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# Power<sup>IT</sup> DYNACOMP 动态响应补偿器

安装,操作以及维护说明书



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# 1. Introduction 使用说明

## 1.1 Intended audience 参阅对象

This manual is intended for all people that are involved in integrating, installing, operating and/or maintaining DYNACOMP equipment. People involved in the integration, installation and maintenance of a DYNACOMP must be qualified electricians and must master the standard electrical wiring practices, electronic components and electrical schematic symbols. End users should focus on the operating instructions (Cf. Chapter 12 ) and maintenance instructions (Cf. Chapter 13 ) of this manual. 该说明书主要提供给包括集成安装，操作和（或）维护 DYNACOMP 设备的所有人员。参与组装，安装和维护 DYNACOMP 的人员必须具备电工操作资格并能精通标准接线，电气组件和电气符号。最终用户必须关注本手册中的操作指南（第 12 章）和维护指南（第 13 章）

## 1.2 Compatibility 适用性:

The present manual is compatible with any DYNACOMP manufactured **after** April 2007, which Technical specifications are given in [Chapter 15](#) of this manual.

The present DYNACOMP product range is not backward compatible with any other DYNACOMP manufactured **before** April 2007.

该手册适用于 2007 年四月之后制造的 DYNACOMP，其技术参数在本手册中第 15 章。该手册适用范围不可追溯 2007 年四月之前制造的 DYNACOMP 产品。

## 1.3 Related and applicable publications 相关适用的出版物

- Power<sup>™</sup> DYNACOMP Pamphlet [English] 动态无功功率补偿手册(英)
- Power<sup>™</sup> Power Factor Controller RVT-D manual [English] 功率因数控制器手册(英)
- Power<sup>™</sup> Power Factor Controller RVT-D Modbus CD [English] 带 Modbus 现场总线的功率控制器光盘(英)
- Dynaswitch manual 动态开关手册
- RS485 Modbus adapter quick start-up RS485 Modbus 现场总线适配器快速启动
- RS485 Modbus adapter user guide RS485 Modbus 适配器使用指南

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## 2. Safety instructions 安全说明



These safety instructions are intended for all work on any DYNACOMP. Neglecting these instructions can cause physical injury and death. All electrical installation and maintenance work on any DYNACOMP should be carried out by qualified electricians. Do not attempt to work on a powered DYNACOMP. 此安全说明适用与所有 DYNACOMP 的工作。忽视该说明将导致受伤甚至死亡。DYNACOMP 上的所有电气安装和维护工作必须由具备电气操作资格的人员进行。禁止对通电的 DYNACOMP 进行操作



After switching off the supply of any DYNACOMP (main and auxiliary connections), always wait for at least 5 minutes before working on the unit in order to allow the discharge of AC capacitors through the discharge resistors. Always verify by measurement that the capacitors have been discharged. AC capacitors may be charged to more than 1800 V. 为了通过放电电阻释放交流电容中的能量，必须在断电（主回路和辅助回路）至少 5 分钟后才能对 DYNACOMP 的组件上进行操作。每次都必须用测量工具检证电容完全放电。交流电容充电量可能大于 1800V。

Before manipulating current transformers (CT's), make sure that the secondary is shortcircuited. Never open the secondary of a loaded current transformer. 在操作电流互感器（CT）前，必须确认二次回路已经短接。电流互感器在有负载的情况下二次回路不能为开路状态。

You should respect all local safety regulations when working on electrical installations and wear required protection clothes (isolating gloves, eye protection, protecting helmet ...) 进行电气安装操作时必须遵守现场安全规范并穿戴防护服（绝缘手套，护目镜，安全头盔...）

**DANGER: To ensure safe access, power supplies to each individual enclosure must be disconnected before opening. 危险：为确保安全，在打开盘柜前，必须确保断开每一个独立盘柜的电源。**

**WARNING: Stored energy. This equipment contains capacitors. Check for residual voltage before working inside the equipment. 警告：储能。该设备带有电容。在设备中操作前必须检查是否有残压。**

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**WARNING: Never discharge AC capacitors through short circuit. Always use a current limiting resistor of minimum 100K $\Omega$ /20Wmin. 警告：交流电容严禁通过短路放电。必须使用最小为 100K $\Omega$ /20Wmin 的限流电阻。**

**WARNING: If the ground is defeated, certain fault conditions in the unit or in the system to which it is connected can result in full line voltage between chassis and earth ground. Severe injury or death can result if the chassis and earth ground are touched simultaneously. 警告：如果接地失效，即设备接入的某一单元或系统出现接地失效将导致整条线路电压集中在底盘和地极之间。同时接触地极和底盘将导致严重的伤害甚至死亡。**

### 3. Industrial<sup>™</sup> for DYNACOMP product range Industrial<sup>™</sup>动态无功功率补偿系列产品

As a key element of its business strategy, ABB has committed to a broad program of product development and positioning under the Industrial<sup>™</sup> umbrella. This initiative is geared towards increasing integration of ABB products as the “building blocks” of larger solutions, while incorporating functionality that will allow multiple products to interact seamlessly as components of real-time automation and information systems. 作为一个商务策略的关键因素，ABB 用 Industrial<sup>™</sup> 的理念来开展产品研发和定位的工作。此举将大大增强 ABB 产品的整合性以构建更强的整体解决方案，与此同时高度的功能性整合将使得不同产品之间的互动达到无缝化以构成实时自动化与信息系统。

ABB DYNACOMP product range represents an important add-on to other fundamental building blocks in the Industrial<sup>™</sup> Architecture. ABB DYNACOMP 系列产品是 Industrial<sup>™</sup> 架构中其他基础产品模块的重要补充。

This product has been tested and certified by ABB Group as **Industrial IT Enabled™**. All product information is supplied in consistent electronic format, based on ABB Aspect Object™ technology. Plug and Produce™ installation and integration with other Industrial IT certified products are available through the ABB Aspect Integrator™ Platform. 本产品已通过 ABB 集团公司相关工业标准的测试认证。所有的产品信息根据 ABB Aspect Object™ 技术提供统一的电子格式。通过 ABB Aspect Integrator™ 平台以 Plug and Produce™ 模式与其他 Industrial<sup>™</sup> 认证产品进行安装和整合。

## 4. Upon reception 验收依据

### 4.1 What this chapter contains 本章节包括的内容

This chapter gives information on how to inspect, transport, identify and store a DYNACOMP. 本章提供如何检查、运输、识别和储藏 DYNACOMP.

### 4.2 Delivery inspection 交付验收

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Depending of its size, any DYNACOMP is delivered in one or several boxes designed to protect adequately the equipment during shipment. Upon reception of the equipment, make sure that the packing is in good condition. Verify the state of the shock and tilting indicators. After removal of the packing, check visually the exterior and interior of the DYNACOMP from transportation damages. Complete the first part of the pre-commissioning check-list (see [Chapter 11](#)).

根据尺寸规格,任何一款 DYNACOMP 将提供一个或几个箱子,旨在满足运输过程中合理保护设备的需要。交付核对时,确认包装是否完好.查看是否有撞击或震动过的痕迹.打开包装后观察 DYNACOMP 是否在运输过程中损坏。如要完成第一部份的试车核对清单,详见第 11 章。

Your DYNACOMP equipment is supplied with a standard set of documentation located top of the master cubicle door, internal side. See documentation location in [Figure 4](#). 您的 DYNACOMP 设备随机提供标准文件放在主模块内部顶部.详细参照档案放置图 4

Verify that all documentation is present, i.e.: 清点所有的档案如下:

- This manual; 使用手册
- Standard electrical drawings and connection diagrams 标准电路图和接线图
- Power<sup>™</sup> Power Factor Controller RVT-D manual 功率因数、控制器、RVT-D 使用手册
- Dynaswitch manual 动态开关手册
- RS485 Modbus adapter quick start , user guide , and CD (if this option has been ordered) RS485 现场总成适配器快速启动, 用户指南和 CD 光盘(事先预订)

Any loss or damage should be notified immediately to your ABB representative. 任何缺失或损坏请及时告知您的 ABB 代理商。

### 4.3 Lifting and transportation requirements 吊装运输要求

DYNACOMP cubicles should always be transported VERTICALLY and should never be tilted over. Please note that each individual cubicle weighs approximately from 350 to 550 kilograms (see [Chapter 15](#)). Transport requirements are given in [Chapter 15](#). DYNACOMP 单元箱都是采用垂直运输,避免倾斜,注意每个独立的箱体重量大约在 350 至 550KG(详见 15 章)。相关的运输要求在 15 章中列出。

Care should be taken to ensure that correct handling facilities are used: 注意使用合适的吊装工具:

- Lifting lugs may be used for individual cubicle handling using the following precautions: 吊装挂钩可用于单个单元的吊装作业,并采取以下预防措施。

- Place a rigid frame to avoid that the roof is fold with the weight of the cubicle 在单元顶部放置一个坚固柜架，避免吊装时单元变形。

OR

- -Remove the lifting lugs, the roof and the spacers 移走吊装挂钩及顶部垫块
- -Replace the lifting lugs on the cubicle for handling 也可以采用替换单元吊装挂钩的方法
- -After transportation, replace all parts as it was initially 运输到达后，可替换回原有部件

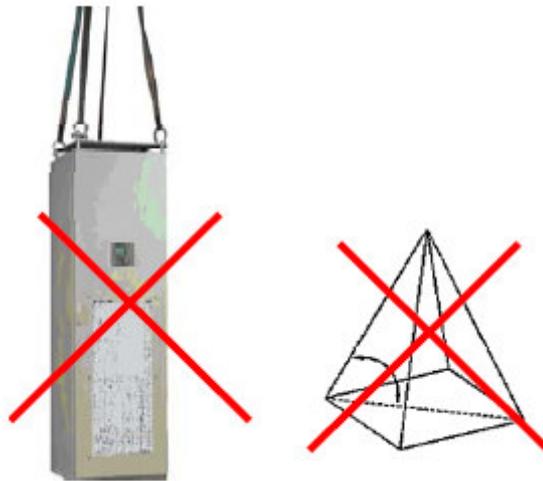


Figure 1: Lifting a single DYNACOMP cubicle 图一：单个 DYNACOMP 单元的吊装

- For cubicles mounted on a common base frame, lifting rods (not provided) should be used (see [Figure 2](#)). 把单元固定在同一基架上,并使用吊装棒(厂商不提供)



Figure 2: Lifting DYNACOMP cubicles mounted on a base frame 图 2：吊装固定在基架上的 DYNACOMP 单元

## 4.4 Identification tag 识别标签

Each DYNACOMP is delivered with nameplates for identification purposes: one nameplate for each cubicle and one for the complete DYNACOMP. 每个 DYNACOMP 单元都提供识别的铭牌,并提供一个整体 DYNACOMP 铭牌。

The nameplate for the complete DYNACOMP is located top right of the master cubicle door, at the outside. The nameplates for each cubicle are located top right of each panel door, at the outside. 整体铭牌被放置在主单元门外面顶部右侧,每个单独的铭牌被放置在门板顶部右侧。

The nameplate information should always remain readable to ensure proper identification during the life of the DYNACOMP equipment. The nameplate (see [Figure 3](#)) includes the DYNACOMP type, the nominal voltage, power, reactor value and frequency as well as a serial number and an ABB internal article code. 永久保留好铭牌相关信息,以确保能够正确识别。图三所示铭牌包含 DYNACOMP 的型号、额定电压、功率,电抗值、频率以及产品系列号和 ABB 内部代码条款。



Figure 3: DYNACOMP identification tags for each individual cubicle (left) and for the complete DYNACOMP (right)图3:左边为每个 DYNACOMP 单元的识别标签右边为 DYNACOMP 整体单元识别标签

## 4.5 Storage 仓储

Whatever your DYNACOMP is stored in its protective package or not installed once unpacked, it should be stored in a clean indoor, dry, dust free and non-corrosive environment. The storage conditions are described in [Chapter 15](#). 包装完好或开包未能及时安装的 DYNACOMP, 必须存放在干燥、无尘、无腐蚀气体的干净房间内。仓储条件在 15 章做详细说明。

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## 5. Hardware description 硬件说明

### 5.1 What this chapter contains 本章概述

This chapter describes typical DYNACOMP equipment and discusses its main components. 该章节就典型 DYNACOMP 设备及其主要部件的说明

### 5.2 DYNACOMP introduction 动态补偿介绍

Each DYNACOMP is basically made of one 'master' cubicle that contains the RVT-D controller and possible other cubicles called 'slave' units, without controller. 每个 DYNACOMP 主要是由一个带有 RVT-D 控制器的主单元，和**其它不带控制器的从单元（如果有）**组成。

The number of cubicles depends on the reactive power need considering that: 单元的数量是根据无功功率的需要考虑

- The maximum reactive power per cubicle (master or slave) is 400 kvar 包括主和从柜在内，每柜的最大功率为 400 kvar。
- The power range may vary using the type of sequence and the number of outputs 无功功率的大小可依据程序类型及输出路数进行改变。
- The value of power steps are fixed to approximately: 100, 200 and 400 kvar (please refer to [Chapter 15](#)) 每级的功率值被固定在大约:50kvar、100 kvar、200 and 400 kvar。(请参照第 15 章)
- Any DYNACOMP can have up to 32 outputs with CAN interconnection system (default) or 12 outputs with traditional opto-coupling outputs. 任何一款带 CAN 的 DYNACOMP 最多能达 32 路输出(缺省)，带光耦驱动的输出最多是 12 路
- By default, each cubicle has to be individually connected to the grid. As an alternative, a common cable entry cubicle can be used. See options, [Chapter 15](#). 默认每个单元可以单独联到电网。**也可以采用公用进线输入单元以连接不同单元。**参照第 15 章
- Master + slave cubicles are both W 800 x D 600 x H 2150 mm by default 主和从单元的默认尺寸都为 **W800\*D600\*H2150MM**
- Optional cable entry cubicle is W 600 x D 600 x H 2150 mm 另外带有电入口的单元尺寸为 **W600\*D600\*H2150MM**
- Each cubicle is free floor standing (floor fixation possible with base frame option, see [Chapter 15](#)) 每个单元无需地脚固定，（地脚基础框架选件参阅 15 章）

### 5.3 DYNACOMP typical cubicle layout 典型 DYNACOMP 单元布局

DYNACOMP equipments may differ from their size, power steps, voltages and options. However, the internal layout principle remains the same, as illustrated in [Figure 4](#) here below: DYNACOMP 设备容量，功率步长，电压和选件可能不一样。但它的内部布局原理保持一致，如下图 4 所示



Figure 4: Examples of typical DYNACOMP cubicles 图 4: 典型 DYNACOMP 单元实例

Table 1: Main components list of a DYNACOMP 表 1 DYNACOMP 主要部件清单

Item 条款	Main components 主要部件
1	Capacitors CLMD83Q type CLMD83Q 型电容器
2	Reactor(s) 电抗器
3	Dynaswitch(es) 动态开关
4	Fuses & power connections 保险管与电源联接
5	RVT-D controller RVT-D 控制器
6	Auxiliaries: 24Vdc power supply for Dynaswitches, Auxiliary power supply fuses, CT terminals, 230V Auxiliary power supply (optional) 附件: 供动态开关使用的 24V 直流电源, 辅助电源保险管, CT 接线端子, 230V 辅助电源 (选件)
7	Documentation holder (always in master cubicle) 档案架 (主单元)

Slave units differ physically from master units in the following: 从柜单元不同于主柜单元的地方如下:

- They don't have any RVT-D controller 没有 RVT-D 控制器
- They don't have a CT connection terminal block. 没有电流互感器 (CT) 接线端子排
- They don't have a documentation holder 没有档案架

### 5.3.1 Electrical topology 电气示意图

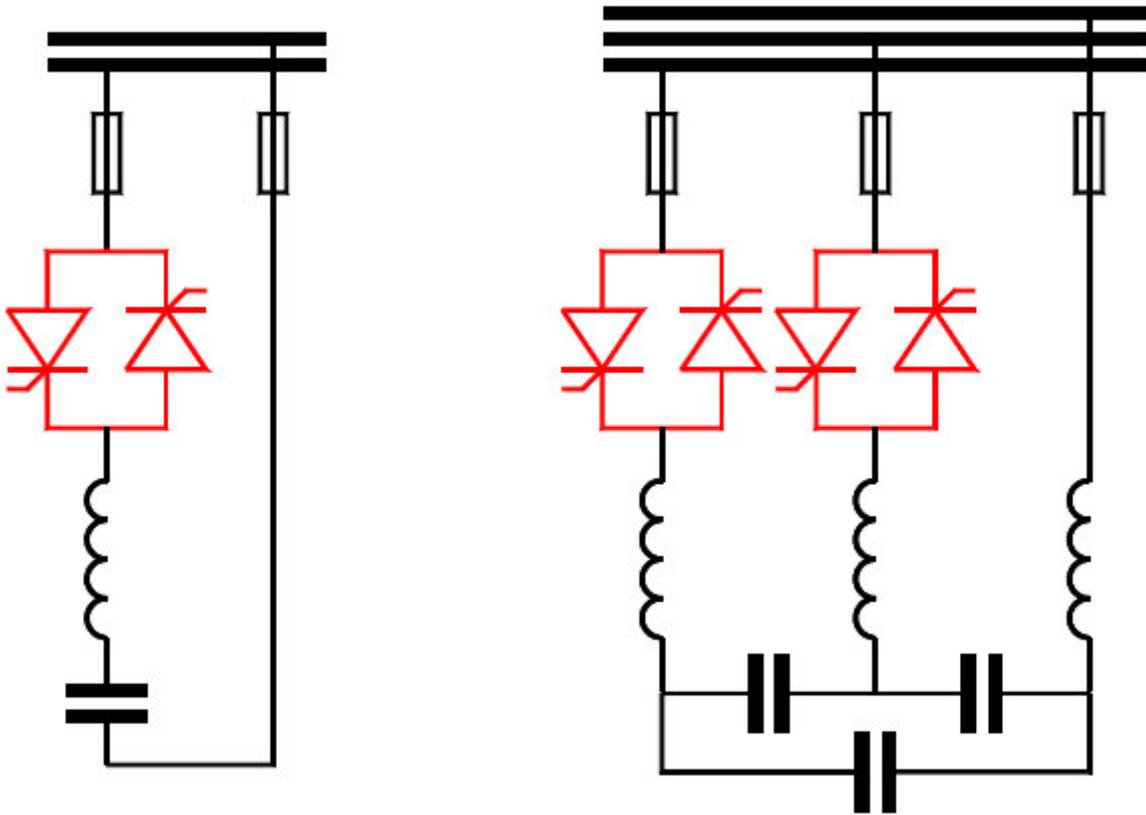


Figure 5: Thyristors pairs for single and three-phase networks 图5: 应用于单相和三相网络的双可控硅

### 5.4 DYNACOMP user connections DYNACOMP 用户接线

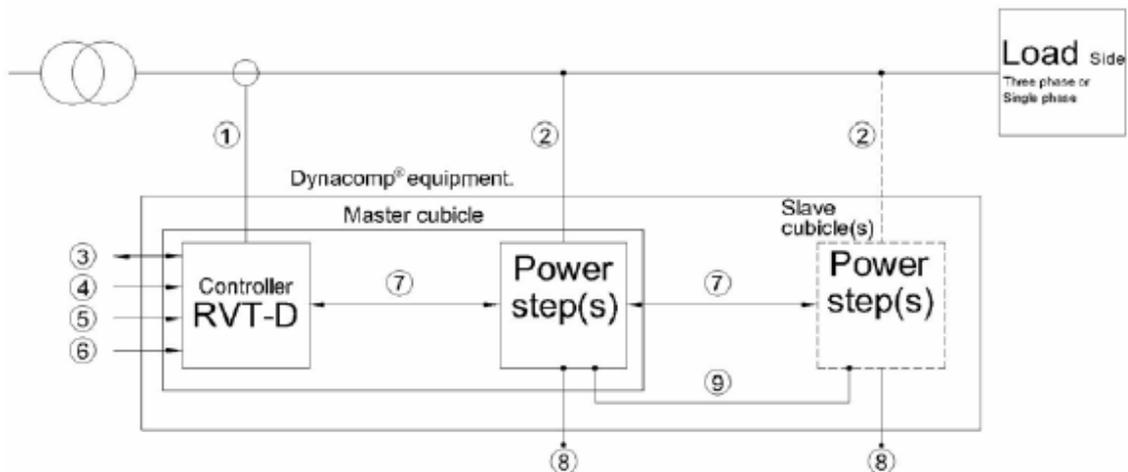


Figure 6: DYNACOMP schematic overview of user connections 图6: 用户接线指南

Table 2: User connections for DYNACOMP 用户接线表格

Item 条款	User connections 用户联接	Connection requirement 联接要求
1	CT connection(s) 电流互感器联接	Mandatory (excepted for basic external trigger control mode, see Chapter 7). CT location depends on control mode, see Chapter 7). 强制(除外部触发控制模式见第7章)CT 的位置,根据控制模式可能变化
2	Power cable connection to the supply 连接到电源的电力电缆	Mandatory for each cubicle (standard configuration) 强制, 每个单元(标准配置)
3	Modbus communication connection or serial communication/printer connection (optional) Modbus 总线通信连接即串行通信或打印机联接(选件)	Not mandatory 不强制
4	Auxiliary power supplies 辅助电源	Mandatory, requested for each cubicle (can be provided, see options Chapter 15 ) 强制, 每个单元(可提供,请见 15 章)
5	Temperature probe connections (optional) 温度传感器连接(选件)	Not mandatory 不强制
6	Opto-coupler inputs for external triggering 外部为光耦输入	Not mandatory 不强制
7	CAN control between cubicles 单元之间 CAN 控制	Mandatory 强制
8	Individual cubicle earth connections 单元分别接地	Mandatory 强制
9	Earth connection between cubicles 单元之间地线互联	Mandatory 强制

Mandatory connections are connections that must be present to make DYNACOMP equipment operational. DYNACOMP power connections, auxiliary power supply and earth connections have to be cabled by the user. 强制联接保证 DYNACOMP 设备能得到正常运行, 如电源辅助、接地等部分需要由用户自行联接。

Connections that are not mandatory can be made to enhance the DYNACOMP equipment basic functionality. Please refer to [Chapter 7](#) for detailed cabling information instructions. 非强制部份的联接用以增强 DYNACOMP 设备的基本功能。详细请参考第 7 章, 电缆联接介绍。

## 5.5 Power<sup>r</sup> RVT-D Power Factor Controller Power<sup>r</sup> RVT-D 功率因数控制器

The RVT-D controller controls the complete DYNACOMP. Its tasks include: 对 DYNACOMP 进行控制的 RVT-D 控制器, 包括以下几项任务:

- Providing a user friendly interface 提供友好的用户接口
- Accepting and executing customer requests 接受并执行用户要求
- Accepting and executing the commissioning of the equipment 接受并执行试车的各种要求

- 
- Giving the possibility to the user to activate steps manually 为用户提供手动操作的相关步骤
  - Calculating and generating automatically the Dynaswitches firing signals based on the line voltage, the current measurements and the user requirements 根据电压和电流测量信号, 以及用户要求的各种当前测量值, 自动计算并产生动态开关触发信号。
  - Receiving possible external trigger signals 接收外部触发信号
  - Ensuring interface with Dynaswitches through a CAN or opto-coupling connection links 为动态开关提供链接 CAN 或光耦的接口
  - Protection of the DYNACOMP (over and under voltage, ...) DYNACOMP 保护(过压和欠压)
  - Displaying measurements (U, I, Cosφ, powers, ...) 测量值显示 (电压, 电流, COSφ, 功率等)
  - Managing communication interfaces: Modbus, alarm contact and serial communication to printer 通信接口管理: Modbus 总线, 报警触点和到打印机的串行通信.

In order to fulfil these tasks the RVT-D controller is connected to the Dynacontrol board of the Dynaswitch by CAN bus. 为满足任务需要, 通过 CAN 总线把 RVT-D 控制和动态控制基板上的动态开关进行通信连接.

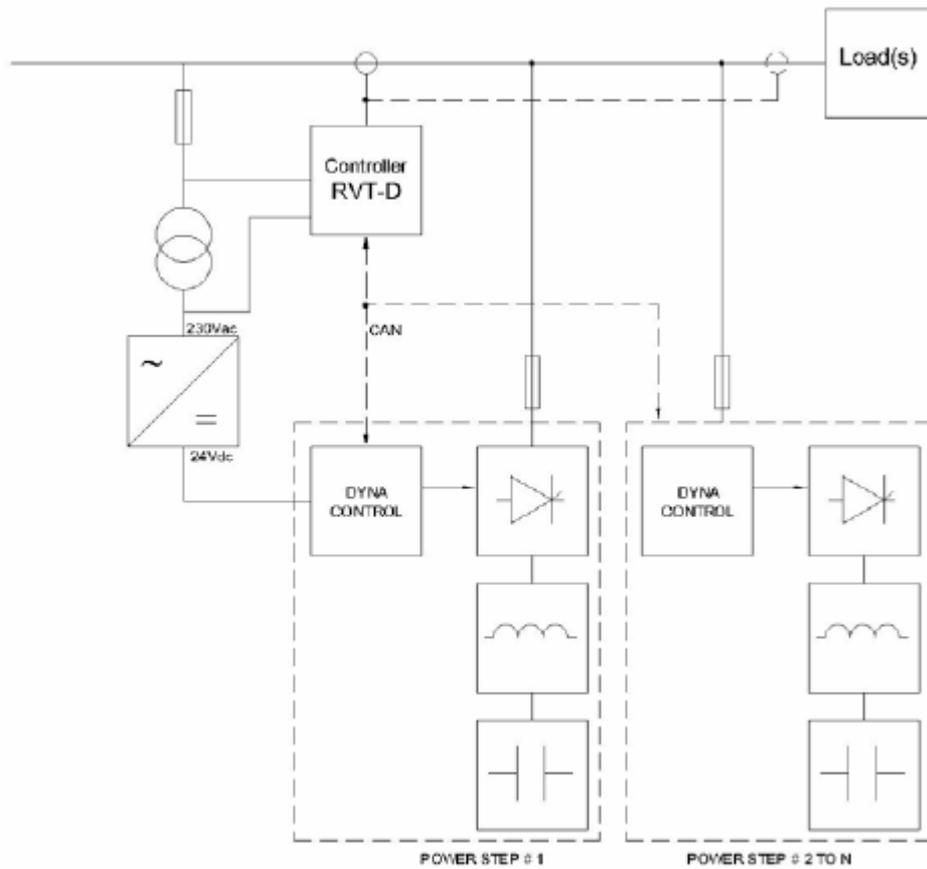


Figure 7: RVT-D controller interface diagram 图7:RVT-D 控制器接口图

Please refer to RVT-D manual for hardware and interfaces description.相关的硬件及接口说明,请参阅 RVT-D 手册

## 5.6 Dynaswitch 动态开关

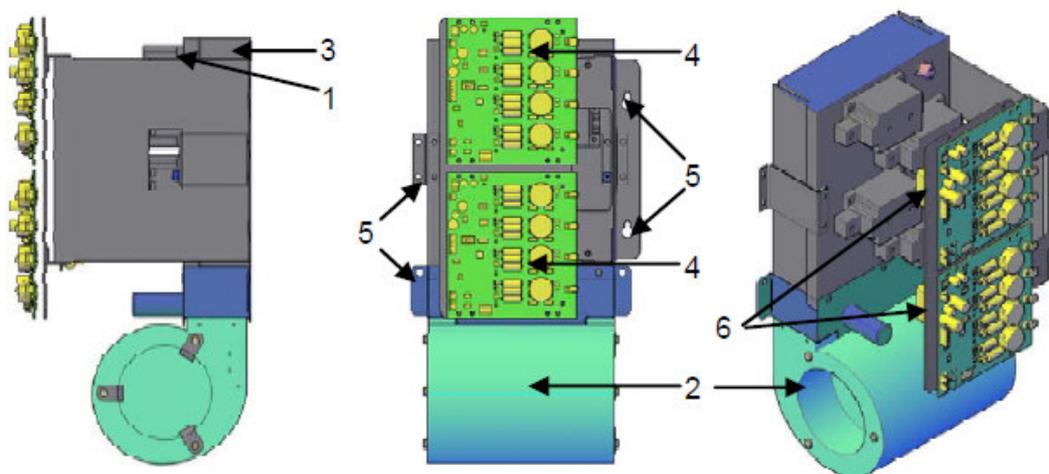


Figure 8: Dynaswitch right and front views 图8:动态开关正视图和前视图

Dynaswitch are made of: 动态开关组成

Table 3: Main components list of a Dynaswitch 表3:动态开关主要部件清单

Item 条款	Main components 主要部件
1	Thyristor semiconductors 半导体可控硅
2	Fan 冷却风扇
3	Heatsink with thermal protections 散热器及保护
4	Dynacontrol board 动态控制板
5	Fixation brackets 固定支架
6	RC snubbers 阻容(RC)阻尼器

From the RVT-D controller signal, the Dynacontrol board will control the Thyristors firing for a quick and transient free switching. 动态控制板接受来自 RVT-D 控制器的指令，可以快速、地触发可控硅，没有浪涌冲击。

The Dynacontrol board also monitors the status of the fuses, the thermal protection status of thyristors, and various error messages. Thanks to the CAN connection, that information is available from the RVT-D controller. 同时动态控制板本身也可以监控保险管状态，可控硅热保护的状态，以及各种错误信息。由于有了 CAN 通信联接，这些信息都将被 RVT-D 控制器有效获取。

Please refer to Dynaswitch manual for hardware and interfaces description. 相关硬件及接口说明，请参照动态开关使用手册

### 5.6.1 Dynacontrol board 动态控制板

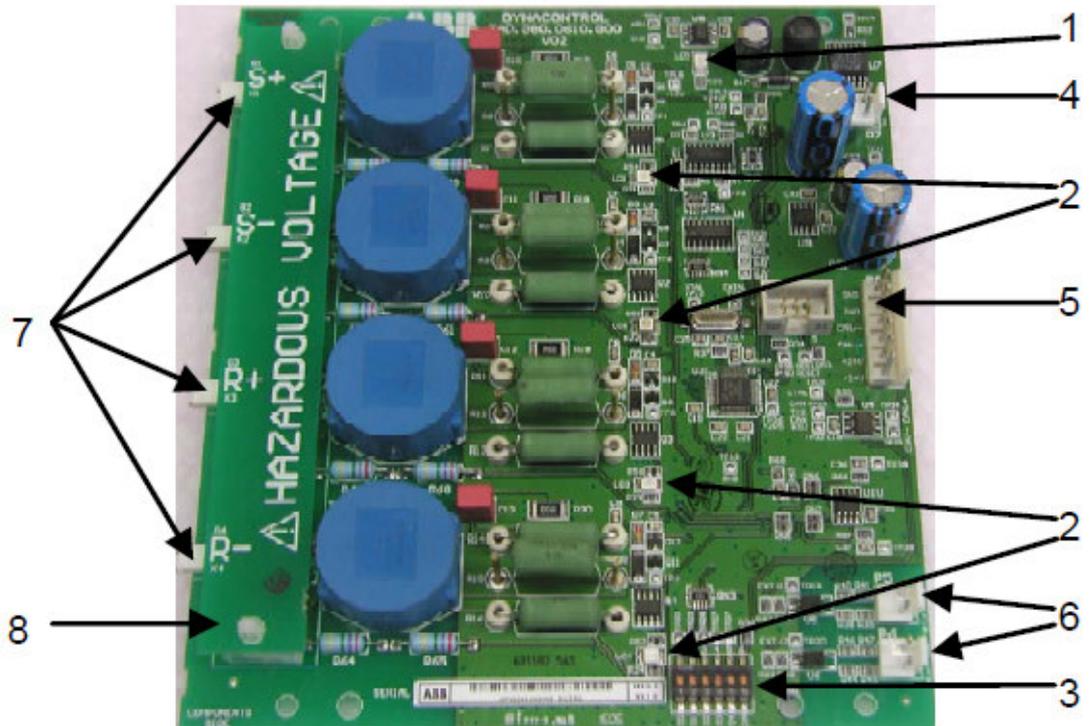


Figure 9: Dynacontrol board layout 图9:动态控制板布局图

Table 4: Dynacontrol board description 表 4:动态控制板说明

Item 条款	Connections and LED's signification 相关联接及 LED's 指示灯显示
1	Power ON indication LED and error signal given by specified blinking 电源开启指示灯亮及错误信息按规定闪烁指示
2	On/Off LED's: presence of a thyristor firing request 亮/灭 LED's:表示可控硅触发
3	Configuration Dip switches DIP 拨码开关设置
4	Enable input: fuse and thermal protection detection 用于保险管和热保护检测的输入端口
5	Power supply (24Vdc) and CAN bus connection 24V 直流电源及 CAN 总线连接端口
6	External control input: optional input to control the switch 外部控制输入: 选择输入到控制开关
7	Gate signals for the thyristors 可控硅门极控制信号
8	Touch proof protection plate 防止触摸保护板

## 5.7 Capacitors 电容器

The capacitors are CLMD83Q special type especially sized for DYNACOMP application. CLMD83Q 专用型的电容器是为 DYNACOMP 使用专门定制的

CLMD83Q are dry type capacitors using well proven technology. CLMD83Q 的干式电容器是一种已被认可的技术

The capacitors are equipped with discharge resistors to get < 75 V after 3 minutes. Discharge resistors are fitted outside the capacitor enclosure. 该电容器已安装放电电阻器，只需三分钟可使电容器电压降低至 75V 以下。放电电阻器被固定在电容器壳体外部。



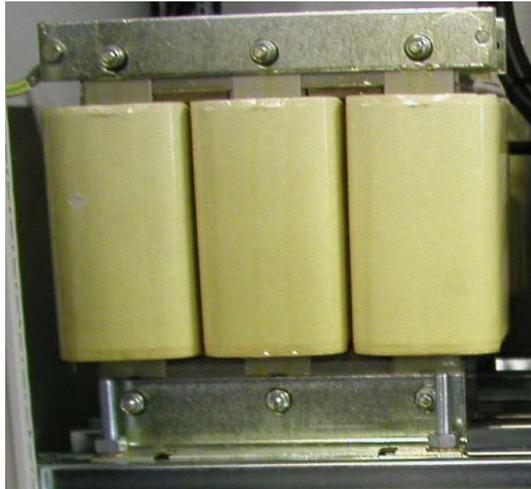
Figure 10: CLMD83Q capacitors 图 10: CLMD83Q 电容器

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## 5.8 Reactors 电抗器

By default, 7% reactors are used for 3-phase DYNACOMP and 14% for single-phase. Please refer to [Chapter 15](#) for reactors detailed specification. 厂商默认值：三相 DYNACOMP 采用 7%电抗器，单相 DYNACOMP 则采用 14%电抗器。详细的电抗器技术要求请参考第 15 章。

In case of specific requirement, (e.g. THDV > 8% or specific spectrum or specific reactor values) see [Chapter 15](#) options for special reactors type. 对于有具体要求的（例如：THD>8%，或具体频谱或电抗器值要求的）请参照第 15 章专用电抗器的选择



## 5.9 Fuses and power connections 保险及电源连接

The fuses are fitted with micro-switches that are connected to the Dynacontrol board. 进线熔断器上有微动开关，信号连接到动态控制板上。

Note: by default, each cubicle is top cable entry. The cables have to be connected to the power terminals. Different types of power terminals are presented in [Figure 12](#). 提示：每个单元默认为顶部电缆进线，该电缆连接至电源接线端子，不同类型的电源接线端子如图 12 所示。

