Digital Power Controllers

数字功率控制器

KTZ Series

KTZ 系列

Three-phase load control

三相负载控制

KT系列三相可控硅调压器/调功器

User Manual

用户手册

杭州正安科技有限公司
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Precautions before usage
安装使用前注意事项：

Notice specifications	核对规格型号
Before installation, please check the specifications of the power controller is right or not, if not, contact the manufacturer.	在安装以前，首先要核对功率控制器的型号规格是否与订货要求相一致。若不符合订货要求，请及时与生产厂家联系。

Notice Files and spare parts	检查资料备件
Before installation, please check the files and spare parts ,(refer to the packing list) 1.user ' s manual 2.quality certificate 3.feedback sheet 4.of spare parts (spare parts are ordered by the customer; accessory is the manual POT)	在安装以前，请检查功率控制器的资料和备件是否齐全。资料和备件清单如下： 1.使用说明书；2.产品合格证； 3.用户质量反馈表；4.备件/附件（备件是指用户订货时所要求的备用器件；附件一般是用户要求手动调节的手动电位器）。

Notice inspection	察看有无损伤
Before installation, please check whether there is breakage, loosening of the screws, sloughing of the connections, if yes, do contact with the manufacturer.	在安装使用前，请察看功率调整器有无在运输过程中出现损伤，如撞伤、螺钉松动、接线脱落等现象。如有明显损伤，请及时和生产厂家联系。

Notice user ' s manual	阅读使用手册
Read user ' s manual carefully before installation.	在安装使用前，请认真阅读使用说明。

KTZ

USER MANUAL
用户手册

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警告

Safety symbols
安全标志

Important safety precautions and special information are indicated in the text of the manual by two symbols:
重要安全警告和特殊信息在本手册中用以下两个标志阐明：

DANGER
危险

This symbol means that failure to take note of the information given in this manual may have serious consequences for the safety of personnel and may even result in electrocution.
这个标志说明如果操作失误可能会引起严重的人员安全问题，可能会造成人员触电的后果。

ATTENTION
注意

This symbol means that failure to take note of the information may
· have serious consequences for the installation or
· lead to the incorrect operation of the power unit
这个标志说明如果没有按手册中的规范可能导致安装不正确或调功器不能正常工作。

These symbols must be observed for particular points.
这些标志必须特别遵守。
However the whole of the manual remains applicable.
然而手册中的其他部分可采取适用性原则。

Personnel
人员

The installation, configuration, commissioning and maintenance of the power unit should only be carried out by personnel **qualified and trained** to work with low voltage electrical equipment in an industrial environment.
安装，配置，试车和维护必须由受过专业训练的人员完成，而且其要有在工业现场环境中的低压电器设备的操作经验。

Independent alarm
独立报警

Given the value of the equipment controlled by **KTZ** products it is the res ponsibility of the user, and it is highly recommended, that an independent safety device (alarm) should be installed. This alarm must be tested regularly.
用户应该对 KTZ 产品控制的设备提高重视，我们强烈建议用户安装一个独立的安全（报警）设备。而且这个报警一定要经过检测合格。

Renzhong can supply suitable equipment.
人中可以提供合适的设备。

Chapter 1
第一章

IDENTIFYING THE CONTROLLERS
控制器信息

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Chapter 1 IDENTIFYING THE CONTROLLERS
第一章 控制器信息

GENERAL INTRODUCTION TO THE KTZ SERIES
ＫＴＺ系列产品概述

The ＫＴＺ series of controllers are thyristor units designed to **control** the electrical **power** of industrial three-phase loads.
ＫＴＺ 系列是晶闸管控制单元，是用来控制工业三相负载的功率。

A **ＫＴＺ** series controller is made up of three channels, each comprising a pair of thyristors connected in anti-parallel.
ＫＴＺ系列控制器由三个通道组成，每一个通道包括一对反并联的晶闸管。

The ＫＴＺ series is designed to control the following loads:
ＫＴＺ系列可以用来控制以下负载：

- inductive (inductors or primary transformer coils),
  感性负载（变压器的主、次级线圈）
- resistive (with low or high temperature coefficient),
  阻性负载（带高低温系数）
- composed of short wave infrared elements.
  远红外发热元件

Three-phase loads can be connected:
三相负载连接方式：

- in star with neutral
  中性点接零的星形接法

• in star without neutral
中性点不接地的星形接法
• in closed delta
封闭内三角接法
• in open delta.
展开外三角接法

The wiring of the controller is **indifferent** to the order of the supply phase rotation. Automatically identify the phase sequence.No need to check the phase sequence.
接线和相序无关紧要。自动判相，无需核对相序
The nominal currents of the **ＫＴＺ** series controllers are between **20A** and **1200A**, per phase, defined at an ambient temperature of 45°C.
ＫＴＺ系列的控制器的电流范围可以从20A到1200A，每相的工作温度在45°C以下。

Attention!
注意

In order to allow for variations in load resistance, the calculated current should not exceed 0.8 times the maximum rated current of the unit.
为了变阻负载，计算电流不应超过控制单元最大额定电流的0.8倍。

The load current is calculated from the supply voltage and the load power (or resistance).
负载电流的计算应该根据工作电压和负载的功率（或阻抗）计算。

With Diode display & Communication
带数码管显示和通讯

Without Diode display & Communication
不带数码管显示和通讯

The unit is controlled by **analogue** signals.
调功器单元的控制信号为模拟信号。

For the input analogue signals, there are four possible voltage levels:
输入的模拟信号包括四种电压等级信号：
0-5 V ; 1-5 V ; 0-10 V ; 2-10 V
and two current levels:
和两种电流信号：
0-20 mA and **4-20 mA.**

The instantaneous state of the thyristor unit, its operating mode, a load failure or the enabled alarms are indicated by message on a 7 segment **display** located on the front panel.
调功器单元的即时状态，工作方式和负载故障均通过前面板上的4位数码管显示出来。

The front panel also includes:
前面板还包括：
• 4 **push button** for the main operating parameters
4个设定操作参数用的按键

An **alarm** system detects failures in the loads and abnormal variations in the voltage and current.
报警系统检测负载的故障和电流、电压的错误变化。

Failure detection **is signalled** by the switches of one alarm relays and by the display.
故障通过一个报警继电器表现出来。

If the current threshold pre-adjusted by the user or in the factory is exceeded, **the current monitoring system**
如果用户或厂家预设电流超标，电流监控系统将：
• stops the thyristor unit in Burst firing or Logic operation
停止晶闸管工作
• limits the current by thyristor angle variation in Phase angle.
限制晶闸管的通过电流。

The electronics of the KTZ controllers are self-supplied from the power voltage and do not require external connections.
KTZ 的电源由自身的动力电压提供，不需要额外的外接电源线。

The control method of the KTZ series includes **line voltage squared** (V2) **compensation** for line variations in the range **+10%** to **-10%** of the nominal voltage of the controller.
KTZ 系列具有电压补偿特性，其电压范围可在控制器标称的+10%到-10%。

A KTZ series controller is equipped with:
KTZ系列控制器配备以下 部件：

· A**'driver board'** which generates thyristor firing pulses, implements control and provides power for the electronics. This board is also used for the signal and operating mode configurations（Please specify before ording）
触发板，提供晶闸管的触发脉冲，执行控制，提供动力。此板经常用作信号和操作模式的配置。（需订货说明）

The user terminal block beside the controller is used for the control signal connection without having to open the front door of the unit.
用户控制线接线端子在控制器边上，无需打开产品前盖。

TECHNICAL SPECIFICATION
技术规范

The K T Z series of controllers is intended for thyristor regulation and control of an industrial three-phase load.
ＫＴＺ 系列控制器是由晶闸管调节控制工业三相负载。

Danger !
危险！

An isolating device must be installed between the equipment and the mains supply in order to perform the maintenance in complete safety.
为了安全必须要在设备和主供电之间加装隔离断路器。

Thyristors are not isolating devices.
晶闸管不是绝缘设备。

Touching load terminals, even if there is no loads current (unit in the off-state), is as dangerous as touching power supply terminals.
即使没有负载电流，触摸负载接线端子和触摸供电端子一样危险。

Attention !
注意！

It is the user's responsibility to ensure that the nominal values of the thyristor unit are compatible with the conditions of installation and operation before commissioning the thyristor unit.
在试车之前，用户有责任确定晶闸管单元的额定值与安装操作条件相匹配。

Power
电源

Nominal current (per phase) （每相）额定电流	25A, 45A, 60A, 80A,**94A，110A，130A，160A，200A，250A，300A，** 400A，500A， or 1000A 。
Line-to-line voltage 相间电压	220 / 380 / 440V (+10%, -15%) 220 / 380 / 440V (+10%, -15%)
Supply frequency 频率	50Hz 50Hz

power and control
电源和控制

Cooling	Natural convection for 20A, 30A ratings Permanent

冷却	25A～45A **智能风机冷却**
fan-cooling **风冷**	for 50A ，100A，150A。。。1000A **force** rating 50A以上，强制风冷
Load **负载**	**All types** of industrial **three-phase** load: 所有类型的工业三相负载： resistive, short wave infrared, inductive, tungsten, 阻性，远红外发热元件，感性，钨， primary transformer coil, etc. 变压器一次侧，等。
Load connection **负载连接**	Independent of the phase rotation order 自动判相，无需核对相序
Load configuration **负载配置**	Closed (3 wires) and open (6 wires) delta 封闭三角（3线）和 开放三角（6线） Star without Neutral (3 wires) and with Neutral (4 wires) 中性点不接地星形（3线）和中性点接零（4线） Load type and assembly configuration using jumpers 负载配置变化用跳线

Control
控制

External control signal : **扩展控制信号：**	Analogue voltage 0 to 5V or 0 to 10V; current 4 to 20mA 模拟电压0-5V或0-10V；电流4-20 mA
Input impedance： **输入阻抗：**	Voltage input: >100kΩ, current input: 120Ω 电压输入大于100KΩ，电流输入：120Ω
Thyristor firing mode **晶闸管出发方式**	• **Phase angle** **移相调压型** Be applicable to resistance load and inductive load 适用于阻性负载和感性负载 Current-limiting function and over-current protection function are Provided 具备电流限制和过流保护功能 Output reslution:Approx. 10 A/D 输出分辨率：10位A/D • **Cycle base zero voltage trigger mode:** **周期调功型** Cycle based, zero voltage trigger,and ON-OFF control mode: 变周期，过零触发，通断控制方式 Be applicable to resistance load 适合于阻性负载 Reduce noise to power supply,with obvious effect of Energy-saving. 对电网干扰小，节能效果明显
Manual power control: **手动控制**	Adjustment output can be adjusted continuously by wxternal manual power adjuster.(The effect is the same as automatic control mode) 调整功率输出可以通过一个连续的外部手动功率调整器。（这个作用和自动模式一样）
Time of soft start and soft stop: **缓启动缓关断时间：**	Both are 15 sec. 均为15sec.

