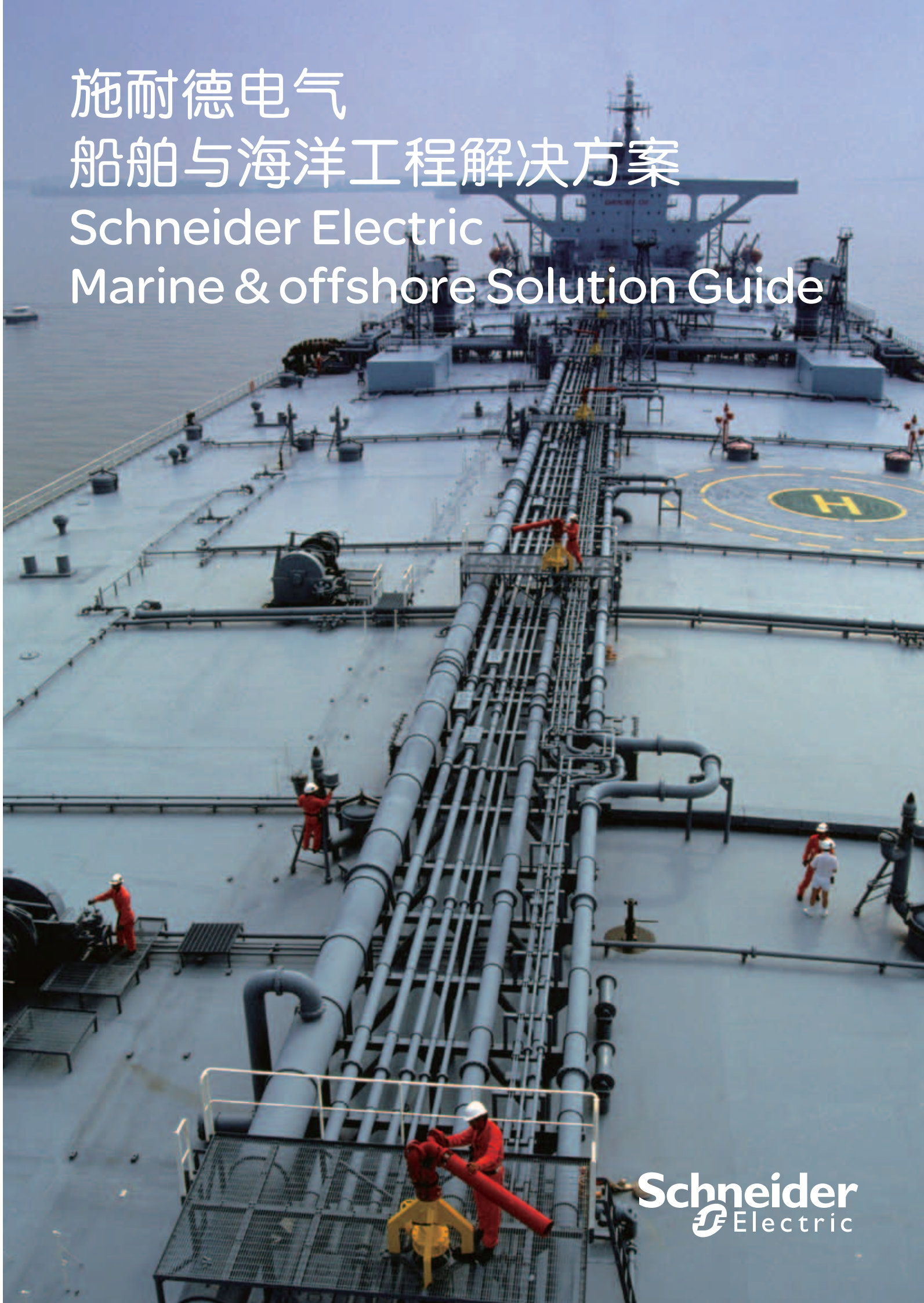


# 施耐德电气 船舶与海洋工程解决方案 Schneider Electric Marine & offshore Solution Guide

施耐德电气船舶与海洋工程解决方案

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施耐德电气  
善用其效 尽享其能





全球能效管理专家施耐德电气为世界100多个国家提供整体解决方案，其中在能源与基础设施、工业过程控制、楼宇自动化和数据中心与网络等市场处于世界领先地位，在住宅应用领域也拥有强大的市场能力。致力于为客户提供安全、可靠、高效的能源，施耐德电气2010年的销售额为196亿欧元，拥有超过110,000名员工。施耐德电气助您——善用其效，尽享其能！

## 施耐德电气在中国

1987年，施耐德电气在天津成立第一家合资工厂梅兰日兰，将断路器技术带到中国，取代传统保险丝，使得中国用户用电安全性大为增强，并为断路器标准的建立作出了卓越的贡献。90年代初，施耐德电气旗下品牌奇胜率先将开关面板带入中国，结束了中国使用灯绳开关的时代。

施耐德电气的高额投资有力地支持了中国的经济建设，并为中国客户提供了先进的产品支持和完善的技术服务，中低压电器、变频器、接触器等工业产品大量运用在中国国内的经济建设中，促进了中国工业化的进程。

目前，施耐德电气在中国共建立了**77**个办事处，**26**家工厂，**6**个物流中心，**1**个研修学院，**3**个研发中心，**1**个实验室，**500**家分销商和遍布全国的销售网络。施耐德电气中国目前员工数近**22,000**人。通过与合作伙伴以及大量经销商的合作，施耐德电气为中国创造了成千上万个就业机会。

## 施耐德电气 EcoStruxure™ 能效管理平台

凭借其对五大市场的深刻了解、对集团客户的悉心关爱，以及在能效管理领域的丰富经验，施耐德电气从一个优秀的产品和设备供应商逐步成长为整体解决方案提供商。今年，施耐德电气首次集成其在建筑楼宇、IT、安防、电力及工业过程和设备等五大领域的专业技术和经验，将其高质量的产品和解决方案融合在一个统一的架构下，通过标准的界面为各行业客户提供一个开放、透明、节能、高效的EcoStruxure™能效管理平台，为企业客户节省高达**30%**的投资成本和运营成本。

## 专业优势 Benefit from an expert on board

施耐德电气是世界闻名的船舶自动化与控制以及电力配电解决方案的提供商，其旗下的TE电器和梅兰日兰两大品牌，在海事领域拥有超过80年的专业经验。公司在全球范围内，一如既往地提供船级社认可的产品、系统和服 务，致力于造船和海运事业。

Schneider Electric, world-wide references in the field of on-board automation and control, electrical distribution, gathers the competencies acquired over 80 years by Telemecanique and Merlin Gerin. It proposes a global and consistent offer of type approved products, systems and services dedicated to marine shipbuilding and operation.

我们的核心理念：无论何时，安全性与经济性都取决于自动化和电力配电系统的可靠性。

Our core ideology is: Whenever safety and economical performance depend on the reliability of automation and electrical distribution systems.

施耐德电气，依靠在研发和工程方面的丰富资源，拥有强劲的竞争实力，无论是设计改造还是实施相关的解决方案，都能满足您的特定需求。从最初的设计阶段一直到船舶的投入使用期间，我们都能保证为您提供专业的支持，让我们的解决方案更加适应您的特定需求，包括降低成本、物流保障、项目实施、维护和翻新等方面。

Schneider Electric, owing to outstanding resources in the field of R&D and engineering, is very famous and strong in Marine and can propose all the competencies to design and implement relevant solutions to satisfy your specific requirements. From the early design stage, and throughout ship life, you are ensured of expert assistance to adapt our solutions to your specific needs: economical, logistical, implementation, maintenance and retrofit.



<b>总体概览</b> .....	<b>2</b>
<b>General Introduction</b> .....	<b>2</b>
1.1 此解决方案的用途 .....	2
1.1 The scope of this solution guide .....	3
1.2 海事行业介绍.....	4
1.2 The introduction of Marine industry.....	5
1.3 船舶整体系统及各个子系统介绍.....	6
1.3 The introduction of the whole system and sub-systems .....	6
<b>客户需求</b> .....	<b>18</b>
<b>Customer Needs</b> .....	<b>18</b>
<b>施耐德电气解决方案</b> .....	<b>24</b>
<b>Schneider Electric Solution</b> .....	<b>24</b>
3.1 施耐德电气解决方案总览.....	24
3.1 Schneider Electric solution overview .....	24
3.2 施耐德电气全球服务方案.....	28
3.2 Schneider Electric global service solution .....	28
3.3 船舶配电系统解决方案.....	32
3.3 Ship Electrical Distribution Solution.....	33
3.4 船舶机械设备和生活设施介绍 .....	96
3.4 Ship machines and living facilities introduction .....	97
3.5 船舶自动化与控制方案 .....	124
3.5 Ship Automation and Control.....	124
<b>参考项目案例</b> .....	<b>132</b>
<b>References</b> .....	<b>132</b>



# 目录

<b>总体概览</b> .....	<b>2</b>
1.1 此解决方案的用途 .....	2
1.2 海事行业介绍 .....	4
1.3 船舶整体系统及各个子系统介绍.....	6
• 海事总体介绍 .....	6
• 船舶电力系统 .....	10
• 船舶机械设备和生活设施.....	14
• 船舶自动化系统.....	16
<b>客户需求</b> .....	<b>18</b>
<b>施耐德电气解决方案</b> .....	<b>24</b>
3.1 施耐德电气解决方案总览 .....	24
施耐德电气产品概览 .....	26
3.2 施耐德电气全球服务方案.....	28
3.2.1 客户需求 .....	28
3.2.2 施耐德电气海事服务总体介绍 .....	29
3.2.3 船舶整个生命周期内的全系列全球服务支持 .....	30
3.2.4 海事全球服务支持 .....	31
3.3 船舶配电系统解决方案.....	32
3.3.1 需求和限制条件细述.....	32
3.3.2 配电结构方案.....	41
3.3.3 施耐德电气产品及应用.....	41
3.3.3.1 中压配电盘-MCset Marine .....	42
3.3.3.2 中压马达控制中心-Motorpact™ .....	50
3.3.3.3 中压环网柜方案-中压环网应用和RM6.....	56
3.3.3.4 中压变压器 .....	60
3.3.3.5 低压配电盘-MB301M .....	62
3.3.3.6 低压配电盘-Okken Marine .....	66
3.3.3.7 智能绝缘检测Vigilohm系统.....	72
3.3.3.8 应用超快速分断电力断路器的解决方案 .....	76
3.3.3.9 电力监控与谐波治理解决方案 .....	78
3.3.3.10 不间断供电系统 .....	84
3.3.3.11 母线应用方案.....	86
3.3.3.12 配电产品组件 .....	92
3.4 船舶机械设备和生活设施介绍 .....	96
3.4.1 OEM全面解决方案.....	98
3.4.2 施耐德电气产品及应用方案 .....	100
3.4.2.1 简单设备的优选方案.....	100
3.4.2.2 分散式设备的优选方案.....	102
3.4.2.3 紧凑型设备的优选方案.....	104
3.4.2.4 高级应用.....	106
3.4.2.5 自动控制产品.....	109
3.4.2.6 变频器和软起动器在船舶中的应用 .....	112
3.4.2.7 马达起动与保护解决方案.....	118
3.4.2.8 传感器元件 .....	120
3.4.2.9 控制及信号单元 .....	121
3.4.2.10 小型自动化元器件.....	122
3.4.2.11 工业机柜.....	123
3.5 船舶自动化与控制方案.....	124
3.5.1 自动电站管理系统 (PMS) .....	124
3.5.2 船舶电站管理系统主要产品介绍 .....	128
3.5.3 视频监控系統 CCTV.....	130
<b>参考项目案例</b> .....	<b>132</b>

<b>General Introduction .....</b>	<b>2</b>
1.1 The scope of this solution guide .....	2
1.2 The introduction of Marine industry.....	4
1.3 The introduction of the whole system and sub-systems .....	6
• Marine general introduction .....	6
• Ship electrical power system.....	10
• Ship machines and living facilities .....	15
• Ship automation system.....	17
<b>Customer Needs .....</b>	<b>18</b>
<b>Schneider Electric Solution.....</b>	<b>24</b>
<b>3.1 Schneider Electric solution overview .....</b>	<b>24</b>
Schneider Electric product overview .....	26
<b>3.2 Schneider Electric global service solution .....</b>	<b>28</b>
3.2.1 Customer needs.....	28
3.2.2 Schneider Electric marine service general introduction .....	29
3.2.3 A complete range of worldwide services throughout the ship's lifecycle.....	30
3.2.4 Schneider Electric world-wide service support.....	31
<b>3.3 Ship Electrical Distribution Solution .....</b>	<b>33</b>
3.3.1 Requirements and constrains.....	33
3.3.2 Architectures.....	41
3.3.3 Schneider Electric products and applications .....	41
3.3.3.1 Medium voltage switch board - MCset Marine .....	42
3.3.3.2 Medium voltage motor control center - Motorpact™ .....	50
3.3.3.3 Medium voltage ring main unit - MV loop application & RM6 .....	56
3.3.3.4 Medium voltage transformer .....	60
3.3.3.5 Low voltage switchboards - MB301M .....	62
3.3.3.6 Low voltage switchboards - Okken Marine.....	66
3.3.3.7 Intelligent insulation detection Vigilohm system.....	73
3.3.3.8 Solution with fast acting circuit breaker-NW UR .....	76
3.3.3.9 Power monitoring and harmonic suppression solution .....	78
3.3.3.10 UPS .....	84
3.3.3.11 Busway application solution .....	86
3.3.3.12 Electrical distribution components.....	92
<b>3.4 Ship machines and living facilities introduction .....</b>	<b>97</b>
3.4.1 Full range of solutions for OEM .....	99
3.4.2 The machinery and utilities products and applications.....	100
3.4.2.1 Preferred implementations for simple machines.....	101
3.4.2.2 Preferred implementations for distributed machines .....	103
3.4.2.3 Preferred implementations for compact machines.....	104
3.4.2.4 Advanced implementations .....	106
3.4.2.5 Automation & control products.....	109
3.4.2.6 Applications of variable speed drive & soft starter in ships.....	112
3.4.2.7 Motor starting and protection solutions .....	118
3.4.2.8 Sensors .....	120
3.4.2.9 Control and signal units .....	121
3.4.2.10 Simple automation components .....	122
3.4.2.11 Industrial cabinet.....	123
<b>3.5 Ship Automation and Control.....</b>	<b>124</b>
3.5.1 Power Management System .....	124
3.5.2 Description of main products used in ship power station management system .....	128
3.5.3 Close-circuit television.....	130
<b>References .....</b>	<b>132</b>



# 总体概览 General Introduction

## 此解决方案的用途

### 适用范围

本书提供了施耐德电气针对海事行业电气系统和自动化控制的综合解决方案，可适用于

- 中国船舶行业
- 海洋石油工业

同时也对于中国海军舰船也有一定参考价值。

这里提出的解决方案都是专门为海事行业而提出，充分考虑到在海事行业的特点和一些特殊要求，凭借施耐德电气在海事领域80多年的优势，极大程度上综合了施耐德电气在全球各国海事领域的先进应用经验。

施耐德电气的全系列的高质量产品和最专业的支持和服务，将使您应用这些解决方案更加高效和完美。





## The scope of this solution guide

### Scope

This manual provides comprehensive Schneider Electric solutions for marine industrial electrical systems and automation controls

- China shipbuilding industry
- Ocean petroleum industry

Such information can also be used as reference for building Chinese navy ships.

These solutions are proposed specifically for marine industry by taking the characteristics and special requirements of this industry into consideration, taking advantage of Schneider Electric's marine expertise for over 80 years, and fully integrating advanced application experiences of Schneider Electric in this field in different countries.

Schneider Electric presents a whole range of quality products and most professional support and services, helping you achieve more efficiency and perfection with these solutions.



全球服务网络和专业的  
技术中心  
Global service network  
and professional  
technical center

确保工作的连续性  
Ensure business  
continuity

全球服务支持  
Global service and  
support

高品质、系列齐全、广泛  
认可的产品  
Complete series of quality  
and widely accepted  
products



## 总体概览 General Introduction

### 海事行业介绍

#### 海事发展介绍

造船行业率先走出国门，迈向国际市场，成为中国最具外向性的产业之一，目前我国造船行业80%左右的完工量是出口船舶，出口的国家地区达一百一十二个，造船总量已连续多年继韩、日之后，稳居世界第三。而且，2005年我国承接新船订单首次超过日本，位居世界第二。2007年第一季度承接新船订单超过韩国，位居世界第一。

海洋石油工业已经成为国民经济支柱产业之一。随着我国经济的快速发展，对石油的需求不断增加，海洋石油开发已成为国家能源战略的重点之一，进入十一五后，海洋石油开发将进入一个高速发展阶段，海洋工程装备的订造将会出现热潮。

作为世界工厂，中国对能源、铁矿石、原材料和出口产品等海运贸易需求，在未来相当长时期内将保持较高水平，从而带动船舶产品需求保持持续兴旺。展望我国海事领域的发展趋势，根据《船舶工业中长期发展规划》，到2015年，中国将成为世界造船强国。到2020年，将超过韩国，成为全球第一。

中国造船业和海洋工程装备业要进一步提高国际竞争力，关键在提高技术实力和设计的创新。随着人民币的升值，国内技术人才的缺乏，国际经济环境的影响，以及海事行业国内国际企业竞争的加剧，毫无疑问，中国造船企业及相关配套工业面临的竞争压力将会大大增加，只有在提高技术实力和设计的创新上有所发展，才能立于不败之地。

## The introduction of Marine industry

### Marine development introduction

Chinese shipbuilding industry has penetrated into international market and became one of the most foreign-oriented industries in China. Currently about 80% of the ships made in China are exported to 112 countries. The total number of ships produced in China has ranked the third in the world for several consecutive years, only next to Korea and Japan. In 2005, the total orders received by Chinese ship manufacturers begin to exceed those by Japanese manufacturers, ranking the second in the world. In Q1 of 2007, the new orders received by Chinese ship manufactures exceeded those by Korea, ranking NO.1 in the world.

Ocean petroleum industry has grown to be one of the mainstay industries for Chinese national economy. With the rapid economical development in China, the demand for petroleum keeps increasing and ocean petroleum development has become one focus of the national energy strategy. Ocean petroleum exploitation will be accelerated in the eleventh-five-year period, and there will be intense demand for ocean engineering equipment.

In China, the world's factory, the demand for shipping trade materials such as power energy, iron ore, raw materials and export products will remain high for a long time in the future, which will lead to continuous increase of demand for ship products. As far as the marine development trend is concerned, according to Shipbuilding Industry Long-term Development Plan, China ship manufacturers will play a leading role in this industry by 2015 . The total ship production scale will exceed Korea in 2020, and by then China will become the No.1 ship manufacturing base in the world.

To further enhance the competitive ability of Chinese ship and marine engineering equipment manufacturers in international market, it is important to boost technical advancement and design innovation. As the value of RMB increases, Chinese ship and marine engineering equipment manufacturers will be under intense pressure due to lack of domestic technical talents, international economical environment and fierce competition in domestic international marine markets. Therefore, the success relies on enhancement of technical strength as well as innovations.



# 总体概览 General Introduction

## 船舶整体系统及各个子系统介绍

### The introduction of the whole system and sub-systems

#### 海事总体介绍

##### 民用商船

种类很多：有杂货船、散货船、多用途船、集装箱船、原油船、成品油船、化学品船、平台供应船、液化天然气船/液化石油气船(LNG/LPG)、冷藏船、滚装船、客滚船、渡船等运输船，以及挖泥船、拖船、救捞船、敷管船、科学考察船等各种工程船等。

#### Marine general introduction

##### Commercial ships

Diversified ships are manufactured, including transportation ships such as general cargo ship, bulk cargo ship, multi-purpose ship, container ship, crude oil tanker, oil product tanker, chemical ship, platform supply ship, liquefied natural gas ship/liquefied petroleum gas (LNG/LPG) ship, refrigerated ship, roll-on/roll-off ship, passenger roll-on/roll-off ship and ferry ships, and various engineering ships such as dredger, tug ship, salvage and rescue ship, pipe-laying ship and scientific investigation ship.



杂货船 General cargo ship



液化天然气船 LNG (球罐型)  
Liquefied natural gas ship (MOSS)



散货船 Bulk cargo ship



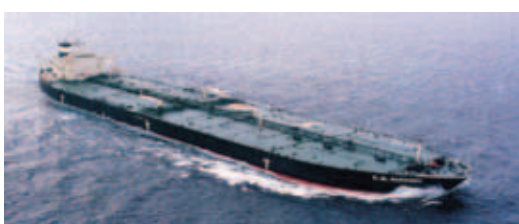
液化天然气船 LNG (薄膜型)  
Liquefied natural gas ship (Membrane)



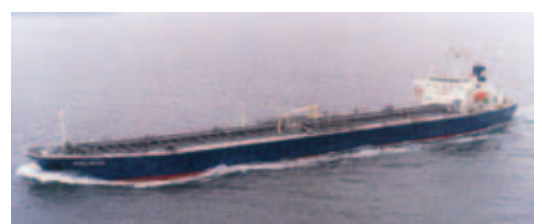
集装箱船 Container ship



液化石油气船 LPG Liquefied petroleum gas ship



油船 Oil tanker



化学品船 Chemical ship



渡船 Ferry ship



挖泥船 Dredger



滚装船 Ro-Ro Roll-on/roll-off ship



科学考察船 Scientific investigation ship

## 海洋工程

主要有海上浮式生产储油船FPSO和海上石油钻井平台

FPSO通常与钻井平台或海底采油系统组成一个完整的采油、原油处理、储油和卸油系统，其作业原理是通过海底输油管线接受从海底油井中采出的原油，并在船上进行处理，然后储存在货油舱内，最后通过卸载系统输往穿梭油轮。

海上石油钻井平台主要有自升式钻井平台和深海半潜式钻井平台等类型。

## Ocean engineering

This mainly includes FPSO (floating production storage & offloading) and offshore oil-drilling platform

Typically, FPSO forms a complete system with an oil-drilling platform or ocean bed oil exploitation system for oil exploitation, crude oil processing, oil storage and oil discharge. It receives the crude oil collected from the oil wells in the ocean bed via the ocean oil transport pipelines. The oil is processed on the ships and stored in the oil cargo tanks before it is transferred to the shuttle tanker through the discharge system.

Offshore oil-drilling platforms mainly include self-elevated platforms and deep-water semi-submersible platforms, etc.



海上浮式生产储油船 FPSO  
Floating production storage & offloading



钻井平台 Oil-drilling platform



# 总体概览 General Introduction

## 中压配电系统

- 中压配电柜
- 中压马达控制中心
- 中压环网柜
- 变压器

## Medium Voltage Distribution System

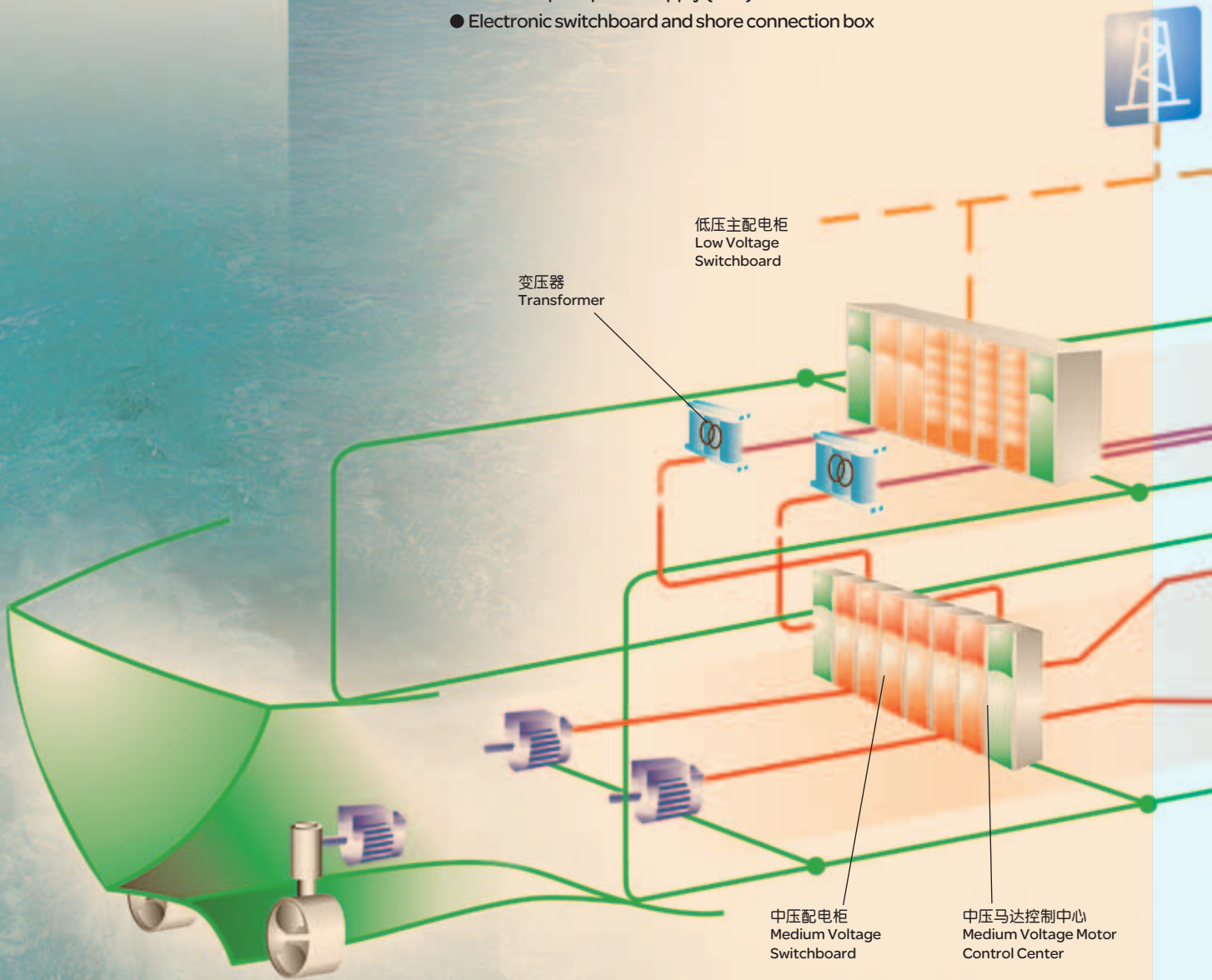
- Medium voltage switchboard
- Medium voltage motor control center
- Medium voltage ring main units
- Transformer

## 低压配电系统

- 主配电板(或称主电站、总配电盘)
- 应急配电板(应急电站、盘)
- 分配电板(盘)(动力、照明)
- 充放电板(盘)
- 不间断供电电源UPS
- 弱电配电板及岸电箱

## Low Voltage Distribution System

- Main switchboard
- Emergency switchboard
- Sub-distribution switchboard (power, lighting)
- Charging and discharging panel
- Uninterrupted power supply (UPS)
- Electronic switchboard and shore connection box



### 船舶机械设备和生活设施

- 动力装置用辅机
- 甲板机械
- 舱室辅机
- 机修机械
- 冷藏通风
- 厨房设备
- 照明设备
- 弱电设备
- 自动化设备
- 其他

### Ship Machines and Living Facilities

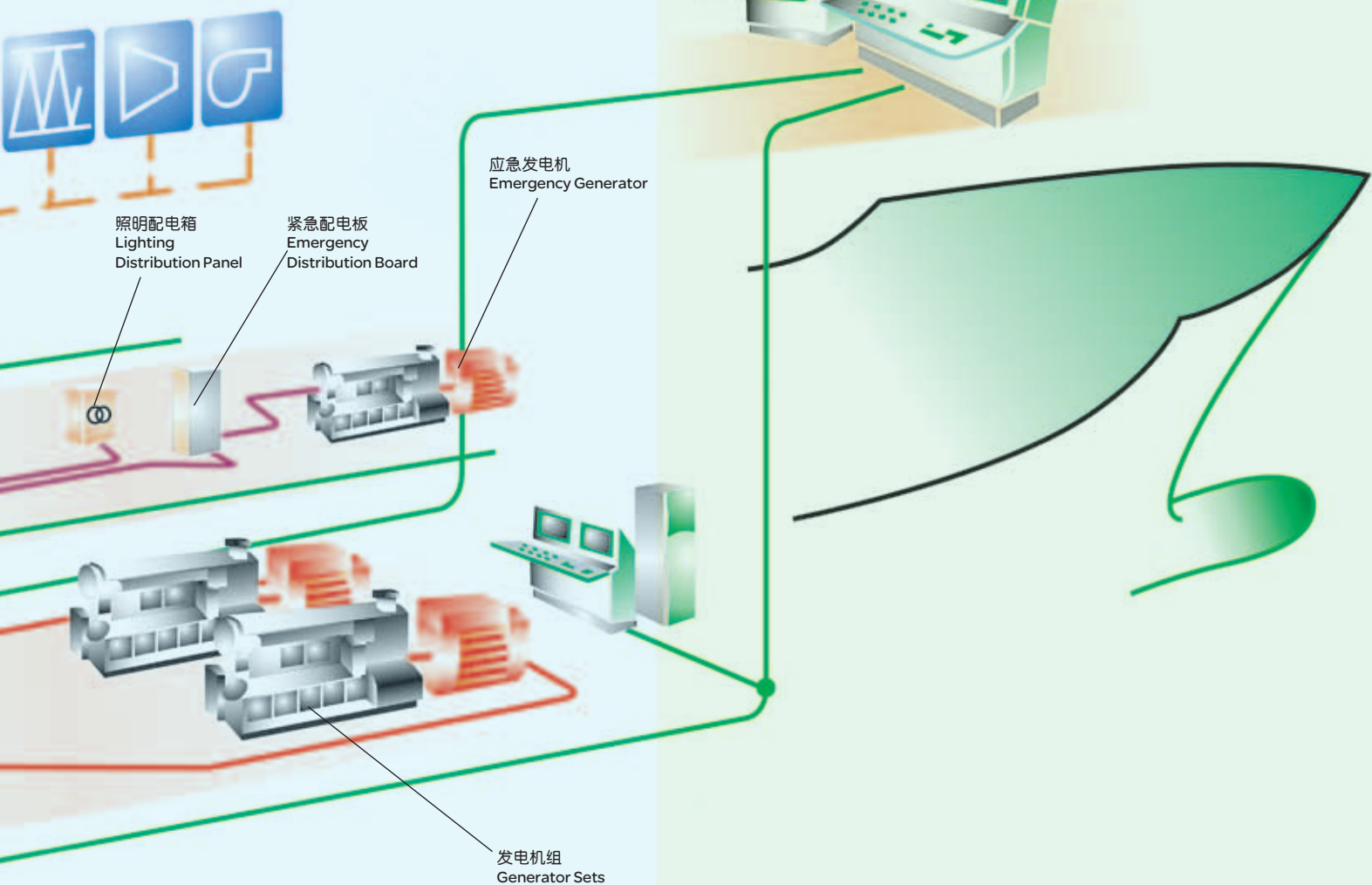
- Auxiliary machines for power units
- Deck machines
- Cabin auxiliary machines
- Maintenance machines
- Refrigeration and ventilation machines
- Kitchen units
- Lighting equipment
- Electronic equipment
- Automation equipment
- Others

### 船舶自动化系统

- 船舶电站管理系统
- 船舶集成监控和报警系统

### Ship Automation System

- Ship power station management system
- Ship integrated monitoring and alarming system





## 总体概览 General Introduction

### 船舶电力系统

近代船舶像一个可移动的海上城市，它有许多设备都需要使用电能，因此在船上都配备有一个发电、配电、输电、用电的独立系统——船舶电气系统。

随着船舶的大型化和自动化程度的不断提高，越来越多的船用设备需要用电能来驱动和控制，船舶电力系统也日趋庞大和复杂。

### Ship electrical power system

Modern ships are like cities floating on the ocean. Because many devices on the ship require power, an independent system is established on the ship to provide functions of power generation, distribution, transmission and utilization. This is called ship electrical power system.

As the ship grows in size and the automation degree increases continuously, more and more ship devices have to be driven and controlled with power, and therefore the ship electrical power system is becoming larger and more complicated.

### 船舶电力系统的组成

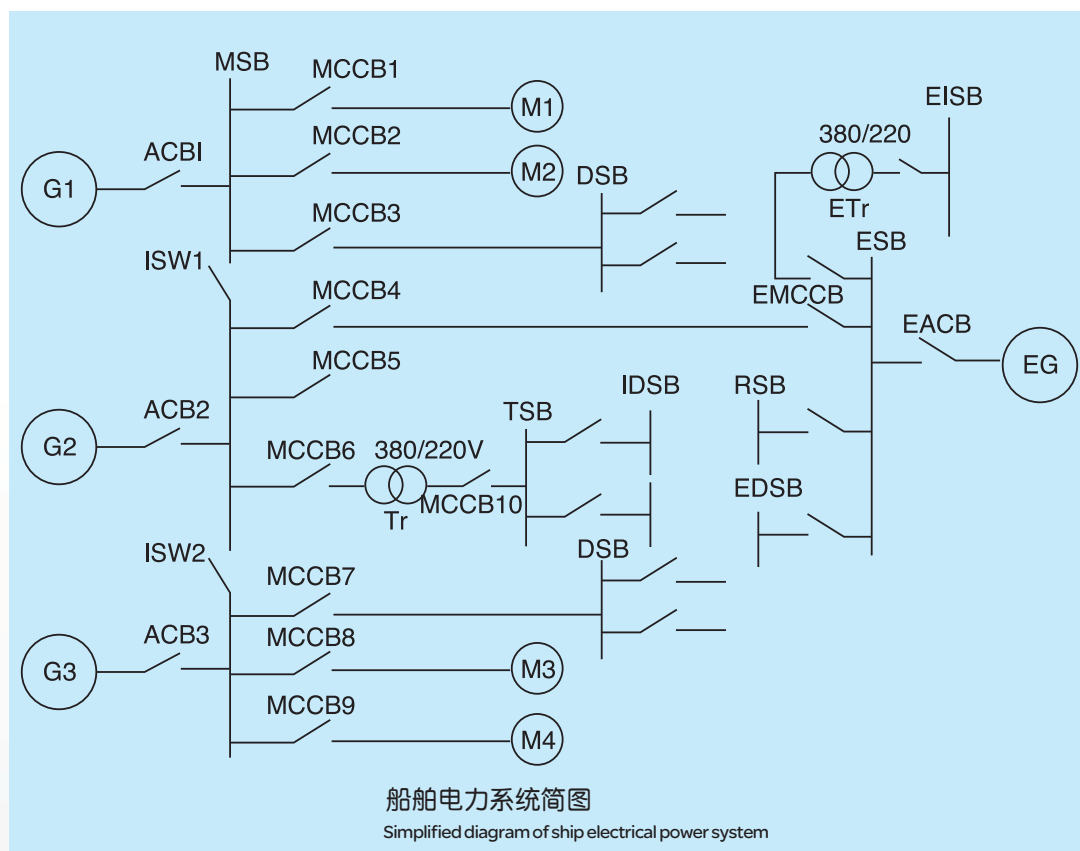
船舶电力网：电能从主配电板（及应急配电板等）通过电缆的传输，经过中间的分配电装置（区配电板，分配电箱等），送往各电气用户。对船舶电力网的基本要求是生命力强，即要求电网在发生故障或局部破损等情况下，仍能保证对负载的连续供电，并限制故障的发展和将故障的影响限于最小范围之内。

### Structure of the ship electrical power system

Ship electric network: Electric power is transmitted from the main switchboard (and emergency switchboard) to different users via power cable and intermediate power distribution systems (distribution switch board, sub-distribution panels, etc.) The basic requirement for the ship electric network is ruggedness. The electric network should be able to provide continuous power supply for the loads even in case of failure or local break, prevent further damage caused by a failure and minimize the impact of the failure.







G-主发电机；EG-应急发电机；ACB-发电机主开关；EACB-应急发电机主开关；MSB-主配电板；ESB-应急配电板；MCCB-配电开关；M-电动机；DSB-分配电板；RSB-无线电分配电板；EMCCB-应急配电开关；ISW-隔离开关；LSB-照明配电板；ELSB-应急照明配电板；IDSB-照明分配电板；EDSB-应急分配电板；Tr-照明变压器；ETr-应急照明变压器。

G-Main generator, EG - Emergency generator, ACB - Airbreak circuit breaker, EACB - Emergency airbreak circuit breaker, MSB - Main switch board, ESB- Emergency switch board, MCCB - Moulded case circuit breaker, M - Motor, DSB - Distribution switch board, RSB - Radio switch board, EMCCB - Emergency moulded case circuit breaker, ISW - Isolation switch, LSB - Lighting switch board, ELSB - Emergency lighting switch board, IDSB - Lighting distribution switch board, EDSB - Emergency distribution switch board, Tr - Lighting transformer, ETr - Emergency lighting transformer.



## 总体概览 General Introduction

### 电源

电源是将机械能、化学能等能源转变成电能的装置。船上常用的电源装置是柴油发电机组、UPS和蓄电池组等。

### 配电装置

配电装置是对电源和负荷进行分配、监视、测量、保护、转换和控制的装置。配电装置的主要功能有

- 正常运行时接通和断开电路（手动或自动）
- 电力系统发生故障或不正常运行状态时，保护装置动作，切断故障元件或发出报警信号
- 测量和显示运行中的各种电气参数（如电压、电流、功率、频率、功率因数、绝缘电阻等）
- 进行某些电气参数或有关的其他参数的调整（如电压、频率即转速的调整）
- 对电路状态、开关状态以及偏离正常工作状态进行信号指示等

配电装置主要可分为主配电板（或称主电站、总配电盘）、应急配电板（应急电站、盘）、分配电板（盘）（动力、照明）、充放电板（盘）、不间断供电电源UPS、弱电配电板及岸电箱等。

船舶配电装置按其结构可分为防护式、防滴式、防水式三种，通常总配电板和应急配电板多采用防护式。详细的要求请参考后文中的船级社要求。

### 船舶输电网

它是全船电缆电线的总称。电网是联系发电机、主（应急）配电板、分配电板和负荷的中间环节，将电源的电能输送到负荷。

### 负荷

即船舶各种用电设备，它是将电能转换成其他形式能量转换装置。船舶负荷大体可分成舱室机械、甲板机械、船舶照明、通导设备、生活及其他用电设施。



## Power supply units

Power supply units convert mechanical energy and chemical energy into electrical energy. The power supply units typically used on ships are diesel generator sets, UPS and accumulator sets.

## Power distribution units

Power distribution units distribute, monitor, measure, protect, convert and control power supply and load. They have the following main functions

- Switch on/off the circuit during normal operation (manual or automatic)
- In case of fault of the power system or under abnormal running conditions, trigger the action of protection devices, disconnect faulty component or give alarm signals
- Measure and display different electrical parameters during operation (such as voltage, current, power, frequency, power factor and insulation resistance)
- Adjust certain electrical parameters or other parameters (such as adjustment of voltage or frequency (RPM))
- Indicate the circuit status, switching status and deviation from normal operation conditions with signals

Power distribution units mainly include main switch board (main power station, general switch board), sub-emergency switch board (emergency power station, emergency switch board), distribution board (power, lighting), charging and discharging board, uninterrupted power supply (UPS), electronic switch board and shore connection box.

Ship power distribution units are classified into three types according to their structures: general protection type, drip-proof type, and waterproof type, among which the general protection type is used in most general switch boards and emergency switch boards. See the section about ship classification societies for detailed requirements.

## Ship power transmission network

This is the general term for all cable and wire on the ship. The network connects the generator, main (emergency) switch board, distribution board to loads, and transmits the electrical power to the loads.

## Loads

Loads refer to different powered devices on the ship, which convert electrical energy into other energy forms. The loads on the ship mainly include cabin machines, deck machines, ship lighting units, communication and navigation equipment, and powered units for living and other purposes.



## 总体概览 General Introduction

### 船舶机械设备和生活设施

在对船舶机械设备和生活设施等用电设备进行分类时，通常是按系统进行分类，一般的分类为

#### 1.动力装置用辅机

为主机和主锅炉等服务的辅机，如滑油泵、海水冷却泵、淡水冷却泵和鼓风机等。

#### 2.甲板机械

包括锚机、绞盘、舵机，起货机和舷梯、起艇机等。

#### 3.舱室辅机

包括生活用水泵、消防泵、舱底泵以及为辅锅炉服务的辅机等。

#### 4.机修机械

包括车床、钻床、电焊机和盘车机等。

#### 5.冷藏通风

包括空调装置、伙食冷库等用辅机和通风机。

#### 6.厨房设备

包括电灶、电烤炉等厨房机械用辅机和电茶炉等。

#### 7.照明设备

包括机舱照明、住舱照明、甲板照明等照明设备和航行灯、信号灯以及电风扇等。

#### 8.弱电设备

包括无线电通信、导航和船内通信设备等。

#### 9.自动化设备

包括电站自动化系统、机舱自动化系统等。

#### 10.其他

例如，蓄电池充电设备、冷藏集装箱和首部侧推装置等以及特种船舶的专用设备。

上述设备的分类，随船舶的种类、吨位和主机型式等不同而有很大差别。



## Ship machines and living facilities

The ship machines and living facilities to be powered are generally classified as follows according to the functions

### 1. Auxiliary machines for power units

Supporting machines for the engine and boiler, such as lubricating pump, sea water cooling pump, fresh water cooling pump and blower.

### 2. Deck machines

Include anchor windlass, winch, steering engine, cargo winch, gangway and boat hoist.

### 3. Cabin auxiliary machines

Include living water pump, fire pump, bilge pump and supporting machines for auxiliary boilers.

### 4. Maintenance machines

Include machine tool, drilling machine, welding machine and turning engine.

### 5. Refrigeration and ventilation machines

Include ancillary machines for air conditioners and ventilators and food refrigeration facilities.

### 6. Kitchen units

Include mechanical ancillary machines for kitchen equipment such as electric cooker and oven, and electric teapot.

### 7. Lighting equipment

Include lighting equipment for engine cabin, living compartment and deck, navigation light, beacon and fan.

### 8. Electronic equipment

Include equipment for radio communication, navigation communication and internal communication.

### 9. Automation equipment

Include power station automation system and engine cabin automation system.

### 10. Others

Such as accumulator charging device, refrigeration container, bow lateral thrust unit and various devices for special ships.

The above classification varies greatly with ship type, tonnage and engine model.





