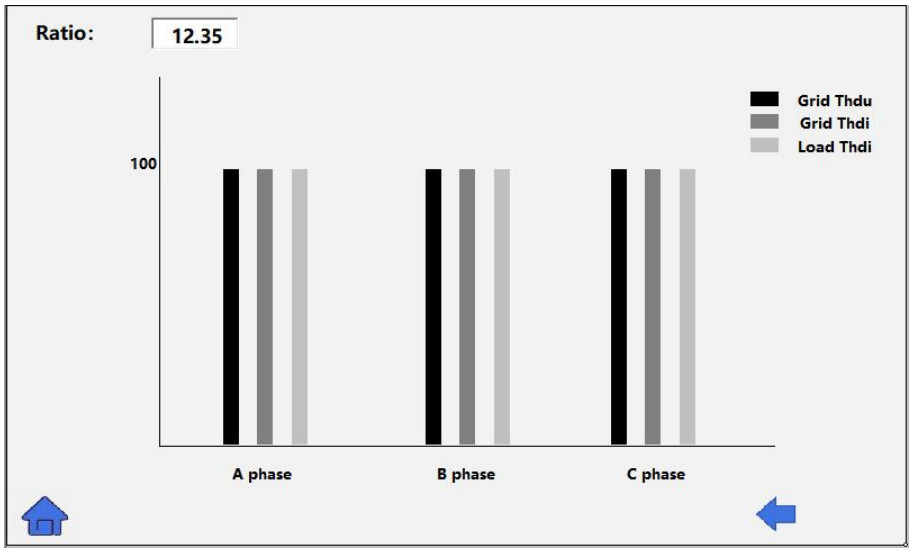


Figure 5.10 THD Bar Chart

5.3 Load Parameter Interface

Click the "Load" button in the navigation bar to enter the Load Parameter Interface:

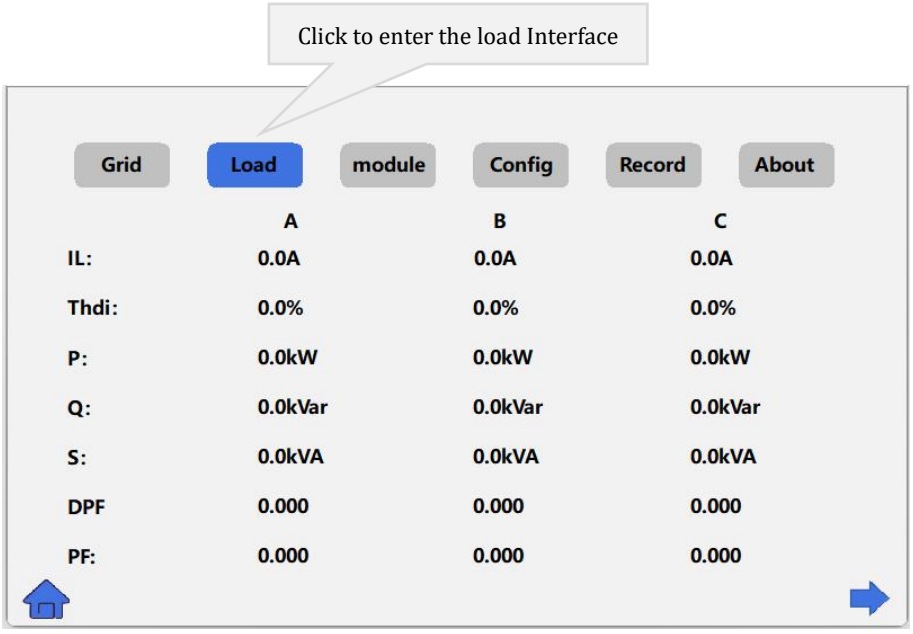


Figure 5.11 Load parameter interface

51th load harmonic current, as shown in Figures 5.12，5.13，5.14 and 5.15：

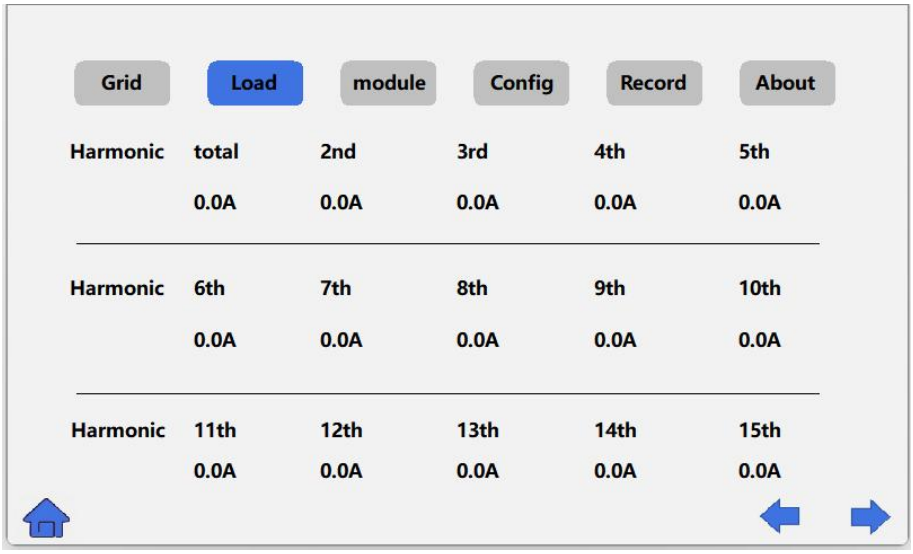


Figure 5.12 Load Harmonic 1 Interface

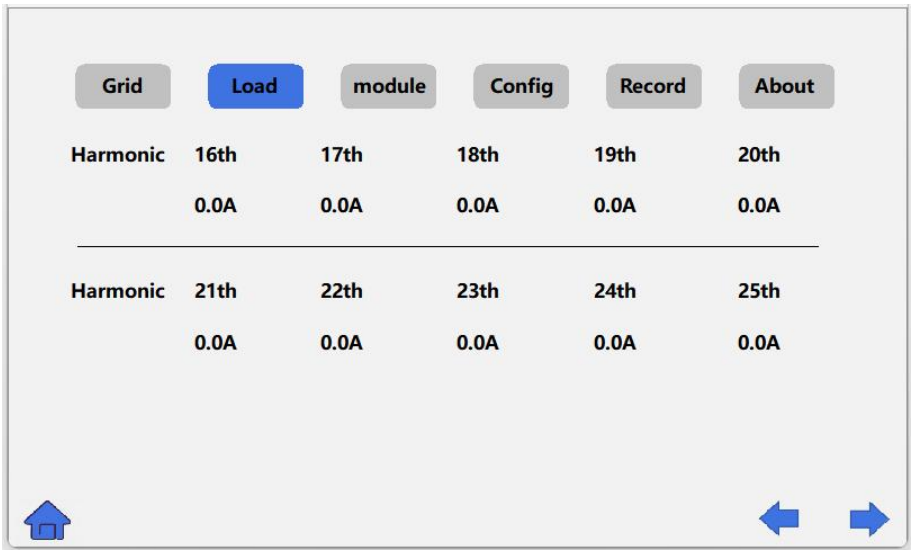


Figure 5.13 Load Harmonic 2 Interface

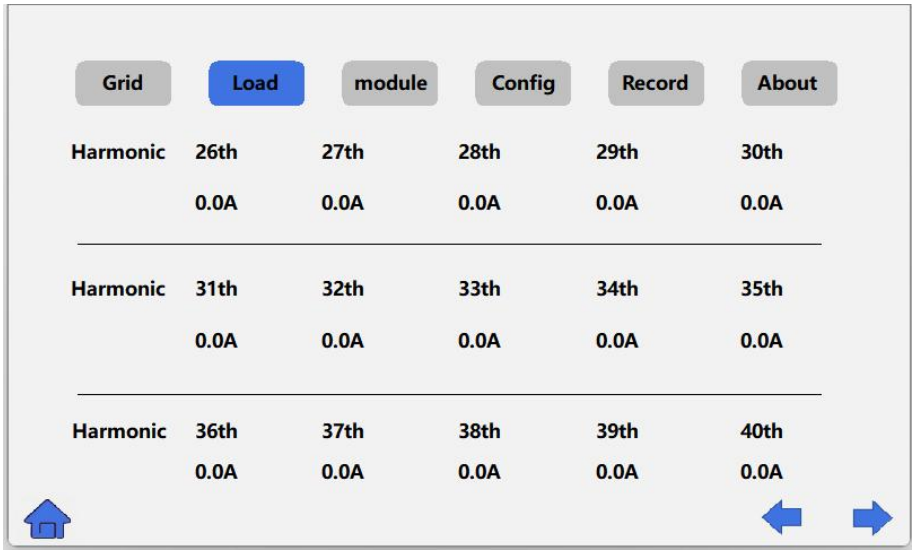


Figure 5.14 Load Harmonic 3Interface

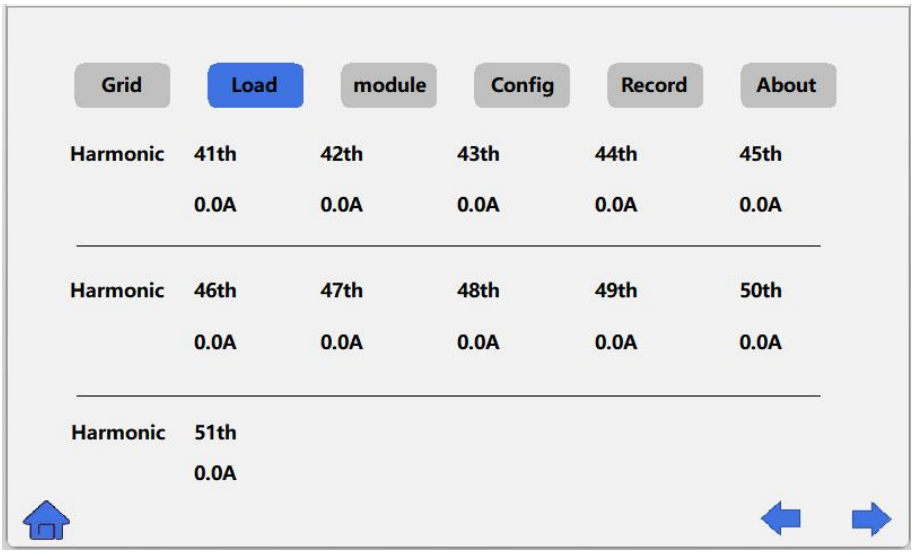


Figure 5.15 Load Harmonic 4 Interface

5.4 Module Parameter Interface

Click the "Module" button in the navigation bar to enter the Module Parameter Interface:

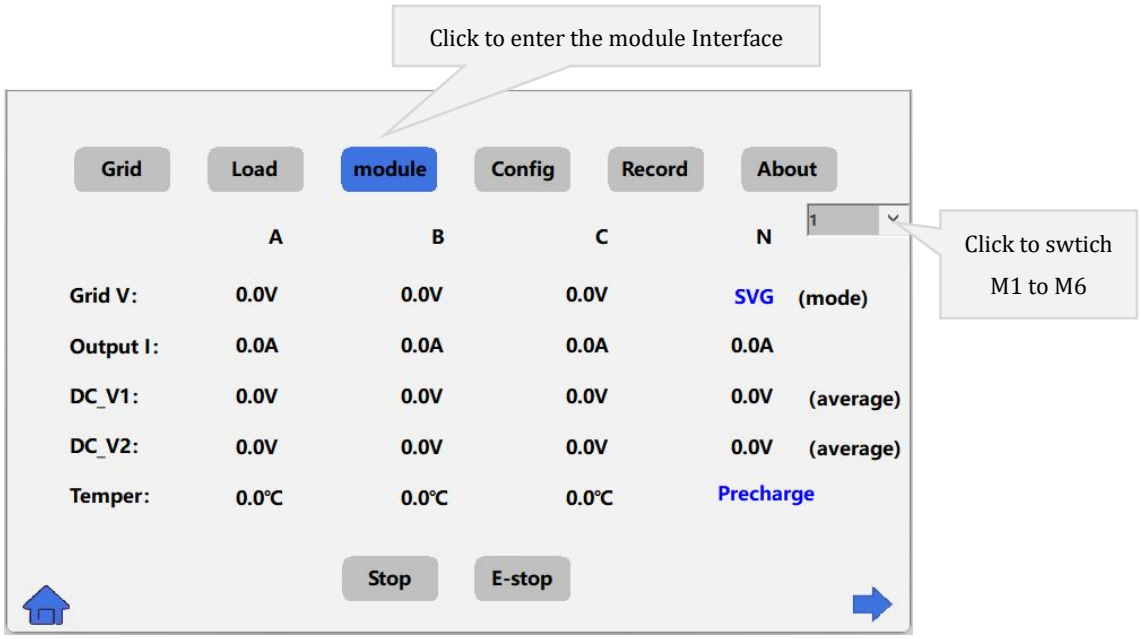


Figure 5.16 Module parameter 1 interface

Note：Device Status Indicators 5 states: Pre-charging, Standby, Start, Stop, Fault.

"Single Module Button" State — In the start state, the Start and Reset buttons are hidden, while the Stop and Emergency Stop buttons are displayed.

Stop: Blocks output.

mergency Stop: Blocks output and trips the main circuit breaker.

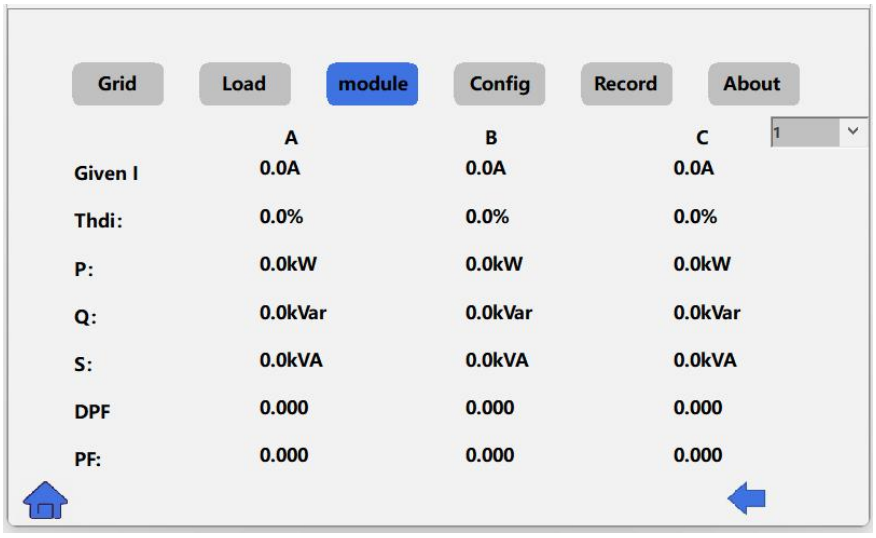


Figure 5.17 Module parameter 2 interface

5.5 Parameter Settings Interface

Click the "Settings" button in the navigation bar. A login page will pop up. Enter your password: 1234. Enter the settings interface to modify parameters:

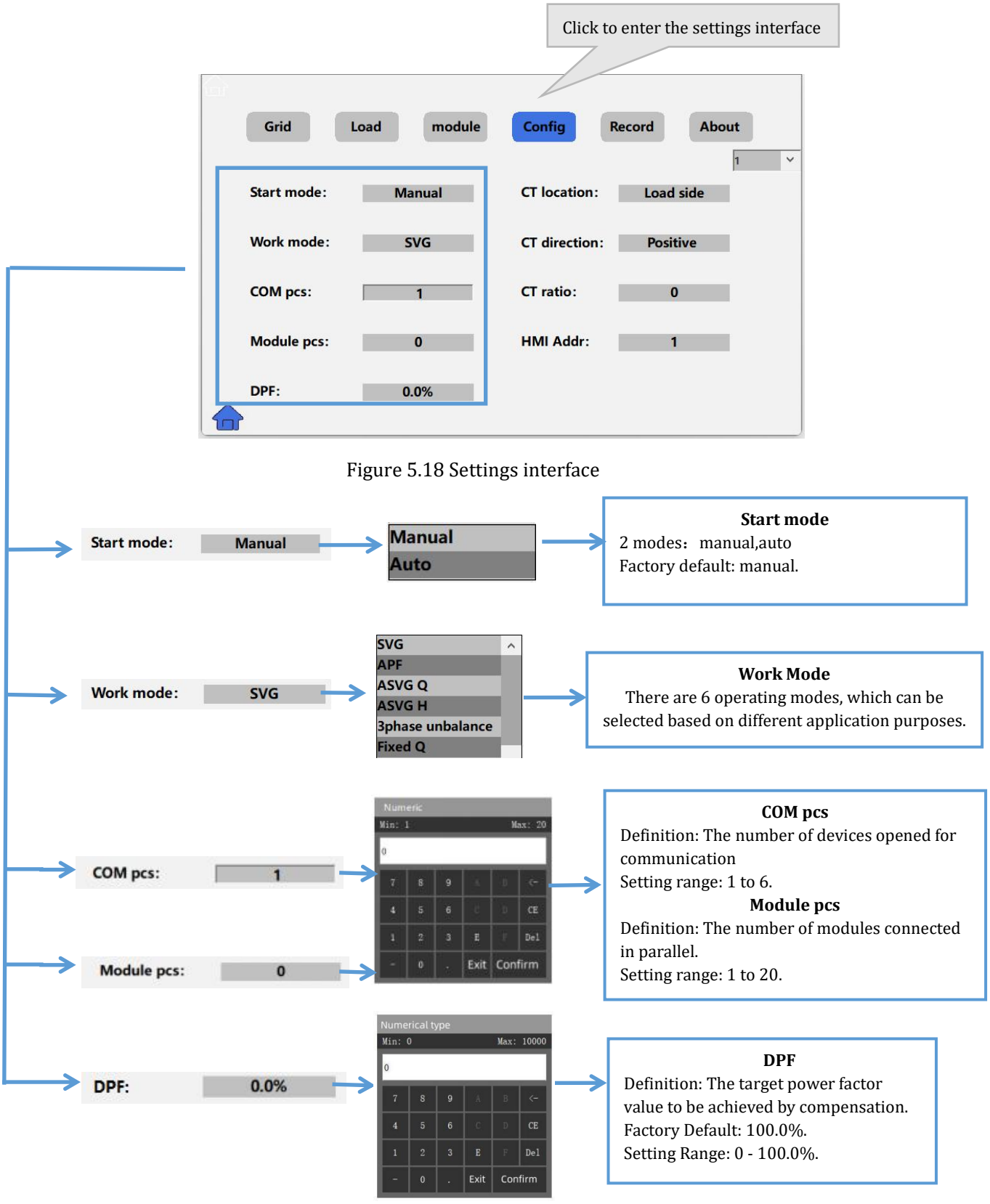
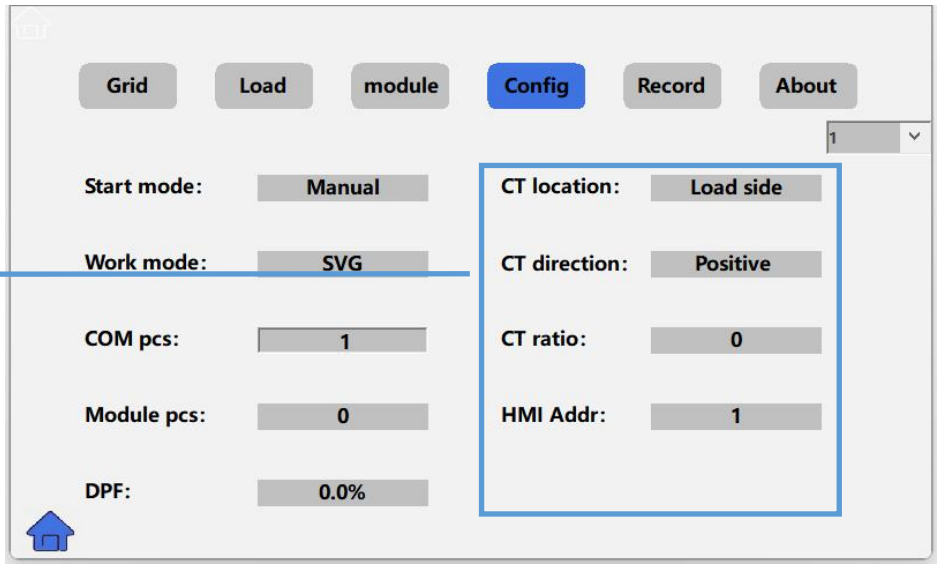


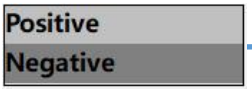
Figure 5.18 Settings interface



CT location

Load Side: Current Transformers installed upstream of connection point.

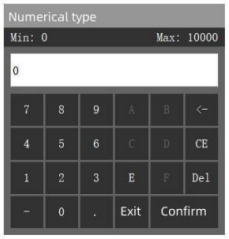
Power Side: Current Transformers installed downstream of connection point.



CT direction

Positive: Power supply points to the load.

Negative: Load points to the power supply.



CT ratio

Definition: The rated current values of the primary and secondary sides of the CT. Factory Default: 200.

Setting Range: 0 - 10000.

HMI Address

The device operation status is detected by associating with the screen station number. Setting range: 0 - 255.

5.6 Real-time recording interface

Click the "Record" button in the navigation bar to enter the real-time recording interface:

Figure 5.19 Real-time recording interface

5.7 Personalization Interface

Click the "about" button in the navigation bar to enter the Personalization interface:

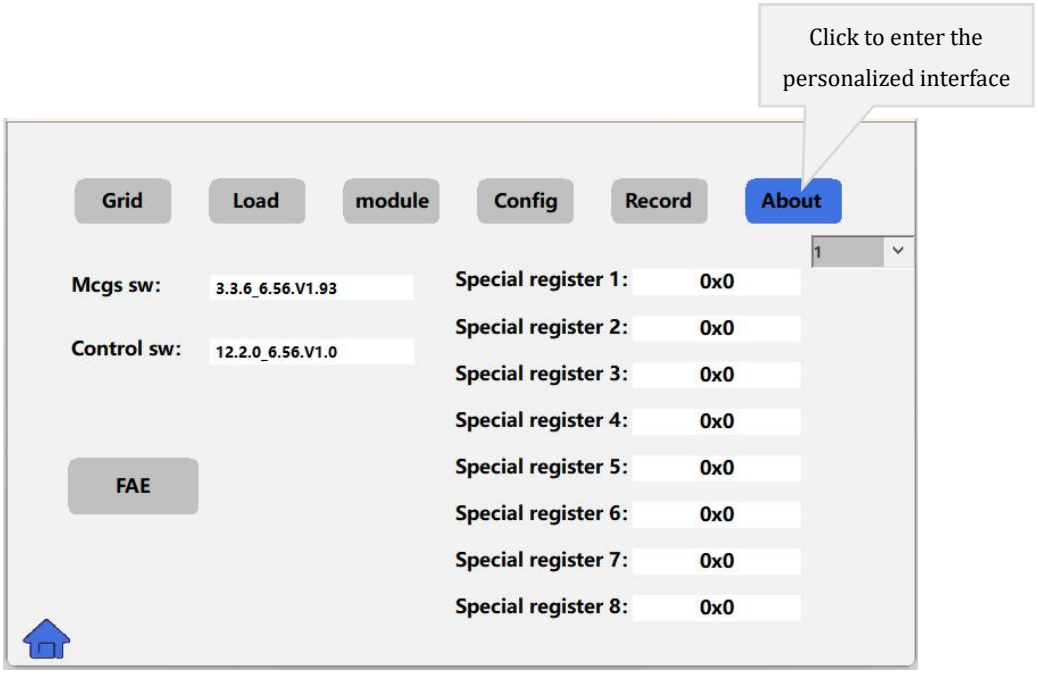


Figure 5.20 Personalized interface

This interface allows viewing of the software version number and device information. Fault codes can be viewed via Special Registers 1-8.

 **Notice**	● If a fault occurs during operation and causes the device to automatically shut down, it will automatically restart after the fault clears. ● Upon power interruption immediately after startup, the current state is retained. Parameters will automatically restore to pre-outage settings when operation resumes.
 **Warning**	● To ensure equipment safety and prevent unauthorized operation, ordinary users must enter the password "1234" to access parameter settings, while debug personnel may log in via the "Debug Parameters" button. ● Technician and administrator passwords are confidential and require authorization from our company for access. On-site debug personnel are strictly prohibited from disclosing technician or administrator passwords to ordinary users or non-professionals. Unauthorized operations may cause equipment malfunction or damage.

Chapter 6 Maintenance

6.1 Maintenance

To ensure the safe and reliable operation of the equipment, our company recommends regular maintenance:Clean dust annually (every 12 months), Replace heat dissipation fans every 4–5 years, Replace DC capacitors every 8 years. In special environments, maintenance intervals may be shortened based on operating conditions. The steps for comprehensive equipment maintenance are as follows:

Step 1: Check Ambient Temperature/Humidity

- Monitor temperature and humidity during APF operation to ensure values are within the equipment's specified range.
- If exceeded, the device MUST be derated.

Step 2: Power Off

- Stop equipment operation and disconnect all power cables.
- Wait AT LEAST 10 MINUTES to ensure complete discharge of DC-side capacitors.
- Open the equipment cabinet door.

Step 3: Clean the Device

- Visually inspect internal components and cables for abnormalities (eg.Deformation, discoloration, etc.)
- Clean all debris and dust from the device, paying particular attention to areas around the cooling fan and air inlets and outlets.
- Ensure no foreign objects are left inside the device.
- Use a soft brush to wipe off dust from the circuit boards.

Step 4: Inspect Circuit Breakers

- Check the circuit breakers for aging degradation and physical damage.

Step 5: Inspect Mechanical/Electrical Connections

- Check whether the electrical connections are secure and replace any oxidized pins or connectors.
- Check whether all mechanical connections are tight and re-tighten any loose parts.

Step 6: Other Abnormalities

- If any other abnormalities occur, perform appropriate repairs.

Step 7: Restart the Device

- Reconnect the primary power cable.
- Restore all connections.
- Restart the device.
- Verify the device status.