Control performance
控制性能

Linearity
线性
Better than ±**2**% of the full scale
优于满度的±**2**%

Stability With variations:
波动的稳定性
· Of the supply voltage +10%, -15%
电压在额定电压的+10%, -15%的范围内
· Of the temperature from 0 to 70°C
温度在0 to 70°C的范围内
stability is better than ±**2**% of full scale
稳定性优于满度的±**2**%

Output range:
输出范围：
Phase angle control mode :0-98% of input voltage
调压型：电源电压的0-98%。
Cycle base zero voltage trigger mode:Ecentricity ratio is 0-100%.
调功型：占空比为0-100%。

Current-limiting:
电流限制：
• Only be applicable to the phase angle control mode.
• 仅适用于移相调压方式
Over-current value can be set in the range of 20～100% of
• rating current.
• 电流限制值可在额定电流的20～100%间设定
• After the current of load is up to the preset value,it will not increase following the intput siganl
• 负载电流达到设定值后不再随输入值增加
• This function can prevent the heater from becoming too hot to break.
• 可防止温度增长过快和烧坏加热器

Alarms and protection
报警 和保护

Voltage
电压
Absence of supply voltage on each phase
(inhibition of the thyristor unit)
电源供电缺相（晶闸管关断）
Under-voltage (thyristor firing stopped below 7**0%** of the nominal thyristor unit voltage)
欠压（低于正常电压的70%）
Over-voltage (alarm for a voltage greater than the nominal thyristor unit voltage by **20%**)
过压（高于正常标称电压的20%）

Over-current protection:
过电流保护：
• Be applicable to the phase angle control mode and cycle base zero voltage trigger mode
• 调功型在导通的时间内“过流保护”功能起作用
• Over-current protection function works in the time of the thyristor opening in the mode of cycle base zero voltage trigger.
• 负载电流达到过流保护设定值后即：停止输出、报警继电器动作、红色 LED 灯直亮

Environment
环境

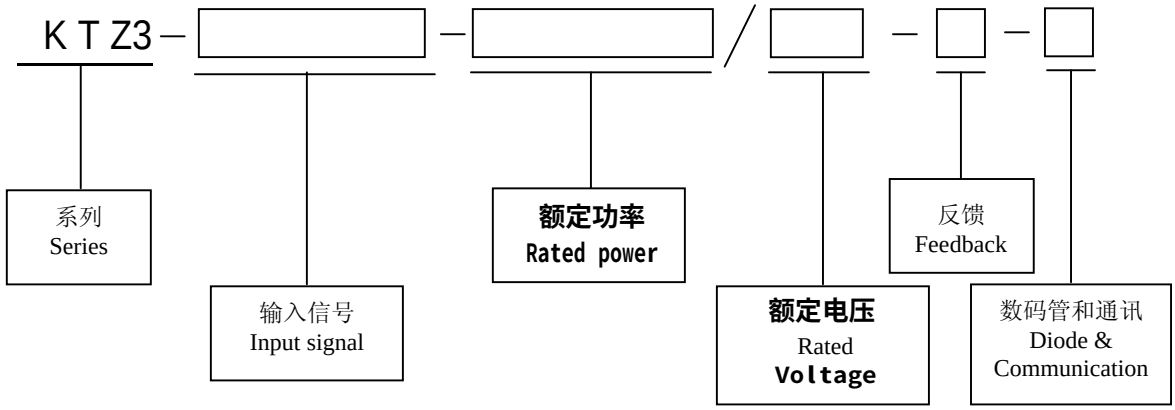
Operating temperature
工作温度
0°C to +45°C at maximum altitude of 2000m
0°C to +45°C，最高海拔2000m以内

Storage temperature
存储温度
-10°C to +70°C
-10°C to +70°C

Thyristor protection
晶闸管保护
High-speed external and **RC** snubbers
快速熔断和阻熔吸收、电子互感器保护

Protection **保护**	IP20 on the front facia 前面板符合IP20
External wiring **扩展接线**	To be carried out in compliance with standard
Operating atmosphere **操作气氛**	Non-explosive, non-corrosive, non-conductive 无暴露，无腐蚀，无传导
Humidity RH: **湿度**	5% to 95%, non-condensing 5% to 95%,无冷凝
Material/Finish **壳体材料及涂层**	Ordinary steel plate/paint coating 钢板/喷塑

PRODUCT CODE
定货代码



输入信号 Input signal	代码 Code
0 – 5V 0 to 5 volts	0V5
1 – 5V 1 to 5 volts	1V5
0 – 10V 0 to 10 volts	0V10
2 – 10V 2 to 10 volts	2V10
0-20 mA 0 to 20 milliamps	0mA20
4-20 mA 4 to 20 milliamps	4mA 20 （默认类型，可省略）

Rated power 额定功率	Code 代码
17KVA	17KVA
29KVA	29KVA
39KVA	39KVA
52KVA	52KVA
62KVA	62KVA

72KVA	72KVA
85KVA	85KVA
105KVA	105KVA
131KVA	131KVA
164KVA	164KVA
197KVA	197KVA
264KVA	264KVA
328KVA	328KVA
397KVA	397KVA

Load power more than 397KVA for customization
额定功率在397KVA以上为定制

Rated Voltage 额定电压	Code 代码
3×220V	3×220V
3×380V	3×380V
3×440V	3×440V

Feedback 反馈	Code 代码
With feedback 带反馈	F
Without feedback 不带反馈	N （默认类型，可省略）

Diode & Communication 数码管和通讯	Code 代码
With Diode & Communication 带数码管显示和通讯	S
Without Diode & Communication 不带数码管显示和通讯	N （默认类型，可省略）

EXAMPLE OF PRODUCT CODE

选型举例

Controller and installation parameters
控制和安装参数

Input signal 4 to 20 milliamps
输入信号4-20 mA
Nominal power 62KVA
额定功率 62KVA
Load Voltage **3×380V**
负载电压 **3×380V**
Without feedback
不带反馈
Without Diode & Communication
不带数码管显示和通讯

Controller code:
控制器代码：

KTZ 3 – 4 mA 20 – 62KVA / 3×380V – N – N 也可省略为：KTZ3-62KVA/3×380V

Chapter 2
第二章

INSTALLATION
安装

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Chapter 2 INSTALLATION
第二章 安装

INSTALLATION - SAFETY
安装安全规范

DANGER!
危险！

K T S units must be installed by personnel qualified and trained to work with low voltage electrical equipment in an industrial environment.
ＫＴＳ调功器单元安装维护必须由受过专业训练的人员完成，而且其要有在工业现场环境中的低压电器设备的操作经验。

Units must be installed in electrical cabinets correctly fan-cooled to ensure that condensation and pollution are excluded.
调功器单元要安装在电气控制柜中，风扇可以排除污染和灰尘。

The cabinet must be closed and bonded to the safety earth in accordance with Standards NFC 15-100, IEC 364 or current national Standards.
控制柜必须保证安全接地。

The units must be mounted with the heatsink positioned vertically, with no obstructions above or below which could inhibit or impede airflow.
调功器单元必须在有强度的安装板上垂直安装，上下不能放置影响空气流通的物品。

If several units are mounted in the same cabinet, they should be arranged in such a way that air expelled from one cannot be drawn into the unit located above it.
如果一个控制柜中安装多个调功器单元，它们的安装排列方式应以不影响空气循环流通的原则。

Attention!

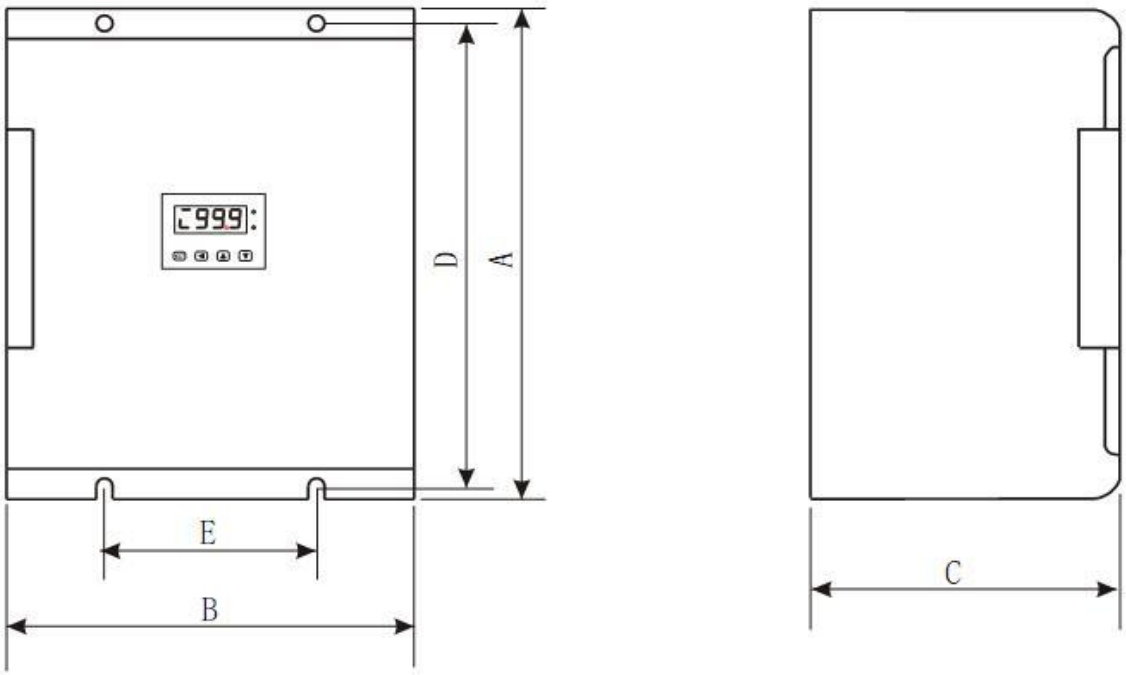
注意！

The units are designed to be used at an ambient temperature less than or equal to 45°C.
调功器单元的使用温度设计为控制柜内的温度要低于45°C。
Leave a minimum gap of 5cm between two units placed side by side.
如果两个单元并排放置，应保证两个之间最小留有5cm的距离。
Excessive overheating of the controller may lead to incorrect operation of the unit.
控制器过热可能导致调功器单元停止工作。
This may in turn cause damage to the components.
这是为了防止元器件的损坏。