Optional power connections are possible see [Chapter 15](#). 其它电源联接可参照第 15 章

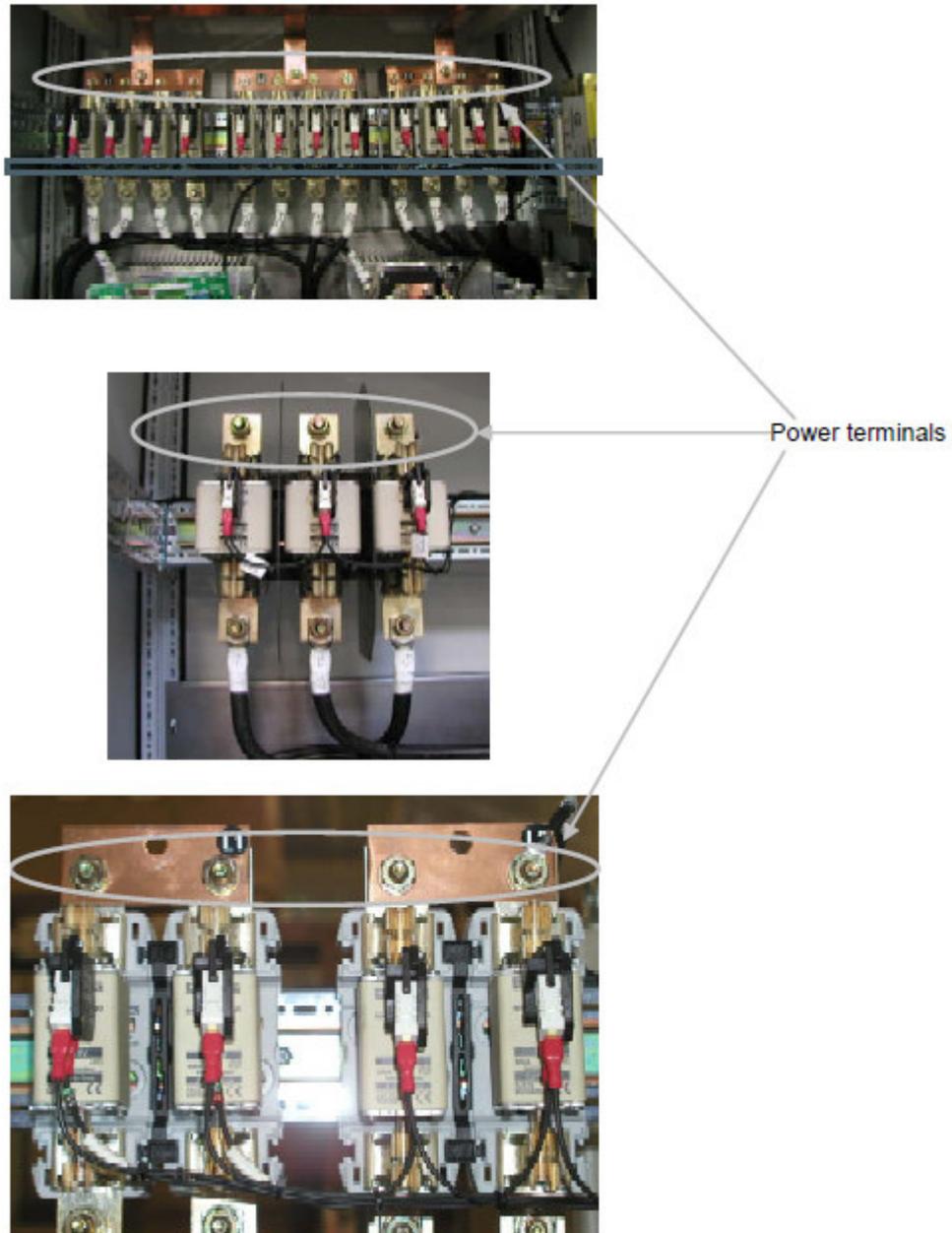


图 12: 保险丝和电源接线端子

## 5.10 5.10 Auxiliary power supply and terminals 辅助电源及其接线端子

By default, each cubicle has to be fed by an external 230V 50 or 60 Hz auxiliary power supply. The cables should be connected to the terminals as shown in [Figure 13](#). The CT terminals are just located beside. 厂商默认每个单元都由外部提供一个 230V/50HZ 或 230V/60HZ 的辅助电源。并连接到如图 13 所示的接线端子上，电流互感器（CT）的接线端子安装在其旁边。

As an option, the auxiliary power supply can be internally generated from power terminals through an auxiliary transformer, see [Figure 13](#). 辅助电源也可从内部电源端通过辅助变压器获得,如图 13 所示

The 230V external power supply or auxiliary transformer feed the fan(s), RVT-D controller and 24Vdc power supply. 从外部 230V 电源或者辅助变压器获得的能量主要供给冷却风扇，RVT-D 控制器和 24V 直流电源使用。

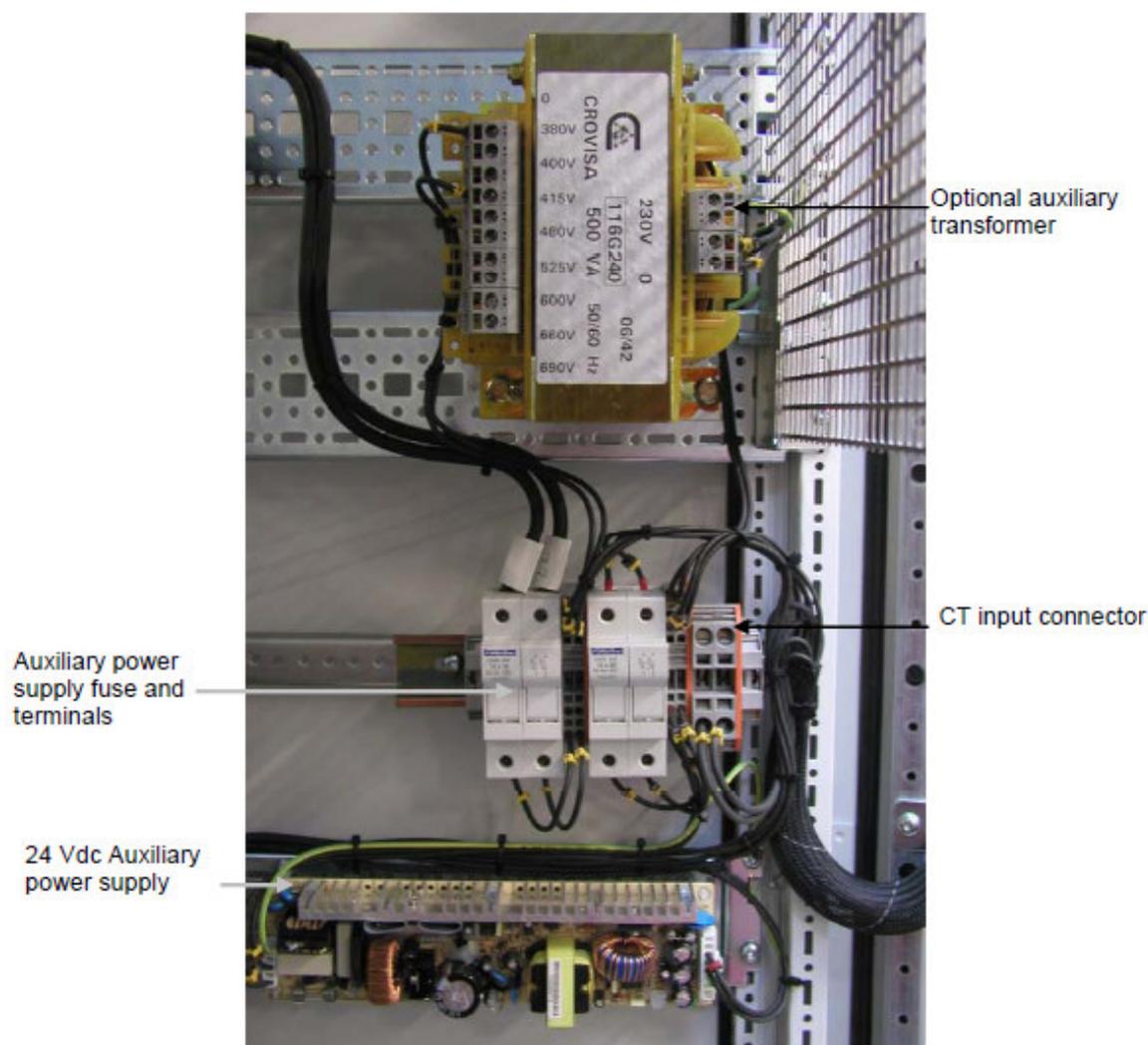


图 13: 辅助电源及其接线端子

## 6. Mechanical installation 机械部分安装

### 6.1 What this chapter contains 本章概述

This chapter gives the required information for the mechanical installation of DYNACOMP equipments. 本章主要是提供 DYNACOMP 设备机械部分安装的相关要求

### 6.2 Installation location requirements 安装位置要求

DYNACOMP equipments must be indoor, on firm and levelled foundation, in a well-ventilated area without dust, aggressive gases and excessive temperatures. Please

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refer to [Chapter 15](#), installation location. DYNACOMP 设备要求安装在户内，并在坚固、平整的基础上，通风良好无粉尘、腐蚀性气体和低温的环境下。请参照第 15 章。（安装位置）

The DYNACOMP foundations have to support the DYNACOMP weight. The DYNACOMP total weight can be calculated from the weights of each individual cubicle given in [Chapter 15](#). 安装位置的基础必须能够承受 DYNACOMP 的重量，根据第 15 章给出的每个单元的重量就可以计算出总重量。

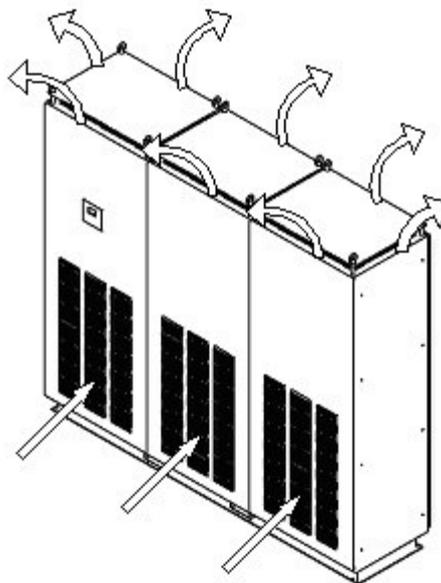
It should also be taken into account that the standard protection degree is IP21 closed door(s) [IP00 open door(s)]. IP43 available as an option, see [Chapter 15](#). 同时也要考虑保护标准等级。关门为 IP41、开门为 IP00。详细参照第 15 章。



**WARNING: Conductive dust may cause damage to this equipment. Ensure that the DYNACOMP is installed in a room where no conductive dust is present.** 警告：确保 DYNACOMP 安装在没有导电粉尘的室内，以避免导电粉破坏该设备。

### 6.3 Airflow and cooling requirements 冷却气流要求

Each DYNACOMP cubicle has its own set of cooling fan(s). The air intakes are located in the cabinet front doors as described in [Figure 14](#). Please note that the cable entry cubicle has no fan. 每个 DYNACOMP 单元都配有冷却风扇。进风口在如图 14 所示的单元前门。请注意电缆进线柜没装冷却风扇。



*Figure14: Cooling air flow for a 3-cubicle DYNACOMP*

图 14: 3 个 DYNACOMP 单元的冷却气流图

For proper cooling, a minimum of 1400m<sup>2</sup>/h airflow has to be supplied to each cubicle. Please ensure that the air used for cooling is regularly renewed and does not contain conductive particles, significant amounts of dust, corrosive or harmful gases (refer to [Chapter 15](#), installation location). 为了保证足够的冷却，每个单元应具备最小 1400m<sup>2</sup>/h 的通风流量。确保通风良好，空气中没有导电粒子，大量粉尘，腐蚀性或有害气体。应定期更新风扇并清理过滤网口的灰尘。（具体参照第 15 章安装位置）

Possible air conditioning system and its sizing depend on the produced heat. Since DYNACOMP can be splitted in several parts and the parts located in different rooms, the losses of each part have to be estimated separately. 合理的空调系统是依据具体生成热量的大小而定。DYNACOMP 可分成 12 个部分，并放置到不同房间，所以其散热问题应分开评估。

Maximum individual cubicle losses are given in [Chapter 15](#). 每个单元的最大散热在第 15 章内有提出。

This heat must be carefully considered in order that the cooling air intake doesn't exceed the allowable temperatures (see [Chapter 15](#)). This point is very important since the life time of the electrical equipment is highly temperature sensitive. 认真考虑散热问题，以避免超出许可范围（见 15 章）。这点非常重要，因为电气设备的寿命直接受到高温的影响。

## 6.4 Noise 噪音

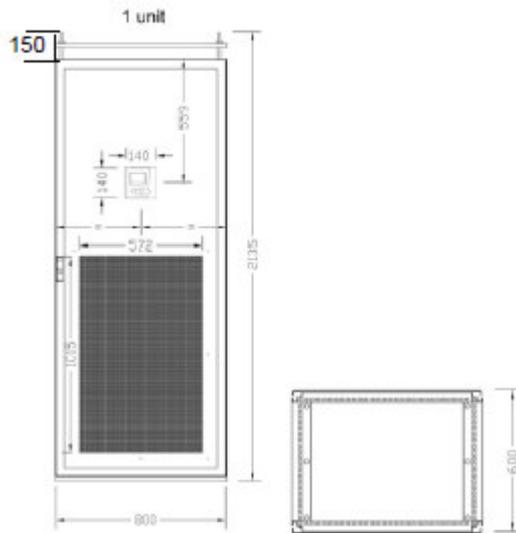
Mainly due to the air forced cooling, all DYNACOMP generate a certain level of audible noise. The audible noise level of the entire DYNACOMP depends on the number of cubicles and on the harmonics of current flowing in the reactor. 噪音主要来源于冷却风扇，以及单元的数量，还有谐波电流流经电抗器而产生的噪音。

Typical noise level for single cubicle is given in [Chapter 15](#). 单个单元的典型噪音分贝在第 15 章给出

The DYNACOMP noise level should be taken into account when choosing an installation area. 当选择安装位置时,应考虑噪音分贝等级

## 6.5 Standard cubicle layout, cubicle assembly and clearances 标准单元布局及安装问题

All DYNACOMP cubicles (masters and slaves) are Rittal TS8 type with W 800 x D 600 x H 2150 mm, see [Chapter 15](#). The cubicles are equipped with an elevated roof and lifting lugs. DYNACOMP 单元（包括主和从单元）其尺寸大小为 W800\*D600\*H2150mm 详见第 15 章。该单元装有顶部吊装结构。



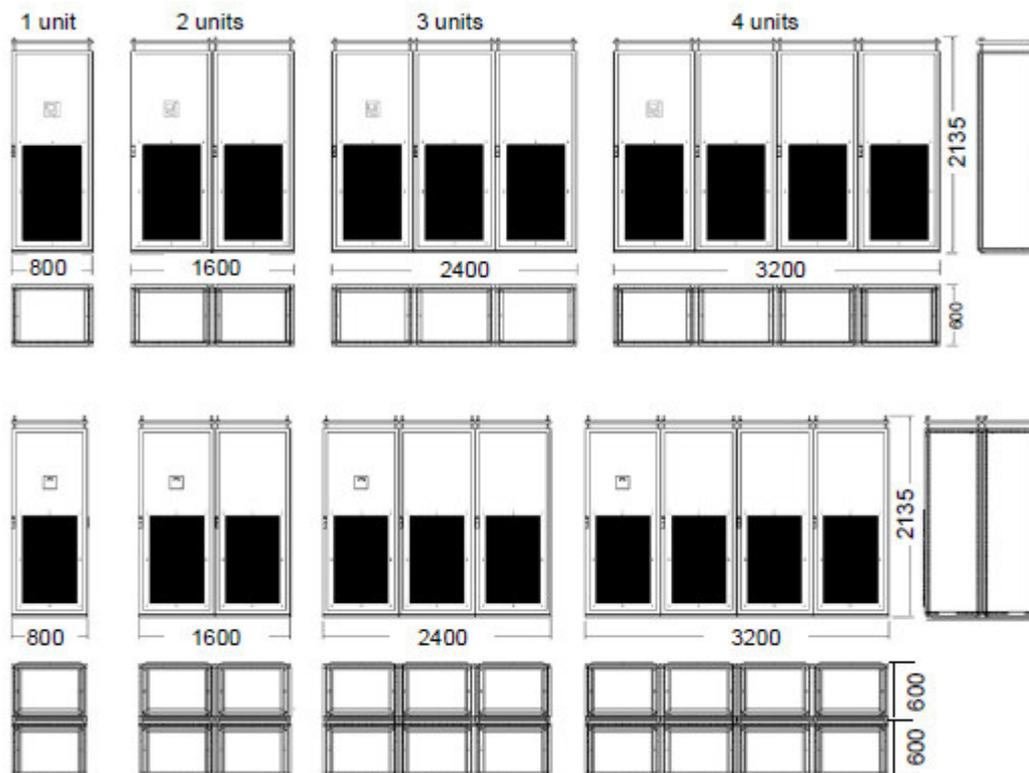
Please note that the cable entry cubicle is normally a narrower (W 600 mm) see [Section 6.7](#) .请注意电缆进线柜通常较窄（W600mm）详细参照 6.7 部分

DYNACOMP cubicles can be placed side by side or back to back. They are free floor standing and, by default they cannot be screwed on the ground. If ground fixation is requested, optional base frame has to be ordered, see [Chapter 15, options](#). DYNACOMP 单元可边靠边或背靠背摆放，它们无须地脚固定，若要求地脚固定，可选择订购基架。详细参阅第 15 章选件部分

**IMPORTANT:** Please note that it is not possible to add the base frame afterwards: this option must be selected when ordering. 重要提示：若须基架应在下订单时注明。

Cubicles of a same DYNACOMP can be grouped into several separated parts. Then, each part has to be assembled as shown in [Figure 16](#). 如图 16 所示：在装配过程中，相同的 DYNACOMP 单元可分别组成几个部分进行。

For any other configurations, please consult us. 对于其它配置，请与我们联系



By default, the standard DYNACOMP cubicles are shipped separately, so they have to be mechanically interconnected on site; see [Section 6.8](#), mechanical interconnection of cubicles. 由于标准 DYNACOMP 单元是分开运输的，因此还须进行现场并柜。详见 6.8 部分单元并柜。

If some heat transfer is expected, 100 mm clearance should be applied between the DYNACOMP cubicles and heat source(s) such as walls or other electrical boards for instance. 若有热导要求，则应让 DYNACOMP 单元与热源如：墙或其它电气盘保持 100mm 的间距。

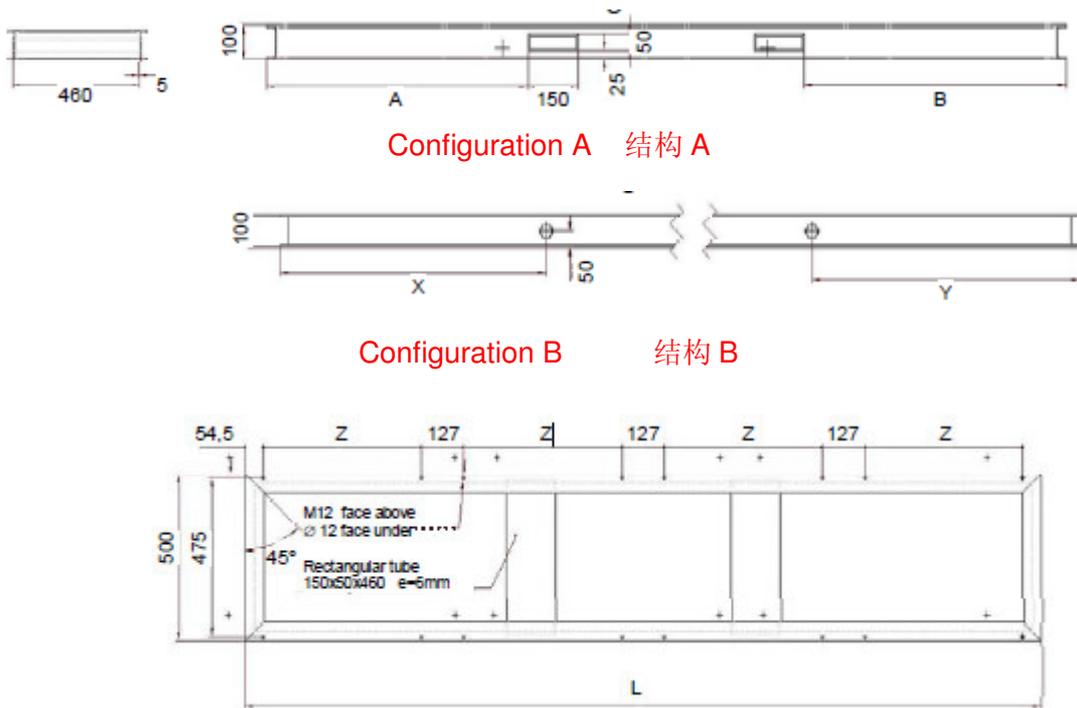
## 6.6 Base frame 基架底座

DYNACOMP can be supplied with an optional 100 mm base frame, see [Chapter 15](#), options. DYNACOMP 可提供 100mm 基架选件，详见第 15 章选件部分

The base frame option must be selected when: 需要使用基架选件的地方包括：

- ground fixation is requested 有地脚固定要求的
- busbar option is ordered 母线排已经安排好的

Typical base frame layout for cubicles placed side by side is given in [Figure 17](#). 典型的单元基架布局在下面的图 17 中给出



Configuration A 结构 A

Configuration B 结构 B

Z = 475 mm for cubicle of 600 mm    600mm 的单元 Z 为 475mm  
 Z = 675 mm for cubicle of 800 mm    800mm 的单元 Z 为 675mm

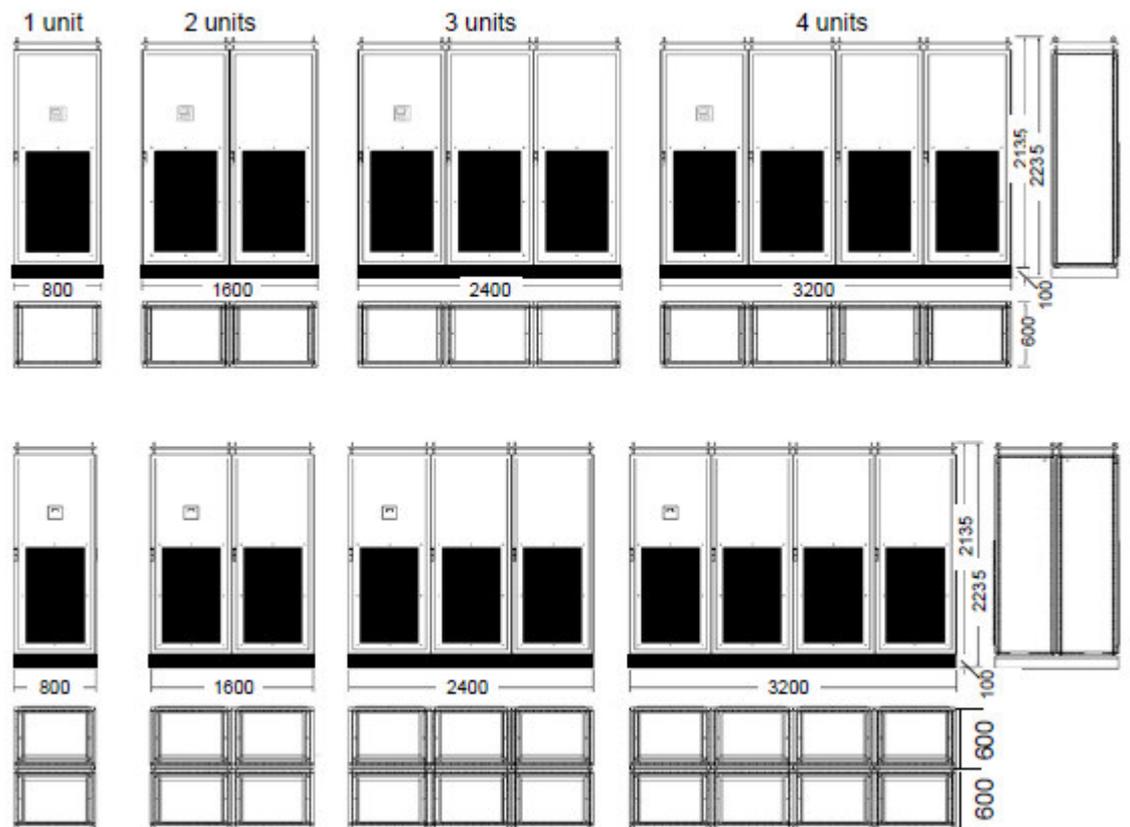
Figure 17: Base frame detailed layout

L	Conf. A		Cubicle type
	A	B	
1386	280	280	1x600 + 1x800
1586	360	360	2x800
1788	478	478	3x600
2390	776	776	4x600
2388	720	836	3x800
	Conf. B		
	X	Y	
2992	800	800	5x600
3190	800	800	4x800
3594	800	800	6x600
3992	800	800	5x800
4196	800	800	7x600
4798	800	800	8x600
4794	800	800	6x800
5596	800	800	7x800
6398	800	800	8x800
2188	450	600	1x600 + 2x800
2990	800	800	1x600 + 3x800

3792	800	800	1x600 + 4x800
4594	800	800	1x600 + 5x800
5396	800	800	1x600 + 6x800
6196	800	800	1x600 + 7x800
7000	800	800	1x600 + 8x800

A single base frame can be used to fix up to 4 cubicles side by side (including cable entry cubicle) or 8 cubicles back to back. 一个基架可固定四个，边靠边可摆放的单元（包括电缆进线柜）。

Figure 18 shows respectively the possible DYNACOMP assemblies with base frame up to 8 cubicles. Please consult us for other configurations. 图 18 所示，有代表性的八个 DYNACOMP 单元安装在一个基架上例图。若需其它的配置，请与我们联系。



## 6.7 Cable entry cubicles 电缆进线柜

Any DYNACOMP can be equipped with a cable entry cubicle (W 600 x D 600 x H 2150 mm, excluding base frame) see [Chapter 15](#), options. 任何一款 DYNACOMP 都能装配电缆进线柜(尺寸:W600\*D600\*2150mm,除基架外)见第 15 章

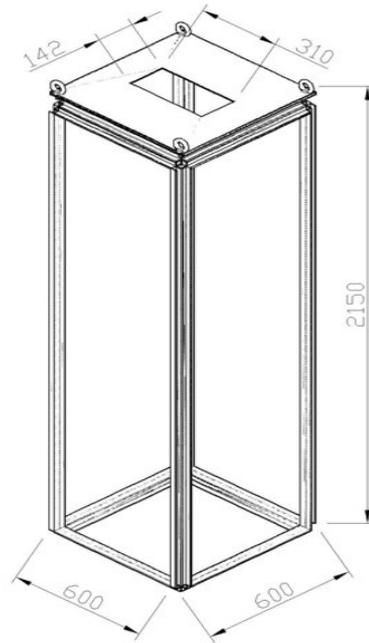
The internal layout of the cable entry cubicle is quite flexible and can be adapted to customer requirements. For instance, it may be equipped with or without: 由于进线柜的内部布局十分灵活，并能采纳用户要求，例如是否要求装配：

- Connection bars 连接铜排

- 
- Circuit breaker 断路器
  - • Surge arrester 避雷装置

Cases where the cable entry option must be selected: 下列情况需要选择电缆进线柜

- bottom cable entry is requested 要求底部电缆进线
- circuit breaker option is selected 需要隔离开关
- a single connection point is requested 单个的连接点

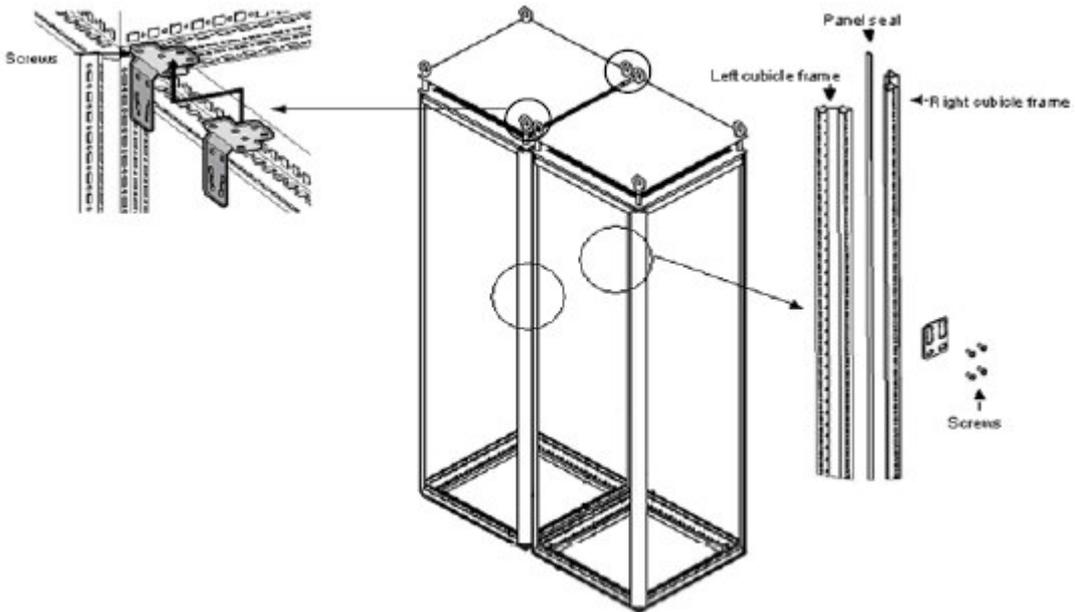


When a single connection point is requested, the cable entry cubicle can be located in several places, as shown in [Figure 18](#) with a two cubicles DYNACOMP. 当选择单独连接点，电缆进线柜可以放置到几个地方。如图 18 所示带有 2 个单元的 DYNACOMP.



## 6.8 Cubicles mechanical interconnection 单元机械互连

By default, DYNACOMP cubicles are delivered separately and they can be mechanically interconnected on site thanks to the interconnection kit. DYNACOMP 单元被分开发货，到原地后可根据提供的组件进行机械互连。



### Interconnection procedure: 互连步骤

- Remove the relevant side panels of the cubicles to be interconnected. Pay attention to the earth wire connection that is connected to each panel. This wire has to be removed. 移除相连侧的盘柜侧门，进行互连接。注意地线的连接，并连接到每个单元
- Fix the divider panel seal on the interior frame between the cubicles. 固定好在单元内部柜架之间隔板密封
- Interconnect the cubicles at 4 fixation points as indicated in the above figure. 连接该单元如上图所示的四个固定点

## 6.9 RVT-D installation RVT-D 安装

By default, the RVT-D is supplied in the face panel of the master cubicle. RVT-D 通常被安装在主单元的前门上。

If RVT-D extension kit is selected, the RVT-D controller is delivered separately and should be installed and connected on site as defined in the RVT-D manual. 如果选择了 RVT-D 扩展组件，该 RVT-D 控制器将被分开提供。并根据 RVT-D 手册要求的位置进行安装和连接。

## 6.10 Cubicles assemblies - summary 单元安装要求

Most popular cubicles assemblies and their respective characteristics are summarized in this section. It aims at bringing useful help to select the suitable DYNACOMP assembly. 最通用的单元装配以及它们各自的特点，将在这部分进行阐述。其目的是为帮助选用合适的 DYNACOMP 设备

Table 5: Popular cubicles assembly 表 5: 通用单元装配

Configurations 配置	Characteristics 特性
1. Standard cubicles, standard configuration (no option) 标准单元, 标准配置	<p>Each cubicle delivered separately 每个单元分开供货            DYNACOMP can be divided in one or several parts, cubicles of each part being placed side by side or back to back. Cubicle can be mechanically interconnected (recommended) DYNACOMP 能被分成一个或几个部分，每个部分可边靠边，背靠背摆放，单元可以用机械互连。（推荐）</p> <p>All cubicle are free floor standing 所有单元无须地脚固定            Top cable entry for each cubicle 每个单元为顶部电缆进线。            230V Auxiliary power supply supplied to each cubicle otherwise auxiliary transformer should be selected 每个单元采用 230V 供电，否则应选择辅助变压器供电。</p> <p>No base frame, no busbar, no circuit breaker 没有基架，母线排和断路器。</p>
2. Floor fixation required 有地脚固定要求	<p>Cubicles are delivered on one several base frame(s). 单元提供一个或几个基架。</p> <p>The DYNACOMP can still be divided in one or several parts, cubicles of each part being fixed on one or several different base frame(s). 该 DYNACOMP 同样被分为一个或几个部分，并且每个单元可固定在一个或几个不同的基架上。</p> <p>Cubicles assembled on different base frame and placed beside each other can be mechanically interconnected. 单元装配到不同基架上，并边靠边紧依着摆放，可用于机械互连。</p> <p>Base frame can be fixed on the ground. 基架可固定在地板上。</p> <p>Top cable entry for each cubicle 每个单元为顶部电缆进线。            230V Auxiliary power supply supplied to each cubicle otherwise auxiliary transformer should be selected 每个单元应采用外部 230V 辅助电源供电，否则需选用辅助变压器供电。</p> <p>No busbar, no circuit breaker 无母线排，无断路器。</p>

<p>3. One Single connection point required (or several single points in case of very large DYNACOMP) 要求一个单独连接点(或几个单独的连接点适用于较大的 DYNACOMP 系统)</p> <p>The idea is to reduce the number of power connection. 这样做是为减小电源连接数量</p>	<p>Busbar should be selected.需选择母排。 Cubicles interconnected with a busbar should be assembled on the same base frame.用母线连接的单元应安装在同一个基架上。 Power connections can be done directly to the busbar(top entry through standard apertures, no need of cable entry cubicle) or thorough a cable entry cubicle.电源可直接从母线上连接出来（采用顶部进线的标准设备，无需电缆进线柜）也可通过电缆进线柜。 The cable entry cubicle can be equipped with circuit breaker, surge arrester or additional internal CT. 该进线电缆柜可装配断路器,避雷器以及内部附带的电流互感器 CT。 DYNACOMP can still be divided in one or several parts, each parts having one single connection point. DYNACOMP 仍然可分为一个或几个部分，每个部分都有单独连接点。 Top or bottom entry is possible with the cable entry cubicle. 进线电缆柜可能带有顶部或底部进线口 230V Auxiliary power supply supplied to each cubicle otherwise auxiliary transformer should be selected 每个单元需要提供 230V 辅助供电电源，否则需选择辅助变压器供电。</p>
<p>4. Bottom cable entry 底部电缆进线</p>	<p>Cable entry cubicle must be used. Please refer to previous configuration (One single connection point) 必须使用电缆进线柜 请参考前面的配置（单一连接点）</p>

## 7. Electrical design and installation 电气设计及安装

### 7.1 What this chapter contains 本章概述

First, this chapter introduces important design considerations about DYNACOMP sizing and EMC compliance 首先本章主要是对 DYNACOMP 尺寸的选型设计和 EMC 电磁兼容性考虑

Next, each electrical connection is carefully considered: 其次,认真考量每个电气连接问题

- Earth connections 电气连接
- Power cables and protection devices selection and connection 电源电缆及设备保护选择连接
- CT selection, installation and connection 电流互感器 CT 的选择，安装及接线
- Auxiliary power supply connection 辅助电源连接
- RVT-D connection and its advanced communication features RVT-D 连接及其先进的通信特征
- Cubicles interconnection 单元互连



**WARNING: DYNACOMP is able to operate on networks where the supply voltage is up to 10% higher than the equipment's rated voltage (including of harmonics but not transients). Since operation at the upper limits of voltage and temperature may reduce its life expectancy, should not be connected to systems for which it is known that over voltages will be sustained indefinitely.**  
**警告：DYNACOMP 可工作在供电电压高于其额定电压 10%的地方。（包括谐波但不包括电压瞬变的地方）若长期工作在额定电压上限，将会产生影响产品寿命的温升。DYNACOMP 设备不可联接到有明显过压，但过压值不确定的场合。**

**Auxiliary circuits are designed to operate at 230 Vrms +/- 10 %. Excessive (auxiliary) voltage levels may lead to DYNACOMP damage.** 辅助电源要求工作在 230 Vrms +/- 10 %，超出此范围可能导致 DYNACOMP 损坏。

**WARNING: ABB Power Quality Products strongly suggests protecting the power cables (with fuses or circuit breaker): the customer has to ensure that the feeding cables to each DYNACOMP cubicle are adequately protected taking into account the DYNACOMP rating and the cable section used.** 警告：ABB 电力产品强烈要求供电线路进行保护（如保险管或断路器），用户应考虑合理的线路保护，确保馈入到每个 DYNACOMP 的供电电压在额定范围内。

**WARNING: Ensure that the DYNACOMP supply is isolated upstream during DYNACOMP installation. If the system has been connected to the supply before, wait for 3 minutes after disconnecting the mains power terminals in order to discharge the capacitors. Always verify by measurement that the capacitors have been discharged. Capacitors may be charged to more than 1800 V.** 警告：安装 DYNACOMP 时确保与上游电源分离。若设备已连接到电源上，断电时应等待 3 分钟，保证电容器电能释放，检测电容是否已完全放电。电容充电后电压可超过 1800V

## 7.2 DYNACOMP sizing and harmonics considerations DYNACOMP 容量大小及谐波考虑

DYNACOMP size (total kvar) should be defined according to the need (target PF, flicker mitigation, etc.). The use of "TAM19" form will ease to collect the relevant information. DYNACOMP 容量大小(总功率 kvar)可依据实际需要而定（目标功率因数，闪变等）选用 TAM19 表将便于收集相关资料。

When DYNACOMP size is defined, special attention should be taken about the network quality. Indeed, harmonics may damage the system in case of resonance. To prevent such a risk, all the DYNACOMP are protected with reactors. Standard reactor values are: 一旦 DYNACOMP 容量大小确定后，应特别注意电网质量。实际上由于谐波共振会导致系统的损坏，所有的 DYNACOMP 都应配有电抗器保护装置。

- 
- 7% reactors for three-phase DYNACOMP 三相 DYNACOMP 采用 7%电抗器
  - 14% reactors for single phase DYNACOMP 单相 DYNACOMP 采用 14%电抗器

Standard design assumes a THDV (Voltage Total Harmonics Distortion) < 8%, with THDV spectrum as specified in [Chapter 15](#). 标准设计，要求电压总畸变 (THDV)<8%，THDV 频谱技术要求在第 15 章给出。