If the device experiences any abnormalities or is in an alarm state, contact us immediately!

Appendix 1 APF Technical Specifications

Category	Item	Index									
Name	Product Name	**APF**									
Specifications	Voltage Level	220V			400V					480V	690V/800V
	Module Specifications	75A	100A	150A	50A	75A	100A	150A	200A	150A	75A 100A
	Module Dimensions	W560*H178*D600									
Input	Operating Voltage	220V、400V、480V、690V、800V（-40%～+20%）									
	Operating Frequency	50/60Hz（-10% ~ +10%）									
	Current Transformer	100:5 ~ 10000:5									
Function	Harmonic Compensation	2nd-51st Order									
	Harmonic Filtration Rate	97%									
	Reactive Power Compensation	-1～+1 adjustable (within the equipment capacity range)									
	Three-Phase Unbalance Compensation	100% unbalance compensation									
Communication Protocol	Communication Method	RS485、Modbus protocol									
	Communication Interface	RS485									
	Upper Computer Software	Yes, all parameters can be set via the upper computer									
	Fault Alarm	Yes, unlimited alarm messages can be recorded.									
	Monitoring	Supports independent monitoring of each module / centralized monitoring of the entire unit									
Technical Specifications	Total Response Time	≤5ms									
	Active Power Loss	≤2%，≤1.5%（SIC）									
	Cooling Method	**Smart Air Cooling**									
	Noise	≤60dB									
	Protection Function	Over 20 protection options, including overvoltage, undervoltage, overheating, overcurrent, and short circuit.									
	CT Installation Location	Load-side/grid-side selectable									
Mechanical Characteristics	Module Weight	≤37kg									
	Color	Matte Black									
Environment Requirements	Operating Temperature	-10℃~+40℃									
	Altitude	< 5000 Meters (Above 1000 Meters, Capacity Decreases by 1% for Every 100-Meter Increase)									
	Relative Humidity	<95%，No Condensation									
	Protection Level	Module IP20									
	Pollution Resistance level	Level 2 (Level 3 customizable)									

Appendix 2 APF Detailed Menu Description

Interface	Name		Definition
Main Interface	Grid	Us	Grid-side voltage
		Is	Grid-side current
		Thdi	Grid-side current distortion ratio
		DPF	Grid-side fundamental power factor
	Compensation Current	Ic_A	Phase A compensation current
		Ic_B	Phase B compensation current
		Ic_C	Phase C compensation current
		Ic_N	Phase N compensation current
	Load	IL	Load-side current
		Thdi	Load-side current distortion ratio
		PF	Load-side power factor
		QL	Load-side reactive power
Grid	Voltage		Three-Phase Voltage
	Current		RMS value of three-phase current on the grid side
	Thdu		Three-Phase Voltage Distortion Ratio
	Thdi		Three-Phase Current Distortion Ratio on the grid side
	Displacement Power Factor （DPF）		Fundamental power factor on the grid side
	Active Power		Active power of phases A, B, and C on the grid side
	Reactive Power		Reactive power of phases A, B, and C on the grid side
	Apparent Power		Apparent power of phases A, B, and C on the grid side
	Power Factor（PF）		Power factor on the grid side
	Frequency		Voltage frequency
Load	Current		RMS value of three-phase current on the load side
	Thdi		Three-Phase Current Distortion Ratio on the load side
	Active Power		Active power of phases A, B, and C on the load side
	Reactive Power		Reactive power of phases A, B, and C on the load side
	Apparent Power		Apparent power of phases A, B, and C on the load side
	Displacement Power Factor （DPF）		Fundamental power factor on the load side
	Power Factor（PF）		Power factor on the load side
	Grid Voltage		Three-Phase Voltage
	Compensation Current		Three-phase compensation current RMS value

Module	Busbar Voltage 1	Three-phase busbar voltage 1 RMS value
	Busbar Voltage 2	Three-phase busbar voltage 2 RMS value
	Temperature	PCB_NTC temperature, heatsink_NTC temperature 1, heatsink_NTC temperature 2
	Given current	RMS value of three-phase current on the module side
	Thdi	Three-phase current distortion rate on the module side
	Active power	Active power of phases A, B, and C on the module side
	Reactive power	Reactive power of phases A, B, and C on the module side
	Apparent power	Apparent power of phases A, B, and C on the module side
	Displacement Power Factor（DPF）	Fundamental power factor on the module side
	Power factor（PF）	Power factor on the module side
Settings	Start Mode	2 types: Manual, Auto. Factory Default: Manual.
	Work Mode	There are 6 operating modes, which can be selected based on different application purposes.
	COM pcs	Definition: The number of devices opened for communication. Setting range: 1 to 6.
	Module pcs	Definition: The number of modules connected in parallel. Setting range: 1 to 20.
	DPF	Definition: The rated current values of the primary and secondary sides of the CT. Factory Default: 200. Setting Range: 0 - 10000.
	CT location	Load Side: Current Transformers installed upstream of connection point. Power Side: Current Transformers installed downstream of connection point.
	CT direction	Positive: Power supply points to the load. Negative: Load points to the power supply.
	CT ratio	Definition: The rated current values of the primary and secondary sides of the CT. Factory Default: 200. Setting Range: 0 - 10000.
	HMI Address	The device operation status is detected by associating with the screen station number. Setting range: 0 - 255.
Records	Real-Time Records	Current alarm time, date, and alarm information
Personalization	Upper-Level Software	Touchscreen program version number
	Control Software	Software program version number.
	Special Register	Displays the device fault word.

Appendix 3 APF Status and Fault Information

Name		Definition
Status	Pre-charge	"Pre-charging" refers to the uncontrolled rectification charging status of the module after power-on.
	Standby	"Standby" indicates that pre-charging is completed, the current-limiting resistor is bypassed, the relay is engaged, and the module is in a standby state.
	Running	"Running Mode" indicates that the module is operating and can perform normal compensation.
	Normal Lockout	"Normal Lockout" indicates the module's IGBT is off and there are no faults.
	Fault Lockout	"Fault Blocking" indicates that the module's IGBT is turned off, and a secondary or tertiary fault exists in the system.
System Level 1 Fault	DSP-EEPROM Communication Fault	When an error occurs in the communication between DSP and EEPROM, a "DSP-EEPROM Communication Fault" warning will be issued.
	Grid Voltage Low Alarm	When the grid voltage is too low (below the set protection value), a "Grid Voltage Low Alarm" warning will be issued.
	Bus Voltage High	When the bus voltage is too high (exceeding the set protection value), a "Bus Voltage High" warning will be issued.
	Ambient Overtemperature	When the internal ambient temperature of the module exceeds the set protection value, an "Ambient Overtemperature" warning will be issued.
	Heatsink Overtemperature	When the heatsink temperature exceeds the set protection value, a "Heatsink Overtemperature" warning is issued.
	Branch1 Overcurrent Alarm	When the Branch1 IGBT bridge arm current exceeds the set protection value, an "Output Overcurrent Alarm" warning will be issued.
	Branch2 Overcurrent Alarm	When the Branch2 IGBT bridge arm current exceeds the set protection value, an "Output Overcurrent Alarm" warning will be issued.
	PI_regulator_I	When an error occurs in the PI_regulator_I,a “PI_regulator_I”warning will be issued.
	PI_regulator_Y	When an error occurs in the PI_regulator_Y,a “PI_regulator_Y”warning will be issued.
	R_regulator	When an error occurs in the R_regulator,a “R_regulator”warning will be issued.
System Level 2 Fault	Emergency Stop	An "Emergency Stop" warning is triggered when: the IGBT is blocked due to excessive current; grid voltage exceeds the set range; or the emergency stop button on the cabinet door or touchscreen is pressed.(The Level 3 fault in the status word is set to 1, tripping the main circuit breaker.)

