



INDUSTRIAL SOLUTION SYSTEMS



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版本号:NT 08-2025

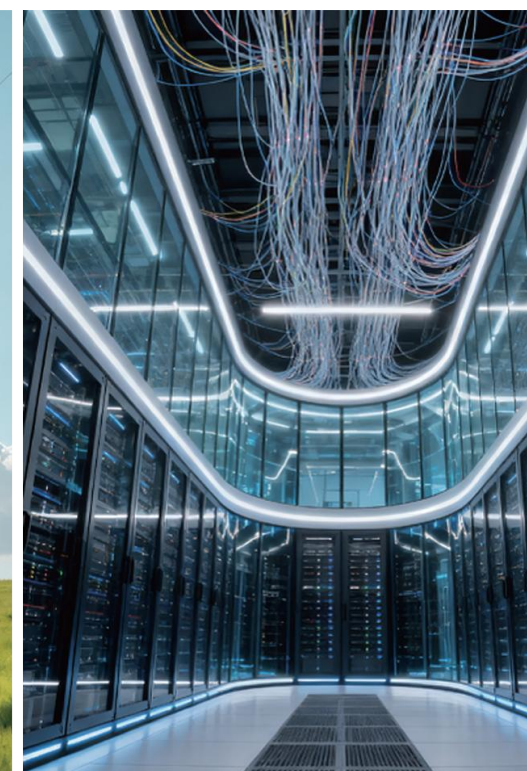
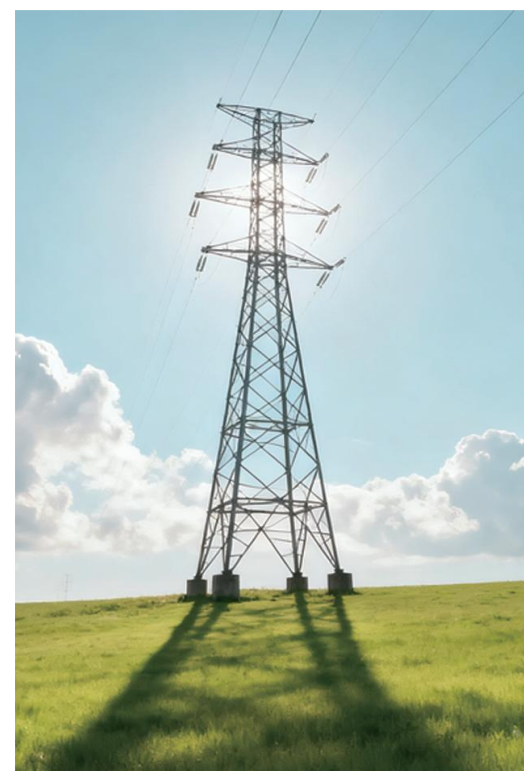


INDUSTRIAL SOLUTION SYSTEMS

配网末端电压波动解决方案

配网电子稳压器 NTQS81

Solution for Voltage Fluctuation at the End of Distribution Network
Electronic Voltage Stabilizer for Distribution Networks NTQS81



纳图电气集团股份有限公司
NATUS ELECTRIC GROUP CO.,LTD.

集团业务 Group Business

集团专注于中低压电力行业的系统集成、EPC工程总包服务及核心产品的研发、生产与销售。在电力设备领域，我们深耕智能电气成套产品、高端电力元器件、先进电能质量治理产品、智能控制仪表与控制系统。基于人工智能与大数据分析的技术积累，我们提供变电站与输电线路的气象灾害预防设备与安全运行综合解决方案。在新技术领域，我们聚焦小区域低空气象高精度预测技术，为低空经济发展提供综合性的产品与服务。



The Group specializes in system integration, EPC turnkey services, and the R&D, production, and sales of core products within the medium and low-voltage power industry. In the field of power equipment, we have deep expertise in intelligent electrical switchgear system, high-end power components, advanced power quality management products, intelligent control instruments, and control systems. Leveraging accumulated expertise in artificial intelligence and big data analytics, we provide comprehensive solutions for meteorological disaster prevention equipment and the safe operation of substations and transmission lines. In the domain of new technologies, we focus on small-area, low-altitude meteorological high-precision prediction technology, offering integrated products and services to support the development of the low-altitude economy.