Special reactor types have to be considered if:专用型电抗器还须做到如下考虑

- THDV is higher than 8% or harmonic spectrum not compliant with technical specification as defined in [Chapter 15](#). Then, reinforced reactors should be selected 如果 THDV 量超过 8%或谐波频谱不能与第 15 章给出相关技术要求兼容,则需要考虑使用增强型电抗器。
- There is a risk of resonance or interference with a given frequency. Then, special reactor value has to be selected (5.67% for instance), see [Chapter 15](#), options. 存在谐振危险或由于频率引起干扰的地方,则需要选择电抗值为 (如 5.67%)。详见第 15 章选项

For any question about harmonics resonance or THDV, please consult your local ABB agent. 有关谐振或 THDV 问题，请联系当地 ABB 代理商。

### 7.3 EMC 电磁兼容

Any DYNACOMP complies with the following EMC standards: 任何一款 DYNACOMP 都遵照下列 EMC 标准设计

- EN 55011/CISPR11: Conducted and radiated emissions according to class A (industrial type) 传导及辐射参照 EN 55011/CISPR11A 级(工业标准)
- EN/IEC 61000-4-2: Electrostatic discharge immunity.防静电标准
- EN/IEC 61000-4-3: Radiated, radio-frequency, electromagnetic field immunity test; 防辐射、音频、电磁场测试标准
- EN/IEC 61000-4-4: Burst immunity test. 防爆测试标准
- EN/IEC 61000-4-5: Surge immunity test. 抗冲击测试标准
- EN/IEC 61000-4-6: Immunity to conducted disturbances, induced by radio-frequency fields. 防传导干扰、音频感应标准
- EN/IEC 61000-4-11: Immunity to voltage dips and short interruption 防电压下降及短路中断

### 7.4 Electrical connections operations 电气连接操作

After the DYNACOMP has been installed (see [Chapter 6](#)), following operations should be properly carried out: 安装 DYNACOMP 后(见第 6 章)应妥当执行下列的操作

1. Carefully select the power cables and protection devices ([section 7.6](#) and [7.7](#)) 认真选择供电电缆线及保护装置 (7.6 和 7.7 部分)
2. Earth the DYNACOMP ([section 7.5](#)) DYNACOMP 接地(7.5 部分)
3. Connect the power cables ([section 7.6](#) and [section 7.8](#)) 供电电缆的连接(在 7.6 和 7.8 部分)
4. Connect the CT, auxiliary power supply and any other control cables used for enhanced functions ([section 7.9](#), [section 7.10](#), [section 7.11](#) and [section 7.12](#)) 连接电流互感器(CT),辅助电源及其它用于增强功能的控制线。
5. Check the insulation resistance (optional, [section 7.5](#)) 检查绝缘阻值 (选件 7.5 部分)
6. Final check: verify that all devices are properly mounted and connected, electrical and mechanical protection active and conform to standards and local regulation. Then, close the doors. 最后, 核对所有部分是否被合理地安装和连接, 电气及机械保护是否有效。并能遵照相关标准及当地规定, 确认没问题后关闭柜门。
7. Start DYNACOMP commissioning procedure ([Chapter 11](#)) 开始 DYNACOMP 试运行步骤 (第 11 章)

## 7.5 Earthing DYNACOMP DYNACOMP 接地

Each cubicle has an earth bar with PE mark located on the top right, see [Figure 23](#) 每个单元右上方都有一个标有 PE 的接地排, 详见图 23



PE 接地排位置

For safety reasons and for proper operation, the following rules should be applied: 为妥当操作和安全的缘故, 应使用下列相关规定

- When a DYNACOMP is made of one single cubicle, the PE-point of the cubicle must be connected directly to the PE-point of the installation. 当 DYNACOMP 为单独单元存在时, 该单元的 PE 点应直接连接到 PE 安装点上。

- When a DYNACOMP is made of more than one cubicle, all PE-points of all the cubicles must be connected directly to the PE-point of the installation and additionally all cubicles enclosures must be interconnected together, see [Figure 24](#). 当 DYNACOMP 系统由多个单元所组成，所有的单元的 PE 点都应直接连接到 PE 安装点上。并把所有的单元外壳连接在一起，详见图 24



图 24：单元接地连接图

For any earth connection, local regulations should be taken into account first, considering that a copper cable of minimum 16 mm<sup>2</sup> is recommended. 任何接地应首先考虑当地的相关规定，推荐采用截面积为 16 mm<sup>2</sup>铜芯电缆线为接地线。

**Remark: in PEN systems, the earth connection of the DYNACOMP must be connected to the installation's earth (PE) and not to the N-conductor.** 对于 PEN 系统，DYNACOMP 接地线应连接到安装接地线（PE）上，不得连接到 N 的导线上。

## 7.6 Selection of power cables 电源电缆线选择

Power cables should be rated at minimum 1.5 times their reactive nominal current. 电源电缆的额定电流值应为有效额定电流的 1.5 倍

When selecting the appropriate cable size due consideration should be given to possible future extension of the equipment. 合理选择电缆线大小，应充分考虑到可能一步扩展的设备。

Since DYNACOMP doesn't generate any harmonics or high frequency; there is no need for special screening of the DYNACOMP power cables. 由于 DYNACOMP 不会产生任何高频谐波，无须对其电源电缆进行专门的屏蔽。

### **Cable cross section selection: 电缆线截面的选择**

Since different parameters like localization, temperature, etc. , do not allow covering all the possible cases of installation, please refer to the local requirements and standards keeping in mind that the sizing current must be considered as a minimum 1.5 times the reactive nominal current. 由于不同的参数如：安装位置、温度等，将不

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可能顾及各种情况。请参照当地的要求及相关标准，切记电缆的大小必须为有效负载电流的 1.5 倍。

## 7.7 Protection devices selection 保护装置的选择

**WARNING: ABB Power Quality Products strongly suggests protecting the power cables (with fuses or circuit breaker): the customer has to ensure that the feeding cables of each DYNACOMP cubicle are adequately protected taking into account the DYNACOMP rating, the cable cross-section used as well as the local network short circuit power. 警告:ABB 电力产品质量强烈要求进行电源电路进行保护,(如保险或断路器)用户应考虑合理的电路保护。确保馈入到 DYNACOMP 单元的供电在额定范围内。电缆的截面积大小还与当地电网的短路能力有关。**

At the location of the DYNACOMP, the network short-circuit power must be taken into consideration to size the protection devices. 在定位 DYNACOMP,保护设备的选型应充分考虑电网的短路能力。

Note: 提示:

- Each DYNACOMP power step is internally protected by fuses ( breaking capability: 80 kA)
- 每个 DYNACOMP 内部都采用熔断器（分断能力为 80 kA）进行保护
- If a circuit breaker is present: see circuit breaker data sheet 若是选用断路器可参照断路器数据清单
- If a Busbar is present, see [Section 7.8.2](#) or consult us 如果选用母线排,见 7.8.2 部分或与我们联系

Protection devices should be sized as follow: 保护设备按下列要求选型

### Circuit Breaker or fuses 断路器或保险

3-Phase:  $I_{CB} = 1.5 * Q / U_{nom} * \sqrt{3}$  三相

1-Phase:  $I_{CB} = 1.5 * Q / U_{nom}$  单相

With:其中

$I_{CB}$  = circuit breaker nominal current (Arms) 断路器额定电流

$I_F$  = fuses nominal current (Arms) 保险额定电流

$Q$  = nominal reactive power (kvar) going through the protective device 通过保护装置的额定无功功率(kvar)

$U_{nom}$  = network nominal voltage (Vrms) 电网额定电压

## 7.8 Power cables connection 电源线路连接



**WARNING:** Local regulations and requirements prevail in determining how practically the equipment has to be connected to the network. In accordance with good cabling practice, ABB Power Quality Products strongly suggests that the feeding cables to the DYNACOMP are protected by their own cable protection device (fuses or circuit breakers). 警告:应根据当地的相关要求连接设备的供电电缆到电网中去。ABB 电能质量产品强烈要求, 用户需自行设置 DYNACOMP 馈线电缆保护设施。(保险管或断路器)

**WARNING:** Ensure that the DYNACOMP supply is isolated upstream during DYNACOMP installation. If the system has been connected to the supply before, wait for 3 minutes after disconnecting the mains power in order to discharge the capacitors. Always verify by measurement that the capacitors have been discharged. Capacitors may be charged to more than 2500 V. 警告:在进行 DYNACOMP 安装过程中, 确保它同上游电网分离开来, 若在之前已进行供电, 切断电源后,至少等待 3 分钟。让电容器上的电能释放。检测电容器上电能是否被完全释放。因为电容器充电后, 两端电压可超过 2500V

All DYNACOMP have to be installed in parallel with the load(s). 所有的 DYNACOMP 应同负载并列安装

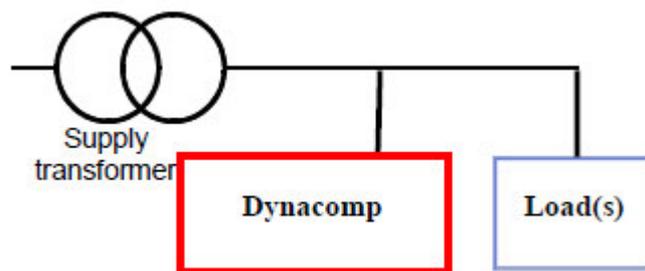


Figure 25: DYNACOMP connection principle 图 25: 动态补偿器连接原理

### 7.8.1 Standard configuration 标准配置

Standard configuration requires three main power connections L1, L2 and L3 (no neutral required) to **each cubicle**. A single connection point can be achieved with an optional cable entry cubicle and/or busbar. 标准配置要求把三相主电源 L1, L2 和 L3(不带中线)连接到每个单元。带单独连接点的单元通过进线电缆柜或母线排来完成连线。

**WARNING:** Make sure that the phase rotation of the feeding supply is clockwise and that the L1, L2 and L3 terminal in each cubicle is connected to the same

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phase for all cubicles. Failure to do so will result to the impossibility to start the DYNACOMP. 警告：为确保馈入电源能处于顺时针相序状态，所有单元的 L1, L2 和 L3 接线端应保持相同相序进行连接。否则将会导致 DYNACOMP 无法正常运行。

### 7.8.1.1 Top cable entry 顶部电缆入口

Before to cabling the power cables plate, holes should be drilled in the top. These holes will take into account number and cross-section of the power cables. 在敷设电源电缆盘之前，需先在单元顶部钻个孔，该孔的大小由电缆线的数量及其电缆线的横截面积决定的。

The top cable entry plate has to be prepared as follow: 顶部电缆进线盘应根据下列要求进行准备

- Remove the top entry Aluminium plate( 6 screws) 打开顶部入口铝盘（有六个螺丝）
- Drill the holes including those for earth cable, CT wire and any other control wires if necessary. 钻孔时应考虑接地线、CT 线以及其它控制线路的需要。
- Insert protections devices around the holes to avoid any cable damage 钻完孔后应在孔周边采取防护措施，以避免电缆线被碰伤。
- Pass the plate over the feeding cables 馈线应从该盘上方穿入
- Screw the plate back in its place 最后把螺丝旋回去

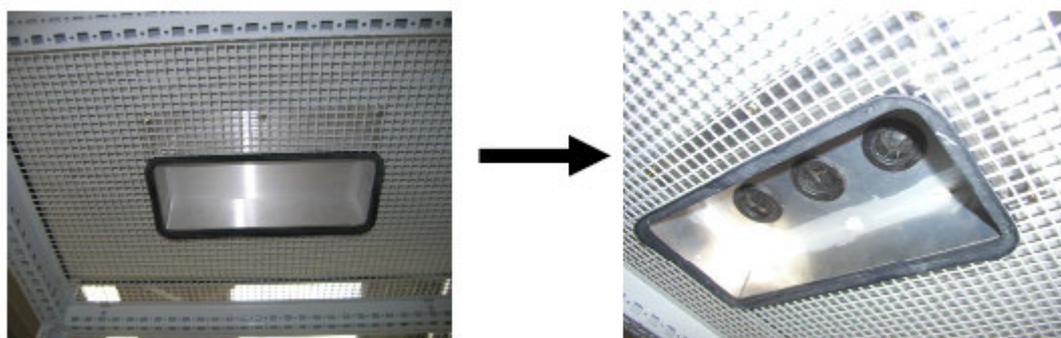


图 26: 顶进电缆板

### 7.8.1.2 Power terminals 电源接线端子

Power cable terminals are located above the fuses. [Figure 27](#) gives the different possible configurations. 电源线的端子被安排在保险上方,图 27 分别给出几种不同的配置.

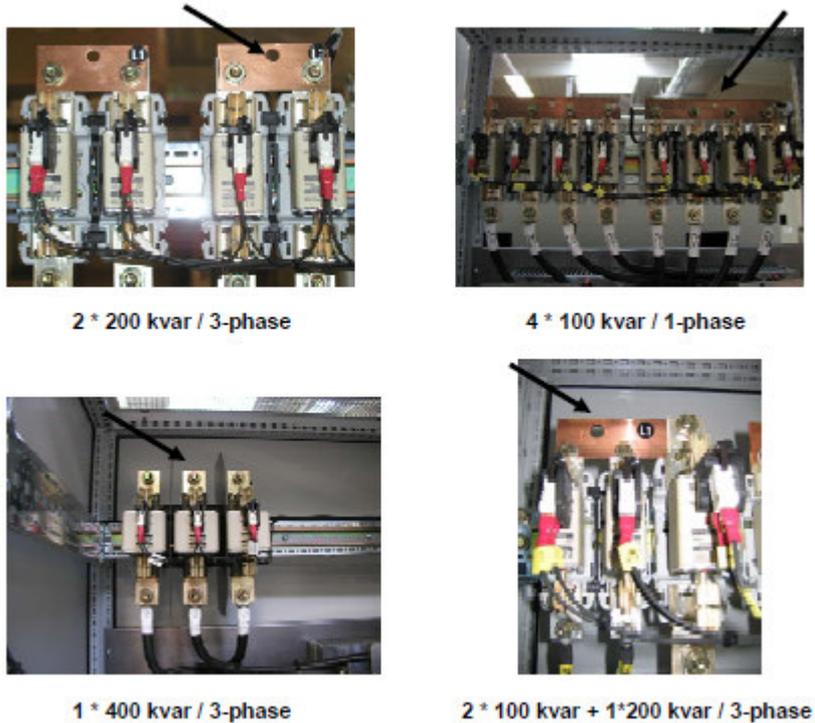


Figure 27: Power terminals and fuses 图 27:电源端子及保险管

The cable lugs should be torqued at 20Nm and should comply with terminals layout: 电缆铜端子应，用力矩 20NmH 上紧，并完成该端子的摆放。

- Maximum lug width: in accordance with terminal width 电缆铜端子最大宽度：根据接线端子宽度而定
- Minimum lug eye diameter: M8 电缆铜端子孔的直径： M8

### 7.8.2 Optional busbar 母线铜排的选择

The optional busbar main advantage is to provide a single connection point. With busbar, proper power connections can be achieved with:选择母线排的主要优点是为用户提供带有母线，合理完成电源的连接：

- Cables directly connected to the optional busbar 电缆线可直接连接到所选择的母线排上
- Feeding busbar (supplied locally) 馈线母线排（当地提供）

[Figure 28](#) gives optional busbar short circuit capability for bars spaced out 600mm.图 28: 给出间距为 600mm 的母线排的短路电流能力

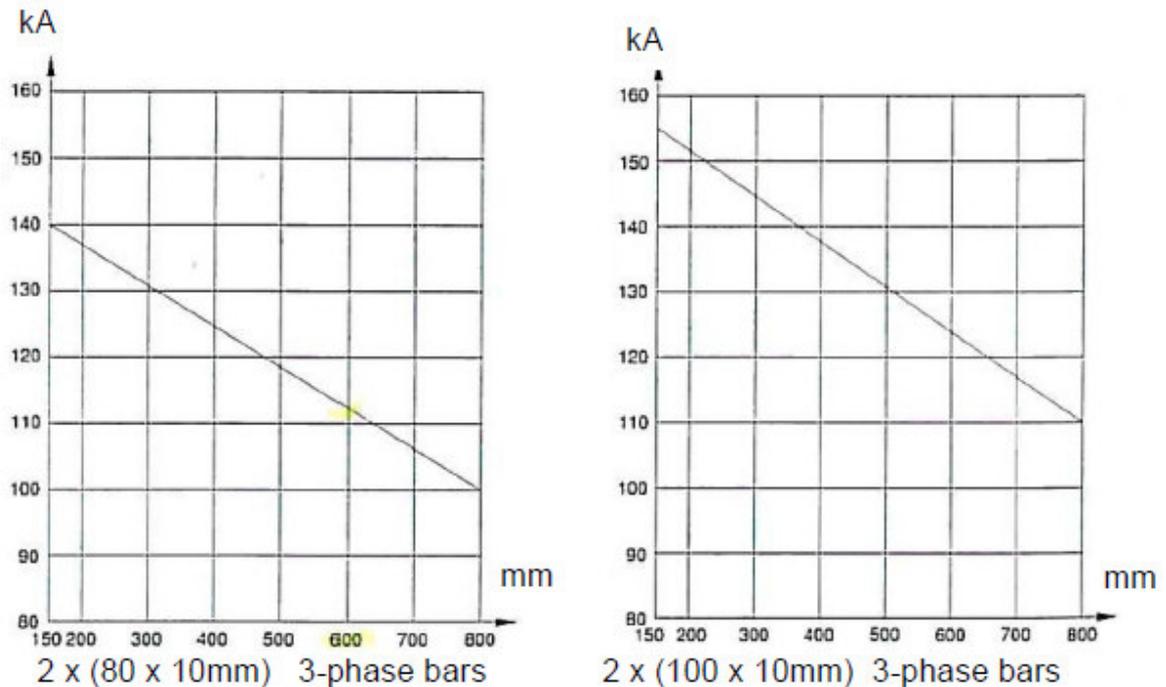


图 28: 间距为 600mm 的母线排的短路容量

### 7.8.3 Cable entry cubicle option 电缆线柜选择

The optional cable entry cubicle is the ideal solution for a single connection point. Many various configurations are possible. For instance: 选择电缆进线柜的最理想解决办法是: 采用单独连接点, 可选择多种配置, 例如:

- Bottom entry 底部进线
- Back side entry 后边进线
- With or without busbar 是否带有母线排
- With or without Circuit Breaker 是否带有断路器

Power connections layout will depend on the selected configuration. 电源连接布局直接由所选择的配置所决定

## 7.9 Current transformers specification 电流互感器技术要求

- 1 or 5 A secondary current rating. 二次侧额定电流 1A 或 5A
- 15 VA burden for up to 30 meters of 2.5 mm<sup>2</sup> cable. For longer cables lengths refer to the [Figure 29](#) here below. In case of the CT is shared with other loads, the VA burden shall be adapted accordingly. 15VA 负载要求截面积为 2.5 mm<sup>2</sup>, 长度为 30 米的电缆线。如需更长, 请参照下图 29。在 CT 还带有其它负载的情况下, 此 VA 负载需另外考虑。
- Class 1 resolution or better. 分辨率一级甚至更高

- Primary side current rating sufficient to monitor the total line current (including transient phenomena such as drive/motor starts) 互感器一次侧额定电流应满足监控器总电流的要求（包括如驱动负载或电机启动造成电流瞬变的情况）



**WARNING: The connection of different loads (including the DYNACOMP) on the same CT must be in series.** 警告：不同的负载连接到同一个 CT 上必须采用串联方式（包括 DYNACOMP 在内）

For complex configurations, several CT(s) and summation CT(s) have to be used, see [section 7.10](#). 对相对复杂的配置如：几个 CT 和矢量式的 CT 被采用的情况下。详见 7.10 部分

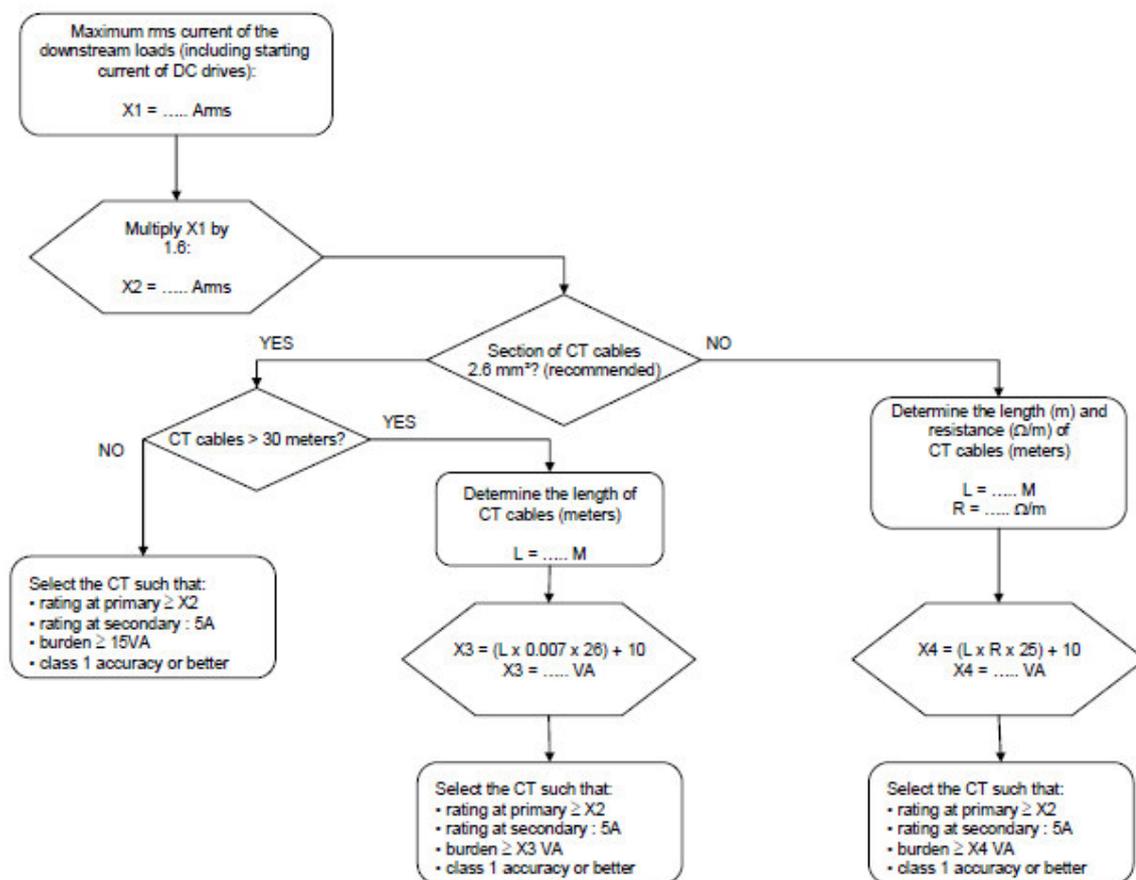


Figure 29: Flow chart for CT determination CT 检测流程图

## 7.10 DYNACOMP control modes and current transformers connection DYNACOMP 控制模式及电流互感器连接

DYNACOMP can operate with different control modes: DYNACOMP 可工作在以下的几种方式

- Closed loop 闭环模式
- Closed loop with additional internal CT 带有内附 CT 的闭环模式
- Open loop 开环模式
- Open loop with additional internal CT 带有内附 CT 的开环模式
- External trigger without CT 不带 CT 的外部触发模式
- External trigger with CT (Open loop mode) 带 CT 的外部触发（开环模式）
- External trigger with CT (Open loop mode) and additional internal CT 带 CT 的外部触发（开环模式）及内附 CT 模式

Major characteristics of each control mode are summarized in [Table 6](#). 每种控制模式的主要特性概述在表 6

Table 6: Control modes major characteristics 表 6: 控制模式主要特性

Control modes 控制模式	Major characteristics 主要特性	Reaction time 响应模式	CT 电流互感器
Closed loop 闭环	-Total current measurement (Load + DYNACOMP) - High accuracy 总电流测量，负载+DYNACOMP 高精度	< maximum 3 periods of time 最大 3 个时间周期	Minimum one CT 最少 1 个 CT
Closed loop with additional internal CT 带有内附 CT 的闭环	-Total current measurement (Load + DYNACOMP) - High accuracy - Auto commissioning 总电流测量，负载+DYNACOMP 高精度，自动试运行	< maximum 3 periods of time 最大 3 个时间周期	Minimum two CT 最少 2 个 CT
Open loop 开环	- Load current measurement only -Faster than closed loop but no feedback control 只有总电流测量响应速度比闭环快，但没有反馈控制	< 1 period of time 小于 1 个时间周期	Minimum one CT 最少 1 个 CT
Open loop with additional internal CT 带有内附 CT 的开环	-Both load current and DYNACOMP current measurement -Accurate and quick 总电流和 DYNACOMP 电流测量、精确，快速	< 1 period of time 小于 1 个时间周期	Minimum <sup>(1)</sup> two CT 最少 2 个 CT

External trigger w/o CT 不带 CT 的外部触发	-DYNACOMP fired by external trigger only -Very fast changing loads with fixed kvar need 为外部能发信号触发，负载变化快，固定的 KVAR 需求	Instantaneous (after the first firing) 瞬时（第一次触发后）	NO CT required 没有 CT 要求
External trigger with CT (open loop) 带 CT 的外部触发（开环）	-DYNACOMP fired by external trigger + load current measurement -Very fast changing loads with fluctuating kvar need 通过外部触发+负载电流测量，负载变化快，但 KVAR 需求变化较大	Instantaneous (after the first firing), follow-up of kvar demand after firing 瞬时（第一次触发后）根据 kvar 指令要求触发	Minimum one CT 最少 1 个 CT
External trigger with CT + with additional internal CT (open loop) 带 CT 的外部触发+带有内附 CT（开环）	-DYNACOMP fired by external trigger + load current and DYNACOMP current measurement -Very fast changing loads with fluctuating kvar need, high resolution - Auto commissioning 外部触发 + 负载电流和 DYNACOMP 电流测量 高精度，自动试运行 负载变化快，无功需求不固定	Instantaneous (after the first firing), follow-up of kvar demand after firing 瞬时（第一次触发后）根据 kvar 指令要求触发	Minimum <sup>(1)</sup> two CT 最少 2 个 CT

(1) Additional internal CTs request a single connection point. They can be supplied as an option, see [chapter 15](#). 内附 CT 要求，单独接线点。可作为选件提供。详见第 15 章

### 7.10.1 CT connection 电流互感器(CT)连接



**WARNING: Special care has to be taken for the connection and location of the CT(s): wrong CT(s) installation is the most common source of problems found at the commissioning stage.**警告:应特别注意电流互感器(CT)的位置及配线,在试车过程最常见的问题是 CT 的安装不正确。

By default, any DYNACOMP is provided with CT terminals that are not shorted. A shorting plug is provided with the DYNACOMP. They should always be kept with the DYNACOMP and accessible for service engineers.任何一款 DYNACOMP 所附带的 CT 接线端子，出厂前都没有进行短路,同时 DYNACOMP 附带提供一个短接线.应注意保管.它是维护工程师必备的物件之一

**WARNING:** When connecting the CT(s) of a live system to the DYNACOMP, the secondary of each CT has to be shorted. Failure to do so may result in CT explosion and consequent damage to the installation. Once the connections to the DYNACOMP have been made, the shorting links can be removed. 警告:当连接电流互感器(CT)到现有的 DYNACOMP 系统,应将电流互感器(CT)的二次侧进行短接,否则可能引起 CT 爆裂。甚至损坏到其它设备。一旦接线完成,应及时移走这个短线。

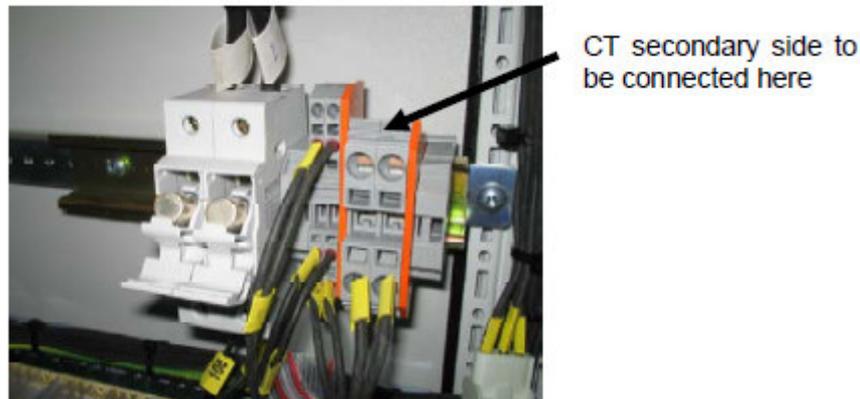


Figure 30: Location of the CT connection terminals 图 30: CT 接线端子的位置

The CT terminal block can handle control cable wiring with sections from 2.5 mm<sup>2</sup> to 10 mm<sup>2</sup>. 该 CT 接线端子可以采用截面积 2.5 mm<sup>2</sup>到 10 mm<sup>2</sup>的电线连接

A range of ring and split core CT's exists on the market to ease CT installation. 市场上有一种多线圈互感器,线组的绕圈数及 CT 的滑芯都有具体标出,这样方便 CT 的安装

CT's are normally marked P1/P2 and S1/S2 and should face the supply transformer while P2 the load side, see [Figure 25](#). CT 通常标有 P1/P2 和 S1/S2, 并正对电源变压器, P2 为负载端子。详见图 25

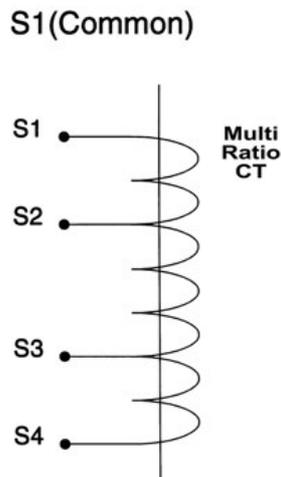
**S1 control wires terminal goes to terminal marked k on the circuit diagram and S2 to terminal marked I on the diagram.** 把 S1 接线端子连接到电路图上标为 K 的端子上, 并把 S2 连接到电路图 I 的线标上。

**Note:** A gray jumper is provided with the bank in a small plastic bag. Use this gray jumper in case shorting of the CT secondary winding is required (e.g. RVT-D controller removal). As long as the RVT-D controller remains wired to the bank, the gray jumper must be removed for proper operation of the bank. 提示: 厂商所提供的灰色跳线, 存放在小塑料袋内。该跳线是用于 CT 二次侧线圈的短接的。(如 RVT-D 控制器被拆下) 一旦这 RVT-D 控制器接完线后, 应移去该灰色短接线, 并妥善保存。

Each cubicle has several base supports to receive cable ties. 每个单元都有提供几个电缆线扎带

**Multi ratio CT's 多倍率 CT's**

When a multi ratio split core CT is used the appropriate ratio is selected by connecting either S2 or S3 or S4 to terminal marked I. The CT ratio should be selected as close as possible to the requested CT specification, see [section 7.9](#). 当使用带有滑芯的多倍率互感器 CT 时，根据您选择的倍率，并把相应的端子接到标有 I 的接线端子上。CT 倍率的选择尽量接近 CT 相关的技术要求。详见 7.9 部分

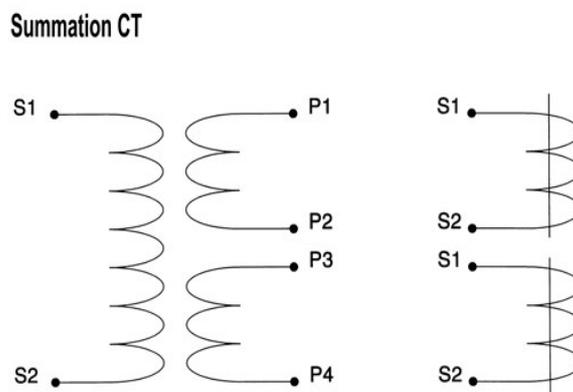


**Summation CT's      矢量式 CT's**

For more complex situation (i.e.: two or more power source connections) the current has to be measured in different points in order the DYNACOMP receives correct measurement in any circumstances. 对于更复杂的情况(例:二个或更多个电源联接), 为保证 DYNACOMP 在任何情况下都能收到正确的电流值, 应采用多点测量的方式。

Then, when several CT's are requested, one or several summing transformer should be used. 当有要求使用几个 CT's 的场合, 同时还需要一个或几个累加变压器。

When a summation current transformer is used the terminal markings will usually be P1, P2, P3, P4 and S1, S2. The secondary connections S1 and S2 should be connected to k and I respectively as before. 当使用矢量式电流互感器时, 通常标有 P1、P2、P3、P4 以及 S1、S2, 同时应把互感器的二次侧 S1 和 S2 分别连接到 K 和 I 端子上。



The first CT should be connected to P1 and P2 while the second CT should be connected to P3 and P4 on the summation CT. **It is important that all CT's monitor**

**current in the same direction.** 当第二个 CT 被连接到矢量式互感器的 P3 和 P4 端子上，那么第一个 CT 应被连接到叠加互感器的 P1 和 P2 端子上。注意：要求所有 CT 的电流方向都是相同的。

### 7.10.2 Closed loop mode 闭环模式

In closed loop mode, the CT must monitor the total current (i.e. load current and DYNACOMP current) as illustrated in [Figure 33](#). 在闭环模式中，电流互感器 CT 要监控总电流（如负载电流和 DYNACOMP 电流）如图 33 所示

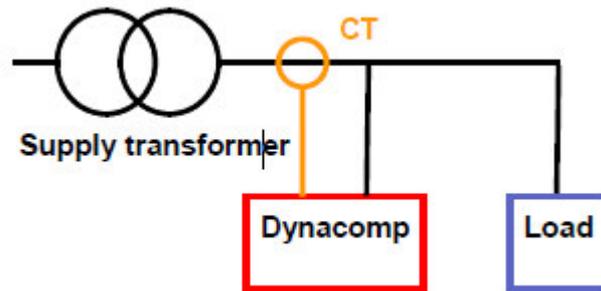


Figure 33: Closed loop mode 图 33: 闭环模式

- Closed loop mode major characteristics are: 闭环模式的主要特征有
- Current measured: both current and DYNACOMP current 电流测量，总电流测量
- High accuracy thanks to measurement feedback 由于带有反馈测量，精度高
- Response time: maximum 3 periods of time 响应时间：最大 3 个周波
- Typical applications: PF correction for fast varying loads such as lifts, windmills, etc. 典型应用：该种 PF 校正方式适用于负载快速变化的地方。例如，吊装、风力发电等。

### 7.10.3 Closed loop mode with additional internal CT 带内附 CT 的闭环模式

In closed loop mode, the CT must monitor the total current (i.e. load current and DYNACOMP current) as illustrated in [Figure 34](#). 在闭环模式中，该 CT 需要监控总电流（如负载电流和 DYNACOMP 电流）如图 34 所示。

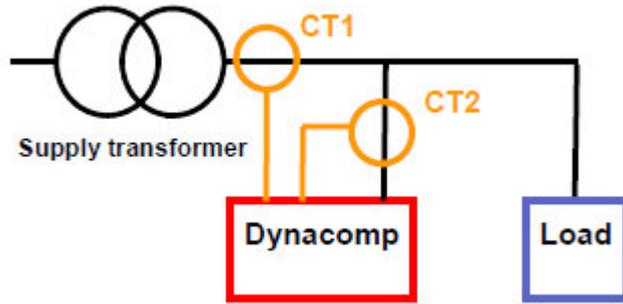


Figure 34: Closed loop mode with additional internal CT

图 34: 带内附 CT 的闭环模式

Closed loop mode major characteristics are: 该闭环模式的主要特征:

- Current measured: both current and DYNACOMP current 电流测量，总电流测量
- High accuracy thanks to measurement feedback 由于带有反馈检测，精度高
- Auto commissioning 自动试运行
- Response time: maximum 3 periods of time 响应时间：最大 3 个周波

Typical applications: PF correction for fast varying loads such as lifts, windmills, etc.  
典型应用：该种 PF 校正适用于负载快速变化的如吊装，风力发电等地方。

#### 7.10.4 Open loop mode 开环模式

In open loop mode, the CT must be sited in a position to monitor the load current only as illustrated in [Figure 35](#). 在开环模式中，电流互感器 CT 被安装在只检测负载电流的位置，如图 35 所示

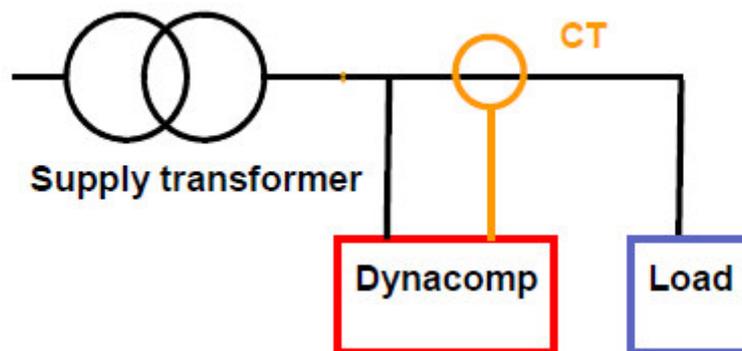


Figure 35: Open loop mode 图 35: 开环模式

Open loop mode major characteristics are: 开环模式的主要特征:

- Current measured: Load current 电流测量，负载电流
- No feedback (less accurate than closed loop) 没有反馈（所以其精度比闭环低）