DIMENSIONAL DETAILS(mm)
详细尺寸(mm)

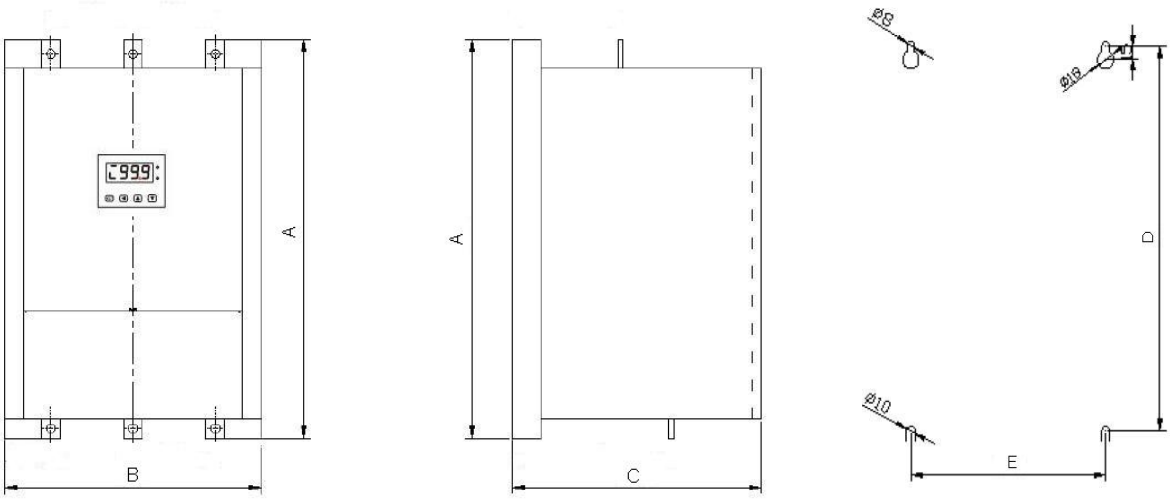
NO. 编号	Power 功率	A（Length）	B（Width）	C(Height)	D（Length）	E（Width）
1	17-62KVA	310	194	220	290	120
2	72-164KVA	420	265	258	400	220
3	197KVA	420	305	258	400	260
4	264-328KVA	460	400	302	440	120+120
5	394KVA	520	400	302	500	120+120
6	526-790KVA	520	640	350	500	220+220

The overall dimensions of KTZ 3 controllers are given in Figure 2-1(1)\(2).
KTZ 3 尺寸图见2-1(1)\(2)。



(17-62KVA)

Figure 2-1(1) The overall dimensions of KTZ controllers



(72-790KVA)

Figure 2-1 (2) The overall dimensions of KTZ controllers

Fasten the 4(6) screws correctly
正确固定4(6)个螺栓。

Chapter 3
第三章

WIRING
接线

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CHAPTER 3 WIRING
第三章 接线

WIRING - SAFETY
接线安全规范

DANGER!
危险！

Wiring must only be carried out by personnel who are qualified to work in a low voltage industrial environment.
调功器单元安装维护必须由受过专业训练的人员完成，而且其要有在工业现场环境中的低压电器设备的操作经验。

It is the user's responsibility to wire and protect the installation in accordance with current professional Standards.
安装接线应符合电工专业标准。

A suitable device ensuring electrical isolation between the equipment and the supply must be installed upstream of the unit in order to permit safe operation.
为了保证安全操作，应在设备和电源供电之间增加适合的设备。

K T Z series units have a protective cover.
ＫＴＺ系列有保护外壳。

DANGER!
危险！

Before any connection or disconnection, ensure that power and control cables or leads are isolated from voltage sources.
在接断线之前，一定要保证电源和控制器切断电源。

For safety reasons, the safety earthing cable must be connected before any other connection is made during wiring and it should be the last cable to be disconnected.
在接线之前首先要保证接地线已良好接地，而在拆线时一定要最后在拆接地线。
The safety earth is connected to the screw located on the slot at the side of the controller and is denoted by the symbol: ⏚
安全地一定要接在指定的螺丝上，而且要有明确指示。

Attention!
注意！

To ensure correct grounding of the **KTZ** unit, make sure that it is mounted on the **reference ground surface** (panel or bulkhead).
为了保证 **KTZ** 单元的正确接地，一定要确定开孔在参考地表。
Failing this, it is necessary to add a ground connection **at most 10cms** long between the earth connection and the reference ground surface.
如果没有的话，应该在在接地端和参考地表有根长度不超过10cm的连接。

DANGER!
危险！

This connection, which is intended to ensure good ground continuity, can never be used to replace the safety earth connection.
这个连接是为了接地的连贯性，而不能代替安全地的连接。

POWER WIRING
电源连接

The control terminal block has a plug-in connector.
控制接线端由接插件连接。
The safety earth is connected to an **M6** screw and bolt.
接地端由M6螺栓连接。

Power wiring diagrams
动力线接线图

The ＫＴＺ power wiring diagram depends on the load configuration.
ＫＴＺ的动力线接线说明要根据负载的配置。
The following three **power** and **safety earth** wiring diagrams are given below to illustrate different types of load configuration.
下面给出各种负载配置的三相动力线和安全地线的接法。

Star without neutral and closed delta configuration

Three-phase loads connected in star without neutral or in closed delta are configured as 3-wire.
中性点不接地的星形和内三角形的三线制的三相负载接法。

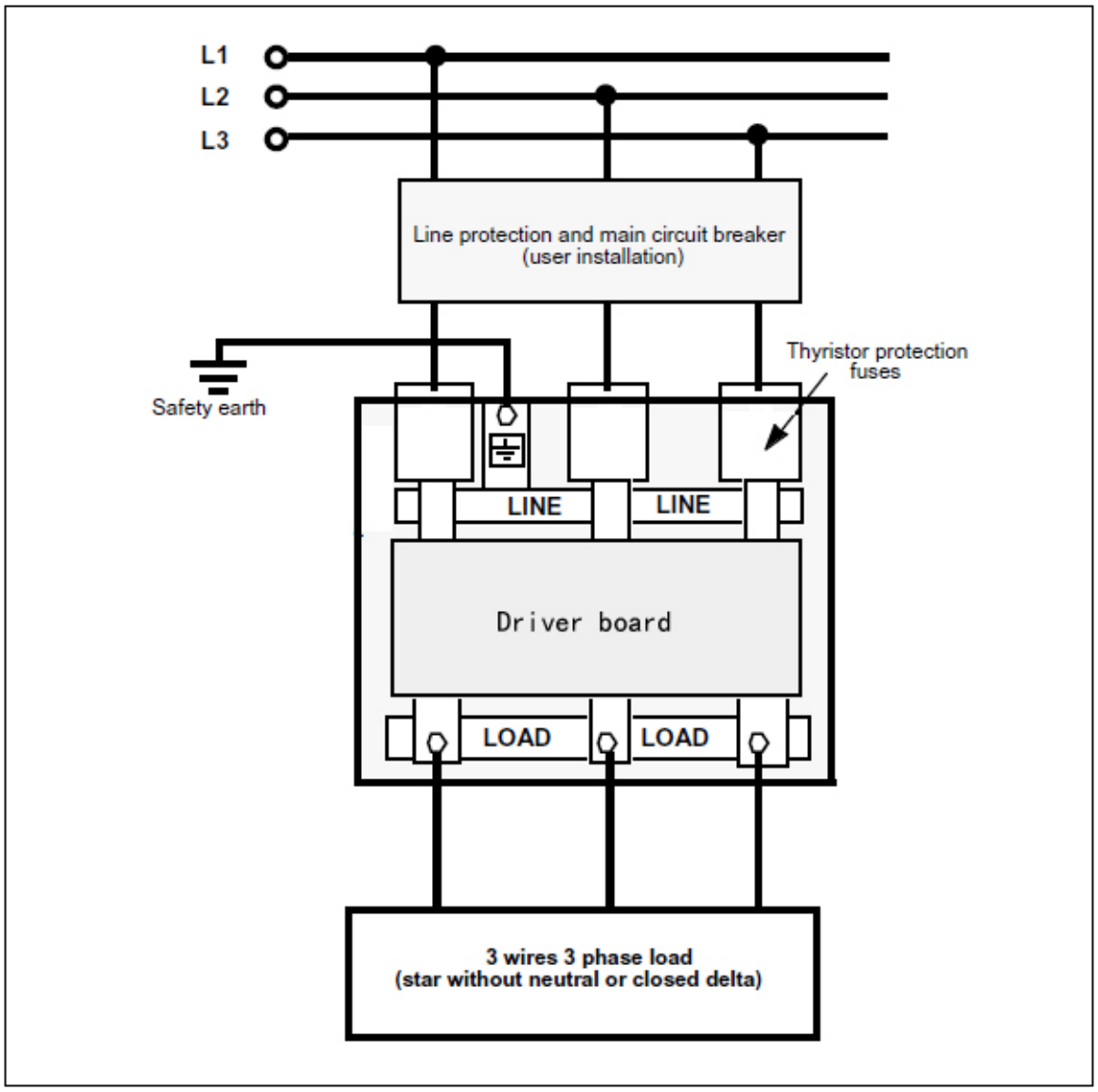


Figure 3-1 Power and safety earth wiring diagram for a 3 wires load

Star with neutral configuration
中性点接零的星形接法

A three-phase load connected in star with neutral is configured as 4-wire.
中性点接零的星形的4线制三相负载接法。