集团理念 Group Vision

纳图电气集团源自德国，立足中国，服务全球。自1956年成立以来，集团以德国技术为基础，深度融合中国智慧与全球视野，依托强大的中国研发与制造团队，精准响应全球市场需求，为各行业客户提供智慧电力的专业解决方案。集团坚持以客户为中心，致力于创新产品、可靠技术与精益制造，携手全球用户共同构建更智能、高效、可持续的电力能源未来。



Natus Electric Group originates from Germany, is firmly rooted in China, and serves the global market. Since its establishment in 1956, the group has built upon German technology deeply integrating Chinese expertise and a global perspective. Supported by a robust Chinese R&D and manufacturing team, we precisely respond to global market demands, delivering professional intelligent power solutions for clients across various industries. Adhering to a customer-centric approach, the group is committed to innovative products, reliable technology, and lean manufacturing, working hand-in-hand with global users to build a smarter, more efficient, and sustainable future for the power and energy sector.



新能源形势下台区供电面临的困难

Challenges Faced by District Power Supply in the New Energy Landscape

间歇性高峰 INTERMITTENT PEAK

间歇性高峰负荷超重载时间频发, 峰谷差过高易造成线损超标。
Frequent intermittent peak load overloads occur, and excessive peak-to-valley differences may lead to line losses exceeding standards.

季节性过载 SEASONAL OVERLOAD

季节性过载: 夏季制冷用电高峰时段过载。
SEASONAL OVERLOAD: Overload during peak summer cooling electricity consumption periods.

分布式光伏 DISTRIBUTED PHOTOVOLTAIC

分布式光伏接入逐渐增多, 接入消纳及安全问题需要新的调控手段。
With the gradual increase in the connection of distributed photovoltaic systems, new regulatory measures are required to address the issues of grid integration, consumption, and security.

电动汽车充电 ELECTRIC VEHICLE CHARGING

电动汽车充电负荷日益增多, 无序充电导致用电高峰叠加。
The increasing load from electric vehicle charging, coupled with disorderly charging practices, has led to overlapping peak electricity demands.

电压越限 VOLTAGE LIMIT VIOLATIONS

用电设备的输出功率、效率和使用寿命受电压影响, 电压降低严重时, 会导致产品质量下降、设备损坏。
The output power, efficiency, and service life of electrical equipment are affected by voltage. When the voltage drops significantly, it can lead to a decline in product quality and even equipment damage.
电能质量问题如功率因数问题、三相不平衡问题严重, 特别是高峰时段台区线路末端低电压问题无法解决。
Power quality issues such as power factor problems and three-phase imbalance problems are serious; especially, the low voltage issue at the end of distribution transformer area lines during peak periods cannot be resolved.

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配电网常见的电能质量问题

Common Power Quality Issues in Distribution Networks

电压越限问题

VOLTAGE LIMIT EXCEEDANCE ISSUE

电压越限问题分为高电压和低电压，会造成设备损坏、电网稳定性差、经济成本增加等问题，易造成火灾，对安全性有一定的威胁。

This issue can be divided into overvoltage and undervoltage, which may cause problems such as equipment damage, poor grid stability, and increased economic costs. It may also easily lead to fires, posing a certain threat to safety.

无功问题

REACTIVE POWER ISSUE

无功问题指无功功率不平衡导致电压波动、设备过载和能效降低等问题，功率因数低下，使线路及变压器的电压降增大。

This issue refers to problems like voltage fluctuations, equipment overload, and reduced energy efficiency caused by unbalanced reactive power. A low power factor will increase the voltage drop of lines and transformers.