- Response time: less than one period of time 响应时间：少于一个周波

Typical applications: PF correction or very fast varying load, and reduction of voltage drop and flicker such as: 典型应用：PF 校正或负载快速变化地方，用于减小电压降落及脉动；

- Spot welding machines 点焊设备
- Rolling mills, cranes, traction, 轧钢厂，起重机及牵引装备

### 7.10.5 Open loop mode with additional internal CT 带内附 CT 的开环模式

In open loop mode with additional CT, two CT are requested at the minimum. One CT must be sited in a position to monitor the total current and another one the DYNACOMP current as illustrated in [Figure 36](#). 带内附 CT 的开环模式中，最少需要二个电流互感器 CT，一个 CT 串装在监控总电流的位置上，另一个安装在用于监控 DYNACOMP 电流的位置。如图 36 所示

In this case, please note that the DYNACOMP current measurement requests a single point connection. If so, it can be measured inside the DYNACOMP itself (see possible options, [Chapter 15](#)). 这种情况下，请注意 DYNACOMP 要求采用单点连接的方式进行电流检测。这样 DYNACOMP 可做到自身内部测量（参照第 15 章选项）

The present configuration combines the speed of open loop with accuracy of closed loop. 现有的这种配置，综合了开环模式的响应速度和闭环模式的精度

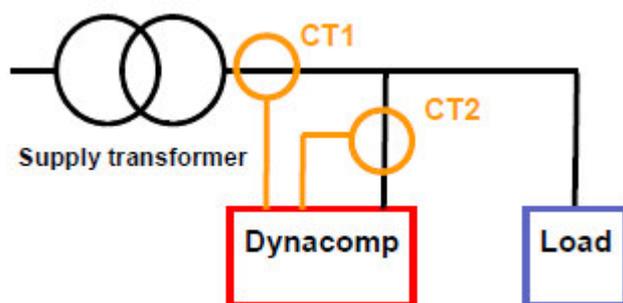


Figure 36: Open loop mode with additional CT 图 36: 带内附 CT 的开环模式

Note: open loop current is calculated by RVT-D controller from CT1 and CT2 measurements. 提示：RVT-D 控制器通过检测到 CT1 和 CT2，便可计算出开环电流值。

Open loop mode with additional CT major characteristics are: 带内附 CT 的开环模式的主要特性

- Two currents measured: total current and DYNACOMP current 两种电流测量：总电流和 DYNACOMP 电流
- High accuracy (thanks to feedback) 高精度（由于带有反馈）

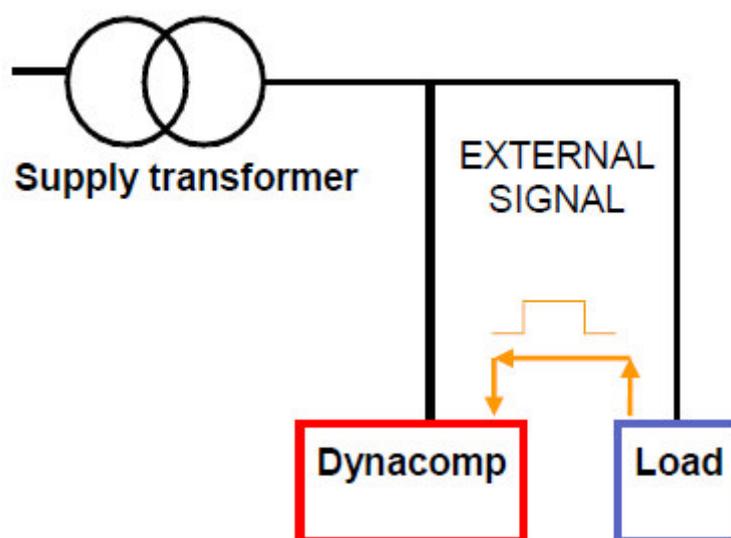
- Response time: less than one period of time 响应时间：小于一个时间周期
- Auto commissioning 自动试运行

Typical applications: same as closed and open loop 典型应用：与开闭环相似

### 7.10.6 External trigger mode without CT 不带电流互感器（CT）的外部触发模式

The present working mode doesn't request any CT. The DYNACOMP is fired by external trigger only as illustrated in [Figure 37. This mode applies for very fast varying load with fixed kvar need](#). 现有的工作方式不需任何 CT，该 DYNACOMP 的触发仅接受外部触发模式。如图 37 所示，这种模式适用于带有固定无功功率的（kvar），要求快速变化的负载。

Note: The load should be synchronized on the network; it means that the firing angle should always be constant. 提示：负载必须跟电网同步，这意味着触发角处于一种恒定值。



EXTERNAL SIGNAL 外部信号 Supply transformer 电源变压器

Figure 37: External trigger mode without CT 图 37：不带 CT 的外部触发模式

External trigger without CT mode major characteristics are: 不带 CT 的外部触发特征

- No current measurement 无电流检测
- Reactive power fixed 固定无功功率值
- Response time: instantaneous after the first firing 响应时间：第一次触发后都是瞬时

Note: the first firing is used by the DYNACOMP to get synchronized with the firing angle of trigger signal by adequate pre-charge of DYNACOMP capacitors. 提示：

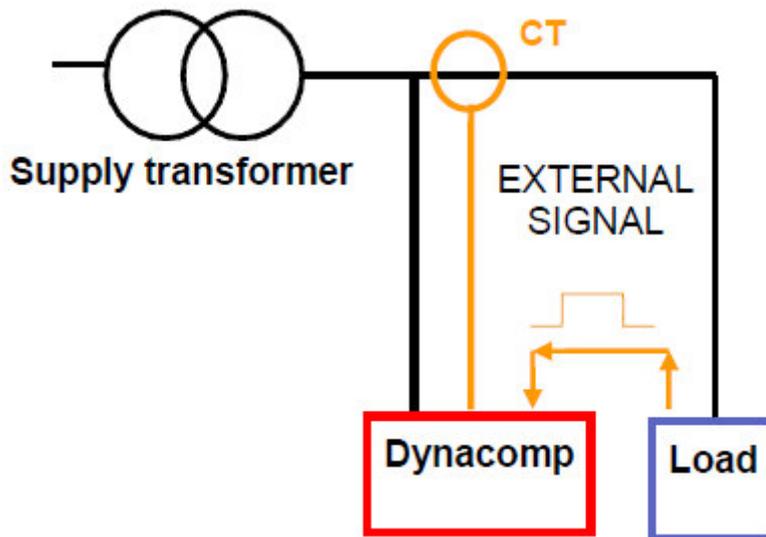
DYNACOMP 的第一个触发是为获取触发角同步信号，用于满足 DYNACOMP 电容器的预充电需要。

Typical applications: PF for ultra fast varying loads, reduction of voltage drops or flicker (ex: spot welding machines) 典型应用：用于超快速变化的负载电容补偿，以减小其电压降落和脉动（如：点焊设备）

### 7.10.7 External trigger mode with CT 带 CT 的外部触发模式

External trigger with CT mode uses the trigger for ultra fast reaction and CT to 'follow the load'.带 CT 的外部触发模式，采用超快速反应的触发器和用于跟踪负载的 CT

Open loop configuration is used as illustrated in [Figure 38](#). This mode applies for ultra fast varying load with fluctuating kvar need.采用开环配置方式如图：38 所示。这种模式适用于带有波动无功功率 kvar 需求和超快速变化的负载。



Supply transformer 电源变压器 EXTERNAL SIGNAL 外部信号

Figure 38: External trigger mode with CT 图 38: 带 CT 的外部触发器

External trigger with CT mode major characteristics are: 带有 CT 外部触发模式的主要特性

- Current measurement in open loop 开环电流测量
- Fluctuating reactive power need 有脉动无功功率要求
- Response time: instantaneous after the first firing 响应时间：第一次触发后，几乎是瞬时

Typical applications: same as external trigger without CT but with fluctuating loads 典型应用：同无 CT 外部触发模式一致，但带有脉动负载。

### 7.10.8 External trigger mode with both CT and additional internal CT 带有 CT 和内附 CT 的外部触发模式

The present control mode combines the benefit of external trigger (ultra fast reaction time) and open loop with additional internal CT (high accuracy). 现有的这种控制模式是由完善的外部触发（超快速反应时间）和内附 CT 的开环模式（高精度）所组成

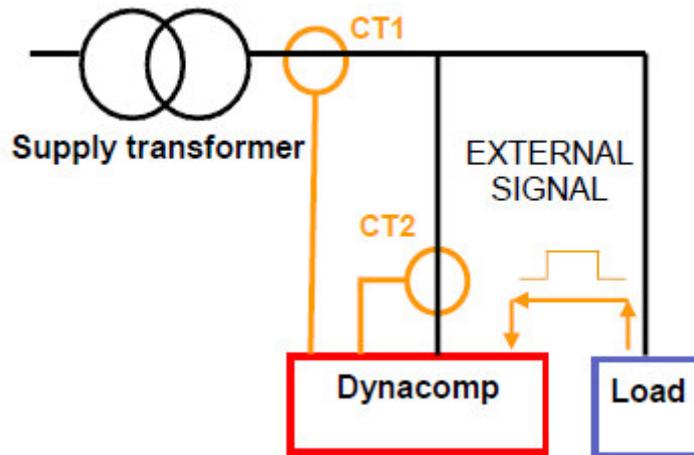


Figure 39: External trigger mode with CT and with additional internal CT 图 39: 带有 CT 的内附 CT 的外部触发模式

External trigger mode with CT and additional internal CT major characteristics are: 带有 CT 的内附 CT 的外部触发模式的主要特性

- Current measurement as in open loop (open loop current calculated by RVT-D) 电流测量与开环相同（开环电流值是通过 RVT-D 进行计算的）
- Fluctuating reactive power 脉动无功功率
- High accuracy 高精度
- Response time: instantaneous after the first firing 响应时间：第一次触发后几乎是瞬时
- Auto commissioning 自动试运行

Typical applications: same as external trigger with changing loads 典型应用：与带变化负载的外部触发方式相同

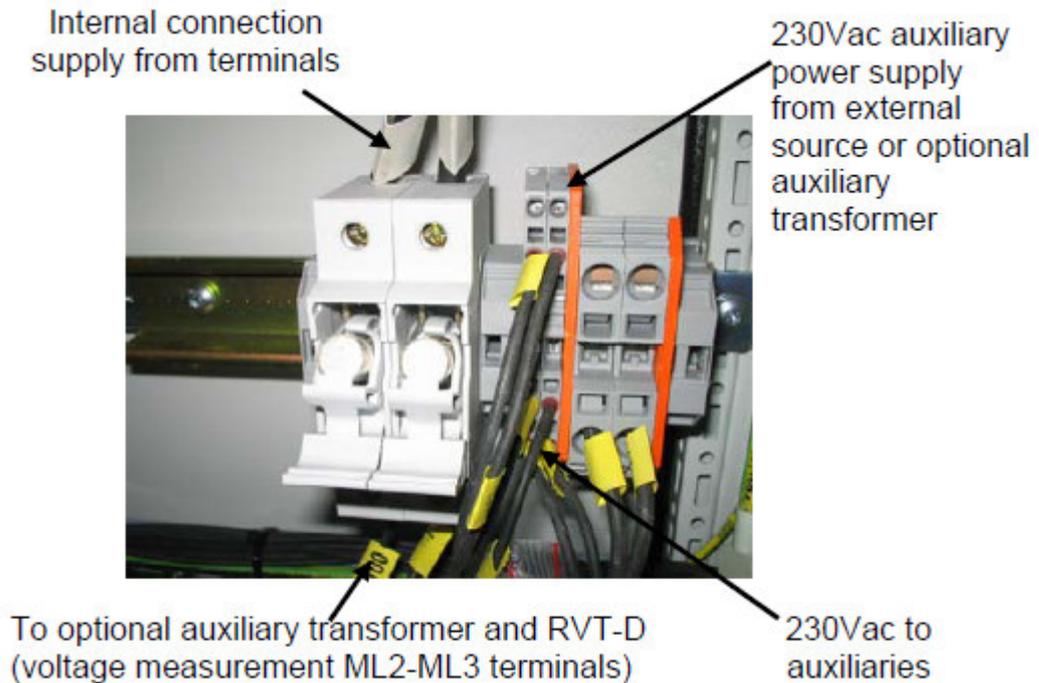
### 7.11 Auxiliary power supply 辅助电源

For standard configuration, 230Vac auxiliary power supply has to be supplied to each cubicle. 作为标准配置：将 230V 辅助电源提供给每个单元

Note: DYNACOMP can be delivered with integrated auxiliary power supply if optional transformer selected. 提示：如果您选择变压器，DYNACOMP 将提供集成辅助电源

**WARNING: Ensure that both power and auxiliary supplies are not live during DYNACOMP installation.** 警告：在安装 DYNACOMP 其间，确保主电源和辅助电源均不带电

The auxiliary power supply should be: 230 Vac +/- 10%, 50 or 60 Hz, 500 VA min, see [Chapter 15](#). 辅助电源要求：230 Vac +/- 10%, 50 /60 Hz, 500 VA ， 详见第 15 章



Internal connection supply from terminals 提供内部连接端子  
230Vac auxiliary power supply from external source or optional auxiliary transformer 从外部提供 230Vac 电源或选用辅助变压器  
To optional auxiliary transformer and RVT-D (voltage measurement ML2-ML3 terminals) 选用辅助变压器及 RVT-D (电压测量端子 ML2-ML3)

Figure 40: Auxiliary power supply terminals

图 40： 辅助电源接线端子

Auxiliary power supply (230Vac) is used to feed:230Vac 的辅助电源供给下面使用

- the FANs 排风扇
- the RVT-D PL2 – PL3 power supply 为 RVT-D PL2—PL3 供电
- the 24Vdc power supply 用于生成直流 24V 电源

## 7.12 RVT-D connection and RVT-D optional features RVT-D 连接及 RVT-D 选件特性

The RVT-D controller is the user interface of the DYNACOMP. RVT-D 是作为 DYNACOMP.的用户接口

By default, it is mounted and connected on the master cubicle face panel. However, it can be placed in another location with the optional extension kit, see [Chapter 15](#).

options. If optional extension kit is selected, the RVT-D has to be connected on site.  
默认：RVT-D 被安装在主单元的正前门上，它也可以安装到其它的位置上。但您需要订购相关的扩展组件。详见 15 章选件

Please note that the extension kit length is 20 meters. 请注意扩展组件的长度为 20 米

**WARNING: Before any cabling, switch off the power supply to the DYNACOMP as well as the auxiliary power supply. When the DYNACOMP has already been energized, it is done by opening the protection device located upstream of the DYNACOMP and opening the auxiliary fuse box present in the DYNACOMP. Wait at least 3 minutes for capacitors discharge. Failure to do so may result in lethal injury or death. 警告：在进行电缆连接前，必须先切断 DYNACOMP 的主电源及辅助电源。若 DYNACOMP 已被运行过，您须切断位于 DYNACOMP 上游的保护装置，及打开 DYNACOMP 自带的辅助保险盖。等待 3 分钟后，使电容上的电能释放完成。错误的操作可能引起致命的伤害或死亡！**

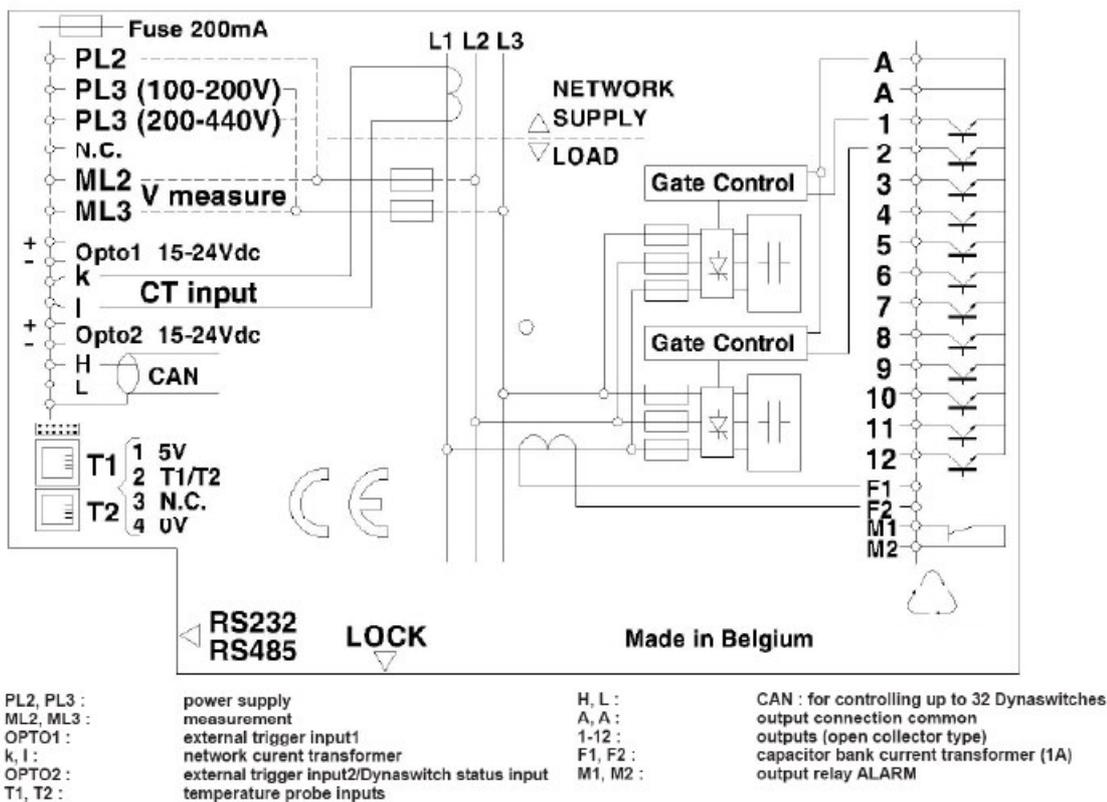


Figure 41: RVT-D electrical interface layout RVT-D 电气连接图

According to customer need, RVT-D optional feature can also be selected: 根据用户需求，RVT-D 可选择以下几种功能

- Connection of the serial printer to the RVT-D controller. 连接串口打印机到 RVT-D 控制器
- Connection of the RS485 Modbus adapter. 连接 RS485 Modbus 适配器

- 
- Connection of the external temperature probes to the main control board. 连接外部温度探头到主控板
  - Connection of the alarm functionality 连接警报功能

For more detail, please refer to RVT-D manual. 了解更详细内容请参阅 RVT-D 手册，

### 7.13 Electrical interconnection of DYNACOMP cubicles DYNACOMP 单元的电气连接

In standard configuration, the interconnection between cubicles are the CAN bus and the earth (each cubicle having its own power and auxiliary supplies). 标准配置，每个单元之间采用 CAN 总线，以及地线进行连接。（每个单元都有自己的主电源和辅助电源）

The CAN connection principle is presented in [Figure 42](#) here below: CAN 连接原理在下面图 42 中给出



**Note:** The RVT-D located in the Master cubicle is always at the end of the CAN control bus. It should be noticed that the other end of the CAN control bus should be loaded by an “end of line load resistor”. This is done by setting ON the dip switch Nr6 noted “CAN” of the last Dynacontrol board 提示：安装在主单元上的 RVT-D 作为 CAN 控制总线终端。尤其要注意，若 CAN 控制为最后一个工作站点，则需连接一个终端电阻。其做法可通过 Nr6 的拨码开关进行设置。

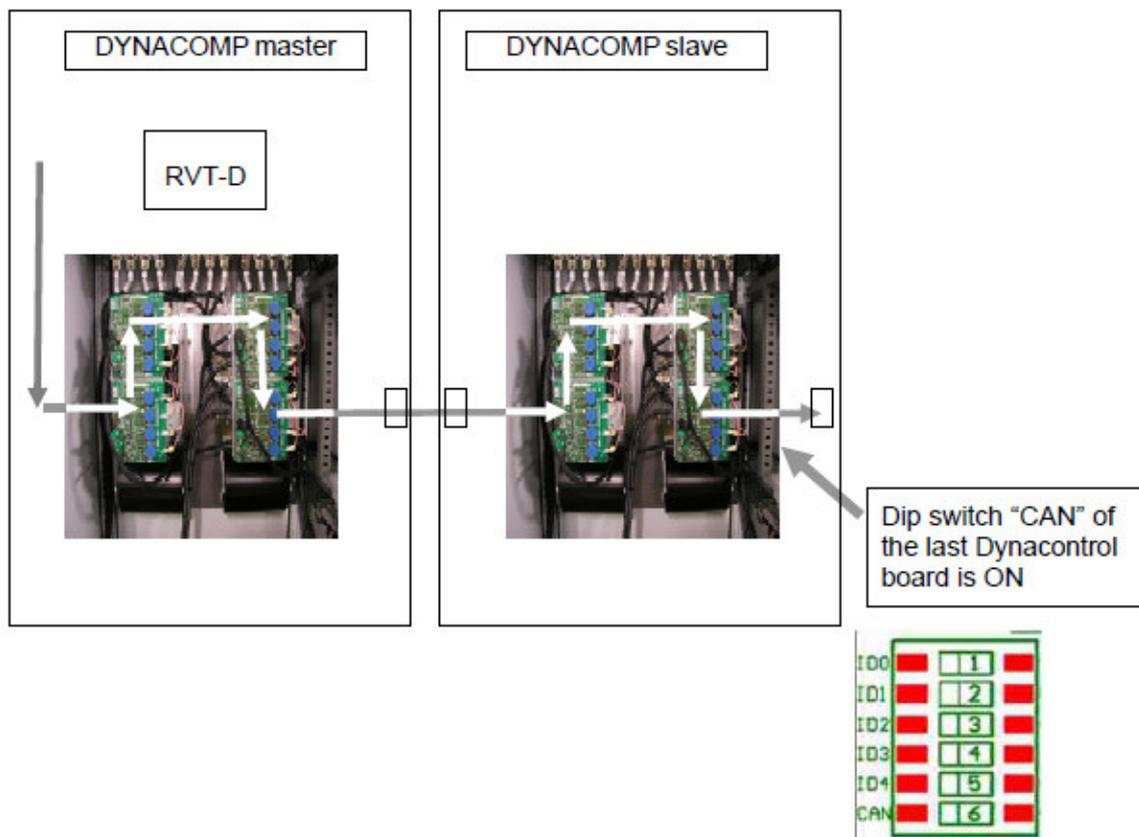


Figure 43: CAN interconnection between cubicles

图 43: 单元之间的 CAN 互连图

## 7.14 External trigger inputs 外部触发输入

External trigger is directly connected to the RVT-D (15-24Vdc optically isolated inputs), see [Figure 41](#). 外部触发可直接连接到 RVT-D 上 (15-24V 的光电隔离输入)

**WARNING: Polarity should be respected. 警告: 应注意极性问题**

For more detail, please refer to RVT-D manual. 更为详细内容请参阅 RVT-D 使用手册

## 7.15 Insulation resistance check 绝缘阻值检查

Each DYNACOMP cubicle has been fully tested and the insulation resistance measured during manufacturing. So there is no need for additional insulation test on site. However, in case of special request, an additional insulation test may be done before commissioning. 在生产过程中, 每个 DYNACOMP 单元的绝缘电阻都已做全面测试。因此无须另外做绝缘测试工作。若在试车之前有特殊要求, 可额外加做一次绝缘测试。

Any damage resulting of this test should be notified immediately to your closest local ABB agent. 在做绝缘测试过程中, 若引起任何损坏, 请及时与您最近的当地 ABB 代理商联系。

**WARNING: Strictly follow the insulation tests procedures outlined below. Applying other methods may damage the DYNACOMP. 警告：应严格遵照下面给出的绝缘测试步骤，采用其它的测试方法可能导致 DYNACOMP 损坏。**

Use a 500 Vdc generator. 使用 500 Vdc 兆欧表

### 7.15.1 Insulation procedure for a three-phase DYNACOMP cubicle 三相

#### DYNACOMP 单元的绝缘测试步骤

- Verify that power and auxiliary supplies are not live 检查主电源及辅助电源不带电
- Put your safety gloves 戴上安全手套
- Remove the incoming fuses to isolate the cubicle from the rest of the installation 移开进线端保险，使单元与其它部份分离
- Remove the auxiliary fuse by opening the fuse box 通过打开保险盖，移去辅助保险管。
- Short circuit L1, L2, and L3. 短接 L1, L2, 和 L3.
- Measure the insulation resistance between L1-L2-L3 and the earth bar (PE) under 500Vdc. 利用 500Vdc 兆欧表测量 L1-L2-L3 相互之间的绝缘电阻。以及它们与地线（PE）之间的绝缘电阻。
- Compare the result with [Table 7](#). The measured resistance depends of the number of Dynacontrol boards used in the cubicle. 与表 7 中值进行对比，测量的电阻值还与单元中所使用的动态控制板的数量有关。

Table 7: Insulation resistance of three-phase configuration

表 7：三相配置的绝缘电阻

Number of Dynacontrol boards 动态控制板数量	Measured resistance 测量阻值
1	$\geq 1 \text{ M}\Omega$
2	$\geq 500 \text{ K}\Omega$
3 or 4	$\geq 250 \text{ K}\Omega$

- Remove the short circuit between phases 移去相间的短接线
- Replace the auxiliary fuses 装回辅助保险
- Replace the main incoming fuses 装回主回路进线保险

**WARNING: End this test by removing the short circuit of the phases.警告：测试完成后应移去相间的短接线**

## 7.15.2 Insulation procedure for a single-phase DYNACOMP cubicle 单相

### DYNACOMP 单元绝缘测试步骤

- Verify that power and auxiliary supplies are not live 检查主电源及辅助电源不带电
- Put your safety gloves 戴上安全手套
- Remove the incoming fuses to isolate the cubicle from the rest of the installation 移开进线端保险，使单元与其它部份相分离
- Remove the auxiliary fuse by opening the fuse box 通过打开保险盖，移去辅助保险
- Short circuit L1 and L2 短接 L1 和 L2
- Measure the insulation resistance between L1-L2 and the earth bar (PE) under 500Vdc. 利用 500Vdc 兆欧表测量 L1-L2 之间的绝缘电阻，以及 L1-L2 与地之间的绝缘电阻

Compare the result with [Table 8](#). The measured resistance depends of the number of Dynacontrol boards that are present in the cubicle 把测得电阻值与表 8 进行对比，同时测量值与单元中所使用的动态控制板的数量有关。

Table 8: Insulation resistance of single-phase configuration 表 8: 绝缘单相电阻配置

Number of Dynacontrol boards 动态控制板数量	Measured resistance 测量阻值
1	$\geq 2 \text{ M}\Omega$
2	$\geq 1 \text{ M}\Omega$
3 or 4	$\geq 500 \text{ K}\Omega$

- Remove the short circuit between phases 移去相间的短接线
- Replace the auxiliary fuses 装回辅助保险管
- Replace the main incoming fuses 装回主回路进线保险

**WARNING: End this test by removing the short circuit of the phases.警告：测试完毕后应移去相间的短接线**

## 8. The RVT-D user interface RVT-D 用户接口

The RVT-D Controller is the control unit of an automatic capacitor bank equipped with static switches (dynamic compensation). It controls the switches targeting a user-

defined  $\cos \varphi$  and/or to reducing voltage drops. RVT-D 控制器是一种带有静态开关（动态补偿）的自动电容组控制单元，RVT-D 通过切换开关以达到满足用户对  $\cos \varphi$  的要求或减小电压降。

All the switching parameters as well as the  $\cos \varphi$  and the control mode (open loop / closed loop / external trigger) may be selected automatically or manually. 所有的开关参数及功率因数  $\cos \varphi$  控制模式（开环/闭环/外部触发模式）都可以被自动或手动模式所选用。

Additionally the RVT-D Controller also provides following functionalities:另外，RVT-D 控制器还提供以下功能

- Measurements 测量
- Protection against unexpected phenomena and/or unauthorized use 防止新手误操作的保护
- Logging of data and alarm messages 数据及警报信息的录入
- Checking and testing of outputs status 检查及测试其输出的状态
- With the optional accessories 所带的选件
- Printout of measurements and parameters 可打印出测量值及相关的参数
- Temperature measurement 温度的检测

Each accessory is supplied with its own Instruction Manual. For more information, please refer to RVT-D installation and operating instructions manual. 了解更多的内容，请参阅 RVT-D 安装及使用说明书，

## 8.1 Front View 前视图

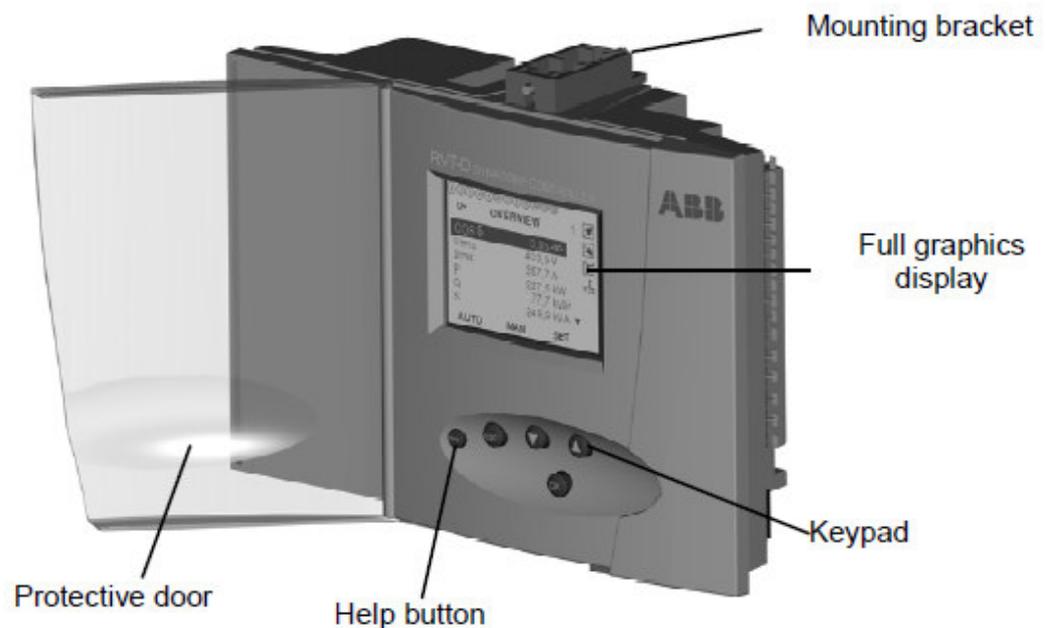


Figure 44: RVT-D front view layout RVT-D 外观前视图



Figure 45: RVT-D controller installed in door panel RVT-D 门板安装前试图

## 8.2 Rear view 后视图

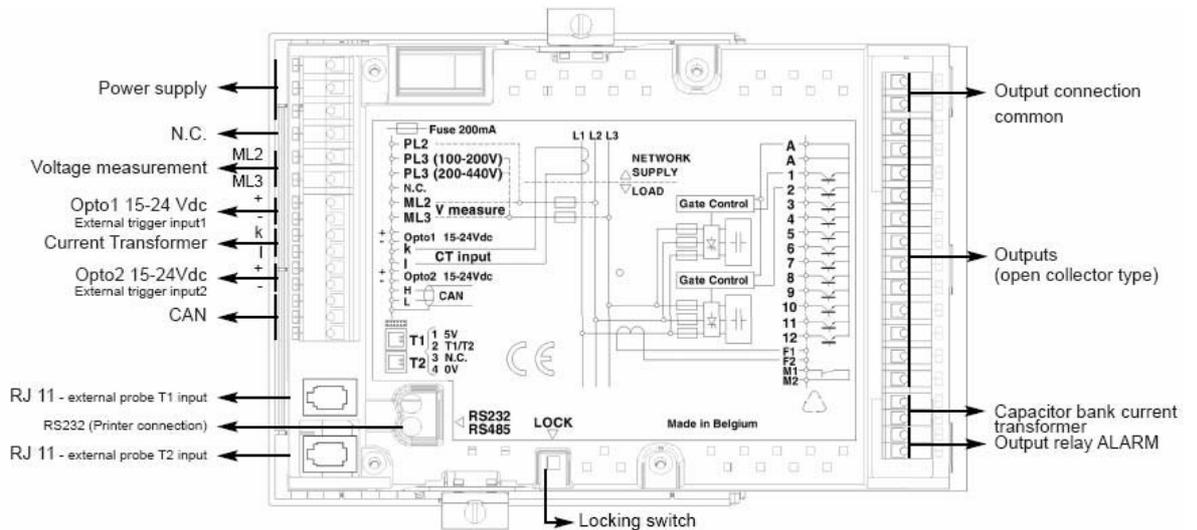
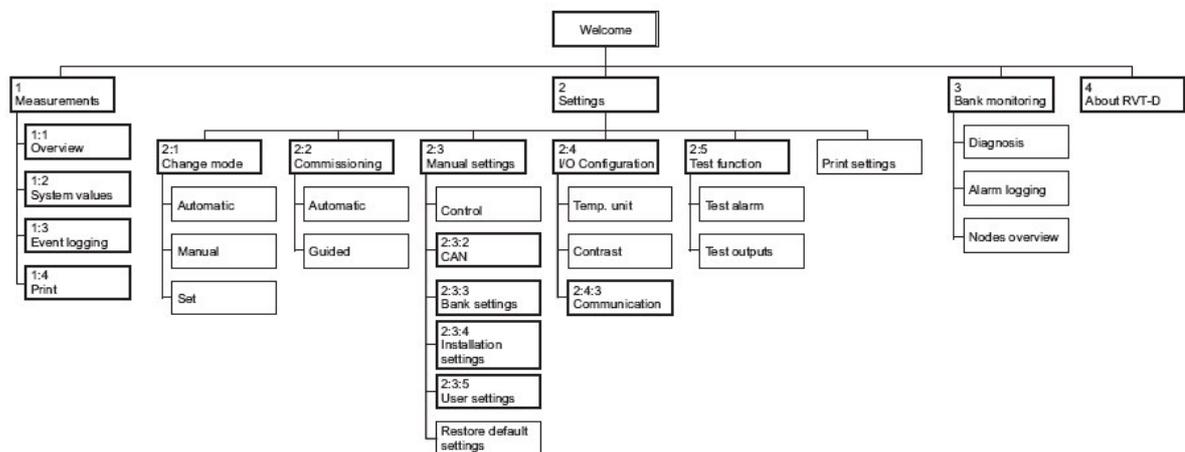


Figure 46: RVT-D rear view layout RVT-D 后视图

## 8.3 Menu chart 菜单流程图



## 9. The Modbus communication interface Modbus 总线通信接口

### 9.1 Overvie 概要

This chapter contains a short description of the Modbus protocol and the RS485 interface.