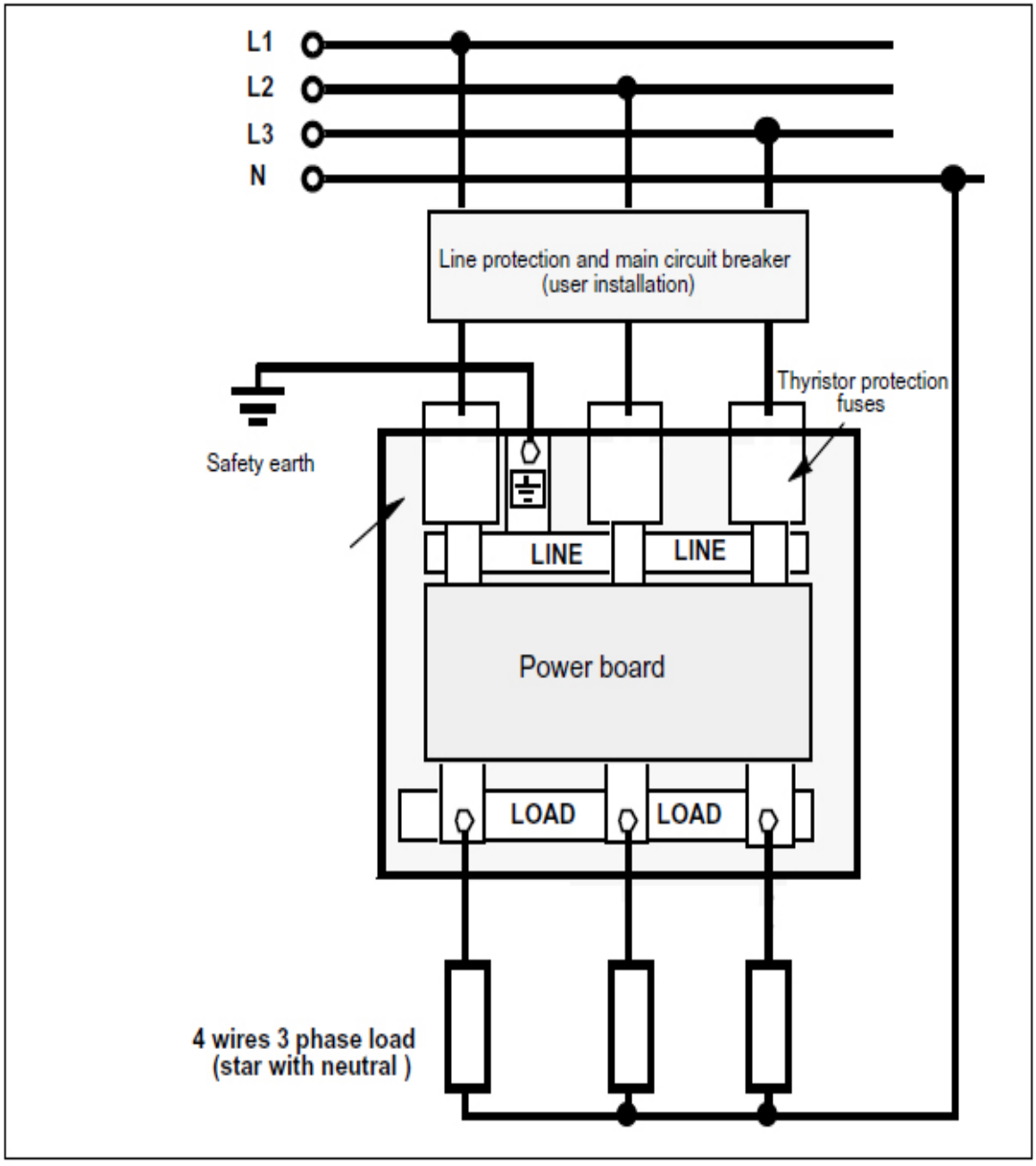
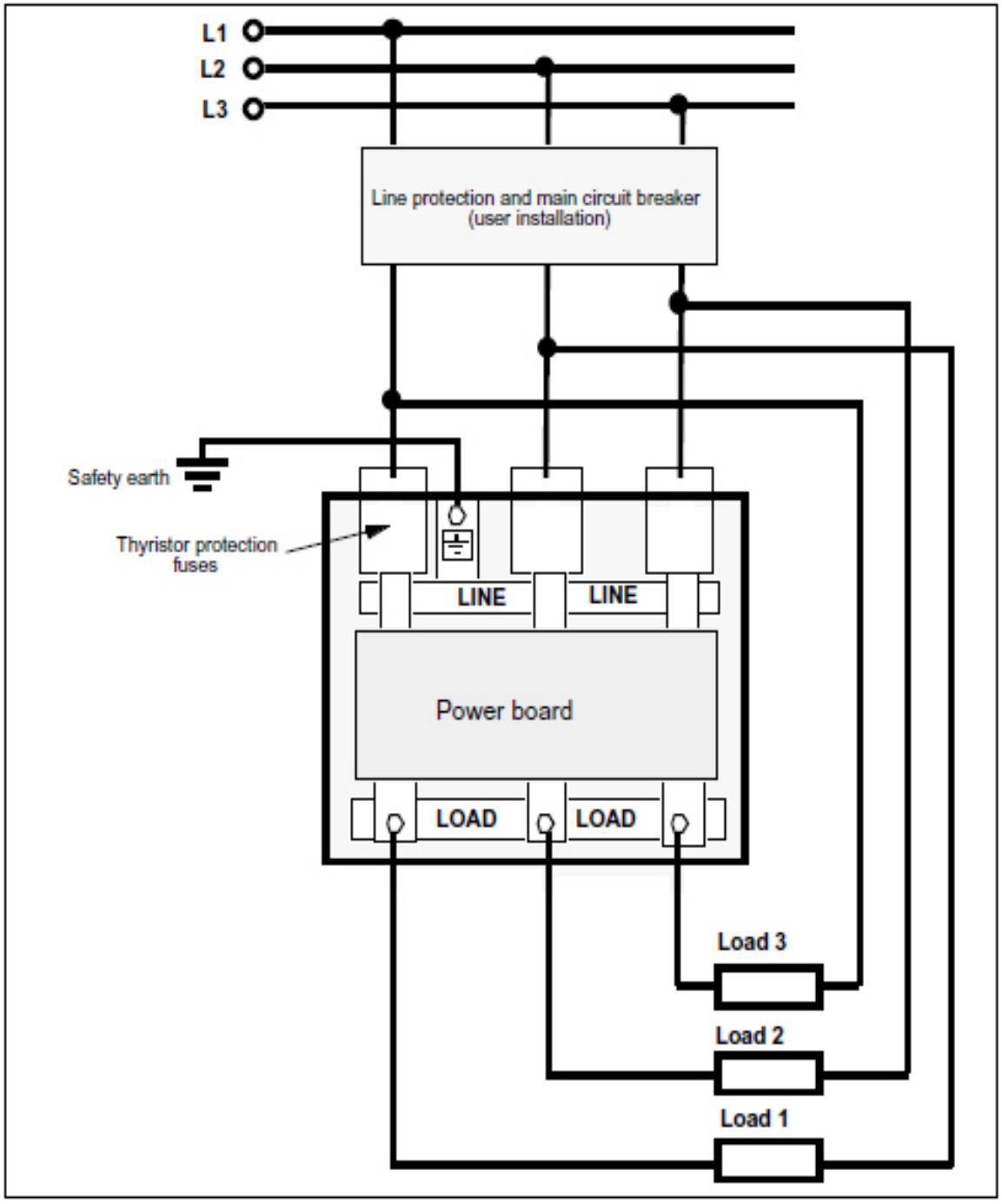


Figure 3-2 Power, safety earth and neutral wiring diagram for a load connected in 'Star with neutral' (4 wires)

Open delta configuration
外三角配置



Important!
重要！
The load wiring given below must be observed.
负载接线一定要按图势说明。

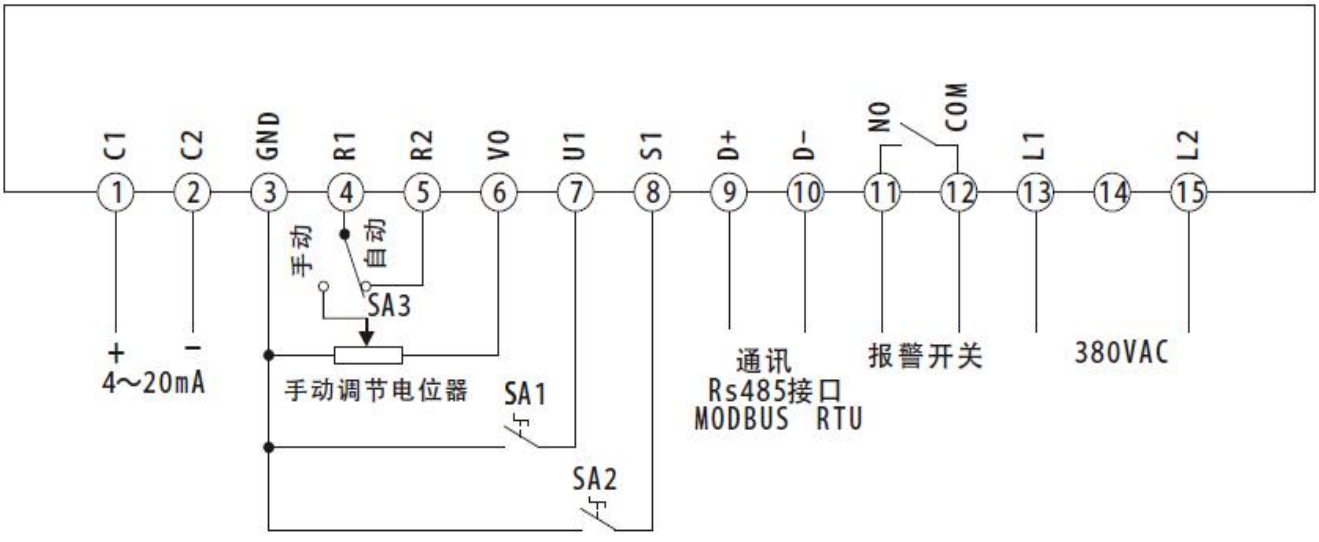
USER TERMINAL BLOCKS

用户接线端子排

General introduction
总体介绍

The user terminal blocks comprise:
用户端子排包括以下内容：
· A control terminal block
控制端子
· A fan terminal block
风机端子（出厂已接好）
The control terminal block is located **beside** the controller on the **left** side.
控制端子在控制器的左边。
The fan terminal block is located **over** the controller on the **top** side.
风扇端子在控制器的上面。
These connectors for the wires **plug in**.
这些连接都是接插件连接。

Terminal numbers 端子号	Designation on label 标签名称	Function 功能
1	**C1**	**Input signal "+"**
2	**C2**	**Input signal "-"**
3	**GND**	**Signal GND**
4	**R1**	**Auto/Manual switch**
5	**R2**	**Auto/Manual switch**
6	**V0**	**Reference voltage**
7	**U1**	**Working mode**
8	**S1**	**Reset**
9	**D +**	**Modbus communication "+"**
10	**D -**	**Modbus communication "-"**
11	**NO**	**Alarm nomal open**
12	**COM**	**Alarm**
13	**L1**	**Power**
14	**NC**	**NC**
15	**L2**	**Power**



Control wiring in local mode
手动控制接线

The controller can be driven in **local mode** by a potentiometer.
控制器在手动模式下可以由电位器控制。

For operation with manual control, a **10k** external potentiometer must be used, connected between terminals **3** (‘**0V**’) and **6** (‘**+5V**’, **0.5mA**).
在手动模式下，需使用一个10KΩ的电位器，在3,6之间。

The potentiometer wiper is connected to the control terminal block input (terminal **4**).
电位器引出端接在4号端子。

Danger !
危险!