新型电能质量问题

NEW TYPES OF POWER QUALITY ISSUES

随着分布式能源（光伏、风电、储能）、电力电子设备（变频器、充电桩）及高灵敏度负荷的普及，配电网出现了许多新型电能质量问题。这些问题不同于传统电网的稳态谐波或电压偏差，具有高频、快速时变、多物理耦合等特征，对电网安全和用户设备构成新挑战。

With the popularization of distributed energy sources (photovoltaic, wind power, energy storage), power electronic devices (frequency converters, charging piles), and high-sensitivity loads, many new types of power quality issues have emerged in distribution networks. Different from the steady-state harmonics or voltage deviations of traditional power grids, these issues feature high frequency, rapid time variation, and multi-physical coupling, posing new challenges to grid safety and user equipment.

谐波问题

HARMONIC ISSUE

谐波问题是指在低压配电网中存在大量的非线性负载，产生谐波污染，造成损耗增加。

This issue refers to the presence of a large number of non-linear loads in low-voltage distribution networks, which generate harmonic pollution and lead to increased losses.

三相不平衡问题

THREE-PHASE UNBALANCE ISSUE

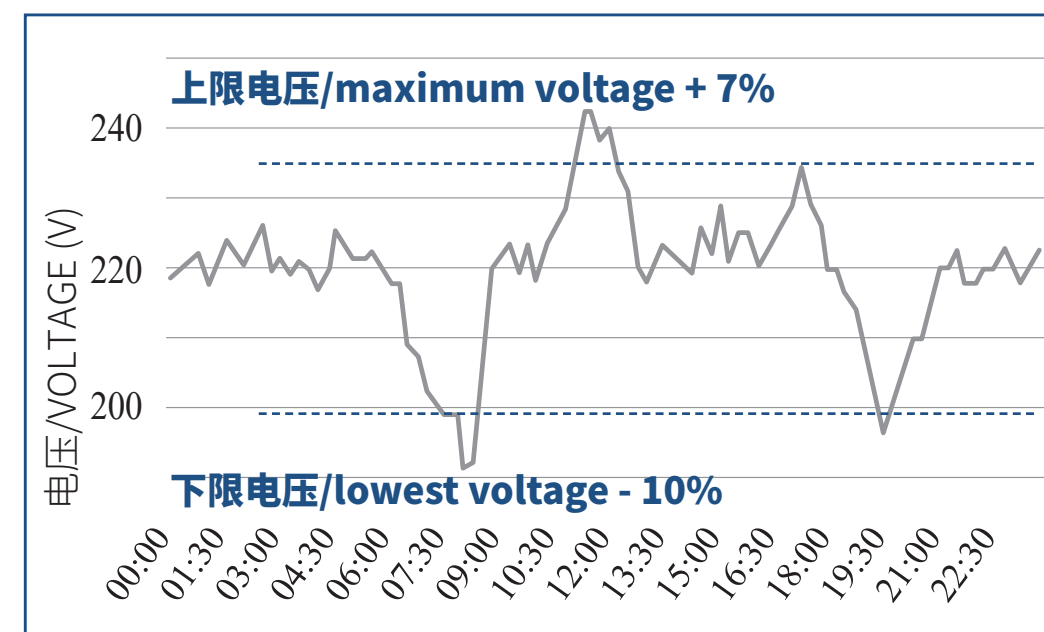
三相不平衡问题会造成配电变压器出力下降，线路损耗增加。

This issue will result in reduced output of distribution transformers and increased line losses.

什么是电压越限

What is Voltage Limit Violations?

- 电压越限是指电力系统中的电压超出了规定的安全运行范围，包括电压过高和电压过低两种情况；
- 随着电压末端大量光伏类设备的接入，配网电压越限问题日渐突出，影响电能质量和用电设备安全运行；
- Voltage Limit Violations refer to situations where the voltage in a power system exceeds the specified safe operating range, encompassing both overvoltage and undervoltage conditions.
- With the increasing connection of numerous photovoltaic devices at the voltage terminals, voltage deviation issues in distribution networks have become increasingly prominent, adversely affecting power quality and the safe operation of electrical equipment.