本章简要阐述 Modbus 通信协议及 RS485 通信接口

#### 9.1.1 Introduction to Modbus Modbus 介绍

Modbus is a serial, asynchronous protocol. The Modbus protocol does not specify the physical interface. The typical physical interfaces are RS-232 and RS-485. The RVT-D controller uses the RS-485 interface. Modbus 是一种串行,异步的通信协议。并没有规定具体的物理通信接口,典型的接口为 RS-232 和 RS-485, RVT-D 控制器使用的是 RS-485。

Modbus is designed for integration with PLCs or other automation devices, and the services closely correspond to the PLC architecture. Modbus 通常被集成到 PLC, 或其它的自动化设备中, 为 PLC 提供有效通讯服务

#### 9.1.2 The Modbus adapter Modbus 适配器

The Modbus adapter is an optional device of ABB PowerIT Power Factor Controller RVT which enables the connection of the RVT to a Modbus system. 该 Modbus 适配器是 ABB 公司功率因数控制器, RVT 的一种选件。它是用于 RVT 和 Modbus 系统通讯作用。

The RVT-D controller is considered as a slave unit in the Modbus network. 在 Modbus 的总线网络中, RVT-D 控制器作为一个从单元出现。

Through the Modbus adapter it is possible to: 通过 Modbus 的适配器, 可实现以下任务:

- Read measurements and logged values 读取测量和记录值
- Read and write settings parameters of the controller 读写控制器的设定参数
- Activate output relays 启动输出继电器
- Read status information 读取状态信息
- Read device identification references 读取设备身份识别信息

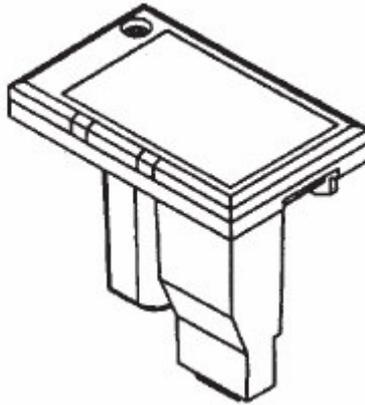


Figure 48: Modbus adapter Modbus 适配器

### 9.1.3 Compatibility 兼容性

The Modbus adapter is compatible with any ABB Power<sup>™</sup> Power Factor Controller RVT-D of version 4.0 or higher. Other ABB controllers may be connected with the adapter. 该 Modbus 适配器兼容 ABB 公司功率因数, 控制器 RVT-D 版本在 4.0 或更新产品.其它的 ABB 控制器可以通过适配器进行连接

The Modbus protocol is compatible with all master stations that support the Modicondefined Modbus serial communication protocol. Modbus 协议兼容所有支持 Modicondefined Modbus 系列通讯协议的主站。

## 9.2 RS485 Modbus adapter RS485 Modbus 适配器

The RS485 Modbus adapter enables the connection of the controller to an RS485 Modbus network. RS485 Modbus 适配器用于连接控制器和 RS485 Modbus 通信网络作用

### 9.2.1 Main features 主要特性

The adapter is self powered through the power supply of the controller 该适配器通过控制器获取电源

- Advantage: an external power supply is not needed. 优点:无需外部电源
- Advantage: low power consumption 优点: 低功耗

The adapter is fixed directly on the back side of the RVT 该适配器被直接固定在 RVT-D 的后边

- Advantage: the Modbus adapter does not need any rail DIN or such fixation methods. 优点: Modbus 适配器无需任何轨道或固定架

The adapter is electrically isolated from the RVT power supply 适配器从 RVT 获取的电源而且在电气上是相互隔离的

- 
- Advantage: the RVT is protected against common mode voltage levels applied on the RS485 network 优点: RVT 具有抑制作用在 RS485 网络上的共模干扰的功能
  - Advantage: no ground loop 优点: 无地环流

The adapter has an integrated terminator resistance which may be connected with a switch 该适配器集成有终端电阻, 可通过开关进行连接

- Advantage: no external device to be added 优点: 无外加设备

The adapter contains transient voltage suppressors 适配器包含有抑制电压瞬变的功能

- Advantage: the device and the network are protected against voltage surges 优点: 该设备和网络都采用过电压保护

The adapter is fitted with transmission and reception indication LED's 适配器还装有接收和传输的 LED's 指示灯

- Advantage: it allows visualizing Modbus queries and Modbus answers. 优点: 它可看到 Modbus 正常通信状态

The controller allows a software adjustment of communication parameters 控制器可通过软件调整通信参数

- Advantage: no multiple hardware dipswitches to handle 优点: 无须对硬件的多路开关进行设置
- Advantage: permits self-tuning of communication parameters with a higher level software application 优点: 允许系统对通信参数进行自适应配置, 这是一种较高级的软件应用

## 9.2.2 Physical dimensions 物理尺寸

The Modbus adapter is especially suitable for application where space requirements are important. 该 Modbus 适配器尤其适用于, 对空间场地有特别要求的地方。

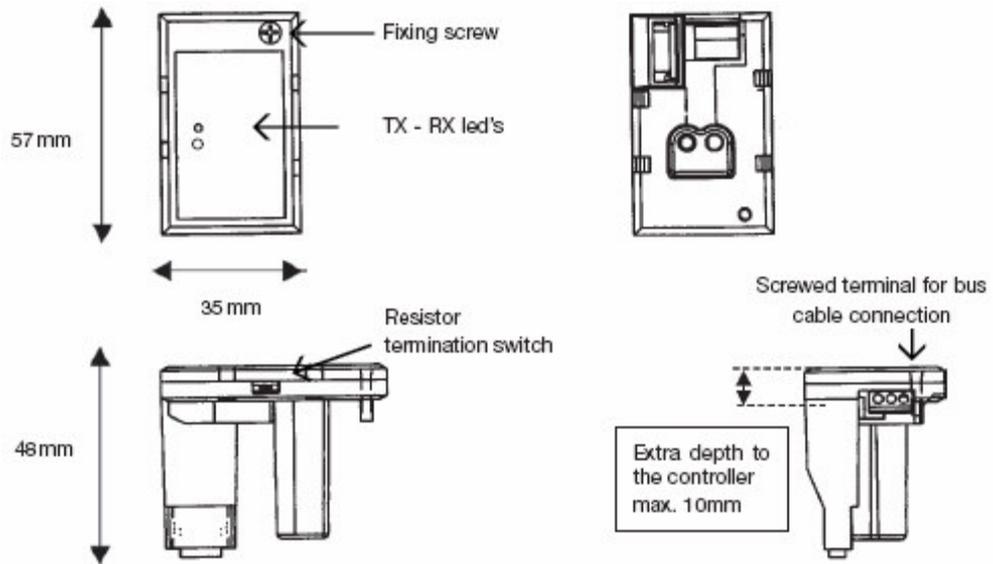


Figure 49: RS485 dimensions RS485 外观尺寸

### 9.2.3 Mounting 安装

The Modbus adapter is specially shaped to fit the controller case and to plug into its dedicated connectors without any other additional fixation part than just a screw. 该 Modbus 适配器的特殊外形，适用于直接安装到控制器上面。除一个螺丝外无须任何固定

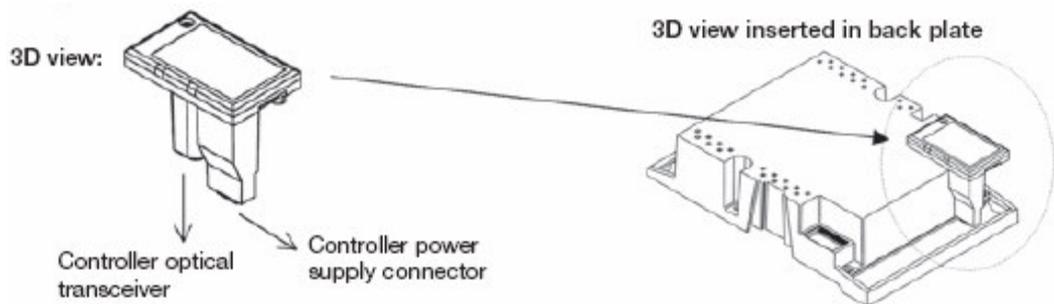


Figure 50: RS485 mounting RS485 安装

### 9.2.4 Technical data 技术数据

- Operating ambient temperature: -20 to +70 °C 使用环境温度: -20 至+70°C
- Number of nodes (Tx drive): 32 max 通信节点数: 最多 32 个
- Rx loading: receiver impedance is 1 unit load per RS485 Modbus adapter RX 负载: 每个 RS485 Modbus 适配器只能接收一个阻抗负载单元
- Size of the Link: 247 stations including repeaters (31 stations and 1 repeater per segment) 247 个基站包括中继器 (每部份包括 31 个站点和 1 个中继器)

- 
- Medium: Shielded, twisted pair RS485 cable (Belden 9841 typical) 通信介质: 双绞带屏蔽的 RS485 电缆线
  - Maximum Bus Length: 1200 m 最大总线长度: 1200 m
  - Topology: Multi-drop 拓扑: 多站点
  - Serial Communication Type: Asynchronous, 2 wires half Duplex 串行通信类型: 异步, 双线半双工
  - Baud rate: 110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 bauds selectable by the user (can be adjusted through the controller menus) 波特率: 110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 供用户选择 (可通过控制器菜单进行调整)
  - Termination resistor: built in, selectable by a switch. 120 ohms resistor is needed at both end of the line and must be switched or not depending on the location in the Modbus network topology. 终端电阻: 内置选择开关, 可根据 Modbus 网络拓扑, 决定是否需要 120  $\Omega$  终端电阻连接到通信线上。
  - Transient voltage suppressors 抑制电压瞬变
  - Screwed terminals on the RS485 side 上紧 RS485 边上的接线端子
  - TX – RX Led indication for easy debugging and troubleshooting TX – RX LED 指示灯, 方便于调试及故障排查
  - Slew-Rate Limited for Error-Free Data Transmission (minimizing EMI and reducing reflections caused by improperly terminated cables) 无差错的数据传输受限于斜率值 (使 EMI 最小化或减小因终端电线选择不当所引起的反射)
  - Drivers are short-circuit current limited 驱动器受限于短路电流环
  - The receiver input has a fail-safe feature in case of broken connection 该接收器输入带有离线故障的保护功能
  - Compatible Devices: Any Modbus device capable of Modbus communication as a master. 兼容设备: 任何一款 Modbus 设备都可以在 Modbus 通信网络中起主机的作用
  - Speed reply time: better than 5 ms @ 57600 bauds 应答时间: 波特率为 57600 时小于 5ms
  - Max data packet: Any complete table provided in the Modbus data table 最大数据包: 在 Modbus 数据中给出完整的表单

### 9.3 Modbus protocol overview      Modbus 总线协议概要

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### 9.3.1 Overview 概要

MODBUS RTU is a non-proprietary serial communications protocol that is widely used in the process control industry. The protocol was developed by Modicon for PLC communications and later released for public use. MODBUS RTU 是一种非专利串行通信协议。它被广泛应用在工业过程控制。该协议还被 Modicon 公司用于开发 PLC 通信。最近宣布并为公众所使用。

This protocol is available in all major Human Machine Interface (HMI) software packages and terminals. Many of the major controller and PLC manufacturers also offer MODBUS protocol as a standard or optional protocol in their instrumentation. 这种协议有效地用于所有主要的人机介面软件包中，大部分主控制器和 PLC 制造商把 MODBUS RTU 协议做为它们的通信标准，或备选协议标准。

The hardware over which MODBUS RTU communications are performed is not defined by the protocol. MODBUS RTU is supported on RS-232, RS-422, RS-485, Ethernet and other electrical standards. It should be noted that MODBUS RTU, MODBUS ASCII and MODBUS Plus are unique communication formats, and are not compatible with each other. This document will discuss MODBUS RTU only. MODBUS RTU 采用硬件对通信协议改进固化，无须定义该协议。MODBUS 支持 RS-232, RS-422, RS-485, 以太网和其它的电气标准。须注意的是 MODBUS RTU 只采用 MODBUS ASCII 和 MODBUS Plus 通信格式，而且不兼容其它的格式。此文档内容只适用于 MODBUS RTU

### 9.3.2 Transactions on Modbus Networks Modbus 相关网络事务

Modbus protocol uses a master-slave technique, in which only one device (the master) can initiate transactions (called 'queries'). The other devices (the slaves) respond by supplying the requested data to the master, or by executing the requested action. Typical master devices include host processors and programming panels. Typical slaves include programmable controllers (such as RVT-D controller). Modbus 协议是种主从通信技术.只有主设备能够进行初始化（也叫做询问）其它的从设备只能响应以及向主设备提供它所要求的数据。或按要求执行动作。典型的主设备包括主处理器和编程面板，典型的从机包含可编程控制器（如 RVT-D 控制器）

The master can address individual slaves, or can initiate a broadcast message to all slaves. 主机可以向每个从机进行寻址，或者发送一个广播信号给所有的从机。

Slaves return a message (called a 'response') to queries that are addressed to them individually. Responses to broadcast queries are not returned to the master. 从机为主机询问地址而返回一条信息（叫应答），若是广播询问无还需返回应答信息。

The Modbus protocol establishes the format for the master's query by placing into it the device (or broadcast) address, a function code defining the requested action, any data to be sent, and an error-checking field. The slave's response message is also constructed using Modbus protocol. It contains fields confirming the action taken, any data to be returned, and an error-checking field. If an error occurred in receipt of the

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message, or if the slave is unable to perform the requested action, the slave will construct an error message and send it as its response. Modbus 协议通过在总线上发出寻址（广播）构建询问过程。接着为定义动作要求的功能代码。需要发送的数据，以及错误检查域，从机的应答信息同样可以采用 Modbus 协议来构建。它包括动作确认域，需要返回的数据以及错误检查域，如果在接收信息过程中产生错误或者从机无法按要求执行动作。这样从机将构建一条错误信息发送到主机。作为应答信号。

## 10. Dynaswitch

## 动态开关

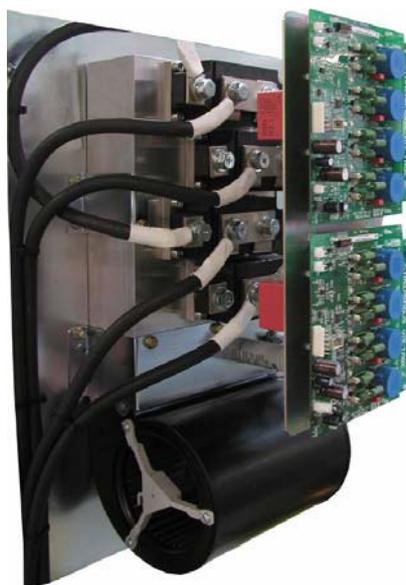


Figure 51: Dynaswitch layout Dynaswitch 外观图

### 10.1 Working principle

### 工作原理

The Dynaswitch is a highly advanced static switch made of two pairs of back to back thyristors controlled by a microprocessor board (Dynacontrol board). 该动态开关是一个高级静态开关，它是由双向反并联可控硅组成的。并接受微处理器板控制（动态开关板）

The Dynaswitch gets its firing orders from the RVT-D and will adequately execute them. 动态开关是从 RVT-D 那里获得符合执行要求的触发指令

It is the reason for contrary to conventional capacitor banks; there is no time delay since switching operations are performed without transient, whatever the residual load voltage of the capacitors. 与传统的电容器组相比较，没有时间延时，即使电容器上带有负载残留电压，执行开关动作时也不会产生电压瞬变。

### 10.2 Description

### 说明

## 10.2.1 Dynaswitch 动态开关

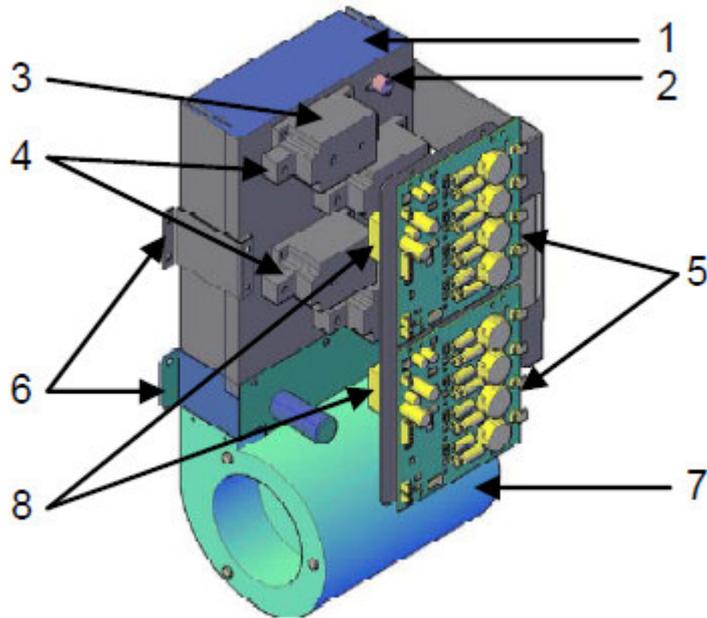


Figure 52: Dynaswitch layout components location 动态开关部件位置布局图

Item 项目	Main components 主部件
1	Heatsinks : thyristors cooling 散热:可控硅冷却
2	Thermal protection: device 热保护:设备
3	Thyristors (two pairs of back to back thyristors)可控硅(双向反并联的可控硅)
4	Power cables terminals 电源接线端子
5	Dynacontrol board 动态控制板
6	Dynaswitch fixation brackets 动态开关固定块
7	Fan 排风扇
8	RC SnubbersRC (电容, 电阻) 阻尼器

## 10.2.2 Dynacontrol board 动态控制图

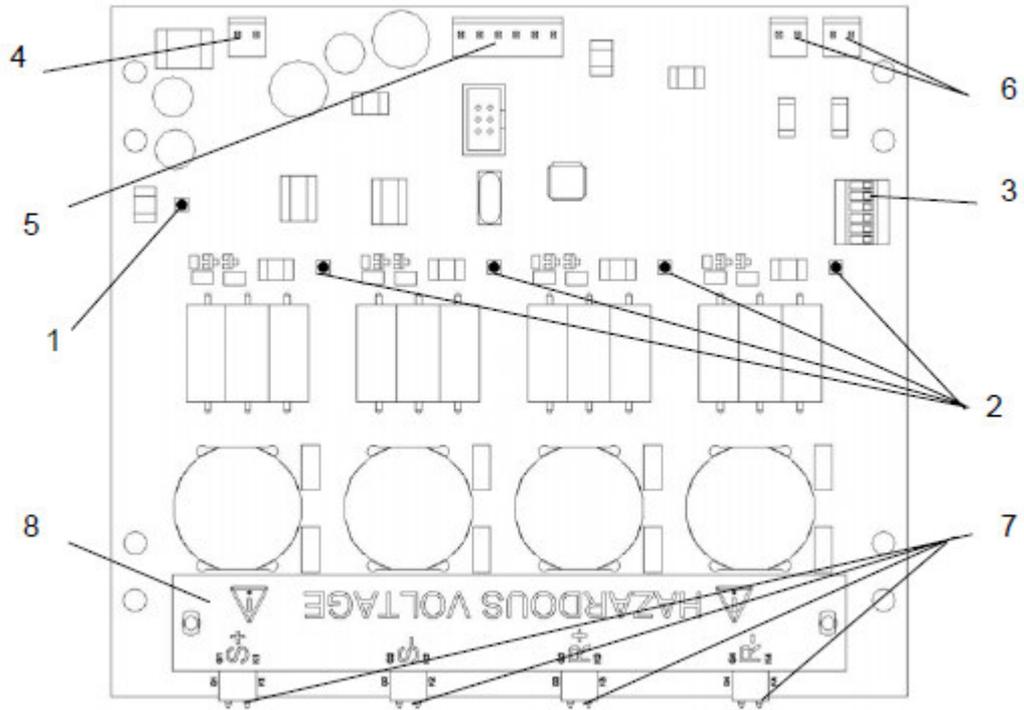


Figure 53: Dynacontrol board layout 动态控制板布局

Table 9: Components of the Dynacontrol board Table 10: ID table

表 9：动态控制板相关部件

Item 条款	Meaning 意义		
1	Blinking frequency Hz 闪烁频率 (HZ)	On time ratio %占空 比	Meaning 意义
	4	50%	Initializing 初始化
	1	6%	Alarm status: enable input open (fuses blown / thermal problem) 警报状态： 启动输入开路 (保险断/过热问题)
	1	94%	Alarm status: other alarm 警报状态： 其它警报
	0.5	50%	Ready 准备
2	On/off LED's: On = presence of thyristors firing order 指示灯亮表示可控硅处于触 发状态		
3	<a href="#">Configuration dipswitches. ID0-ID4 switches define the node address as described in the Table 10 below.</a> 开关设置: ID0-ID4 开关用于设置该站点的地址, 详见表 10		
4	Enable input: fuse and thermal protection detection (open circuit gives an error signal to the Dynacontrol board) 启动输入: 保险丝及热保护检测 (当开路时给动 态控制板发送故障信息)		
5	Power supply (24 Vdc) and CAN bus connection 24V 直流电源及 CAN 总线连接		

6	External control inputs: optional inputs to control the switch. 24V input fires the switch on. Please note that the CAN bus is still needed for synchronization and error reporting purposes. For three-phase configuration, only use P5 input. For single-phase, use P5 for S-phase, P6 for R-phase 外部控制输入：选用外部输入控制该输入信号，24V 输入信号使开关处于触发状态。请注意 CAN 仍需要同步信号。且用于出错报告。对于三相柜，只须 P5 端输入。对于单相柜，S 相使用 P5，R 相使用 P6
7	Thyristors gate signals 可控硅触发门极信号
8	Touch proof protection plate 防触碰保护面板

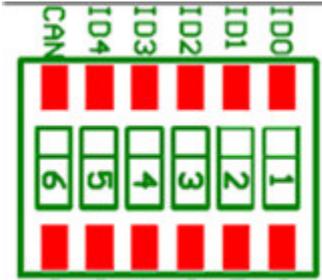


Figure 54: Dipswitches layout Dipswitch 示意图

Table 10: ID table 表 10: ID 表

Step n°	ID4	ID3	ID2	ID1	ID0
1	0	0	0	0	0
2	0	0	0	0	1
3	0	0	0	1	0
4	0	0	0	1	1
5	0	0	1	0	0
6	0	0	1	0	1
7	0	0	1	1	0
8	0	0	1	1	1
9	0	1	0	0	0
10	0	1	0	0	1
11	0	1	0	1	0
12	0	1	0	1	1
13	0	1	1	0	0
14	0	1	1	0	1
15	0	1	1	1	0
16	0	1	1	1	1
17	1	0	0	0	0
18	1	0	0	0	1

19	1	0	0	1	0
20	1	0	0	1	1
21	1	0	1	0	0
22	1	0	1	0	1
23	1	0	1	1	0
24	1	0	1	1	1
25	1	1	0	0	0
26	1	1	0	0	1
27	1	1	0	1	0
28	1	1	0	1	1
29	1	1	1	0	0
30	1	1	1	0	1
31	1	1	1	1	0
32	1	1	1	1	1

Legend: 图注

1 means switch ON 1 表示开

0 means switch OFF 2 表示关

Please note that the CAN switch of the dipswitch must be on for the last node only (to indicate the termination of the CAN bus). 请注意 CAN 拨码开关，应设置为最近要求的站点地址（便于指明 CAN 总线的终端）

### 10.3 Alarms 警告

Several failures can be detected on the Dynacontrol boards: 动态控制板可检测出下列几种错误

- Enable loop open error: 启动开环出错

Fuse blown or thermal protection is open. This error stops the step. The status LED blinks at 1Hz frequency with 6% on time ratio. To get out from this state:

保险断开或热保护开路，出现这种错误将停止下一步的动作。LED 指示灯的频率在 1HZ 的占空比为 6%的方式进行闪亮。用以下方式摆脱该状态

- switch off the power supply 关闭电源
- remove the failure 排除故障
- switch on the power supply 重新打开电源
- Power connection wire error: 电源连接线有误

---

The switches voltages are measured during initialization after power ON. If the phase order is not according to the set-up parameters received from RVT-D, the Dynacontrol board goes into error mode. The status LED blinks at 1Hz frequency with 94% on time ratio. To get out from this state: 在合上电源后的初始化过程中, 开关的电压值已被检测。如果相序与 RVT-D 发送过来的参数不相符, 动态控制板将给出一个出错信息, 表现为 LED 的频率为 1HZ。占空比为 94%的状态进行闪烁。用以下方式脱离这种状况。

- switch off the power supply 关闭电源
- check the power cables connection. 检查电缆连接是否正确
- switch on the power supply 重新打开电源
- Capacitors discharge time too big: 电容器放电时间太长

The error is set if the DC voltage does not decrease under 100V within 6 minutes (360sec) when AC voltage (>97Vrms) is present. Discharge time measured during start-up: the system waits for the capacitors discharge. 当加上一个 (>97Vrms) 的交流电压在电容器上面, 经过 6 分钟(即 360 秒)直流电压无法降低到 100V 以下。放电时间检测在启动过程中进行, 系统等待电容器放电。若超出这个范围, 将给出出错警报。

This error indicates a possible discharge resistor problem. 这种出错指示可能是放电电阻有问题造成

- Synchronization not received error: 接收不到同步, 出错

If during more than 5 periods, the synchronization signal is not received, error is set and the step is stopped. The status LED blinks at 1Hz frequency with 94% on time ratio. The synchronization message must be available for 250 consecutive periods before exiting from that error state.

如果超出 5 个周期, 同步信息未能接收到, 便显示出错并停止下一步动作。LED 指示灯的频率为 1HZ, 占空比为 94%的方式闪亮。想要退出这种错误状态, 同步信号必须连续 250 个有效周期, 方可解决。

## 10.4 Troubleshooting 故障排查

See status report on RVT-D screen. 见 RVT-D 状态报告显示

## 10.5 Technical data 技术数据

- Supply voltage 24 Vdc +/- 10 %. 电源电压 24 Vdc +/- 10 %
- Switch for: 50 Hz & 60 Hz network. 电网频率 50 Hz & 60 Hz
- Power consumption: 25 W maximum. 功耗: 最大为 25W

## 10.6 RC snubbers 阻尼器

By construction, all Dynaswitch thyristors are fitted with their own RC snubbers, see [Figure 55](#). 所有动态开关的可控硅都安装有相对应的 RC 阻尼器，见图 55

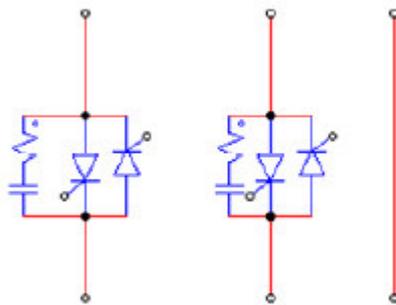


Figure 55: RC snubber RC 阻尼器

The RC snubbers efficiently protect the thyristors against possible misfiring that could arise with voltage notches. Example of a voltage notches is given in [Figure 56](#). Actually, thyristors are especially sensitive to voltage notches and could be badly damage without their RC snubber. 该 RC 阻尼器能有效地阻止因电压缺口造成的可控硅误触发现象。下面给出电压陷波的实例图 56，实际上可控硅对电压缺口尤为敏感。如果没有 RC 阻尼器，会给可控硅带来严重的破坏。

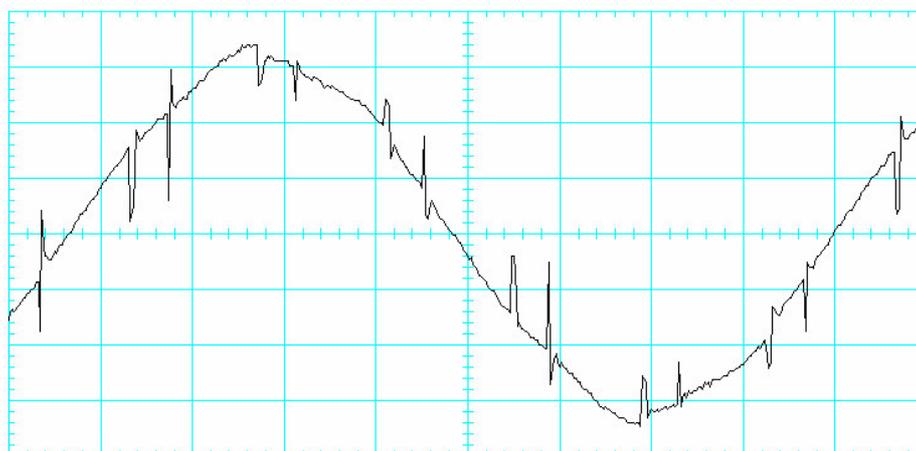


Figure 56: Example of line voltage polluted by notches 电压陷波示意图

## 11. Commissioning instructions 调试说明书

### 11.1 What this chapter contains 本章概要

This chapter explains how to commission the DYNACOMP. DYNACOMP commissioning must be conducted in strict accordance with the present procedure. 本章主要说明如何对 DYNACOMP 进行试运行，并严格遵守相关的流程。



Before commissioning, make sure that you are familiar with: - 试车之前，应熟悉以下内容

The DYNACOMP hardware (see [Chapter 5](#)). - DYNACOMP 硬件（见第 5 章）

The mechanical installation requirements (see [Chapter 6](#)). - 机械安装及要求（见第 6 章）

The electrical installation requirements (see [Chapter 7](#)). - 电气安装及要求（见第 7 章）

The DYNACOMP programming interface RVT-D (see [Chapter 8](#)). - DYNACOMP 可编程接口 RVT-D（见第 8 章）

The Modbus communication interface (see [Chapter 9](#)) if Modbus communication has to be set up. 如果采用 Modbus 通信则要求 Modbus 通信接口（见第 9 章）

The commissioning procedure is made of 8 steps that should be strictly followed. Please refer to commissioning report given in [section 11.10](#). 试车具体步骤由以下八步组成。并要求严格遵守执行。请参照在 11.10 部分给出的试车报告。

Table 11: DYNACOMP commissioning steps 表 11: DYNACOMP 试车步骤

Steps 步骤	Actions 作用
Step 1	Visual and installation check 目视及装配检查
Step 2	Voltage rating and phase rotation check 额定电压及相序检查
Step 3	Setting of Dynacontrol boards 对动态控制板进行设置
Step 4	Apply power to the DYNACOMP 给 DYNACOMP 上电
Step 5	Basic commissioning parameters set up (using RVT-D) 利用 RVT-D 对基本试车参数进行设置
Step 6	Before starting the DYNACOMP 准备运行 DYNACOMP
Step 7	Start the DYNACOMP in Manual Mode 用手动模式运行 DYNACOMP
Step 8	Start the DYNACOMP in Automatic Mode 用自动模式运行 DYNACOMP

## 11.2 Step 1: Visual and installation check 第一步:目视及安装检查



**WARNING: Make sure that the DYNACOMP supply is isolated during the visual and installation check. For safety reasons, this must be done upstream of the DYNACOMP. Open the auxiliary power fuse holder. Verify that the DYNACOMP capacitors are discharged before touching them. Failure to adhere to these guidelines may result in lethal electric shock and/or DYNACOMP damage.**警告:在作目视及安装检查时,为安全起见必须先断开所有 DYNACOMP 电源,包括辅助电源。在触碰电容器之前,应先检查电容器是否放电完毕,如果没按要求操作,可能引起人身伤害和 DYNACOMP 的损坏

**WARNING: Make sure that the DYNACOMP is installed at a location where no conductive dust is present. Conductive dust when distributed in the DYNACOMP panel may lead to equipment failure.**警告-: 必须确保 DYNACOMP 安装在没有导电灰尘的地方,否则将会导致 DYNACOMP 失效

- Check that the mechanical and electrical installation fulfils the requirements described in [Chapter 6](#) and [Chapter 7](#) of this manual. 检查所有的机械和电气安装。是否符合手册第 6 章和第 7 章的相关要求
- Pay attention to the ambient temperature, cf DYNACOMP cooling requirements, [Chapter 15](#). 尤其注意环境温度及 DYNACOMP 冷却的要求,在第 15 章给出
- Visual DYNACOMP inspection (e.g. for transportation damage). 目视检查 DYNACOMP 在运输过程中是否遭破坏
- Check the tightness of all connections including power cable, CT, RVT-D and the Dynacontrol board connections. 检查所有的接线端子是否上紧,如电源线,CT, RVT-D 以及动态控制板的连接线。
- Ensure that the feeding cable protection devices are rated appropriately. 确保馈线电缆保护装置的可靠性
- Check that the DYNACOMP cooling fans are free running. 检查 DYNACOMP 的冷却风扇是否运转灵活

## 11.3 Step 2: Auxiliary voltage rating and phase rotation check 第 2 步: 辅助额定电压及相序的检查

- When optional auxiliary transformer is used, check if its tap setting corresponds to actual network (the auxiliary transformer is normally delivered properly configured). If

not, adjust the tap setting. 当选用辅助变压器时，应检查变压器的抽头接线是否与电网相符（辅助变压器通常在出货前已设置完成）。若不符合要求，可重新设置。

The auxiliary transformer (option) is located at the top of the DYNACOMP (see [Figure 13](#)). Ensure that the DYNACOMP is isolated (preferably upstream) before adjusting the transformer tap setting. 该辅助变压器（选件）被安排在 DYNACOMP 的顶部（见图 13）。在进行变压器抽头变更设置时，请确保 DYNACOMP 与上游电网分离开。



**WARNING: The DYNACOMP is able to operate on networks where the supply voltage is up to 10% higher (including harmonics but not transients) or 10% lower than the equipment rated voltage. Since operation at the upper limits of voltage and temperature may reduce its life expectancy, the DYNACOMP should not be connected to systems for which it is known that the overvoltage will be sustained indefinitely. Auxiliary circuits are designed to operate in a +/- 10% range of the equipment nominal auxiliary voltage (230 Vrms, internally derived). Excessive (auxiliary) voltage levels may lead to DYNACOMP damage.**  
警告：DYNACOMP 可工作在电网电压，超过额定电压 10%或更高（包含谐波成份，但不包含瞬变电压），或低于额定电压 10%的地方。如果 DYNACOMP 长期工作在超压的情况下，会因温度升高影响设备的使用寿命。辅助电压可工作在额定 230V±10% 范围内，超出此范围可能会损坏 DYNACOMP

**WARNING: The tap setting of the auxiliary transformer's primary should be adapted according to the network voltage to avoid a too high or too low auxiliary voltage. If the tap setting for your network voltage is not available, then choose a tap just above the network voltage present (e.g. for 390V network choose 400V tap setting). Excessive (auxiliary) voltage levels will lead to DYNACOMP damage.**警告：辅助变压器抽头的设置，应符合电网电压要求，避免电压过高或过低。如果抽头不符合你当地电网电压，那应选择高一档的电压抽头（如 390V 电网则选取 400 抽头）辅助电压超高将会导致 DYNACOMP 损坏

The voltage phase rotation at power terminals must be clockwise (L1 (R, U) -> L2 (Y, V) -> L3 (B, W) -> L1 (R, U)). 电源端子的电压相序必须是顺时针 L1 (R, U) -> L2 (Y, V) -> L3 (B, W) -> L1 (R, U)。

**WARNING: Applying voltage to the DYNACOMP for the phase rotation check may only be done after ensuring that the network voltage level is acceptable for the DYNACOMP operation.**警告：相序核对完成后给 DYNACOMP 供电，并确保电源电压是在 DYNACOMP 允许范围内。

When checking the phase rotation with a phase rotation meter on the DYNACOMP power terminals, ensure that the auxiliary fuse box is open during the measurement process. 当利用相序表在 DYNACOMP 电源接线端子上测量相序，应确保辅助电源保险盖处于打开状态。

**WARNING: In a multi-cubicle DYNACOMP configuration, care must be taken to connect cubicles identically (same individual phases and same phase rotation).警告：多单元配置成的 DYNACOMP 中，应对这些相同单元进行细致连接（如单相和相序）**

In normal operation the voltage phase rotation of a master cubicle is not clockwise, the Dynacontrol boards will refuse to switch ON the steps. The alarm status LED will blink rapidly (see Section 10.2.2 ). 如果在正常操作时，主单元的电压相序不是顺时针方向。动态控制板将无法运行。警报状态灯将快速地闪烁（见 10.2.2 部分）

### 11.4 Step 3: Setting of Dynacontrol boards 第三步:动态控制板的设置

- Cubicles must be connected with the CAN interconnection cable (see [Chapter 7](#)). 单元采用 CAN 通信电缆进行互连(见第 7 章)

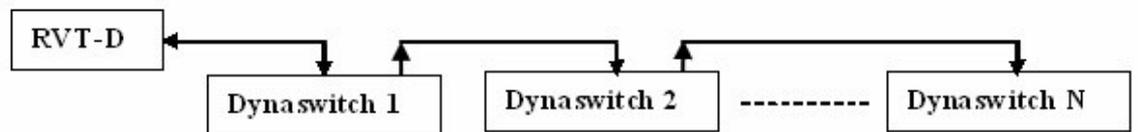


Figure 57: Multi drop CAN interconnection between the RVT-D and Dynacontrol boards RVT-D 和 Dynacontrol 连接示意图

- Check the configuration dip switches of the Dynacontrol boards to determine their CAN addresses. Depending on the position of the Dynaswitch in the cubicle, the CAN address associated to this step will be allocated as described below. 检查动态控制板上用于设置 CAN 地址的 DIP 拨码开关，根据动态开关在单元中所处的位置决定。与地址分配有关内容在下章进行说明。
- If the DYNACOMP consist of multiple cubicles the CAN address should be increased from the 1st cubicle to the last one and the dipswitches will be programmed accordingly. 如果 DYNACOMP 是由多个单元组成的，CAN 地址将从第一个递增到最后一个。因此需对 DIP 拨码开关进行相应设置。

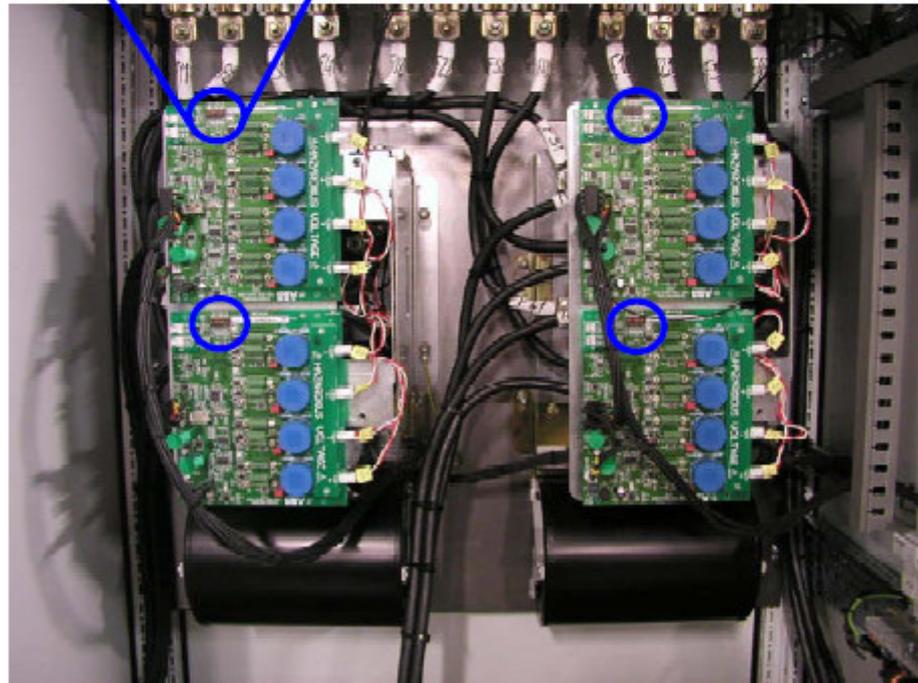
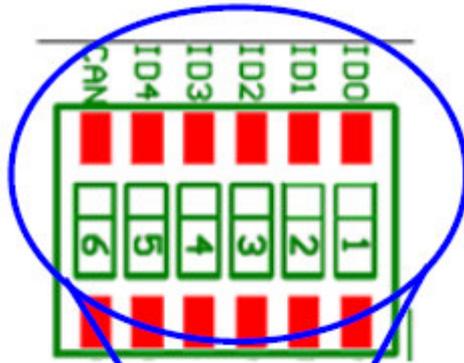