With the door open, dangerous live parts may be accessible if the KTZ thy ristor unit is switched on.
如果KTZ调功器单元正在工作，打开盖门会有危险。

Chapter 4
第四章

CONFIGURATION
配置

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Chapter 4 CONFIGURATION
第四章 配置

CONFIGURATION - SAFETY
配置安全规范

The controller is configured , located on the driver board.
触发板上有控制器的配置部分。

Important!
重要！

The controller is supplied fully configured in accordance with the product code on the identification label and is ready for operation after wiring.
控制器必须完全按根据产品代码配置完毕后，才能接线准备使用。

This chapter is included with a view to:
这章包括以下内容：
· Checking that the configuration is suitable for the application
检查配置是否符合要求
· Modifying, if necessary, certain characteristics of the controller on site.
修改必需的控制器参数。

DANGER!
危险！

For safety reasons, re-configuration of the controller must be carried out with

---

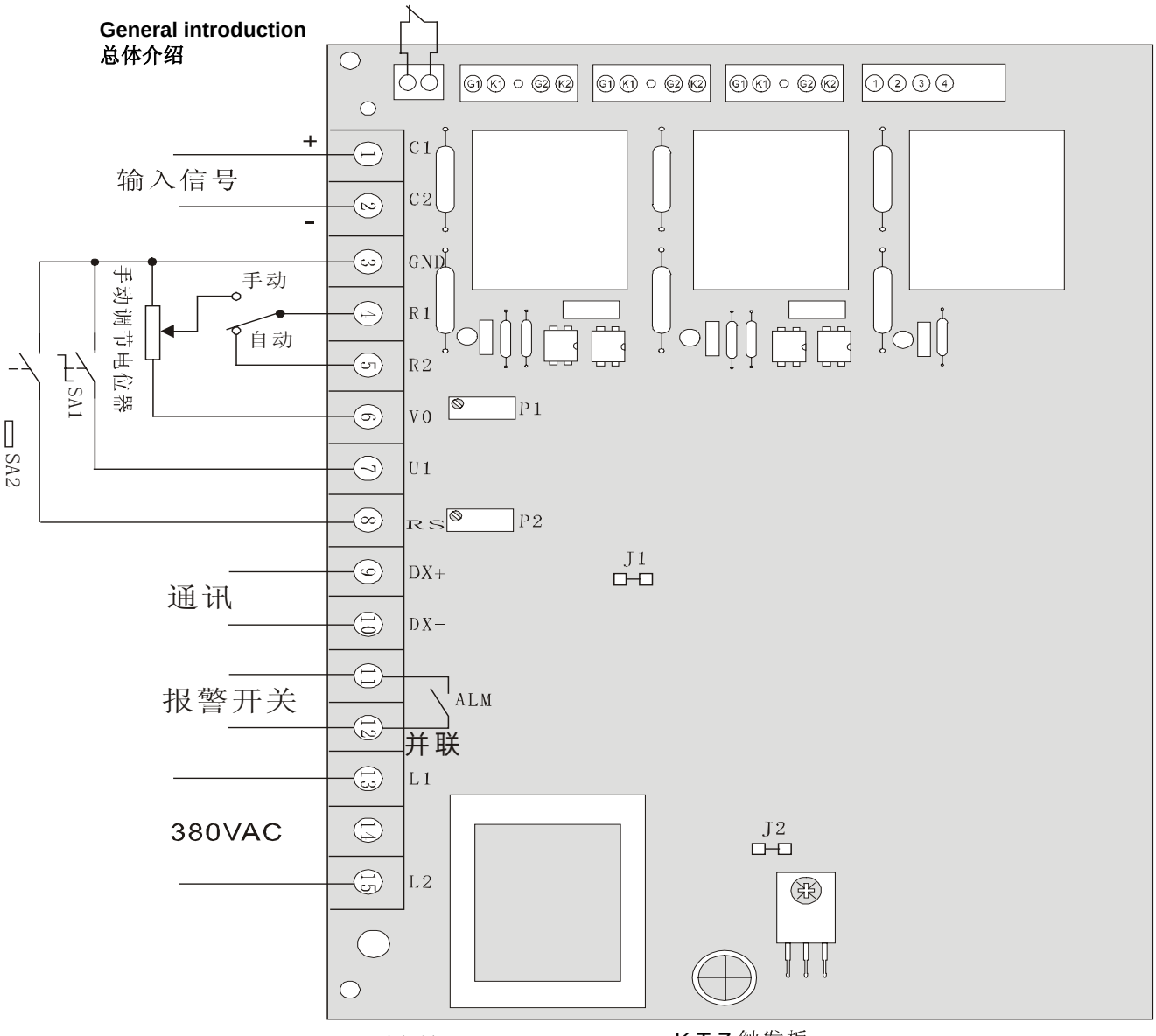
the unit switched off and by personnel qualified and trained to work with electrical equipment in a low voltage industrial environment.
为了安全，调功器单元的再配置必须在切断电源的情况下由受过专业训练的人员完成，而且其要有在工业现场环境中的低压电器设备的操作经验。

Before starting the re-configuration procedure, ensure that the controller is isolated and that any accidental power-up is not possible.
在再配置之前，请确保控制器已经隔离电源，并且不会意外上电。

After re-configuring the controller, amend the codes on the identification label to prevent any later maintenance problems.
重新配置以后，修改标签说明，以便日后维护。

DRIVER BOARD CONFIGURATION
触发板配置

General introduction
总体介绍



KTZ 触发板

SA1:调功调压转换
SA2:启停开关

General introduction
总体介绍

- potentiometer
  电位器

P1: Scale range adjuster
P1:量程调整电位器

P2:Setting over-current adjuster
P2:过流设定电位器

P3:Cuttent-limiting adjuster
P3:电流限制电位器

- 端子代码及定义
  Terminal code and definition

1，2： C1，C2：Control signal input
1，2： C1，C2:控制信号输入

3，8： GND，S1： Active and reset switch
3，8： GND，S1： 运行及复位状态转换

4，5： R1，R2：External power adjustment
4，5： R1，R2：外部电压调节

3，7:：GND，U1：Work mode switch
3，7:：GND，U1：工作方式选择

9，10： D+ ， D- ：Communication
9，10： D+ ， D- ： 通讯

11，12： NO，COM： Alarm
11，12： NO，COM：报警输出端

13，15： L1，L2：Power
13，15： L1，L2：电源输入端

Chapter 5
第五章

OPERATION
操作

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Chapter 5 OPERATION
第五章 操作

CONTROL OPERATION
控制操作

ＫＴＺ controllers include an internal control loop.
ＫＴＺ数字功率控制器采用先进的微处理器数字锁相环控制技术。

Thyristors
晶闸管

The 3 pairs of thyristors modulate the supply voltage which is applied to the three-phase load.
三相晶闸管功率控制器调压后给负载。

Display board
显示板

Four operation push button located on the **display board** (which is mounted parallel to the driver board) can be accessed on the front panel. They are used to adjust the main thyristor unit operating parameters without having to open the front door.
四个操作按键固定在调节板上（与触发板平行放置）在前面板上。这些按钮可以调整调功器的主要参数而无须打开前盖。

The functions of the operation potentiometers are indicated on the front panel of the thyristor unit and are explained in the relevant paragraph .

前面板的操作板功能在相应章节有说明。

If the thyristor unit is replaced, the potentiometer board can be transferred to the new thyristor unit and thus retain all the adjustments specific to the application concerned.
如果晶闸管更换以后，调整板可以继续使用并保留原来的调参数。

Display
显示

Four **7** segment display is used for steady and flashing messages indicating the current operating mode of the thyristor unit, the alarm state and the error or fault type.
四个7段数码管显示直亮、闪烁显示晶闸管工作的电流、电压等参数和报警及错误故障的类型。

Diagnostic connector
通讯诊断连接

The values from the feedback and the operation of the thyristor unit are available on the diagnostic connector located on the side panel.
通过前面板的诊断连接口，可以看到晶闸管的工作参数和反馈参数。

Driver board
触发板

The analogue control signals and parameter retransmissions are applied to the driver board **user terminal blocks**.
模拟控制信号可以通过现场总线MODBUS 485用户接线端块实现的。

The **synchronisation** circuit supplies the microprocessor with three signals corresponding to the sign of the line voltages measured and a signal corresponding to the zero voltage crossing.
同步环提供给微处理器相应的三相相电压和零电压点。

A square raising circuit supplies four signals corresponding to the squares of the measured signals: $\mathbf{I1^2}$, $\mathbf{I2^2}$, $\mathbf{I3^2}$ and $\mathbf{V^2}$.
平方放大电路提供四个相应信号：$\mathbf{I1^2}$, $\mathbf{I2^2}$, $\mathbf{I3^2}$ and $\mathbf{V^2}$ 。

An '**OR**' circuit selects the highest value from the squares of the three currents which is compared to an adjustable threshold of the current limit setpoint.
通过一个‘或’电路选择三个电流平方的最大值和电流限定的设定值做比较。

The **multiplexer** selects the signal applied to the analogue/digital converter inside the microprocessor from the measurements, front panel potentiometer voltages and the control signals, according to the program procedure.
多路选择信号器将采集到的模拟信号通过10位A/D转换器送给微处理器，这些模拟信号是通过程序过程采集到的电压、控制等信号。