	AD Reference Error	If the analog circuit sampling is not successfully debugged, an "AD Reference Error" warning is issued.
	Phase Loss	A "Phase Loss" warning is triggered when a phase is missing in the grid voltage.
	Hardware Overcurrent	A "Hardware Overcurrent" warning is issued when an overcurrent condition is detected by the hardware circuit.
	Hardware Drive Power supply	A "Hardware Drive Power Supply" warning is issued when the drive power supply is detected as abnormal by the hardware circuit.。
	Voltage Phase Sequence Mismatch	A "Voltage Phase Sequence Mismatch" warning is triggered when the phase relationship of voltages in phases A, B, and C does not match.
	Load Current Phase Sequence Mismatch	A "Load Current Phase Sequence Mismatch" warning is triggered when the phase relationship of currents in phases A, B, and C does not match.
	Grid Overvoltage	A "Grid Overvoltage" warning is issued when the grid voltage is too high and exceeds the preset protection value.(The status word Level 3 fault is set to 1, tripping the main circuit breaker.)
	Grid Voltage Low Fault	A "Grid Voltage Low Fault" warning is issued when the grid voltage is too low and drops below the preset protection value.
	Grid Power Loss	A "Grid Voltage Low" warning is issued when there is no power in the grid.
	Grid-side Phase Lock Failure	A "Grid-Side Phase Lock Failure" warning is issued when an error occurs in the phase-locked loop regulator.
	Grid Frequency Error	A "Grid Frequency Error" warning is issued when an abnormal grid frequency is detected.
	Hardware Bus Voltage Overhigh	A "Hardware Bus Voltage Overhigh" warning is issued when the bus voltage is detected as too high by the hardware and exceeds the preset protection value.
	Excessive Bus Voltage Difference	An "Excessive Bus Voltage difference" warning is issued when an excessive difference in bus voltage is detected by the software.
	Startup Bus Voltage Low	A "Startup Bus Voltage Low" warning is issued when the bus voltage during startup (from pre-charge completion to standby) is below the preset protection value.
	Output Peak Overcurrent	An "Output Peak Overcurrent" warning is issued when the maximum output current exceeds the preset protection value.
	Output Overcurrent Fault	An "Output Overcurrent Fault" warning is issued when the RMS output current exceeds the preset protection value.
	Neutral Overcurrent Fault	A "Neutral Overcurrent Fault" warning is issued when the zero-sequence current RMS exceeds the preset protection value.
	Fan Fault	A "Fan Fault" warning is issued when an input or output error is detected in the fan.

	PCB Overtemperature	A "PCB Overtemperature" warning is issued when the internal ambient temperature of the module exceeds the preset protection value.
	Heatsink Temperature Too High	A "Heatsink Overtemperature" warning is issued when the heat sink temperature exceeds the preset protection value.
	Pre-Charge Inverter Current Overhigh	An "Pre-Charge Inverter Current Overhigh" warning is issued when the inverter current exceeds the preset protection value before startup (Level 3 fault in the status word is set to 1, tripping the main circuit breaker.)
	IGBT Blocked, Inverter Current Overhigh	An "IGBT Blocked, Inverter Current Overhigh" warning is issued when the inverter current exceeds the preset protection value during operation.(Level 3 status word faults are set to 1, tripping the main circuit breaker.)
	Udc_A1 Overvoltage	A "Udc_A1 Overvoltage" warning is issued when the DC bus voltage of phase A1 is too high and exceeds the preset protection value.
	Udc_B1 Overvoltage	A "Udc_B1 Overvoltage" warning is issued when the DC bus voltage of phase B1 is too high and exceeds the preset protection value.
	Udc_C1 Overvoltage	A "Udc_C1 Overvoltage" warning is issued when the DC bus voltage of phase C1 is too high and exceeds the preset protection value.
	Udc_A2 Overvoltage	A "Udc_A2 Overvoltage" warning is issued when the DC bus voltage of phase A2 is too high and exceeds the preset protection value.
	Udc_B2 Overvoltage	A "Udc_B2 Overvoltage" warning is issued when the DC bus voltage of phase B2 is too high and exceeds the preset protection value.
	Udc_C2 Overvoltage	A "Udc_C2 Overvoltage" warning is issued when the DC bus voltage of phase C2 is too high and exceeds the preset protection value.
Algorithm Fault Word	NCAP_A1 Regulator	When the NCAP_A1 regulator algorithm is incorrect, the "NCAP_A1 Regulator" warning is issued.
	NCAP_B1 Regulator	When the NCAP_B1 regulator algorithm is incorrect, the "NCAP_B1 Regulator" warning is issued.
	ID Regulator	When the ID regulator algorithm is incorrect, the "ID Regulator" warning is issued.
	IQ Regulator	When the IQ regulator algorithm is incorrect, the "IQ Regulator" warning is issued.
	I0 Regulator	When the I0 regulator algorithm is incorrect, the "I0 Regulator" warning is issued.
	Udc Regulator	When the Udc regulator algorithm is incorrect, the "Udc Regulator" warning is issued.
	Harmonic Regulator	When the harmonic regulator algorithm is incorrect, the "Harmonic Regulator" warning is issued.
	CPU2 Harmonic Regulator	When the CPU2 harmonic regulator algorithm is incorrect, the "CPU2 Harmonic Regulator" warning is issued.

Appendix 4 APF communication data point

1. Communication Protocol: RS485_MODBUS_RTU_SLAVE; Communication Baud Rate: 9600bps; Data Bits: 8 bits; Parity Bit: None; Stop Bit: 1 bit; Protocol Function Code: 03.

2. Wiring Instructions:The RS485 signal positive (+) wire from the host device (e.g., industrial computer for remote monitoring) should be connected to the RS485+ terminal located on the upper-left corner of the back of dual serial port touchscreen. The RS485 signal negative (-) wire from the host device should be connected to the RS485- terminal on the upper-left corner of the back of the dual serial touchscreen.

3. The data table of the system data forwarding interface is as follows：

No.	Description	Unit	Range	Remarks	R/W	Data Address	
						Decimal (10-bit)	Hexadecimal (16-bit)
1	Grid-Side Thdv_A	%	-100~100	Actual Value = Communication Value	R	0	0
2	Grid-Side Thdv_B	%	-100~100	Actual Value = Communication Value	R	1	1
3	Grid-Side Thdv_C	%	-100~100	Actual Value = Communication Value	R	2	2
4	Grid-Side DPF_A	%	-100~100	Actual Value = Communication Value	R	3	3
5	Grid-Side DPF_B	%	-100~100	Actual Value = Communication Value	R	4	4
6	Grid-Side DPF_C	%	-100~100	Actual Value = Communication Value	R	5	5
7	Grid-side active power_A	kW	-32767~+32767	Actual Value = Communication Value/10	R	6	6
8	Grid-side active power_B	kW	-32767~+32767	Actual Value = Communication Value/10	R	7	7
9	Grid-side active power_C	kW	-32767~+32767	Actual Value = Communication Value/10	R	8	8
10	Grid-side reactive power_A	kVar	-32767~+32767	Actual Value = Communication Value/10	R	9	9
11	Grid-side reactive power_B	kVar	-32767~+32767	Actual Value = Communication Value/10	R	10	A
12	Grid-side reactive power_C	kVar	-32767~+32767	Actual Value = Communication Value/10	R	11	B
13	Grid-side apparent power_A	kVA	-32767~+32767	Actual Value = Communication Value/10	R	12	C
14	Grid-side apparent power_B	kVA	-32767~+32767	Actual Value = Communication Value/10	R	13	D
15	Grid-side apparent power_C	kVA	-32767~+32767	Actual Value = Communication Value/10	R	14	E
16	Grid-side total harmonic current	A	0~65535	Actual Value = Communication Value/10	R	15	F

17	Grid frequency	Hz	0~65535	Actual Value = Communication Value	R	16	10
18	Load current_A	A	0~65535	Actual Value = Communication Value/10	R	17	11
19	Load current_B	A	0~65535	Actual Value = Communication Value/10	R	18	12
20	Load current_C	A	0~65535	Actual Value = Communication Value/10	R	19	13
21	Load Thdi_A	%	-100~+100	Actual Value = Communication Value	R	20	14
22	Load Thdi_B	%	-100~+100	Actual Value = Communication Value	R	21	15
23	Load Thdi_C	%	-100~+100	Actual Value = Communication Value	R	22	16
24	Load DPF_A	%	-100~+100	Actual Value = Communication Value	R	23	17
25	Load DPF_B	%	-100~+100	Actual Value = Communication Value	R	24	18
26	Load DPF_C	%	-100~+100	Actual Value = Communication Value	R	25	19
27	Load PF_A	%	-100~+100	Actual Value = Communication Value	R	26	1A
28	Load PF_B	%	-100~+100	Actual Value = Communication Value	R	27	1B
29	Load PF_C	%	-100~+100	Actual Value = Communication Value	R	28	1C
30	Load active power_A	kW	-32767~+32767	Actual Value = Communication Value/10	R	29	1D
31	Load active power_B	kW	-32767~+32767	Actual Value = Communication Value/10	R	30	1E
32	Load active power_C	kW	-32767~+32767	Actual Value = Communication Value/10	R	31	1F
33	Load reactive power_A	kVar	-32767~+32767	Actual Value = Communication Value/10	R	32	20
34	Load reactive power_B	kVar	-32767~+32767	Actual Value = Communication Value/10	R	33	21
35	Load reactive power_C	kVar	-32767~+32767	Actual Value = Communication Value/10	R	34	22
36	Load apparent power_A	kVA	-32767~+32767	Actual Value = Communication Value/10	R	35	23
37	Load apparent power_B	kVA	-32767~+32767	Actual Value = Communication Value/10	R	36	24