## 总体概览 General Introduction

### 船舶自动化系统

自20世纪70年代起，在船舶自动化技术方面出现了强烈的需求，并蓬勃发展起来。

当今，在船舶自动化方面，存在众多的应用，其中有些最基本的应用：

### 船舶电站管理系统

船舶电站管理系统是对于船舶电站的自动化控制和管理系统。

船舶电站一般有3台柴油发电机组，可能还带有轴带发电机；船舶电站管理系统就是根据控制要求，对于这些发电机组的监测、设置报警和控制。而且，对于周期性无人值班机舱的船舶，各船级社规范对电站自动化有具体的要求，例如为了保证连续供电，要求：

- 如果一台发电机供电，当机组发生故障时，备用发电机组应能在一定时间内自动启动，并合闸向重要负荷供电
- 如果由两台或两台以上的发电机并联供电，当其中一台机组发生故障时，应有措施以保证向重要负载连续供电
- 当运行的发电机组超负载时，应能自动卸去非重要负载，保证对重要负载的供电，或自动启动备用发电机并网供电
- 还包括何种情况下报警，何时限制合闸次数和自动启动次数等等要求

现代化的船舶电站管理系统，具有更多的功能，如电站的功率管理，它可根据电网负载情况，自动起停柴油发电机组，使电站运行在最佳状态，具有更好的经济性。还有对于启动重负载的控制、负载的对称和不对称分配等进行管理。

### 船舶集成监控和报警系统

船舶集成监控和报警系统是集机舱动力系统及辅助系统自动控制、监测、报警等于一体化的监控系统。

系统包括主动力系统、发电系统、空调系统等多个子系统的控制与监测，例如，机舱监测报警、电站管理、泵控制等。

## Ship automation system

The demand for ship automation technologies increases rapidly from the 1970s.

There are many applications in the field of ship automation, including the following basic ones:

### Ship power station management system

Ship power station management system is an automation control and management system for the ship power station.

The ship power station typically has three diesel generator sets, and shaft generators in some cases. The ship power station management system monitors, controls and sets alarms for these generator sets based on control requirements. For ships having engine cabin without any person on duty regularly, all ship classification societies define substantial requirements for the automation of ship power station. E.g., the following requirements have to be met to ensure power supply continuity:

- If the power is supplied by one generator, in case of fault of the generator set, the standby generator set should be able to start up automatically within a specified time and close the circuit to power critical loads
- If the power is supplied by two or more generator sets in parallel, means should be provided to power the critical loads uninterruptedly when any of these generator sets has a fault
- In case of overload of the generator set under operation, the system should be able to disconnect non-critical loads to ensure the power supply of critical ones or start standby generator for combined power supplies
- The system should also define alarming conditions, limit to times of closing operations and automatic starting operations

Modern ship power station management system has more functions such as station power management. It can start/stop the diesel generator sets automatically according to the loads of the electric network to optimize the operation of the power station and achieve better economy. It also manages starting heady load and load symmetry/asymmetry distribution.

### Ship integrated monitoring and alarming system

Ship integrated monitoring and alarming system is a monitoring system that combines automatic control, monitoring and alarming functions for engine power system and auxiliary system.

It provides control and monitoring over many subsystems including main power, power generation and air conditioner such as cabin monitoring and alarming, power station management and pump control.



## 客户需求 Customer Needs

### 确保更安全更可靠航行和作业

因为船舶或海洋工程长时间航行或作业在茫茫大海上，毫无疑问，安全可靠的持续运行是其首要需求。而电气和控制系统则是其心脏，所以确保电气和控制系统的安、可靠运行极为重要。

一般来说，与陆用设施相比，海上船舶和工程对于持续安全可靠运行的要求要高很多，而环境条件要恶劣很多。在这样的条件下，为了确保电气和控制系统的安、可靠运行，需要更慎重的进行系统设计和设备选型，并更谨慎的选用相关设备。

#### 1) 满足船用环境条件

由于船用环境条件的特殊性，决定了对船用电气设备的特殊要求。还必须考虑船舶或海上工程的航行和作业海区、船舶类型、吨位、主机的类型和输出功率和有无特殊要求等因素，而且适用的规则和规范可能不同，其要求的性能确切指标也会略有不同。

#### 2) 外壳防护等级

船舶电气设备的外壳防护型式对于船上人命和财产的安全十分重要。

电气设备的外壳防护型式，应符合IEC529号出版物《外壳防护等级分类》或与其等效的国际标准的规定。表示防护等级的标志由特征字母IP及后面加两位数字组成。

#### 3) 系统电气参数

正确选择合适的电气参数（电流种类、电压、频率、接地系统），来保证供电系统的可靠性。

#### 4) 设备电气参数

为各设备以及保护装置，选择合适的电气参数和性能，对于保证供电系统的可靠性至关重要。具体内容将在后文中详细阐述。常见参数类型为：额定运行参数（额定电压、额定电流、额定频率等），额定短时耐受电流，以及介电性能（额定绝缘电压）等。





## To ensure sailing and working more safely and more reliably

Safe, reliable and continuous operation is obviously the basic requirement for ships and offshore works because they have to sail or work at sea for long. Since the electrical and control system is the heart of the ship, it is very important to keep safe and reliable operation of such system.

Typically, ocean ships and offshore works have higher requirements for safe, reliable and continuous operation and have to face tougher environment than terrestrial facilities. Thus, to ensure the safe and reliable operation of the electrical and control system, the system design and model selection must be carried out carefully, and supporting equipment should be selected with great care.

### 1) Meet environment requirements for ships

The ship electrical equipment has to meet special requirements because of the special environment the ships work in. Other factors should be considered as well such as the sailing and working range of the ships or offshore works, ship type, tonnage, engine type, output power and special requirements. Besides, different rules and regulations might have slightly different requirements for performance and indexes.

### 2) Enclosure protection degree

The enclosure protection type of the ship electrical equipment is very important for the safety of personnel and property on ships.

The enclosure protection type of the ship electrical equipment should comply with IEC 529 Publication: Classification of Degrees of Protection Provided by Enclosures or equivalent international standards. The mark indicating protection degree consist of characteristic letters (IP) followed by two digits.

### 3) System electrical parameters

Select appropriate electrical parameters (current type, voltage, frequency and grounding system) to ensure the reliability of the power supply system.

### 4) Equipment electrical parameters

It is important to ensure the reliability of the power supply system by selecting proper electrical parameters and performance for different types of equipment and protection devices. This will be described later in detail. Common parameters include rated operation parameters (rated voltage, current and frequency), rated short time withstand current, and dielectric performance (rated insulation voltage).



## 客户需求 Customer Needs

### 确保工作的连续性

船舶的负载有很多，但各自的重要性是很不相同的，有些负载如果不能正常工作会导致生命、财产受到严重威胁或损失，而也有些负载故障则属于可承受范围。

所以，为各部分负载提供最合适程度的保护和备用是确保工作连续性的重点。

考虑到船舶运行工况，不同类型、不同用途的船舶其运行工况会有所不同，这里大致列举一些典型工况：

- 航行 — 满载全速航行状态
- 进出港 — 港内低速航行或机动状态
- 压载 — 进出港压载航行状态
- 停泊 — 停泊码头或系船无客、无货状态
- 装卸货 — 如货船、油船、集装箱船等装货、卸货状态
- 作业 — 如工程船的海上作业，海上平台的正常作业状态等
- 应急 — 一般考虑船舶失火等紧急情况

不同工况、不同船舶（如客船和货船）、不同航区（如远洋船和内河船）的各种负荷的重要性会不同，同时还要考虑经济性，所以这里需要工程人员更详细的全面考虑。

### Ensure continuity of operation

The ships have many loads of different significances, among which some might be severe threat to human lives and properties or cause great loss if they are not operated properly while others are tolerable under fault condition.

Thus, to ensure continuity of operation, it is important to provide the most appropriate protections and different backup degree for different loads.

The operation conditions of the ships depend on their types and purposes. Some typical operation conditions are listed below:

- Sail – Full-load and full-speed sailing
- Port entry/departure – Low-speed sailing in the port or in mobile status
- Ballast – Sailing into/out of the port in ballast
- Berth – Berthing without passengers or cargo
- Load/unload cargo – Loading/unloading of cargo ships, oil tankers and container ships
- Operation – Such as offshore operation of engineering ships and normal operation condition of offshore platforms
- Emergency – Emergent cases such as ships caught on fire

The importance of different loads depends on operation condition, ship type (such as passenger ship and cargo ship), and navigation area (such as ocean-going ship and river ship). Another consideration is economy. The engineers need to balance these factors.

## 全球服务支持

大多数的各种船舶往返于不同国家或地区的各个港口，如果船舶的某些电气设备发生意外故障，为了保证船东和客户的利益，避免由此引起重大的安全、时间、货物、合同期限等损失，此时非常需要及时的当地服务支持，如检修排除故障或更换部件等。

所以，设备供应商完备的全球服务体系和高水平的技术能力是对于船东来说至关重要的因素。

## 船舶整个生命周期内的服务支持

一般来说，船舶的整个生命周期包括设计、建造、运营以及维修改造等各个阶段，而且要确保长达几十年的服务时间。

如前所述，船舶与陆上建筑不同的是

- 要求整个生命周期内，更高的可靠性和更低的故障率；而且，船舶电气系统不能够像陆上建筑那样可以非常方便的扩展和改造，所以在设计和建造阶段需要更全面的考虑
- 在船舶整个服务运营期间，尤其是在长期恶劣的环境下运行后，由于各个设备的使用频率和使用方法不同，所以各设备的损耗和剩余生命也很不明确，此时为了确保可靠性，好的服务支持对于船东来说就更加重要

所以，在设计阶段，要进行可行性研究、方案设计、安装、调试直到通过船级社验收。

在建造阶段，要进行设备安装、测试、调试、港口和试航过程中的技术支持，以及操作员培训等。

在运营阶段，正常期限的质保服务、电话和在线支持、延长的质保和维护合同，备件服务等。

在改造阶段，测试评估系统的可靠性、系统调整以及升级改造方案。

## Global service and support

Most ships sail among ports of different countries or regions. If the electrical equipment on a ship breaks down, timely local service and support (such as troubleshooting or part replacement) is required to protect the interest of the ship owner and the customer and avoid major loss concerning safety function, time, goods and contract term.

Therefore, complete global service system and strong technical capability of equipment suppliers are very important for the ship owners.

## Service and support during the whole life cycle of the ships

Typically, the whole life cycle of a ship includes all stages of design, construction, operation, maintenance and reconstruction. The service provided will last as long as dozens of years.

As described above, ships are different with terrestrial buildings in the following aspects

- The ships require higher reliability and lower failure rate during the whole life cycle. The design and construction of ships should also consider the fact that ship electrical system can't be easily expanded and reconstructed like terrestrial buildings
- During the whole service and operation life of the ships, especially after long operation in tough environment, it is hard to determine the loss and remaining life of different types of equipment due to different use frequencies and methods. Hence, the ship owner needs good service and support to ensure reliability

Due to the above reasons, feasibility study, planning, installation and testing should be carried out in design stage until the ship passes the inspection of the ship classification society.

During the construction stage, the equipment is installed, tested and adjusted, and technical support for port and trial voyage as well as operator training should be provided.

During the operation stage, normal warranty service, telephone and online support, extended warranty service, maintenance contract and spare part services should be provided.

The reconstruction stage should include system reliability reevaluation, system adjustment, upgrading and reconstruction planning.



## 客户需求 Customer Needs

### 工程需求

#### 节省空间

船舶上空间宝贵，所以节省电气设备占用空间很有价值。这要从设备高度、面积、各组件的本身大小等各方面来综合优化。

尤其是对于海上平台等空间异常宝贵的设施，节省空间直接意味着节省大量的金钱。

所以，选用专为海事而开发的、充分考虑空间需求的设备，非常有价值。

#### 保证电气安装质量

很多电气故障源于安装质量不好，而且船舶上“振动”属于正常工作条件，所以对于电气安装质量的要求比陆上设备要高得多。这要从两方面来确保：

- 设备本身的结构设计，充分考虑海上对于安装的要求
- 工程中严格的工程管理两方面都至关重要

所以，选用专为海事而开发的、考虑海上设备安装要求的设备，并确保严格的工程管理，对于整体可靠性非常重要。

#### 易使用、易维护

“易使用”意味着操作人员可以很方便的理解和使用设备，这实际上关系着电气系统总体的可靠和高效。

“易维护”意味着在整个生命周期内，操作人员可以很快的了解设备运行情况，并更快更好的进行设备维护工作。

### Engineering requirements

#### Save space

It is of great significance to save space occupied by electrical equipment because of limited dimensions of the ships. To achieve this, equipment height, area and component sizes should be optimized.

In particular, for facilities with quite limited space such as offshore platforms, space optimization directly leads to saving of a great deal of money. Therefore, the equipment designed for marine purposes that can best meet space requirements should be selected among others.

#### Ensure quality of electrical installation

Many electrical failures result from poor installation. Because vibration is common on ships, the quality of electrical installation should be much higher than that of terrestrial equipment. This is ensured by the following two factors:

- Ensure that equipment structure is designed to completely meet requirements for ship installation
  - Provide high-standard engineering management
- Both of the above factors are very important.

In sum, to ensure overall reliability, the equipment designed for marine purposes that can meet ship installation requirements should be selected and strict engineering management should be provided.

#### Easy to use and maintain

“Easy to use” means the operators can understand and use the equipment at ease. This will contribute to general reliability and high efficiency of the electrical system.

“Easy to maintain” means that during the whole life cycle of the equipment, the operators are able to understand the operation condition of the equipment quickly and carry out better and faster maintenance work.

## 经济性需求

我们不仅要确保船舶的可靠性、安全性，还需要在充分保证可靠性、安全性的情况下，仔细考虑和验证“经济性”，来综合平衡整体性能和成本。因为经济性计算是个非常庞大而且复杂的命题，远不能简单的从设备价格角度来衡量，还要综合考虑对互相关联的设备以至于对整个系统的影响，考虑空间、安装、人力以及整个船舶服务期间内的运行和维护成本等。

经验证明，以下思路对于“经济性”，可以起到最实际的指导作用。

- 从设计上，选择最优化的系统设计方案
- 综合考虑船舶整个生命周期内的初始投资、风险损失、运行成本和维护成本

## 综上所述

船舶和海洋工程的可靠性和安全性，需要从系统结构设计、电气设备（质量、性能、人性化、是否专门为海事设计等）、工程安装以及服务等多个角度和过程进行控制和选择。其经济性，需要从全局的角度，并考虑到风险因素，来综合优化和平衡。

实践证明，选择本行业最专业的供应商提供的产品、服务和解决方案是最简单有效的方法。因为海事这个行业有很多特殊需求和很多小的细节要考虑，尤其对于电气系统，细节往往会成为非常重要的因素；而且，电气系统和设备往往需要从全局的角度进行设计和考虑。对于这些方面，只有拥有多年海事应用经验的“专业”供应商才有能力考虑到。

## Economical requirements

In addition to reliability and safety of the ships, economical requirements should also be considered and verified carefully to achieve balanced overall performance and cost. The evaluation on economical requirements is very complicated, involving a lot of factors apart from equipment price, such as equipment interdependence, influence on the whole system, space, installation, manpower, and operation and maintenance cost during the whole ship service life.

The following experience-based guidelines are provided to help achieve the best economical effect.

- Select the optimized system design solutions
- Consider the original investment, risk evaluation, operation cost and maintenance cost as a whole in the whole life cycle of the ships

## Conclusion

The reliability and safety of ships and offshore works should be controlled and selected by taking a lot of factors and processes into consideration, such as system structure design, electrical equipment (quality, performance, human care, marine purpose), engineering installation and services. All economical factors should be optimized and well balanced, during which the risks should also be considered.

Experience shows that adoption of products, services and solutions provided by most professional suppliers is the most simple and effective way. This is because many special and detailed requirements have to be considered in marine industry. In particular, the success of electrical system usually relies on details. Besides, it is always required that the electrical system and equipment be designed and considered by means of overall planning. Only professional suppliers with experience of many years in marine industry are able to achieve this target.



## 施耐德电气解决方案总览

### Schneider Electric solution overview

#### 中压解决方案

- 中压配电柜方案
- 中压马达控制中心方案
- 冷冻集装箱船中压环网柜应用方案
- 变压器

#### Medium voltage electrical distribution solution

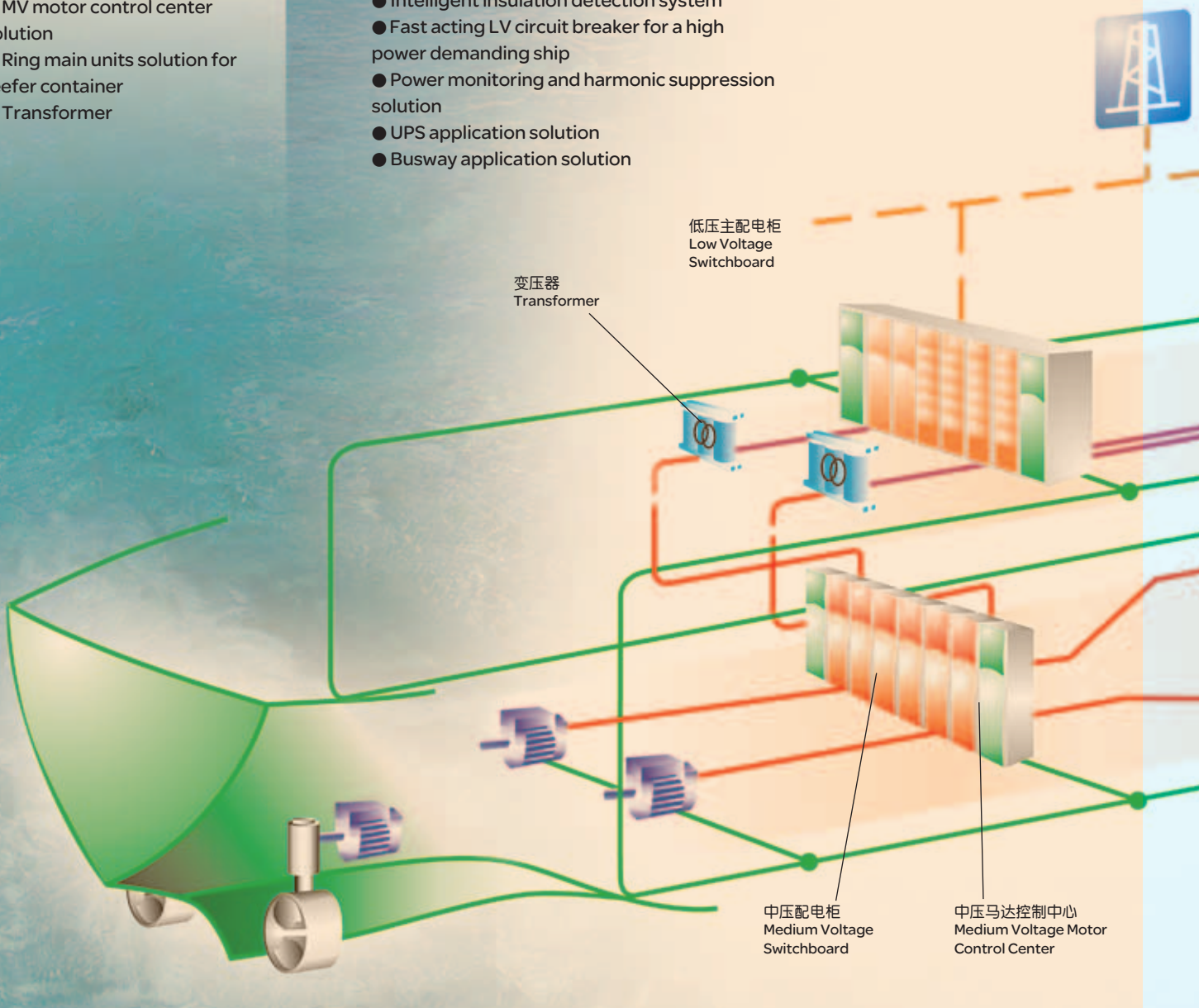
- MV electrical distribution board solution
- MV motor control center solution
- Ring main units solution for reefer container
- Transformer

#### 低压解决方案

- 低压配电柜
- 智能绝缘检测系统
- 超快速分断实现在大电力负荷时保留低压系统的方案
- 电力监控与谐波治理解决方案
- UPS不间断供电系统
- 母线应用方案

#### Low voltage electrical distribution solution

- LV electrical distribution switch board
- Intelligent insulation detection system
- Fast acting LV circuit breaker for a high power demanding ship
- Power monitoring and harmonic suppression solution
- UPS application solution
- Busway application solution



### 船舶机械设备和生活设施解决方案

- 简单设备的优选方案
- 分散式设备的优选方案
- 紧凑型设备的优选方案
- 高级应用方案
- 自动控制产品
- 传动系统
- 马达起动及保护
- 传感器元件
- 控制及信号单元
- 小型自动化元器件
- 工业机柜系统

### Ship Machines and Living Facilities Solution

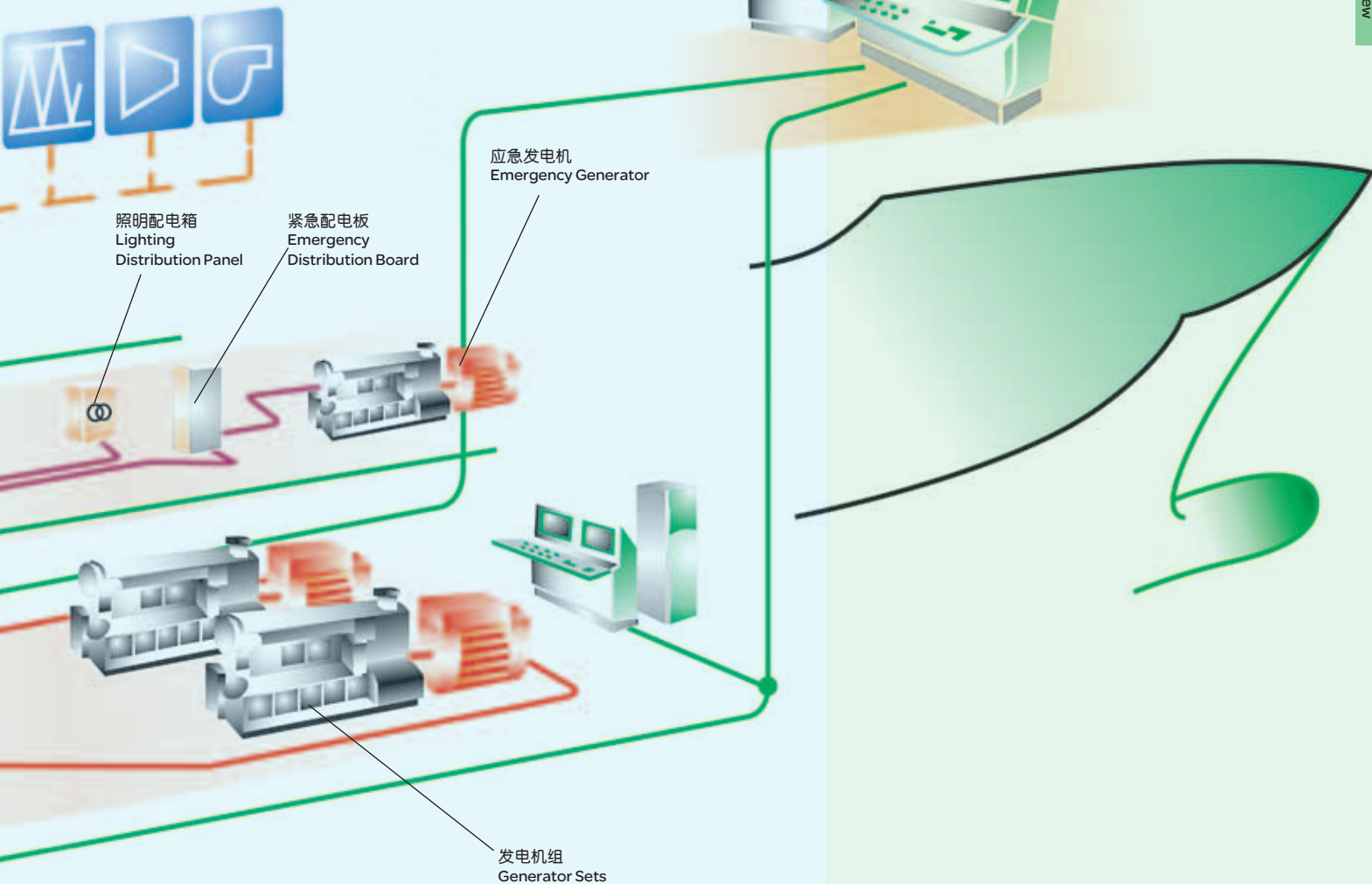
- Preferred implementations for simple machines
- Preferred implementations for distributed machines
- Preferred implementations for compact machines
- Advanced implementations
- Automation & control products
- Drive system
- Motor starting and protection
- Sensor components
- Control and signal units
- Small automation components
- Industrial cabinet systems

### 船舶自动化系统

- 船舶电站管理系统
- 视频监控系统

### Ship Automation System

- Ship power station management system
- Close-circuit television system





# 施耐德电气解决方案 Schneider Electric Solution

## 施耐德电气产品概览 Schneider Electric product overview





### 主要配电设备

- 中压配电柜 – PIX-V
- 中压马达控制中心 – Motorpact™
- 中压环网柜 – RM6
- MV/LV和LV/LV变压器（树脂浇注式、干式等）
- 低压配电板 – MB301M, MB401M, Okken Marine
- 不间断电源 (UPS) – Galaxy5500, Gutor

### 主要自动化系统

- 自动电站管理系统 – PMS
- 视频监控系统

### 主要自动控制设备

- 变频器
- 软起动器

### 其他船用设备

- 电力和照明分配电板
- 岸电箱 / 电工试验板 / 充放电板
- 组合起动屏 / 单体起动器
- 机舱集控台、桥翼控制台
- CCTV

### 中压配电元器件

开关、熔丝、断路器、接触器和数字保护。

### 低压配电元器件

空气断路器、塑壳断路器、微型断路器、接地漏电保护和绝缘监控、控制 / 监控测量设备、功率因素校正与谐波滤波、防水配电箱、工业插头与插座。

### 工业控制元器件

接触器、过载继电器、电机保护断路器、起动开关、起动器安装附件、智能电机起动器和控制器、限位开关、接近传感器、光电传感器、压力传感器、识别系统、视觉系统、安全类产品、按钮和指示灯、凸轮开关、控制按钮盒、报警灯柱、工业机柜、运动控制。

### 自动化器件

可编程逻辑控制器PLC、逻辑智能继电器、接口与分布式I/O、时间继电器、控制测控继电器、计数器、开关电源与安全隔离变压器、插入式中间继电器、接线端子、文本显示、图形终端。

### Main Power Distribution Equipments

- Medium Voltage (MV) Switchgear-PIX-V
- MV Motor Control Center - Motorpact™
- MV Ring Main Unit-RM6
- MV/LV and LV/LV Transformer-Cast Resin, Dry, etc
- LV Switchboard-MB301M, MB401M, Okken Marine
- Uninterrupted Power Supply (UPS)-Galaxy5500, Gutor

### Main Automation Systems

- Power Management System-PMS
- Close-circuit Television System

### Main Automation Systems

- Variable Speed Drive – ATV Series
- Soft Starter – ATS Series

### Other Equipment for Marine

- Power & Lighting Distribution Boards
- Shore Connection Board / Workshop Test Panel / Charging & Discharging Panel
- Group Starter Panels / Individual Starter Panels
- Engine Room Control Console, Wheelhouse & Wing Consoles
- CCTV

### MV Electrical Distribution Components

Switches, Fuses, Circuit Breakers, Contactors and Digital Protection.

### LV Electrical Distribution Components

Air Circuit Breaker, Module Case Circuit Breaker, Miniature Circuit Breaker, Earth-leakage Protection and Insulation Monitor, Control/ Monitoring Measurement Device, Power Factor Correction and Harmonic Filtering, Waterproof Enclosure, Industrial Plug & Sockets.

### Industrial Control Components

Contactor, Overload Relay, Motor Circuit Breaker, Starting Switches, Starter Installation Accessories, Intelligent Motor Starter and Controller, Limited Switches, Proximity Cells, Photoelectric Systems, Vision Systems, Safety Products, Pushbuttons and Pilot Lights, Cam Switch, Control Stations, Illuminated Beacons, Industrial Enclosure, Motion Control.

### Automation Components

PLC, Logic Smart Relay, Interface & Distributed I/O, Time Relay, Control Measure & Control Relay, Count Counter, Power Supply & Transformer, Plug-in Relay, Terminal Block, Text Display, Graphic Terminals.



# 施耐德电气解决方案 Schneider Electric Solution

## 施耐德电气全球服务方案

### Schneider Electric global service solution

#### 全球、全系列、贯穿整个船舶生命周期

Provide whole range of services around the world throughout the life cycle of the ships

#### 随时、随地、专业

Professional services anywhere at any time

#### 客户需求

##### 船舶整个生命周期内的服务支持

在船舶整个服务运营期间，尤其是在长期恶劣的环境下运行后，由于各个设备的使用频率和使用方法不同，所以各设备的损耗和剩余生命也很不明确，此时为了确保可靠性，好的质量保证和及时有效的服务支持对于船东来说就更加重要。

##### 全球服务支持

大多数的各种船舶往返于不同国家或地区的各个港口，如果船舶的某些电气设备发生意外故障，为了保证船东和客户的利益，避免由此引起重大的安全、时间、货物、合同期限等损失，此时非常需要及时当地的当地服务支持，如检修排除故障或更换部件等。

所以，设备供应商完备的全球服务体系和高水平的技术能力对于船东来说至关重要的因素。

#### Customer needs

##### Service and support during the whole life cycle of the ships

During the whole service and operation life of the ships, especially after long operation in tough environment, it is hard to determine the loss and remaining life of different types of equipment due to different use frequencies and methods. Hence, the ship owner needs good warranty as well as timely and effective service and support to ensure reliability.

##### Global service and support

Most ships sail among ports of different countries or regions. If the electrical equipment on a ship breaks down, timely local service and support (such as troubleshooting or part replacement) is required to protect the interest of the ship owner and the customer and avoid major loss concerning safety function, time, goods and contract term.

Therefore, complete global service system and strong technical capability of equipment suppliers are very important for the ship owners.

## 施耐德电气海事服务总体介绍

施耐德电气旗下TE电器、梅兰日兰都是业界领导者，拥有超过80年的应用经验，是海事领域中的重要厂商。

施耐德电气的机构遍布全球，能充分贴近您的需求，确保完美的服务质量。

- 售前技术支持
- 售后质保期内服务
- 质保期外服务
- 高级服务：谐波诊断和消除；选择性分析；预防性维护等
- 全球的服务网络
- 技术培训

选择施耐德电气，便意味着您可以依托其全球范围内的服务体系，在欧洲、北美洲、南非、中东和亚洲的主要港口获得强有力的支持。

我们的专家团队的专业水平来源于不间断的技术培训，这保证了我们的专家能充分深入地了解各种类型的船舶系统，并对特殊的海事规范有着丰富的经验。无论在世界上任何地方，我们的专家都能够以最快的速度解决您遇到的各种问题。

## Schneider Electric marine service general introduction

Gathering under a unique flag the expertise of leaders such as Telemecanique and Merlin Gerin and owing over 80 years' application experience, Schneider Electric is a key-player in marine.

Present all over the world, Schneider Electric always remains very close to your needs and guarantees the impeccable quality of the services it provides.

- Pre-sales technical support
- After sales service during warranty period
- Service beyond warranty period
- Advanced service: Harmonics analysis and filtering, Selectivity, Preventive maintenance, etc
- Global service network
- Technical training

With Schneider Electric, you can rely on a world-wide presence, close to the main harbours in Europe, North America, Southern Africa, Middle East and Asia.

The professionalism of our expert teams relies on a continuous technical training. It ensures them thorough knowledge of every type of on-board system. In addition to their considerable experience of specific marine constraints, our experts can be immediately operational and solve any kind of challenge, everywhere in the world.





# 施耐德电气解决方案 Schneider Electric Solution

## 船舶整个生命周期内的全系列全球服务支持

### 设计工程

- 可行性研究、方案设计
- 安装，调试，直到通过船级社验收

### 安装和调试

- 进行设备安装
- 测试
- 调试
- 港口和试航过程中的技术支持
- 操作员培训

### 运营

- 满足您需要的质保服务
- 电话和现场支持
- 延长质保期和维护合同
- 备件服务，满足您的需求

### 检修和改造

- 检测、调整和升级服务

### 高级服务

- 诊断
- 谐波
- 选择性

## A complete range of worldwide services throughout the ship's lifecycle

### Design engineering

- Feasibility studies, solution designing
- Installation, commissioning until the acceptance of your equipment by classification companies

### Installation and commission

- Handling equipment installation
- Testing
- Commissioning
- Technical assistance during harbor and sea trials
- Operator training

### Operation

- Warranty adapted to your needs
- Assistance over the phone, on site
- Extended warranty, maintenance contracts
- All necessary spare parts to fit your equipment

### Retrofit

- Audit, adaptation and upgrading.

### Advanced service

- Audit
- Harmonics
- Selectivity



## 海事全球服务支持 Schneider Electric world-wide service support

施耐德电气为您提供完整的服务体系，在全球的各海事服务网点，您都可以得到我们提供的专业的支持。  
Schneider Electric offers you a complete range of service to support you relying on our world – wide dedicated marine service centers.



Europe			America		
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Denmark	Schneider Electric Denmark A/S Batlorpbakken 14-DK-2750 Ballerup	Tel: (45)45 73 78 88 Fax: (45)44 68 52 55	CANADA	Dartmouth Center 100 Isley Ave Unit K Dartmouth, Nova Scotia	Tel: (1)902 468 2621 Fax: (1)902 468 2499
FINLAND	Schneider Electric Finland OY P.O.Box 410 Kalkkipellontie 6 ESPOO	Tel: (358)10 446 6436 Fax: (358)10 446 6776		Centre de service de Montréal Pt Claire 825 Bancroft arrondissement Pt Claire Montreal, Quebec	Tel: (1)514 697 4790 Fax: (1) 514 697 8906
FRANCE	Marine Center Brest  POSTE 9 Dion des Constructions navales Brest Naval	Tel: (33)4 91 03 03 67 (33)2 98 43 09 87 Fax: (33)4 91 60 49 26	UNITED STATES	Schneider Electric Canada/Richmond 2551 Viking Way, Unit 100 Richmond, British Columbia	Tel: (1)604 273 3531 Fax: (1)604 273 2218
	Schneider Electric - Pole Chantiers services 38 TEC Plant/ T1.37,quai Paul Louis MERLIN Grenoble	Tel: (33)4 76 57 97 19 Fax: (33)4 76 57 71 96		Schneider Electric Marine Services, Inc.  637 East Dania Beach Blvd	Tel: (1)954 923 7933 Cell: (1)305 753 7054 Fax: (1)954 923 7935
	Marine Center Le Havre  51 rue de l'église Le Havre	Tel: (33)4 91 03 03 67 (33)2 35 25 04 37 Fax: (33)4 91 60 49 26			
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SWEDEN	Schneider Electric AB	Tel: (46)8-623 84 00			
Africa			Aisa		
SOUTH AFRICA	Schneider Electric SOUTH AFRICA Corner, Bekker & Montrose Roads, Halfway Howse, Private Bag X139, Midrand	Tel: (27)11 254 65 09 Fax: (27)11 254 68 64	China	Schneider Electric China Schneider Electric Building, No. 6, East WangJing Rd., Chaoyang District Beijing 100102 P.R.C.	Tel: (86)10 8434 6699 Fax: (86)10 8450 1130
			Hong Kong	Schneider Electric Hong Kong Rooms 3108-3128, 31/F, Sun Hung Kai Centre, 30 Harbour Road, Wanchai	Tel: (852)2579 9615 Fax: (852)2811 1029
			India	Schneider Electric India Pvt. Ltd., A-29, Mohan Co-operative Indl. Estate, Mathura Road, New Delhi	Tel: (91)11 4159 0000 Fax: (91)11 4167 8012
			JAPAN	Schneider Electric Japan Ltd Todigoe F Blg 5F 1-8-2 Torigoe Taitou-Ku Tokyo Japan	Tel: (81)3 5821 1389 Fax: (81)3 5821 1110
			SINGAPORE	Schneider Electric Singapore Pte Ltd 10 Ang Mo Kio Street 65 #02-17/20 TechPoint	Tel: (65)648 55 239 Fax: (65)648 45 654
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## 船舶配电系统解决方案

### 需求和限制条件细述

一般来说，与陆用设施相比，海上船舶和工程对于持续安全可靠运行的要求要高很多，而环境条件要恶劣很多。在这样的条件下，为了确保电气和控制系统的安全、可靠运行，需要更慎重的进行系统设计和设备选型，并更谨慎的选用相关设备。

船舶电力网：电能从主配电板（及应急配电板等）通过电缆的传输，经过中间的分配电装置（区配电板、配电箱等），送往各电气用户。对船舶电力网的基本要求是生命力强、即要求电网在发生故障或局部破损等情况下，仍能保证对负载的连续供电，并限制故障的发展和将故障的影响限于最小范围之内。

### 1) 满足船用环境条件

由于船用环境条件的特殊性，决定了对船用电气设备的特殊要求。还必须考虑船舶或海上工程的航行和作业海区、船舶类型、吨位、主机的类型和输出功率和有无特殊要求等因素，而且适用的规则和规范可能不同，其要求的性能确切指标也会略有不同。

但一般来说，一般船用电气设备应该在下表规定的条件下正常工作：

环境因素	正常工作环境条件
周围空气温度	-25°C — +45°C
海上潮湿空气影响	有
盐雾影响	有
油雾影响	有
霉菌影响	有
倾斜	横向 $\leq 22.5^\circ$ ，纵向 $\leq 10^\circ$
摇摆	横向 $\leq 22.5^\circ$ ，纵向 $\leq 10^\circ$
振动	有
冲击 <sup>(1)</sup>	有

(1) 指船舶正常运营时产生的冲击。

## Ship Electrical Distribution Solution

### Requirements and constrains

Typically, ocean ships and offshore works have higher requirements for safe, reliable and continuous operation and have to face tougher environment than terrestrial facilities. Thus, to ensure the safe and reliable operation of the electrical and control system, the system design and model selection must be carried out more carefully, and supporting equipment should be selected with more care.

Ship electric network: Electric power is transmitted from the main switchboard (and emergency switchboard) to different users via power cable and intermediate power distribution systems (distribution board, sub-distribution panel, etc.) The basic requirement for the ship electric network is ruggedness. The electric network should be able to provide continuous power supply for the loads even in case of failure or local break, prevent further damage caused by a failure and minimize the impact of the failure.

### 1) Meet environment requirements for marine

The ship electrical equipment has to meet special requirements because of the special environment the ships work in. Other factors should be considered as well such as the sailing and working range of the ships or offshore works, ship type, tonnage, engine type, output power and special requirements. Besides, different rules and regulations might have slightly different requirements for performance and indexes.

However, typically the ship electrical equipment should work under the following normal conditions:

Environment factor	Normal operation condition
Ambient temperature	-25°C — +45°C
Humid air on the sea	Yes
Salt mist	Yes
Oil mist	Yes
Mould	Yes
Inclination	Lateral $\leq 22.5^\circ$ , longitudinal $\leq 10^\circ$
Swing	Lateral $\leq 22.5^\circ$ , longitudinal $\leq 10^\circ$
Vibration	Yes
Shock <sup>(1)</sup>	Yes

(1) Shock during the normal operation of the ships



## 2) 外壳防护等级

船舶电气设备的外壳防护型式对于船上人命和财产的安全十分重要。

电气设备的外壳防护型式，应符合IEC529号出版物《外壳防护等级分类》或与其等效的国际标准的规定。表示防护等级的标志由特征字母IP及后面加两位数字组成。

## 2) Enclosure protection degree

The enclosure protection type of the ship electrical equipment is very important for the safety of personnel and property on ships.

The enclosure protection type of the ship electrical equipment should comply with IEC 529 Publication: Classification of Degrees of Protection Provided by Enclosures or equivalent international standards. The mark indicating protection degree consist of characteristic letters (IP) followed by two digits.