Figure 58: Dipswitches settings Dipswitch 设定

The number and switch position should be programmed, see Dynaswitch manual 该开关位置及设置，详见动态开关手册

- 1 means switch ON 1 表示开关“开”
- 0 means switch OFF 0 表示开关“闭”
- The switch nr 6 (CAN) should be ON (1) only for the last Dynacontrol board to determine the end of CAN bus. 只有最后一个动态控制板方可把（CAN）开关置 1。这表示该板为最后一个站点。

For more information about the DIP switches configuration, refer to [Section 10.2.2](#) Dynacontrol board 有关更多 DIP 开关设置的内容，参考 10.2.2 节(动态控制板)

## 11.5 Step 4: Energized the DYNACOMP

## 第四步：DYNACOMP 通电

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If the voltage rating and phase rotation check is successful, if the setting of the Dynacontrol board is properly performed and if the auxiliary transformer tap setting has been adapted to the network voltage, the power supply can be applied. 如果检查额定电压及相序都没问题。动态控制板也已妥当设置，并且辅助变压器的相应抽头被连接上，便可以送电。

Remarks: 备注:

If the auxiliary transformer option is not present, then the auxiliaries are fed through a direct 230Vac power supply. The user should apply the DYNACOMP power and auxiliary power supply separately. 如果用户没有选用辅助变压器，该辅助电源 230Vac 另外供给，用户必须把 DYNACOMP 主电源及辅助电源分开提供。

When the auxiliary fuse holder is closed and power is applied to the DYNACOMP, the DYNACOMP fans will start running; the Dynacontrol board and the RVT-D will start: 当辅助电源的保险手柄位于关的位置，DYNACOMP 便可得电，DYNACOMP 的排风扇开始运行，动态控制板和 RVT-D 也开始工作。

- The LEDs on the Dynacontrol board will be activated (see [Section 10.2.2](#)). 动态控制板上的 LED 指示灯被点亮（见第 10.2.2 节）
- The alarm status LED should blink at 4Hz with a duty cycle of 50%. If this is not the case please refer to the Dynaswitch manual. 警报指示灯的频率为 1HZ，占空比为 50%的方式闪烁。若不是这种状态，则参考动态开关手册

The four On/Off LED's should be switch off when no step is ON. 当开关步没有执行时，4 个亮/灭 LED 灯全被关闭。

The RVT-D will initialize and show the Welcome-screen and Manual Mode. RVT-D 初始化以及显示“欢迎”屏和手动模式



**WARNING: If the voltage level or phase rotation is incorrect, the installation should be corrected before starting to switch steps to avoid potential DYNACOMP malfunctioning and/or damage.** 警告：在启动执行开关步之前，如果有电压等级或相序不正确，应及时纠正。可避免 DYNACOMP 潜在的故障或（和）破坏。

## 11.6 Step 5: Basic commissioning parameters set up (using RVT-D) 使用 RVT-D 进行试车基本参数设置

In order to set up the basic commissioning parameters with the RVT-D, navigate to [Welcome/Settings/Commissioning]. An overview of the main menus of the RVT-D is given in [Section 8.3](#) 为了给 RVT-D 进行试车基本参数设置，通过菜单导航到（欢迎/设置/试车）RVT-D 主菜单的概述在 8.3 节中给出

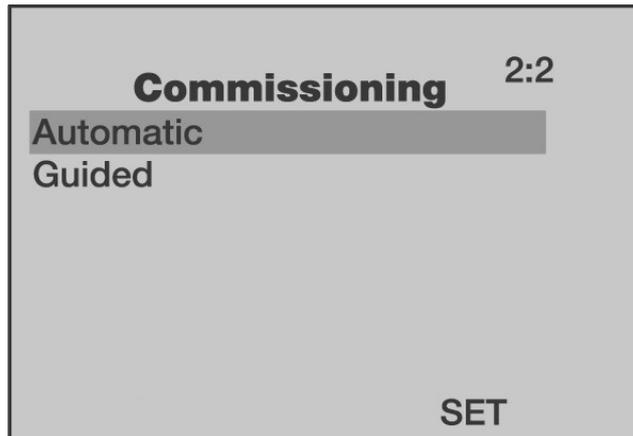


Figure 59: RVT-D commissioning menu RVT-D 初始化目录

If the window or some of its items are locked (i.e. a small  symbol or  symbol is present on the screen), the hardware and/or software lock has been engaged. Refer to the RVT-D manual for more information on these features and for guidelines on how to unlock the DYNACOMP setting menu's. 如果窗口或一些其它条款被锁定，（例如：一个小“钥匙”或“锁”符号出现在屏幕上）这说明硬件或软件的锁功能被激活，更多关于如何去解锁 DYNACOMP 设定菜单内容，请参阅 RVT-D 使用手册。

In the commissioning procedure, the following basic parameters have to be specified: 在试运行过程中，要求设置下列基本参数

- The network characteristics like the network nominal voltage 电网特性譬如电网额定电压
- The CT rating and connection 电流互感器 CT 的比率及接线
- The CAN control parameters and Node information CAN 控制参数及节点（站点）信息
- The steps power and sequence 每级的功率及顺序
- The type of control ( Open loop , Closed loop , External trigger) 控制类型（开环闭、闭环、外部触发）



**WARNING: Setting up a wrong DYNACOMP configuration may lead to DYNACOMP malfunction and/or damage.警告：错误的 DYNACOMP 设置可能导致 DYNACOMP 的故障或(和)损坏**



**WARNING: The secondary circuit of a loaded CT must never be opened. Otherwise extremely high voltages may appear at its terminals which can lead to physical danger or destruction of the CT.**警告：电流互感器 CT 的二次侧不允许被开路，否则在其端子上会产生极高的电压，可能导致人身危害或 CT 的破坏。

**WARNING: Before starting the commissioning, make sure that: The CTs have been connected to the DYNACOMP terminals All shorting links in the CT path have been removed (i.e. on the CTs, on the DYNACOMP CT terminals ...)**警告：在试车之前，必须确保 CT 已被连接到 DYNACOMP 的接线端子上，CT 回路上的所有短接线都移走(如：在 CT 上或 DYNACOMP 的 CT 接线端子)

### 11.6.1 Automatic commissioning procedure 自动试运行过程

The Automatic commissioning procedure needs to get the measurement of DYNACOMP current to monitor the switching of the various steps. The DYNACOMP current can be measured with an additional internal CT if a single connection point is available (see [Chapter 15](#), options). 自动试车过程中，需要获取 DYNACOMP 的电流测量值，并监控开关(管)的各种步骤。DYNACOMP 电流值可以通过内附 CT 测量获得。适用于单独连接点的方式。(见 15 章选件)

Advantages of DYNACOMP current measurement: DYNACOMP 电流测量的优点

- Measure the power of each step and recognize the switching sequence during automatic commissioning. 测量每一级的功率，并确认在自动试运行期间，开关(管)的工作顺序
- Have the complete measurement information to be displayed on the RVT-D screen in case of Open Loop control. 在开环控制模式下所测量到信息都将在 RVT-D 屏幕上显示出来
- Get the functionality of a closed loop power factor control while keeping the rapidity of an open loop control. 保留开环控制的快速反应,同时具备闭环功率因数的特征

Refer to the RVT-D manual for guidelines on how to enter data when using the Automatic commissioning procedure. The RVT-D will ask the user to enter the data of: 在进行自动试车过程中，RVT-D 要求用户录入下列数据请参考 RVT-D 使用手册。它将指导你如何录入数据：

- the load CT 负载电流互感器
- the DYNACOMP CT (if any) DYNACOMP 电流互感器（如果有的话）

- 
- the voltage transformer scaling if any 电压变压器的标定（如果有的话）
  - the CAN control enabling parameter CAN 控制启动参数
  - the Node type 节点类型
  - the type of control 控制类型



**WARNING: The "Node type" parameter defined the compensation type (capacitive or reactive). Indeed, the Dynaswitch allows switching 3 phase or single phase loads as well as capacitive or reactors load. It is important to select the parameter according the load actually connected. Avoiding doing so may cause the destruction of some switches. This parameter is a factory setting and can not be changed.**警告：节点类型参数是由补偿类型决定的（电容性或电抗性）。实际上，动态开关允许三相负载和单相负载的切换。以及电容性负载和电抗性负载的切换。为避免可能引起部分开关(管)的破坏，根据负载的实际连接，进行参数的选择，这参数为工厂设置参数，不许更改。这一点是很重要的。

Then the RVT-D will switch ON each step to measure the reactive power available and the switching sequence. 为了去测量有效无功功率值及开关动作顺序，RVT-D 的开关(管)将在每个级都会被打开。

### 11.6.2 Guided commissioning procedure 试车步骤指南

This commissioning procedure can be performed for all DYNACOMP configurations (whatever there is or not an optional additional CT inside the DYNACOMP). 试车的步骤可根据 DYNACOMP 所有设置执行(不管 DYNACOMP 里面是否附带 CT)

Refer to the RVT-D manual to know how to enter data when using the Guided commissioning procedure. The RVT-D will ask the user to enter the data of: 使用试车步骤指南时，可参考 RVT-D 使用手册，去了解如何录入数据。RVT-D 将告诉用户录入以下数据。

- the load CT 负载电流互感器 CT
- the phase shift introduced by the measurement connections, depending on the which phases are used for voltage and current measurement 通过测量连接，导入相位移，这主要取决于被测量相的电压和电流量
- the DYNACOMP CT (if any) DYNACOMP 互感器（如果有的话）
- the type of DYNACOMP, single or three phase DYNACOMP 的类型，单相还是三相
- the voltage transformer scaling if any 电压变压器的标定（如果有的话）

- the nominal voltage 额定电压值
- the CAN control enabling parameter CAN 控制启动参数
- the Node type 节点（终点）类型
- the switching sequence 开关切换顺序
- the reactive power of the smallest step 最小步阶的无功功率值
- the type of control 控制类型
- the target power factor 目标（设定）功率因数

### 11.6.3 Manual commissioning 手动试运行

All these settings can of course be manually defined with the Manual setting mode. Please refer to the RVT-D operating manual to know how to change parameters. 手动设定模式下，所有的设定过程都可以定义。详细请参照 RVT-D 使用手册，了解如何修改参数。

## 11.7 Step 6: Before starting the DYNACOMP 第六步：启动 DYNACOMP 之前

After commissioning the RVT-D, basic parameters set-up is now defined. Depending on the application, the RVT-D may require other advanced parameters. RVT-D 试车完成后，基本参数的设定已建立。为进一步应用，RVT-D 还需设置一些更为高级的参数。

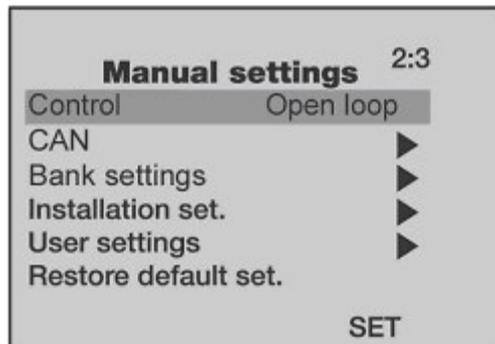


Figure 60: Manual settings 手动设定

- For adjusting the CAN parameters, go to [/Welcome/Settings/Manual settings/CAN]. 调整 CAN 参数，可从以下路径进入
- For adjusting or reviewing the DYNACOMP main parameters, go to [/Welcome/Settings/Manual settings/Bank settings]. 调整或读取 DYNACOMP 主参数，可由以下路径进入
- For adjusting or reviewing the installation related parameters, go to [/Welcome/Settings/Manual settings/Installation settings]. 调整或读取相

关参数，可由以下路径进入 [Welcome/Settings/Manual settings/Installation settings]

- For adjusting or reviewing the PF or Vdrop target, go to [Welcome/Settings/Manual settings/User settings]. 调整或读取目标 PF 或电压降可由以下路径进入
- For adjusting or reviewing the Protections and Alarm features, go to [Welcome/Settings/Manual settings/Bank settings/Protections]. 调整或读取保护及警报特性，可由以下路径进入
- For adjusting or reviewing the Event logging, go to [Welcome/Measurements/Event logging]. 调整或读取事件记录，可由以下路径进入

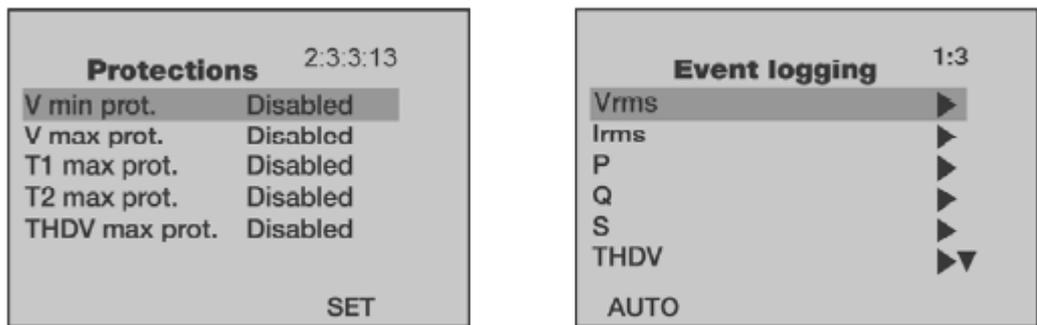


Figure 61: Protections and event logging 保护和事件记录

For more information about manual settings, refer to the RVT-D installation and operating instruction manual. 更多手动设置的内容，请参考 RVT-D 安装及操作使用说明书

## 11.8 Step 7: Start the DYNACOMP in Manual Mode 第七步：DYNACOMP 手动模式运行

The DYNACOMP should be set in the Manual Mode to manually switch each of the available steps. 将 DYNACOMP 设置在手动模式，手动控制每组电容的投切

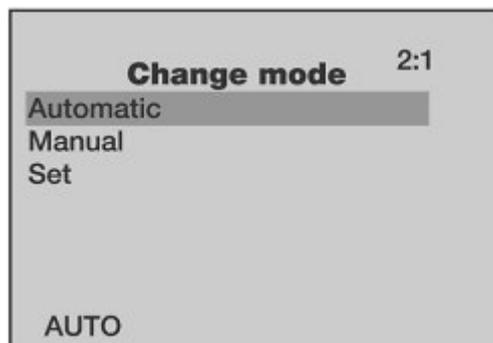


Figure 62: Change mode 改变模式

- 
- For adjusting the Mode into Manual Mode, go to [Welcome/Settings/Change mode/Manual]. 调整模式进入手动模式由以下路径进入
  - To switch ON a step, go to [Welcome/Measurement/Overview/Switch ON 1 step]. 手动切换某一步为“合”状态，由以下路径进入
  - To switch OFF a step, go to [Welcome/Measurement/Overview/Switch OFF 1 step]. 手动切换某一步为“关”状态，由以下路径进入

For each step actually switched ON, it is recommended to check the following things:  
如果每步已被切换到开状态，建议核查以下事项：

- The RVT-D indicate the output that is switched on RVT-D 已指明某个回路已开通
- The corresponding Dynaswitch is turned ON (cf ON/OFF LED's of the Dynacontrol boards) 检查相应的动态开关是否已被打开(参照动态控制板上 LED 的指示灯亮/灭情况)
- The current step is effectively delivered. 检查相应的补偿电流是否正确

Remarks: 备注

If any fault message appears, the DYNACOMP has encountered a fault that needs to be corrected before the DYNACOMP can be started in Automatic Mode. Refer to [Chapter 14](#) for troubleshooting the problem. 如果有错误信息出现,表明 DYNACOMP 遇到故障需进行处理，之后 DYNACOMP 才能开始自动模式。参考第 14 章，故障排除。

## 11.9 Step 8: Start the DYNACOMP in Automatic Mode 第八步：用自动模式启动 DYNACOMP

Once previous first 7 steps have been achieved, actual DYNACOMP performances can be checked. Then automatic mode should be selected. 一旦完成以上的七步，说明 DYNACOMP 实际性能已检查完毕，可以选择自动模式。

For selecting the Mode into Automatic Mode, go to **选择自动模式可由以下路径进入：**

[Welcome/Settings/Change mode/Automatic].

The DYNACOMP is now ready to operate according to the selected control mode, see [section 11.6](#) (open loop, closed loop or external trigger). 根据所选择的控制模式 DYNACOMP 已进入准备运行状态。见 11.6 节(开环、闭环、或外部触发)

Remarks: refer to [Chapter 14](#) for troubleshooting problems. 备注：参考第 14 章故障排除

In order to check the DYNACOMP performance, it is necessary to monitor different physical values (U, I, P ...). This will help to better adjust some parameters to get better reaction time and optimal performances. 为了检查 DYNACOMP 的性能，又必

要用其他的方式监控不同的物理量(电压、电流、功率)，这有助于更好地调整参数，以便获取更好的反应时间及优化性能。

### 11.9.1 Closed loop control 闭环控制

Closed loop control is typically selected when the main targets are both to reduce the reactive power and to reach a target power factor. DYNACOMP performances (e.g. the PF) can be checked with another power quality measurement device. 减少无功功率并能达到目标(设定)的功率因数，采用闭环控制是一种经典的选择。DYNACOMP 的性能(如 PF)，可以采用其它电力检测设备进行校验。

Adjusting the target power factor (User settings) will optimize the DYNACOMP performances. 通过调整目标功率因数(用户设定值)，可以优化 DYNACOMP 的性能

It is also important to verify that the operating behaviour is stable. Indeed, if the Installation settings (Istep,  $\Delta$ Istep, Hysteresis parameters) are not well adjusted, the DYNACOMP may enter in oscillation (e.g. if power steps exceeds the requested accuracy). 核实 DYNACOMP 的运行状况是否稳定，是十分重要的事情。实际上如果结构设置(步电流、步电流差值、回差参数)未被妥当设置，DYNACOMP 可能进入振荡状态(如,步长超出要求的精度范围)

[Figure 29](#) gives an example of some important setting parameters. 图 29: 给出一些重要参数的设置例子

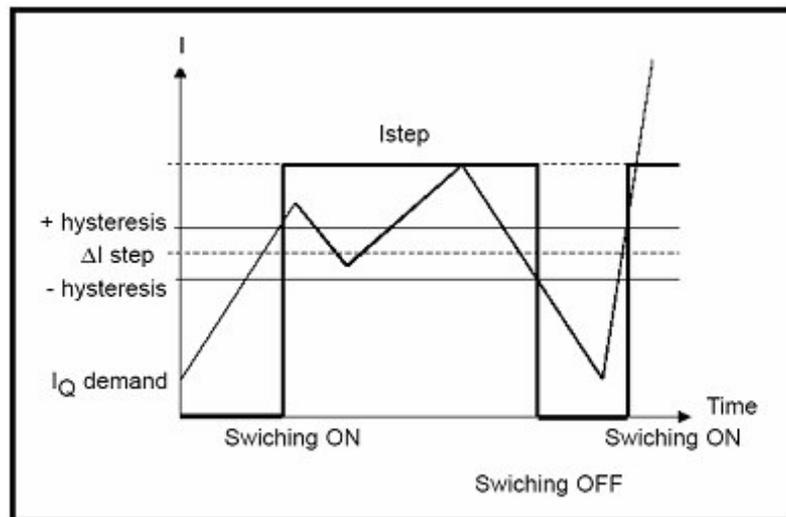


Figure 63: Example of closed loop expected performances 闭环控制原理举例

### 11.9.2 Open loop control 开环控制

Open loop control is used when a very fast response time is expected (e.g. fast varying loads or flicker problems). 有快速响应时间要求的场合,应采用开环控制方式(例如:快速变化负载或瞬变电压的问题)

Main parameters to adjust: 主要参数调整

- 
- Vdrop R/X or target power factor in User settings 用户设置下面的“电压降”和目标“功率因数”
  - Istep,  $I_{\Delta}$ step, Hysteresis, Qspeed, Sequence strategy parameters in Installation settings “步长电流” “步长电流总值” “回差值” “无功速度” “顺序参数” 等都在结构设置下面
  - Switch delay in Bank settings 在组别设置下面的参数有“开关延迟”

A power quality measurement device must be used to check the performances. So, it is recommended to compare: 使用电能质量表对相关性能进行核对, :

- The reactive power of the network with and without the DYNACOMP 带和没带 DYNACOMP 时的电网无功功率
- The line current in the installation with and without the DYNACOMP 装上和没装上 DYNACOMP 时的线电流
- The network voltage fluctuations with and without the DYNACOMP 装上和没装上 DYNACOMP 时的电网电压波动值
- The available apparent power with and without the DYNACOMP 装和没装上 DYNACOMP 时整个装置的有效功率值

Remark: 备注

With voltage increase, some parameters adjustments may be necessary if unexpected instabilities (Istep,  $\Delta$ Istep, Hysteris parameters) arise. 为了确保系统稳定运行, 随着电压升高, 一些参数需要调整(如步电流、步差值、回差参数)等。

### 11.9.3 External trigger control 外部触发控制

External triggering signal can be connected through to 2 programmable digital inputs. 外部触发信号连接到 2 个输入端上, 他们可以编程设定

These digital inputs (15-24Vdc) may be configured to switch ON or to switch OFF the DYNACOMP with the rising edge, or the falling edge. Some delay may also be adjusted. For instance it is possible to introduce some programmable delays between the edge on input 1 and the switching ON, as well as between the edge of input 2 and the switching OFF, see [Figure 64](#). 随着 DYNACOMP 上升沿及下降沿的变化(15 至 24V 直流电压)数字输入端, 可控制开关(管)的开和关。例如:可能在信号上升沿和开关(管)打开之间, 以及信号下降沿和开关(管)关闭之间, 引入可编程来决定时间延迟。见图 64

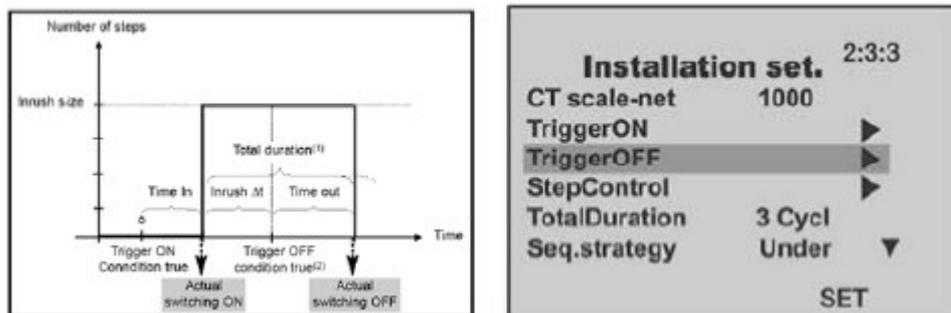


Figure 64: External triggering control settings 外部触发控制设置

Obviously, external trigger mode is only possible if trigger signal exists. 显然，只有具备触发信号，才能使用外部触发模式

Highest performances are reached when: 在下列情形下，系统性能已达到最大值

- The load demand represents an entire number of network periods f 负载要求已达到电网总周期数
- The load firing angle is fixed. 负载触发角度已被固定

It is possible to adjust the triggering control to many load shapes and load speeds. 为了去满足更多负载类型及负载速度，可以重新调整触发控制方式

**Please do not forget to fill in the commissioning report: may be very useful afterwards. 请别忘填写试车报告，这对以后或许非常有用**

## 11.10 Commissioning report 试车报告

The commissioning report must be filled during the commissioning. 在试车过程中，必须填写该报告

Before installation and operation of the DYNACOMP, read the relevant sections of the Instruction Manual. 在安装以及操作 DYNACOMP 之前，须先阅读本使用手册的相关章节

### 11.10.1 Identification 鉴定

<b>DYNACOMP type<sup>(a)</sup></b> DYNACOMP 类型		
<b>Global ratings<sup>(a)</sup></b> 全部额定值	<b>Grid nominal voltage (V)</b> 电网额定电压(V)	
	<b>Total power (kvar)</b> 总功率(视在功率) kvar	

	<b>Network frequency (Hz) 电网频率(HZ)</b>			
	<b>Article code 产品编号</b>			
	<b>Number of steps 总步数</b>			
<b>Common cable entry cubicle</b> 共用电缆进线柜	<b>Present/not present 有/没有</b>			
<b>Unit ratings/serial number<sup>(b)</sup></b> 单元额定值/系列号		<b>Rating (...x... kvar)</b> 额定值	<b>Serial number</b> 系列号	<b>Article code<sup>(a)</sup></b> 产品
	<b>Unit 1 (M)</b> 单元 1			
	<b>Unit 2</b>			
	<b>Unit 3</b>			
	<b>Unit 4</b>			
	<b>Unit 5</b>			
	<b>Unit 6</b>			
	<b>Unit 7</b>			
	<b>Unit 8</b>			
<b>Software version<sup>(c)</sup></b> 软件版本	<b>RVT-D software PVT-D 软件</b>			
<b>Installation location</b> 安装位置				
Remarks: 备注:  (a) See main identification tag located on the master cubicle door. 详见位于主单元门上的主识别标签  (b) See identification tag located on each cubicle door. 详见位于每个单元门上的识别标签  (c) Information available on RVT-D [/Welcome/About RVT-D]. RVT-D 的有效信息,可从此路径下获得/Welcome/About RVT-D]				

### 11.10.2 On-site inspection 现场验收

After transportation and installation 运输以及安装完成以后

<b>Ambient conditions</b> 环境情况	<b>OK/NOK</b>
• Check the ambient temperature (< 40 °C) 检查环境温度，应低于 40 °C	
• Check the installation altitude (< 1000 m) 检查安装的海拔高度，应小于 1000 米	
• Check the ventilation (room and enclosure) 检查通风(室内或箱体)	
• Ensure that no sources of conductive dust are present 确保现场没有灰尘源	
<b>Internal connections<sup>(a)</sup></b> 内部连接	
x Disconnect the DYNACOMP from the supply including the auxiliary circuit (disconnection recommended by upstream protection) 断开 DYNACOMP 的电源,包括辅助电源(建议断开上游的保护装置)	
• Verify and (if necessary) change auxiliary transformer primary tap setting to correspond to network nominal voltage rating <sup>(b)</sup> 核对并(如果需要)改变辅助变压器一次侧抽头设置,以符合电网的额定电压	
• Wiring of main and auxiliary circuit 接上主和辅助线路	
• Tightness of all electrical connections 上紧所有的电气连接端子	
• Connectors properly plugged in 接好各个连接插件	
• Fixation of components 固定好所有的部件	
x Clearances 清洁卫生	
• Cooling fans running freely 冷却风扇运行良好	
• RVT-D power supply connection RVT-D 电源连接	
• RVT-D CAN Bus connection RVT-D CAN 总线连接	
• Earth interconnection between different units 不同单元之间的地线互联	
• CAN interconnection between different units CAN 各个站（节）点之间的通信互连	
x Earth interconnection 地线连接	
<b>Installation<sup>(a)</sup></b> 安装	
• Check cross-sections of power supply cables (L1-L2-L3)检查 (L1-L2-L3)电源电缆的横截面积	
• Check cross-section of protective conductors (PE) (> = 16 mm <sup>2</sup> ) connected to each cubicle and between cubicles. 检查连到每个单元之间的保护导线，(PE)的横截面积大于或等于 16 mm <sup>2</sup>	

• Check tightness of conductor fixations 检查导线是否上紧，并固定好	
• The material of busbars, terminals and conductors must be compatible (corrosion) 母线排,接线端子,导线必须相互兼容(防腐蚀)	
• Check the setting and operation of the protective apparatus 检查保护设施的操作及设置是否正常	
• Check rated current of the power supply cable fuses (if applicable) 检查电源线保险丝的额定电流(如果有使用的话)	
• Check the voltage in accordance with the specification 检查电压是否符合具体的要求	
• Check the phase rotation order at the DYNACOMP power terminals (with DYNACOMP auxiliaries off) (clockwise) <sup>(b)</sup> (only for 3-phase) 检查 DYNACOMP 电源端子的相序(关掉辅助电源)应为顺时针方向 (适用于三相)	
• Check visually the current transformers 目视检查电流互感器	
-Wiring (k - l) 接线(k - l)端	
-Ratio 比率	
-Installed at the right side (see <a href="#">Section 7.10</a> ) 安装在右边(见 7.10 节)	
-Check external trigger connections 检查外部触发连接	
• Remove all jumpers of all current transformers (CTs and Summing CTs) 移去所有的电流互感器跳线(CTS 和叠加式 CTS)	
• Remove all jumpers of the CT connection terminal in the DYNACOMP itself (if present) 移去 DYNACOMP 上面连接 CT 端子的所有跳线(如果有的话)	
Remarks: 备注: (a) Refer to Section 11.2 参考 11.2 节 (b) Refer to Section 11.3 参考 11.3 节	

### 11.10.3 Dynaswitches configuration 动态开关设置

Dynacontrol board connections 动态控制板连接	OK/NOK
• Check the presence and tightness of all thyristor gate connections 检查现有的可控硅门极连线，并上紧	
• Check the presence and tightness of the 24Vdc and CAN connections 检查现有 24V 电源及 CAN 连线，并上紧	
• Check the presence and tightness of Fuses and thermal protection 检查	

现有和保险丝及热保护，并上紧					
<b>Setting of Dynacontrol boards dipswitches 设备动态控制板上的拨码开关</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
-Setting of dip switches of Dynacontrol board 1 设置动态控制板上 DIP 拨码开关板 1					
-Setting of dip switches of Dynacontrol board 2 设置动态控制板上 DIP 拨码开关板 2					
-Setting of dip switches of Dynacontrol board 3 设置动态控制板上 DIP 拨码开关板 3					
-Setting of dip switches of Dynacontrol board 4 设置动态控制板上 DIP 拨码开关板 4					
-Setting of dip switches of Dynacontrol board 5 设置动态控制板上 DIP 拨码开关板 5					
-Setting of dip switches of Dynacontrol board 6 设置动态控制板上 DIP 拨码开关板 6					
-Setting of dip switches of Dynacontrol board 7 设置动态控制板上 DIP 拨码开关板 7					
-Setting of dip switches of Dynacontrol board 8 设置动态控制板上 DIP 拨码开关板 8					
-Setting of dip switches of Dynacontrol board 9 设置动态控制板上 DIP 拨码开关板 9					
-Setting of dip switches of Dynacontrol board 10 设置动态控制板上 DIP 拨码开关板 10					
-Setting of dip switches of Dynacontrol board 11 设置动态控制板上 DIP 拨码开关板 11					
-Setting of dip switches of Dynacontrol board 12 设置动态控制板上 DIP 拨码开关板 12					
-Setting of dip switches of Dynacontrol board 13 设置动态控制板上 DIP 拨码开关板 13					
-Setting of dip switches of Dynacontrol board 14 设置动态控制板上 DIP 拨码开关板 14					
-Setting of dip switches of Dynacontrol board 15 设置动态控制板上 DIP 拨码开关板 15					
-Setting of dip switches of Dynacontrol board 16 设置动态控制板上 DIP 拨					

码开关板 16					
-Setting of dip switches of Dynacontrol board 17 设置动态控制板上 DIP 拨码开关板 17					
-Setting of dip switches of Dynacontrol board 18 设置动态控制板上 DIP 拨码开关板 18					
-Setting of dip switches of Dynacontrol board 19 设置动态控制板上 DIP 拨码开关板 19					
-Setting of dip switches of Dynacontrol board 20 设置动态控制板上 DIP 拨码开关板 20					
-Setting of dip switches of Dynacontrol board 21 设置动态控制板上 DIP 拨码开关板 21					
-Setting of dip switches of Dynacontrol board 22 设置动态控制板上 DIP 拨码开关板 22					
-Setting of dip switches of Dynacontrol board 23 设置动态控制板上 DIP 拨码开关板 23					
-Setting of dip switches of Dynacontrol board 24 设置动态控制板上 DIP 拨码开关板 24					
-Setting of dip switches of Dynacontrol board 25 设置动态控制板上 DIP 拨码开关板 25					
-Setting of dip switches of Dynacontrol board 26 设置动态控制板上 DIP 拨码开关板 26					
-Setting of dip switches of Dynacontrol board 27 设置动态控制板上 DIP 拨码开关板 27					
-Setting of dip switches of Dynacontrol board 28 设置动态控制板上 DIP 拨码开关板 28					
-Setting of dip switches of Dynacontrol board 29 设置动态控制板上 DIP 拨码开关板 29					
-Setting of dip switches of Dynacontrol board 30 设置动态控制板上 DIP 拨码开关板 30					
-Setting of dip switches of Dynacontrol board 31 设置动态控制板上 DIP 拨码开关板 31					
-Setting of dip switches of Dynacontrol board 32 设置动态控制板上 DIP 拨码开关板 32					
-Setting of CAN dip switch of last Dynacontrol board 设置最后一块动态控制					

板上 CAN: DIP 拨码开关板					
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#### 11.10.4 Enetgize he DYNACOMP

#### 激活 DYNACOMP

• Close auxiliary circuit fuse box 合上辅助电路保险盖	
• Close DYNACOMP door 关上 DYNACOMP 单元门	
• Apply voltage to the DYNACOMP (restore upstream protection) 给 DYNACOMP 送电(恢复上游保护)	
• Dynacontrol boards LEDs light up and blink 动态控制板上的 LED 灯点亮或闪烁	
• RVT-D booting and showing 'Welcome' screen RVT-D 启动, 并在屏幕上显示“欢迎”	
x Fan(s) start(s) running' 风扇开始转动	

#### 11.10.5 Basic commissioning parameters set up 基本试车参数的设置

Program RVT-D <sup>(a)(b)</sup> RVT-D 编程	
x CT settings CT 设置	
CT scale-net <b>CT 有效定标</b>	
Phase shift 相位数	
x DYNACOMP CT settings DYNACOMP CT 设置	
CT scale cap <b>CT 容量定标</b>	
Invert lcap 转换电流容量	
• DYNACOMP connection parameters DYNACOMP 连接参数	
-1Ph/3Ph 单相/三相	
Vscaling 电压定标	
-Vnominal 额定电压	
x CAN settings CAN 设置	
CAN control CAN 控制	

Node Type 节点(站点)类型	
Sequence 顺序	
-Qstep 无功功率步	
-Control type (Closed loop ; Open loop ; External trigger) 控制类型(闭环、开环、外部触发)	
Target cos $\phi$ 目标(用户设定) cos $\phi$ 值	
Bank settings 组别设置	
Remarks: (a) Refer to RVT-D manual for more information on this topic. (a)与主题相关的信息, 参考 RVT-D 使用手册 (b) Cf RVT-D [/Welcome/Settings/Commissioning]备注: (b) Cf RVT-D 可由此路径获得[/Welcome/Settings/Commissioning]	

### 11.10.6 11.10.6 Testing:Manual mode 11.10.6 测试: 手动模式

• Apply the voltage on the DYNACOMP 给 DYNACOMP 送电	
• Set the RVT-D in Manual Mode 设置 RVT-D 为手动运行模式	
• Switch on and off step by step by pushing buttons “Switch On 1 step” and “Switch Off 1 step” 逐步按下开关 “开” 和 “关” 按钮, 试测第一步的开关情况	
• On the controlled step 按步进行控制	
-Check the 4 red LED's indicating a request of conduction on the thyristor gate 检查可控硅门极, 触发导通的四个红色 LED 指示灯	
-Measure the current in each phase (I = Irms / STEP) 测量每相的电流值	
-Check current waveform in each phase (it must be sinusoidal) 检查每相的电流波形(必须为正弦波)	

### 11.10.7 Testing:Automatic mode 11.10.7 测试：自动模式

• Apply the voltage on the DYNACOMP 给 DYNACOMP 送电	
• Remove all jumps of: 移除所有的跳线	
-All current transformers (CT's and SCT's) 所有电流互感器	
-The jumper of the CT connection terminal in the DYNACOMP itself DYNACOMP 连接 CT 端子的所有跳线	
• If the DYNACOMP control is “Closed loop”, adjust the following parameters 若 DYNACOMP 控制方式是“闭环”，调整以下参数	
- Istep 步长电流值	
-ΔIstep 步长电流差值	
- Hysteresis 回差值	
- Qspeed 无功响应速度	
- Sequence strategy 顺序方案	
- Vdrop R/X 电压降	
• If the DYNACOMP control is “Open loop”, adjust the following parameters 若 DYNACOMP 控制方式是“开环”，调整以下参数	
- Istep 步电流值	
-ΔIstep 步电流差值	
- Hysteresis 回差值	
- Qspeed 无功响应速度	
- Sequence strategy 顺序方案	
- Vdrop R/X 电压降	
• If the DYNACOMP control is “External trigger”, adjust the following parameters 若 DYNACOMP 控制方式是“外部触发”，调整以下参数	
- Trigger ON 触发打开	
- Start current 启动电流	
- Time in 触发开始时间	