38	Load apparent power_C	kVA	-32767~+32767	Actual Value = Communication Value/10	R	37	25
39	Total harmonic current on the load side	A	0~65535	Actual Value = Communication Value/10	R	38	26
40	Command word	bit	A pulse width of no less than 4 seconds	0：start 1：stop 2：reset	W	39	27
41	One-click start/stop	bit	One-click start/stop	0：Start/stop independently 1：One-click start/stop	W	40	28
42	Communication status	bit	communication status	0:correct 1：error	R	41	29
43	Module 1_work mode	bit	work mode	0:SVG 1:APF 2:SAPF 3:ASVG	R	47	2F
44	Module 1_System Status Word	bit	current status	0: Pre-charge 1: Standby 2: Run 3: Stop	R	48	30
45	Module 1_Heatsink_NTC Temperature1	℃	-200~200	Actual Value = Communication Value	R	49	31
46	Module 1_Heatsink_NTC Temperature2	℃	-200~200	Actual Value = Communication Value	R	50	32
47	Module 1_Grid-side voltage_A	V	0~65535	Actual Value = Communication Value/10	R	51	33
48	Module 1_Grid-side voltage_B	V	0~65535	Actual Value = Communication Value/10	R	52	34
49	Module 1_Grid-side voltage_C	V	0~65535	Actual Value = Communication Value/10	R	53	35
50	Module 1_Grid-side current_A	A	0~65535	Actual Value = Communication Value/10	R	54	36
51	Module 1_Grid-side current_B	A	0~65535	Actual Value = Communication Value/10	R	55	37
52	Module 1_Grid-side current_C	A	0~65535	Actual Value = Communication Value/10	R	56	38
53	Module 1_Device Current_A	A	0~65535	Actual Value = Communication Value/10	R	57	39
54	Module 1_Device Current_B	A	0~65535	Actual Value = Communication Value/10	R	58	3A
55	Module 1_Device Current_C	A	0~65535	Actual Value = Communication Value/10	R	59	3B
56	Module 1_Grid-side PF_A	%	-100~100	Actual Value = Communication Value	R	60	3C
57	Module 1_Grid-side PF_B	%	-100~100	Actual Value = Communication Value	R	61	3D
58	Module 1_Grid-side PF_C	%	-100~100	Actual Value = Communication Value	R	62	3E

59	Module 1_Grid-side Thdi_A	%	-100~100	Actual Value = Communication Value	R	63	3F
60	Module 1_Grid-side Thdi_B	%	-100~100	Actual Value = Communication Value	R	64	40
61	Module 1_Grid-side Thdi_C	%	-100~100	Actual Value = Communication Value	R	65	41
62	Module 1_Unbalance _A	%	0~65535	Actual Value = Communication Value	R	66	42
63	Module 1_Unbalance_B	%	0~65535	Actual Value = Communication Value	R	67	43
64	Module 1_Unbalance_C	%	0~65535	Actual Value = Communication Value	R	68	44
65	Module 1_Total bus voltage	V	0~65535	Actual Value = Communication Value	R	69	45
66	Module 1_Average bus voltage1	V	0~65535	Actual Value = Communication Value	R	70	46
67	Module 1_Average bus voltage2	V	0~65535	Actual Value = Communication Value	R	71	47
68	Module 1_CT coefficient_A		0~30000	Actual Value = Communication Value	R	72	48
69	Module 1_CT coefficient_B		0~30000	Actual Value = Communication Value	R	73	49
70	Module 1_CT coefficient_C		0~30000	Actual Value = Communication Value	R	74	4A
71	Module 1_Number of Modules		0~65535	Actual Value = Communication Value	R	75	4B
72	Module 1_Reactive Power Setting	%	-100~100	Actual Value = Communication Value	R	76	4C
73	Module 1_System status word 1		0~65535	Actual Value = Communication Value	R	77	4D
74	Module 1_System Level 1 Fault Word		0~65535	Actual Value = Communication Value	R	78	4E
75	Module 1_System Level 2 Fault Word 1		0~65535	Actual Value = Communication Value	R	79	4F
76	Module 1_System Level 2 Fault Word 2		0~65535	Actual Value = Communication Value	R	80	50
77	Module 1_Load Distribution Ratio	%	0~100	Actual Value = Communication Value	R	81	51
78	Module 1_PCB_NTC temperature	℃	-200~200	Actual Value = Communication Value	R	82	52
79	Module 1_Command word	bit	A pulse width of no less than 2 seconds	0：start 1：stop 2：reset	W	83	53

80	Module 1_Start mode	bit	Start mode	0:manual； 2：auto	R	84	54
81	Module 2_work mode	bit	work mode	0:SVG 1:APF 2:SAPF 3:ASVG	R	147	93
82	Module 2_System Status Word	bit	current status	0: Pre-charge 1: Standby 2: Run 3: Stop	R	148	94
83	Module 2_Heatsink_NTC Temperature1	℃	-200~200	Actual Value = Communication Value	R	149	95
84	Module 2_Heatsink_NTC Temperature2	℃	-200~200	Actual Value = Communication Value	R	150	96
85	Module 2_Grid-side voltage_A	V	0~65535	Actual Value = Communication Value/10	R	151	97
86	Module 2_Grid-side voltage_B	V	0~65535	Actual Value = Communication Value/10	R	152	98
87	Module 2_Grid-side voltage_C	V	0~65535	Actual Value = Communication Value/10	R	153	99
88	Module 2_Grid-side current_A	A	0~65535	Actual Value = Communication Value/10	R	154	9A
89	Module 2_Grid-side current_B	A	0~65535	Actual Value = Communication Value/10	R	155	9B
90	Module 2_Grid-side current_C	A	0~65535	Actual Value = Communication Value/10	R	156	9C
91	Module 2_Device Current_A	A	0~65535	Actual Value = Communication Value/10	R	157	9D
92	Module 2_Device Current_B	A	0~65535	Actual Value = Communication Value/10	R	158	9E
93	Module 2_Device Current_C	A	0~65535	Actual Value = Communication Value/10	R	159	9F
94	Module 2_Grid-side PF_A	%	-100~100	Actual Value = Communication Value	R	160	A0
95	Module 2_Grid-side PF_B	%	-100~100	Actual Value = Communication Value	R	161	A1
96	Module 2_Grid-side PF_C	%	-100~100	Actual Value = Communication Value	R	162	A2
97	Module 2_Grid-side Thdi_A	%	-100~100	Actual Value = Communication Value	R	163	A3
98	Module 2_Grid-side Thdi_B	%	-100~100	Actual Value = Communication Value	R	164	A4
99	Module 2_Grid-side Thdi_C	%	-100~100	Actual Value = Communication Value	R	165	A5
100	Module 2_Unbalance_A	%	0~65535	Actual Value = Communication Value	R	166	A6

101	Module 2_Unbalance_B	%	0~65535	Actual Value = Communication Value	R	167	A7
102	Module 2_Unbalance_C	%	0~65535	Actual Value = Communication Value	R	168	A8
103	Module 2_Total bus voltage	V	0~65535	Actual Value = Communication Value	R	169	A9
104	Module 2_Average bus voltage 1	V	0~65535	Actual Value = Communication Value	R	170	AA
105	Module 2_Average bus voltage 2	V	0~65535	Actual Value = Communication Value	R	171	AB
106	Module 2_CT coefficient_A		0~30000	Actual Value = Communication Value	R	172	AC
107	Module 2_CT coefficient_B		0~30000	Actual Value = Communication Value	R	173	AD
108	Module 2_CT coefficient_C		0~30000	Actual Value = Communication Value	R	174	AE
109	Module 2_Number of modules		0~65535	Actual Value = Communication Value	R	175	AF
110	Module 2_Reactive Power Setting	%	-100~100	Actual Value = Communication Value	R	176	B0
111	Module 2_System Status Word 1		0~65535	Actual Value = Communication Value	R	177	B1
112	Module 2_System Level 1 Fault Word		0~65535	Actual Value = Communication Value	R	178	B2
113	Module 2_System Level 2 Fault Word 1		0~65535	Actual Value = Communication Value	R	179	B3
114	Module 2_System Level 2 Fault Word 2		0~65535	Actual Value = Communication Value	R	180	B4
115	Module 2_Load Distribution Ratio	%	0~100	Actual Value = Communication Value	R	181	B5
116	Module 2_PCB_NTC temperature	℃	-200~200	Actual Value = Communication Value	R	182	B6
117	Module 2_Command word	bit	A pulse width of no less than 2 seconds	0：start 1：stop 2：reset	W	183	B7
118	Module 2_Start mode	bit	Start mode	0:manual；2：auto	R	184	B8
119	Module 3_work mode	bit	work mode	0:SVG 1:APF 2:SAPF 3:ASVG	R	247	F7
120	Module 3_System Status Word	bit	current status	0: Pre-charge 1: Standby 2: Run 3: Stop	R	248	F8
121	Module 3_Heatsink_NTC Temperature 1	℃	-200~200	Actual Value = Communication Value	R	249	F9