表1防护等级的应用

Table 1 Application of protection degree

防护等级 Protection degree	安装区域的物理条件 Physical conditions of the installation area	安装区域的特定例子 Examples of installation areas
IP20	仅与带电部件有机械接触的危险 Hazards caused by mechanical contact with live parts	干燥的居住舱、干燥的控制室和监测室 Dry living compartment, dry control and monitoring room
IP22	暴露于滴水和/或通常的机械损伤的危险 Hazards caused by exposure to dripping and / or normal mechanical damage	机器处所和锅炉舱地板以上的处所，控制室、舵机舱、冷藏机器舱、应急机器舱、食品储藏室和普通储藏室/间 Machine room and space over the floor of the boiler room, control room, steering engine room, refrigeration machine room, emergency machine room, buttry and common storage room/ compartment
IP34	水的危险和/或更大的机械损伤的危险 Hazards caused by water and / or serious mechanical damage	浴室和淋浴间，机器处所和锅炉舱地板以下的处所，封闭的燃油净化器室，封闭的滑油净化器室，压载泵舱，冷藏舱、厨房和洗衣间，在双层底或管隧中的管轴 Bathroom and shower room, machine room and space below the floor of the boiler room, sealed fuel oil purifier room, sealed lubricant purifier room, ballast pump room, refrigeration room, kitchen and laundry, tube axis in double-layer bottoms or tunnels
IP55	喷水的危险，存在货物粉尘粒子、重大机械损伤、烟雾和湿气（蒸汽潮气）的危险 Hazards caused by water spraying, powder or particles of the goods, serious mechanical damage, mist and humidity (vapor and moisture)	通常的货舱和露天甲板 Common cargo space and open deck
IP56	受到波浪作用的危险 Hazards caused by wave	可能受到波浪冲击的露天甲板 Open deck exposed to the wave shock
IPX8	在潜水状态下运行的危险 Hazards caused by submerged operation	舱底水阱 Water trap at the bottom of the cabin



### 3) 系统电气参数

正确选择合适的电气参数，可以保证供电系统的可靠性。

#### 电流种类

一般船舶都优先采用交流电制，只有对于特殊船和小型船舶，如工作船和小艇等才会考虑直流电制。所以这里只介绍交流电制的系统。

#### 电压

目前各规范和规则，对于船舶的额定电压和最高电压均有明确的规定。一般来说常见的低压等级是690V附近、440V附近、230V附近等，常见的高压等级是11KV附近、6.6KV附近、3.3KV附近等。至于为什么说“附近”是因为受点设备和供电设备电压会因为电压降原因而要求不同，而且各国的习惯不同，比如出口船低压供电设备常要求440V，而国内船舶低压供电设备电压常要求“400V”等。

#### 频率

频率一般是50Hz或60Hz，但这一规定不包括弱电设备所需的特殊频率以及海上平台等特殊设备的频率。

#### 接地系统

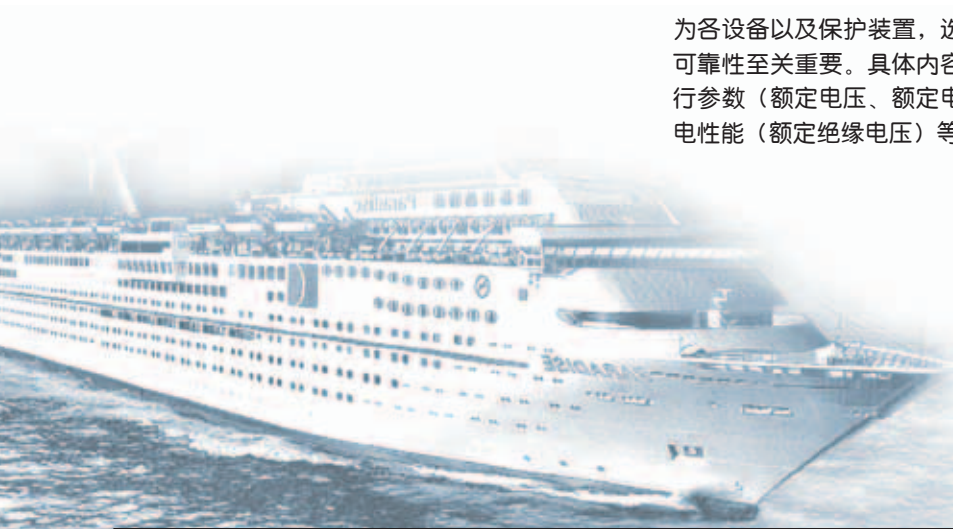
这里有很多相关的规定，对于有些特殊船型也有特殊要求，比如对于油船必须采用单相双线绝缘或三相三线绝缘系统。

一般来说，目前国内外船舶低压系统最常用的系统是三相三线绝缘系统，中压系统一般采用中性点高电阻接地方式。其原因在于，三相三线绝缘系统的三相之间只有磁的联系而没有直接电的联系，因此某单相接地故障不会影响其他两相，所以其优点是对于供电连续性的帮助最大，其缺点就在于要求很高的过电压倍数。对于低压系统其过电压倍数较容易满足，但对于中压系统要满足过电压倍数其引起的成本会增加很多。而中性点高电阻接地方式，则对于中压系统能很好的平衡两者的关系。

总之，应针对不同的船型、不同的功率要求和负载特点，综合分析性能要求、安全裕度和经济性等各项因素来确定电压和系统结构。

### 4) 设备电气参数

为各设备以及保护装置，选择合适的电气参数和性能，对于保证供电系统的可靠性至关重要。具体内容将在后文中详细阐述。常见参数类型为：额定运行参数（额定电压、额定电流、额定频率等），额定短时耐受电流，以及介电性能（额定绝缘电压）等。



### 3) System electrical parameters

Selection of appropriate electrical parameters helps ensure reliability of the power supply system.

#### Type of current

Alternating current is preferred for most ships. Direct current is only adopted by special and small ships such as service boats and small boats. Hence, we only focus on AC system here.

#### Voltage

Rated voltage and maximum voltage are defined explicitly by all regulations and rules. The most typical low-voltage ranges are near 690V, 440V and 230V. The most typical high-voltage ranges are near 11KV, 6.6KV and 3.3KV. These ranges are not accurate because the requirements for voltages of supply and powered equipment differ due to voltage drop and conventions of different countries. E.g., the LV power supply equipment of exported ships usually requires 440V, while that for domestic ships usually requires “400V” .

#### Frequency

The typical frequency is 50Hz or 60Hz. However, this specification doesn't apply to electronic equipment requiring special frequency and special equipment such as that on offshore platforms.

#### Grounding system

There are many requirements for grounding system, including some special requirements for special ships. E.g., single-phase 2-wire insulation or three-phase 3-wire insulation system is a must for oil tankers.

Currently, the most commonly used LV system in domestic and foreign ships is three-phase 3-wire system. MV system typically used neutral point high-resistance grounding. Because the three phases of a three-phase 3-wire system only have magnetic connection and there is no direct electrical connection, grounding fault in a single phase won't disturb the other two, thus ensuring uninterrupted power supply. The disadvantage of three-phase 3-wire system lies in large over-voltage multiple, which is easy to achieve in LV system, but leads to substantial increase of cost in MV system. In contrast, neutral point high-resistance grounding helps achieve balance between these two factors in MV systems.

In sum, the voltage and system structure should be determined by considering different factors as a whole such as ship type, power requirement, load characteristics, performance, safety margin and economy.

### 4) Equipment electrical parameters

It is important to ensure the reliability of the power supply system by selecting proper electrical parameters and performance for different types of equipment and protection devices. This will be described later in detail. Common parameters include rated operation parameters (rated voltage, current and frequency), rated short time withstand current, and dielectric performance (rated insulation voltage).



# 施耐德电气解决方案 Schneider Electric Solution

## 5) 确保工作的连续性

船舶的负载有很多，但各自的重要性是很不相同的，有些负载如果不能正常工作会导致生命、财产受到严重威胁或损失，而也有些负载故障则属于可承受范围。

所以，为各部分负载提供最合适程度的保护和备用是确保工作连续性的重点。

考虑到船舶运行工况，不同类型、不同用途的船舶其运行工况会有所不同，这里大致列举一些典型工况：

- 航行 — 满载全速航行状态
- 进出港 — 港内低速航行或机动状态
- 压载 — 进出港压载航行状态
- 停泊 — 停泊码头或系船无客、无货状态
- 装卸货 — 如货船、油船、集装箱船等装货、卸货状态
- 作业 — 如工程船的海上作业，海上平台的正常作业状态等
- 应急 — 一般考虑船舶失火等紧急情况

不同工况、不同船舶（如客船和货船）、不同航区（如远洋船和内河船）的各种负荷的重要性会不同，同时还要考虑经济性，所以这里需要工程人员更详细的全面考虑。粗略来说：

## 5) Ensure uninterrupted operation

The ships have many loads of different significances, among which some might be severe threat to human lives and properties or cause great loss if they are not operated properly while others are tolerable under fault condition.

Thus, to ensure continuity of operation, it is important to provide the most appropriate protections and different backup degree for different loads.

The operation conditions of the ships depend on their types and purposes. Some typical operation conditions are listed below:

- Sail – Full-load and full-speed sailing
- Port entry/departure – Low-speed sailing in the port or in mobile status
- Ballast – Sailing into/out of the port in ballast
- Berth – Berthing without passengers or cargo
- Load/unload cargo – Loading/unloading of cargo ships, oil tankers and container ships
- Operation – Such as offshore operation of engineering ships and normal operation condition of offshore platforms
- Emergency – Emergent cases such as ships caught on fire

The importance of different loads depends on operation condition, ship type (such as passenger ship and cargo ship), and navigation area (such as ocean-going ship and river ship). Another consideration is economy. The engineers need to balance these factors. In short:

重要程度 Significance	负荷类型 Load type	备注 Remarks
关键负荷 Critical loads	航行灯、信号灯 Navigation light, beacon 应急报警和信号装置 Emergency alarming and signaling devices 应急无线电设备和导航设备 Emergency radio and navigation equipment 应急照明 Emergency lighting 所有紧急状况下所需要的船内通信设备 Ship internal communication devices in all emergent cases 火灾探测和报警系统、防火门 Fire detection and alarming system, fire door 操作水密门所需的供电和操作设备 Power supply and operation equipment for waterproof doors 应急消防泵、自动喷水器泵 Emergency fire pump, automatic sprinkler pump 应急舱底泵及其电动遥控设备 Emergent bilge pump and electric remote-control devices 应急时使用的舵机 Emergency steering engine 等等 Others	紧急情况下全体人员的生命安全、船舶安全 Safety of the whole crew and the ship in emergent cases
重要负荷 Important loads	确保主机正常运行的设备（空压机、空气泵、循环和冷却水泵、油泵、分油机等） Equipment used to ensure normal operation of the engine (air compressor, air pump, circulation and cooling water pump, oil pump, oil separator) 确保船舶关键功能正常的设备（给水泵、舵机、锚机、压载泵、机炉仓通风设备等） Equipment used to ensure critical ship functions (feed water pump, steering engine, anchor windlass, ballast pump, ventilators in engine and boiler room) 自动化系统 Automation system 专用设备（如冷藏船的冷藏设备，化学品液货船的控温设备，海上平台的水下钻井设备等） Special equipments (such as refrigeration equipment on refrigeration ship, temperature control devices on ships carrying liquid chemicals, underwater drilling equipment of the offshore platforms) 等等 Others	船舶操作和安全、重大损失 Ship operation and safety, major loss
正常负荷 Normal loads	其他与正常功能相关的设备 Other equipment related to normal functions	工作连续性 Continuity of operation
优先切除负荷 Loads to be abandoned first in emergent cases	非重要负荷，指短时间不运转不会对船舶推进和操舵有损害，也不会危害乘客、船员、货物、船舶以及机械安全的设备。 Non-critical loads, e.g. the equipments which will neither damage ship propulsion and helming nor do harm to the safety of passengers, crew, goods, ship and mechanism.	紧急情况下，可优先切除此部分负荷。因为很可能长期在海上，所以这部分负荷也很重要。 These loads can be abandoned first in emergent cases. They are also important since the crew has to live long at sea.



# 施耐德电气解决方案 Schneider Electric Solution

一般措施是：船舶上各性质相近的用电设备都由相应的单独电网供电，可分为：

- 船舶主电网，由总配电板直接供电，供给各种船舶辅机的电动拖动
- 照明电网，提供船舶内外照明，由电压变压器从主电网供电
- 弱电装置电网，包括电传令钟、舵角指示器、电话设备、火警信号及警铃等
- 应急电网，包括应急照明、应急动力（如舵机电源）、助航设备电源等
- 其它等

一般来说，根据关键负荷和重要负荷的具体要求和功率，可确定应急发电机和蓄电池组（有时UPS）的容量；同时也可以据此优化电网结构和供电策略。

## 6) 海洋石油平台电力系统

与船舶电力系统极为相似，但又有其特殊性。总结来说

- 低压主变一般为几千kVA，由于并联运行，要求各级断路器具有高分断能力和完备的保护
- 由于一些工作负荷，如电潜泵等需要由400V经升压变压器后供电，但升压变压器在送电瞬间会产生巨大涌流，在断电瞬间又会在断路器主触头间产生很大电弧，因此要求保护和断路器必须具备大的耐受冲击能力
- 海洋平台很多电力负载需要持续工作，如果中断可能导致的损失会非常大。所以，其对供电连续性要求更高，配电设备应具有长寿命、免维护与检修方便的特点
- 海洋平台空间成本极高，供电设备在安全可靠的前提下，减少占用空间，具有非常大的价值

In general, the electrical devices of similar nature on the ship are powered by a single electric network. The electric networks include

- Main electric network of the ship: The general distribution board supplies power to different auxiliary machines and electric drives
- Electric network for lighting: It provides onboard and offboard lighting and the power is supplied by the voltage transformer from the main electric network
- Electric network for electronic devices: It powers the electric annunciator, helm indicator, telephone device, fire alarming device and alarm bell
- Electric network for emergent case: It provides emergent lighting, emergent power and powers navigation aids
- Others

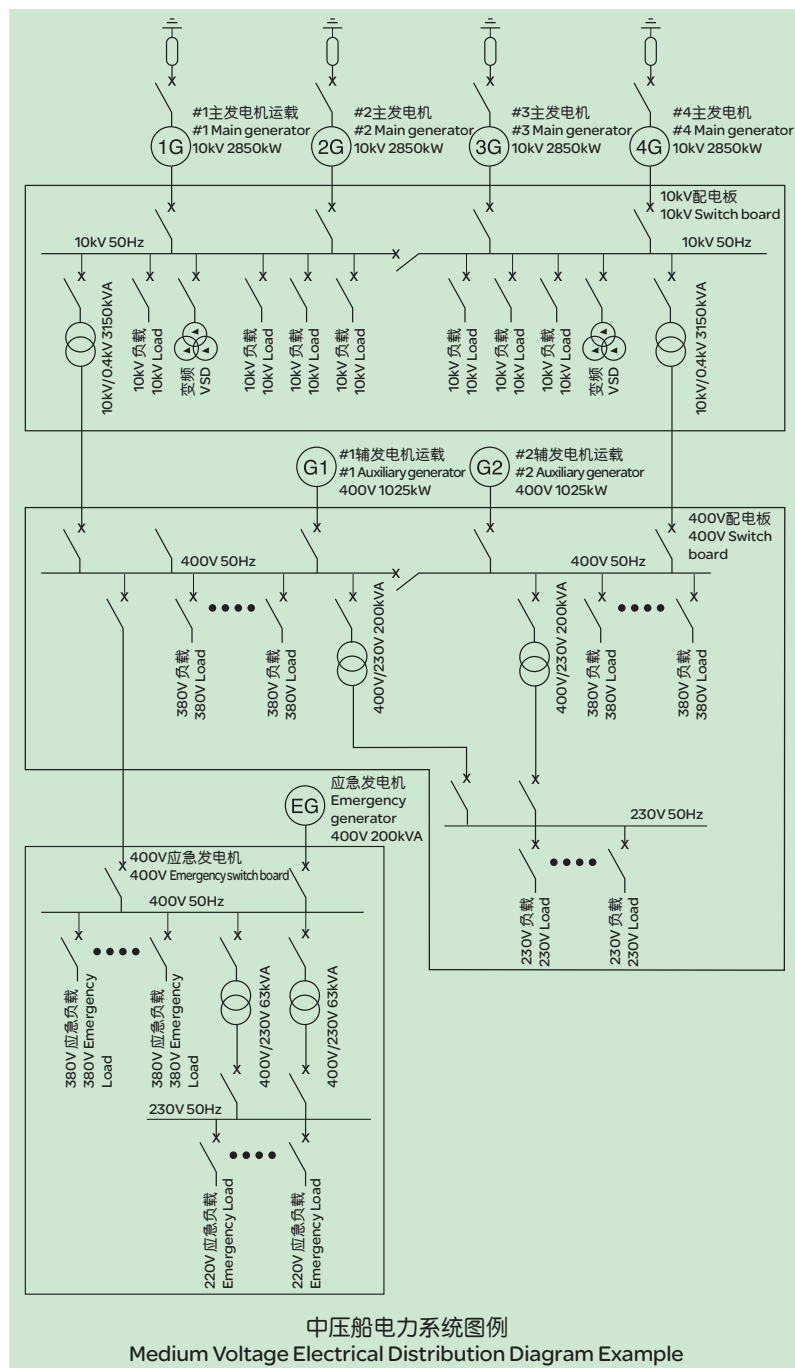
Typically, the capacity of the emergency generator and accumulator sets (UPS in some cases) can be determined by the requirements and power of critical and important loads.

## 6) Electrical power system for offshore petroleum platforms

It is very similar to ship electrical power system, but has the following unique features

- The rated voltage of the LV main transformer is typically a few thousand kVA. Parallel operation is adopted, which requires high breaking capacity and complete protection of circuit breakers of different levels
- Some loads (such as electric submersible pump) are fed by the step-up transformer that uses 400V as input. This transformer can generate high inrush transient current during feeding, and large arc between the main contacts of the circuit breaker at the moment of power cut. Therefore, the protection devices and circuit breakers must have large current withstand capacity
- Many electrical loads on the offshore platforms have to work 24 hours a day, and an interruption might result in major loss. That's why they have higher requirements for uninterrupted power supply. The power distribution devices should have a long service life, and be maintenance-free and easy to inspect and repair
- Since the space cost of offshore platforms is very high, the power supply equipment should save as much space as possible while ensuring safety and reliability

## 配电结构方案 Architectures



## 施耐德电气产品及应用 Schneider Electric products and applications

设备 Equipment	施耐德电气产品 Schneider Electric Product	页码 Page
中压配电盘 Medium voltage switch board	MCset Marine	42
中压马达控制中心 Medium voltage motor control center	Motorpact™	50
中压环网柜 Medium voltage ring main unit	RM6	56
中压变压器 Medium voltage transformer	Schneider Electric	60
低压配电盘 Low voltage switchboard	MB301M	62
	Okken Marine	66
智能绝缘检测设备 Intelligent insulation detection equipment	Vigilohm	72
超快速分断开关 Fast acting circuit breaker	NW UR	76
配电监控设备 Power monitoring equipment	PowerLogic	78
谐波有源滤波器 Harmonic active power filter	Accusine	82
不间断供电系统 Busway application solution	APC-MGE UPS	84
母线 Busway	I-LINE	86
	Canalis	



## 中压配电盘-MCset Marine Medium voltage switch board - MCset Marine

### 广泛应用的中压配电盘

### Widely accepted medium voltage switch board

#### 主要特点

##### 严格满足标准

MCset 在各类严酷的运行条件下，都能一展身手：通过对配电柜的要求最为严格的Shell 牌石油的认证，获得Lloyds Register (LR)，Det Norske Veritas (DNV)，Registro Italiano Naval (RINA)，Germanischer Lloyd (GL)，Bureau Veritas (BV)，中国船级社 (CCS) 的认证。同时，MCset 还可以用于核电站，在核电站的设备必须能够经受住1E级的抗震考验。

##### 经济尺寸

对于6-10kV的电压等级，1250A，31.5kA以内的参数，MCset的柜宽只有570mm宽，大大节省了配电室的空间。

##### 靠墙安装

MCset 所有操作，如母排搭接，电缆链接，断路器操作，都可以在柜前进行，所以完全可以靠墙安装，进一步减小配电室的面积需求。

##### 操作简便

MCset的操作指示由彩色的标准化的图形和符号表示，对于不同的设备的操作，用不同的颜色而不仅是用文字来加以区分，方便寻找到相关的操作指导，标准化的图形和符号也非常方便操作人员理解。无需死记硬背操作规程。MCset的断路器，接地开关，PT熔断器手车均使用同一个操作手柄。且所有机构都采用丝杆传动系统，操作人员无需费力即可轻松操作这些重型设备。门板采用可旋转并且带锁的门把手，既可以轻松锁住门板，又可以轻松的将门打开。

#### Main features

##### Comply with standards strictly

MCset can work smoothly under all tough conditions. It has passed the strictest certification for cabinets by Shell Petroleum, and acquired the certificates of Lloyds Register (LR), Det Norske Veritas (DNV), Registro Italiano Naval (RINA), Germanischer Lloyd (GL), Bureau Veritas (BV) and China Classification Society (CCS). MCset can only be used in nuclear power stations, which require equipment of 1E anti-seismic class.

##### Save much space

The 6-10kV MCset models with a current of no more than 1250A and 31.5kA have a width of only 570mm, saving much space for the power distribution room.

##### Mounting against wall

Since all MC set operations (such as busbar jointing, cable connection and circuit breaker operation) can be performed in front of the cabinet, it can be mounted against the wall to save further space for the power distribution room.

##### Easy to operate

The operations of MCset are indicated by standardized color figures and symbols. Instead of wording to avoid misinterpretation of operating instruction, different colors are used to represent different types of equipment so that the operators can easily locate corresponding instructions. The standardized figures and symbols are easy to understand, freeing the operators from rote learning of operation procedures. MCset circuit breaker, grounding switch and PT fuse truck use the same operation handle, and all mechanisms adopt screw rod transmission, allowing the operators to handle heavy equipment at ease. The door panels are equipment with rotary handles with lock, which can lock or open the panels easily.





### 安全可靠

十多项联锁保障安全操作，防止操作人员及无关人员的误操作。

内燃弧保护，通过50kA/0.15s，40kA/1s的燃弧测试，保障一旦发生燃弧故障时，不会伤害配电柜周围的人员。

3种锁具进一步锁定各关键部件的状态，确保操作顺序和操作安全。其中2锁1钥匙和3锁2钥匙能够很好的实现柜间的机械程序锁。

手车位置，接地刀都有明显的机械位置指示，操作人员可以很方便的识别各设备的位置状态。

防反转操作手柄防止手柄反转，阻止操作人员误操作。

### Safe and reliable

Over a dozen interlocking functions are provided to ensure safety and avoid unintentional operation by the operators or other people.

Internal burning arc protection that has passed 50kA/0.15s, 40kA/1s burning arc tests is adopted to protect people near the cabinet in case of any burning arc fault.

Three locking mechanisms lock critical components to ensure operation sequence and safety, among which the mechanism with 2 locks and 1 key and that with 3 locks and 2 keys are perfectly suitable for mechanical interlocking between cabinets.

Both the handcart and grounding knife have remarkable mechanical position indicators so that the operators are able to identify the position and status of different units.

Anti-reversion function is provided to prevent the handle from rotating reversely, thus avoiding accidental operation.



## 独特设计

MCset的柜体各部件的设计都采用了独特的设计理念，在实现各种联锁的基础上，也保证了各组件能相互配合得天衣无缝。

1. 断路器抽架，直接与断路器手车配合的导轨，静触头盒都装在抽架上，确保断路器手车的互换性。同时，柜体框架也是搭建在抽架之上，使得柜体结构更加坚固。
2. 断路器手车，手车地盘除了摇入摇出的机构之外，还融入了十分丰富的联锁，包括位置指示，和操作指导，将手车的功能发挥到了极致。
3. 接地开关操作机构盒，操作机构盒上除了接地开关的位置显示之外，同样融入了丰富的联锁，并还包含了带电显示器，指示电缆端的带电情况，保障操作人员的安全。

接地刀本体，独特的动静刀闸配合方式，使得接地刀轻松承受较大的接地电流。保障操作安全。

## 技术先进

与时俱进，MCset还在不断的将新技术融入配电设备的应用上面：

1. 透明化工厂（Transparent Ready™）系统，MCset的所有运行参数可以通过sepam传递到网络浏览器上，工作人员可以无需再到配电室就可以实时检测设备的运行情况，并依需求对MCset进行操作。
2. 温度实时检测系统，采用光纤将敏感点的温度24小时实时传送到监控中心，并可以设定相应的阈值在温度超出时实现报警和保护动作。
3. 内燃弧保护探测系统，内燃弧发生后，内燃弧探测系统可以在140ms内将故障线路切除，最大限度减少燃弧故障的破坏性。

## Unique design

The parts of MCset cabinet are designed based on unique concept to realize required interlocking functions while achieving perfect combination of different components.

1. Circuit breaker chassis: Both the guiding rail used directly with the circuit breaker and the static contact box are fixed on the chassis to guarantee the interchangeability of the handcart. The cabinet frame is also mounted on the chassis for firm structure.
2. Circuit breaker handcart: In addition to rack-in and rack-out mechanisms, the handcart has many interlocking functions including position indicators, which help the operator make the best use of the handcart.
3. Grounding switch operation mechanism box: In addition to the position indication of grounding switch, it has many interlocking functions as well. A voltage indicator is also provided to indicate whether the cable terminal is live, thus protecting the operators.

The Grounding knife adopts unique combination of dynamic and static knife switches, which enables the knife to bear large grounding current and ensures safe operation.

## Advanced technologies

MCset always takes advantage of latest technologies in the applications of power distribution devices:

1. Transparent Ready™ system: All running parameters of MCset can be transmitted to the network browser through sepam. The operators can perform real-time inspection on the devices and operate MCset as required without having to go to the power distribution room.
2. Real-time temperature system: The temperature of sensitive points is transmitted to the monitoring center via optic fiber in real time 24 hours a day. Temperature threshold values can be set for real-time alarming and protection actions.
3. Internal burning arc detection system: After an internal burning arc appears, this system can cut off the faulty line within 140ms to minimize the damage caused by the burning arc.



### 方案完备

多种馈线单元，实现对不同负载的保护和控制：

1. 断路器，常用馈电回路
2. 接触器，对马达和电机的控制
3. 负荷开关熔断器组合，变压器

可安装多种类型的CT，也可以在一相上安装2个CT  
还可以与施耐德电气专业的马达控制柜Motorpact连接。

### 质量和环保

施耐德电气有严格的控制质量控制系统保障合格的设备出厂。

97%的施耐德电气工厂都通过ISO14001体系认证。

93%的施耐德电气产品是采用环保设计理念。

产品在寿命周期后施耐德电气还提供相应的回收服务。

### Complete solutions

Different feeder units to protect and control different loads:

1. Circuit breaker: Common feeder loop
  2. Contactor: Control the motors
  3. Combination of load switch and fuse, transformer
- Different CT models can be used, and two CT can be used in one phase. Motorpact, a special Schneider motor control cabinet, can also be connected.

### Quality and environment protection

Schneider Electric ensures the quality of devices to be delivered by strict quality control procedures.

97% of Schneider factories have passed ISO14001 certification, and 93% of Schneider Electric

products are designed in compliance with environment protection principles.

Schneider Electric also provides recycling services

for products at the end of their life cycle.

## 技术参数 Technical parameters

### SF6 进线馈线回路 - AD1/AD2/AD3/AD4S

### SF6 Incoming feeder - AD1/AD2/AD3/AD4

特点 Characteristics		AD1		AD1 接触器contactor		AD2			AD3			AD4
额定电压 Rated voltage	kV	7.2	12	7.2	12	7.2	12	17.5	7.2	12	17.5	24
额定绝缘等级	kV rms 50Hz - 1mn	20	28	20	28	20	28	38	20	28	38	50
Rated insulation level	kV脉冲impulse 1.2/50 ms	60	75	60	60	60	75	95	60	75	95	125
额定电流	A	200		●	●							
Rated current		250		●	●							
		630		●	●	●	●	●		●		●
		1250		●	●	●	●	●		●		●
		2000										●
		2500							●	●	●	●
		3150 <sup>(3)</sup>							●	●	●	●
分断能力 Breaking capacity	kA	31.5	31.5	50 <sup>(1)</sup>	50 <sup>(1)</sup>	50	40	31.5	50	50	31.5	31.5
短时耐受电流	(kA rms. 1s)	31.5	31.5	50 <sup>(1)</sup>	50 <sup>(1)</sup>	50	40	31.5	50	50	31.5	31.5
Short time withstand current												
短时耐受电流	(kA rms. 3s)	31.5	31.5	50 <sup>(1)</sup>	50 <sup>(1)</sup>	40	40	31.5	40	40	31.5	16 or 25
Short time withstand current												
尺寸与重量	H (mm)	2500		2500		2500			2500			2525
Weight and dimensions	W (mm)	570		570		700			900			900
	D (mm) <sup>(2)</sup>	1575		1575		1575			1575			1750
	重量 Weight (kg) <sup>(2)</sup>	600		600		700			800			1100

(1) 带熔断器。

(2) 总值+175mm，用于带四面内燃弧保护的配电盘。

(3) 若要求更高的额定值，请联系我们。

(1) Limited by fuses.

(2) Overall + 175mm for 4-sided internal arcing protected switchboards.

(3) For higher ratings: please consult us.

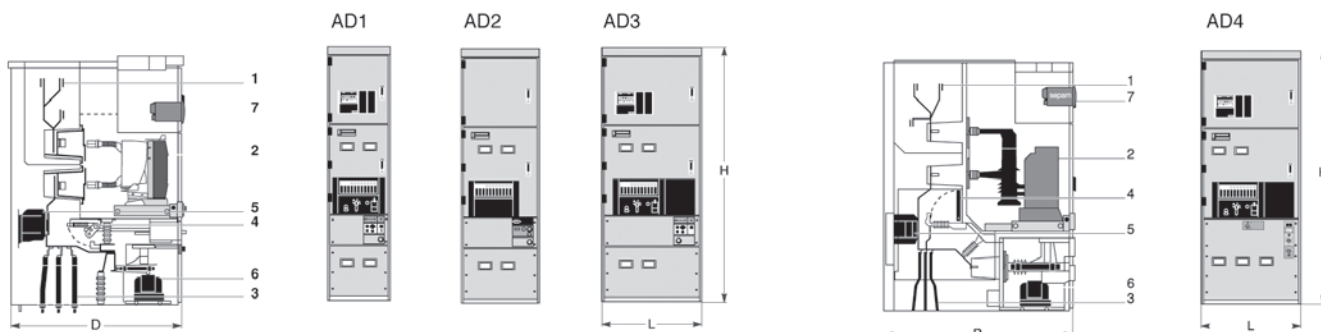


## 真空进线馈线回路 - AD1/AD2/AD3 Vacuum Incomer feeder

特点 Characteristics		AD1		AD1 接触器 contactor	AD2			AD3								
额定电压 Rated voltage	kV	7.2	12	7.2	7.2	12	17.5	7.2	12	17.5	7.2	12	17.5			
额定绝缘等级	kV rms 50Hz - 1mn	20	28	20	20	28	38	20	28	38	20	28	38			
Rated insulation level	kV 脉冲impulse 1.2/50ms	60	75	60	60	75	95	60	75	95	60	75	95			
额定电流	A	250		●												
Rated current	630	●	●		●	●	●	●			●		●			
	1250	●	●		●	●	●	●			●		●			
	2500								●	●	●	●	●	●		
分断能力 Breaking capacity	kA	25	25	50 <sup>(3)</sup>	31.5	31.5	25	31.5	25	31.5	40	25	31.5	40	25	31.5
短时耐受电流 (kA rms 1s)	25	25	50 <sup>(3)</sup>	31.5	31.5	25	31.5	25	31.5	40	25	31.5	40	25	31.5	
Short time withstand current																
短时耐受电流 (kA rms 3s)	25	25	50 <sup>(3)</sup>	31.5	31.5	25	31.5	25	31.5	40	25	31.5	40	25	31.5	
Short time withstand current																
尺寸与重量	H (mm)	2500			2500			2500								
Weight and dimensions	W (mm)	570			700			900								
	D (mm) <sup>(1)</sup>	1550			1550			1550								
	近似重量(kg) <sup>(2)</sup>	850			1000			1300								
	Approximate weight															

- (1) 总值+175mm，用于带四面内燃弧保护的配电盘。  
 (2) 全部配备的柜体。  
 (3) 带熔断器。

- (1) Overall + 175mm for 4-sided internal arcing protected switchboards.  
 (2) Fully equipped cubicle.  
 (3) Limited by fuses.



### 中压隔室

1. 隔室母线互连
2. 抽出式架构
3. 可以从前面连接中压电缆
4. 接地开关
5. 电流互感器
6. 电压互感器 (选配抽出式熔断器)

### MV compartments

1. Busbars for cubicle interconnection
2. Withdrawable portion
3. MV connections by cables accessible from the front face
4. Earthing switch
5. Current sensors
6. Voltage transformers (optionally equipped with withdrawable fuses)

### 低压隔室

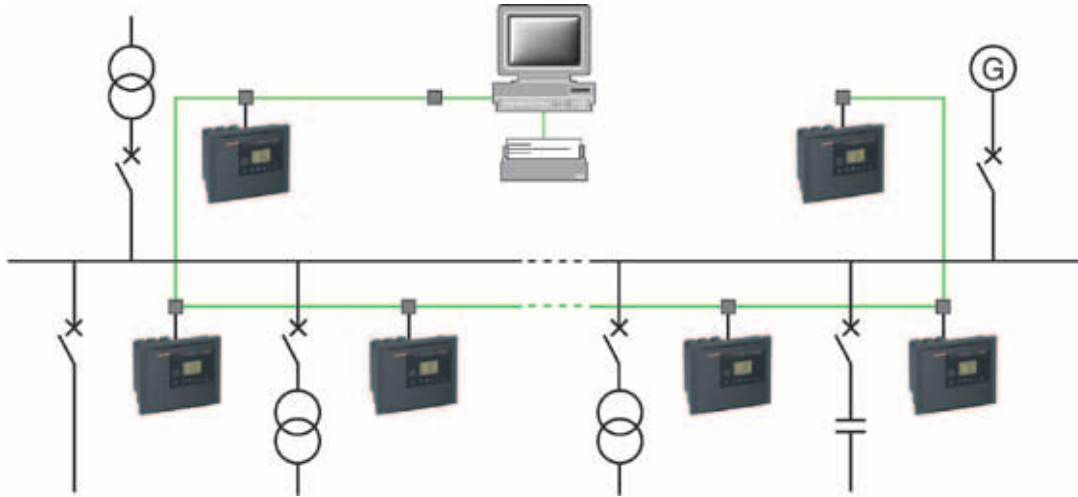
7. 低压附件和综合保护测控装置都放在一个隔室中，与中压部分分开。

### LV compartment

7. Low voltage auxiliaries and the protection, monitoring & control unit are in a compartment which is separated from the MV part.

## Sepam 80 系列综合保护测控装置

### Sepam 80 series integrated device for protection, measurement and monitoring



Sepam的设计，旨在通过以下的集成功能，进行中压单元的控制和操作

- 保护
- 测量
- 干扰记录
- 通信(选配件)

Sepam单元的内部结构由两片微处理器组成，用于实现下列功能

过流、接地故障、断路器失灵保护、不平衡保护、电压保护、频率保护等保护功能，全电量测量，谐波测量，实现遥控开合操作，可完成电压、电流等参数越限报警、事件顺序记录。

在制造电气系统和开发具有多功能保护单元的过程中，施耐德电气积累了大量经验，能够实现标准的电网管理

- 逻辑选择性
- 自复位循环
- 后加速保护
- 自动通信测量功能、故障检测与排除功能，其设计特别考虑到了如下应用方面的需要
- 防火区变电站
- 配电母线排
- 变压器
- 电机
- 发电机

Sepam is designed to manage control and operation of medium voltage units through the following range of integrated functions

- protection
- measurement
- disturbance recording
- communications (optional)

The internal structure of the Sepam unit is made up of two microprocessors dedicated to the following functions

Protection against over current, grounding fault and breaker circuit failure, protection against unbalance, voltage protection, frequency protection, full-charge measurement, harmonic measurement, remote control switch on/off, parameter (voltage, current) out-of-limit alarming, event sequence recording.

The considerable experience acquired of manufacturing electrical systems and developing multifunctional units helps Schneider Electric establish standard electric network management system

- logic selection
- self-resetting loop
- post acceleration protection
- automatic communication and measurement, fault detection and elimination, with special focus on the following applications during design
- fire zone substation
- distribution busbar
- transformer
- motor
- generator



# 施耐德电气解决方案 Schneider Electric Solution

## 中压海事配电装置MCset Marine 部分应用案例

船舶类型 建筑物名称或号码	船主 造船所	主要规格	类别
2x 旅游船 “大厅的骄傲” “鹿特丹的骄傲” 2003	P & O (英国) Fincantieri (意大利)	主配电盘 6,6kV – 2500A	L.R.S. RINA
旅游船 2003	Irish Ferries (爱尔兰) Aker Finnyard (芬兰)	主配电盘 6,6kV – 1250A	L.R.S.
海上平台 140人的生活区 2004	VIETXOPETRO (越南) PTSC (越南)	主配电盘 6,6kV – 630A	L.R.S.
挖泥船 – 耙吸式 挖泥船 2004	Port de Paris (法国) Astilleros Espanoles Gijon (西班牙)	主配电盘 6,6kV – 1250A	B.V.
渡船 Dokter Wagemaker 2003	TESO (荷兰) Damen Shipy. Galati (罗马尼亚) Damen Shipyard Flushing (荷兰)	主配电盘 6,6kV – 1250A	L.R.S.
液化天然气运输船 2004	TMT (台湾) DSME (韩国)	主配电盘 6,6kV – 1250A	GL
4 x 8,400 TEU集装箱船 2004	MSC (意大利) DSME (韩国)	主配电盘 6,6kV – 1250A	GL
2 x 8,400 TEU集装箱船 2005	CP Offen (德国) DSME (韩国)	主配电盘 6,6kV – 1250A	GL
敷管船 2005	Subsea 7 (挪威) Merwede (荷兰)	主配电盘 6,6kV – 1250A	L.R.S
AKPO FPSO 2006	TOTAL (法国) Hyundai Heavy Indust. (韩国)	配电盘 6,6kV – 1250A	BV
敷管船 2006	Subsea 7 (挪威) Merwede (荷兰)	主配电盘 6,6kV – 1250A	L.R.S
7000吨全旋转式海洋浮吊船 2006	Zhen Hua Port Machinery (中国) HuaRun DaDong Ship Eng Co. (中国)	主配电盘 6,6kV – 630A	C C S
8 x 多任务护卫舰 2006	Marine Nationale (法国) DCN (法国)	主配电盘 6,6kV – 630A (VCB breakers)	BV
浮船坞 2006	STX shipyard (韩国) STX shipyard (韩国)	主配电盘 6,6kV – 630A	LR + KRS
液化天然气船 2006	Sovcomflot (俄罗斯) DSME (韩国)	主配电盘 6,6kV – 630A	DNV
2 x 8,000标准箱集装箱船 2006	M.O.L (日本) Koyo Dockyard Co, Ltd (日本)	主配电盘 6,6kV – 1250A	LR
液化天然气船 2007	Sovcomflot (俄罗斯) DSME (韩国)	主配电盘 6,6kV – 630A	DNV
3 x 11,000标准箱集装箱船 2007	CGA-CGM (法国) DSME (韩国)	主配电盘 6,6kV – 1250A	BV
2 x 旅游船 C33 & D33 2007	Norwegian Cruise Lines (美国) AKER (法国)	主配电盘 11kV – 3150A	DNV
潜水供应船 2007	Subsea 7 (挪威) Merwede (荷兰)	主配电盘 6,6kV – 1250A	L.R.S
1 x 11,000标准箱集装箱船 2007	Conti Rederei (德国) DSME (韩国)	主配电盘 6,6kV – 1250A	DNV

## MV Marine switchgear-MCset Marine Part of references

Type of Vessel Name or No of Building	Ship Owner Shipyard	Main ratings	Class
2 x Cruise Ferries " Pride of Hall " " Pride of Rotterdam " 2003	P & O (UK) Fincantieri (Italy)	Main Switchboard 6,6kV – 2500A	L.R.S. RINA
Cruise Ferry 2003	Irish Ferries (Ireland) Aker Finnyard (Finland)	Main Switchboard 6,6kV – 1250A	L.R.S.
Off-shore Platform 140Men Living Quarter 2004	VIETXOPETRO (Vietnam) PTSC (Vietnam)	Main Switchboard 6,6kV – 630A	L.R.S.
Dredger- Hopper suction dredge 2004	Port de Paris (France) Astilleros Espanoles Gijon (Sp)	Main Switchboard 6,6kV – 1250A	B.V.
Ferry Dokter Wagemaker 2003	TESO (NL) Damen Shipy. Galati (Romania) Damen Shipyard Flushing (NL)	Main Switchboard 6,6kV –1250A	L.R.S.
1 x LNG Carrier 2004	TMT (Taiwan) DSME (Korea)	Main Switchboard 6,6kV –1250A	GL
4 x 8,400 TEU Container 2004	MSC (Italy) DSME (Korea)	Main Switchboard 6,6kV –1250A	GL
2 x 8,400 TEU Container 2005	CP Offen (Germany) DSME (Korea)	Main Switchboard 6,6kV –1250A	GL
Pipe-Laying Ship 2005	Subsea 7 (Norway) Merwede (NL)	Main Switchboard 6,6kV –1250A	L.R.S
AKPO FPSO 2006	TOTAL (France) Hyundai Heavy Indust. (Korea)	Switchboards 6,6kV –1250A	BV
Pipe-Laying Ship 2006	Subsea 7 (Norway) Merwede (NL)	Main Switchboard 6,6kV –1250A	L.R.S
7000 T Full Revolving Ocean Engineering Floating Crane 2006	Zhen Hua Port Machinery (China) HuaRun DaDong Ship Eng Co. (China)	Main Switchboard 6,6kV – 630A	C C S
8 x Multi Missions Frigates (FREMM) 2006	Marine Nationale (France) DCN (France)	Main Switchboard 6,6kV – 630A (VCB breakers)	BV
Floating dock 2006	STX shipyard (Korea) STX shipyard (Korea)	Main Switchboard 6,6kV – 630A	LR + KRS
LNG carrier 2006	Sovcomflot (Russia) DSME (Korea)	Main Switchboard 6,6kV – 630A	DNV
2 x 8,000 TEU Container 2006	M.O.L (Japan) Koyo Dockyard Co, Ltd (Japan)	Main Switchboard 6,6kV – 1250A	LR
LNG carrier 2007	Sovcomflot (Russia) DSME (Korea)	Main Switchboard 6,6kV – 630A	DNV
3 x 11,000 TEU Container 2007	CGA-CGM (France) DSME (Korea)	Main Switchboard 6,6kV – 1250A	BV
2 x Cruise Vessels C 33 & D 33 2007	Norwegian Cruise Lines (USA) AKER (France)	Main Switchboard 11kV – 3150A	DNV
Diving Supply Vessel 2007	Subsea 7 (Norway) Merwede (NL)	Main Switchboard 6,6kV – 1250A	L.R.S
1 x 11,000 TEU Container 2007	Conti Rederei (Germany) DSME (Korea)	Main Switchboard 6,6kV – 1250A	DNV



## 中压马达控制中心-Motorpact™ Medium voltage motor control center - Motorpact™

创新设计，完备保护  
Innovative design, complete protection

### 创新设计的价值

丰富的功能Motorpact™中压马达控制柜提供了最高效的控制和保护手段，适于范围广泛的、包括软启动在内的各种应用场合。  
通过配置，它们还能用于变压器馈线回路。

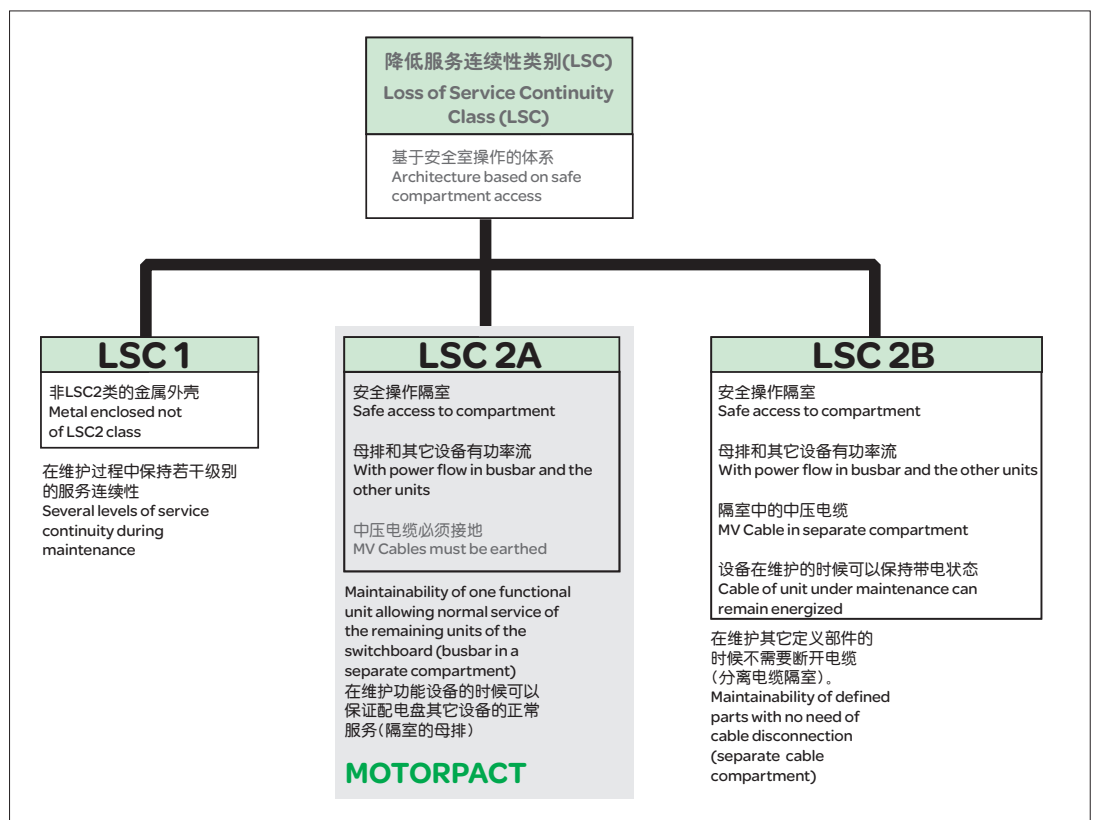
1. FVNR直接电机启动
2. RVAT降压自耦变压器电机启动
3. RVSS降压软启动电机启动