- Trigger OFF	触发关闭	
-Time out	触发停止时间	
- Step Control	步控制	
- Total duration	总时间周期	
- Sequence strategy	顺序方案	
Inrush Size	脉冲幅度	
-Inrush $\Delta T$	脉冲时差	
- Istep	步电流值	
- $\Delta I$ step	步电流差值	
- Hysteresis	回差值	
- Qspeed	无功响应速度	
- Sequence strategy	顺序方案	
- Vdrop R/X	电压降	
• Fill in the appropriate table given here below 填写好下列所给表单		
• Verify the DYNACOMP operation 核对 DYNACOMP 的运行情况		
• Set RVT-D in "AUTO" automatic mode 设置 RVT-D 为 "AUTO" 自动模式		
• While the load is running 一旦带负载运行		
• on the DYNACOMP DYNACOMP 方面		
-check good operation 检测运行是否良好		
-no error message on the RVT-D RVT-D 上没有错误信息显示		
• measure if the target is reached ( $\cos \varphi$ ) 测量是否已达到目标值( $\cos \varphi$ )		
• measure voltage fluctuations 测量电压的波动		
• measure total current 测量总电流		
• measure reactive power reduction 测量无功功率是否下降		
• measure apparent power reduction 测量装备功率是否下降		

### 11.10.7 Selected parameters (RVT-D) 参数选择

RVT-D Parameters values / Open Loop Control RVT-D 参数值 / 开环控制

Bank settings 组别设置	Default value 缺省值
CT scale-cap CT 定标容量	
Invert Icap 变换电流容量	
V nom 额定电压	
V scaling 定标电压	
1Ph / 3Ph 单相/三相	
Q step 步无功量	
Sequence 顺序	
Outputs 输出	
Linear/circular 线性/圆形	
Reset Delay 复位延迟	
Protection levels: 保护等级	
V min prot. 最小电压保护	
V max prot. 最大电压保护	
T1 max prot. T1 最大温度保护	
T2 max prot. T2 最大温度保护	
THDV max prot. THDV 最大值保护	
Bank settings 组别设置	

Qspeed 无功响应速度	
Seq.strategy 顺序方案	
Phase shift	

相位移	
CT-net CT 有效值	
<b>User settings</b> 用户设置	<b>Default value</b> 缺省值
Target cos $\varphi$ 目标 cos $\varphi$	
V drop R/X 电压降	
Alarm: 警报	
Alarm delay 警报延迟	
Alarm rst delay 警报复位延迟	
Alarm cos $\varphi$ 警报 cos $\varphi$	

<b>I/O configuration</b> I/O 设置	<b>Default value</b> 缺省值
Temp. unit 温度.单位	
Contrast 对比亮度	
<b>Event logging</b> 事件记录	<b>Default value</b> 缺省值
Urms 有效电压值	
Irms	

有效电流值	
<b>P</b> 有功功率	
<b>Q</b> 无功功率	
<b>S</b> 视在功率	
<b>THDV</b>	
<b>THDI</b>	
<b>f</b>	
<b>f +</b>	
<b>Δ Q</b> 无功功率差值	
<b>Temp. 1</b> 温度 1-	
<b>Temp. 1 +</b> 温度 1+	
<b>Temp. 2</b> 温度 2-	
<b>Temp. 2 +</b> 温度 2+	

Print meas. 打印方式	Default value 缺省值
Repeat Print 重复打印	
Printer Repeat Delay 打印机重复延迟	
Installation settings	Default value

结构设置	缺省值
<b>CT scale-net</b> CT 有效定标值	
<b>Istep</b> 步电流值	
<b>ΔIstep</b> 步电流差值	
<b>Hysteresis</b> 回差值	

Bank settings 组别设定	Default value 缺省值
<b>CT scale-cap</b> CT 定标容量	
<b>Invert Icap</b> 变换电流容量	
<b>V nom</b> 额定电压	
<b>V scaling</b> 定标电压	
<b>1Ph / 3Ph</b> 单相/三相	
<b>Q step</b> 无功步阶	
<b>Sequence</b> 顺序	
<b>Outputs</b> 输出	
<b>Linear/circular</b> 线性/圆形	

<b>Switch delay</b> 开关延时	
<b>Reset Delay</b> 复位延时	
<b>Protection levels:</b> 保护等级	
<b>V min prot.</b> 最小电压保护	
<b>V max prot.</b> 最大电压保护	
<b>T1 max prot.</b> T1 最大保护	
<b>T2 max prot.</b> T2 最大保护	
<b>THDV max prot.</b> THDV 最大值保护	
<b>Bank settings</b> 组别设置	

<b>Qspeed</b> 无功响应速度	
<b>Seq.strategy</b> 顺序方案	
<b>Phase shift</b> 相位移	

<b>User settings</b> 用户设置	<b>Default value</b> 缺省值
<b>Target cos <math>\varphi</math></b>	

目标 $\cos \varphi$	
V drop R/X 电压降	
Alarm: 警报	
Alarm delay 警报延时	
Alarm rst delay 警报复位延时	
Alarm $\cos \varphi$ 警报 $\cos \varphi$	

I/O configuration I/O 设置	Default value 缺省值
Temp. unit 温度.单位	
Contrast 对比亮度	
Event logging 事件记录	Default value 缺省值
Urms 有效电压值	
Irms 有效电流值	
P 有功功率	
Q 无功功率	

S 视在功率	
THDV	
THDI	
f	
f +	
$\Delta Q$ 无功功率差值	
Temp. 1 - 温度 1-	
Temp. 1 + 温度 1+	
Temp. 2 温度 2-	
Temp. 2 + 温度 2+	

<b>Print meas.</b> 打印方式	<b>Default value</b> 缺省值
<b>Repeat Print</b> 重复打印	
<b>Printer Repeat Delay</b> 打印机重复延时	
<b>Installation settings</b> 结构设置	<b>Default value</b> 缺省值
<b>CT scale-net</b> CT 有效定标值	
<b>Istep</b> 步电流值	

<b>Δstep</b> 步电流差值	
<b>Hysteresis</b> 回差值	

RVT-D 参数值/外部触发控制

<b>Bank settings</b> 组别设置	<b>Default value</b>	<b>Trigger OFF:</b>		<b>I/O configuration</b> I/O 设置	<b>Default value</b> 缺省值
<b>CT scale-cap</b> CT 定标容量		<b>TriggerOFF</b>		<b>Temp. unit</b> 温度单位	
<b>Invert lcap</b> 变换电流容量		<b>Time Out</b>		<b>Contrast</b> 对比亮度	
<b>V nom</b> 额定电压		<b>StepControl:</b> 步控制			
<b>V scaling</b> 定标电压		<b>StepControl</b> 步控制		<b>Print meas.</b> 打印方式	<b>Default value</b> 缺省值
<b>1Ph / 3Ph</b> 单相/三相		<b>Istep</b> 步电流		<b>Repeat print</b> 重复打印	
<b>Q step</b> 无功步		<b>Δstep</b> 步电流差值		<b>Repeat-Delay</b> 重复延时	
<b>Sequence</b> 顺序		<b>Hysteresis</b> 回差值			
<b>Outputs</b> 输出		<b>Qspeed</b> 无功响应速度		<b>Event logging</b> 事件记录	<b>Default value</b> 缺省值
<b>Linear/circular</b> 线性/圆形		<b>Seq.strategy</b> 顺序方案		<b>Urms</b> 有效电压值	
<b>Reset Delay</b> 复位延时		<b>TotalDuration</b> 时间总周		<b>Irms</b> 有效电流值	

		期			
Protection levels: 保护等级		Phase shift 相位移		P 有功功率	
V min prot. 最小电压保护		CT-net CT-有效值		Q 无功功率	
V max prot. 最大电压保护				S 视在功率	
T1 max prot. T1 最大值保护		User settings 用户设定	Default value 缺省值	THDV	
T2 max prot. T2 最大值保护		Inrush Size 脉冲幅度		THDI	
THDV max prot. THDV 最大值保护		Inrush Δt 脉冲时差		f	
Bank settings 组别设置		Target cos φ 目标 cos φ		f +	
		V drop R/X 电压降		Δ Q	
Installation settings 结构设置	Default value	Alarm: 警报		Temp. 1 温度 1-	
CT scale-net CT 有效定标		Alarm delay 警报延时		Temp. 1 + 温度 1+	
Trigger ON: 触发器打开		Alarm rst delay 警报复位延时		Temp. 2 – 温度 2-	
TriggerON		Alarm cos φ		Temp. 2 + 温度 2+	

		警报 cos $\varphi$			
StartCurrent					
Time In					

11.10.8 11.10.9 Comments 11.10.9 注释

## 12. Operating instructions 操作说明书

### 12.1 What this chapter contains 本章概述

This chapter explains how to operate your DYNACOMP. It assumes that the DYNACOMP has been installed and commissioned (see previous chapters). The following operations are discussed: 本章主要阐述 DYNACOMP 的操作方法，假定 DYNACOMP 设备已经安装和调试完毕（见前面章节）情况下进行讨论。

- Starting and stopping the DYNACOMP DYNACOMP 的启动和停止
- Modifying the user requirements 按用户要求进行修改
- Changing the temperature unit 改变温度单位
- Changing the RVT-D contrast 改变 RVT-D 对比亮度
- Consulting DYNACOMP measurements 咨询 DYNACOMP 的方法
- Consulting DYNACOMP statistics and manufacturer data 咨询 DYNACOMP 统计的相关信息及制造数据

DYNACOMP behaviour on faults – retrieving error information DYNACOMP 的故障状况——错误信息的恢复

For practical additional information, please refer to RVT-D manual. 另外的实用信息，请参考 RVT-D 使用手册

DYNACOMP may also be operated through Modbus communication. Please refer to [Chapter 9](#). DYNACOMP 也可通过 Modbus 总线通信进行操作，请参照第 9 章



**WARNING: High AC and DC voltage may be present inside DYNACOMP cubicle(s). Do not touch any DYNACOMP parts unless you have ascertained that they do not carry dangerous voltage levels.** 警告：在 DYNACOMP 的单元内

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可能存在直流高压电，请不要触碰到 **DYNACOMP** 的任何部件。除非你能够确定它已不带电！

## 12.2 Starting and stopping the DYNACOMP 启动及停止 DYNACOMP

After the commissioning, the DYNACOMP is normally ready to operate. Verify that power supplies are live and set the automatic mode. 试车完成后，DYNACOMP 通常可运行操作，核查是否已通电及设置为自动模式

- For selecting the Automatic Mode, go to [Welcome/Settings/Change mode/Automatic]. 选择自动模式，按以下路径：[Welcome/Settings/Change mode/Automatic]

The DYNACOMP will now start delivering reactive power according the selected mode (open loop, closed loop, or external trigger). DYNACOMP 已将根据您选择的模式(开环、闭环或外部触发)，开始提供无功功率

If the DYNACOMP has to be stopped, Manual Mode should be selected. 如果 DYNACOMP 被中断,您可选择手动模式

For changing into Manual Mode, go to [Welcome/Settings/Change mode/Manual]. 选择手动模式,按以下路径:[Welcome/Settings/Change mode/Manual].

## 12.3 Modifying the user requirements 根据用户要求修改

If locks haven't been engaged, the user can change the customer settings. Settings can be changed from [Welcome/Settings/Manual settings.].如锁功能未能被激活，可修改用户设置。该设置可从以下路径去改变：（欢迎/设置/手动设置）

The user requirements can be divided in two categories: 用户的要求基本可分为以下两种类型：

- Settings related to DYNACOMP mode, reactive power requirements and voltage drop control setting. 与 DYNACOMP 模式相关设定，无功功率要求及电压降控制设定。
- Settings related to alarms, and events logging. 与警报相关设定，及事件的记录

Advanced user requirements have to be set from the 'User settings' menu ([Welcome/Settings/User settings]). 高级用户设定可从以下路径进行（欢迎/设置/用户设置）

Refer to the RVT-D installation and operating instruction for detailed information on these topics. 与此相关，更为详细的内容可参考 RVT-D 安装及操作使用说明

**It is recommended that the advanced functions be set up by a skilled commissioning engineer.高级功能的设置，建议由较高**

技术水平的调试工程师执行

## 12.4 Changing the temperature unit and RVT-D contrast 温度单位及 RVT-D 对比亮度的更改

The temperature unit can be changed ( $^{\circ}\text{C}$  to  $^{\circ}\text{F}$  or vice versa), go to [Welcome/Settings/I/O Configuration/Temp unit]. 温度单位能够在“摄氏”和“华氏”之间进行切换。可由以下路径进入 Welcome/Settings/I/O Configuration/Temp unit].

The RVT-D contrast can be changed from [Welcome/Settings/ I/O Configuration/Contrast]. RVT-D 的对比亮度可从以下路径进行修改 **Welcome/Settings/ I/O Configuration/Contrast**

## 12.5 Access to DYNACOMP measurements 访问 DYNACOMP 的测量值

DYNACOMP measurements can be consulted from [Welcome/Measurements].DYNACOMP 测量值可从以下路径获得(欢迎/测量值)

Designation	Unit	Description	Range (1)	Accuracy	Maximum Value Displayed
<b>Voltage</b>					
Vrms	V	Rms Voltage	Up to 690Vac	$\pm 1\%$	100 kV
V1	V	Rms voltage at the fundamental frequency	Up to 690Vac	$\pm 1\%$	100 kV
Frequency	Hz	Fundamental voltage frequency	45Hz - 65Hz	$\pm 0.5\%$	40Hz - 70 Hz
THDV	%	Total harmonic voltage distortion on voltage	0 - 300%	$\pm 1\%$	300 %
V harm. table		Voltage harmonics displayed in a table	2 <sup>nd</sup> -49 <sup>th</sup>		See later in this paragraph
V harm. chart		Voltage harmonics displayed in a bar graph	2 <sup>nd</sup> -49 <sup>th</sup>		See later in this paragraph
<b>Current</b>					
Irms	A	Rms Current	0 - 5 A	$\pm 1\%$	100 kA
I1	A	Rms current at the fundamental frequency	0 - 5 A	$\pm 1\%$	100 kA
THDI	%	Total harmonic current distortion on current	0 - 300%	$\pm 1\%$	300 %
I harm. table		Current harmonics displayed in a table	2 <sup>nd</sup> -49 <sup>th</sup>		See later in this paragraph
I harm. chart		Current harmonics displayed in a bar graph	2 <sup>nd</sup> -49 <sup>th</sup>		See later in this paragraph
I1-cap	A	Rms capacitor current at the fundamental frequency	0 - 1 A	$\pm 3\%$	100 kA
<b>Power</b>					
Cos $\phi$ (2)		Displacement power factor (2)	-1 - +1	$\pm 0.02$	-1 - +1
PF (3)		Power factor (3)	-1 - +1	$\pm 0.02$	-1 - +1
P		Active power	0 - 10 kW	$\pm 2\%$	0 - 100 MW
Q	W	Reactive power	0 - 10 kvar	$\pm 2\%$	0 - 100 Mvar
S	var	Apparent power	0 - 10 kVA	$\pm 2\%$	0 - 100 MVA
$\Delta Q$	VA	Missing power to reach the pre-set alarm cos $\phi$	0 - 10 kvar	$\pm 2\%$	0 - 100 Mvar
$\Delta N$	var	Missing capacitor steps to reach the pre-set alarm cos $\phi$			
<b>Temperature (optional)</b>					
T1	$^{\circ}\text{C}$ or $^{\circ}\text{F}$	Temperature T1 (optional external probe 1)	-40 $^{\circ}\text{C}$ $\rightarrow$ + 105 $^{\circ}\text{C}$	$\pm 2^{\circ}\text{C}$	-40 $^{\circ}\text{C}$ $\rightarrow$ + 150 $^{\circ}\text{C}$
T2	$^{\circ}\text{C}$ or $^{\circ}\text{F}$	Temperature T2 (optional external probe 2)	-40 $^{\circ}\text{C}$ $\rightarrow$ + 105 $^{\circ}\text{C}$	$\pm 2^{\circ}\text{C}$	-40 $^{\circ}\text{C}$ $\rightarrow$ + 150 $^{\circ}\text{C}$

Figure 65: DYNACOMP available measurements Dynacomp 可测量参数表

## 12.6 Consulting DYNACOMP statistics and manufacturer data 咨询 DYNACOMP 统计信息及制造商数据

DYNACOMP statistics can be consulted from [Welcome/Bank Monitoring]. Interesting information about the DYNACOMP load and its operating point can be sorted out as well as logged events that may be very useful for troubleshooting. For instance: 咨询 DYNACOMP 统计信息可从以下路径获取 : (欢迎 / 监控组) 关于 DYNACOMP 负载及相关操作要点, 等重要信息和记录事件一一被分类出来。方便用户对故障的排查, 例如:

- 
- [Welcome/Bank Monitoring/Diagnosis] : gives the switching number for each step 路径: 给出每一步的开关切换数量
  - [Welcome/Bank Monitoring/Alarm logging] : gives 5 latest alarms 路径: 给出最近的五个警报信息
  - [Welcome/Bank Monitoring/Nodes overview] : gives the status of each CAN node 路径: 给出每个 CAN 节点 (站点) 的状态
  - [Welcome/About RVT-D] : gives the software version and the serial number of the RVT-D 路径: 给出软件版本及 RVT-D 的系列号

## 13. Maintenance instructions 维护说明书

### 13.1 What this chapter contains 本章概述

This chapter describes the maintenance instructions to be carried out. Even if maintenance operations have been reduced to the minimum, they have to be carried out carefully to ensure smooth operation during the whole equipment lifetime. 本章主要描述, 执行维修的方法, 即便需要维修的可能已被降到最低。但仍然要认真去保证, 在设备使用寿命周期内, 能圆满完成各项维修任务



**WARNING: All maintenance work described in this chapter should only be undertaken by a qualified electrician. The safety instructions presented in Chapter 2 of this manual must be strictly respected.**警告: 本章已描述的所有维修工作, 只能由有资格的电气技术人员担当。并严格遵守本使用手册, 及第二章给出的安全使用说明

**WARNING: High AC and DC voltages may be present in the DYNACOMP cubicle(s). Do not touch any DYNACOMP parts unless you have ascertained that they do not carry dangerous voltage levels.**警告: DYNACOMP 单元内可能存在直流和交流高电压, 请不要触碰 DYNACOMP 任一部件。除非你已确认它们没带电

### 13.2 Maintenance intervals 13.2 维护间隔

[Table 12](#) lists the recommended routine maintenance intervals. Depending on the operating and ambient conditions, the intervals of [Table 12](#) may have to be reduced accordingly. Announced intervals assume that the equipment is operating under the specified operating conditions (see [Chapter 15](#)). 表 12 是厂商推荐的日常维护间隔时间表, 根据工作情况及环境的不同, 可适当缩短表 12 所示的间隔时间。宣明该间隔时间表, 是在假定您的设备运行在特定的工作条件下(见 15 章)

Table 12: DYNACOMP recommended maintenance intervals 表 12: DYNACOMP 推荐维护间隔时间

Maintenance 维护	Intervals 间隔时间	Instructions 说明
Standard maintenance procedure 标准维护过程	Every 6 to 12 months, depending on the dustiness/dirtiness of the environment. 每 6 至 12 月一次, 取决环境卫生	<a href="#">Section 13.3</a>
Cooling fan(s) replacement 更换冷却风扇	Every 4 years (35000 hours) 每 4 年 (35000 小时)	<a href="#">Section 13.4</a>
Capacitor replacement 电容器更换	Every 20 years 每 20 年	<a href="#">Section 13.4</a>

For convenience [Section 13.5](#) presents a maintenance template that can be used by the maintenance engineer. 为方便维护工程师使用, 在 13.5 节中给出一个维护模板

### 13.3 Standard maintenance procedure 13.3 标准维护步骤

#### Step 1: Check the ambient temperature conditions 第一步:检查环境温度条件

While DYNACOMP is running, check the ambient temperature and make sure there is no abnormal temperature raise. If so, it may indicate a problem with the switch room cooling/ventilation system. 一旦 DYNACOMP 开始运行, 应及时检测环境温度, 并确保没有异常升温。否则表明开关柜的冷却或通风系统出问题。

#### Step 2: Record the DYNACOMP operating status 第二步: 记录 DYNACOMP 的运行状况

- While DYNACOMP is running, register the RVT-D measurements (PF , Voltage , reactive power, switching response time to the load) 一旦 DYNACOMP 开始运行, RVT-D 的测量值 (PF、电压、无功功率、开关响应、负载的时间) 就会被记录下来。
- Register the DYNACOMP-operation number / step ([/Welcome/Bank monitoring/Diagnosis]). 记录 DYNACOMP 操作数/步 (路径)
- Browse the 'event logging' menu ([/Welcome/Measurements/Event logging]) to register possible abnormal events. 按此路径浏览“事件记录”菜单, 去查看记录的异常事件。
- Register the 5 possible latest logged alarms that the system has recorded (if any) ([/Welcome/Bank monitoring/Alarm logging]).
- 系统会保留最后产生的五个警报信息记录 (如果有的话) (路径)
- While DYNACOMP is running, check that the cooling fans are running normally. Pay attention to any suspicious noise that may indicate a fan

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failure. 当 DYNACOMP 开始运行，检查冷却风扇运行是否正常。尤其注意，任何可疑的噪声，表明该风扇已有问题。

- While DYNACOMP is running, check the 24Vdc power supplies (green LED ON) on each Dynacontrol Board. 一旦 DYNACOMP 开始运行，检查每个动态控制（绿色 LED 灯亮）板上 24V 直流电源是否正常。

### **Step 3: Stop the DYNACOMP      第三步：停止 DYNACOMP**

- Switch the DYNACOMP off and open the protective device (e.g. circuit breaker) power supply. 关闭 DYNACOMP 以及打开保护装置(如断路器)电源
- Open the auxiliary circuit fuses of all master and slaves cubicles. 打开所有主, 从单元的辅助线路保险丝
- Wait at least 3 minutes for the discharge of the capacitors. 等待至少 3 分钟，让电容器进行放电
- Ensure that the capacitors have completely discharged before going to step 4. 在进行第四步作业前，确保电容器上的电能已被释放完毕

### **Step 4: Internal inspection and cleaning      第四步：内部检查及卫生清理**

- Visual inspection of the DYNACOMP. Report any indication about possible abnormal DYNACOMP stress (e.g. abnormal colour of components or wires). 目测 DYNACOMP 检查报告，任何出现的异常（如部件及电线颜色异常）
- Remove all dust deposits in and around the DYNACOMP. Pay special attention to the fans and Dynaswitch heatsinks. Especially if RVT-D reports Dynaswitch alarm error. 去除所有沉积在 DYNACOMP 内部及周边的灰尘。尤其要注意排风扇及动态开关的散热。特别是 RVT-D 报告，动态开关出错警报的时候。
- Ensure that the fan rotates properly. 确保排风扇转动良好
- Ensure that the control cards are free of dust. If necessary remove dust from them with a soft brush or a vacuum cleaner. 保证控制卡上没有灰尘，否则需清除卡上的灰尘，应使用软刷子或真空清理器

### **Step 5: Check DYNACOMP parts condition      第五步：检查 DYNACOMP 配件情况**

- Check the circuit breaker. 检查断路器（空气开关）
- If melted or damaged fuse is found, replace it. In this case, it is good practice to change the fuses of all other phases even if not damaged. 如果发现保险丝熔化或损坏，请更换。这里有个好经验：即便其它相的保险丝还没损坏，也一并更换掉它们。
- Check the discharge resistors are OK 检查放电电阻是否正常
- Check the Snubbers boards state 检查阻尼板的状况是否正常

- 
- Check the Dynacontrol boards 检查动态控制板
  - Check the 24Vdc power supply state 检查 24V 直流电源的情况
  - Check the transformer state 检查变压器的情况

**Step 6: Check the tightness of all electrical and mechanical connections 第六步：检查所有电气和机械接线端子是否都上紧**

- Ensure that all electrical connections are properly fixed and that connectors are properly plugged in. Remove oxidation traces of pin connectors if present. Small stiff brush can be used. 确保所有电气连接线都被固定好，插好。如果接线端子上有氧化层需要去除。可使用小硬刷子
- Check the mechanical fixation of all components and retighten if necessary. 检查所有部件的机械固定，必要时可重新上紧

**Step 7: Correct all abnormal situation 第七步：纠正所有异常情况**

For troubleshooting advices, please refer to [Chapter 14](#). 设备的故障排除，请参考第 14 章

**Step 8: Restart the DYNACOMP 第八步：重新启动 DYNACOMP**

- Reapply the power to the supply and close the auxiliary fuse. Verify that the fans start running and that the control boards and RVT-D are activated. 重新送上电源并合上辅助保险丝，检查排风扇是否开始运转。以及控制板和 RVT-D 已被激活
- Restart the DYNACOMP. If major servicing work has been done it is recommended to follow the commissioning instructions (see [Chapter 11](#)). 重新启动 DYNACOMP.，如果主要的维修工作都已完成。建议按 11 章提供的试车说明进行操作
- Verify the DYNACOMP performance. 核查 DYNACOMP 性能

## 13.4 Fan replacement 更换排风扇

Fan failure is often announced by a noise or an abnormal temperature increase despite regular cleaning. Then it is recommended to replace the fan. Contact your ABB service provider to get new fan. 排风扇的故障，经常体现在噪音大，或尽管已定期清理过，仍有异常的温升。建议更换风扇，联系你的 ABB 服务商为您提供新的排风扇。

Fans replacement procedure: 排风扇更换步骤

- Ensure that the power to the DYNACOMP is switched off and that there is no residual voltage left in the DYNACOMP cubicle (e.g. capacitors). 确保 DYNACOMP 的电源开关已断开，而且没有残余电压在 DYNACOMP 单元内（如电容器）
- Remove the electrical connection. 拆去排风扇的电源线

- Remove the fan (unscrew fixation screws located left and right side). 拆下排风扇（松开左右两边的紧固螺丝）
- Replace the components, fix them back and connect them back. Refer to the fan label to know which fan wire has to be connected to which terminal. Ensure that the electrical connections of the fan and the fan capacitors are correct before energizing. 更换损坏的部件，连接并固定到原来位置。参照风扇表单，了解具体的接线端子，保证风扇的电路及风扇启动电容连接正确，方可启动运行。



Figure 66: Overview of cooling fan related items 风扇外观图

The components description is given in [Table 13](#) 部件的描述在表 13 中给出

Table 13: Cooling fan related items description

表 13: 冷却风扇相关条款描述

Item 条款	Description 描述
1	Terminal block 接线端子块
2	Fan capacitor 风扇电容
3	Cooling fan 冷却风扇
4	Fixing bracket 固定座

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13.5 Servicing report 维修报告

13.5.1 13.5.1 DYNACOMP identification DYNACOMP 标识卡

<b>DYNACOMP type<sup>(a)</sup></b> 类型				
<b>Global ratings<sup>(a)</sup></b> 整件额定值	<b>Grid nominal voltage (V)</b> 电网额定电压			
	<b>Total power (kvar)</b> 总(视在)功率			
	<b>Network frequency (Hz)</b> 电网频率			
	<b>Article code</b> 协议代码			
	<b>Number of steps</b> 步数			
<b>Common cable entry cubicle</b> 共用电缆进线柜	<b>Present/not present</b> 有/没有			
<b>Unit ratings/serial number<sup>(b)</sup></b> 额定单位/系列号		<b>Rating (kvar)</b> (...x...)	<b>Serial number</b>	<b>Article code<sup>(a)</sup></b>
	<b>Unit 1 (M)</b>			
	<b>Unit 2</b>			
	<b>Unit 3</b>			
	<b>Unit 4</b>			
	<b>Unit 5</b>			
	<b>Unit 6</b>			

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	<b>Unit 7</b>		
	<b>Unit 8</b>		
<b>Software version<sup>(c)</sup></b> 软件版本)	<b>RVT-D software</b>		
<b>Installation location</b> 安装位置			
<b>Remarks:备注</b> (a) See main identification tag located on the master cubicle door. (b) See identification tag located at the inside and outside of each cubicle door. (c) From RVT-D, [Welcome/About RVT-D]. (a) 见主单元门上的主识别标签 (b) 见每个柜门内或外部的识别标签 (c) 从 RVT-D (欢迎/关于 RVT-D) 路径获得			

### 13.5.2 Standard maintenance procedure 标准保养步骤

<b>Ambient conditions and derating condition (DYNACOMP running) 环境情况及降额情况(DYNACOMP 运行)</b>	
• Check the ambient temperature (< 40 °C) 检查环境温度小于 40 °C	
• Check the installation altitude (< 1000 m) 检查安装在海拔高度 1000 米以下	
• Check the ventilation (room and enclosure) 检查通风情况 (室内或箱体)	
• Ensure that no conductive dust is present in the DYNACOMP panel 确保 DYNACOMP 控制板没有灰尘	
<b>DYNACOMP operating status record (DYNACOMP running) DYNACOMP 工作状态记录 (在 DYNACOMP 运行过程中)</b>	

x DYNACOMP measurement check 检查 DYNACOMP 测量值	
- Power factor 功率因数	
-Voltage measurement (Vrms) 电压测量值 (有效电压值 Vrms)	
-Reactive power (kvar) 无功功率 ((kvar)	
-Steps switched ON following the load variation (Y/N) 根据负载变化步开关, 打开与否	
-Number of switching step 1	
-Number of switching step 2	
-Number of switching step 3	
-Number of switching step 4	
-Number of switching step 5	
-Number of switching step 6	
-Number of switching step 7	
-Number of switching step 8	
-Number of switching step 9	
-Number of switching step 10	
-Number of switching step 11	
-Number of switching step 12	
-Number of switching step 13	
-Number of switching step 14	
-Number of switching step 15	
-Number of switching step 16	
-Number of switching step 17	
-Number of switching step 18	
-Number of switching step 19	
-Number of switching step 20	
-Number of switching step 21	
-Number of switching step 22	

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-Number of switching step 23		
-Number of switching step 24		
-Number of switching step 25		
-Number of switching step 26		
-Number of switching step 27		
-Number of switching step 28		
-Number of switching step 29		
-Number of switching step 30		
-Number of switching step 31		
-Number of switching step 32		
• Event logging window 事件录入窗口		
-Abnormal events present? (Y/N) If 'Y', describe them in the 'comments' section of this report. 有异常事件吗? (Y/N)如“是”把这报告填写在“注释”部分		
• Alarm logging window 警报记录窗口		
-Alarms are present? (Y/N) If 'Y', describe them in the 'comments' section of this report. 有警报吗: (Y/N)如“有”把报告填写在“注释”部分		
• All fans are rotating normally (Y/N) 所有的排风扇都运转正常吗(Y/N)		
• 24Vdc green LED is lighted (Y/N) 24V 直流绿色 LED 灯亮否		
<b>Shut down the DYNACOMP, remove supply to the unit and open auxiliary fuses</b> 关闭 DYNACOMP, 断开主电源及辅助电源		
• Ensure that components do not carry dangerous voltage levels anymore. 确保部件不带电		

<b>Inspect and clean the DYNACOMP 检查及清洁 DYNACOMP</b>	
• All components/cabling looks OK? (Y/N) 所有部件和电缆看上去正常吗? (Y/N)	
• If 'N', describe the problems in the 'comments' section of this report. 如果不正常, 把报告填写在“注释”部分	
• Remove all dust deposits in and around the DYNACOMP (fans, heatsinks, PCBs, ...) 清除沉积在 DYNACOMP 内部及周边的灰尘(风扇散热器, PCB 板)	
• Remove fan obstructions. Fans running freely? (Y/N) 清理风扇堵塞物后, 运行自如吗 (Y/N)	
IF 'N', fans may have to be replaced. 如果不是, 把风扇更换	
<b>Conditions of DYNACOMP parts DYNACOMP 配件状况</b>	
• Circuit breaker is OK? (Y/N) 断路器正常吗? (Y/N)	
• Fuses are OK? (Y/N) 保险丝完好吗? (Y/N)	
IF 'N', describe the problems in the 'comments' section of this report. 如不是, 把相关问题填写在“注释”部分	
• Discharge resistors are OK? (Y/N) 放电电阻正常吗? (Y/N)	
• Snubbers are OK? (Y/N) 阻尼电阻正常吗? (Y/N)	
• Dynacontrol boards look OK? (Y/N) 动态控制板看上去正常吗? (Y/N)	
• 24Vdc power supplies are OK? (Y/N) 24V 直流电源正常吗? (Y/N)	
• Transformer is OK? (Y/N) 变压器正常吗? (Y/N)	
<b>Tightness of electrical and mechanical connections 上紧所有电气及机械连接</b>	
• Check tightness of all electrical connections 检查, 上紧所有电气连接	
• Check the mechanical fixation of all components 检查所有部件的机械固定	
• Retighten connections/fixations if necessary 如有必要, 重新上紧接线端及紧固器	
<b>Correct the outstanding problems 纠正突出的问题</b>	
<b>Restart the DYNACOMP 重新启动 DYNACOMP</b>	
• Close the auxiliary circuit fuse box 合上辅助电源的保险盖	
-Dynacontrol board LEDs light up 动态控制板上 LEDs 灯亮起	

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- RVT-D is starting RVT-D 开始运行		
- Fan(s) start(s) running 排风扇开始运行		
<b>Start the DYNACOMP 启动 DYNACOMP</b>		
If major servicing work has been done, follow the commissioning instructions to start the DYNACOMP 如果主要的维修工作已完成，接下来的试车指示就是启动 DYNACOMP		

### 13.5.3 Special service actions 具体维护情况

Fan replacement 风扇更换	
x Which fan? 哪一个风扇?	
• Fan operation hours? 风扇已工作多少个小时?	

### 13.5.4 Comments 13.5.4 注释

	<b>Servicing Engineer</b> 维修工程师	<b>Customer's representative</b> 客户代表
<b>Name</b> 姓名		
<b>Signature</b> 签名		
<b>Date</b> 日期		

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## 14. Troubleshooting 14 故障的排除

### 14.1 14.1 What this chapter contains

### 14.1 本章概述

This chapter contains the DYNACOMP troubleshooting guide. 本章包括 DYNACOMP 故障指南



**WARNING: All troubleshooting and repair work described in this chapter should only be undertaken by a qualified electrician. The safety instructions presented in [Chapter 2](#) of this manual must be strictly respected.**警告：本章描述的所有故障，排查及维修必须由有资格的电气技术人员来担当，并严格遵照本使用手册第二章，中所给出的安全说明

**WARNING: High AC and DC voltages may be present in the DYNACOMP cubicle(s). Do not touch any DYNACOMP parts unless you have ascertained that they do not carry dangerous voltage levels.**警告：DYNACOMP 单元可能存在直流或交流高压电，不得触碰 DYNACOMP 内的任何部件。除非您已确认没电

**WARNING: Some checks may have to be made with the supply on and the DYNACOMP doors opened. These tests must be carried out only by authorized and qualified personnel, in accordance with the local regulations. Apply the safety guidelines that are presented in Chapter 2. Failure to adhere with the safety guidelines may result in lethal physical injury.**警告：有些检查需要打开 DYNACOMP 单元门，以及带电测试。这种测试仅限于得到授权并有相应资格的人员。根据当地相关要求从事，并按照第二章给出的“安全指南”进行。否则将可能导致身体伤害

### 14.2 Failure mode analysis of a DYNACOMP 14.2 DYNACOMP 故障模式分析

Efficient troubleshooting requests clear and correct failure understanding to define the proper solution to apply. For instance: 有效地进行故障排查，要求理解故障，并能制定合理的解决方案。例如：

- A hardware failure will request device replacement. 硬件故障需要更换器件

- An alarm message may simply need to adjust some parameter. 警告信息可能只需简单的参数调整

In any case, any alarm or error message will always be displayed by the RVT-D. To help the fault tracing and repair of defective parts a troubleshooting guide is given hereafter. 在通常情况下，所有警报及故障信息都在 RVT-D 上显示着。为帮助故障追踪及损坏配件的故障排查，故障排查指南在后面给出

## 14.3 Troubleshooting analysis 故障排除分析

### 14.3.1 Collect information 信息收集

Firstly, all the relevant information should be collected, such as: 首先:收集相关的信息, 譬如

- 24Vdc power supply LED's : 24V 直流电源 LED's 指示灯
- Alarm status LED of the Dynacontrol2 board 动态控制板上的警报指示 LED 的状态
- ON/OFF LED's of the Dynacontrol2 board 动态控制板上的亮/灭 LED's 指示灯
- RVT-D display , alarm messages , wrong measurements, ... RVT-D 显示警报信息，错误测量.....