根据国家标准 GB/T 12325—2008《电能质量供电电压偏差》中：

- 20kV 及以下三相供电电压偏差为标称电压的 $\pm 7\%$ ；
- 220V 单相供电电压偏差为标称电压的 $+7\%$ 、 -10% 的规定，将低于 198V 的供电电压规定为低电压；

According to China's National Standard GB/T 12325—2008 Power Quality - Deviation of Supply Voltage:

- The deviation of three-phase power supply voltage for 20kV and below shall be within $\pm 7\%$ of the nominal voltage;
- The deviation of 220V single-phase power supply voltage shall be within $+7\%$ and -10% of the nominal voltage. Based on these provisions, a supply voltage lower than 198V is defined as low voltage;

电压超限产生原因

Causes of Voltage Limit Exceedance

季节性负荷变化

用户用电呈周期性变化的现象;

Seasonal Load Changes

The phenomenon of periodic fluctuations in user electricity consumption;

新能源接入

光伏类设备大量并网造成线路末端电压偏高;

New Energy Integration

The large-scale grid connection of photovoltaic equipment has caused elevated voltage at the end of the line;

电压超限 Voltage Limit Violations

运营管理层面

- 中低压配电网电压调控能力弱;
- 配电变压器分接头位置不合适;

Operational Management Aspects

- Weak voltage regulation capability of medium and low-voltage distribution networks;
- Improper position of tap changers in distribution transformers;

技术层面原因

- 线路供电半径过长;
- 无功补偿设置不合理;
- 低压三相负载不平衡;
- 电源点布置不当;

Technical Reasons

- Excessively long power supply radius of lines;
- Unreasonable configuration of reactive power compensation;
- Imbalance of low-voltage three-phase loads;
- Improper placement of power points;

配网电子稳压器 NTQS81

New Technology Type Nominal- Digital Stabilizer Appliance NTQS81

配网电子稳压器主要用于配电台区, 消除电压超限现象。NTQS81可实时监测电网电压, 并自动调节输出电压。无论电网电压如何快速变化, 均可确保输出电压在设定范围内, 避免因负载变化或输入电压波动导致的电压不稳。

Electronic Voltage Stabilizer for Distribution Networks are primarily used in distribution substations to eliminate voltage overshoot phenomena. The NTQS81 continuously monitors grid voltage and automatically adjusts output voltage. Regardless of how rapidly grid voltage fluctuates, it ensures output voltage remains within the preset range, preventing voltage instability caused by load changes or input voltage variations.

配网电子稳压器同时可用于远程监控和管理, 便于实时掌握运行状态并进行远程控制, 提升管理效率。

Distribution network electronic voltage stabilizers can also be used for remote monitoring and management, enabling real-time tracking of operational status and remote control, thereby enhancing management efficiency.