### The value of innovative design

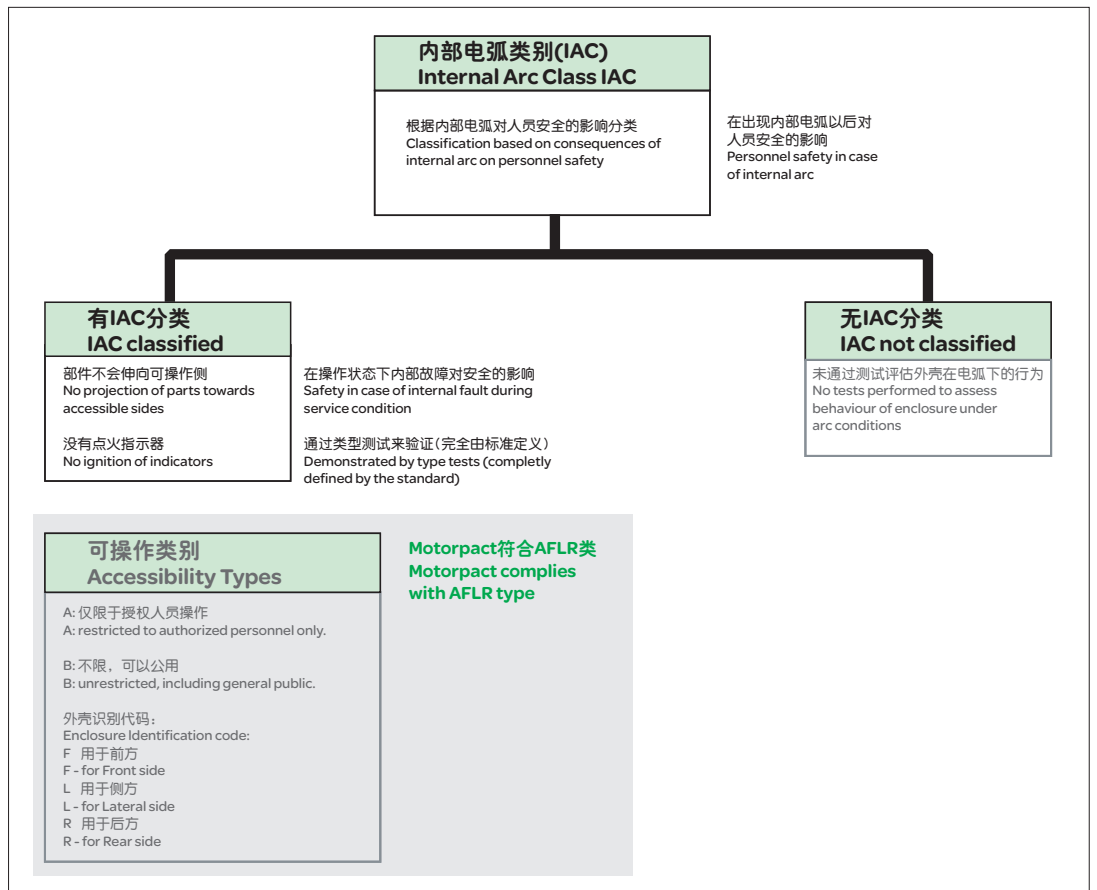
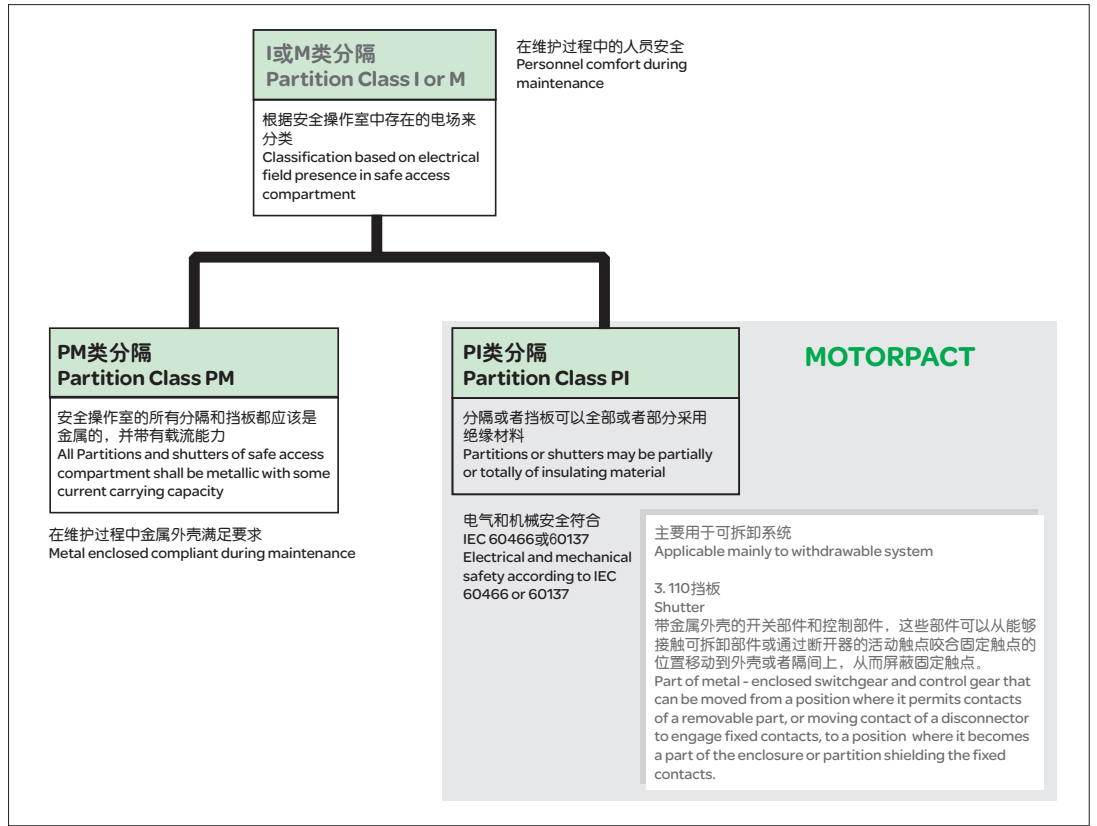
Versatility Motorpact™ MV motor starters provide the most efficient control and protection means for a wide range of applications including soft-starter. They can also be configured for transformer feeder loops.

1. FVNR direct on-line motor starter
2. RVAT step-down auto transformer motor starter
3. RVSS step-down soft starting motor starter

### Motorpact类别说明 Motorpact class specification









## 主要特点

### 充分的安全性

- 在所有低压隔室中可完全防止内燃弧
- 充分进行安全隔离，防止意外情况
- 从配电盘的前面就可以看到隔离开关触头的接地位置
- 带开断容量的电缆接地开关
- 所有操作都要在柜门关闭的情况下进行
- 通过简单的互锁，防止人员的误操作

### 可靠性

- 采用隔离开关，结构简单，减少了部件数目，并提供了更加简单而稳定的互锁功能
- 多功能铸造元件，减少了部件数目，从而减少了维护和热损耗
- 借助低功率电流互感器（LPCT）、Sepam数字继电器，为各种各样的电机应用提供了可行的方案
- 低压部分的隔室有助于提高电磁兼容性（EMC）和更好的进行布线
- 设计符合所有相关的IEC标准和NEMA标准



## Main features

### Full safety

- Fully tested to internal arc withstand in all MV compartments
- Fully safe compartmented design preventing inadvertent access
- Visible earthed position of disconnecter contacts from the front of the switchboard
- Cable earthing switch with making capacity
- All operations performed with closed door
- Operator errors prevented through simple interlocks

### Reliability

- Simple architecture by use of a line disconnecter, reducing the number of parts and providing simple and robust interlocks
- Multifunctional cast components minimizing parts, consequently reducing maintenance and heat loss
- Pre-engineered solutions with low power current transducer (LPCT) and Sepam digital relay providing proven designs for the full range of motor applications
- Separate LV compartment enhancing EMC and wire management
- One design complying with all relevant IEC and NEMA standards





# 施耐德电气解决方案 Schneider Electric Solution

## 易于维护

- 配电盘上无需断电，就可以对电机启动器部件进行所有必需的维护
- 免维护的真空接触器
- 高耐用，免维护的隔离开关
- 应用热诊断系统进行预防性维护

## 电网监控

工业应用场合中，电力供应的可用性和质量是十分关键的。能耗成本的减少以及设备的优化也是我们重点考虑的问题。

施耐德电气将互联网技术集成到电力设备中，提供了创新、优化的方案，满足了人们的需求。通过普通网络浏览器，让人们能方便快捷而安全地共享数据。

借助“透明就绪”的Motorpact，您可以实现：

- 远程监控
- 能耗跟踪
- 电能质量管理
- 电机和变压器跟踪
- 测量，数据日志记录，记录时间戳……

## 紧凑而灵活

- 紧凑的布局，宽度为375mm
- 从前面、后面、顶端和底端都可以进线
- 简单而紧凑的隔间结构，可以与其它的施耐德电气设备进行扩展
- 十分有利于改造和升级

## Maintenability

- All necessary maintainable motor starter components accessible without de-energizing the switchboard
- Maintenance free vacuum contactor
- High endurance, maintenance free disconnecter
- Thermal diagnosis system for predictive maintenance

## Power web monitoring

The availability and the quality of electrical supply for industrial sites are vital. Reduction of energy costs and equipment optimization are also major concerns.

Schneider Electric's integration of Web technologies into power equipment provides an innovative, optimised response to these needs. It allows simple, fast, secured sharing of data by all the players, via a common Web browser.

With “Transparent Ready” Motorpact, you can achieve:

- Remote monitoring
- consumption follow-up
- quality management
- motors and transformers follow-up
- Measuring, data logging, time stamping...

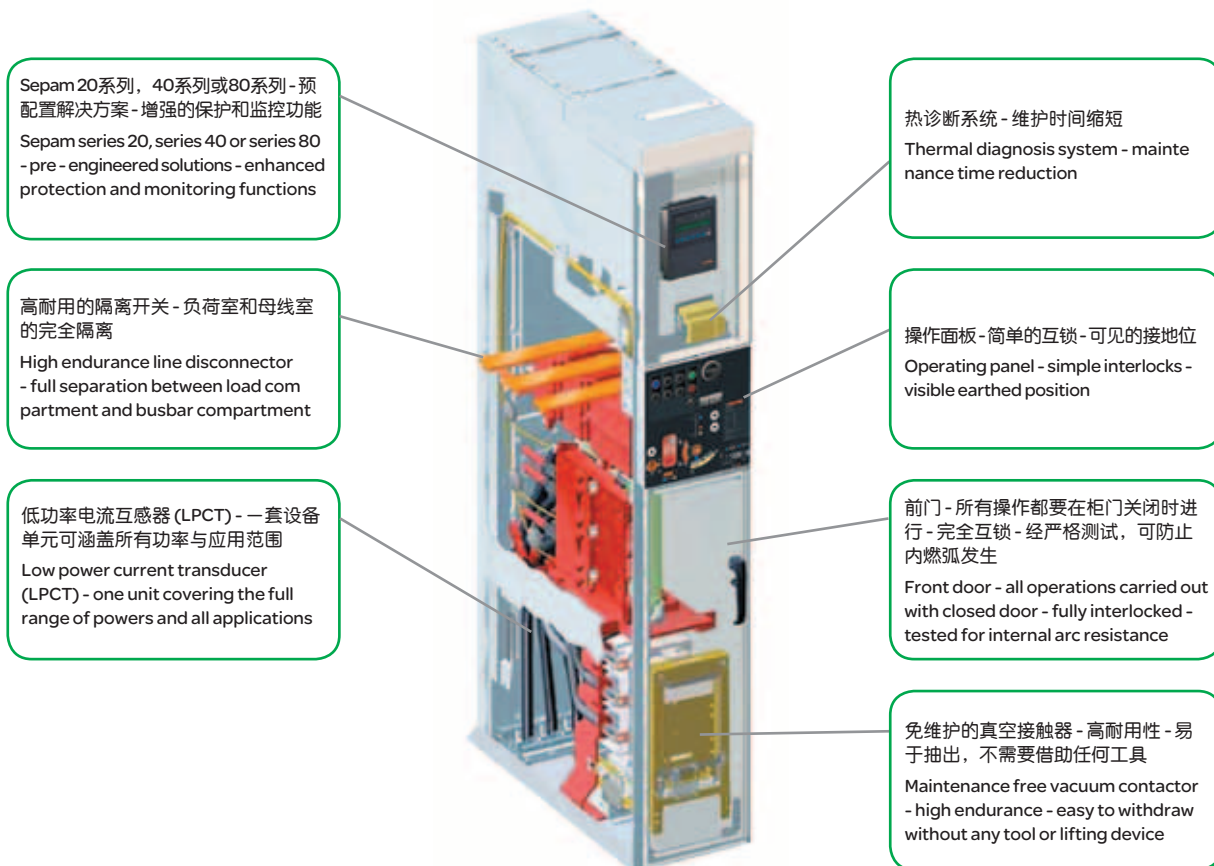
## Compactness and flexibility

- Compact footprint of 375mm width
- One design allowing front, rear, top and bottom cable entries
- Simple and compact transitions cubicles, allowing extension to other Schneider Electric equipment
- Ideal for retrofit applications

## 技术参数 Technical parameters

额定电压 (kV)	7.2
额定绝缘等级 (kV)	
雷电冲击耐受电压 (kV峰值)	60
工频耐受 - 1分钟 (kV rms)	20
额定频率 (Hz)	50/60
额定工作电流 (A)	200/400
额定短时耐受电流 (kA)	50kA 2s 40kA 2s
母线额定电流 (A)	630/1250 2500 3150
温升(环境温度50°C时无需降容)(°C)	55
接地开关最大冲击电流 (kV峰值) (电缆接线带限流熔断器)	14.0
防内燃弧耐受电流 (kA)	25kA 1s 40kA 0.5s 50kA 0.25s
高度	2500mm
深度	950mm
宽度	375mm

Rated voltage (kV)	7.2
Rated insulation level (kV)	
Lightening impulse withstand voltage 1.2/50ms (kV peak)	60
Power frequency withstand - 1min (kV rms)	20
Rated frequency (Hz)	50/60
Rated operational current (A)	200/400
Rated short time withstand current (kA)	50kA 2s 40kA 2s
Rated busbar currents (A)	630/1250 2500 3150
Temperature rise(No derating at 50°C ambient) (°C)	55
Earthing switch fault making current available (kV peak) (Cable protection with current limiting fuses)	14.0
Internal arc withstand current available (kA)	25kA 1s 40kA 0.5s 50kA 0.25s
Height	2500mm
Depth	950mm
Width	375mm



一种紧凑、安全、可靠、多用途的中压马达控制柜  
 A compact, safe, reliable and versatile MV motor starter



# 施耐德电气解决方案 Schneider Electric Solution

## 中压环网柜方案 - 中压环网应用和RM6

### Medium voltage ring main unit - MV loop application & RM6

针对冷冻集装箱船和海洋工程，优化的中压配电方案

Optimized medium voltage electrical distribution solution, for reefer containers and offshore

#### RM6 方案的优点

● 显著地减少了中压开关柜所占用的空间。这种方案采用了密封压力系统，十分紧凑，而且免维护。RM6的4功能单元 (2单元连接电网和2单元连接变压器回路) 的尺寸仅为 1619mm(宽) × 1140mm(高) × 692mm(深)

● 将RM6靠近负荷区 (冷冻集装箱等)，显著地减少了布线占用的空间

● RM6的模块化设计有助于将来的扩展，或者在环路上容易地增加RM6全功能单元，这使整个环网非常灵活

● 环网配电系统提供了冗余，使得供电系统更可靠

● 专用的防振动底座，工厂振动实验及过压释放系统，确保更高的设备可靠性

#### Advantages of RM6 Proposal

● Significantly reduce MV switchgear space, compact and maintenance-free because of sealed pressure system. Dimensions of RM6 - 4 functional unit (2 x Network connection and 2 x Transformer feeder) is only 1619mm(W) x 1140(H) x 692(D)

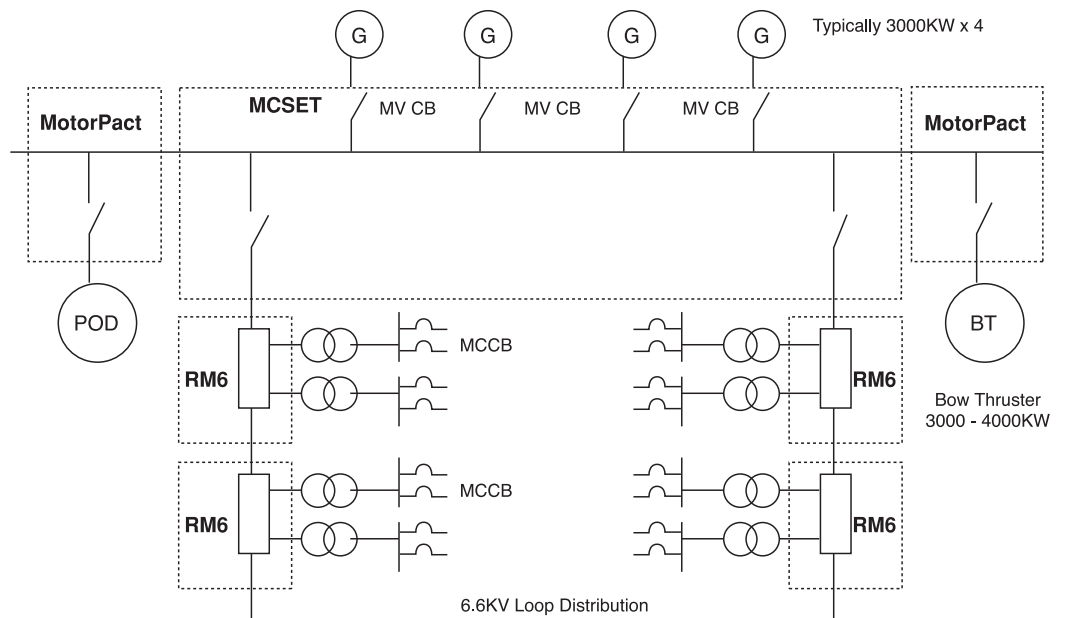
● Significantly reduce wiring space by placing RM6 close to loads (reefer containers, etc)

● Modular design of RM6 can allow future extension or easily add RM6 complete functional unit in loop line, which makes the loop very flexible

● Redundancy in loop distribution system to ensure a more reliable power supply system

● Special anti-vibrate basement, vibration test in factory and over pressure release system, to ensure more reliability of equipments





RM6是紧凑型中压开关系列产品，组合了所有中压功能单元。RM6是一种全SF6的开关设备，其所有的开关和母线均被永久密闭在充有SF6气体的壳体中。

RM6能够对24KV电网中的开放式环网或辐射式电网上一个或两个变压器进行连接、供电和保护。

RM6按照IEC标准的要求进行设计、制造及试验。



The RM6 is a compact unit combining all MV functions units to enable connections. The RM6 is a totally SF6 switchgear and the switchgear and busbars are enclosed in a gas-tight chamber, filled with SF6 and sealed for life.

RM6 can supply and protect one or two transformers on an open ring or radial network of power network up to 24KV.

The RM6 proposed in this offer has been designed, manufactured and tested in compliance with IEC recommendations.



## 主要特点

### 大范围应用

- 中压网络节点环网单元
- 终端
- 线路保护
- 用于二级环网连接MV/MV系统

### 确保人身安全

- 三位置开关，天然联锁，有效避免误操作
- 可视性接地功能
- 带电显示系统
- 内燃弧承受指标符合IEC60298规定
- 开关位置指示可靠
- 位于金属外壳底部的安全阀释放瞬时过电压
- 所有带电部件均被密封于金属外壳的SF6气体中
- 零表压仍可稳定运行，不会击穿

### 占地面积小

- 外形尺寸仅为宽×高×深  
1619 (4路) × 1140 × 710
- 特别是高度小方便用于户外开关站
- 扩展接口不占用额外的高度或宽度空间

### 免维护

- 密封压力符合IEC60298标准
- 密封性能为工厂的例行项目，能保证30年的使用寿命
- 开关的主要元件如触头，母线等均为免维护
- 高防护等级，有效阻止灰尘和水的进入
- 采用了获得专利的梅兰日兰螺旋式气密系统保证机械连接，确保气密性

### 高可靠性

- 技术性能符合IEC标准
- 具有ISO9001国际质量保证体系的设计证书和ISO9002产品制造证书
- 丰富的运行经验保证质量

### 扩展性强

- 提供多种模块和柜型用于扩展组合
- 扩展接口全封闭
- 扩展简单，仅需通过添加在主母线上加以定向绝缘衬套互相连接的独立模块实现，同时，无需处理任何气体，无需任何特别的工具，对地板无需任何特别的准备工作

### 安装操作简单，方便

- 柜前维护
- 在现场扩展容易
- 所有的控制元件安装在相同的并便于操作的高度
- 接地指示平行于眼睛高度，更换熔丝快捷
- 电缆安装简单方便，安装高度一致
- 二次电缆通过低压间隔集中走线
- 固定只需4个地脚螺栓，固定简便
- 可以在不断开连接设备的情况下，经RM6直接向电缆注入电压，测试电缆的绝缘和查找故障

## Main Features

### Full range of using

- MV network node and ring main unit
- Terminal
- Line protection
- use for secondary ring main to connect MV/MV system

### Ensure personal safety

- 3 position switchgear with natural interlocking to avoid misoperation
- Visible earthing
- Voltage indicating system available
- Internal arc withstand in conformity with IEC60298
- Dependable position indicating devices
- The safety valve at the bottom of the metal enclosure release the Instantaneous overvoltage
- All the electriferous components are enclosed in a gas-tight chamber filled with SF6 gas
- Steady running even if zero pressure, no discharge

### Space saving

- Small size WxHxD 1619 (4 units) x1140x710
- Especially low height which is easy to be used for outdoor substation
- The extensible interface occupy no additional height or width space

### Free maintenance

- Pressure system sealed for life in conformity with IEC60298
- Sealed performance is the routine test requirements in the factory, assure its 30 year's life
- The main components such as contacts and busbars are all free maintenance
- High degree of protection, effectively prevent dust and water
- spirality pressure system of patent MG technology insure the pressure seal

### High reliability

- IEC Certified
- ISO9001 certification for design and ISO9002 certification for production
- Benefits from experience accumulated from 500,000 functional units installed world-wide

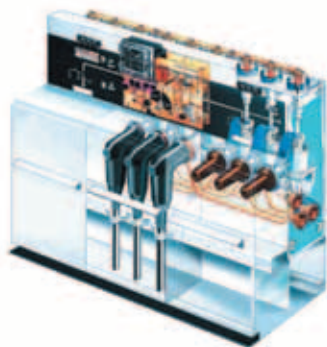
### Strong extended ability

- Supply multi-moduled and types of cubicles to be extended and combined
- Fully enclosed extended interface
- The addition of one or more functional units can be carried out by simply adding stand-alone modules that are connected to each other at busbar level by direct field bushings. At the same time, without handling any gas, without any special tooling and without any particular preparation of the floor

### Simple and convenient installation and operation

- Maintenance from the front
- Easy to be extended in site
- All controls located at the same convenient operator height
- Visible earthing at eye-level view position Quick fuse replacement
- Simplifies cable connector installation and consistent installation height
- Integrated low voltage wireway across LV room
- Fixed with only 4 foot bolts and easy installation
- In order to test cable insulation and look for faults, can inject a direct voltage through the cables via RM6, without disconnecting the connecting devices





### 断路器功能强大

- 采用旋转灭弧加气体自扩散技术，可靠切断短路电流
- 三工位断路器
- VIP系列继电保护装置完全符合IEC60255，具有全系列开关装置的保护曲线，便于和上级保护实现选择性配合，并且无需辅助电源

### Stong functional circuit breaker

- Use the technology of rotating and gas self-diffusing to cut off the short circuit currents
- 3 position CB
- VIP series protection relay, which is in complete conformity with IEC 60255, offers a complete range of protection curves in adapt to different discrimination needs with the main protection upstream and no need auxiliary power supply

## 技术参数 Technical parameters

Description 说明			
Rated voltage (IEC) 额定电压	kV rms	12	
Operating voltage 工作电压	kV rms	10	
Insulation level 绝缘水平			
Rated withstand voltage at power frequency 工频耐压 60 Hz/1 min kV rms		42	
Rated impulse withstand voltage 冲击耐压 1.2/50 $\mu$ s		95	
NETWORK AND BUSBARS 主回路及母线			
Rated current 额定电流	A	630	
Rated short time withstand current 额定短路耐受电流	kA	20	25
Making capacity for switch-disconnectors and earthing switches 负荷开关/隔离开关/接地开关关合电流	kA peak k	50	62.5
Internal arc withstand current available 内燃弧耐受能力			
Internal withstand current available 内燃弧耐受电流	kA	20/1s	
TRANSFORMER 变压器			
Rated current 额定电流	A	200	
FUSE-SWITCH 负荷开关-熔断器组合电器			
Breaking capacity 开断能力	kA	20	25
Making capacity 关合能力	kA peak	50	62.5
CIRCUIT BREAKER 断路器			
Short-circuit breaking capacity 短路电流开断能力	kA rms	20	25
Making capacity 关合能力	kA peak	50	62.5
SELF CONTAINED UNIT 其他参数			
Degree of protection 防护等级			
Enclosure 柜体	IP67		
Operating Mechanism 操作机构	IP3X		



# 施耐德电气解决方案 Schneider Electric Solution

## 中压变压器 Medium voltage transformer

满足船舶与海洋工程需求的变压器  
A transformer specific to marine & offshore applications

### 主要特点

#### 丰富的经验

三十年来，我们在全球海军、商船和近海工程应用方面，以及在潜艇、航母、油轮、集装箱船舶、作业平台等方面积累了丰富的经验，这些都有助于我们提供更好的产品。

#### 可靠的安装

从设计阶段开始，可靠性就是最重要的因素。为了确保让您的设备拥有最长的服务期，我们只用质量最好的绝缘材料，并保证设备的技术性能指标。

#### 限制设备中的热效应

我们所提供的设备发热更少，同时还配备了冷却系统，如自然风冷、强制风冷、直接水冷、间接水冷等等。

#### 满足机械方面的规范

我们的设计、仿真和测试工具帮助我们提供的产品，能承受机械方面的要求，包括震动、加速和船只倾侧等。

#### 高质量的设备

施耐德电气变压器得到了ISO 9002认证。我们的设备得到了许多船级社的认可，如：BV, DNV, LRS, ABS, RINA等等。

### Main Features

#### Recognised know-how

Throughout the world, our on-board equipment benefits from the 30 years of experience we have in Navy, Merchant Navy and off-shore platform applications, as well as that in submarines, aircraft carriers, liners, oil tankers, container ships, platforms, etc.

#### A reliable installation

Reliability is considered to be a predominant factor from the design phase. To ensure the maximum service life for your equipment, we only use high quality insulating materials and we guarantee the technical characteristics of the equipment.

#### Limiting the thermal effects on your equipment

We offer equipment with reduced heat dissipation and with suitable cooling systems: natural air, forced air, direct water, indirect water, etc.

#### Coping with the mechanical constraints

Our design, simulation and test tools to allow us to supply dedicated products, able to withstand the mechanical constraints: vibration, acceleration, listing, etc.

#### High quality equipment

Schneider Electric transformer is ISO 9002 certified. Our equipment is recognised by ship classification societies such as: BV, DNV, LRS, ABS, RINA, etc.



### 性能

- 树脂浇注干式变压器或浸渍式变压器
- 功率: 160VA to 6MVA
- 电压  $\leq 36\text{kV}$
- 频率  $\leq 6\text{kHz}$
- 自然风冷、强制风冷、水冷或油冷, 强制风冷和水冷
- 交流或直流  $\leq 20\text{kA}$
- 铜线绕组或铝线绕组

您可以从我们提供的产品中选择一款最适合您需要的产品

- 单相
  - 三相
  - 三相 / 单相
- 可将三相电网变至单相电网

### Performance

- Dry type cast resin or impregnated equipment
- power: 160VA to 6MVA
- voltage  $\leq 36\text{kV}$
- frequency  $\leq 6\text{kHz}$
- natural air, forced air, water or oil cooling, Airforced and Waterforced
- alternating or direct current  $\leq 20\text{kA}$
- copper or aluminium winding

Within our range, you will find the equipment which is best suited to your requirements

- single-phase
  - three-phase
  - three-phase/single-phase
- allows a 3-phase network to be converted into a 1-phase network.



## 低压配电盘 – MB301M

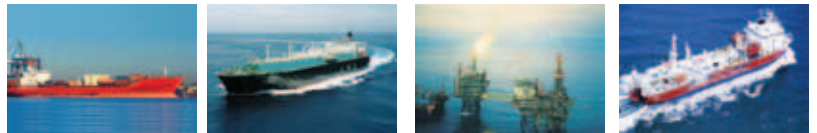
### Low voltage switchboards - MB301M

高可靠性低压开关柜，专用于海事领域 (船舶与近海工程)

High level safety low voltage system, dedicated to Marine (ship and offshore) applications

MB301M海事专用开关柜是施耐德电气最新为船舶和近海工程开发升级的低压开关柜。

MB301M主要针对钢制海船、FPSO和海洋石油平台等海事应用领域对低压设备的高安全性和其应用环境的特殊性。



### 主要特点

**可靠性：保证设备无故障运行，保护人员及设备的安全**

- MB301M满足IEC 439-1&3关于全型式试验开关柜的组装标准
- MB301M的设计考虑 DNV标准关于型式试验认证程序的要求，并且试验程序和试验是在DNV认可和监督下进行的

**可用性：设备功能充分满足应用需求，且保证设备的最长正常使用寿命**

- 符合各大船级社的标准：ABS, BV, CCS, DNV, GL, LR, RINA等船级社
- MB301M多功能系列低压配电柜：配电柜 (D型) 电动机控制中心 (固定式：Mf型) 电动机控制中心 (抽屉式：Mw型)
- MB301M是一个集成了施耐德电气开关元件的完整系统，所有施耐德电气保护设备都是按最优化的协调配合而设计制造的

**可维护性：保证设备能快速维护**

- MB301M由标准化预制元件组成，更具有灵活性，快速安装，便于修改或功能单元扩展等优点
- 当地制造，更具灵活性和适应性，世界级的开关柜生产商，提供质量保证专业化团队的良好服务

TTA  
type tested





## MB301M

The MB301M type switchboard is new version, which is dedicated to marine & offshore low voltage application

MB301M is used to make distribution switchboards on vessel or platform, which a high level of safety is needed.



### Main Features

**Reliability: Operation without breakdowns, protection of life and property**

- MB301M fulfills the IEC standard 439-1&3 requirements for type testing assemblies (TTA)
- MB301M is designed according to "Type Approval Programme" of DNV rules, and testing procedure and tested with supervision and recognition of DNV office

**Availability: Satisfied application requirement, and reach maximum uptime**

- MB301M is in compliance with main marine societies requirements: ABS, BV, CCS, DNV, GL, LR, RINA, etc
- MB301M, a multi-function range with three type of configuration Type D, Mf, Mw
- MB301M is a complete system integrating Schneider switchgear components. All Schneider protective devices are designed and manufactured for optimum coordination and can now be installed in a switchboard designed specially for them

**Maintainability: Fast servicing and maintaining**

- MB301M is composed of standard prefabricated components which guarantee flexibility and quick manufacture, modification or extension
- Flexibility and availability through local manufacturing, guaranteed by world class electrical switchboard, proximity of specialized teams



## 主要电气参数 Main electrical parameter

### 电气参数 Electrical Parameter

柜型 Type	D	Mf	Mw
额定绝缘电压 Rated insulation voltage	1000V AC	1000V AC	1000V AC
额定运行电压 Rated operating voltage	690V AC	690V AC	690V AC
额定短时耐受电流 Rated short-time withstand current	至100kA - 1s Up to 100kA - 1s	至100kA - 1s Up to 100kA - 1s	至100kA - 1s Up to 100kA - 1s
额定峰值耐受电流 Rated peak withstand current	至220kA Up to 220kA	至220kA Up to 220kA	至220kA Up to 220kA
主母线额定电流 Rated main busbars current	至6300A Up to 6300A	至6300A Up to 6300A	至6300A Up to 6300A
分支母线额定电流 Rated distribution busbars current	至3200A Up to 3200A	至3200A Up to 3200A	1000A 1000A
电气净距和爬距(毫米) Clearance and creepage distances (mm)	20和30 20 and 30	20和30 20 and 30	20和30 20 and 30

### 机械参数 Mechanical Parameter

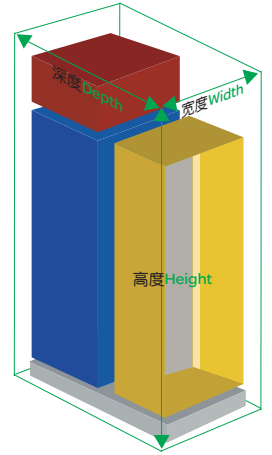
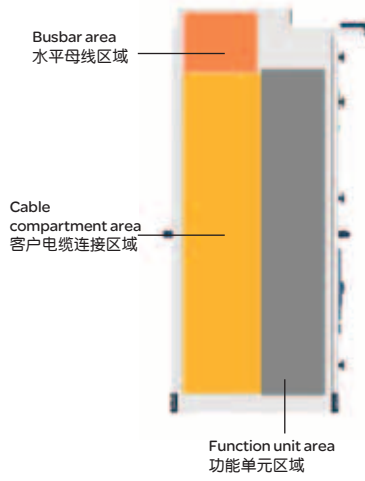
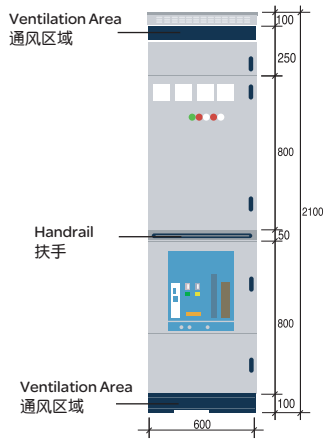
分隔型式 Forms	2b-3b-4	2b-3b-4	3b-4
防护等级 Degree of protection	IP 20-22-23,32(option)	IP 20-22-23,32(option)	IP 20-22-23,32(option)
外形尺寸 Dimension (mm)			
宽度 Width (毫米mm)	600 / 800 / 1200	600	500 / 700
深度 Depth (毫米mm)	800 / 1100	800 / 1100	800 / 1100
高度 Overall Height (毫米mm)	2100	2100	2100
有效高度(1个模数 = 50mm) Functional height (1module=50mm)	32个模数 32 modules	32个模数 32 modules	11个单元3模数/单元 11 units of 3 modules

#### MB301M多功能系列

- 配电柜 (D型)
- 电动机控制中心 (固定式: Mf型)
- 电动机控制中心 (抽屉式: Mw型)

#### MB301M a multi-function range

- Distribution switchboard (Type D)
- Motor control centre (Fixed: Type Mf)
- Motor control centre (Withdrawable: Type Mw)



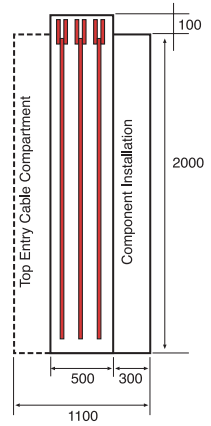
### 母线系统 Busbar system



D, Mf型柜体母线系统  
Busway in D, Mf Type



Mw型柜体垂直母线  
Busway in D, Mw Type



### 主要功能单元 Main function unit



固定分隔式安装方式  
Fix type installation



抽屉式安装方式  
Withdrawable type installation





## 低压配电盘-Okken Marine Low voltage switchboards-Okken Marine

完美、可靠、先进  
Perfect、Reliable、Premium



### 完美、可靠的低压配电盘

#### 全型式实验柜

- 对柜体每个细节做精心设计，并通过实验验证
- 受控制的柜内温升，经过真实方案的验证
- 抵抗电气故障和内部燃弧的完整装配结构
- 遵照国际标准 (IEC60439-1&3, EN50529, etc.) 通过 ASEFA/LOVAG 的验证

通过挪威船级社(DNV)严格的型式认可

### Perfect and reliable LV switchboard

#### Type Tested Assembly switchboard

- designed and tested system for every item of switchgear
- controlled temperature rise, tested in true configurations
- complete assembly withstands electric faults or internal arc
- complying with international standards (IEC60439-1&3, EN50529, etc.) certified by ASEFA/LOVAG

Type approval certificated by Det Norske Veritas (DNV)







## 优化的投资

### 高度的灵活性和融合性

- 回路设计有多种解决方案
- 配电和马达保护回路在同一柜体内的整体融合
- 不同方案的整体融合：固定式，插拔式，抽出式混装在同一面柜中
- 高度的安装密度使整个系统尺寸得以优化
- 可以便捷地添加或更换回路

### 减少成本和安装时间

- 多种电缆接入方式（顶部/底部，前部/后部）
- 宽阔的接线空间
- 快速，可靠的母线和柜体连接系统

## Optimized investment

### High level flexibility and mixability

- A wide range of solutions for each feeder
- Total mixability of power distribution and motor feeders within a column
- Total mixability of different types of feeders: fixed, plug-in, withdrawable within the same column
- Size can be optimized thanks to high packing density
- Additions or modifications are facilitated

### Reduced costs and installation time

- Multiple cable entry options (top/bottom, front/rear)
- Wide connection zones
- Quick connection between busways and switchboard





# 施耐德电气解决方案 Schneider Electric Solution

## 高安全性

### 防止内燃弧的保护

- 柜体符合IEC61641 & AS3439标准
- 柜体内燃弧限制 (100kA rms/300ms)
- 回路内燃弧限制 (80kA rms/300ms)

### 防止内燃弧危险

- 拥有专利的“Polyfast”技术限制在出线侧发生燃弧
- 双夹头的使用限制了母线发生的燃弧危险

### 对于操作人员完全安全的带电维护和系统升级

- 用于人员安全的分隔设计
- 使用门锁或挂锁进行操作控制

### 故障危险的防护

- 带电体用IP20的封板覆盖
- 对抽屉和可插拔式单元的防误操作保护（使用机械连锁，预脱扣装置等）

## 高实用性

### 通过Polyfast和双夹头的使用，使系统带电情况下的更换和升级成为可能

- 在设计位置安装出线回路
- 出线回路的更改
- 柜体方案的更改

### 快速通道用于对工作中的设备进行调节

### 红外测温技术使系统带电时进行温升控制成为可能

## High level safety

### Protection against internal arc

- Switchboard complying with IEC61641 & AS3439 standards
- Arc confinement within a column (100kA rms/300ms)
- Arc confinement within a feeder (80kA rms/300ms)

### Prevention of internal arc hazards

- Polyfast technology inhibits the appearance of any arc at the feeder level
- The double clamp used inhibits any arc hazard on the busbar

### Maintenance and upgrades performed on load are completely safe for the operational personnel

- Partitioning suited to personnel safety
- Access control using locks (doors) or padlocks (drawers)

### Error risk prevention

- Live parts are covered by IP20 screens
- Handling error prevention applies when drawing out drawers and disconnectable mounting plates (using interlocks, strikers, etc.)