122	Module 3_Heatsink_NTC Temperature2	℃	-200~200	Actual Value = Communication Value	R	250	FA
123	Module 3_Grid-side voltage_A	V	0~65535	Actual Value = Communication Value/10	R	251	FB
124	Module 3_Grid-side voltage_B	V	0~65535	Actual Value = Communication Value/10	R	252	FC
125	Module 3_Grid-side voltage_C	V	0~65535	Actual Value = Communication Value/10	R	253	FD
126	Module 3_Grid-side current_A	A	0~65535	Actual Value = Communication Value/10	R	254	FE
127	Module 3_Grid-side current_B	A	0~65535	Actual Value = Communication Value/10	R	255	FF
128	Module 3_Grid-side current_C	A	0~65535	Actual Value = Communication Value/10	R	256	100
129	Module 3_Device Current_A	A	0~65535	Actual Value = Communication Value/10	R	257	101
130	Module 3_Device Current_B	A	0~65535	Actual Value = Communication Value/10	R	258	102
131	Module 3_Device Current_C	A	0~65535	Actual Value = Communication Value/10	R	259	103
132	Module 3_Grid-side PF_A	%	-100~100	Actual Value = Communication Value	R	260	104
133	Module 3_Grid-side PF_B	%	-100~100	Actual Value = Communication Value	R	261	105
134	Module 3_Grid-side PF_C	%	-100~100	Actual Value = Communication Value	R	262	106
135	Module 3_Grid-side Thdi_A	%	-100~100	Actual Value = Communication Value	R	263	107
136	Module 3_Grid-side Thdi_B	%	-100~100	Actual Value = Communication Value	R	264	108
137	Module 3_Grid-side Thdi_C	%	-100~100	Actual Value = Communication Value	R	265	109
138	Module 3_Imbalance_A	%	0~65535	Actual Value = Communication Value	R	266	10A
139	Module 3_Imbalance_B	%	0~65535	Actual Value = Communication Value	R	267	10B
140	Module 3_Imbalance_C	%	0~65535	Actual Value = Communication Value	R	268	10C
141	Module 3_Total bus voltage	V	0~65535	Actual Value = Communication Value	R	269	10D
142	Module 3_Average bus voltage 1	V	0~65535	Actual Value = Com Value	R	270	10E

143	Module 3_Average bus voltage 2	V	0~65535	Actual Value = Communication Value	R	271	10F
144	Module 3_CT coefficient_A		0~30000	Actual Value = Communication Value	R	272	110
145	Module 3_CT coefficient_B		0~30000	Actual Value = Communication Value	R	273	111
146	Module 3_CT coefficient_C		0~30000	Actual Value = Communication Value	R	274	112
147	Module 3_Number of Modules		0~65535	Actual Value = Communication Value	R	275	113
148	Module 3_Reactive Power Setting	%	-100~100	Actual Value = Communication Value	R	276	114
149	Module 3_System status word 1		0~65535	Actual Value = Communication Value	R	277	115
150	Module 3_System Level 1 Fault Word		0~65535	Actual Value = Communication Value	R	278	116
151	Module 3_System Level 2 Fault Word 1		0~65535	Actual Value = Communication Value	R	279	117
152	Module 3_System Level 2 Fault Word 2		0~65535	Actual Value = Communication Value	R	280	118
153	Module 3_Load Distribution Ratio	%	0~100	Actual Value = Communication Value	R	281	119
154	Module 3_PCB_NTC temperature	℃	-200~200	Actual Value = Communication Value	R	282	11A
155	Module 3_Command word	bit	A pulse width of no less than 2 seconds	0：start 1：stop 2：reset	W	283	11B
156	Module 3_Start mode	bit	Start mode	0:manual; 2：auto	R	284	11C
157	Module 4_work mode	bit	work mode	0:SVG 1:APF 2:SAPF 3:ASVG	R	347	15B
158	Module 4_System Status Word	bit	current status	0: Pre-charge 1: Standby 2: Run 3: Stop	R	348	15C
159	Module 4_Heatsink_NTC Temperature 1	℃	-200~200	Actual Value = Communication Value	R	349	15D
160	Module 4_Heatsink_NTC Temperature 2	℃	-200~200	Actual Value = Communication Value	R	350	15E
161	Module 4_Grid-side voltage_A	V	0~65535	Actual Value = Communication Value/10	R	351	15F
162	Module 4_Grid-side voltage_B	V	0~65535	Actual Value = Communication Value/10	R	352	160
163	Module 4_Grid-side voltage_C	V	0~65535	Actual Value = Communication Value/10	R	353	161

164	Module 4_Grid-side current_A	A	0~65535	Actual Value = Communication Value/10	R	354	162
165	Module 4_Grid-side current_B	A	0~65535	Actual Value = Communication Value/10	R	355	163
166	Module 4_Grid-side current_C	A	0~65535	Actual Value = Communication Value/10	R	356	164
167	Module 4_Device Current_A	A	0~65535	Actual Value = Communication Value/10	R	357	165
168	Module 4_Device Current_B	A	0~65535	Actual Value = Communication Value/10	R	358	166
169	Module 4_Device Current_C	A	0~65535	Actual Value = Communication Value/10	R	359	167
170	Module 4_Grid-side PF_A	%	-100~100	Actual Value = Communication Value	R	360	168
171	Module 4_Grid-side PF_B	%	-100~100	Actual Value = Communication Value	R	361	169
172	Module 4_Grid-side PF_C	%	-100~100	Actual Value = Communication Value	R	362	16A
173	Module 4_Grid-side Thdi_A	%	-100~100	Actual Value = Communication Value	R	363	16B
174	Module 4_Grid-side Thdi_B	%	-100~100	Actual Value = Communication Value	R	364	16C
175	Module 4_Grid-side Thdi_C	%	-100~100	Actual Value = Communication Value	R	365	16D
176	Module 4_Imbalance_A	%	0~65535	Actual Value = Communication Value	R	366	16E
177	Module 4_Imbalance_B	%	0~65535	Actual Value = Communication Value	R	367	16F
178	Module 4_Imbalance_C	%	0~65535	Actual Value = Communication Value	R	368	170
179	Module 4_Total bus voltage	V	0~65535	Actual Value = Communication Value	R	369	171
180	Module 4_Average bus voltage 1	V	0~65535	Actual Value = Communication Value	R	370	172
181	Module 4_Average bus voltage 2	V	0~65535	Actual Value = Communication Value	R	371	173
182	Module 4_CT coefficient_A		0~30000	Actual Value = Communication Value	R	372	174
183	Module 4_CT coefficient_B		0~30000	Actual Value = Communication Value	R	373	175
184	Module 4_CT coefficient_C		0~30000	Actual Value = Communication Value	R	374	176

185	Module 4_Number of Modules		0~65535	Actual Value = Communication Value	R	375	177
186	Module 4_Reactive Power Setting	%	-100~100	Actual Value = Communication Value	R	376	178
187	Module 4_System Status Word 1		0~65535	Actual Value = Communication Value	R	377	179
188	Module 4_System Level 1 Fault Word		0~65535	Actual Value = Communication Value	R	378	17A
189	Module 4_System Level 2 Fault Word 1		0~65535	Actual Value = Communication Value	R	379	17B
190	Module 4_System Level 2 Fault Word 2		0~65535	Actual Value = Communication Value	R	380	17C
191	Module 4_Load Distribution Ratio	%	0~100	Actual Value = Communication Value	R	381	17D
192	Module 4_PCB_NTC temperature	℃	-200~200	Actual Value = Communication Value	R	382	17E
193	Module 4_Command word	bit	A pulse width of no less than 2 seconds	0：start 1：stop 2：reset	W	383	17F
194	Module 4_Start mode	bit	Start mode	0:manual；2：auto	R	384	180
195	Module 5_work mode	bit	work mode	0:SVG 1:APF 2:SAPF 3:ASVG	R	447	1BF
196	Module 5_System Status Word	bit	current status	0: Pre-charge 1: Standby 2: Run 3: Stop	R	448	1C0
197	Module 5_Heatsink_NTC Temperature 1	℃	-200~200	Actual Value = Communication Value	R	449	1C1
198	Module 5_Heatsink_NTC Temperature 2	℃	-200~200	Actual Value = Communication Value	R	450	1C2
199	Module 5_Grid-side voltage_A	V	0~65535	Actual Value = Communication Value/10	R	451	1C3
200	Module 5_Grid-side voltage_B	V	0~65535	Actual Value = Communication Value/10	R	452	1C4
201	Module 5_Grid-side voltage_C	V	0~65535	Actual Value = Communication Value/10	R	453	1C5
202	Module 5_Grid-side current_A	A	0~65535	Actual Value = Communication Value/10	R	454	1C6
203	Module 5_Grid-side current_B	A	0~65535	Actual Value = Communication Value/10	R	455	1C7
204	Module 5_Grid-side current_C	A	0~65535	Actual Value = Communication Value/10	R	456	1C8
205	Module 5_Device Current_A	A	0~65535	Actual Value = Communication Value/10	R	457	1C9