The driver board **microprocessor** controls the entire operation of the thyristor unit and the message display.
微处理器控制着整个晶闸管的动作和显示的信息。

The amplification of the input signals converts the low level signals and amplifies the retransmissions.
输入放大电路将弱信号放大传输。

One **relays** are used for the external detection of the active alarm state.
一个报警继电器指示报警状态。

A **diagnostic connector** located on the front panel of the thyristor unit is used to control or measure the main thyristor unit operating parameters.
位于调功器前盖的MODBUS 485通讯接口可以用来控制调功器的动作参数。

The **watchdog** monitors the correct functioning of the software; in the event of a fault, it sends a '**Reset**' signal to the microprocessor.
看门狗监视软件是否正常工作，如果发生错误，微处理器会得到一个复位信号。

THYRISTOR FIRING MODES
晶闸管触发方式

'Phase angle' mode
移相角调压模式

In '**Phase angle**' mode, the power transmitted to the load is controlled by firing the thyristors on a part of the supply voltage alternation.
在移相触发模式中，负载的功率控制是靠晶闸管的提供的交流电压的部分电压完成的。

For the three-phase load configuration in star **with neutral**, the load voltage is composed of portions of supply '**phase-neutral**' voltage alternations.
如果三相负载是中性点接零的星形接法，负载电压有一部分是靠供电电压的零线交替提供的。

For the three-phase load configuration in **open** delta, the load voltage is composed of portions of **line-to-line** voltage alternations.
如果负载是外三角形接法，负载电压有一部分是靠供电的线电压交替提供的。

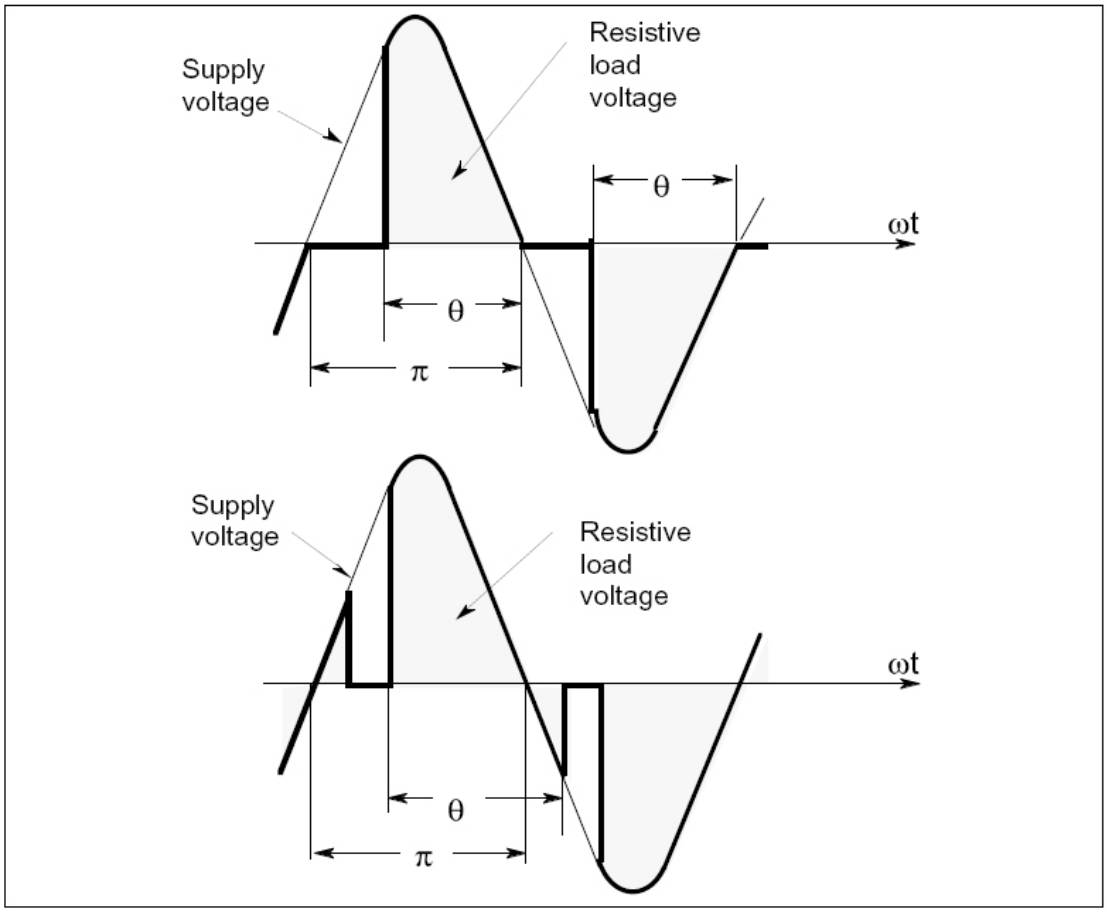

Figure 5-1 Load voltage in 'Phase angle' (star with neutral or open delta)
负载电压，（中性点接零或开放三角形）

The firing angle (ν) varies in the same way as the control system signal.
触发角（ν）的变化同样的作为控制信号。
The output power is not a linear function of the firing angle.
输出功率和触发角不是线性的。

The three-phase load voltage, configured in star **without neutral** or in **closed** delta (3 wire configuration), is composed

of portions of **two**- or **three-phase** waves according to the thyristor firing angle value.
如果负载接法是星形中性点不接零或内三角形（3线制），三相负载电压根据晶闸管的触发角的两个或三个波形组成。

In **two-phase** operation, the thyristor output voltage (between 'LOAD' terminals) is the voltage between two **firing** phases.
在两相操作中，晶闸管输出电压在两个触发相中。

In **three-phase** operation, the voltage of each load arm is the **phase** voltage for the star without neutral configuration or the **line-to-line** voltage for the closed delta configuration.
在三相负载中，如果是中性点不接零的星形每相负载电压就是相电压，在内三角形中每相负载电压就是线电压。

The figure below shows two examples of **three-phase resistive** voltages configured in star without neutral.
下面是两个中性点不接零的星形接法的三相负载电压的例子。

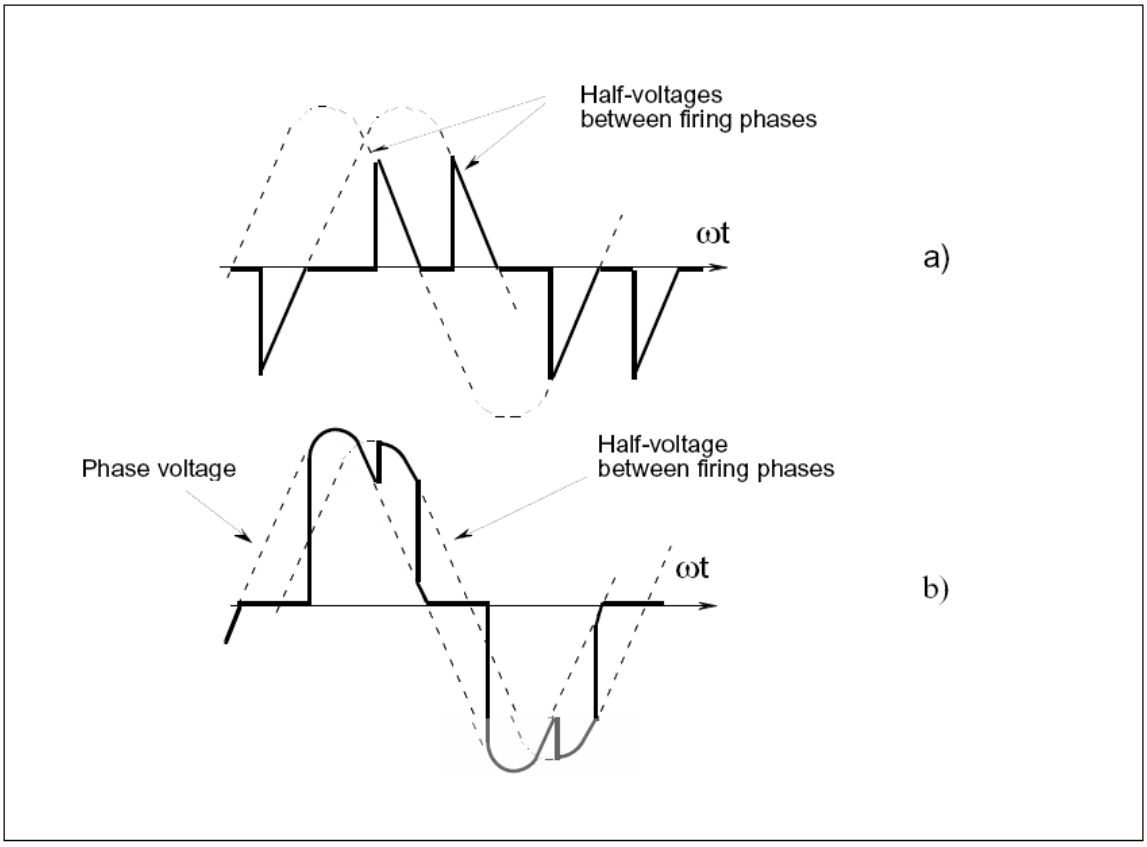

Figure 5-2 Resistive load voltage (star without neutral) in 'Phase angle'
移相阻性负载电压（中性点不接零的星接）

For a small firing angle (∖<60°), the load voltage is composed of portions of half-voltages between phases (figure 5-2,a).
如果触发角小于60度（∖<60°），负载电压由相间的半电压组成。（图5-2,a）

For a large firing angle (∖>60°), the load voltage is composed of portions of voltage of one phase and portions of half-voltages between phases (figure 5-2,b).
如果触发角大于60度(∖>60°),负载电压由一相和相间的半电压组成。（图5-2, b）

'Burst firing' mode
调功模式

The '**Burst firing**' mode is a **proportional cycle** which consists of supplying a series of **complete** supply voltage **periods to the load**. (see figure 5-3).
调功模式是一个比例圈，是由一系列的完整供电组成给负载的。

Thyristor firing and non-firing are synchronised with the supply and are performed **at zero voltage** for a resistive load.
对于阻性负载，于供电同步的触发电压和非触发电压是在零电压点执行的。