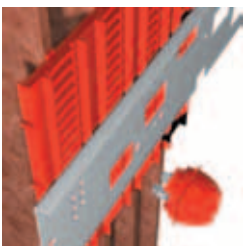
## High level availability

### Modifications and evolution for on-load switchboards through Polyfast and the double clamp used

- Installing feeders in the planned locations
- Modifying feeders
- Modifying the column configuration

### Fast access to products for adjusting the units in service

### Temperature rise control is possible with power on using infrared measurement techniques



## 降低维护和升级成本 Reduced maintenance and upgrade costs



### 减少维护成本

- 双夹头的使用使垂直母线不受磨损
- 80%的零件同时适用于配电和马达馈线回路

### Reduced maintenance costs

- No wear affecting the vertical busbar thanks to the use of a double clamp
- 80% of parts are shared between power distribution and motor feeders



## 主要电气参数 Electrical Characteristic

额定电流 Rated current	7300A
主母排 Main bus	4000A
垂直母排 Vertical bus	50/80/100/150kA
短时耐受电流 Rated short-time current withstand	110/176/220/330kA
峰值耐受电流 Rated peak current withstand	50/60Hz
额定频率 Rated frequency	690V AC
额定运行电压 Rated operational voltage	1000V
额定绝缘电压 Rated insulation voltage	12kV
额定冲击耐受电压 Rated impulse withstand voltage	IV
过电压等级 Overvoltage category	2b/3b/4a/4b
分隔型式 Form	IP31/42/54
防护等级 IP level	



## 什么是低压配电柜型式?

### What is a LV switchboard forms?

借助隔板或分隔装置对部件进行内部分离：型式  
Internal separation of assembly by barriers or partitions: Forms

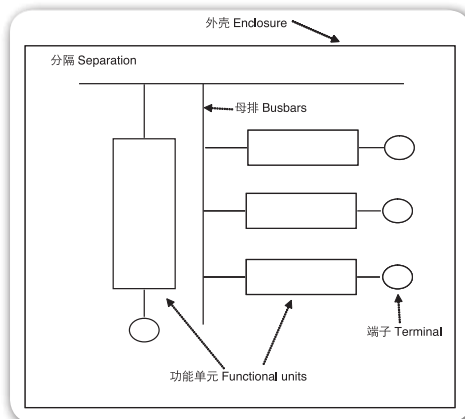
#### 目标

- 针对与邻近功能单元的带电部位发生接触提供保护
- 降低启动电弧故障的风险
- 防止固体异物从部件的一个单元进入相邻的单元
- 在制造商和用户之间达成协议

#### Objective

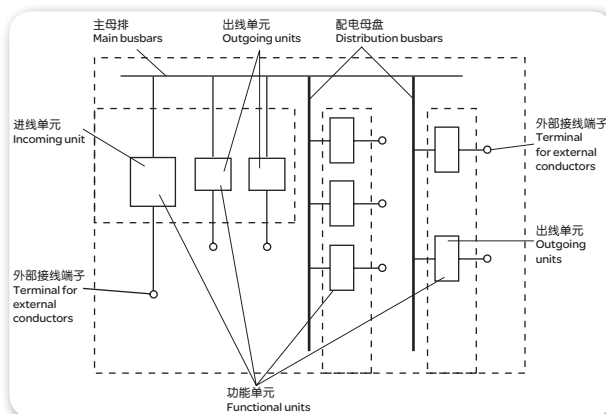
- Protection against contact with live parts belonging to the adjacent functional units
- Limitation of the probability of initiating arc fault
- Protection against the passage of solid foreign bodies from one unit of an assembly to an adjacent unit
- Agreement between manufacturer and user

#### 型式1：无分隔 Form 1: no separation

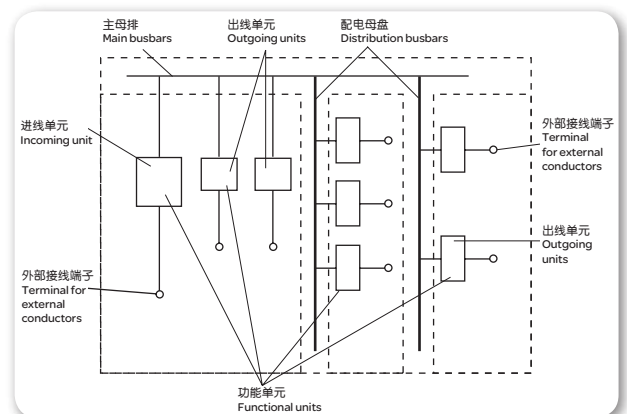


#### 型式 2 Form 2

- 将母排与功能单元分开
- 外部接线端子和母排分开
- Separation of busbars from the functional units
- Terminals for external conductors are separated from the busbars



型式 2A Form 2A

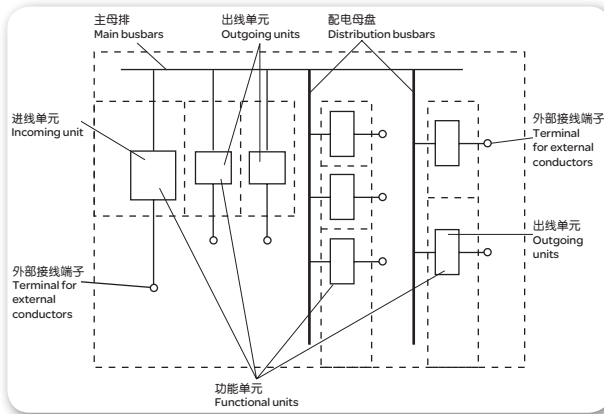


型式 2B Form 2B

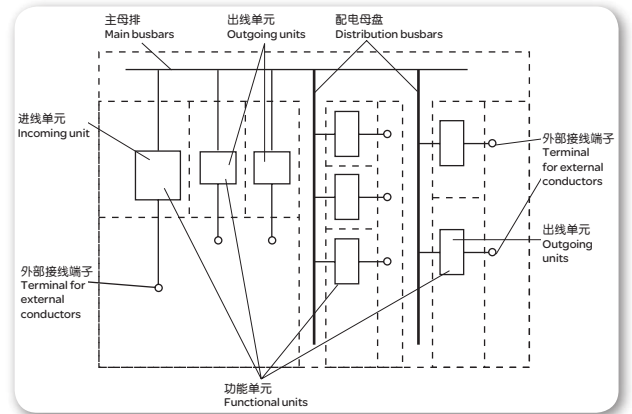
### 型式 3B

#### Form 3B

- 将母排与功能单元分开，并将所有功能单元彼此分开
- 将外部接线端子与功能单元分开，但不是各个端子都彼此分开
- Separation of busbars from the functional units and separation of all the functional units from one another
- Separation of the terminals for external conductors from the functional units, but not from each other



型式 3A Form 3A

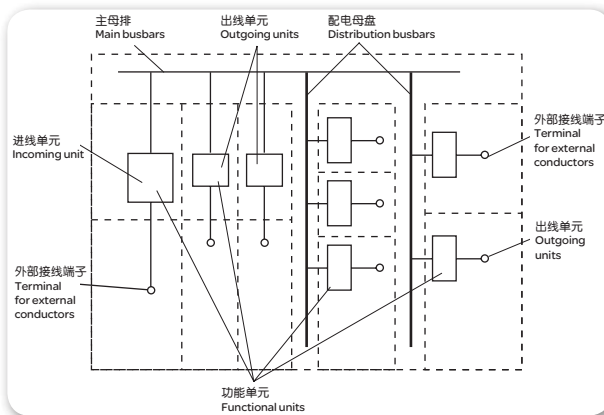


型式 3B Form 3B

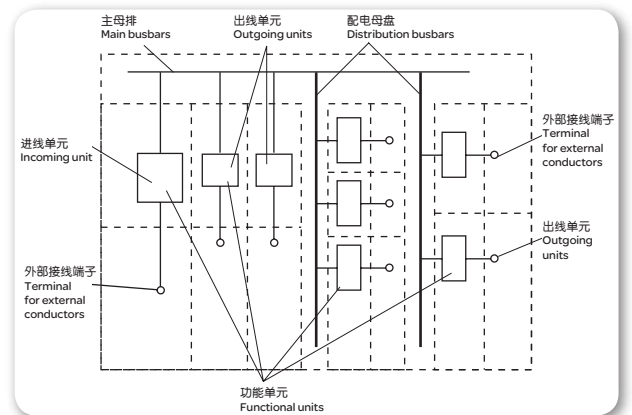
### 型式 4

#### Form 4

- 将母排与功能单元分开，并将所有功能单元彼此分开，包括外部接线端子，它们是功能单元的一个独立部分
- Separation of busbars from the functional units and separation of all functional units from one another, including the terminals for external conductors which are an integral part of the functional unit



型式 4A Form 4A



型式 4B Form 4B



## 智能绝缘检测Vigilohm系统

### 智能、先进的绝缘检测系统



绝缘监视设备  
Insulation monitoring device

### 连续供电

为了保护生命和财产安全，必须通过正确的电气装置，来确保连续供电。IT系统给连续供电提供了最好的保证。即使在出现第一次绝缘故障时设备仍然能够继续供电，并不会危及到人员生命。但是必须检测到第一次故障并在下一次故障发生之前将问题解决。

### 原理

在IT系统上提供了绝缘监视，用于一发生绝缘故障就进行检测和指示。通过一个绝缘监视设备（IMD）来执行基本功能，在某些文档中也称作永久或连续绝缘监视器（相应的简写为PIM或CIM）。监视设备在装置与地线之间注入一个直流或低频交流电压。通过产生的电流来确定绝缘电阻。此技术可以用于所有类型的装置：交流、直流、整流、交流/直流混合等。

### 功能

测量、指示和定位绝缘故障

带或不带通信总线的Vigilohm系统可以完成下列基本功能

- 测量所有类型装置的绝缘水平
- 手动或自动定位绝缘故障

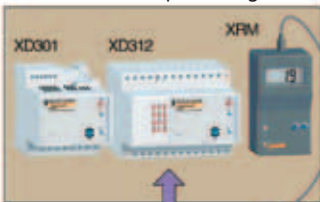
通信总线增加了以下功能

- 测量接地电路的绝缘电阻和接地泄漏电容
- 在IMD显示单元上集中了各种故障定位测量法
- 与监控器进行通信（发送测量结果和接收设置）

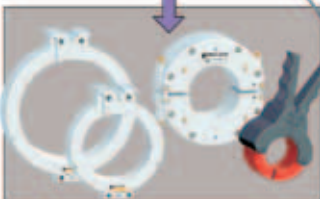
绝缘监视  
Insulation monitoring



故障检测与定位  
Fault detection and positioning



传感器  
Sensor



## Intelligent insulation detection Viglohmsystem

### Intelligent and advanced insulation detection system

#### Continuity of service

Proper electrical devices should be used to protect the safety of personnel and properties and ensure continuous power supply. IT system provides the best guarantee for continuity of power supply even in case of the first insulation fault, while not threatening safety of people. However, the fault must be detected and eliminated before the next fault occurs.

#### Principle

IT system provides insulation monitoring to detect and indicate any insulation fault. The basis function is performed by an insulation monitoring device (IMD), which is also known as permanent or continuous insulation monitor (PIM or CIM) in some documents. The monitoring device applies a DC or low-frequency AC voltage between the monitored units and the earthing wire and determines the insulation resistance with the current. This technique can be used in all types of units, including AC, DC, rectification, and AC/DC hybrid ones.

#### Function

Measure, indicate and locate insulation fault

The Viglohmsystem with or without communication bus provides the following basic function

- Measure insulation level of all types of units
- Locate insulation faults manually or automatically

The following functions are added to the communication bus

- Measure the insulation resistance and grounding leakage capacitance of the grounding circuit
- Integrate different fault locating and measurement methods in IMD display units
- Communicate with the monitor (determine setting for measurement data transmission and receiving)



## 主要特点

### 离线绝缘监视

电机启动失败可能会导致严重后果，尤其是某些重要应用。由于在电机不运行期间集聚在绝缘材料细微裂缝中的潮气引发的绝缘问题使得电机经常不能启动。SM21设备监视危险电机离线时的绝缘情况。绝缘故障引发报警或电机启动锁定。

### 故障定位

为了保证最大限度的连续供电，一旦检测到绝缘故障，就必须进行故障定位并消除故障。

#### ● 手动故障定位

使用Vigilohm System XRM接收机与电流探针来逐个测试装置中的不同点来定位故障。接收机捕捉低频故障定位信号。

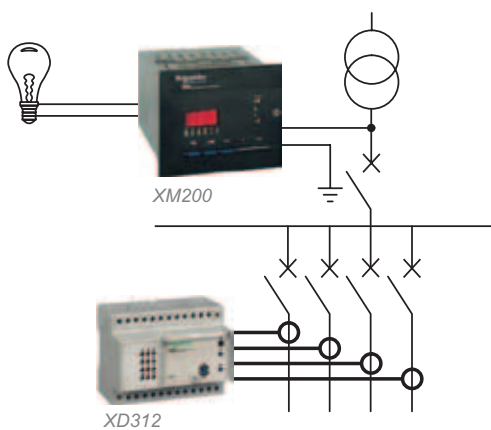
#### ● 自动故障定位

为了易于定位绝缘故障，Vigilohm能够使XM200绝缘监视设备与下列设备组合使用：

- XD301/XD312故障探测器，用于监视装置的不同电路
- XRM接收机，用于移动式故障定位

### 对于电气干扰的不敏感性

Vigilohm系统具有高精度测量的特点，并对于电气干扰具有不敏感性。Vigilohm系统设计用于在现代装置上运行，不会受到诸如变频器、UPS以及开关式电源等负载产生的谐波的影响。



自动故障定位 Automatic fault-locating





## Main features

### Offline insulation monitoring

Motor starting failure might lead to serious consequences, especially in some important applications. The insulation faults caused by moisture accumulated in the small cracks of insulation materials during the downtime of the motor often results in starting failure. SM21 device can monitor the motor insulation when offline. Insulation faults will trigger alarming or locking of motor starting function.

### Fault-locating

To ensure uninterrupted power supply, the fault must be located and eliminated as soon as possible after any insulation fault is detected.

#### ● Manual fault-locating

Vigilohm System XRM receiver and current probe are used to test the unit point by point in order to locate the fault. The receiver captures low-frequency fault-locating signals.

#### ● Automatic fault-locating

To facilitate the locating of insulation faults, Vigilohm allows the combination of XM200 insulation monitoring device and the following devices:

- XD301/ XD312 fault detector, used to monitor different circuits of the unit
- XRM receiver, used for mobile fault-locating

### Insensitivity to electrical disturbance

Vigilohm system provides high-precision measurement and is insensitive to electrical disturbance.

Vigilohm system is designed to operate on modern devices and is immune to harmonic effects in loads such as frequency converter, UPS and switching power supply.





## 应用超快速分断电力断路器的解决方案 Solution with fast acting circuit breaker-NW UR

如何在高电力负荷时应用低压系统  
How to remain at low voltage on a high power demanding ship

Masterpact UltraRapid是一种新型、独特的快速分断的电力断路器，它使用了Thomson效应的超快线圈。它使在高电力负荷需要的船舶上保留低压系统成为可能。

NW UR 断路器适合具有很高限流要求的特定应用场合

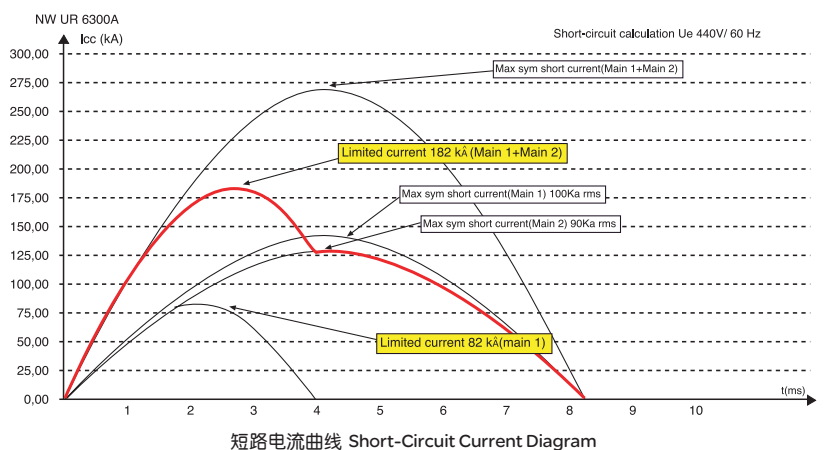
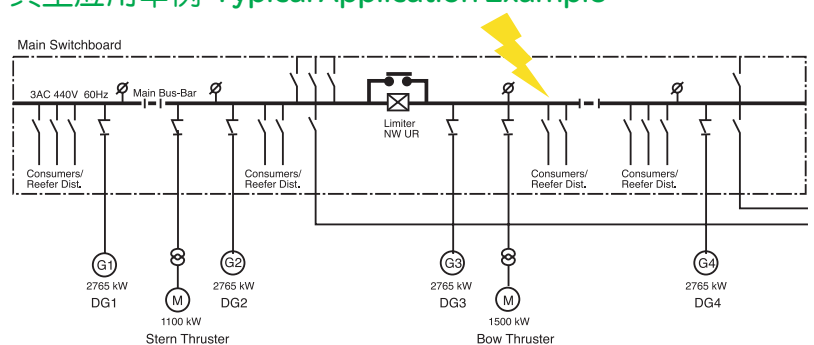
- 海事应用中的联络开关
- 母线系统中消除电弧故障
- 限制出线回路的反向短路功率

Masterpact UltraRapid is a new, unique and fast acting Power Circuit Breaker using Thomson Effect ultra fast coils. It gives the feasibility to retain at low voltage system on a high electric power demanding ship.

Masterpact UltraRapid is addressing specific applications requiring high level of limitation

- Coupling in Marine Application
- Elimination of arc fault in busbar system
- Limitation of reverse feeder short circuit power

### 典型应用举例 Typical Application Example



## 工作原理

过载和低短路电流由标准的Micrologic控制单元进行保护。UR检测基于函数 $d(i)/d(t)$ ，它提供了正常情况下的测量值。在短路情况下，实际值如果大于测量值，UR控制单元将马上(在300us内)向电容器发送一个断开指令，并释放触头。整个分断时间在5ms到8ms之间(取决于电压)。

### How does it work?

The standard Micrologic is working for overload and low short circuit. The UR detection is based on a function  $d(i)/d(t)$  which gives a gauge for "normal" conditions. In case of short circuit will be higher than the gauge, and the UR Control Unit will immediately (within 300us) send an opening order to the capacitors and release the contacts. The total opening time is between 5ms to 8ms (depending on the voltage).

Masterpact Ultra Rapid属于著名的Masterpact产品体系，它保持了这一体系的优点，为用户带来了以下益处

- 在短路保护方面，具有相同的保护和友好的用户界面
- 在配电柜中，相同的安装方式
- 相同系列的附件

Masterpact Ultra Rapid is keeping the assets of the well-known Masterpact range for the same customer benefits

- Same protection and end-user friendly interface for limited short circuits
- Same installation in switchboards
- Same range of accessories and auxiliaries

## 技术参数 Technical Parameters

Rated Current 额定电流	1600A, 3200A (Frame size 1 框架尺寸1) 5000A, 6000A (Frame size 2 框架尺寸2)
Rated Voltage 额定电压	240V AC up to 690V AC 240V AC, 最高690V AC
Poles 极数	3, 4
Ultimate breaking capacities (kA rms): Icu 极限分断能力 VAC 50/60Hz	150kA (up to 440V) (最高440V) 100kA (690V)
Rated service breaking capacity (KA rms) 使用分断能力	Ics=100%Icu
Electro-dynamic withstand 电动力耐受	35 kA (Frame 1 框架1) 70 kA (Frame 2 框架2)
Connection 连接	Drawout 抽出式
Mechanical Endurances 机械寿命	2500 cycles次
Electrical 电气寿命	Contacts = 1000 cycles (frame size 1) (触头) 1000次(框架尺寸1) 500 cycles (frame size 2) 500次(框架尺寸2)
Standards 标准	IEC 60947-1 and 60947-2 IEC 68230 (type 2) IACS recommendations for Lloyds Veritas certification 英国劳氏船级社认证



## 电力监控与谐波治理解决方案

### Power monitoring and harmonic suppression solution

专业、智能的电力监控与谐波治理方案  
Professional & intelligent power monitoring and harmonic suppression solution

PowerLogic电力监控系统充分运用现代电子技术、计算机技术、网络技术、控制技术及现场总线等先进技术，可以全面的对船舶变配电系统的一次设备进行遥测、遥信、遥控及电能质量监视、历史数据分析等操作。PowerLogic电力监控系统可以根据船上不同负载的重要性等级，配置不同功能的电力监控产品实现船舶上分散供电系统的数据采集、集中监控管理，提高船舶电力系统透明性、安全性、可靠性、经济性和智能化水平。

PowerLogic power monitoring system makes full use of modern electronic, computer, network, control and field bus technologies to provide functions such as telemeter, telecommand, telecontrol as well as power quality monitoring and history data analysis. PowerLogic power monitoring system allows combination of different functional power monitoring products according to importance levels of onboard loads and enables distributed power supply and distribution system data acquisition as well as centralized monitoring and management, thus improving transparency, safety, reliability, economy and intelligence of the ship power system.

## PowerLogic 船舶电力监控系统方案

### PowerLogic ship power monitoring solution

根据负荷重要性等级，合理配置监控设备，达到最优监控功能

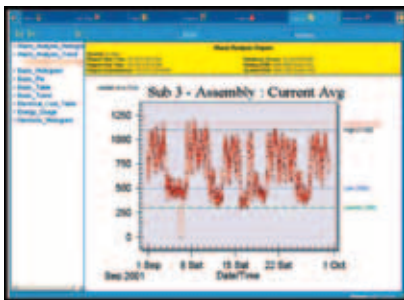
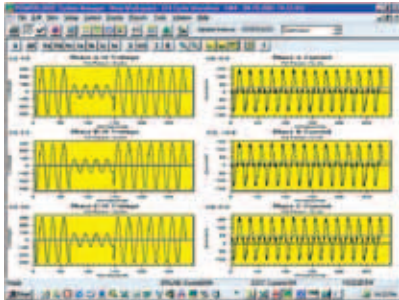
The monitoring devices are configured reasonably according to importance level of onboard loads to ensure optimal monitoring.

发电机主开关和低压进线 配置ION7650电能质量监测装置

- 对船舶电力系统主进线进行电气参数全面精确测量
- 对船舶供电的电能质量重要参数进行实时监测和深入分析
- 总体把握船舶供电系统运行工况

Main switch of generator and LV incomings are equipped with ION7650 power quality monitoring devices, which:

- fully and accurately measure the electrical parameters of important incoming of the ship power system
- provide real-time monitoring and in-depth analysis for important power quality parameters of ship power supply system
- control the general operation conditions of the whole ship power supply system



**关键负荷和重要负荷** 馈线配置PM810电力参数测量仪

- 对负荷的供电情况进行电气参数全面测量
- 对重要负荷，如各种泵类设备、电机、自动化设备等供电质量进行监测和分析
- 对重要负荷的开关工作状态远端采集和控制
- 为设备安全运行提供重要数据

**Critical and important loads** are equipped with PM810 power meter, which:

- comprehensively measure electrical parameters for load power supply and distribution system
- monitor and analyze power quality of important loads such as various pumps, motors and automation devices
- obtain data concerning operation status of important switches and control them remotely
- provide important data to ensure that equipments operate safely

**正常负荷** 馈线配置MC系列多回路监控单元

- 对负荷的基本电力参数进行实时测量
- 对负荷的开关进行远端状态采集或控制

**Normal loads** are equipped with MC series multiple-circuit monitoring units, which:

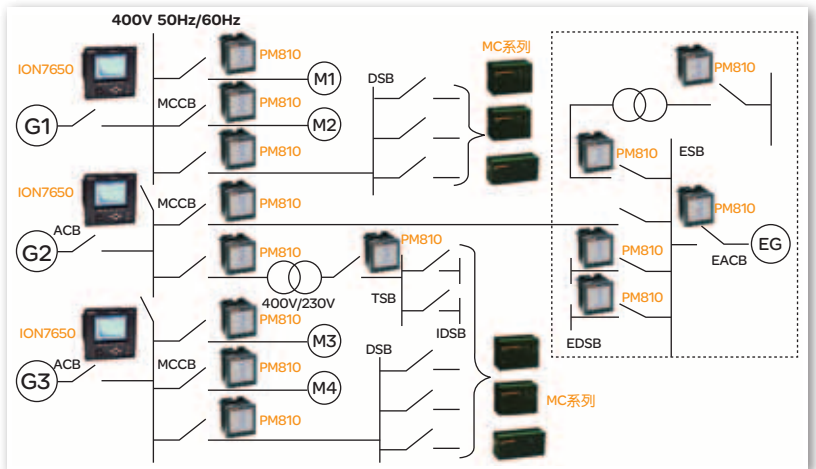
- provide real-time monitoring for basic electrical parameters of the loads
- obtain data concerning switch status of loads and control them remotely

**PowerLogic船舶电力监控 – 配置方案示意图**

**PowerLogic ship power monitoring system – configuration scheme**

配置方案示意图

Configuration scheme



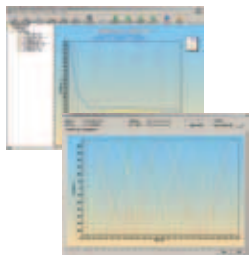


## PowerLogic 船舶电力监控系统方案

### PowerLogic ship power monitoring system solutions



ION7650 电能质量监测装置  
power quality monitoring unit



电能质量波形记录  
Power quality waveform recording

	监控设备 Monitoring unit	设备功能 Functions
发电机主开关监控应用方案 Generator main switch monitoring application solution	ION7650 电能质量监测装置 Power quality monitoring unit	<p>常规监测 General monitoring</p> <p>遥测、遥信、遥控 Telemeter, telecommand, telecontrol</p> <p>电能质量监视 Power quality monitoring</p> <ul style="list-style-type: none"> <li>● 谐波检测和分析(511次谐波) Harmonic monitoring and analysis (511st harmonic)</li> <li>● 电压波动及闪变监测 Voltage fluctuation &amp; transient sag/swell monitoring</li> <li>● 三相不平衡电压的监测 Voltage 3-phase unbalance monitoring</li> <li>● 频率波动监测及记录(0.005Hz) Frequency fluctuation monitoring (0.005Hz)</li> <li>● 暂态、瞬态波形捕捉 Temporary &amp; transient waveform catch</li> <li>● 电压上冲下陷监测 Over-voltage and under-voltage monitoring</li> </ul> <p>记录 Recording</p> <ul style="list-style-type: none"> <li>● 最大、最小值、平均值记录 Min/max/average recording</li> <li>● 事件记录 (1ms分辨率/优先级/顺序) Event recording (1ms differentiating rate/priority/sequence)</li> </ul> <p>逻辑编程控制与通讯 Programmable control and communication</p> <ul style="list-style-type: none"> <li>● 可编程逻辑和定值越限 Programmable control/over-condition alarms</li> <li>● 最大有5个并行通信口, 可配RS-232/RS-485/红外数据接口等 Up to 5 ports for parallel communication, with RS-232/RS-485/Infrared data port/etc.</li> <li>● 多通讯规约 Multi-protocol</li> </ul>



PM810  
电力参数测量仪  
PM810 power meter



MC系列  
多回路监控单元  
MC series multiple-circuit monitoring unit

	监控设备 Monitoring unit	设备功能 Functions
关键负荷重要负荷监控方案 Critical and important loads monitoring solutions	PM810 电力参数测量仪 (带RS485通讯) PM810 power meter (with RS485 communication)	<ul style="list-style-type: none"> <li>● 大屏幕背光式液晶显示 Large display backlit LCD</li> <li>● 测量电流、电压、功率、电度、功率因数等 Measure current, voltage, power, energy values and power factor, etc.</li> <li>● 频率、总谐波畸变、最大/最小瞬时值等 Frequency, harmonic distortion, max/min instantaneous values</li> <li>● 各种越限、低限报警 Different threshold alarms and lower limit alarms</li> <li>● I/O口: 最多13个数字量输入和5个脉冲输出 I/O ports: 13 digital inputs and 5 pulse outputs at maximum</li> </ul>
正常负荷监控方案 Normal loads monitoring solutions	MC系列 多回路监控单元 (带RS485通讯) MC series multiple-circuit monitoring unit (with RS485 communication)	<p><b>MC09:</b></p> <ul style="list-style-type: none"> <li>● 测量9个单相电流或3个三相电流、母排电压 Measure 9 single-phase currents or 3 three-phase currents and bus bar voltage</li> <li>● 越限、低限报警,可设定延时 Threshold alarms and lower limit alarms, and configurable delay</li> </ul> <p><b>MC18:</b></p> <ul style="list-style-type: none"> <li>● 18个数字量输入(采集18个开关状态量) 18 digital inputs (acquire 18 switching status parameters)</li> </ul> <p><b>MC08:</b></p> <ul style="list-style-type: none"> <li>● 8个数字量输入、8个继电器输出 8 digital inputs and 8 relay outputs</li> <li>● 可设定继电器工作模式: 普通继电器或脉冲继电器 Configurable relay operation mode: normal relay or pulse relay</li> </ul>

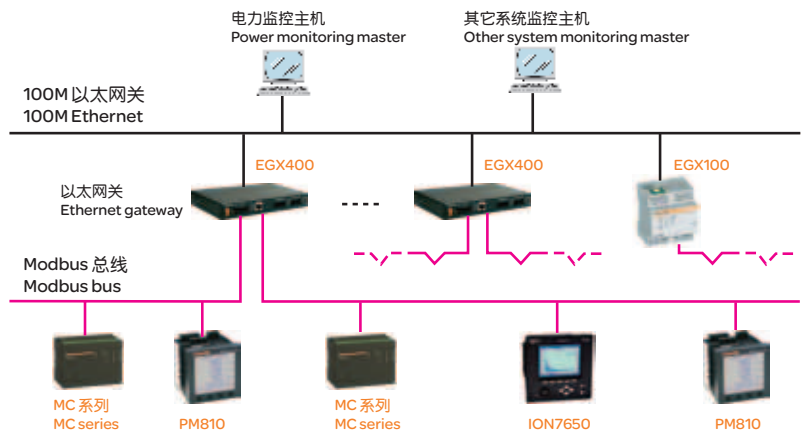
先进的电力监控技术!  
 智能的解决方案!  
 透明的电力监控系统!  
 Advanced power monitoring technology!  
 Intelligent solutions!  
 Transparent power monitoring system!

## PowerLogic船舶电力监控系统网络方案

### PowerLogic ship power monitoring system network solution

优化简便的组网方案配合强大的现场智能监控设备，PowerLogic电力监控系统可以全面满足船舶供配电系统智能化管理的高级要求，使电力系统透明化。

Thanks to optimal and convenient network configuration schemes and powerful field intelligent monitoring units, PowerLogic power monitoring system completely meets high requirements for intelligent management of ship power system, thus helping create a transparent power system.



## PowerLogic船舶电力监控带来的客户效益

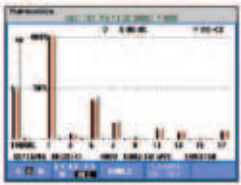
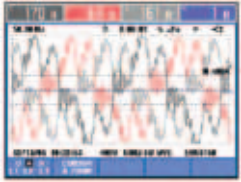
PowerLogic电力监控系统为用户提供了专业的、智能的电力系统运行管理工具，它正在全世界100多个国家的电气系统中发挥重要作用，为客户带来丰厚的回报!

- 提高电力系统运行可靠性
  - 全面、准确、实时监视配电系统运行状况
  - 实现预警报告，及时发现故障，使配电系统更加安全可靠
- 全面提高用电效率
  - 提高管理水平，真正实现对配电系统智能化管理
  - 提高运行效率，信息化管理使配电系统清晰、透明

### Benefits of the PowerLogic ship power monitoring system

PowerLogic Power Monitoring System offers the customer with professional, intelligent operation management tool, playing an important role in electric systems of over 100 countries and bringing great return to its customers!

- Enhanced reliability of power system
  - providing comprehensive, accurate and real-time monitoring for operation conditions of power distribution system
  - providing pre-alarm report, finding out the failure timely, so as to make power distribution system more reliable
- Full improvement of power utilization efficiency
  - improving management level and really providing intelligent management for power distribution system
  - raising operational efficiency and providing information management so as to make power distribution system clear and transparent



三相电流波形&谐波电流畸变率  
3-phase current waveform & harmonic current distortion ratio

## 谐波危害 Harm of harmonic

船舶电力系统中存在一些非线性负载，这些负载工作时产生大量谐波会造成自身电网污染，使系统的发供电设备出线出现许多异常现象和故障

- 电压、电流波形畸变
- 继电器保护误动，出现停电事故
- 电动机过热、附加损耗增大、效率降低
- 变压器实际使用容量减少
- 对通信电子设备、敏感设备造成干扰，控制系统故障

对船舶自身电力系统进行谐波治理，是保证供电系统安全、稳定运行的重要措施

Some nonlinear loads in the ship power system generate a large number of harmonic components during operation that might lead to harmonic pollution within the grid, which in turn will cause many abnormal conditions and failures of the system power supply and distribution devices such as:

- Waveform distortion (voltage and current)
- Error action of relay protection mechanism and consequent power outage
- Motor overheat resulting in more additional loss and lower efficiency
- Decreased capacity of the transformer during operation
- Disturbance to communication electronics and sensitive devices and failure of the control system

Taking proper measures to suppress harmonic in the ship power system is very important for safe and reliable operation of the power supply system.

## 谐波治理解决方案

### Harmonic suppression solution

#### 低压有源电力滤波器AccuSine，谐波治理的完美解决方案

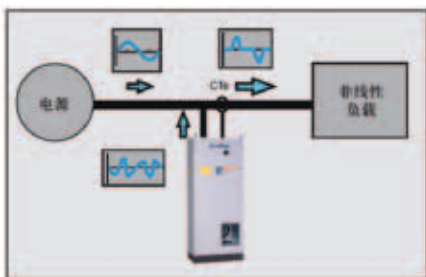
AccuSine通过外部互感器实时采集电流信号，通过内部监测电路分离出其中的谐波部分，并通过IGBT逆变出与系统中的谐波大小相等，相位相反的补偿电流，实现滤除谐波的功能。

- AccuSine的输出是根据系统的谐波量动态变化的，因此不会出现过补偿的问题
- AccuSine的内部过载保护功能，当系统的谐波量大于滤波器容量时，可以自动限制载100%额定容量输出，不会发生滤波器过载

#### LV active power filter AccuSine, a perfect solution for harmonic suppression

AccuSine acquires real-time signals through external transformer and filters out harmonic component with internal monitoring circuit, and then generates a compensation current that has the same amplitude as the harmonic current but opposite phase through IGBT inverter to eliminate the harmonic.

- Since the output of AccuSine varies dynamically according to harmonic of the system, there is no worry about overcompensation
- AccuSine provides internal overload protection, which limits the output to 100% of the rated capacity when the harmonic exceeds the capacity of the filter, thus avoiding any overload of the filter

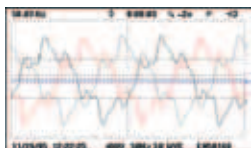


AccuSine工作原理图  
Operating principle of AccuSine

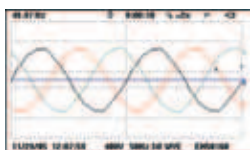


施耐德推荐船上电力系统选择AccuSine/3L有源滤波器。

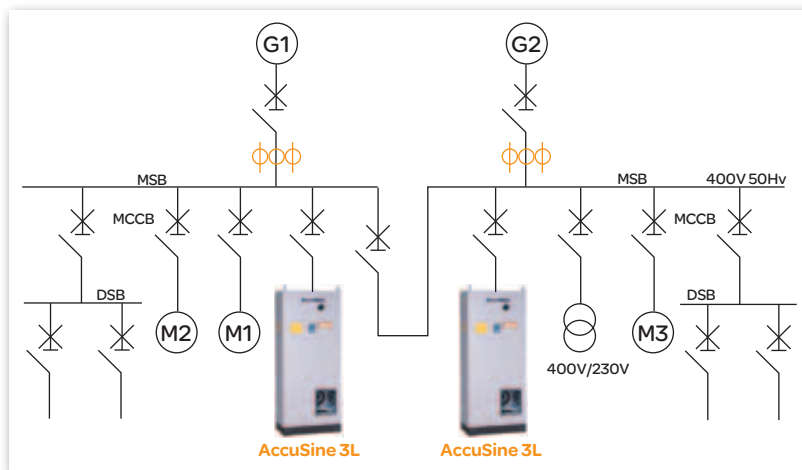
Schneider Electric recommends AccuSine/3L active filters for ship power system.



AccuSine投入前  
Before using AccuSine



AccuSine投入后  
After using AccuSine



AccuSine/3L

### AccuSine/3L-技术参数

#### AccuSine/3L- technical parameters

<b>输入 Input</b>	
工作电压 (V) Operating voltage (V)	208~480 +/-10%
工作频率 (Hz) Operating frequency (Hz)	50/60Hz +/-3Hz
<b>性能指标 Performance indices</b>	
滤波能力 Filter capacity	<5% THD(I) 额定容量 rated capacity
滤波范围 Filter range	2~60次谐波 2-60 individual harmonic
功率因数校正 Power factor correction	有, 可设定 Yes, configurable
响应时间 Response time	<100us
阶跃变化谐波全响应时间 Full-response time of step-change harmonic	<10 ms
过载保护 Overload protection	自动限流在100%额定输出 Automatic current-limiting at 100% rated output
IGBT频率 IGBT frequency	20K Hz
<b>产品配置 Product configuration</b>	
单机运行 Standalone operation	可以 Yes
并联运行 Parallel operation	最大可10台并联 Up to 10 devices can be connected in parallel
<b>环境条件 Environment conditions</b>	
环境温度 Operation temperature	0°C~40°C
存储温度 Storage temperature	-40°C~65°C
相对湿度 Relative humidity	最大95%, 无凝露 95% at maximum, without condensation
海拔高度 Elevation above sea level	1000米以下 Below 1000m



## 不间断供电系统 UPS

APC-MGE UPS系统：为您的高质量电源解决方案提供理想的工具。  
APC-MGE UPS SYSTEMS: your partner in Power Quality Solutions.

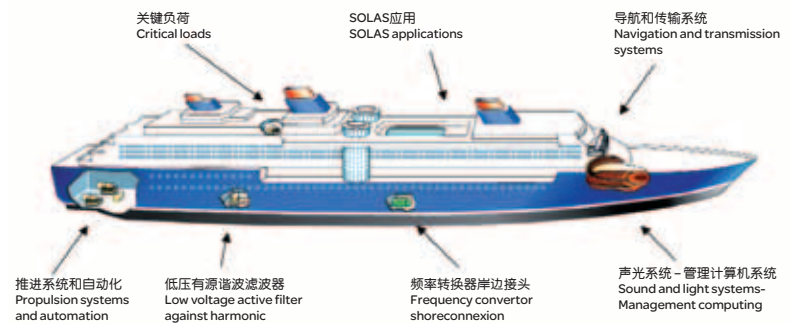
在海事领域拥有独一无二的专业知识。  
A unique expertise in the marine environment.



船舶的尺寸正在变得越来越大，效率和灵活性也越来越高。为了实现预期的功能，必须采用计算机化或者自动化解决方案，这些方案需要用到安全可靠的电源系统。

Ships are bigger and more efficient. They are more flexible. To achieve these performances, computerised or automatic solutions must be used, that require a secure power system.

在此类实际应用中，电源的可用性非常重要：  
Applications where the availability of electrical power is vital:



APC-MGE UPS系统，为所用船舶应用提供了一套完整的解决方案。  
APC-MGE UPS SYSTEMS, a complete range of solutions for all your applications on board.

APC-MGE UPS系统  
APC-MGE UPS SYSTEMS

- 为您提供全球和本地服务：通过专门的全球协调方案缩短和您的距离
- 在海事领域拥有独一无二的专业知识：为您提供合适的工业产品，满足海事应用需求
- 40年来积累的丰富经验：为您提供中肯的建议，帮助你实现目标
- 借助合适的解决方案确保船载设备的全面操作性和安全性
- 解决方案具有高度可用性和灵活性
- Your Global and Local partner: a worldwide dedicated coordination with a local intimacy and proximity
- Know-how in marine environment: industrial products adapted for marine applications
- 40 years wealth of experience: advise you on how to satisfy your requirement
- Solutions to insure overall equipment operation and so security on-board
- Solutions with high availability and flexibility

APC-MGE UPS系统为所有船舶应用提供了一套完整的解决方案  
APC-MGE UPS SYSTEMS, a complete range of solutions for all your applications on board

- $\geq$  IP22
- 经船级社核准
- 可以提供并行配置
- 可以为专用操作间提供铅酸蓄电池或NICAD电池
- $\geq$  IP22
- Classification society approval
- possibility to provide parallel configuration
- possibility to propose lead acid or NICAD battery sited in a dedicated room

功率：10kVA-800kVA  
输入：3P 440V 50/60Hz  
输入频率公差：+/-10%  
输出电压：3P+N 400V 50/60Hz

Power: 10kVA-800kVA  
Input: 3P 440V 50/60Hz  
Input frequency tolerance: +/-10%  
Output voltage: 3P+N 400V 50/60Hz





## 母线应用方案

### Busway application solution

母线槽系统，安全传输电能。  
模块式的紧凑结构，减少了重量。

Busbar trunking systems, safety transport of electrical energy.  
modular, compact, decrease in weight

## 母线槽系统的历史

### History of busbar trunking systems

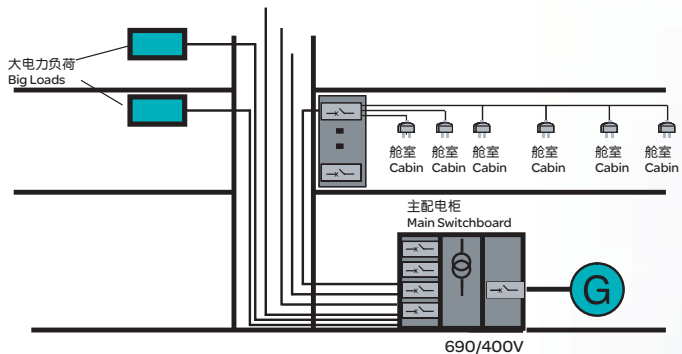
#### 诞生于美国

#### Invention of the U.S.A

- 在1920年首次使用，在1950年第一次在德国用于汽车工业
- 在1995年中第一次用于船舶
- 1st application in 1920 for automotive industry in Germany in 1950
- 1st application on board of vessels middle of 1995

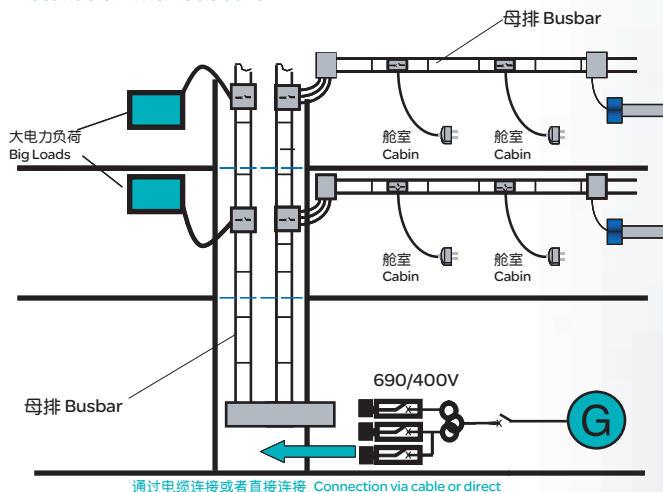
#### 传统的安装

#### Conventional installation



#### 使用母排的安装

#### Installation with busbars





可以在带电的情况下插拔终端头  
Tap-offs are pluggable under voltage



带有两个断路器的终端头  
Tap-off with two circuit breakers



内部和外部防火装置  
internal and external firestop





# 施耐德电气解决方案 Schneider Electric Solution



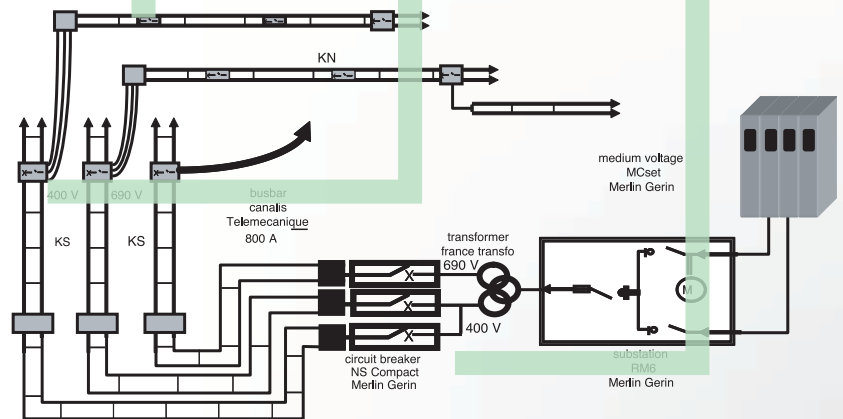
为船舱供电的地面水平母排  
horizontal busbars in a floor  
in order to feed the cabins



带有终端头的抬升网电源  
rising mains with tap-off



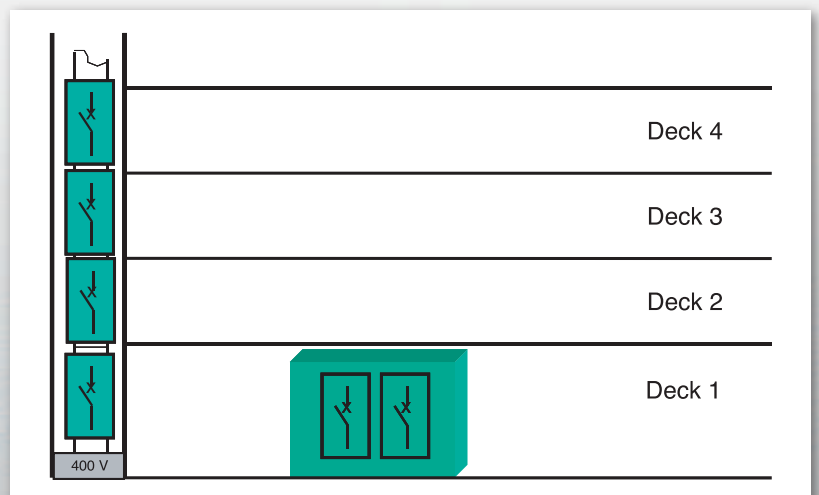
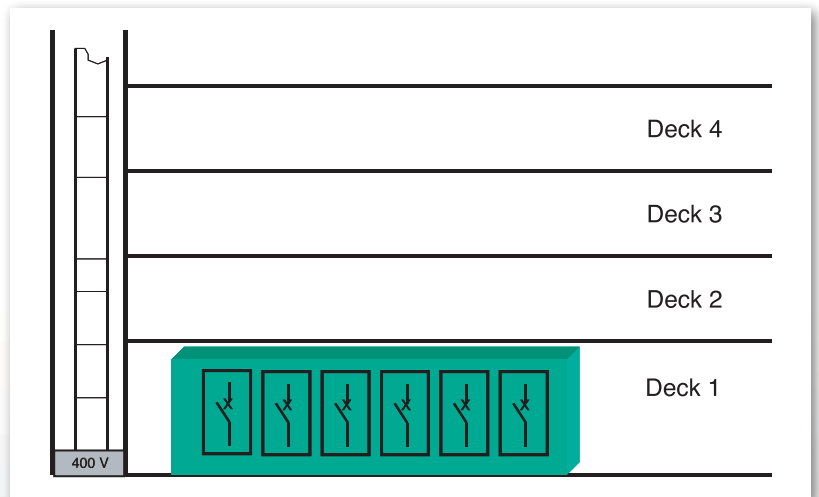
把电站直接连到母排  
direct connection from  
substation to busbar



通过合适的方法将断路器连接到母排  
connection from circuit breaker to busbar by means

只重复使用4个部件来安装一个母排馈电点、母排、固定夹和终端头。  
repetition of only 4 components to install one busbar feeding point, busbar,  
fixing clips and tap-offs.