在台区配电中, 通过配网末端电子稳压器可以有效解决农网改造投资成本高昂, 以及传统治理装置应用效果有限的问题。

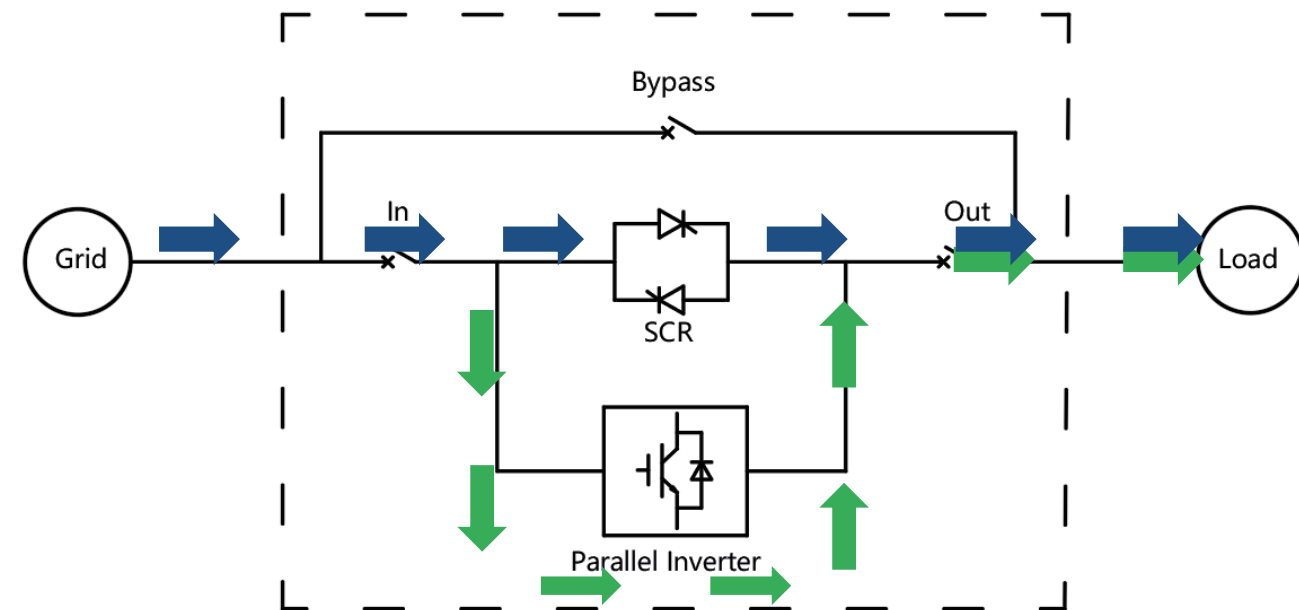
In distribution networks, terminal electronic voltage stabilizers effectively address the high investment costs associated with rural grid upgrades and the limited effectiveness of traditional voltage regulation devices.



04 / NTQS81



NTQS81 / 05



**NTQS81 的
可选工作模式
Optional Operating
Modes of NTQS81**

电子调压 / 稳压模式: 电子调压模块串入系统中, 当电网电压处于偏低或偏高时, 电子稳压模块持续调整输出电压, 使用户端电压趋于平稳状态。

Electronic Voltage Regulation/Voltage Stabilization Mode: The electronic voltage regulation module is integrated into the system. When grid voltage is abnormally low or high, the electronic voltage stabilizer continuously adjusts the output voltage to maintain stable voltage at the user end.

后备停机模式: 由晶闸管串入系统中, 电子稳压器处于关闭状态, 电网电压直接通过晶闸管向用户端供电, 设备损耗极低。

Backup Shutdown Mode: A thyristor is connected in series into the system, and the electronic voltage regulator is in the off state. The grid voltage is directly supplied to the user end through the thyristor, resulting in extremely low equipment loss.

检修/旁路模式: 当设备需要维护检修时, 旁路开关闭合, 进出线断路器断开, 负载正常供电, 设备本体完全处于电气隔离状态, 此时, 可对设备进行维护检修。

Maintenance/Bypass Mode: When the equipment requires maintenance, the bypass switch closes, the incoming and outgoing circuit breakers open, and the load continues to receive normal power supply. The equipment itself is completely electrically isolated, allowing maintenance work to be performed.

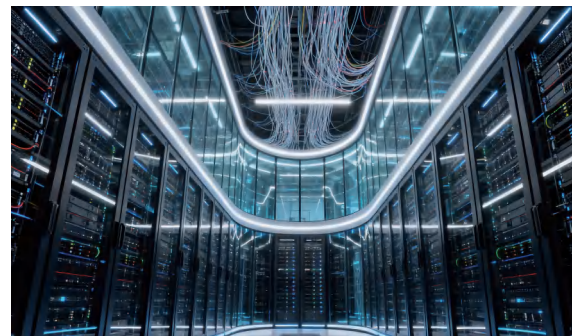


商业领域

数据中心：为服务器、存储设备等提供稳定电压，防止数据丢失或设备故障；

大型商场：用于照明、电梯、空调等系统，确保设备正常运行，提升用户体验；

医院：为医疗设备提供稳定电压，保障设备安全运行，避免医疗事故；



Commercial Sector

Data Centers: Provide stable voltage for servers, storage devices, and other equipment to prevent data loss or equipment failure;