206	Module 5_Device Current_B	A	0~65535	Actual Value = Communication Value/10	R	458	1CA
207	Module 5_Device Current_C	A	0~65535	Actual Value = Communication Value/10	R	459	1CB
208	Module 5_Grid-side PF_A	%	-100~100	Actual Value = Communication Value	R	460	1CC
209	Module 5_Grid-side PF_B	%	-100~100	Actual Value = Communication Value	R	461	1CD
210	Module 5_Grid-side PF_C	%	-100~100	Actual Value = Communication Value	R	462	1CE
211	Module 5_Grid-side Thdi_A	%	-100~100	Actual Value = Communication Value	R	463	1CF
212	Module 5_Grid-side Thdi_B	%	-100~100	Actual Value = Communication Value	R	464	1D0
213	Module 5_Grid-side Thdi_C	%	-100~100	Actual Value = Communication Value	R	465	1D1
214	Module 5_Imbalance_A	%	0~65535	Actual Value = Communication Value	R	466	1D2
215	Module 5_Imbalance_B	%	0~65535	Actual Value = Communication Value	R	467	1D3
216	Module 5_Imbalance_C	%	0~65535	Actual Value = Communication Value	R	468	1D4
217	Module 5_Total bus voltage	V	0~65535	Actual Value = Communication Value	R	469	1D5
218	Module 5_Average bus voltage 1	V	0~65535	Actual Value = Communication Value	R	470	1D6
219	Module 5_Average bus voltage 2	V	0~65535	Actual Value = Communication Value	R	471	1D7
220	Module 5_CT coefficient_A		0~30000	Actual Value = Communication Value	R	472	1D8
221	Module 5_CT coefficient_B		0~30000	Actual Value = Communication Value	R	473	1D9
222	Module 5_CT coefficient_C		0~30000	Actual Value = Communication Value	R	474	1DA
223	Module 5_Number of Modules		0~65535	Actual Value = Communication Value	R	475	1DB
224	Module 5_Reactive Power Setting	%	-100~100	Actual Value = Communication Value	R	476	1DC
225	Module 5_System Status Word 1		0~65535	Actual Value = Communication Value	R	477	1DD
226	Module 5_System Level 1 Fault Word		0~65535	Actual Value = Communication Value	R	478	1DE

227	Module 5_System Level 2 Fault Word 1		0~65535	Actual Value = Communication Value	R	479	1DF
228	Module 5_System Level 2 Fault Word 2		0~65535	Actual Value = Communication Value	R	480	1E0
229	Module 5_Load Distribution Ratio	%	0~100	Actual Value = Communication Value	R	481	1E1
230	Module 5_PCB_NTC temperature	℃	-200~200	Actual Value = Communication Value	R	482	1E2
231	Module 5_Command word	bit	A pulse width of no less than 2 seconds	0：start 1：stop 2：reset	W	483	1E3
232	Module 5_Start mode	bit	Start mode	0:manual； 2：auto	R	484	1E4
233	Module 6_work mode	bit	work mode	0:SVG 1:APF 2:SAPF 3:ASVG	R	547	223
234	Module 6_System Status Word	bit	current status	0: Pre-charge 1: Standby 2: Run 3: Stop	R	548	224
235	Module 6_Heatsink_NTC Temperature 1	℃	-200~200	Actual Value = Communication Value	R	549	225
236	Module 6_Heatsink_NTC Temperature 2	℃	-200~200	Actual Value = Communication Value	R	550	226
237	Module 6_Grid-side voltage_A	V	0~65535	Actual Value = Communication Value/10	R	551	227
238	Module 6_Grid-side voltage_B	V	0~65535	Actual Value = Communication Value/10	R	552	228
239	Module 6_Grid-side voltage_C	V	0~65535	Actual Value = Communication Value/10	R	553	229
240	Module 6_Grid-side current_A	A	0~65535	Actual Value = Communication Value/10	R	554	22A
241	Module 6_Grid-side current_B	A	0~65535	Actual Value = Communication Value/10	R	555	22B
242	Module 6_Grid-side current_C	A	0~65535	Actual Value = Communication Value/10	R	556	22C
243	Module 6_Device Current_A	A	0~65535	Actual Value = Communication Value/10	R	557	22D
244	Module 6_Device Current_B	A	0~65535	Actual Value = Communication Value/10	R	558	22E
245	Module 6_Device Current_C	A	0~65535	Actual Value = Communication Value/10	R	559	22F
246	Module 6_Grid-side PF_A	%	-100~100	Actual Value = Communication Value	R	560	230
247	Module 6_Grid-side PF_B	%	-100~100	Actual Value = Communication Value	R	561	231

248	Module 6_Grid-side PF_C	%	-100~100	Actual Value = Communication Value	R	562	232
249	Module 6_Grid-side Thdi_A	%	-100~100	Actual Value = Communication Value	R	563	233
250	Module 6_Grid-side Thdi_B	%	-100~100	Actual Value = Communication Value	R	564	234
251	Module 6_Grid-side Thdi_C	%	-100~100	Actual Value = Communication Value	R	565	235
252	Module 6_Imbalance_A	%	0~65535	Actual Value = Communication Value	R	566	236
253	Module 6_Imbalance_B	%	0~65535	Actual Value = Communication Value	R	567	237
254	Module 6_Imbalance_C	%	0~65535	Actual Value = Communication Value	R	568	238
255	Module 6_Total bus voltage	V	0~65535	Actual Value = Communication Value	R	569	239
256	Module 6_Average bus voltage 1	V	0~65535	Actual Value = Communication Value	R	570	23A
257	Module 6_Average bus voltage 2	V	0~65535	Actual Value = Communication Value	R	571	23B
258	Module 6_CT coefficient_A		0~30000	Actual Value = Communication Value	R	572	23C
259	Module 6_CT coefficient_B		0~30000	Actual Value = Communication Value	R	573	23D
260	Module 6_CT coefficient_C		0~30000	Actual Value = Communication Value	R	574	23E
261	Module 6_Number of Modules		0~65535	Actual Value = Communication Value	R	575	23F
262	Module 6_Reactive Power Setting	%	-100~100	Actual Value = Communication Value	R	576	240
263	Module 6_System Status Word 1		0~65535	Actual Value = Communication Value	R	577	241
264	Module 6_System Level 1 Fault Word		0~65535	Actual Value = Communication Value	R	578	242
265	Module 6_System Level 2 Fault Word 1		0~65535	Actual Value = Communication Value	R	579	243
266	Module 6_System Level 2 Fault Word 2		0~65535	Actual Value = Communication Value	R	580	244
267	Module 6_Load Distribution Ratio	%	0~100	Actual Value = Communication Value	R	581	245

268	Module 6_PCB_NTC temperature	℃	-200~200	Actual Value = Communication Value	R	582	246
269	Module 6_Command word	bit	A pulse width of no less than 2 seconds	0：start 1：stop 2：reset	W	583	247
270	Module 6_Start mode	bit	Start mode	0:manual；2：auto	R	584	248

Appendix 5 APF status word and fault word

bit / Name	System status word 1	System level 1 fault word	System level 2 fault word 1	System level 2 fault word 2
bit0	Pre-charge state	IIC communication failure	emergency stop	starting bus voltage too low
bit1	Pre-charge complete	low grid voltage alarm	AD reference error	Output Peak Overcurrent (Software)
bit2	Standby	high bus voltage alarm	phase loss	output overcurrent
bit3	Running	ambient temperature overtemperature alarm	hardware overcurrent	neutral overcurrent fault
bit4	Stop	heatsink overtemperature alarm	hardware driver power supply	fan fault
bit5	IGBTlockout	branch 1 overcurrent alarm	hardware IGBT short circuit	PCB overtemperature
bit6	IGBT fault lockout	regulator integral limiting	voltage phase sequence mismatch	Heatsink Over Temperature
bit7	Level 1 Fault	Regulator output limiting	load current phase sequence mismatch	inverter current too high during pre-charge.
bit8	Level 2 Fault	R regulator output limiting	grid voltage high	inverter current high during IGBT lockout.
bit9	Level 3 Fault	Branch 2 overcurrent alarm	grid voltage low	Udc_A1 overvoltage
bit10	Test run	Reserved	Grid-side power loss	Udc_B1 overvoltage
bit11	self-startup completed		Grid-side phase lock failure	Udc_C1 overvoltage
bit12	System capacitive switching		grid frequency	Udc_A2 overvoltage
bit13	Heartbeat signal		hardware bus voltage too high	Udc_B2 overvoltage
bit14	Relay status		kernel communication failure	Udc_C2 overvoltage
bit15	Udc reference complete		bus voltage difference too large	Reserved

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