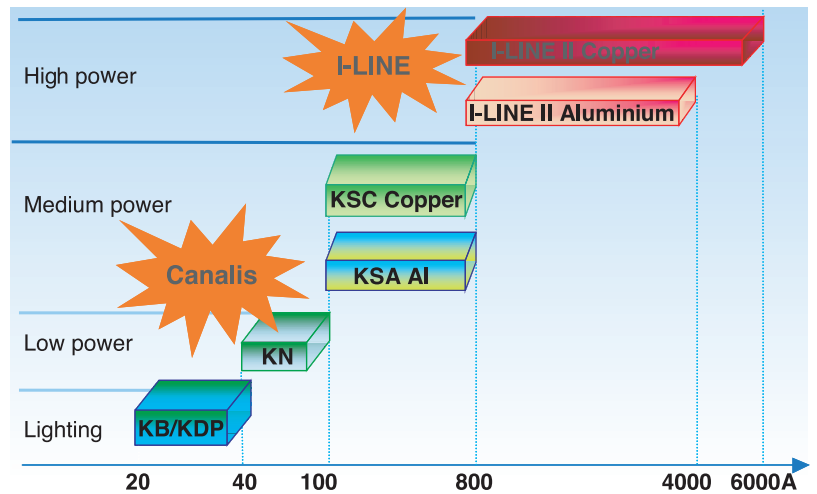
从集中分布到分散分布，可使得主配电柜 (MSB) 减少数量。  
From central to distributed architecture, enable to decrease the number of main switchboard.





# 施耐德电气解决方案 Schneider Electric Solution

## 施耐德电气母线产品范围及参数 Schneider Electric busbar range and parameters



- 额定工作电流：20-6000A
- 额定工作电压：690VAC，额定绝缘电压：1000VAC
- 防护等级：IP40~IP66可选
- 导体材料：铜或铝
- 热稳定性：50~100KA

- Rated working current: 20-6000A
- Rated working voltage: 690VAC, rated insulation voltage: 1000VAC
- Protection degree: IP40~IP66 (optional)
- Conductor material: copper or aluminium
- Thermal stability: 50~100KA





## 主要特点

### Main Features

#### 可靠性 Reliability

- 能与施耐德电气其他配电设备实现无缝连接，如变压器、配电柜
- 除在国内测试以外，还通过了国际上的ASTA及ASEFA测试
- 优质的杜邦聚酯绝缘材料，B级130°C；耐压等级高
- 高纯度导体，铜：99.95%以上，铝98%以上；精良的导体表面处理，铜导体表面全长镀银，铝导体表面全长镀锡
- 独特的接头设计，使接触电阻最小化，温升最低化
- 外壳聚酯粉末静电喷涂，盐雾试验达1000小时
- 产品100%经过7500V直流高压的出厂测试
- Seamless connection with other Schneider power distribution devices, such as transformer and cabinet
- Have passed national tests as well as international ones such as ASTA and ASEFA
- Quality DuPont polyester insulation material, Class B, 130°C, high dielectric strength
- High-purity conductor, copper purity: over 99.95%, aluminum purity: over 98%. Refined conductor surface processing, silver plated across the whole length of copper conductor surface, and tinned across the whole length of aluminum conductor surface
- Unique connector designed to minimize the contact resistance and temperature rise
- Enclosure painted with polyester powder by means of electrostatic spray, salt mist testing for 1000 hours
- All products are tested under a DC voltage of 7500V before delivery



#### 简便性 Simplicity

- 布线：专业的设计软件简便、快速；点对点式项目管理团队全程跟踪项目
- 生产：模块化结构、标准的生产流程、预订单管理流程
- 安装：高兼容性的插接口、可控力矩的连接头
- 维护：免维护产品，生命周期长
- Wiring: professional design software for easy and fast operation, dedicated project management team keeping track of the project all the way
- Production: Modular structure, standard production procedure, order form management procedure
- Installation: Highly compatible sockets, connectors with adjustable torque
- Maintenance: Maintenance-free, long service life

#### 灵活性 Flexibility

- 部件丰富，长度，防护等级可灵活配置，满足不同建筑的尺寸，环境上的要求
- 分接单元可以直接插拔，随时扩展，无需断电
- 标准的部件能够满足您现场位置的变化
- 负载可灵活增减
- A wide range of parts with flexible configurations (length and protection degree) are provided to match the sizes of different buildings and meet different environment requirements
- Tapping units can be plugged directly and extended at any time without the need to de-energize
- Standard components are provided to facilitate change of position on the site
- The loads can be added or deleted flexibly



## 配电产品组件 Electrical distribution components

TE电器和梅兰日兰所有标准产品的开发，都遵照了欧洲和国际标准以及世界上主要船级社的规范，如ABS, BV, CCS, DNV, GL, KRS, LRS, RINA, RS等。

All Telemecanique and Merlin Gerin standard products are developed in compliance with European and international standards, and regulations of the main worldwide classification companies such as ABS, BV, CCS, DNV, GL, KRS, LRS, RINA, and RS.

### Masterpact 空气断路器

#### 杰出的性能和革新

- 满足各种使用环境的要求
- 专利的灭弧技术确保了无与伦比的安全性
- 更加智能化的Micrologic控制单元
- 易集成于通信系统实现监控管理
- 安装灵活，无需维护，使用寿命长
- 模块化设计和复合材料的环保产品
- .....

#### 空气断路器产品系列

- 从630A到1600A的Masterpact NT，是世界上最小的空气断路器
- Masterpact NW从800A到6300A，到4000A规格的产品都具有相同的尺寸，这一系列范围的产品都具有通用的附件，从而简化了维护工作

#### Air circuit breakers product range

- Masterpact NT from 630 to 1600A, the smallest Air circuit breaker in the world
- Masterpact NW from 800 to 6300A, same dimensions up to 4000A, auxiliaries common to the whole range, simplified maintenance

### Masterpact air circuit breaker

#### Outstanding performance and innovation

- Meet requirements for different operation environments
- Patented arc-quenching technique ensures unparalleled safety
- More intelligent Micrologic control units
- Easy integration into communication systems for monitoring and management
- Flexible installation, maintenance-free, long service life
- Environmental products with modular design and complex materials
- .....



## Compact NSX塑壳断路器

### 智慧开启 无限未来

经典的Compact NS塑壳断路器自1994年推出市场以来，立即以其自身的优良特性和对低压配电系统所提供的完美保护获得了使用者对它的信赖。

#### NSX 100-630断路器 塑壳断路器中的经典产品

- 专利技术的双旋转触头分断系统 (100A-630A)
  - 极高的分断能力， $I_{cs}=100I_{cu}$ 最高可达150kA
  - 超强的限流能力，把短路危害限制在最小
  - 优秀的级联技术为客户提供产品配置最优的方案
  - 压力跳闸系统最快可在2毫秒内切断故障电流
  - 独一无二的低压配电系统全选择性方案
  - 完善的产品系列，满足客户的各种需求
  - 规格齐全模块化产品，提供便捷的灵活性和可靠性
- .....

#### NS630b-1600断路器

- 源于空气断路器的设计理念
- 采用全新Micrologic控制单元，提供更精确的保护
- 体积小，安装方便
- 种类齐全的附件满足更多用途需要
- 提供固定式和抽屉式



NSX100-250



NSX400-630



NS630b-1600

## Compact NSX moulded case circuit breaker

### Intelligence for your future

Since its introduction in 1994, classic Compact NS molded case circuit breaker quickly gained wide recognition among the users due to excellent features and perfect protection for LV power distribution systems.

#### NSX 100-630 circuit breaker Classic products among molded case circuit breakers

- Patented dual rotating contact breaking system (100A-630A)
  - Very high breaking capacity,  $I_{cs}=100I_{cu}$ , up to 150kA
  - Extremely powerful current-limiting capability to minimize the impact of short circuit
  - Provide the customers with optimized product offers with excellent cascading technique
  - Pressure tripping system can cut off the faulty current in just two milliseconds
  - Unique and full-range solutions can be selected for LV power distribution system
  - Complete product series are provided to meet different customer needs
  - Complete range of modular products with simplicity, flexibility and reliability
- .....

#### NS630b-1600 circuit breaker

- Design concept originating from airbreak circuit breaker
- New Micrologic control units providing more accurate protection
- Compact and easy to install
- Complete range of accessories to meet diversified requirements
- Fixed and withdrawable installation



# 施耐德电气解决方案 Schneider Electric Solution

## Micrologic 控制单元

### 可靠的保护，完备的功能

- 十种控制单元，满足各种应用
- 全系列带液晶显示屏，测量读数直观
- 在线整定，整定值在液晶屏上同步显示，确保整定准确
- 标准Modbus通信总线，轻松实现系统监控

### 四种测量功能

- A: 电流
- P: 电流 + 电压 + 功率 + 功率因数 + 电能 + 频率
- H: P型 + 电能质量管理(谐波)
- E: 电流 + 电压 + 功率

### 完备的保护功能

- 四类基本保护: LI, LSI, LSIG, LSIV
- Mic P, H型附加更多保护及报警功能

## 电源自动转换开关ATS

施耐德电气公司面向全球推出了新一代PC级电源自动转换产品WTS，全系列产品秉承了施耐德电气公司一贯的设计思想：模块化设计。产品布局紧凑，是由执行断路器、电动转换模块、电源隔离模块和控制器四大部分构成。

### 两种控制器，充分满足用户需求

- A型：内置式控制器
  - 失压、断相和消防控制
- B型：智能型控制器
  - 失压、欠压、过压、断相、通讯和消防控制

## Micrologic control units

### Reliable protection and complete function

- Ten types of control units for different applications
- Complete range of LCDs for intuitive measurement and reading
- Online tuning. The tuned values are displayed on LCDs simultaneously to ensure accuracy of tuning
- Standard Modbus communication bus for easy system monitoring

### Four measurement functions

- A: Current
- P: Current + Voltage + Power + Power factor + Power consumption + Frequency
- H: P types + Power quality management (harmonic)
- E: Current + Voltage + Power

### Complete protection

- Four basic protections: LI, LSI, LSIG, LSIV
- More protection and alarming functions for Mic P and H types

## Power supply automatic transfer equipment ATS

Schneider Electric presents the new generation of PC class power supply automatic switching products WTS that inherits the consistent design concept of Schneider Electric: modular design. These compact products consist of four main parts: actuator/circuit breaker, electric switching module, power supply insulation module and controller.

### Two types of controllers to fully meet customer needs

- Type A: embedded controller
  - Voltage drop, phase failure and fire fighting control
- Type B: Intelligent controller
  - Voltage drop, under-voltage, over-voltage, phase failure, communication and fire fighting control





## 微型断路器

电流规格为1到125A，分断能力从6到50kA，全系列附件通用。



### 主要特点

- 高分断但小体积
- 可以直接轨道安装



### 主要性能参数

- 额定电流：10A, 16A, 20A, 25A, 32A, 40A, 50A, 63A, 80A
- 分断能力：36kA (H), 50kA (L)
- 极数：1, 2, 3, 4极

## Miniature circuit breakers

The rated current is from 1 to 125A, and the breaking capacity is from 6 to 50 kA, with auxiliaries common to the whole range.

### Main features

- High breaking capacity yet small in size
- Can be mounted directly on the rails

### Main functional parameters

- Ampere Ratings: 10A, 16A, 20A, 25A, 32A, 40A, 50A, 63A, 80A
- Breaking Capacity: 36kA (H), 50kA (L)
- No. of Poles: 1, 2, 3, 4 Poles



## 电机启动器

- 6到2750A的接触器
- 热保护与电子保护继电器
- 电机保护断路器

## Motor starter

- Contactors from 6 to 2750A
- Thermal and electronic protection relay
- Circuit breaker for motor protection



## 绝缘控制器

Vigilohm系列，用于最高1000Vac和1200Vdc的电网，自动定位故障回路。

## Insulation controllers

Vigilohm series for electric network up to 1000Vac and 1200Vdc, with automatic fault circuit locating function.

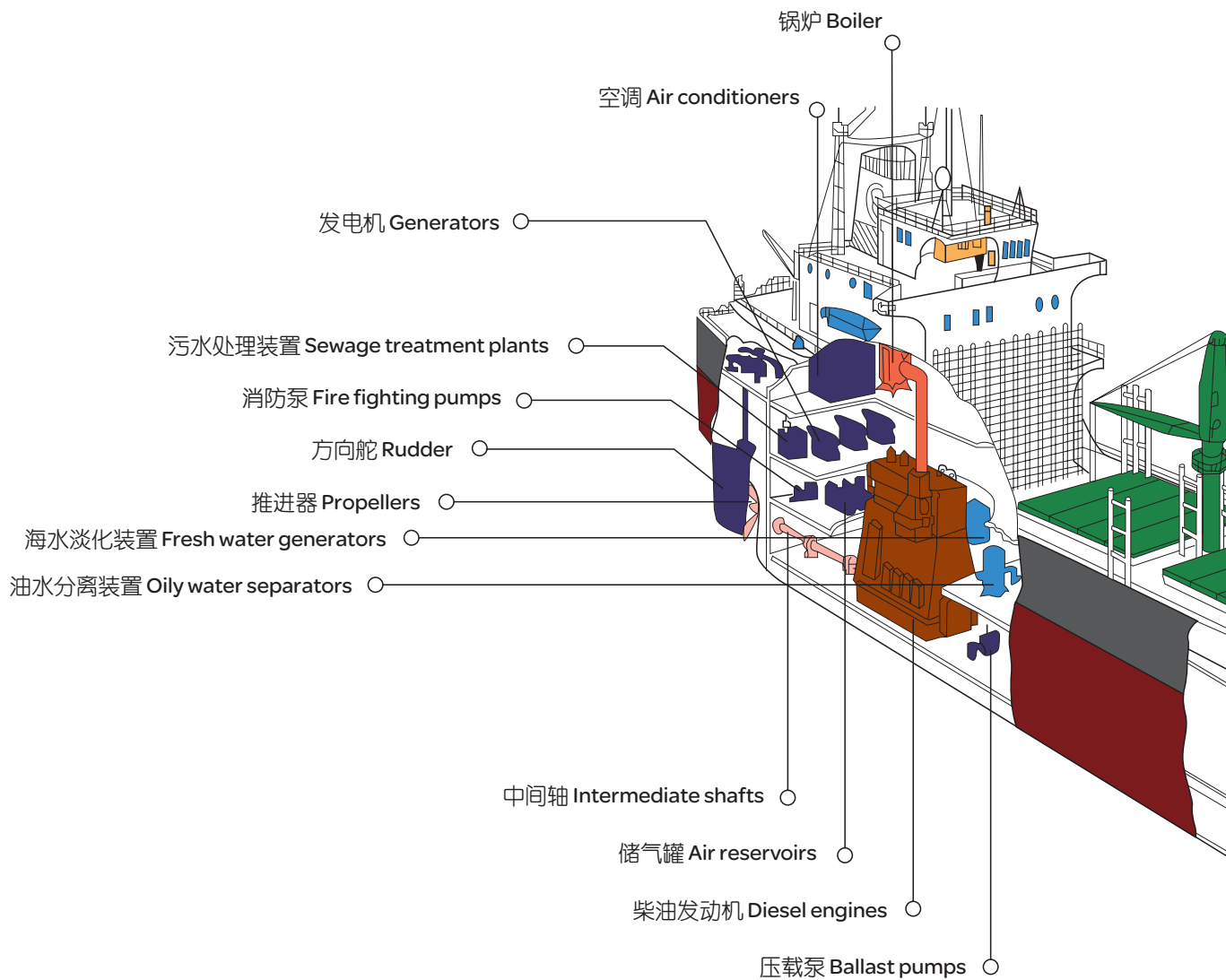


# 施耐德电气解决方案 Schneider Electric Solution

## 船舶机械设备和生活设施介绍

施耐德电气为船舶机械设备和生活设施等用电设备的制造提供高质量元器件。

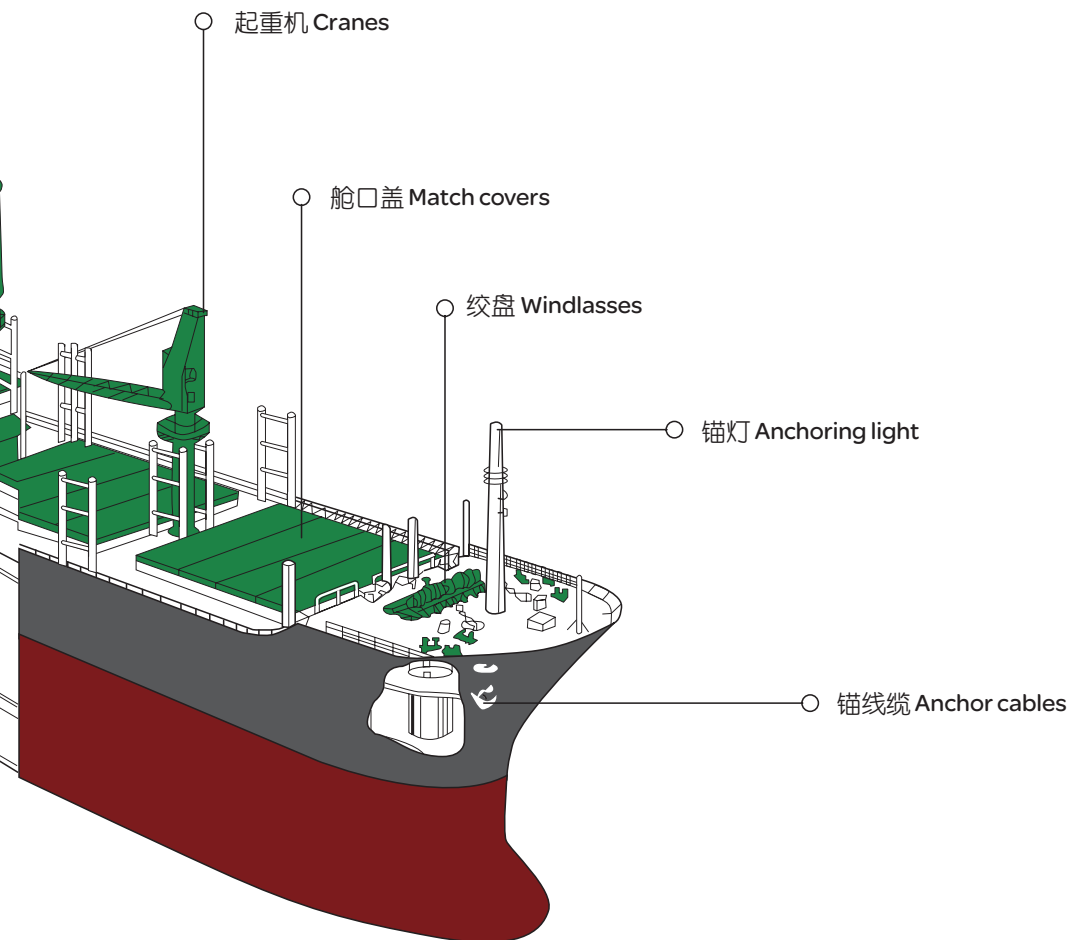
1. 动力装置用辅机
2. 甲板机械
3. 舱室辅机
4. 机修机械
5. 冷藏通风
6. 厨房设备
7. 自动化设备
8. 其他



## Ship machines and living facilities introduction

Schneider Electric provides parts and components for the production of ship machines and living facilities

1. Auxiliary machines for power units
2. Deck machines
3. Cabin auxiliary machines
4. Maintenance machines
5. Refrigeration and ventilation machines
6. Kitchen units
7. Automation equipment
8. Others





## OEM 全面解决方案

施耐德电气针对船舶与海洋工程OEM客户提供了全面解决方案：

致力于与客户实现长期、稳定、基于双赢的战略合作伙伴关系。与客户共同建立良好的品牌及企业形象。针对于单机设备和整体系统提供了配电、自动控制、仪表检测、数据采集等全面的解决方案。除此之外，施耐德电气还为客户提供强有力的技术支持和细致周到的服务。

### 全范围的电气与控制产品

包括全系列的PLC控制器，变频器，运动控制产品，低压控制产品，人机界面和人机对话产品，各种传感器和小型自动化元件，以及现场总线和工业机柜系统等全范围的工业控制和自动化产品。

### 高效快速、覆盖全球的售后服务

施耐德电气公司训练有素的售后队伍为OEM客户提供相应快速的维修换货服务和高效正确的现场故障处理。

同时，通过国际售后服务体系，销售到世界各地的施耐德电气产品都能得到当地施耐德电气专业服务。

### 细致周到的技术支持

施耐德电气公司遍布全国的销售工程师，技术支持工程师和应用工程师为您提供强有力的技术支持和细致周到的服务，包括应用指南、产品选型、技术培训及编程调试等等。

### 优质、安全、高性能产品

施耐德电气的产品都经过严格的检验，以确保客户满意。所有产品都满足国际质量和安全标准的要求，通过各大主要船级社的型式认证。

### 快捷准时的物流供货

施耐德电气公司投巨资在上海、北京、广州、成都建立了物流中心，拥有业内最完善的物流体系，通过门对门的运输服务，确保客户快捷、准时地收到产品。

### 先进完善的解决方案

简、易、精、智，更灵巧，更智能，使用更方便的设计理念方便了您的产品选型、设计、调试和维护，来自同一品牌的产品实现系统间的完美集成，加速新产品的研发，缩短新产品面市周期。



## Full range of solutions for OEMs

### Schneider Electric provides a full range of solutions for marine & offshore OEMs:

Schneider Electric focuses on establishing long, stable and mutual beneficial strategic partnership with the customers, and building brand and enterprise image together with the customers by providing comprehensive power distribution, automatic control, instrument inspection, and data acquisition solutions for standalone equipment and integrated systems. Schneider Electric also provides strong technical support and complete service for the customers.

#### Full range of electrical and control products

These industrial control and automation products include whole range of PLC controllers, frequency converters, motion controls, HMIs and human-machine dialogue products, different sensors and simple automation components as well as field bus and industrial cabinet system.

#### Fast and efficient after-sales service throughout the world

Properly trained after-sale service team of Schneider Electric provides rapid maintenance and replacement services for OEM customers and handles onsite problems efficiently and accurately. In the meanwhile, the international after-sale service system ensures that proper services are provided by electricians of Schneider Electric for our products sold to everywhere in the world.

#### Professional technical support

The sales engineers, technical support engineers and application engineers of Schneider Electric across the country provide strong technical support as well as thoughtful and sincere services for you, including application instruction, product selection, technical training, programming and debugging.

#### Products of high quality, safety and performance

All Schneider Electric products have been tested according to strict standards to ensure complete customer satisfaction. All products meet international quality and safety standards and have passed the type approval certification of all main ship classification societies.

#### Rapid and timely logistics and delivery

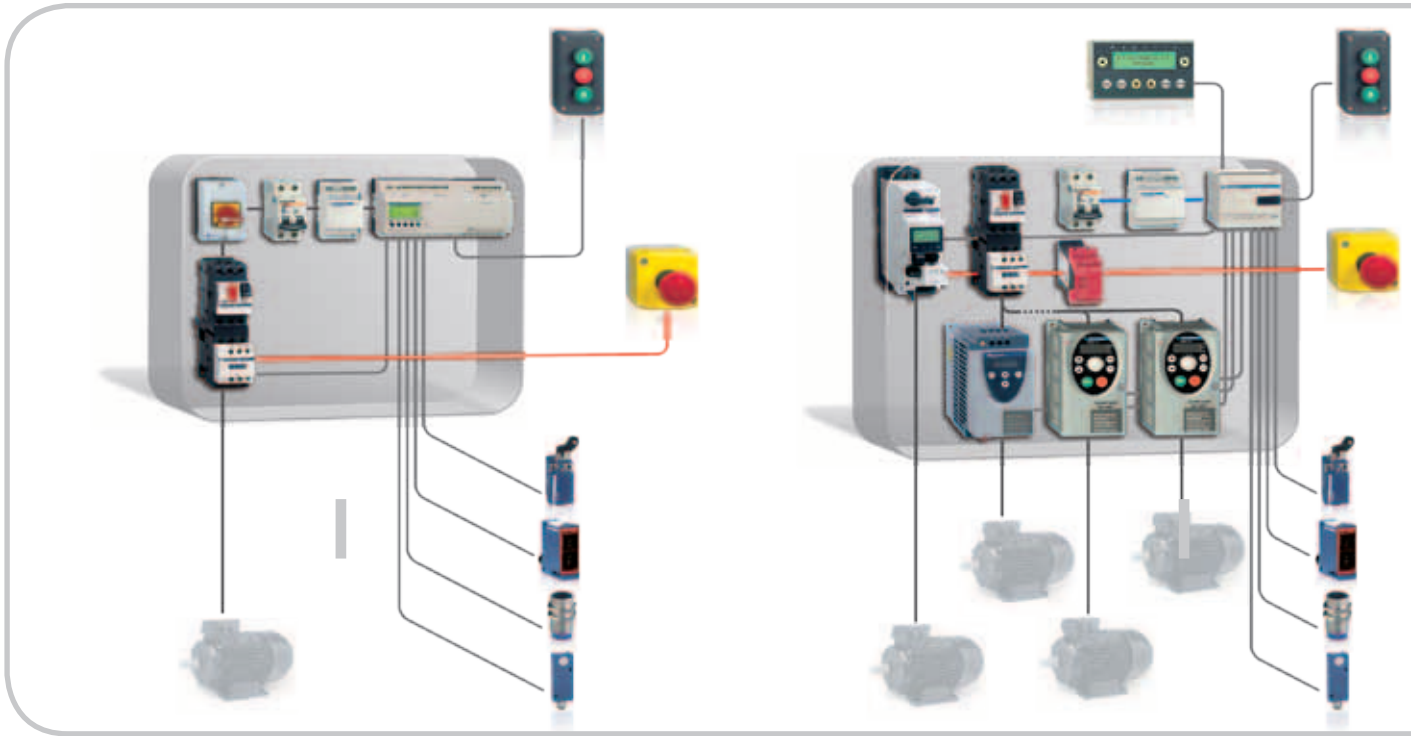
Schneider Electric has made great investment to establish logistics centers in Shanghai, Beijing, Guangzhou and Chengdu. These centers form the most complete logistics network and ensure fast and timely product delivery by means of door-to-door delivery.

#### Advanced and complete solutions

Simply smart, more flexible and more intelligent products and more favorable design concepts facilitate your product selection, design, testing and maintenance. The products of the same brands used for different systems can be integrated perfectly, which accelerates the development of new products and expedite time to market.



## 简单设备的优选方案



### 自动化入门阶段的最佳实施方案

#### 性能

- 逻辑控制器Zelio Logic, 最多40个I/O
- 2个软起动器或变频器(ATV11)

#### 安装

- 单机设备
- 硬接线
- 最小化编程时间

#### 布置

- 安装在一个控制柜中

#### 成本

- 可编程继电器的价格比传统继电器更低廉
- 维护简单 - 不需要PC

#### 尺寸

- 小尺寸设备

### The best implementation for starting in automation.....

#### Performance

- Simple controller Zelio Logic, up to 40 I/O
- 2 direct motor starters or speed drives (ATV11)

#### Installation

- Stand alone machine
- Hard-wired cabling
- Minimized programming time

#### Constraint

- Installed in one cabinet

#### Cost

- Programmable relay cheaper than traditional relays
- Simple to maintain - no PC required

#### Size

- Small footprint products

### 恰如所需的配置方案, 应用效果已经验证

#### 性能

- 小型控制器Twido, 最多264个I/O
- 4个变频器(ATV11/31)
- 文本屏

#### 安装

- 单机设备
- 硬接线

#### 布置

- 安装在一个控制柜中

#### 成本

- 使用库实现简单编程
- 简便的工程与维护

#### 尺寸

- 紧凑型设备 < 20m<sup>2</sup>

### Just what you need with guaranteed results.....

#### Performance

- Simple controller Twido, up to 264 I/O
- 4 speed drives (ATV 11/31)
- Text HMI

#### Installation

- Stand alone machine
- Hard-wired cabling

#### Constraint

- Installed in one cabinet

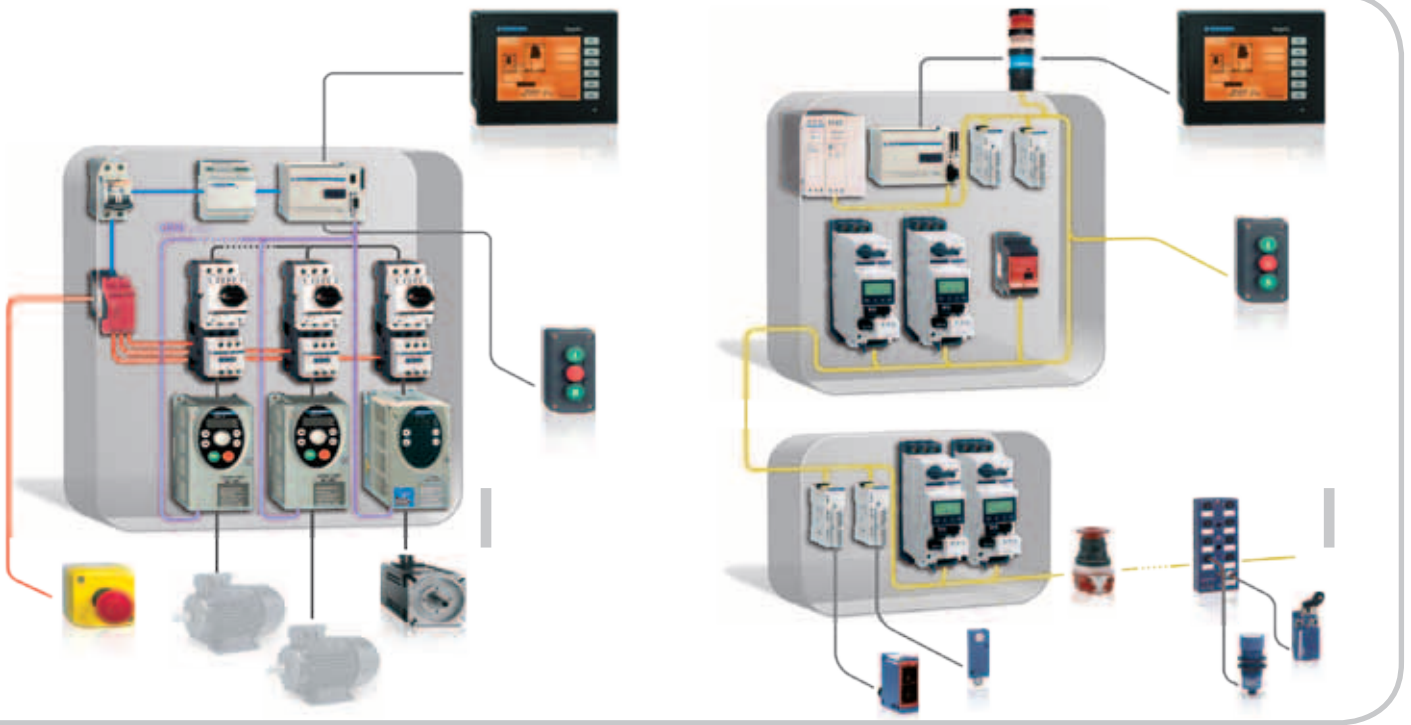
#### Cost

- Easy programming using libraries
- Easy engineering and maintenance

#### Size

- Compact machine < 20m<sup>2</sup>

## Preferred implementations for simple machines



### 实施简单，易于移植... 连接驱动设备的优化解决方案

#### 性能

- 小型控制器Twido, 最多264个I/O
- 4个变频器(ATV11/31), (可选2个Lexium 05)
- 文本屏/触摸屏

#### 安装

- 单机设备
- CANopen
- 软件: 使用库及功能块简化编程
- 集成CANopen配置

#### 布置

- 安装在一个控制柜中

#### 成本

- 使用CANopen简化布线

#### 尺寸

- 紧凑型设备 < 20m<sup>2</sup>

### Easy to implement, open to evolutions The optimized solution to connect drives...

#### Performance

- Simple controller Twido, up to 264 I/O
- 4 variable speed drives (4 ATV31), (option 2 Lexium 05)
- Text/graphic display

#### Installation

- Stand alone machine
- CANopen
- Software: libraries and function blocks to ease programming
- CANopen configuration integrated

#### Constraint

- Installed in one cabinet

#### Cost

- Optimized cabling with CANopen

#### Size

- Compact machine < 20m<sup>2</sup>

### 简单，灵活，可靠... 适于简单安装和扩展安装

#### 性能

- 小型控制器Twido, 最多264个I/O
- 文本屏/触摸屏
- 故障安全: 完全集成

#### 安装

- 单机设备
- AS-Interface
- 软件: 库及功能块
- 配置工具, 包括设计和产品选型
- 巨大的选择空间, IP20和IP67接口

#### 布置

- 分散在几个控制柜中

#### 成本

- 工程实施简单方便
- 使用AS-Interface优化布线

#### 尺寸

- 网络长度: 最大100米

### Simple, flexible and reliable the solution for simple and extended installations...

#### Performance

- Simple controller Twido - up to 264 I/O
- Text / graphic display
- Safety: totally integrated with Safety at work

#### Installation

- Stand alone
- AS-Interface
- Software: libraries and function blocks
- Configuration tool including design & product selection
- Large choice of IP20 & IP67 interfaces

#### Constraint

- Distributed in several cabinets

#### Cost

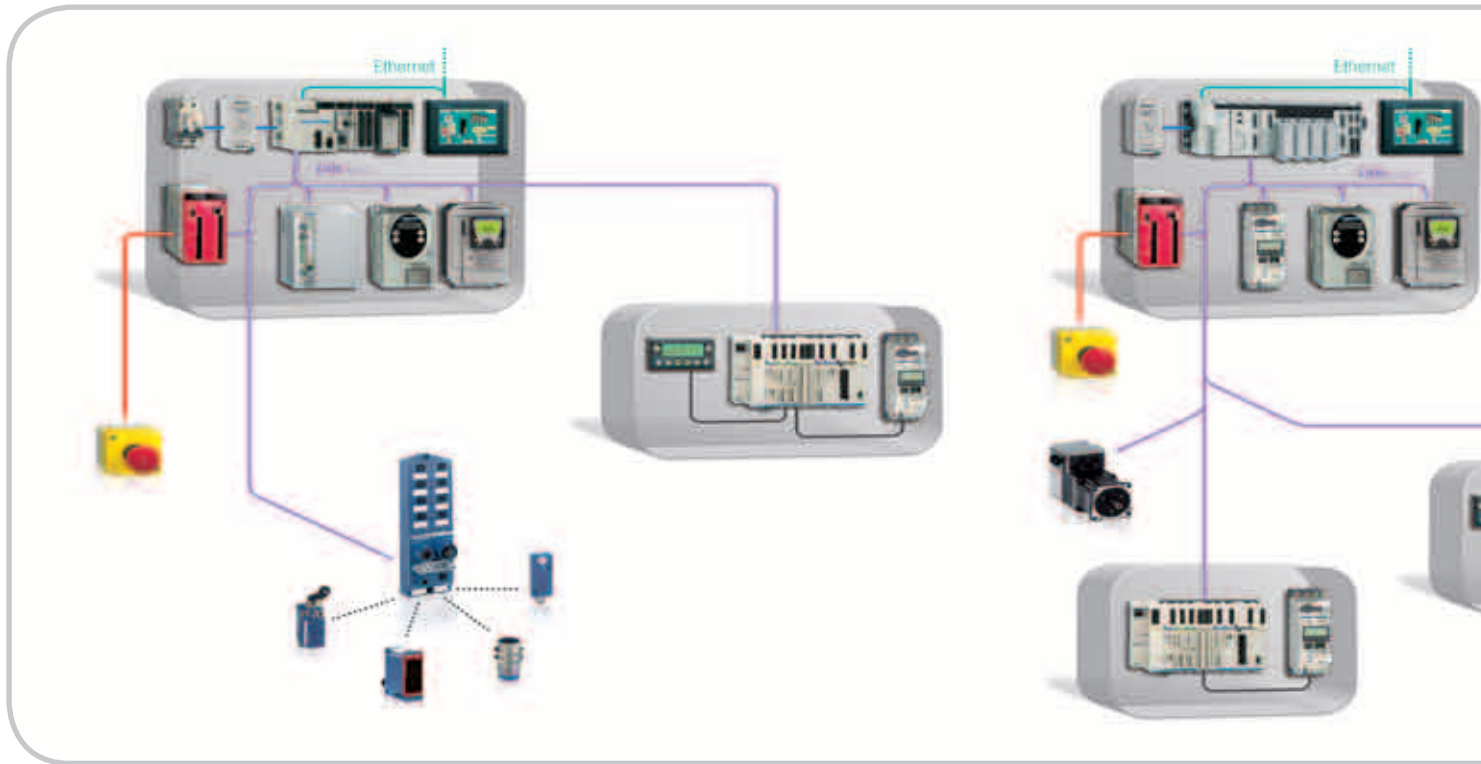
- Easy engineering
- Optimized cabling with AS-Interface

#### Size

- Network length: up to 100m



## 分散式设备的优选方案



### 灵活，开放，服务集成性能

- 可编程逻辑控制器Modicon M340
- 最多连接14个ATV31/71或伺服驱动
- 图形化显示
- 故障安全控制器
- 以太网或更高层次

### 安装

- 单机或联网
- CANopen
- Unity Pro, 包括库和功能块

### 布置

- 分布在几个控制柜中

### 成本

- 性价比具有竞争力

### 尺寸

- 分散的，模块化机器或设备>20m<sup>2</sup>

### Flexibility and openness with performance and integration of services

#### Performance

- PLC Modicon M340, up to I/Os
- Up to 14 inverters ATV 31/71 or Servo drives (Lexium 05/15)
- Graphic display
- Safety Preventa controller
- Ethernet for upper level