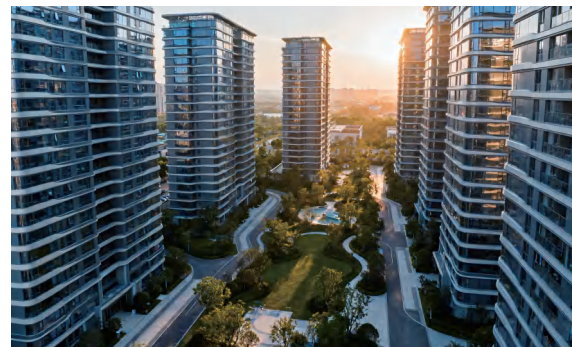
Large Shopping Malls: Used in lighting, elevators, air conditioning, and other systems to ensure the normal operation of equipment and enhance user experience;

Hospitals: Provide stable voltage for medical equipment to ensure the safe operation of equipment and avoid medical accidents;

民用领域

住宅小区：用于电梯、水泵、照明等公共设施，确保居民生活便利；

家用电器：为空调、冰箱、电视等提供稳定电压，延长电器寿命；



Civil Sector

Residential Communities: Used for public facilities such as elevators, water pumps, and lighting to ensure the convenience of residents' lives;

Household Appliances: Provide stable voltage for air conditioners, refrigerators, televisions, and other appliances to prolong the service life of the appliances;

工业领域

制造业：用于生产线、数控机床等设备，确保电压稳定，避免生产中断或设备损坏；

石化行业：在炼油厂、化工厂等关键设备中，保障电压稳定，防止生产事故；

冶金行业：用于高炉、电炉等设备，确保电压稳定，提升生产效率和产品质量；



Industrial Sector

Manufacturing Industry: Used in production lines, CNC machine tools, and other equipment to ensure voltage stability and avoid production interruptions or equipment damage;

Petrochemical Industry: Ensures voltage stability in key equipment such as refineries and chemical plants to prevent production accidents;

Metallurgical Industry: Used in equipment such as blast furnaces and electric furnaces to ensure voltage stability, thereby improving production efficiency and product quality;

公共设施

交通设施：用于地铁、火车站、机场等，确保照明、信号系统、电梯等设备正常运行；

市政设施：用于路灯、交通信号灯、监控系统等，保障城市正常运行；



Public Facilities

Transportation Facilities: Used in subways, railway stations, airports, etc., to ensure the normal operation of equipment such as lighting, signal systems, and elevators;

Municipal Facilities: Used in street lamps, traffic lights, surveillance systems, etc., to ensure the normal operation of the city;

新能源领域

光伏发电：用于光伏逆变器，确保输出电压稳定，提升发电效率；

风能发电：用于风力发电系统，确保输出电压稳定，提升系统可靠性；



New Energy Sector

Photovoltaic Power Generation: Used in photovoltaic inverters to ensure stable output voltage and improve power generation efficiency;

Wind Power Generation: Used in wind power generation systems to ensure stable output voltage and improve system reliability;

通信领域

通信基站: 为基站设备提供稳定电压, 确保通信网络正常运行;
信息中心: 为通信设备提供稳定电压, 保障数据传输和处理;

Communications Sector

Communications Base Stations: Provide stable voltage for base station equipment to ensure the normal operation of communication networks;
Information Centers: Provide stable voltage for communication equipment to ensure data transmission and processing;