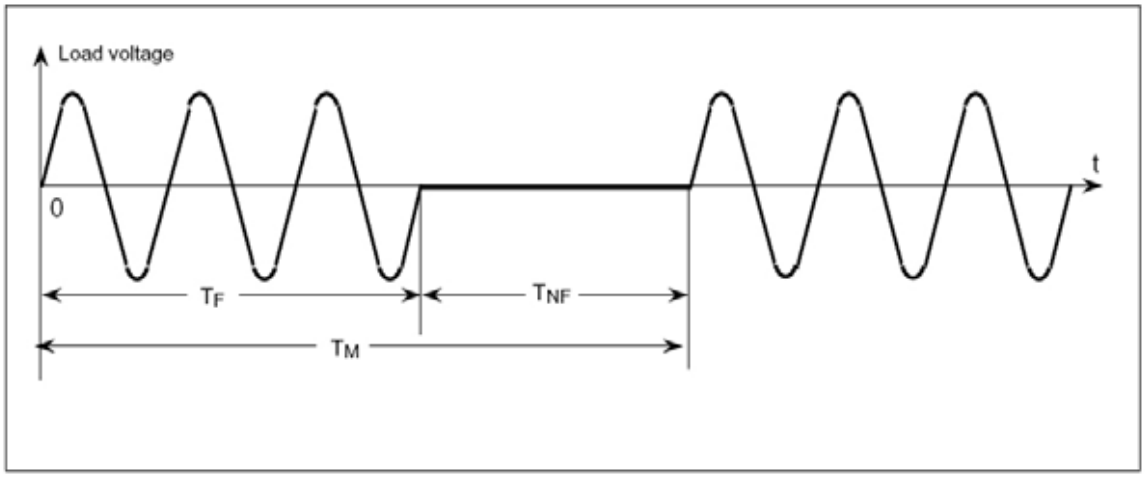

Figure 5-3 'Burst firing' mode (T_F - firing time; T_M - modulation period)
调功模式（T_F -触发时间；T_M-调节时间）

The control algorithm of the **JS3000** series takes into account the value of the r.m.s. load voltage **squared**.
KTZ 系列的运算法则采用的是负载电压的平方值。

The square of the r.m.s. load voltage represents the power dissipated in a purely resistive load whose resistance remains constant with temperature.
负载电压的平方值表明了功率消耗为阻性负载的持续温度。

The output power of the controller is linear between **0**% and **100**% of maximum power for an analogue input signal variation between **4**% and **96**% of full scale.
控制器的输出功率的0%到最大功率的100%与输入信号的4%到额定范围的96%成线性变化。

Control precision is guaranteed to **±2**% of the power dissipated in the load (for constant resistance).
控制精度保证在负载消耗功率的**±2**%。

The output power of the controller is calibrated according to the nominal voltage specified when ordering.
控制器输出功率的计算根据定货时的标称电压。

Chapter 6
第六章

COMMISSIONING PROCEDURE
试车程序

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Chapter 6 COMMISSIONING PROCEDURE
第六章 试车程序

Read this chapter carefully before commissioning the controller
试车之前请仔细阅读本章

COMMISSIONING PROCEDURE - SAFETY
试车程序安全规范

Important!
重要！

cannot be held responsible for any damage to persons or property or any financial loss or costs arising from incorrect use of the product or failure to observe the instructions contained in this manual.
“不负责由于对产品不正确的使用或不遵守本手册的指导而导致的人员或财产或金钱的损失。

It is therefore the user’s responsibility to ensure, before commissioning the unit, that all the nominal ratings of the power unit are compatible with the conditions of use and the installation.
因此，用户在试车之前有责任确保标称的额定功率与安装和使用的是相符的。

DANGER!
危险！

A thyristor is not an isolating device.
晶闸管不是孤立的设备。

Touching a load terminal even with a zero load current is as dangerous as touching mains live.
在无负载的情况下，触摸负载端子与触摸主回路同样危险。

Only personnel qualified and trained to work with low voltage electrical equipment in an industrial environment should have access to the interior of the unit.
只有受过专业训练，而且有在工业现场环境中的低压电器设备的操作经验的人员才能接触调功器单元内部。

Access to internal components of the controller is prohibited to users who are not authorised to work in an industrial low voltage electrical environment.
The temperature of the heatsink may exceed 100°C.
不允许非在工业现场环境中的低压电器设备的操作经验和授权人员接触调功器内部组件。受热面温度可能超过100°C。

Avoid all contact, even occasional, with the heatsink when the controller is operational. The heatsink remains hot for around 15mins after the unit has been switched off.
在控制器工作时，避免接触受热面，甚至是偶然接触。在调功器单元断电以后的15分钟内，受热面的周围仍会保持很热。

CHECKING THE CHARACTERISTICS
检查特性

Load current
负载电流

The maximum load current must be less than or equal to the value of the nominal current of the controller, taking into account the load and power supply variations.
最大的负载电流一定要小于或等于控制器的额定标称电流，估计负载功率提供的变化。

If three identical loads are configured in **closed delta**, the current of each phase of the controller is **$\sqrt{3}$ times greater** than the current in each **branch** of the load.
如果同样的负载是内三角形接法，控制器的每相电流要比负载分立的分支电流大**$\sqrt{3}$倍。**

For a given power (**P**) of a three-phase load and with line-to-line voltage VL, the current to be compared with the nominal current of the controller is:
给定一个三相负载的功率和相与相之间的电压，则额定标称电流如下：

$$I = \frac{P}{\sqrt{3} \times VL}$$

For open delta, the current to be compared with the nominal current of the controller is:
如果是开放三角形接法，则控制器的额定标称电流如下：

$$I = \frac{P}{3 \times VL}$$

Supply voltage
供电电压

For starts configurations without neutral or closed delta,the nominal value of the thyristor unit voltage must be greater than or equal to the line to line voltage of the supply used.
对于中性点不接零的星接或封闭三角形接法，晶闸管单元的标称电压一定要高于或等于供电电压。

Danger!
危险！

Never use a thyristor unit with a supply voltage greater than the nominal unit voltage specialed in the coding .
晶闸管单元一定不能用在比定货电压高的供电系统中。

If the line voltage is less than 80% of the nominal voltage,the thyristor unit is inhibited.
如果电压低于标称电压的80%，晶闸管单元将停止工作。

Attention!
注意！

In order for the control algorithm to function correctly, the nominal unit voltage rating must be as close as possible to the supply voltage.
为了保证控制器运算功能能正确完成，额定标称电压应该最可能接近电源提供的电压。

Control signals控制信号

Configuration on the driver board must be compatible with the type and level of the control signals.
触发板的配置应该与输入信号的类型和级别相一致。

POWERING UP THE CONTROLLER
控制器上电

K T Z series controllers are ready to operate correctly **immediately** after installation and wiring in accordance with this user manual.
按用户手册安装接线结束后，ＫＴＺ系列可以准备正常工作。

After checking that the nominal parameters of the controller (voltages, currents, input signal and load configuration) are compatible with those of the installation, apply volts to the controller.
检查完控制器的标称参数（电压，电流，输入信号和负载配置）和安装参数一致后，控制器可以正式上电。

Check that the current in each phase of the controller is equal to **0** in the **absence** of the control signal.
检查无输入信号时，控制器的各相电流是否为零。

Make sure that the r.m.s. current in each phase **does not exceed** the nominal controller rating when the setpoint is at **maximum**.
当设定值为最大时，确保每相电流不超过控制器的额定标称电流。

Chapter 7
第七章

DISPLAY MESSAGES
显示信息

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Chapter 7 DISPLAY MESSAGES
第七章 显示信息

GENERAL
总述

During the thyristor unit commissioning procedure and during its operation, messages are displayed on the front panel display. These messages inform the user on:
在调功器试车和工作时，前面数码管会显示相关信息。这些信息包括：

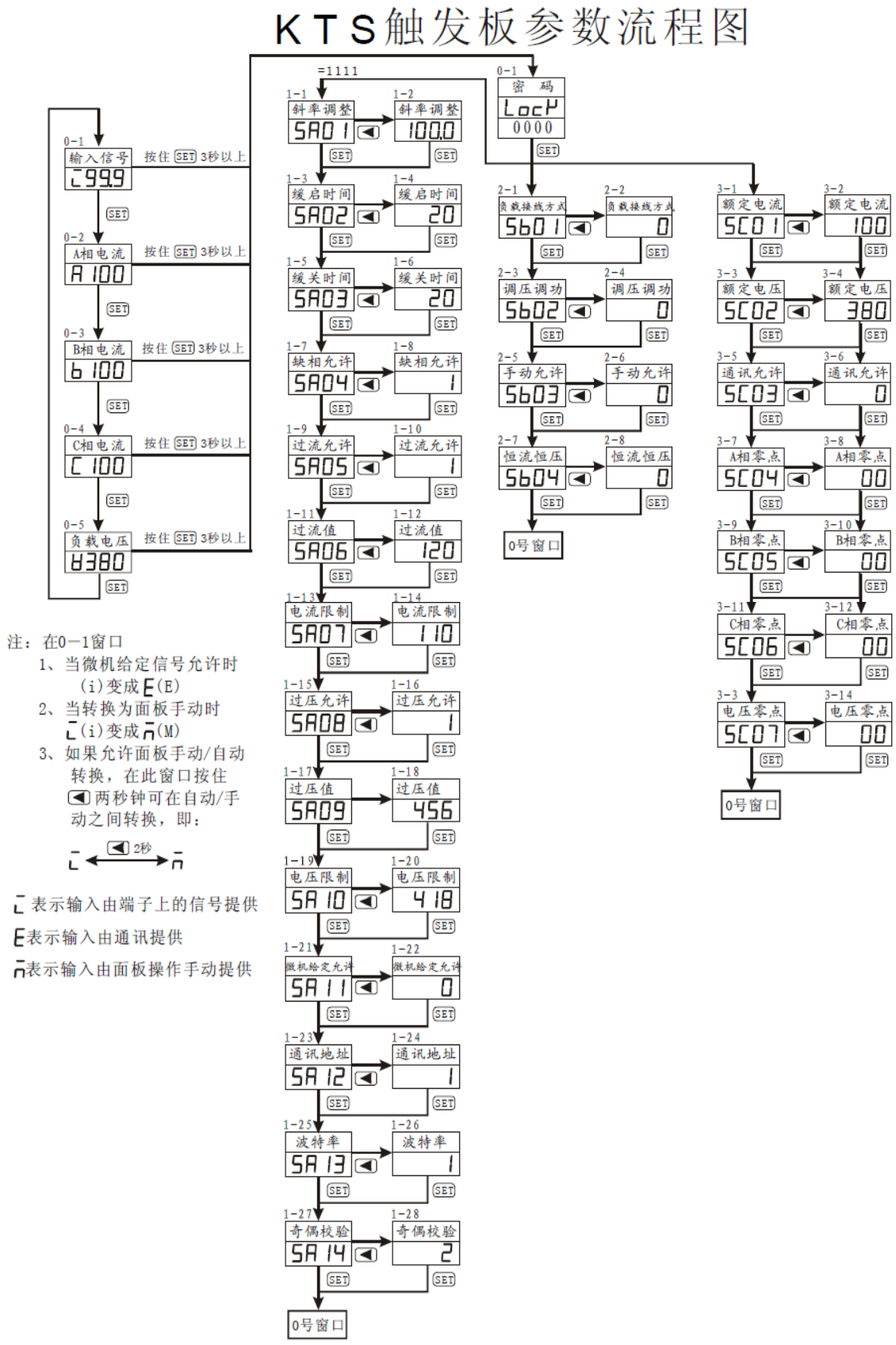
- the type of thyristor unit operation
  调功器工作方式
- the enabled alarms
  使能的报警
- the errors and the faults.
  错误和故障