#### Installation

- Stand-alone or networked
- CANopen
- Unity Pro, libraries and function blocks

#### Constraint

- Distributed in several cabinets

#### Cost

- Competitive performance/cost ratio

#### Size

- Distributed, modular machine or equipment > 20m<sup>2</sup>

### 高性能，模块化结构用于分散安装性能

- 可编程逻辑控制器Premium, 最多400 I/O
- 最多连接16个ATV31/71或伺服驱动 Lexium 05/15

- 图形化显示

- 故障安全控制器
- 以太网或更高层次

### 安装

- 单机或联网
- CANopen
- Unity Pro, 包括库和功能块

### 布置

- 在几块场地中安装

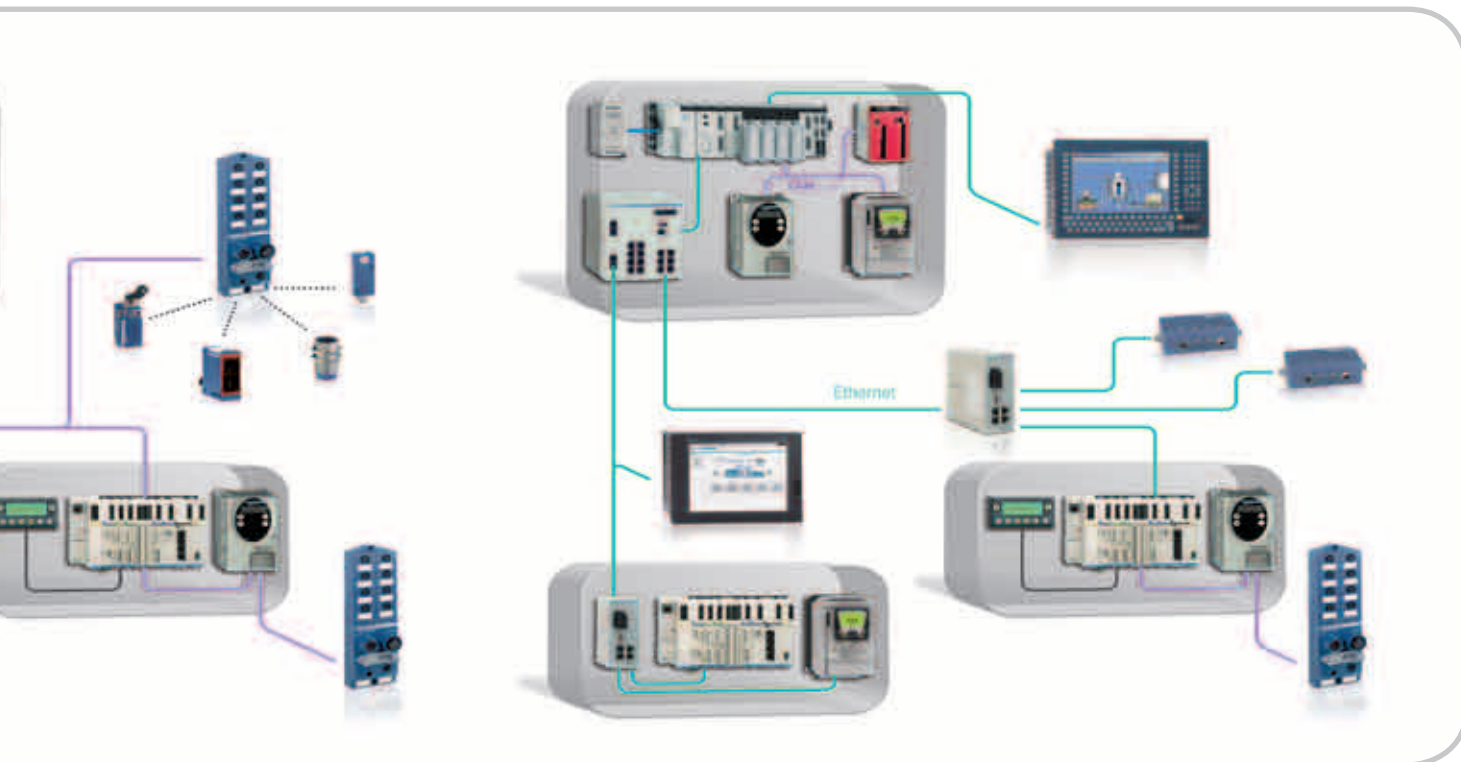
### 成本

- 编程和配置成本最小化
- 使用CANopen, 优化布线

### 尺寸

- 分散的，模块化机器或设备>20m<sup>2</sup>

## Preferred implementations for distributed machines



### High performance and modularity for distributed installations

#### Performance

- PLC Premium, up to 400 I/O
- Up to 16 inverters ATV31/71 or servo drives Lexium 05/15
- Graphic display
- Safety Preventa controller
- Ethernet for upper level

#### Installation

- Stand-alone or networked
- CANopen
- Unity Pro, libraries and function blocks

#### Constraint

- Installed in several enclosures

#### Cost

- Minimised programming and commissioning cost
- Optimized cabling with CANopen

#### Size

- Distributed, modular machine or installation > 20m<sup>2</sup>

### 借助于透明化和标准IT功能，通过高级设计及配置实现高级功能性能

- 可编程逻辑控制器Premium，最多800 I/O
- 最多连接20个ATV31/71
- 在Sercos总线上实现最多8轴控制
- 图形化显示
- Factory Cast HMI, Vijeo界面
- 通过网页实现远程诊断

#### 安装

- 单机或联网
- 以太网或CANopen
- Unity Pro, 包括库和功能块
- 互联网自动化工具
- 简单的模块化

#### 布置

- 在几块场地中安装

#### 成本

- 降低工程成本

#### 尺寸

- 网络长度：长距离安装

### Advanced design and commissioning with advanced features, thanks to transparency and standard IT

#### Performance

- PLC Premium, up to 800 I/O
- Up to 20 inverters ATV 31/71
- Up to 8 axes on Sercos bus
- Graphic display
- Factory Cast HMI, Vijeo Look
- Remote diagnostics via the Web

#### Installation

- Stand-alone or networked
- Ethernet and CANopen
- Unity Pro, libraries and function blocks
- Web automation tools
- Simple modularity

#### Constraint

- Installed in several enclosures

#### Cost

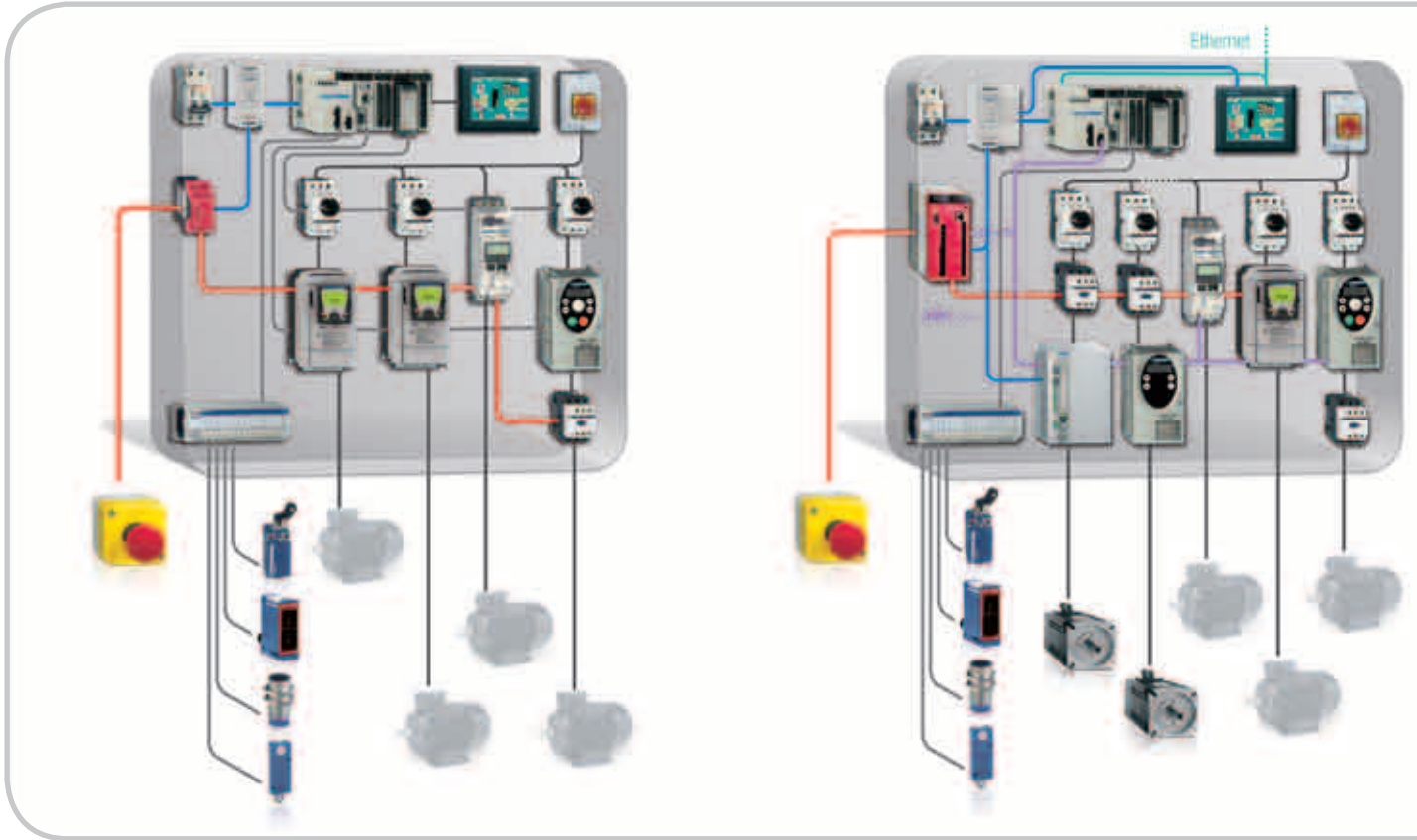
- Reduced engineering cost

#### Size

- Network length: large installations



## 紧凑型设备的优选方案 Preferred implementations for compact machines



### 小区域方案

#### 性能

- 可编程逻辑控制器Modicon M340，最多150个I/O
- 最多连接8个ATV11/31/71
- 图形化显示
- 可选：以太网或更高层次

#### 安装

- 单机或联网
- 硬接线
- Unity Pro，包括库和功能块

#### 布置

- 安装在单独的控制柜中

#### 成本

- 性价比具有竞争力

#### 尺寸

- 紧凑型设备<20m<sup>2</sup>

### Performance in a small footprint

#### Performance

- PLC Modicon M340, up to 150 I/Os
- Up to 8 inverters ATV 11/31/71
- Graphic display
- Option: Ethernet for upper level

#### Installation

- Stand-alone or networked
- Hard-wired cabling
- Unity Pro - libraries and FB

#### Constraint

- Installed in a single cabinet

#### Cost

- Competitive performance/cost ratio

#### Size

- Compact machine < 20m<sup>2</sup>

### 开放的易移植方案，基于CANopen的通讯和运动控制

#### 性能

- 可编程逻辑控制器Modicon M340，最多150个I/O
- 最多连接14个ATV31/71，或伺服驱动Lexium 05/15
- 图形化显示
- 故障安全：Preventa控制器
- 可选：以太网或更高层次

#### 安装

- 单机或联网
- 硬接线 (I/O)，运动控制和故障安全使用CANopen
- Unity Pro，包括库和功能块

#### 布置

- 安装在单独的控制柜中

#### 成本

- 性价比具有竞争力

#### 尺寸

- 紧凑型设备<20m<sup>2</sup>

### Open to evolutions with communication and motion ready-to-use on CANopen...

#### 性能

- PLC Modicon M340, up to 150 I/Os
- Up to 14 inverters ATV 31/71 or servo drives Lexium 05/15
- Graphic display
- Safety: Preventa controller
- Option: Ethernet for upper level

#### 安装

- Stand-alone or networked
- Hardwired (I/Os), Motion and Safety on CANopen
- Unity Pro; libraries and FB

#### Constraint

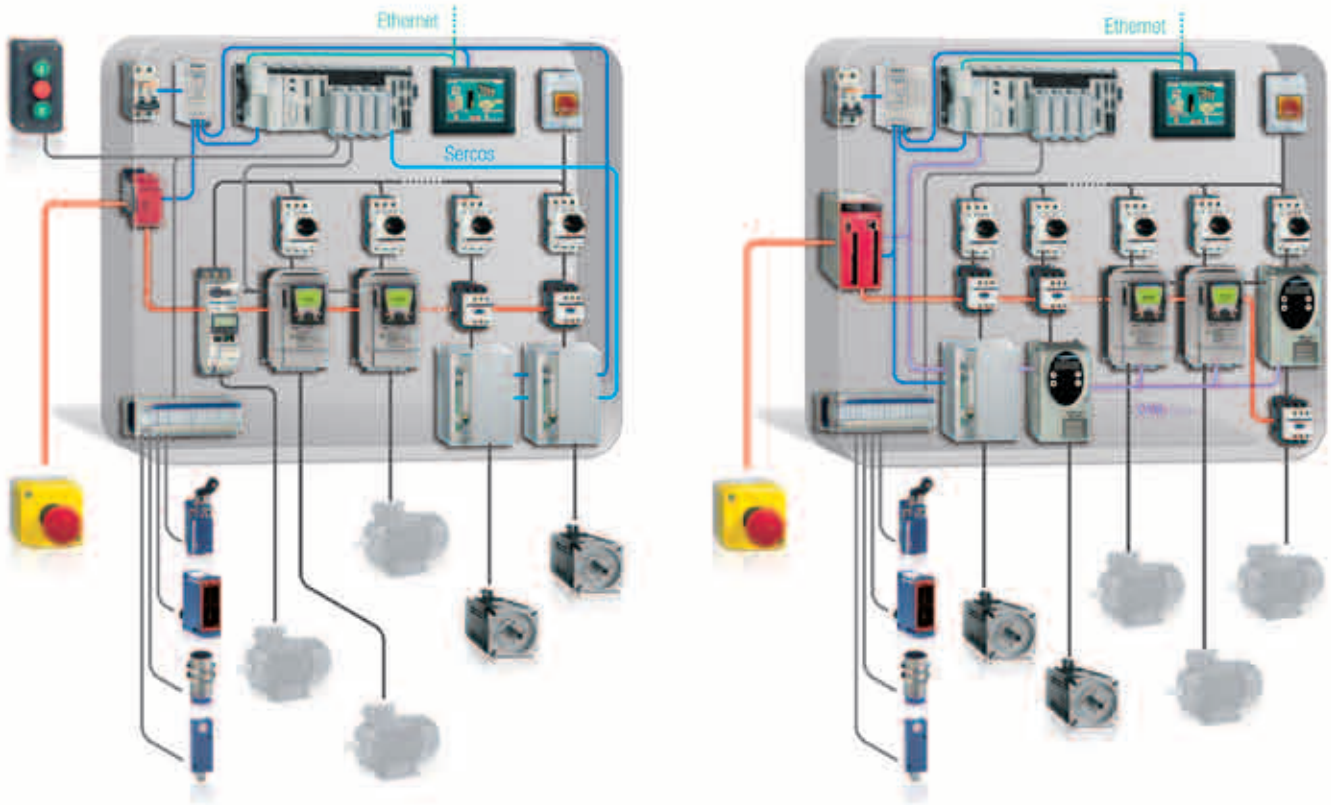
- Installed in a single cabinet

#### Cost

- Competitive performance/cost ratio

#### Size

- Compact machine < 20m<sup>2</sup>



### 高性能，专家级解决方案 性能

- 可编程逻辑控制器Premium, 最多400个I/O
- 最多连接8个ATV31/71, 或伺服驱动Lexium 05/15
- SERCOS最多16轴
- 图形化显示
- 以太网或更高层次

### 安装

- 单机或联网
- 硬接线 (I/O)
- Unity Pro, 包括库和功能块

### 布置

- 安装在单独的控制柜中

### 成本

- 使用完整的工具降低编程和配置费用

### 尺寸

- 紧凑型设备<20m<sup>2</sup>

### The solution for experts seeking to achieve high performance...

#### Performance

- PLC Premium, up to 400 I/O
- Up to 8 inverters ATV31/71 or servo drives Lexium 05/15
- Up to 16 axes on SERCOS
- Graphic display
- Ethernet for upper level

#### Installation

- Stand-alone or networked
- Hard-wired cabling
- Unity Pro - libraries and FB

#### Constraint

- Installed in a single cabinet

#### Cost

- Minimised programming and commissioning costs with complete set of tools

#### Size

- Compact machine < 20m<sup>2</sup>

### 全面的CANopen解决方案，性能强大，使用灵活 性能

- 可编程逻辑控制器Premium, 最多400个I/O
- 最多连接16个ATV31/71, 或伺服驱动Lexium 05/15
- SERCOS最多16轴
- 图形化显示
- 故障安全: Preventa控制器
- 以太网或更高层次

### 安装

- 单机或联网
- 硬接线 (I/O), 运动控制和故障安全使用CANopen

- Unity Pro, 包括库和功能块

### 布置

- 安装在单独的控制柜中

### 成本

- 使用CANopen优化布线

### 尺寸

- 紧凑型设备<20m<sup>2</sup>

### All the features of CANopen combining high end performance and flexibility Performance

- PLC Premium, up to 400 I/O
- Up to 16 inverters ATV 31/71 or servo drives Lexium 05/15
- Up to 16 axes on SERCOS
- Graphic display
- Safety: Preventa controller
- Ethernet for upper level

### Installation

- Stand-alone or networked
- Hardwired (I/Os), Motion and Safety on CANopen

- Unity Pro, libraries and FB

### Constraint

- Installed in a single cabinet

### Cost

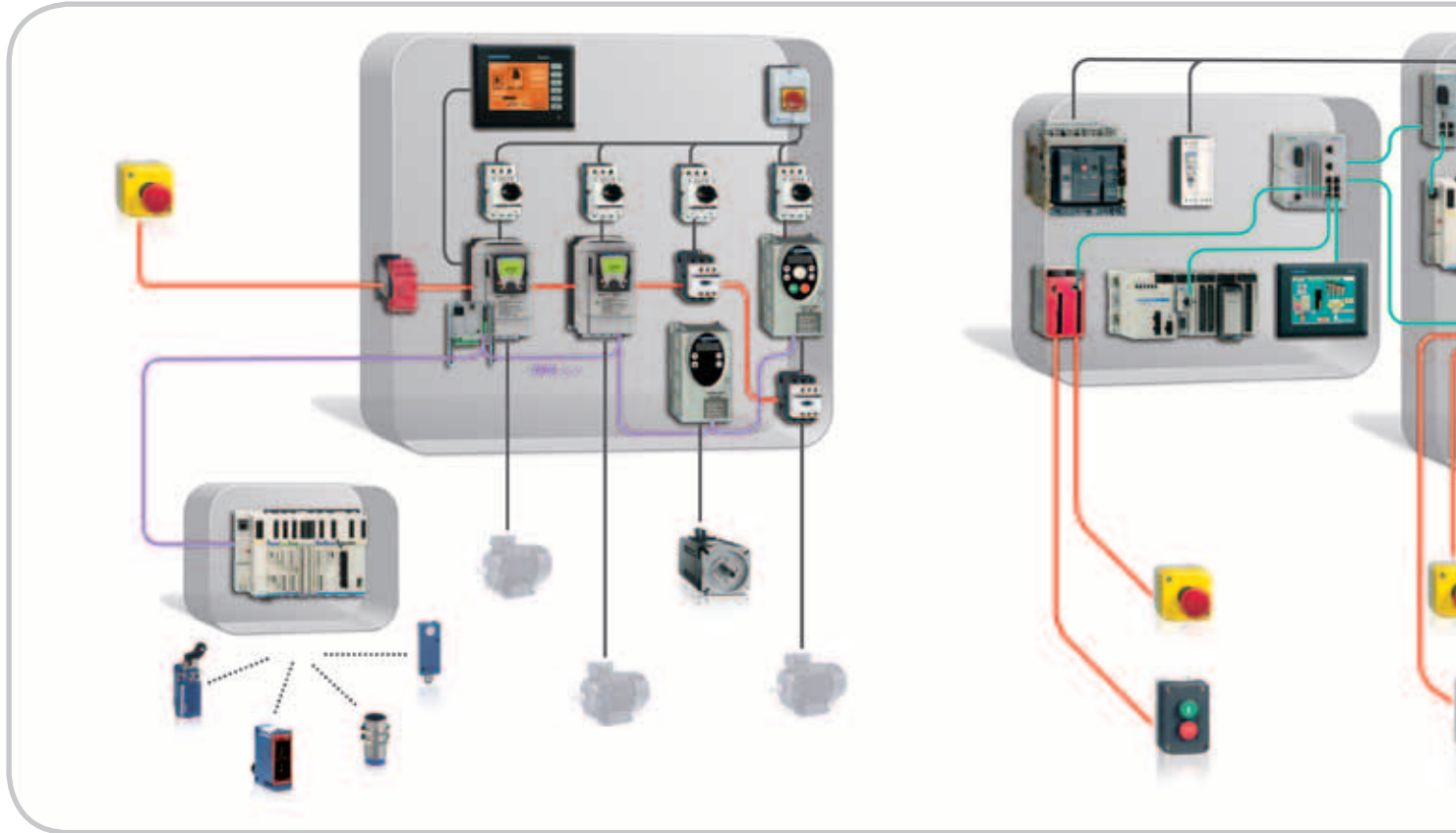
- Optimized cabling with CANopen

### Size

- Compact machine < 20m<sup>2</sup>



## 高级应用 Advanced implementations



### 与众不同：没有PLC的解决方案！

#### 性能

- 变频器ATV71内置控制器
- 最多100个I/O
- 7个变频器“ATV31/71”
- 5个Lexium 05 + 伺服电机BSH/BDH
- 图形化显示
- 可选：以太网或更高层次

#### 安装

- 单机设备或联网
- CANopen和Modbus
- 软件：CoDeSys和PowerSuite

#### 布置

- 分布在几个控制柜中

#### 成本

- 工程实施简便易行
- 维护简便，不需要PC

#### 尺寸

- 小规模产品
- 紧凑型或大型机械设备
- 网络长度：250kbits/s时250米，500kbits/s时100米

### The difference: a solution without PLC!

#### Performance

- Variable speed drive ATV71 controller Inside
- Up to 100I/O
- 7 variable speed drives ATV 31/71
- 5 Lexium 05 + servo motors BSH/BDH
- Option: Ethernet connection to upper level
- Text / Graphic HMI

#### Installation

- Stand alone machine or networked
- Cabling: CANopen & Modbus
- Software: CoDeSys & PowerSuite

#### Constraint

- Distributed in several cabinets

#### Cost

- Easy engineering
- Simple to maintain - no PLC required

#### Size

- Small footprint products
- Compact or large machine or equipment
- Network length: at 250 kbits/s 250m, at 500kbits/s 100m

### 差异化，基于将合作伙伴整合到我们庞大的产品体系中的能力

#### 性能

- 可编程逻辑控制器Modicon M340
- 安全PLC XPSMS40
- 最多300个I/O
- 最多100故障安全I/O
- 最多10路故障安全AI
- 2个逆变器
- 文字/图形化显示

#### 安装

- Modbus/Ethernet/CANopen
- 软件：XPSMFWIN、Unity和Advantys配置工具

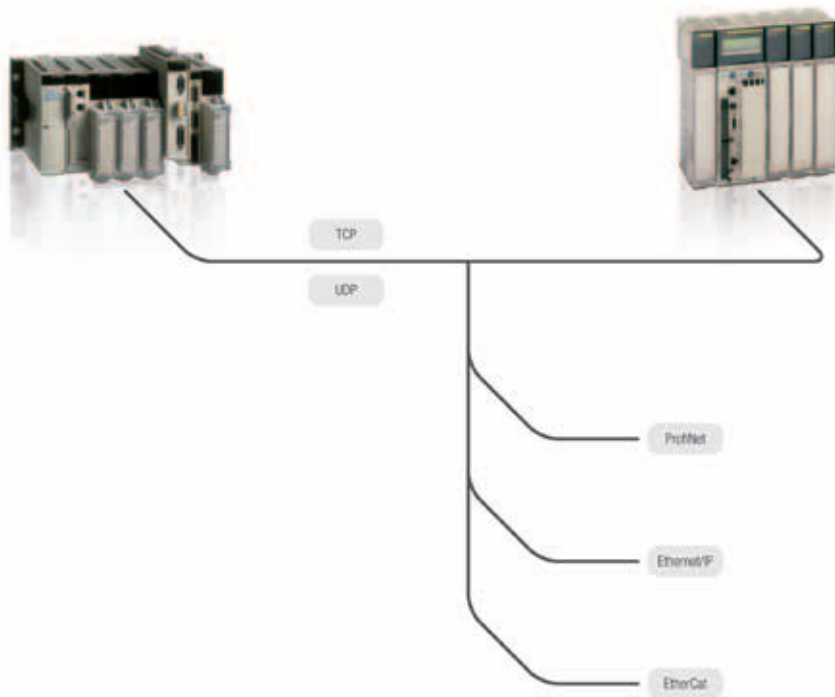
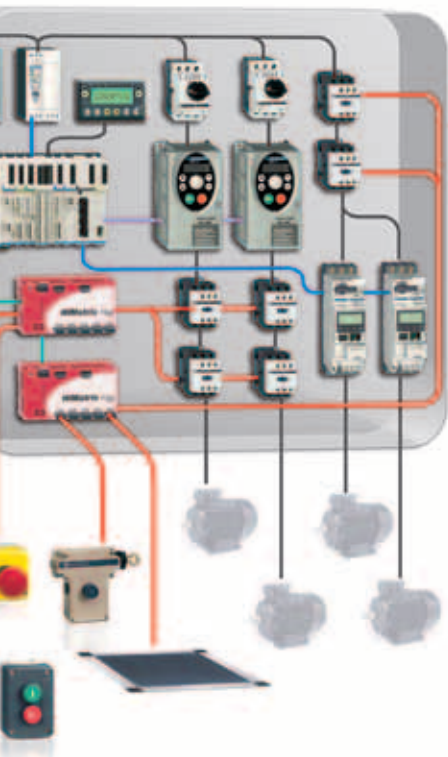
#### 布置

- 分布在几个控制柜中
- EN/IEC 61508 SIL class 3
- EN954-1 cat.4

#### 成本

- 工程实施简便易行





Difference is based on capability to combine partners with our large catalog...

#### Performance

- PLC Modicon M340
- Safety PLC XPSMS40
- Up to 300 I/O
- Up to 100 safety I/O
- Up to 10 safety AI
- 2 Inverters
- Text / Graphic HMI

#### Installation

- Modbus/Ethernet/CANopen
- Software: XPSMFWIN & Unity & Advantys Config Tool

#### Constraint

- Distributed in several cabinets
- EN/IEC 61508 SIL class 3
- EN 954-1 cat. 4

#### Cost

- Easy engineering

差异化，基于使用TCP或UDP在以太网上自由通讯的能力性能

- 16 × UDPCom, 1460 Byte/ch
- 16 × TCPCom, 2040 Byte/ch
- 自由组合

#### 安装

- 使用可编程逻辑控制器Quantum和Premium的标准硬件
- 使用标准Unity功能块

#### 成本

- 工程实施简便易行
- 易于维护

Difference is based on the capability to communicate freely on Ethernet using TCP or UDP...

#### Performance

- 16 × UDPCom, 1460 Byte/ch
- 16 × TCPCom, 2040 Byte/ch
- Free combination

#### Installation

- Simply use the standard Hardware for PLC Quantum and Premium
- Simply use the standard Unity Function blocks

#### Cost

- Easy engineering
- Easy to maintain



# 施耐德电气解决方案 Schneider Electric Solution

## OEM全面解决方案

### Complete range of solutions for OEMs

施耐德电气提供全系列、安全、可靠、高性能的产品满足船舶与海洋工程行业OEM客户的需要。

Schneider Electric provides a complete range of safe, reliable and high performance products to meet the needs of OEM customers in marine & offshore industries.

## OEM客户，我们提供全面解决方案

### We provide full range of solutions for OEM customers

- 自动控制产品
  - 传动系统
  - 马达起动及保护
  - 传感器元件
  - 控制及信号单元
  - 小型自动化元器件
  - 工业机柜系统
- 
- Automation & control products
  - Drive system
  - Motor starting and protection
  - Sensor components
  - Control and signal units
  - Simple automation components
  - Industrial cabinet systems



Zelio Logic



Twido



M340



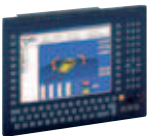
Premium



XBTN



XBTG



IPC



Vijeo Look

## 自动控制产品

### Automation & control products

施耐德电气提供全范围的自动控制元器件供用户选择，可编程逻辑控制器 (PLC)，人机界面 (HMI) 等，使您的设备和系统更加自动化，更可靠。

Schneider Electric presents a complete range of automation & control components for the users to make selections. The programmable logic controller (PLC) and human-machine interface (HMI) help improve automation function and achieve more reliability for your equipment and system.

#### 特点

##### Features

- 产品范围宽，从低端到高端应用都有相应产品对应
- 硬件安全、可靠，通过各大船级社认证
- 多种通讯方式，MODBUS、ETHERNET, PROFIBUS, CANOPEN等，非常方便与其他系统进行数据交换和组成集成系统
- 简单、易用、易维护
- Wide range of products, including those for low end and high end applications
- Safe and reliable hardware that has passed the certification of main ship classification societies
- Different communication protocols are provided such as MODBUS、ETHERNET, PROFIBUS and CANOPEN to facilitate data exchange with other systems and system integration
- Simple, easy to use and maintain

#### 典型应用举例

##### Examples of typical applications

- 制冷系统、锅炉系统、甲板机械、发电机组等自动控制
- 各种泵，电动机械之间的联锁，顺序控制等
- HVAC系统中，泵、风机等根据现场传感器信号的闭环控制等
- 整个系统的通讯、数据交换等
- Automation & controls including refrigeration system, boiler system, deck machines and generator sets
- Various pumps, interlocking between electric machines, sequence control
- Closed-loop control by pumps and fans based on signals of field sensors in HVAC system
- Communication and data exchange of the whole system



# 施耐德电气解决方案 Schneider Electric Solution



## Premium

适用于中大型控制系统。通过X bus总线或Advantys模块构成分布式控制系统，最大2048点，能完全满足各类系统控制要求。

This is suitable for medium and large control systems. It forms a distributed control system with X buses or Advantys modules with 2048 points at maximum, which can fully meet control requirements of different systems.

## M340

适用于中大型控制系统，1024点DI/O，256点AI/O，具有极高的性价比，100%国际标准及海事认证。

This is suitable for medium and large control systems with normal requirements. It has 1024 points DI/O, 256 points AI/O at maximum and has very high performance/price ratio, meeting 100% international standards and Marine certifications.

## Twido

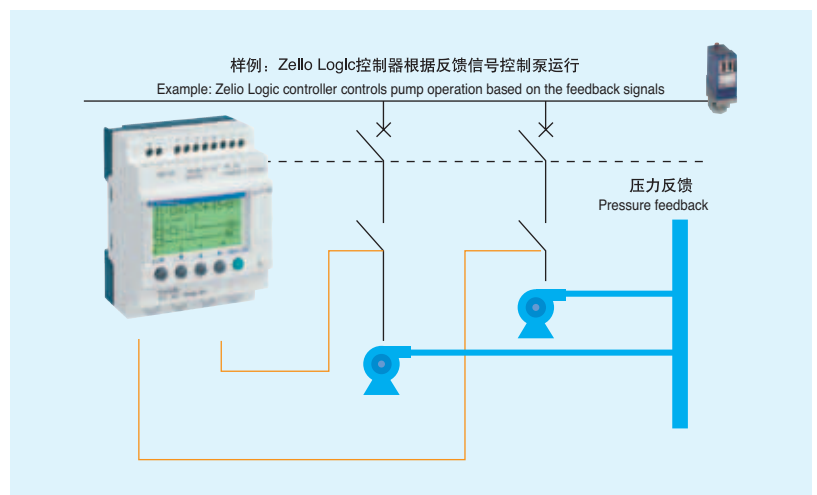
主要用于小型控制系统，是一种紧凑型控制器，尺寸小巧，功能非常灵活，可最大程度优化成本要求，最大264点，能满足系统的基本控制要求。

This is mostly used in small control systems. It is a compact integral controller with flexible functions for best cost optimization. It has 264 points at maximum and can meet basic system control requirements.

## Zelio Logic

主要应用于简单的控制，也可用于大中型系统辅助设备的分散自动化，最大40点。尺寸小和易于安装的优点。

This is mainly for simple controls, and can also be used in distributed automation of auxiliary devices of large and medium systems. With 40 points at maximum, it is compact in size and easy to install.



Zelio Logic 控制两个泵的运行，根据实际压力反馈判定是否开启或停止泵及开停泵的数量，同时通过程序亦可实现泵的自动切换（当一个泵有故障）及实现平均分配泵的运行时间等。

Zelio Logic controls the operation of two pumps by determining whether to start or stop the pumps and which pump (s) should be started / stopped. Zelio also has programs for automatic pump switching (in case of fault of one pump) and equal division of pump operation time.



### 现场控制站I/O-Modicon Advantys

#### Field control station I/O-Modicon Advantys

- 模块化设计，结构紧凑，主控制器可通过总线或网络管理自动化岛
- 采用Canopen的背板总线技术，为所有模块提供了电源分配管理、故障集中诊断、I/O数据采集的功能，I/O模块可带电插拔，保证现场维护的快速方便
- 强大灵活的设备集成能力，可以连接多种现场设备，如“传感器，执行器，变频器

● 开放的现场总线及网络接口，支持：Ethernet TCP/IP, Profibus DP, Interbus, Modbus Plus, Fipio, Canopen, DeviceNet

● This control station adopts modular and compact design. The main controller can manage the automation islands through the bus or network

● Canopen backplane bus technology is adopted. All modules are provided with power supply distribution management, centralized fault diagnosis and I/O data acquisition functions. I/O modules can be hot plugged to ensure fast and easy field maintenance

● Powerful and flexible equipment integration capability is provided to connect many field devices such as sensors, actuators and converters

● Open field bus and network interface in support of Ethernet TCP/IP, Profibus DP, Interbus, Modbus Plus, Fipio, Canopen and DeviceNet

### 操作员站人机界面产品 - Magelis XBT G,N

#### Operator station HMI product - Magelis XBT G,N

施耐德电气公司提供完整的工业级人机界面产品。满足工业现场操作员站人机界面的需求。

Schneider Electric presents a full range of industrial HMI products to meet the requirements for operator station HMIs on industrial sites.

开放的通讯接口协议保证与多种控制系统连接，如：SNPX, MPI/PPI, AS511/3964R, DF1/DH485, SYSMACWAY, Modbus, FIPIO/FIPWAY, Unitelway, Modbus, KS, TCP/IP以太网等。

Open communication interface protocols ensure connection with many control systems such as SNPX, MPI/PPI, AS511/3964R, DF1/DH485, SYSMACWAY, Modbus, FIPIO/FIPWAY, Unitelway, Modbus, KS and TCP/IP Ethernet.

- 64bits RISC CPU, 266MHz
- USB接口，内置以太网
- 65K色，图像效果逼真
- 强大动画功能，流畅动画效果
- 支持JAVA Script

- 64bits RISC CPU, 266MHz
- USB interface, with integrated Ethernet
- 65K color, lifelike image effect
- Powerful animation function and smooth animation effect
- JAVA Script Support





## 变频器和软起动器在船舶中的应用

### Applications of variable speed drive & soft starter in ships

#### 变频器和软起动器在船舶中应用的益处

##### Benefits of variable speed drive & soft starter in ships

当前船舶制造业处于高速发展的阶段，船舶的控制系统、监测系统、动力系统及相关配套设备的自动化水平不断提高，整船的电气系统不断优化，加之船舶电网与陆上电网相比容量小、抗扰动能力相对较弱等特点，使得变频器和软起动器近年来在船舶的应用不断提高。

Currently, the shipbuilding industry keeps a high-speed development: the automation level of ship control system, monitoring system, propulsion system and relevant matching devices increases constantly; the power system of whole ship is optimized constantly; additionally, the ship electrical network is smaller in power capacity and weaker in anti-interference compared with terrestrial electrical grid system. Consequently, more and more variable speed drives and soft starters have been applied to ships in recent years.

变频器和软起动器在船舶中的应用带来的益处，可以从三个方面来看，包括设备和系统性能的提高、电气系统的优化及节能。

Benefits from applications of variable speed drive & soft starter in ships can be seen from the following 3 aspects: improvement of performance of equipments & systems, optimization of power system and energy saving.





● 设备和系统性能的提高 Improvement of performance of equipments & systems

提高设备生产效率和系统性能，如锚绞机、起重机、电力推进系统等。

Improving productivity of equipments and performance of system, such as capstan engine, crane and electric propulsion system, etc.

● 电气系统的优化 Optimization of power system

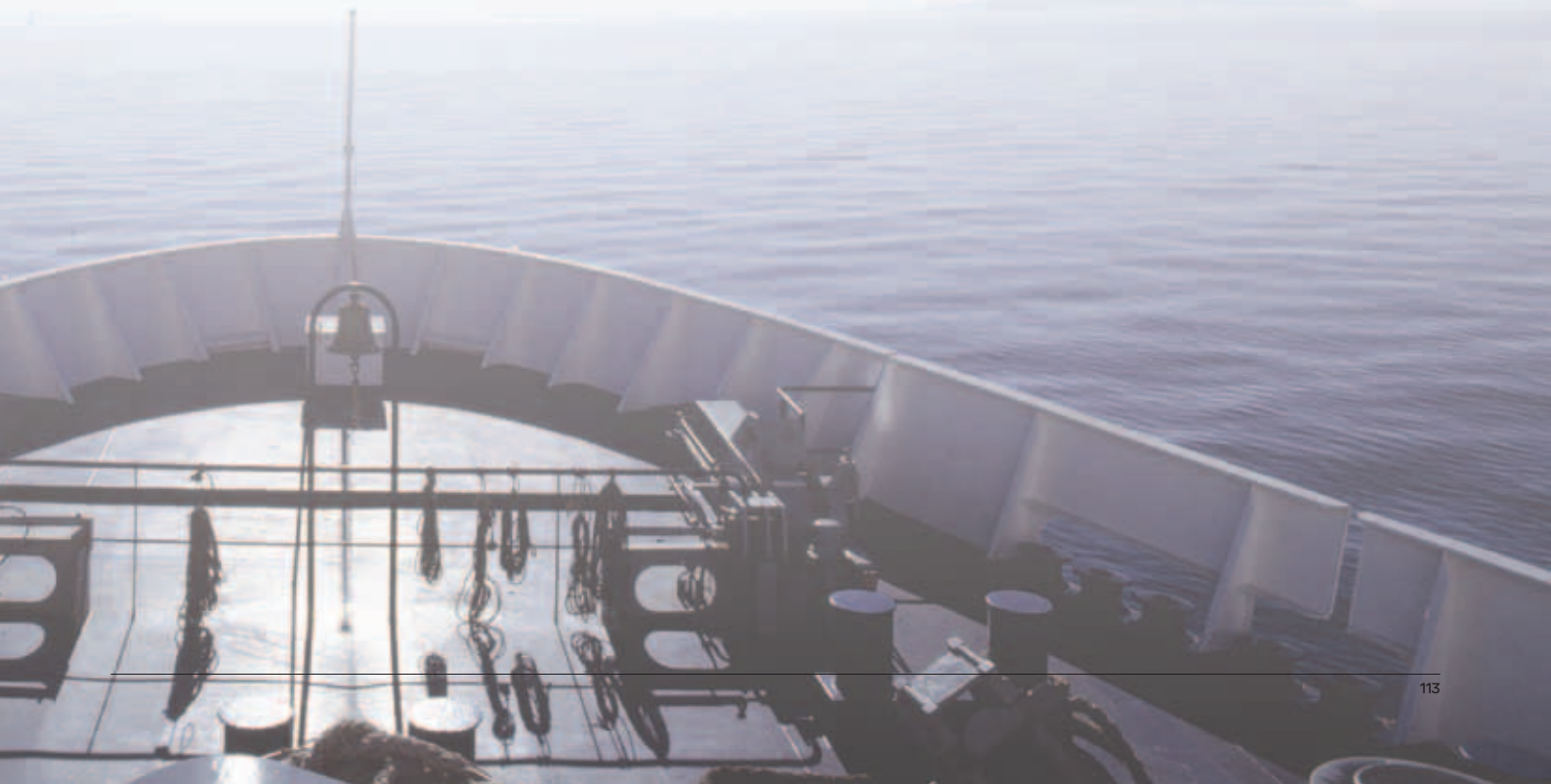
在船舶中很重要的负载为电机，电机自身的特点决定了其在起动过程中冲击电流大，降低电机的起动电流可以通过变频器和软起动器得以实现，同时可避免传统起动方式造成的跳闸、电压波动现象，提高船舶小容量电网的质量。

As a very important load in ships, motor has its own features determining that it has great impulse current in the starting process, therefore, reduction of starting current of motor can be realized through variable speed drive and soft starter, avoiding phenomena of trip and voltage fluctuation caused by traditional starting method and improving the quality of the small-capacity electrical network in ships.

● 节能 Energy saving

变频器的应用为船舶中大量的风机和泵类负载提供了广阔的节能空间，可降低能耗，提升船舶的能量密度，如深井泵、通风风机，冷却水泵等。

Large quantity of fans & pumps in ships provide great energy-saving space thanks to the application of variable speed drive, thereby reducing energy consumption and improving energy density of ships, such as deep well pump, ventilation fan and cooling pump, etc.





## 施耐德电气变频器和软起动器产品介绍

### Introduction of Schneider Electric variable speed drive & soft starter

负载的类型分为恒转矩负载和变转矩负载，在船舶中恒转矩负载主要包括起升设备、锚绞机等，变转矩负载包括各种风机、泵类负载以及船舶电力推进的驱动器等。施耐德电气变频器根据负载的类型分为ATV71恒转矩变频器和ATV61变转矩变频器。施耐德电气还提供ATS48转矩控制软起动器，主要针对风机泵类负载。

Loads are divided into constant torque type and variable torque type. Constant torque loads for ships mainly consists of hoisting equipment and capstan engine, etc.; variable torque loads include various fans, pumps, and electric propulsion drives for ships, etc. On the basis of the type of loads, Schneider Electric variable speed drives consist of ATV71 variable speed drive for constant torque and ATV61 variable speed drive for variable torque. Schneider Electric also provides torque control soft starter ATS48 mainly specific to fans & pumps.

#### ATV71恒转矩变频器

##### ATV71 variable speed drive for constant torque

ATV71变频器是恒转矩高性能变频器，其特点满足船舶的需要：

ATV71 variable speed drive is a high-performance variable speed drive for constant torque with the following features meeting the requirements of ships:

- 出色的电压输入特性 Outstanding voltage input features
  - 具有不同的电压等级380V - 480V (N4系列, 功率至500kW), 500V - 690V (Y系列, 功率至630kW)
  - 电压跌落最大可达50%，特别适合船舶的电网系统
  - Varied voltage levels 380V - 480V (N4 series, with the power up to 500kW), 500V - 690V (Y series, with the power up to 630kW)
  - Voltage sag may reach up to 50%, especially suitable for the electrical network system of ships
- 优越的环境适应能力 Excellent environmental adaptability
  - 除具有IP20单机外，还提供IP23、IP54柜机变频器
  - 提供电路板加厚涂层产品 (S337)，适合海洋潮湿、酸碱度大的特点
  - 完美的过力矩能力，170%可持续60s，220%可持续2s
  - Except for IP20 stand-alone machine, IP23 and IP54 cabinet variable speed drives are also available
  - Circuit board thickened coating products (S337), suitable for features of high marine humidity, acidity and alkalinity
  - Perfect over torque capability, 170% (duration 60s), 220% (duration 2s)
- 谐波与电磁兼容性能 Harmonics and electromagnetic compatibility
  - 内置了A级EMC滤波器，保证船舶电气控制设备的使用安全
  - 多种抑制谐波的方法，如内置的直流电抗器、无源滤波器、有源滤波器等
  - Built-in Class-A EMC filter ensures safety of use of ship control equipments





○ Multiple methods of harmonic suppression, such as built-in DC reactor, passive filter and active filter, etc.