农业领域

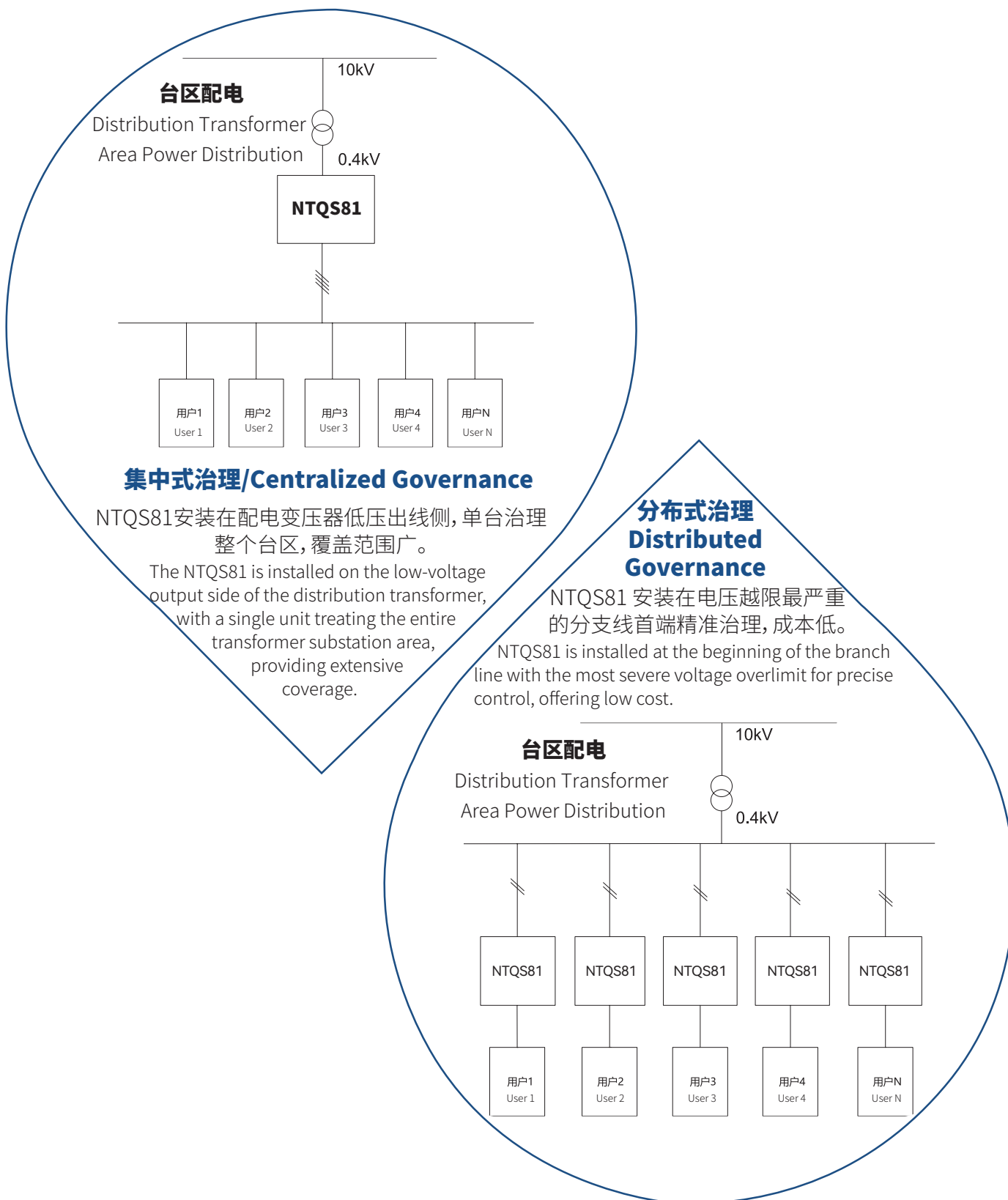
灌溉系统: 用于水泵、控制器等设备, 确保电压稳定, 保障灌溉系统正常运行;
温室大棚: 用于照明、温控等设备, 确保电压稳定, 提升农业生产效率;