### 14.3.2 Troubleshooting guide 故障排除指南

Table 14: Power supply problems 表 14: 电源故障

Table 15: Abnormal states of the Dynacontrol board LEDs (after auxiliary power is applied)		
Symptom 症状	Cause 原因	What to do 如何处理
All the indicator LEDs on the Dynacontrol boards (LEDs) remain OFF. No display on RVT-D. Fan(s) not running. 动态控制板上所有的 LED 的指示灯保持灭。RVT-D 没有显示排风扇没有运转	The reactive power compensator (auxiliaries) is/(are) not energized. 无功功率补偿 (辅助器) 没有上电激活	<ul style="list-style-type: none"> <li>• Check if the protection (circuit breaker, mains fuses ...) feeding the reactive power compensator is switched on.</li> <li>• Check if the auxiliary fuse box is closed and the fuses are OK.</li> <li>• Check that the 230V auxiliary voltage is arriving at the X11 connector</li> <li>• Check the mains and auxiliary supply voltages. 检测保护 (断路器, 主回路保险) 无功功率补偿器, 进线开关是否打开, 检查辅助保险是否正常, 检查 230V 辅助电源是否接到 X11 接线端子上. 检查主和辅助电源电压</li> </ul>

<p>After applying the auxiliary power to the system, all Dynacontrol board LEDs are functioning normally but no fans or they run at low speed. The fans do not exhibit mechanical failure problems. 送上辅助电源后，所有动态控制板上的 LED 灯显示正常.但风扇不运转或转速较慢，且风扇不存在机械故障</p>	<ul style="list-style-type: none"> <li>• Fan voltage supply is too low. 风扇电压太低</li> <li>• The tap setting on the auxiliary voltage transformer is set at a too high level. 辅助变压器的二次测抽头所选择的电压级数过高。导致二次测输出电压偏低</li> </ul>	<ul style="list-style-type: none"> <li>• Check the tap setting of the auxiliary voltage transformer and adapt if necessary. 检查辅助变压器，抽头设置的电压，必要时重接。</li> <li>• Check the supply voltage to see that it is within the tolerance range of the nominal DYNACOMP settings. 检查电源电压看它是否在 DYNACOMP 额定电压要求的范围内</li> </ul>
<p>After applying the auxiliary power to the system, the DYNACOMP fan runs properly but the Dynacontrol boards LEDs are not functioning. 系统送上辅助电源后，DYNACOMP 运转正常，但动态控制板上的 LED 指示灯均没有指示</p>	<p>The 24 Vdc power supply feeding the controller boards has failed. 供给控制板的 24V 直流电源不正常</p>	<ul style="list-style-type: none"> <li>• Check the 24 V power supply feeding the Dynacontrol boards. 检查动态控制板上 24V 电源进线是否正常。</li> <li>• Check the feeding cable between the X11 connector and the 24 V power supply. • Check the feeding cable from the 24 V power supply to the Dynacontrol boards 检查 24V 供电及 X11 端子上的馈入电线是否正常。检查连接到动态控制板上的 24V 电源是否正常</li> </ul>
Symptom 症状	Cause 原因	What to do 如何处理
<p>The Status LED blink at 4Hz 50% duty cycle LED 指示灯以 4HZ 频率，50%占空比的状态闪亮</p>	<p>The system is initializing 系统正在初始化</p>	<ul style="list-style-type: none"> <li>• Wait until the end of initializing 等待初始化完成</li> </ul>
<p>The Status LED blink at 1Hz 6% duty cycle LED 指示灯以 1HZ 频率，6%占空比的状态闪亮</p>	<p>Enable input is open 保护输入被激活</p>	<ul style="list-style-type: none"> <li>• Check the mains fuses</li> <li>• The thermal protection of the Dynaswitch is activated or a wire of the loop is broken</li> <li>• The fan is not rotating 检查主保险管动态开关上的热保护被激活或环路线断开排风扇没有工作</li> </ul>
<p>The Status LED blink at 1Hz 94% duty cycle LED 指示灯以 1HZ 频率，6%占空比的状态闪亮</p>	<p>An alarm event occurs on the Dynaswitch 动态开关板上有警报事件发生</p>	<ul style="list-style-type: none"> <li>• Check the RVT-D error message 检查 RVT-D 上的错误信息</li> </ul>
<p>Table 16: Fault messages reported by the RVT-D controller of the DYNACOMP</p>		
Fault message 错误信息	Cause 原因	What to do 如何处理

<p>Insufficient reactive power caused an alarm <math>\cos \phi</math> condition. 不足的无功功率引起 <math>\cos \phi</math> 报警情况</p>	<p>The DYNACOMP doesn't have enough reactive power (kvar) to reach the alarm <math>\cos \phi</math> DYNACOMP 没有足够无功功率达到</p>	<p>• Check the alarm <math>\cos \phi</math> • Measure the needed reactive power and/or contact your ABB service provider</p> <p>检查 <math>\cos \phi</math> 报警测量所需无功功率</p> <p>或联系 ABB 供应商</p>
<p>At least one Dynaswitch reports an error status. Check in Bank monitoring / Nodes overview. 至少一个动态开关报告出错状况，检查组别监控/节点概要</p>	<p>Reporting "Missing" 报告“丢失”</p>	<p>• There's no node with the corresponding Id 无节点相对应的电流 ID</p>
<p>At least one Dynaswitch reports an error status. Check in Bank monitoring / Nodes overview. 至少一个动态开关报告出错状况，检查组别监控/节点概要</p>	<p>Reporting "Fuse err." 报“保险出错”</p>	<p>• The thermal protection has been activated due to a high temperature on the Dynaswitch cooler • One or more mains fuse(s) is blown 由于动态开关冷却装置温度较高，引起热保护动作一个或多个主保险丝断开</p>
<p>At least one Dynaswitch reports an error status. Check in Bank monitoring / Nodes overview. 至少一个动态开关报告出错状况，检查组别监控/节点概要</p>	<p>Reporting "Sync. err" 报“同步出错”</p>	<p>• RVT-D sends inconsistent synchronizing signal RVT-D 发送不协调的同步信息</p>
<p>At least one Dynaswitch reports an error status. Check in Bank monitoring / Nodes overview. 至少一个动态开关报告出错状况，检查组别监控/节点概要</p>	<p>Reporting "Wire err." 报“接线出错”</p>	<p>• Wrong connection of gates , power cables , RVT-D RVT-D 门极连接线出错</p>
<p>At least one Dynaswitch reports an error status. Check in Bank monitoring / Nodes overview. 至少一个动态开关报告出错状况，检查组别监控/节点概要</p>	<p>Reporting "Rst del." 报“复位延迟”</p>	<p>• The Dynaswitch is in the reset phase after an initialization 动态开关初始化后，进入复位阶段</p>

At least one Dynaswitch reports an error status. Check in Bank monitoring / Nodes overview. 至少一个动态开关报告出错状况，检查组别监控/节点概要	Reporting "Discharg." 报“放电”	<ul style="list-style-type: none"> <li>There is a failure in the discharge resistors of the capacitors 可能是电容器的放电电阻故障</li> </ul>
At least one Dynaswitch reports an error status. Check in Bank monitoring / Nodes overview. 至少一个动态开关报告出错状况，检查组别监控/节点概要	Reporting "Disc. Warn." 报“放电警报”	<ul style="list-style-type: none"> <li>There is a problem in the discharge resistors, reporting a warning, but the switching can go on 问题可能在放电电阻，虽警报开关仍在工作</li> </ul>
At least one Dynaswitch reports an error status. Check in Bank monitoring / Nodes overview. 至少一个动态开关报告出错状况，检查组别监控/节点概要	Reporting "Multiple." 报“多路”	<ul style="list-style-type: none"> <li>Two nodes have the same Id. ("Two nodes / Id disabled") 两个节点的ID相同（两节点ID未启动）</li> </ul>
T probe: No signal. 温度探头没有信号	An external temperature probe was enabled, but not reporting any measurement 外部温度探头虽被启动，但不能检测任何信号	<ul style="list-style-type: none"> <li>Check the external temperature probe wire</li> <li>Check the connection to the RVT-D 检查外部温度探头连线 检查到 RVT-D 连接线</li> </ul>
Maximum Vrms protection threshold reached! All capacitors are disconnected. 最大有效电压达到保护阈值，断开所有的电容器	Occurs when the measured voltage is above "V max prot.". 测量电压大于最大电压保护值	<ul style="list-style-type: none"> <li>Check the network voltage measurement 检查电网电压</li> <li>Check the measurement done by the RVT-D 检查 RVT-D 测量电压值</li> <li>Check the V max protection threshold 检查最大电压保护值</li> </ul>
Internal temperature protection threshold reached! All capacitors are disconnected. 最大有效电压值达到保护阈值，断开所有的电容器	Occurs when the RVT-D internal temperature is above 85°C. RVT-D 内部温度高于 85°C.	<ul style="list-style-type: none"> <li>Check the ambient temperature of the DYNACOMP 检查 DYNACOMP 环境温度</li> <li>Check the temperature inside the cubicle 检查单元内部温度</li> <li>Check the RVT-D temperature 检查 RVT-D 的温度</li> </ul>
T1 protection threshold reached! All capacitors are disconnected. T1 温度值达到保护阈值，断开所有的电容器	Occurs when the external temperature probe T1 reports a temperature above 外部温度探头 T1，报告温度超高	<ul style="list-style-type: none"> <li>Check the ambient temperature of the DYNACOMP 检查环境温度</li> <li>Check the temperature inside the cubicle 检查单元内部温度</li> </ul>

Table 17: Fault messages reported by the RVT-D controller during the automatic

<i>commissioning</i>		
disconnected. 断开	"T1 max prot." T1 超保护	<ul style="list-style-type: none"> <li>• Check the T1 max protection threshold 检查 T1 最大保护阈值</li> </ul>
T2 protection threshold reached! All capacitors are disconnected. T2 达到最大保护阈值，所有电容器被断开	Occurs when the external temperature probe T2 reports a temperature above "T2 max prot." T1 警报超温保护	<ul style="list-style-type: none"> <li>• Check the ambient temperature of the DYNACOMP 检查 DYNACOMP 环境温度</li> <li>• Check the temperature inside the cubicle 检查单元内温度</li> <li>• Check the T2 max protection threshold 检查 T2 最大保护阈值</li> </ul>
THDV protection threshold reached! All capacitors are disconnected. THDV 达到保护阈值，所有电容器被断开	Occurs when the measured THDV is above "THDV max prot." 检测“THDV”超保护警报	<ul style="list-style-type: none"> <li>• Check the THDV of the installation 检查 THDV 的安装</li> <li>• Check the THDV max protection threshold 检查 THDV 的最大阈值</li> </ul>
Minimum Vrms protection threshold reached! All capacitors are disconnected. 最大有效值降到最小保护下限，所有电容器被断开	Occurs when the measured voltage is above "V min prot." 出现电压低于最低电压保护值	<ul style="list-style-type: none"> <li>• Check the network voltage measurement 检查网络电压值</li> <li>• Check the measurement done by the RVT-D 用 RVT-D 检查测量值</li> <li>• Check the V min protection threshold 检查电压保护下限值</li> </ul>
<b>Fault message 出错信息</b>	<b>Cause 原因</b>	<b>What to do 如何处理</b>
Current too small on first step. 在第一步中电流太小	The CT may be short circuited CT 可能的短路	<ul style="list-style-type: none"> <li>• Check CT short-circuit or see RVT-D manual 检查 CT 是否短路，参见 RVT-D 使用手册</li> </ul>
Zero step size declared on first location of sequence. 在第一脉冲位置报告，步幅值为零	Wrong setting of sequence. 顺序设置有误	<ul style="list-style-type: none"> <li>• Set a non-zero size. 设置为非零幅值</li> </ul>
Phase error: 相位出错	The controller could not find a known configuration 控制器未能发现已知的设置值	<ul style="list-style-type: none"> <li>• Try again or set the parameters manually 重新设置手动参数</li> </ul>

<p>The automatic commissioning failed while recognizing the switching sequence and adapting the sensitivity (Istep)</p> <p>识别开关顺序及所采用灵敏度时，自动试车出错</p>	<p>The steps cannot be recognized 步未能被识别</p>	<ul style="list-style-type: none"> <li>• Check the CT's 检查 CT's</li> <li>• Check the CT's location 检查 CT's 位置</li> <li>• Check the current of the steps 检查步电流值</li> <li>• Try again when the load is quiet 一旦负载停止重试</li> </ul>
<p>Istep too small (Istep &lt; 0.01). 步电流太小，小于 0.01</p>	<p>Not enough current in the current input of the RVT-D RVT-D 没有足够电流输入</p>	<ul style="list-style-type: none"> <li>• Check the CT ratio or see manual 检查 CT 的倍率,并参阅使用手册</li> </ul>
<p>Unknown sequence. 触发顺序未知</p>	<p>The RVT-D cannot recognize the steps RVT-D 未能识别步</p>	<ul style="list-style-type: none"> <li>• Relative weight too big. 相对负荷太大</li> <li>• Try again or adjust manually 手动调整并重试</li> </ul>
<p>At least one non capacitive step has been found.</p> <p>至少一个步被发现没有容抗</p>	<p>Steps are not capacitive power 步没容抗功率</p>	<p>x Check steps 检查步</p>
<p>No current detected in line CT during auto set-up. The DYNACOMP may not work properly! 在自动启动期间，CT 未检测到电流，可能是 DYNACOMP 工作不正常</p>	<p>Warning 警告</p>	<ul style="list-style-type: none"> <li>• Check line CT 检查 CT</li> </ul>
<p>Line CT in open loop. The DYNACOMP may not work properly! CT 线存在开环可能，DYNACOMP 工作不正常</p>	<p>Warning 警告</p>	<ul style="list-style-type: none"> <li>• Check if it is requested by the application 检查是否，是应用有关的要求</li> </ul>
<p>Line CT in the wrong phase. The DYNACOMP may not work properly! CT 所接相序不正确，可能 DYNACOMP 工作不正常</p>	<p>Warning. 警告</p>	<ul style="list-style-type: none"> <li>• Put line CT and capacitor bank CT in the same line 放置 CT 和电容组的 CT 在同一相上</li> </ul>
<p>Remark: If the problem persists, contact your ABB service provider. Provide him with all the relevant information, i.e. DYNACOMP serial number and type, status of the Dynaswitch control LEDs, Error messages displayed and DYNACOMP behaviour. 备注：如果问题难解决，请联系 ABB 供应商，并给他们提供相关的信息，例如：DYNACOMP 系列号及型号，动态控制器 LEDs 指示灯状态，显示的错误信息以及 DYNACOMP 的运行情况</p>		

Table 18: Abnormal behaviour of the DYNACOMP

Symptom	Cause	What to do
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<p>The controller does not switch on or off steps although there is a considerable variable inductive load.</p> <p>控制器无法对允许范围内感应负载的变化，做出步开关切换</p>	<p>Bad setting 设置不当</p>	<ul style="list-style-type: none"> <li>• Check that the RVT-D is in Automatic mode 检测 RVT-D 是否工作在自动模式。</li> <li>• Check if settings are set correctly and according to the selected control mode 检查是否根据选择的控制方式，进行合适参数设置</li> <li>• Check that the CT short circuit bridge is removed 检查 CT 短路线是否移去</li> </ul>
<p>The preset power factor is not achieved</p> <p>未能达到预设的功率因数。</p>	<p>Bad setting or low current 设置不当或电流偏低</p>	<ul style="list-style-type: none"> <li>• At low or no load, a low power factor can correspond to a very small inductive current. The corresponding capacitor steps are too large for compensation</li> </ul> <p>由于负载太小或空载，较低的功率因数已可满足很小电感电流，没有相一致的电容器步</p>
<p>All capacitors are switched ON although the required reactive power is relatively low.</p> <p>虽然无功功率要求很低，但所有电容器都被用上</p>	<p>Bad setting 设置不当</p>	<ul style="list-style-type: none"> <li>• Check setting of phase and settings : 检查相序及设置</li> <li>- Istep, ΔIstep and hysteresis in open and closed loop mode. 步电流，步电流差值，回差值，在开环及闭环模式下</li> <li>- Trigger OFF, time out and total duration in external trigger mode. 在整个外部触发周期中，触发器不工作，没有脉冲输出</li> </ul>
<p>Remark: If the problems persist, contact your ABB service provider. Provide him with all the relevant information, i.e. DYNACOMP serial number and type, status of the control LEDs, error messages displayed and DYNACOMP behaviour.</p> <p>备注：如果问题难解决，请联系 ABB 供应商，并给他们提供相关的信息，例如：DYNACOMP 系列号及型号，动态控制器 LEDs 指示灯状态，显示的错误信息以及 DYNACOMP 的运行情况</p>		

### 14.3.3 Spare part list for normal and dedicated DYNACOMP servicing 专门提供给 DYNACOMP 的备件清单

Table 19: Spare part list 表 19: 备件清单

Ref.	Description 说明	Order code 订货号
1	Spare fuses for auxiliary circuit 10X38 6A 690V gl 辅助线路的保险丝备件	10.420.00465
2	Spare fuses for power circuit 主线路的保险丝备件	Depending on the DYNACOMP 根据 DYNACOMP 要求
3	Fan 133X190R 230V 185W 540M3/H 风扇	10.460.07876
4	RVT-D controller with Backlighting RVT-D 控制器显示背光灯	20.065.89254
5	Dynacontrol board 动态控制板	10.580.08786
6	Power supply 230Vac/24Vdc 100W 230V 交流电源	10.530.09046

## 15. Technical specification 技术要求

Installation location 安装位置			
Indoor installation on firm foundations in a clean and controlled environment 安装固定在干净, 有空调的户内			
	Operation installed for stationary use 安装用于固定用途	Storage in the protective package 存储带有保护包装	Transportation in the protective package 动输带有防护包装
<b>Altitude</b> 海拔高度	Nominal output at 0 to 1000m (3300ft) above sea level (1) 额定海拔小于 1000 米内	-	-
<b>Temperature</b> 温度	0 to 40 °C (32 to 104 °F) (2)	-10 to 70 °C (14 to 158 °F)	-10 to 70 °C (14 to 158 °F)
<b>Working max average T° (over 24h)</b> 最在平均工作温度 (24 小时)	35 °C (95 °F)	-	-
<b>Relative humidity</b> 相对湿度	Max. 95% non condensing 最大 95%无结露	Max. 95%	Max. 95% 最大 95%

<b>Contamination levels</b> (IEC 60721-3-3) 污染等级	Chemical class 3C2 (3) Mechanical class 3S2 (5) 化学 3C2 (3 级机械 3S2 (5)	Chemical class 3C2 (3) Mechanical class 3S3 (6) 化学 3C2 (3 级机械 3S2 (5)	Chemical class 3C3 (4) Mechanical class 3S3 (6)
<b>Atmosphere pressure</b> 大气压力	70 – 106 kPa	-	-
<b>Vibration</b> (IEC 60068-2-6) 震动标准	0.3mm (2-9Hz) 1m/s <sup>2</sup> (9-200Hz)	0.3mm (2-9Hz) 1m/s <sup>2</sup> (9-200Hz)	0.3mm (2-9Hz) 1m/s <sup>2</sup> (9-200Hz)
<b>Shock</b> (IEC 60068-2-27) 撞击标准	Not allowed 不允许	Not allowed	40m/s <sup>2</sup> - 22ms
<b>Free fall</b> 自由下落	Not allowed 不允许	Not allowed	Not allowed 不允许

(1) At sites over 1000m (3300ft) above sea level, please consult ABB Power Quality Products. 若海拔高超过 1000 米请联系 ABB 质控部门

(2) According to IEC 60831-1. 根据 EC 60831-1.

(3) Locations with normal levels of contaminants, experienced in urban areas with industrial activities scattered over the whole area, or with heavy traffic. 确定污染等级区, 通道位于城市工作

(4) Same as (3), but applies also to locations with immediate neighbourhood of industrial sources with chemical emissions. 与 3 点相似, 用于接近化学排放的工作源区域

(5) Locations without special precautions to minimize the presence of sand or dust, but not situated in proximity to sand or dust sources. 定位在没有专业防护沙尘, 也没有直接接近护沙尘源头区域

(6) Same as (5) but applies also to locations in close proximity to sand or dust sources. 类似于 (5) 但也用于靠近沙, 尘源的位置 Voltage tolerance 电压偏差	+/- 10 % for all the range, normal operation 额定电压 +/- 10 % 整个范围内, 工作均能正常
Transient voltage fluctuations 瞬时电压波动	Max +/- 30% 最大为 +/- 30%  Note: In such working conditions, Vmin and Vmax alarm and protection should be disabled 提示: 在这种工作条件下, 警报电压最大值及最小值保护,

	都无法动作
<p>Network frequency Frequency tolerance Maximum rate of frequency variation</p> <p>电网频率 频率偏差 最大频率变化率</p>	50 Hz or 60 Hz +/- 5% 20%/s
<p>Maximum phase jump of network voltage</p> <p>电网电压最大相位跳动角度</p>	30°
<p>Network voltage distortion (THDV)</p> <p>电网电压形变</p>	<p>&lt; 8%, each harmonics being lower than: 每个谐波应低于 8%</p> <p>- for three-phase H3&lt;0.5%, H5=H7&lt;5%,H11&lt;3%,H13&lt;2% 适应于三相</p> <p>- for single-phase H3&lt;3%, H5=H7&lt; 5%, H11&lt;3%, H13&lt;2% 适应于单相</p> <p>- for other conditions, see options 其它情况, 详见选件部分</p>
<p>Voltage notch limits</p> <p>电压凹陷极限</p>	<p>Notch depth can be as high as 100%, Notch duration: max 700µs</p> <p>凹陷深度可达 100% 凹陷周期最大 700µs</p>
<p>Line voltage imbalance (only for 3-phase systems)</p> <p>线电压不平衡 (适用于三相系统)</p>	<p>Max. ±5%</p> <p>最大±5%</p>
<p>Environment class (according to IEC 60439-1)</p> <p>环境等级 (根据 EC 60439-1 )</p>	<p>Class 2</p> <p>2 级</p>
<b>Current transducer - CT 电流变送器——CT</b>	
<p>Technical requirement</p> <p>技术要求</p>	<ul style="list-style-type: none"> <li>- Class 1.0 or better 1.0 级或更高</li> <li>- - Burden: min 15 VA for cables up to 30 m (2.5 mm<sup>2</sup>). For cable &gt; 30 m or smaller section, see manual 负荷:最小 15VA, 电线长 30 米,(截面小于 2.5 mm<sup>2</sup>见使用手册</li> <li>- -1 or 5 A secondary rating 二次测额定电流 1 或 5A</li> </ul>

DYNACOMP characteristics DYNACOMP 特性	
<p>General concept: modular design. 一般概念：微型组合设计</p> <p>- All the DYNACOMP cubicles are identical (excepted for the narrower and optional cable entry cubicle). - The power steps ratings have been standardized (see table here below).</p> <p>所有 DYNACOMP 单元都相同(除那种窄形单元或选用进线单元外)功率步率为标准化(见下表)</p>	
cubicle DYNACOMP DYNACOMP 单元	Dimensions: W 800 x D 600 x H 2135 mm (including lifting lugs, without base frame) Type: MNS 3.0
Modularity 调制性	<p>All steps connected in parallel Limit per cubicle, whichever is reached first: 并行连接所有步每个单元限定达到:</p> <p>-400 kvar per cubicle 每个柜 400 kvar</p> <p>-4 power steps in the same cubicle Cubicles of a same DYNACOMP may have different power ratings Maximum number of power steps per DYNACOMP: 32 (with CAN control) or 12 (with opto isolated outputs) 每个单元具备 4 个功率步，相同 DYNACOMP 单元可以有不同功率等级，每个 DYNACOMP 最大功率步为 32 个(带 CAN 控或 12 个带光耦隔离输出)</p>
Sequences 顺序	<p>For flicker mitigation: 缓和闪变</p> <p>1:1:1...:1 (mandatory) For other uses, no restriction For information, most popular and cost effective sequences: - 1:2:2:...:2 or 1:1:2:2:...:2 - 1:2:4:...:4 or 1:1:2:4:...:4</p> <p>1: 1: 1 强制，其它使用，没限制最通用以及高级顺序，仅供参考</p>
Degree of protection (IEC 60 529) 保护等级 (IEC 60 529)	<p>IP21 closed door (IP00 open door) IP43 as an option</p> <p>IP21 关门，IP00 开门，IP43 作为备选</p>
Colour 颜色	<p>RAL 7035 (light gray) Any special colours as an option</p> <p>RAL7035 (亮光色) 其它特别颜色作为备选</p>
Cubicle weights (unpacked) 单元重量 (去除包装)	
200 kvar cubicle 200 kva 单元	<p>Approx. 350 kg</p> <p>大约 350 kg</p>
300 kvar cubicle 300 kva 单元	<p>Approx. 450 kg</p> <p>大约 450 kg</p>

400 kvar cubicle 400 kva 单元	Approx. 550 kg 大约 550 kg
Mechanical installation 机械安装	Free floor standing 无地脚固定 Cubicles can be mounted side by side or back to back 单元可进行边靠边或背靠背安装
	Floor fixation: only possible with optional base frame 带地脚固定，适用于选用基础框架
Cable entry 电缆进线	Standard configuration: each cubicle supplied individually, top cable entry 标准设置：每个单元分开提供，顶部进线 Other configurations: bottom cable entry, single connection point, etc. See options 其它配置：底部进线，单独连接点等，见选件。
Cooling requirement for each cubicle 每个单元的冷却要求	- Air forced cooling 风力冷却 - A minimum of 1400 m <sup>3</sup> /h cooling air has to be supplied to each cubicle (excepted for cable entry cubicle) 每个单元电最小必须提供 1400 m <sup>3</sup> /h 的冷却风量（电缆进线柜除外） - Clean air required (see Installation location here upper) 清洁要求（见安装） - Airflow: from door panel to top 气流：从门板到顶部
Auxiliary power supply 辅助电源	230 Vac +/- 10%, 50 or 60 Hz, 500 VA min To be supplied by user for each cubicle, otherwise optional 每个单元都由用户自行提供。除非选用变压器（见选件） transformer is selected (see options) 230 Vac +/- 10%, 50 or 60 Hz, 最小 500 VA min
Neutral connection 中线连接	Not applicable 没有使用
Capacitors 电容器	CLMD83Q special type Each capacitor is equipped with its own discharge resistor (located outside the capacitor enclosure) sized to get 75V after 3 minutes 专用型号 CLMD83Q

	每个电容器都装有放电电阻（装在电容器外罩上）大小为 3 分钟使电容上电压低于 75V
Reactors 电抗器	Standard value: 标准值
	-Three-phase configuration : 7%*三相设置 7%
	-Single-phase configuration : 14%*单相设置 14%
	* with max 8% THDV and according to spectrum as defined in network voltage characteristics 根据电网电压特性的频谱决定，THDV 最大为 8%
	For special reactors values or higher THDV: see options 选用特别电抗器或较高 THDV 值，见选件
Dynaswitch 动态开关	- Thyristor technology switch with auto protection against wrong connection 可控硅开关技术，带有防接线出错功能 - All switches include: thyristor, snubbers, heatsink, fan and electronic control board 所有开关包括：可控硅，阻尼器，散热器，风扇以及电气控制板
Surge withstand capability (with optional surge arrester) 耐压能力带可选用避雷针	According to IEC61643-1 根据 IEC61643-1
Rated insulation voltage (Ui) 额定绝缘电压值	690 Vac according to IEC60439-1 690 Vac 根据 IEC60439-1
RVT-D	Controller designed fo 控制器设计作用 r:
	-fast PF correction 快速 PF 校正
	- flicker mitigation 缓和闪变
	2 digital inputs, 1 CAN or 12 digital optocoupler outputs, 1 NC alarm contact and 1 NO fan contact: see RVT-D manual 2 个数字输入，1 个 CAN 及 12 个数字光耦隔离输出，1 个常闭警报接触器输出，及 1 个常开风扇接触器输出，见 RVT-D 使用手册
Response time and control mode 响应时间及控制模式	- Closed loop (response time: max 3 cycles) 闭环（响应时间：最大 3 个循环周期） • CT on the line side 主线测的 CT • CT on the line side with additional CT in DYNACOMP

	主线测 CT 带有内附 CT 的 DYNACOMP
	<ul style="list-style-type: none"> <li>- Open loop (response time: &lt; 1 cycle) 开环 (响应时间小于 1 个循环周期)</li> <li>• Normal open loop (CT on the load side) 常开环 (CT 在负载侧)</li> <li>• CT on the line side with additional CT in DYNACOMP 在线侧内带 CT 的 DYNACOMP</li> <li>- External trigger (response time: instantaneous*)</li> <li>• Without CT 没有 CT</li> <li>• CT in open loop CT 在开环内</li> <li>• CT on the line side with additional CT in DYNACOMP * after first firing 在线侧内带 CT 的 DYNACOMP 指点一个触发脉冲后</li> </ul>
Switching strategy 开关方案	Linear or circular (see RVT-D manual) 线性或圆形 (见 RVT-D 手册)

Phase-to-earth resistance (per cubicle) 每个单元相对的电阻值	> 200 kΩ for all configurations 所有配置大于 200 kΩ
Noise intensity per cubicle 每个单元噪声强度	< 60 dBA (1 meter from cubicle door, 1 m high) 小于 60 分贝 (离单元门 1 米高)
Communication 通信	Through RVT-D controller display Through Modbus RTU (with optional adapter) Through RS-232 port with printer 连到 RVT-D 控制器显示 连到 Modbus RTU (带选用适配器) 连到 RS-232 带有打印机
Programming 编程	Through RVT-D controller display Through Modbus RTU (with optional adapter)连到 RVT-D 控制器显示连到 Modbus RTU (带选用适配器)
<b>Fuses information</b>	
Each power steps is individually protected by gL fuses 每个功率步由一个独立的 GL 保险丝保护	

Input power cables protection 输入电力 电缆保护	To be supplied by customer (as well as the power cables) Optional circuit breaker available: see options 由用户提供（电缆线）也可选用断路器，见选件
Auxiliary circuit fuses 辅助线路保险丝	10 x 38 6A 690V gG
<b>Compliance with standards 遵照标准</b>	
ABB Industrial IT ABB 工艺	
CE certified: CE 许可 European Directive EMC 89/336/EEC including amendment 93/68/EEC (Electro Magnetic Compatibility) 电磁兼容 European Directive LVD 73/23/EEC including amendment 93/68/EEC (Low Voltage Directive)	
IEC60439-1	Low-voltage switchgear and control gear assemblies. 低压开关设备以及控制机构装配 Part 1: Type-tested and partially type-tested assemblies 第二部分：类型测试及极性类型测试安装
IEC60529	Degree of protection provided by enclosures (IP code) 外壳提供的保护等级
IEC 60831-1 IEC 60831-2	Shunt power capacitors of the self-healing type for a.c. systems having a rated voltage up to and including 1 000 V 系统额定电压大于等于 1000VAC，并联电力电容，为交流自愈式
IEC 61921	Power capacitors – Low-voltage power factor correction banks 电力电容器，低压功率因数校正
EN55011	Conducted and radiated emissions according to class A (industrial type) 电导及辐射依据（工业类）A 级
EN61000-4-2	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity 测试及测量
EN61000-4-3	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test 辐射，射频，静电均抗干扰测试
EN61000-4-5	Electromagnetic compatibility (EMC)- Part 4-5: Testing and measurement techniques - Surge immunity test 测试

EN61000-4-6	<p>Electromagnetic compatibility (EMC)- Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields</p> <p>抗电导干扰，射频感应</p>
<p><b>Options 选件</b></p>	
<p>All options must be ordered with the DYNACOMP as they are assembled at manufacturing stage. Exceptions are marked with an * and can be ordered later.</p> <p>除标有“*”号可后来追加订货，其它所有 DYNACOMP 选件都必须在设备制造前订购</p>	
Base frame 基架	<p>One base frame can gather up to 9 cubicles including cable entry cubicle (side by side or back to back configuration) 100 mm high, black</p> <p>一个基架可以装上 9 个单元，包括进线柜（肩并肩或背靠背安装）100MM 高，黑色</p>
<p>Cable entry cubicle 电缆进线柜</p>	<p>Dimensions: W 600 x D 600 x H 2150 mm (without base frame) 尺寸: W 600 x D 600 x H 2150 mm (没有带基架)</p> <p>Type: Rittal TS8 类型: : Rittal TS8</p> <p>Typical situations for a cable entry cubicle: 典型的电缆进线柜</p> <ul style="list-style-type: none"> <li>-single connection point requested 要求单独连接点</li> <li>-bottom cable entry requested 要求底部电缆进线</li> <li>-circuit breaker requested 要求带断路器</li> </ul> <p>Possible accessories: 可能部件</p> <ul style="list-style-type: none"> <li>-base frame (recommended) 基架（推荐）</li> <li>- connection bars 连接母线排</li> <li>- circuit breaker 断路器</li> <li>-additional CT for capacitor current measurement 带电容器电流检测 CT</li> <li>- surge arrester 避雷装置</li> </ul>
<p>Busbar 母线排</p>	<p>In copper or tinned copper Located top of the cubicles Base frame mandatory with busbar option</p> <p>用铜或镀锡铜</p> <p>安装在单元顶端</p> <p>基架强制性带母线选件</p>

<p>Additional internal CT 内附 CT</p>	<p>Single connection point requested Principle: 单独连接点要求原理</p> <p>An additional CT measures the total DYNACOMP current bringing the advantages of both closed and open loop 内附 CT 测量 DYNACOMP 总电流，其优点具有开环及闭环性能。：</p> <ul style="list-style-type: none"> <li>-open loop reaction time (&lt; 1 cycle) 开环响应时间 (&lt;1 周期)</li> <li>-PF control with same accuracy as closed loop PF 控制具有与闭环相同的精度</li> <li>- Automatic commissioning 自动试运行</li> <li>-Access to closed loop data measurement: PF, kVA, kvar, kW, etc 访问闭环测量数据，PF, kVA, kvar, kW, etc</li> </ul>
<p>Circuit breaker 断路器</p>	<p>Located in the cable entry cubicle Rating according to DYNACOMP size 安装在进线电缆柜额定值，依据 DYNACOMP 大小决定</p>
<p>Surge arrester 避雷针</p>	<p>Located in the cable entry cubicle Rating according to DYNACOMP size 安装在进线电缆柜额定值，依据 DYNACOMP 大小决定</p>
<p>IP43</p>	<p>According to IEC60529 依据 IEC60529 标准</p> <ul style="list-style-type: none"> <li>-RITTAL door mounted filters RITTAL 单元门上安装过滤网</li> <li>-Protection against rain 防雨水保护</li> </ul>
<p>Reinforced reactors 加固的电抗器</p>	<p>For 8% &lt; THDV &lt; 12%</p> <p>Each harmonic being lower than: 每个谐波须低于</p> <ul style="list-style-type: none"> <li>- for three-phase: 适用于三相 H3&lt;1%, H5&lt;9%, H7&lt; 6.5%, H11&lt;4.5%, H13&lt;4%</li> <li>- for single-phase, please consult ABB Power Quality Products 对于单相，请咨询 ABB 电力产品质量管理部</li> </ul>
<p>5.67% reactors 5.67% r 电抗器</p>	<p><b>Only with three-phase configuration 适用于三相的配置</b></p> <p><b>For THDV &lt; 8%, each harmonic being lower than: H3&lt;0,5%, H5=H7&lt;5%, H11&lt;3%, H13&lt;2%每个 谐波须低于 H3&lt;0,5%, H5=H7&lt;5%, H11&lt;3%, H13&lt;2%</b></p>
<p>Other special reactors 其它未用电抗器</p>	<p>For any special reactor values or higher THDV, please consult ABB Power Quality Products <b>其它规格电抗器值或较高 THDV，请咨询 ABB 电能质量产品。</b></p>
<p>Auxiliary transformer 辅助变压器</p>	<p>One auxiliary transformer per cubicle 每个单元一个辅助变压器。</p> <p>This option prevents the customer to provide any external power supplies 选件可使用户免去提供任何外部电源</p> <p>Auxiliary transformer is internally connected to power terminals 辅助变压器内接到电源接线端子</p>

Isolated RS232-485 converter* 带隔离式 RS232-485 转换器	Used for long distance communication using Modbus RTU communication 如使用长距离通信，可采用 Modbus RTU 进行通信
Printer* 打印机	To be connected to the RVT-D RS232 optical link Used to print the RVT-D parameters, settings, logs and measurements 连接到 RVT-D 的 RS232 用于打印 RVT-D 参数，设定值，记录及测量值
Set of two External temperatures probes* 设置两个外部温度探头	Cable length: 3 or 10 m 电缆长度：3 或 10 m
Alarm status lamp 警报状态灯	One lamp in the master cubicle 一个灯在主单元内
	Lamp is 24Vdc LED type LED 灯是直流 24V
Any various RAL colors 任意 RAL 颜色	
Shock absorber 震动吸收器	Shock absorbers will be sized case by case (according to IEC 60068-2-27) Mounted on base frame option 震动吸收器尺寸是根据标准要求具体选型，安装基架选项
Cubicle interconnection kit 单元互连组件	- To be used when 2 cubicles have to be fixed side by side or back to back - One kit per 2 cubicles - 用于把 2 个单元边靠边或背靠背连接使用。 - 每 2 个单元一套组件
RVT-D controller extension kit RVT-D 控制器扩展组件	For any RVT-D location other than face panel of master cubicle RVT-D supplied separately 任何 RVT-D 在主单元安装其它的面板 The kit includes RVT-D 分别提供组件包括： -CAN cables (20 m long, supplied with RVT-D) CAN 电缆带有螺丝盘的主单元面板块（20 米长，与 RVT-D 一起提供） -Master cubicle face panel blocked with screwed plate 带有螺丝盘的主单元面板块
CAN extension kit cable CAN 扩展电缆组件	20 m long, to be used for distant cubicles 200 米长，用于距离较远的单元

## 16. Contact information

16 联系信息

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