Two types of message are shown on the display.
信息显示有两种：
- **Steady** messages indicating the current thyristor unit operating mode.
  直亮指示电流和工作模式

- **Flashing** messages indicating **abnormal** operation (an error or a failure).
  闪烁信息显示错误和故障。

Flow chart of parameters

参数流程图



SA serier parameter explanation
SA系列参数说明

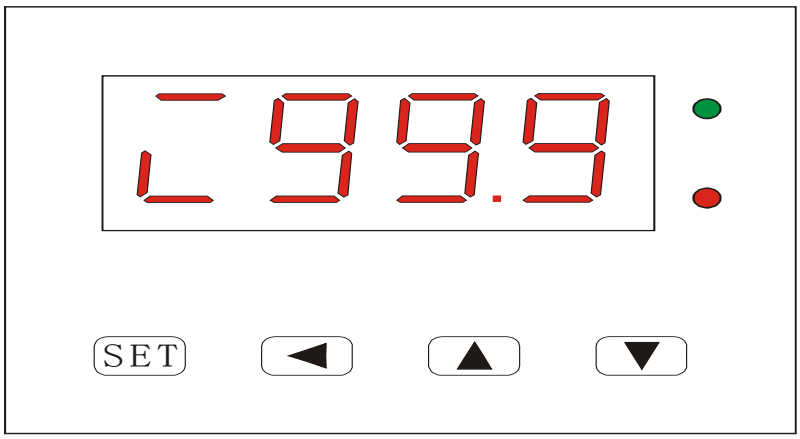
SA series parameter for user operation
SA系列参数为客户操作使用

code 显示代码	Function 功能	Range or value 范围或数值	Remark 备注
SA01	External power adjustment 斜率调整参数	0-100%	
Sa02	Soft start 缓启动时间	0- 60sec 0—60秒	
Sa03	缓关断时间	0—60秒	
Sa04	Running with absence of upply 电源缺相运行允许	0: Running with bsence of supply 0:电源缺相继续运行， 1:stop with absence of supply 1:电源缺相停止运行	
SA05	Over-current function 过流限流功能允许	0:Without over-current function 0:不允许过流限流功能， 1:With over-current function 1:允许过流限流功能	
SA06	Value of over-current 过流报警值	0.1—1.2Ie	Ie:current rating Ie:额定电流
SA07	Value of limited current 电流限制值	0.1—1.1Ie	Ie:current rating Ie:额定电流
Sa08	Over and limit voltage 过压限压功能允许	0:Without over and limit voltage 0:不允许过压限压功能， 1:with over and limit voltage 1:允许过压限压功能	
SA09	Value of over voltage 过压报警值	0.1—1.2Ve	Ve:rating voltage Ve为额定电压
SA10	Value of limited voltage 电压限制值	0.1—1.1Ve	Ve:rating voltage Ve为额定电压
SA11	Modbus communication MODBUS通讯方式选择	0:RTU, 1:ASCII	
Sa12	Address of communication 通讯地址	1—247	
SA13	Bps of communication 通讯波特率	4800,9600,19200	19200 display 1920 19200显示1920
Sa14	parity check 奇偶校验位	0:no check,1:odd,2:even 0:无校验，1:奇校验，2:偶校验	
Sa15	Signle of computer 计算机给定信号允许	0:local 0:给定信号为本地给定， 1:computer 1:计算机给定	

Attention
注意

The SA15 parameter is set 1 only by computer,only 0 is set by panel.
SA15参数只能由计算机改成1，面板操作只能改成0，不能改成1。

Explanation of Panel and key
面板及按键说明



SET	Settings key	设置键
◄	Shift key	移位键
▲	Up key	增加键
▼	Down key	减小键

Chapter 8 ALARMS
第八章 报警

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Chapter 8 ALARMS
第八章 报警

The alarms used by the K T Z thy ristor unit protect the thyristors and the installation against **abnormal operation** and give the user **information** on the type of failures that have occurred.
ＫＴＺ晶闸管单元使用的报警可以保护晶闸管的错误动作，并且提供发生的故障信息。

Danger !
危险！
Alarms cannot be used to replace personnel protection.
报警不能用来代替人员防护。

ALARM STRATEGY
报警原理

The ＫＴＺ thyristor unit alarms are entirely **managed by the microprocessor** of the driver board which retransmits its data (alarms enabled or not) **using the display** on the thyristor unit front panel and **alarm relays**.
ＫＴＺ晶闸管单元的报警完全由触发板的微处理器管理，而报警数据和信息由前面板的数码管显示和报警继电器指示。

The enabled state of all the alarms is indicated by the front panel **display** and **alarm relays** .
所有使能的报警状态全部由前面板显示和报警继电器指示。

The highest level alarms detect the following failures:
高级报警检测故障如下：
- absence of one or more supply phases
  电源缺一相或几相
- over-current in Burst firing modes
  调功模式过流
- under-voltage

欠压
• thyristor short-circuit
晶闸管短路
• external measurement signal failure.
外部输入信号错误
• neutral failure (fuse blow-out on the driver board).
不确定故障（触发板保险烧掉）

The detection of one of these failures causes the thyristor unit operation to be inhibited
这些故障可以引起晶闸管单元停止工作。

The low level alarms monitor:
低级报警检测：
• the over-voltage
过压
• the current unbalance
电流不平衡
• the first over-current in Burst firing mode.
调功模式过流

ALARM RELAYS
报警继电器

The alarm relays are located on the driver board:
报警继电器安装在触发板上：

the relay for all the other alarms (**general alarm relays**).
任意报警发生，继电器都会动作

The switch cut-off capacity is**2 A** (**250 Vac** or **30 Vdc**)**.**
报警继电器的开关容量为2A . (**250 Vac** or **30 Vdc**)**.**

The switch operating voltage must never be greater than **250 Vac**.
报警继电器的开关的电压不能超过250 Vac。

Alarm acknowledgement
报警常识

With Diode display & Communication
带数码管显示和通讯

reference chapter 7.(参考第七章)。

Without Diode display & Communication
带数码管显示和通讯

three function indicator:
三个功能指示灯：

Green lights: 绿色平光：	Active 运行状态
Red and Green blinks: 红灯和绿灯闪烁：	Reset 复位状态
Red and Green lights: 红灯和绿灯平光：	Setting over-current value 过电流标定指示

Red and green blink alternately： 红绿交替：	Radiator is over-temperature 散热器超温
Red lights： 红色平光：	Over-current protection 过电流保护
Red blinks： 红色闪烁：	Lack-phase in main loop while control board is provided with power supply. 主板正常供电时，主回路缺相

Chapter 9
第九章

MAINTENANCE
维护

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Chapter 9 MAINTENANCE
第九章 维护

DANGER!
危险！

The controller must be maintained by personnel qualified and trained to work with low voltage electrical equipment in an industrial environment.
调功器的维护必须由受过专业训练的人员完成，而且其要有在工业现场环境中的低压电器设备的操作经验。

The user's installation must be protected upstream (non high-speed fuses, thermal or electromagnetic circuit breaker, suitable fuse-isolator) and must comply with current standards.
用户的安装必须有隔离断路器的保护，而且要符合电流标准。

FUSES
保险

Thyristor protection
晶闸管保护

The thyristors in the ＫＴＺ series controllers are protected in the following way:
ＫＴＺ系列控制器的晶闸管保护方式如下：
· external high speed fuses against overcurrents (except for short-wave infrared applications)
额外的快速熔断保护过流
· RC snubbers and MOVs (varistors) protect against over-fast voltage variations and transient overvoltages when the thyristors are not conducting.
阻熔吸收保护晶闸管未导通时的瞬间过压。

DANGER!
危险！

High-speed fuses are used only for the protection of thyristors against large amplitude overloads.
快速熔断只能保护晶闸管的过流。
Under no circumstances should these high-speed fuses be used to protect the installation.
不能将快速熔断用作隔离断路器的保护装置。

To protect the thyristors in the ＫＴＺ series, 3 fuses and a **tri-polar** fuse-holder must be used.
为了保护ＫＴＺ系列的晶闸管，每相均有快速熔断。

SERVICING
维修

JS3000 controllers must be mounted with the heatsink positioned vertically, with no obstructions above or below which could inhibit or impede airflow.
JS3000控制器必须垂直安装，在其上下面都没有阻碍物阻碍空气流通。

Attention!
注意！

If several units are mounted in the same cabinet, they should be arranged in such a way that air expelled from one cannot be drawn into the unit located above it.
如果一个控制柜中安装多个调功器单元，它们的安装排列方式应以不影响空气循环流通的原则。

In order to ensure correct cooling of the unit, users are advised, depending on the degree of environmental pollution, to regularly **clean the heatsink** and the **protective fan guard**.
为了保证调功器单元的正常冷却，建议用户，根据环境污染情况，定期的清洁受热面，保护风机正常。

DANGER!
危险！

Cleaning should only be carried out when the controller supply is disconnected and at least 15 minutes after it has ceased operating.
清洁工作必须在控制器切断电源停止工作15分钟以后进行。
Every six months check that the screws of the power and safety earth cables are correctly tightened .
每6个月检查动力线和接地线的螺栓是否紧密。

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