Agricultural Sector

Irrigation Systems: Used in equipment such as water pumps and controllers to ensure stable voltage and guarantee the normal operation of irrigation systems;
Greenhouses: Used in equipment such as lighting and temperature control systems to ensure stable voltage and improve agricultural production efficiency;



场景 Scenario	稳压器作用 Function of Distribution Electronic Voltage Stabilizer	技术选型要点 Key Points of Technical
光伏高渗透率台区 Photovoltaic High-Penetration Distribution Areas	抑制午间反送电导致的高电压 Suppressing High Voltages Caused By Reverse Power Flow During Midday	优先选择降压稳压 (支持逆向调压) Prioritize Step-Down Voltage Stabilization (supporting reverse voltage regulation)
偏远农村长线路末端 Long-distance Line Terminus in Remote Rural Areas	补偿线路压降, 提升低电压 Compensate for Line Voltage Drop, Enhance Low Voltage	优先选择升压稳压 (支持逆向调压) Prioritize Step-Up Voltage Stabilization (supporting reverse voltage regulation)
工业园区冲击性负荷 Industrial Park Shock Loads	平抑电机启动时的瞬时压降 Stabilize Transient Voltage Drop During Motor Startup	高过载能力 (短时 200% 额定容量) High Overload Capacity (200% rated capacity for short-term)
敏感负荷供电 (如医院) Power Supply for Sensitive Loads (e.g., hospitals)	维持电压恒定, 避免设备宕机 Maintain Voltage Stability and Avoid Equipment Downtime	优先选择双向稳压 Prioritize Bidirectional Voltage Stabilization
组合方案 Combination Schemes	优势 Advantages	适用场景 Applicable Scenarios
稳压器 + SVG Voltage Regulator + SVG (Static Var Generator)	动态无功补偿 + 精准调压 Dynamic Reactive Power Compensation + Precise Voltage Regulation	冲击性负荷与光伏并存的复杂台区 Complex Distribution Areas With Coexistence of Impact Loads and Photovoltaics
稳压器 + 线路调压器 Voltage Regulator + Line Voltage Regulator	解决长线路末端电压梯度问题 Solve the Problem of Voltage Gradient at the End of Long Lines	农村辐射状供电网络 Rural Radial Power Supply Network
稳压器 + 储能系统 Voltage Regulator + Energy Storage System	通过充放电辅助调压, 减少稳压器损耗 Assist in Voltage Regulation Through Charging and Discharging to Reduce Voltage Regulator Losses	高光伏渗透率台区 (削峰填谷) High Photovoltaic Penetration Distribution Areas (for peak shaving and valley filling)



台区配电在输电距离长, 用户集中等情况下使用NTQS81装置。NTQS81装置投运前的波形图:

Distribution in transformer areas uses the NTQS81 device under conditions such as long transmission distances and concentrated users. Waveform diagram of the NTQS81 device before commissioning:



NTQS81装置投运后的波形图:

Waveform diagram of the NTQS81 device after commissioning:



序号 Serial Number	电压 等级 Voltage Level	设备型号 Equipment Model	设备容量 Equipment Capacity	调压范围 Voltage Regulation Range	安装方式 Installation Method	治理方式 Governance Method
1	400V	NTQS81-30-0.4	30kVA	-40%~30%	户外电线杆上 安装 Installation on Outdoor Utility Poles	集中式 / 分布式 治理 Centralized / Distributed Governance
		NTQS81-60-0.4	60kVA			
		NTQS81-90-0.4	90kVA			
		NTQS81-120-0.4	120kVA			
		NTQS81-150-0.4	150kVA			
2	220V	NTQS81-10-0.22	10kVA		户外电线杆上 或壁挂安装 Installation on Outdoor Utility Poles or Wall- Mounted Installation	集中式 / 分布式 治理 Centralized / Distributed Governance
		NTQS81-20-0.22	20kVA			
		NTQS81-30-0.22	30kVA			
		NTQS81-40-0.22	40kVA			
		NTQS81-50-0.22	50kVA			



PRECISION IN DETAIL