● 丰富的应用功能 Abundant application functions

○ ATV71提供多种免费的宏配置，使应用功能如同“游戏”一样简单

○ 可编程控制卡的应用将更大的拓展应用的功能，变频器在您的手中将随心所欲，无所不能

○ ATV71内置Modbus和CANopen两种通讯协议，兼容主流通讯协议

○ 除具备了全球的各种认证外，还具有挪威船级社的DNV认证，保证用户的放心使用

○ ATV71 offers multiple free macro configurations, making application function as simple as a “game”

○ Application of programmable control card extends application functions significantly; variable speed drive does your will at your hands

○ ATV71 builds in the two types of communication protocols of Modbus and CANopen and complies with mainstream communication protocols

○ Except for various global certifications, ATV71 also has DNV certification of Det Norske Veritas, ensuring users to use the product with complete peace of mind



ATV61变转矩变频器

ATV61 variable speed drive for variable torque

ATV61与ATV71一脉相承，电压等级、防护等级、EMC、谐波的处理等能力与ATV71完全相同，有别之处在于：

● ATV61的功率N4系列为630kW，Y系列为800kW

● ATV61的过转矩性能为130%可持续60s

● ATV61还将提供更多适应于风机泵类负载的应用功能，如流量的监测、过负荷的监测、欠负荷的监测等功能

ATV61 and ATV71 share the same origin. The voltage level, protection level, EMC, and harmonics processing capability of ATV61 are identical with that of ATV71, and the differences are shown as follows:

● Power of ATV61: 630kW (N4 series); 800kW (Y series)

● Over torque capability of ATV61: 130% (duration: 60s)

● ATV61 also offers more application functions suitable for fans & pumps, such as flow monitoring, over-load and under-load detection, etc



ATS48转矩控制软起动器

ATS48 torque control soft starter

ATS48软起动器具有施耐德电气的转矩控制专利技术（TCS），可保证电机的起动停止如同丝绸般柔滑，17A到1200A的宽广的电流范围适合于低压电机的所有需求，380V、690V两种电压等级满足不同的电压需求，DNV认证保证了其与变频器的一致性。

ATS48 soft starter features Schneider Electric Torque Control System (TCS), ensuring that motor can start and stop as smooth as silk; the broad current range of 17A - 1200A is suitable for all requirements of low-voltage motor; the two voltage levels of 380V and 690V may satisfy different voltage requirements; DNV certification ensures its consistency with variable speed drives.



## 典型应用和方案

### Typical applications and solutions

#### 变频器在船舶艏尾侧推的应用

##### Applications of variable speed drive for bow-stern propulsion

船舶电力推进是船舶推进技术的一个新的革命，施耐德电气在船舶的艏尾侧推上具有广泛的成功应用。采用施耐德电气变频器的电力推进具有突出的优势：

Ship electrical propulsion is a revolution of ship propulsion technology. Schneider Electric has extensive and successful applications in terms of bow-stern propulsion technologies in ships. It adopts electric propulsion of variable speed drive featuring the following outstanding advantages:

- 改变了传统的柴油推进结构方式，省去了齿轮箱的机械结构，提高了系统的可靠性和传动的效率
  - 采用变频器结合定矩桨的方式提高了系统的可靠性，结构简单，操作更加方便灵活，降低故障率，方便维护
  - 变频器的无极调速使调速的范围可在零速与额定转速之间进行调整，加速快、制动距离短
  - 采用变频器降低起动电流，抑制对电网的冲击
- Change of traditional diesel propulsion; elimination of mechanical structure of gear box; improvement of system reliability and transmission efficiency
- Improvement of system reliability by adopting the method of combining variable speed drive and fixed pitch blade; simple structure; convenient and flexible operation; reduction of failure rate; and easy maintenance
- Stepless speed adjustment of variable speed drive ranges from zero speed to rated speed; quick acceleration and short braking distance
- Reduction of starting current and suppression of impact on the electrical network by adopting variable speed drive

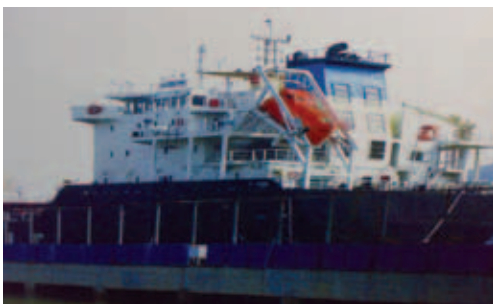
#### 变频器和软起动器在船舶货油泵的应用

##### Applications of variable speed drive and soft starter for cargo oil pumps in ships

大型原油、成品油轮、加油船都配有货油泵装卸系统，早期的货油泵系统在起动初期控制系统总是发生跳闸，主要是由于电机在起动的过程中起动电流过大所致。施耐德电气变频器和软起动器在货油泵中的应用具有如下的优势：

All large-scale crude oil tankers, product oil tankers and fuel ships are equipped with handling system of cargo oil pumps. Control systems of early cargo oil pump systems suffer frequent trips during the initial stages of the starting mostly due to excessive starting current of motor in the starting process. Applications of Schneider Electric variable speed drives and soft starters in cargo oil pumps have the following advantages:

- 极大的降低起动电流，与直接起动的7倍额定电流相比，变频器以额定电流起动，降低了对电网的冲击
- 在限制起动电流的同时，降低了冲击转矩，可延长机械设备的使用寿命
- 货油泵多为螺杆泵或齿轮泵，而非传统的离心泵类负载，因此需要采用具有高的过力矩能力的ATV71变频器



- Significant reduction of starting current; compared with 7 times of rated current of direct starting, Schneider Electric variable speed drive starts with rated current, thereby reducing the impact on the electrical network
- The impulse torque has been reduced at the same time of limitation of starting current, thereby extending the life of machineries
- A majority of cargo oil pumps are screw pumps or gear pumps other than non-traditional centrifugal pump load, therefore, ATV71 variable speed drive with high over torque capabilities are required

### 变频器在海洋钻井平台中的应用

#### Applications of variable speed drive in offshore oil drilling platforms

当前电潜泵在海洋平台中得到广泛的应用，传统的全压工频工作存在诸多的弊端如工艺上出现抽空、烧泵等事故；工频起动对电网的冲击大、机械设备维修费用高；由于地下情况的不确定性，无法保证泵处于最佳的工作点，因此效率低下。采用施耐德电气变频器使得以上的问题得到完全的解决：

Currently, submersible electrical pump has been widely used in offshore oil drilling platforms. Traditional full-voltage and normal power frequency works suffer from many disadvantages, such as faults of pump down, pump burning, etc. Normal power frequency starting has great impact on electrical network and gives rise to high maintenance costs. And it does not guarantee that the pump remains at the optimal operating point due to uncertainties under the ground, thereby causing low efficiency. The above problems can be solved completely by adopting Schneider Electric variable speed drive:

- 潜油泵配套变频器实现电机的软起动，降低电网和机械的冲击
- 变频器的输出频率可以根据井底的油压高低而自动调整，避免了诸如抽空等工艺上的问题
- 潜油泵的电压等级通常为1140V-2400V，采用低压变频器驱动高压潜油泵的“高-低-高”方案将大大的节省初期投入，并且具有高稳定性、易维护的特点
- 变频输出避免了工频运行造成的能量浪费
- 采用IP54防护等级的柜式变频器可以抵御海洋应用的恶劣环境
- Submersible pump matching variable speed drive can realize soft starting of motor, thereby reducing impact on the electrical network and machineries
- Output frequency of variable speed drive can be adjusted automatically according to oil pressure at the bottom of the well, thereby avoiding problems such as pump down, etc.
- Voltage levels of submersible electrical pumps are usually 1140V-2400V. The “high - low - high” scheme with low voltage variable speed drive driving high voltage submersible pump will economize initial investment significantly and has high stability and easy-to-maintain features
- Variable frequency output can prevent from energy waste caused by normal power frequency operation
- Adoption of IP54 cabinet type variable speed drive can withstand severe environment of marine applications





## 马达起动与保护解决方案

## Motor starting and protection solutions

世界上最大的接触器、断路器……生产厂家，产品规格、档次多而全。6-2750A交直流接触器。

World's largest manufacturer of contactor, circuit breakers..., providing full and complete range of products, including AC & DC contactors from 6A to 2750A.

### 选型时可参照样本

### The following are a few examples for model selection.

#### ● TeSys T电动机管理系统

TeSys T是一种电动机管理系统，为单相或3相恒速交流电动机提供电动机保护、电动机参数测量、监视以及与现场总线通信的功能，电动机最大电流可达810A。

#### ● TeSys T motor management system

TeSys T is an advanced motor management system which could provide protection, measurement, monitoring and communication with field bus to the motor up to 810A (Ie).

#### ○ 基本保护和监测功能

防止热过载，通过PTC探针的电动机热保护，防止接地故障，防止相不平衡与缺相，防止起动时间过长和电动机堵转，负荷波动监测，相序监测。

#### ○ Basic protection and monitoring functions

Thermal overload protection; Motor temperature protection by probes; Earth fault protection; Phase imbalance and loss protection; Long start protection and jam protection; Load variation monitoring; Phase sequence monitoring; etc.

#### ○ 高级保护和监测功能（扩展模块）

过/欠电压保护和测量，过/欠功率保护和测量，基于功率因数的保护和测量，甩负荷。

#### ○ Advanced protection and monitoring functions (with expansion module)

Over/under voltage protection & measurement; Over/under power protection & measurement; Protection & measurement on power factor; Load shedding.

#### ○ 通信功能

Modbus, Profibus DP, DeviceNet, CANopen, 以太网。

#### ○ Communication

Modbus, Profibus DP, DeviceNet, CANopen, Ethernet.

#### ○ 统计与诊断功能

保护的历史数据，电动机操作的历史数据，各种类型故障的历史数据，诊断报告。

#### ○ Statistics & fault management

Protection histories; Motor operation histories; Every kind of fault histories; Diagnostic report.

#### ● LC系列接触器

LC系列：最大容量AC1可达2750A，AC3可达1800A，可满足所有功能要求，可按用户要求的配置定制(如需要常闭主触点等特殊应用场合)。

#### ● Model LC contactors

LC series: The maximum capacity is 2750A for AC1 and 1800A for AC3. These contactors can meet all functional requirements and be customized according to customer needs (such as for special occasions in need of NC contacts).

#### ● LR系列热继电器

为了延长电机寿命和增强运行的可靠性，选择合适的热保护非常重要，这样可以防止电机运行时异常发热，同时确保设备运转的最大的连续性，避免不必要的停机。

#### ● Model LR thermal relay

To extend the service life of motors and improve operation reliability, it is important to select proper thermal protection so as to prevent abnormal heating, ensure maximum device operation continuity, and avoid unnecessary downtime.

LRD/LR9D/LR9F系列：2.6-1000A的常规热继电器，3相全保护。

LRD/LR9D/LR9F series: 2.6-1000A normal thermal relay with full three-phase protection.





LR97/LT47系列：通过定时操作特性而不是发热特性实施对电动机的保护，特别适用于需要频繁启动和反接制动以及启动时堵转时间较长的场合。可实现缺相保护，堵转保护和机械搬振动保护。保护不受环境温度的影响。

LR97/LT47 series: The motors are protected based on timed operation characteristics instead of heating characteristics. They are especially suitable for applications requiring frequent starts and plug braking and those with long stall time during starting. They also provide protection against phase failure, stalling, mechanical vibration and ambient temperature.



● GV2/GV3系列  
最大容量83A，具有隔离，短路保护、电机热保护功能，可以用于直接控制电动机。

● GV2/GV3 series  
With a maximum capacity of 83A, they provide isolation, short circuit protection and motor thermal protection, and can be used to directly control the motors.



● C65系列  
1-4极，最大容量63A，用于控制回路的隔离和短路保护。

● C65 series  
With 1 to 4 poles and a maximum capacity of 63A, these products are used for circuit isolation control and short circuit protection.

● NS/NSE/EZD系列  
最大容量可达1600A，满足所有功能需求。

● NS/NSE/EZD series  
Meet all functional requirements with a maximum capacity of 1600A.

## 特殊继电器

### RM4系列相序、缺相和相不平衡检测继电器

严重相位不平衡和缺相可能造成电机或变频器的损坏。维修后的相序错误造成运行方向相反也可能造成设备伤害。

### RM4系列电压检测继电器

电压不足会造成起重力矩的大幅下降和运行电流上升。电压过高会损坏很多重要设备。

### 特点

- 高的电气和机械寿命
- 高的绝缘等级，H级
- 低功耗，例如，接触器的直流线圈可直接连接PLC输出点
- 结构紧凑，安装尺寸小

## Special relays

### RM4 series relays for the detection of phase sequence, phase failure and unbalance

Serious phase unbalance and phase failure might cause damage to the motor or the converter.

Reverse running direction due to wrong phase sequence after repair might also lead to equipment damage.

### RM4 series voltage detection relays

Under-voltage leads to drastic decrease of lifting torque and increase of operation current. Over-voltage, in the meanwhile, causes damage to many critical devices.

### Features

- Long electrical and mechanical lifetime
- High insulation class (Class H)
- Low power consumption (E.g., the DC coils of the contactor can be connected directly to the PLC outputs)
- Compact structure and small installation size



## 传感器元件

### 压力检测及控制

Nautilus系列机电式和电子式的压力传感器供用户选择。最大量程为600bar，分为可调压差和固定压差两种方式。

模拟量输出的信号类型为：4-20mA/0-10V，硬件本身具有抗6倍过压能力，避免水锤带来的损害。

#### 特点

- 精确度高，信号漂移小
- 操作简单易学
- 抗水锤与过压冲击能力强
- 自诊断功能
- 强大保护功能，短路、极性反接、过载、接线错误等
- 等等

### 其他限位开关和接近开关

通用的和专用的Osi灵感系列限位开关，接近开关和光电传感器，可满足用户的各种应用需求

- 使用方便，操作和维护简单
- 为用户制造更加简单，更具智能化的产品，改善其使用性能
- 系列齐全，有效的选型
- 精确度高
- 高度可靠的性能

## Sensors

### Pressure detection and control

Nautilus series electromechanical and electronic pressure sensors have a maximum measurement range of 600bar. They work either in adjustable differential pressure mode or in fixed differential pressure mode.

The analogue output signals are 4-20mA/0-10V. The device can tolerate an over-pressure equal to 6 times of normal pressure and avoid damage caused by water hammer.

#### Features

- High precision and small signal drift
- Simple and easy-to-learn operation
- Resist water hammer and over-voltage impact
- Self-diagnosis
- Powerful protections against short circuit, reverse polarity, overload and wrong wiring
- etc

### Other limit switches and proximity switches

Universal and dedicated Osi series limit switches, proximity switches and photoelectric sensors meet different application requirements.

- Easy to use, operate and maintain
- Produce simpler and more intelligent products for the users for better performance
- Complete series for better selection
- High precision
- High reliability



## 控制及信号单元

规格齐全，品种多样。无论在整体系统设计还是模块化系统设计，都为您提供完美的选择。主要有

- 塑料式，金属式，直径：Ø16，Ø22，Ø30
- 按钮，带灯按钮，指示灯，带灯的发光体为：LED或白炽灯
- 选择开关 - 有 / 无钥匙，2位，3位等
- 急停按钮
- 等等

### 主要特点

- 基于人体工程学设计
- 颜色鲜艳，明亮
- 高防护等级，高寿命，有抗电击保护
- 模块化设计，灵活性好
- 结构紧凑



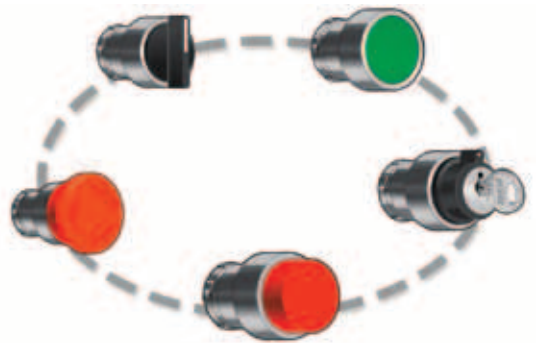
## Control and signal units

A complete range of specification and models are provided. You can make perfect selection with the overall and modular system design. The main types are listed below

- Plastic type, metal type, with a diameter of Ø16, Ø22 or Ø30
- Button, button with light, indicator light, using LED or incandescent lamp as light source
- Selector switch - with / without keys, 2-position or 3-position
- Emergency stop button
- etc

### Main features

- Designed based on ergonomics
- Bright color
- High protection degree, long service life, with protection against electric shock
- Modular design and good flexibility
- Compact structure



LED：施耐德电气采用专利技术，100,000小时的使用寿命，内部具有保护功能，较小的电流消耗。

LED: With patented technology of Schneider Electric, these products have a service life of 100,000 hours and internal protection. The current consumption is small.



## 小型自动化元器件

小型自动化元器件与施耐德电气公司的其他产品配合在一起，以全范围的产品和先进的技术解决方案，提供完美的电气控制，为企业和设备带来附加值。

### 包括

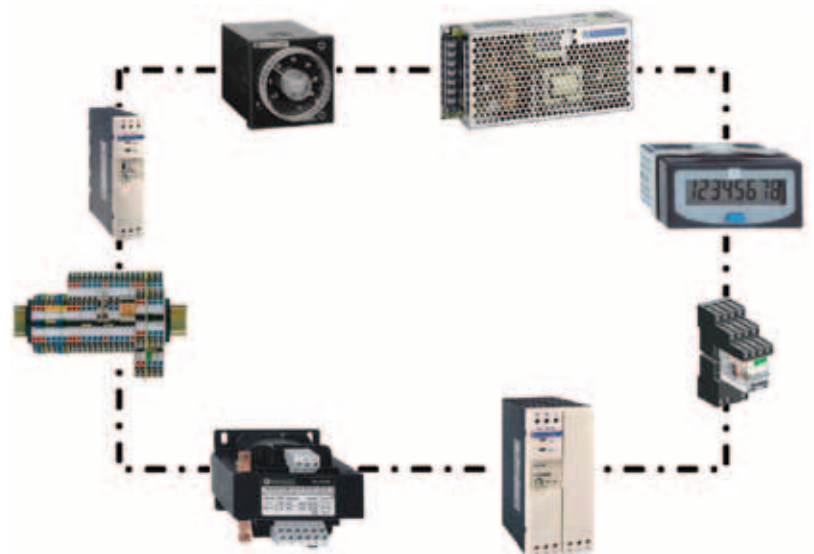
- Phaseo开关电源及隔离变压器
- Zelio Relay中间继电器
- Zelio Time时间继电器
- Zelio Count计数器
- Zelio Control控制和测量继电器
- Telefast预接线系统
- 等等

## Simple automation components

Together with other Schneider Electric products, simple automation components provide complete range of offers and technical solutions for perfect electrical control, and add value to equipments and enterprises.

### These include

- Phaseo switching power supply and isolating transformer
- Zelio intermediate relay
- Zelio time relay
- Zelio counter
- Zelio control and measurement circuit
- Telefast pre-wiring system
- etc





## 工业机柜

采用环保材质和工艺及人体工程学设计，表面防锈喷涂处理并配置标准手柄锁，具备IP66防护等级和IK10抗冲击等级，多种款式及各种附件可供选择，同时提供即购即用的客户导向服务，包括开孔加工，颜色可选，特殊尺寸等。

### 主要

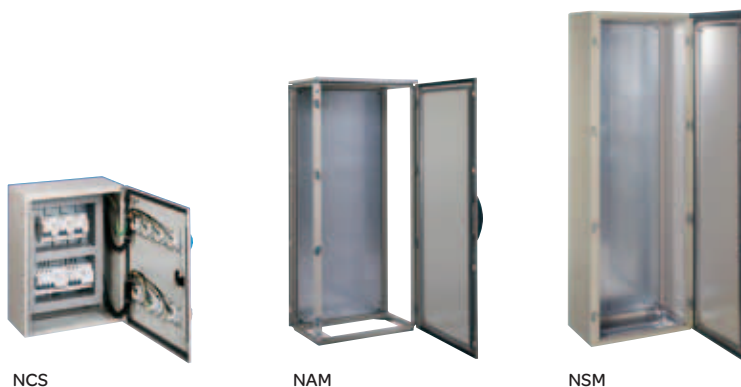
- NCS 小型封闭式多功能控制箱（最大尺寸：1000 × 800 × 300mm）
- NAM 大型整体落地式控制柜（最大尺寸：2000 × 1600 × 400mm）
- NSM 大型组合式拼装式控制柜（最大尺寸：2200 × 1200 × 600mm）

## Industrial cabinet

The industrial cabinets are made of environmental materials and are designed according to ergonomic principles. The surface is painted with antirust materials and standard handle lock is equipped. They conform to protection degree IP 66 and anti-shock degree IK 10. A wide range of models and accessories are provided for the users to make selection. Customer-oriented services, including hole-drilling, processing, customized color and size, are also provided to enable the customers to use the products immediately after purchase.

### Main models

- NCS small sealed multifunctional control box (maximum size: 1000 × 800 × 300mm)
- NAM large floor-standing integral control box (maximum size: 2000 × 1600 × 400mm)
- NSM large modular control box (maximum size: 2200 × 1200 × 600mm)



NCS

NAM

NSM



## 船舶自动化与控制方案

### Ship Automation and Control

#### 自动电站管理系统 (PMS)

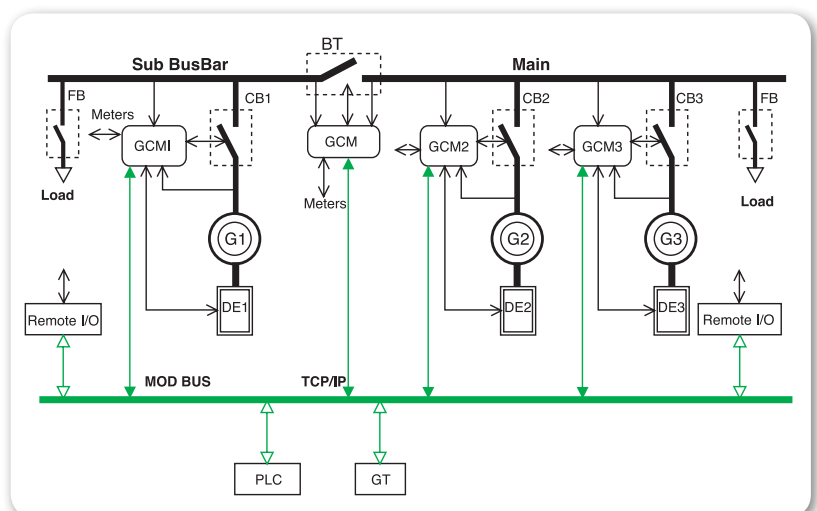
#### Power Management System

为了更有效的操作和管理，绝大多数船舶都会使用自动电站管理系统(PMS)；随着船电技术的不断进步和广泛应用，现代船舶的自动化程度越来越高，对船舶自动电站系统也提出了更高的要求

- 更完善的功能
- 根据船舶和客户的具体情况定制更优化的方案
- 人性化的操作，更符合客户的使用习惯
- 维护更简便

For more efficient operating performance and management, most of modern vessels are using "Power Management System". Along with the unceasing progress and extensive application of marine electrical technology, the modern vessels naturally have higher requirements for the power management system

- More operative functions
- To propose optimized system solution customized with specification and different requests of customers
- User-friendly operation, to meet customers' using habit better
- Easier and user-friendly maintenance



## 自动电站管理系统

PMS系统在交互系统中对几个发电机组能够执行分布式控制。

### PMS系统主要提供如下功能

- 发电机运行模式
  - 自动
  - 半自动
  - 手动
- 基于负载和电流的自动启动 / 停止柴油发电机组
  - 传送PMS启动/停止命令
  - 需要停止运行中的发电机组时安全启动备用发电机组
  - 在发电机组故障时传送PMS启动命令
- 失电保护功能
  - 汇流排失电检测
  - 失电启动顺序 (DG启动优先权)
- 频率控制
  - 频率控制的目标是用于保持DG发电机组的额定频率
- 负荷分配
  - 对称负荷分配
  - 非对称负荷分配
- 重载询问
  - 当发生了重型负载请求时，系统将检查并确认为重载负载提供有条件的连接
- 柴油发电机报警与状态检测

## Power Management System (PMS)

The PMS system is able to carry out distributed control of several generator sets within the interactive system.

### The PMS provides the following main functionality

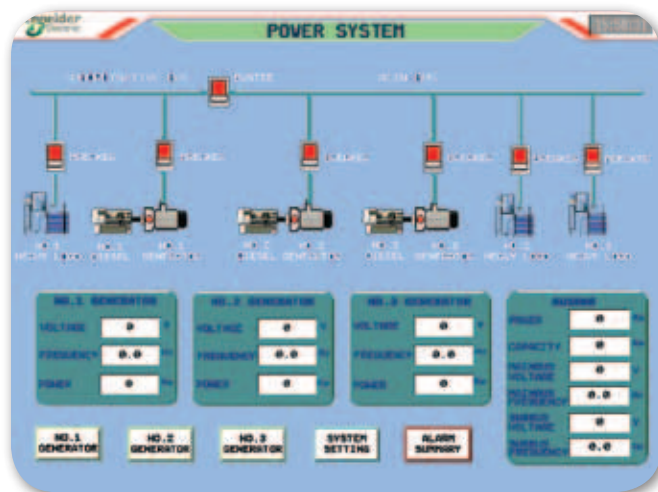
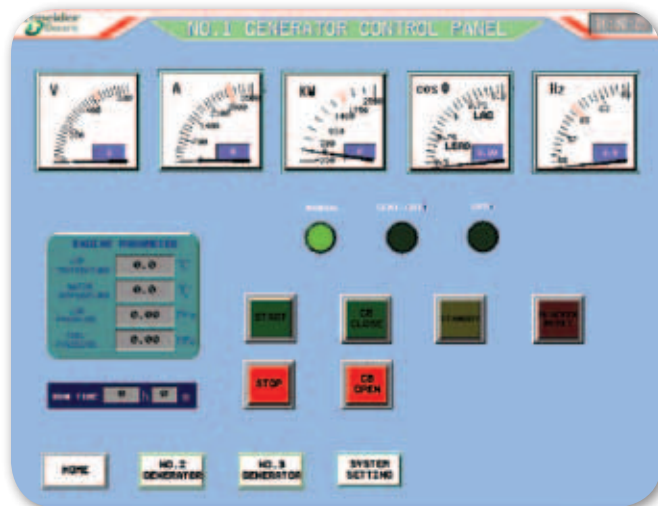
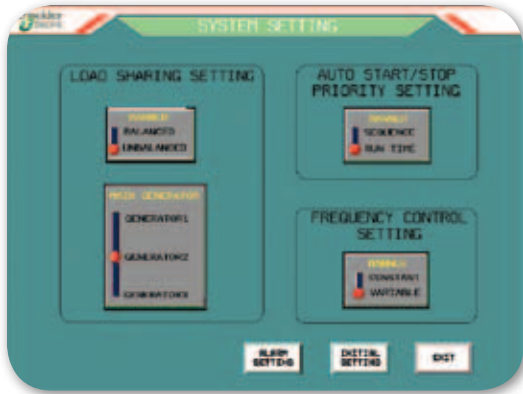
- DG operating modes
  - Automatic
  - Semi-auto
  - Manual
- Load and current dependent auto start/stop of diesel-generator sets
  - Transmission of PMS start/stop commands
  - Safety start of stand-by generator sets due to expected stop of a running generator set
  - Transfer of PMS start command in case of failed engagement of the generator set
- Blackout function
  - Dead busbar detection
  - Blackout start sequence (DG start priority)
- Frequency control
  - The target for the frequency control is for maintaining the nominal frequency of the DG sets
- Load sharing
  - symmetrical load sharing
  - Asymmetrical load sharing
- Heavy load request
  - When requested by a heavy consumer, system checks and confirms for conditional connection of heavy consumers
- Diesel generator alarm and status detection



# 施耐德电气解决方案 Schneider Electric Solution

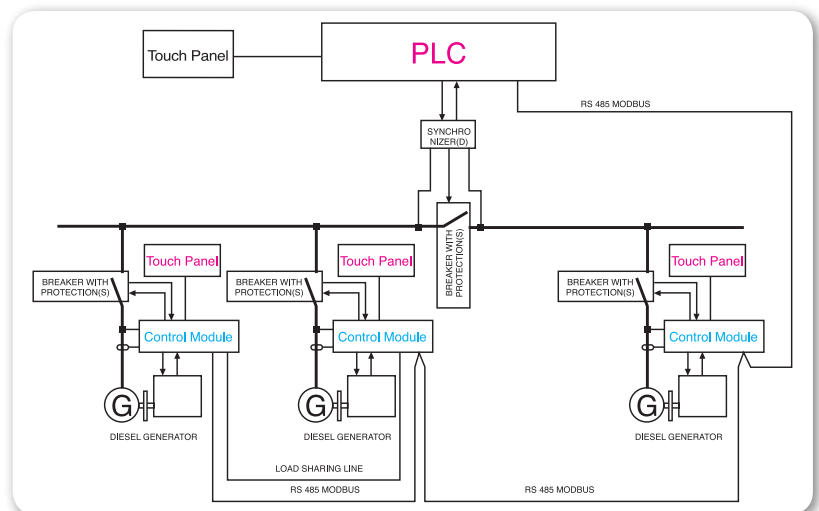
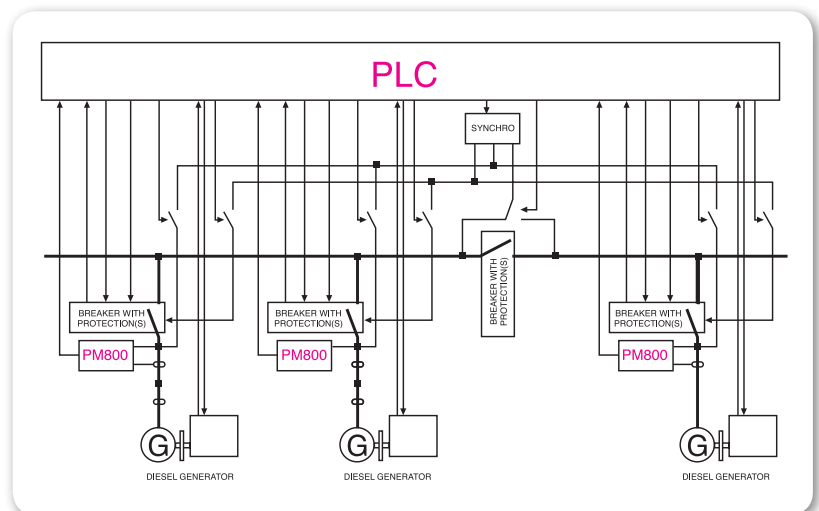
## 船舶电站管理系统特点

- 功能丰富，可根据客户需求灵活定制优化的系统解决方案
- 配置灵活，安装容易，人性化的操作面板和界面，使得使用和维护更简单
- 采用工业以太网总线，所有设备均可分布于各个舱室，且十分方便与其他系统通信
- 易扩展，系统升级、诊断可远程实现
- 强大的抗干扰性保护，使系统可靠性增强，能适应恶劣环境下正常工作
- 触摸屏单元用于屏幕图像显示、控制及参数设定
- 模拟仪表或趋势图显示各通道的实际状态
- 时实的报警列表及历史查询



## Features of ship power station management system

- Rich functions and system solutions that can be customized and optimized according to customer needs
- Flexible configuration, simple installation, intuitive operation panels and interface for easy use and maintenance
- Industrial Ethernet bus is equipped. All devices can be fixed in different cabins and communicate easily with other systems.
- Extensible, remote system upgrading and diagnosis
- Powerful protection against disturbance for improved system reliability and smooth operation in tough environment
- Touch screen units for image display, control and parameter setting
- Simulation instrument or trend charts display actual conditions of different channels
- Real-time alarm list and history inquiry





## 船舶电站管理系统主要产品介绍

### Description of main products used in ship power station management system



#### 6种屏幕尺寸

小型 (3.8"), XBT GT1000系列

中型 (5.7"), XBT GT2000系列

大型 (7.5", 10.4", 12.1", 15"), XBT GT4000/5000/6000/7000

#### 6 screen sizes

Small (3.8"), XBT GT1000 series

Medium (5.7"), XBT GT2000 series

Large (7.5", 10.4", 12.1", 15"), XBT GT4000/5000/6000/7000

#### 4种功能级别

● 优化型: XBT GT, 1 Utility端口 (Mini-Din 或 USB) + 串行端口

● 低端型: XBT GT优化型 + CF插槽

● 标准型: XBT GT低端型 + 以太网端口

● 高端型: XBT GT标准型 + 多媒体端口

#### 4 function models

● Optimal: XBT GT, 1 Utility port (Mini-Din or USB) + serial port

● Low-end: XBT GT Optimal + CF slot

● Standard: XBT GT Low-end + Ethernet port

● High-end: XBT GT Standard + Multimedia port



#### 可编程逻辑控制器

产品范围广泛, 适用于船舶自动化应用。

#### Programmable logic controllers

Used on a wide range of specialized platforms and ideal for ship automation applications.



#### 智能分布式I/O

提供设备集成, 以及通过许多现场总线接口进行连接。

#### Intelligent distributed I/O

Device integration and connectivity via many field bus interfaces.



## 电能监测装置

### Power monitoring

#### 电力参数测量仪PM800系列

#### Electrical parameter meter PM800 series

电力参数测量PM800系列是高性能的监测仪表，在单个96x96mm的装置中，可以提供监测电气设备所需的各种测量功能，它具有易读数的LCD大显示屏，可以同时监测三相和中性线。显示屏具有抗反光和刮擦的特性，界面直观，带有自导功能的菜单。独特的白色底光和大字体，即使是特殊的光线和视角，也具有易读性。

PM800系列的基本配置中，有标准的RS485通信接口、1个数字输入、1个数字输出、THD和报警功能。除此之外，PM820和PM850还提供可定制的记录及单次谐波的电流和电压值。PM850是第一个提供波形捕捉功能的表计。

PM 800 series for the measurement of electrical parameters are high-performance monitoring instrument. They provide all necessary measurement functions for monitoring electrical equipment in a single 96x96mm device. A large display screen that can be read easily is equipped for simultaneous monitoring of three phases and neutral line. The display screen resists reflection and abrasion. The intuitive interface contains menus with instructions. Unique white background color and big fonts facilitate easy reading even in special lighting conditions and when viewed from a special angle.

The basic functions of PM800 series include standard RS485 communication interface, one digital input, one digital output, THD and alarming function. In addition, PM820 and PM850 have customized records and display current and voltage values of a single harmonic. PM850 is the first of its kind to provide waveform acquisition function.

#### PM810/820/850元件编号

#### Number of PM810/820/850 component

#### Merlin Gerin品牌 Merlin Gerin grand

PM810电力参数测量仪，带THD，报警、I/O PM810 electrical parameter instrument, with THD, alarm and I/O	PM810MG
PM820电力参数测量仪，带谐波，报警、I/O 80kb的记录 PM810 electrical parameter instrument, with harmonic, alarm, I/O, and 80kb records	PM820MG
PM850电力参数测量仪，带谐波，报警、I/O 800kb的记录，波形捕捉 PM810 electrical parameter instrument, with harmonic, alarm, I/O, 80k0b records, and waveform acquisition	PM850MG
<b>选件和附件 Options and accessories</b>	
2个继电器输出，2个数字输入 2 relay outputs and 2 digital inputs	PM8M22
2个继电器输出，6个数字输入 2 relay outputs and 6 digital inputs	PM8M28
2个继电器输出，2个数字输入，2个模拟输出，2个模拟输入 2 relay outputs, 2 digital inputs, 2 analogue inputs and 2 analogue inputs	PM8M2222
PM810记录、非易失性时钟和谐波模块 PM 810 records, non-volatile time clock and harmonic module	PM810 LOG



## 视频监控系统 CCTV Close-circuit television

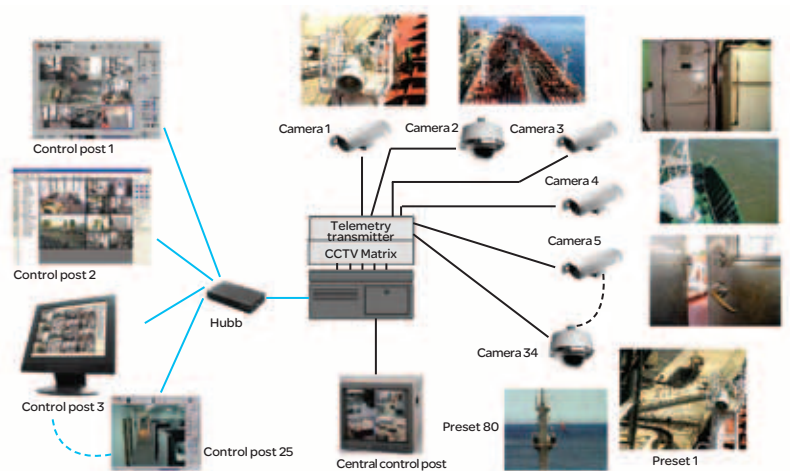
对于FPSO和海上平台，为了更好的保障人身安全和设备的可靠运行，施耐德电气提供了视频监控系统，并从2005年开始，成功应用于西班牙海洋工程中。

For FPSO and offshore platform, to ensure the workers' safety and reliably running of varibale equipments, Schenider Electric supply Close-circuit television system and this system has been used in Spain Offshores successfully from 2005.

- 专注于视频监控系统CCTV
- 安防领域的领导者
- 强大的研发部门
- 压缩技术
- 数码影像记录
- 软件：直观、易用

- Specialized in CCTV systems
- Leader in the security Market
- High R&D department in
- Compression technologies
- Digital video recorders
- Software: intuitive, easy use

## 系统结构 The architecture





## 解决方案

- 兼顾多点
- 实时监控船舶的所有关键设备
- 监控周围环境和所有的设施
- 保证船舶安全
- ……

所以，最终我们可以把多点集中监控起来。

## 安全

### 为什么我们能保证安全

- 所有时间都在记录
- 用户不仅可以实时看见船舶的实况，还可以回看一个月前同一时间的状况
- 每个有以太网连接的地方都可以查看船舶监控情况
- 多个用户级别
  - 管理员
  - 超级用户
  - 用户
- 如果网络被切断，记录设备仍然会记录所有信息，所以我们不会丢失任何信息
- 如果影像记录设备DVR和摄像头之间的线缆被切断，DVR会发送警告给用户
- 可以集成成为闭路监控系统CCTV，ActiveEye等多个软件都可以帮助用户监控
- 可以把CCTV系统和其他系统集成，例如
  - 门禁控制
  - 暖通空调控制HVAC
  - 照明控制Lighting
  - ……

可以在同一个监控软件中看见所有系统的信息



## The solution

- Several points to consider
- See in real time all the maneuvers of the ship
- Control the perimeter and all the machinery
- Give security
- …

So finally we could include all this points in only one.

## Security

### Why we give security

- We are recording every time
- The user could see the what's going on in his ship in real time, but also what was going on one month before, for example, all at the same time
- Every place where they are an ethernet connection is possible to view what's going on
- Several user levels
  - Administrator
  - Supervisor
  - User
- If the net will be cut, the recorder record all the information, so we NEVER lose information
- If the cabling between the DVR and the camera will be cut, the DVR send an alarm to the user
- Possibility to integrate in the CCTV system, several software, like ActiveEye, who can help the guards
- Possibility to integrate the CCTV system in other systems like
  - Access control
  - HVAC
  - Lighting
  - …

And see all of them in the same monitoring software.



## 参考项目案例 References



### 部分项目案例 Some Project References

船厂 Shipyard	船东 Owner	船号 Vessel / Hull NO.	年份 Year	船级社 Class	提供的设备/艘 Equipment Supplied (per Shipset)
Yang Zi Jiang Shipyard 扬子江造船厂	Zeppenfeld, Germany	2x1200TEU Geared Reefer Container (3rd & 4th shipsets) 2x1200TEU 冷藏集装箱船(3#, 4#)	2004	BV	1x Main Switchboard 主配电盘 1x Emergency Switchboard 应急配电盘 1Lot Individual / Group Starter Panel 1套 单个 / 组合启动屏 1Lot Power / Lighting Distribution Boards 1套 动力/照明配电盘 1x Battery Charging & Discharging Board 电池充电和放电板 1x Shore Connection Box 岸电箱 1x Test Panel 电工试验板 1Lot Emergency Switch OFF Panel 1套 应急停止屏 1Lot Spare Parts 1套 备用件 1x Engine Control Console 集控台 1x Bridge Control Console 驾控台 2x Wing Consoles (Port & Stbd) 两翼控制台 (Port & Stbd) 2x Cold Chamber Alarm 冷藏报警系统 1x Hospital Call System 医院呼叫系统 1x Luminuous Call Column system 报警灯柱 1x General Alarm system 通用报警系统 1x Nautical Alarm system 航海报警系统 1x Watch alarm system 观测报警系统 1x Alarm Monitoring System 报警监控系统 1x Reefer container monitor Sys 冷藏集装箱监控系统
Yang Zi Jiang Shipyard 扬子江造船厂	Peter Doehle Germany	8 x 1574 Teu Container Vessel 8 x 1574 Teu 集装箱船	2004	GL	1x Main Switchboard 主配电盘 1x Emergency Switchboard 应急配电盘 1x Local GSP and Individual Starter Panel 组合启动屏和单体启动器 1x Power / Lighting Distribution Boards 动力 / 照明配电盘 1x Battery Charging & Discharging Board 电池充电放电板 1x Shore Connection Box 岸电箱 1x Test panel 电工试验板



船厂 Shipyard	船东 Owner	船号 Vessel / Hull NO.	年份 Year	船级社 Class	提供的设备/艘 Equipment Supplied (per Shipset)
					1x Emergency Switch OFF Panel 应急停止屏 1Lot Spare Parts 1套 备件
Bohai Shipyard 渤海造船厂	Nanjing Changjiang Oil Transportation 南京长江油运	1x 46,000 dwt Oil Tanker 1x 46,000 dwt 油轮	2004	CCS	1x Main Switchboard 主配电盘 1x Emergency Switchboard 应急配电盘 1Lot Spares 1套 备件
Dalian Shipyard 大连造船厂	Nanjing Changjiang Oil Transportation 南京长江油运	2x 110,000 dwt Oil tanker 2x 110,000 dwt 油轮	2004	CCS	1x Main Switchboard 主配电盘 1x Emergency Switchboard 应急配电盘 1x No.1&No.2 Group Starter Panel 第1与第2组启动屏
ChengXi Shipyard 澄西造船厂	Parakou	2x 53,000 dwt Handymax Double Hull Bulk Carrier (9 & 10th) 2x 53,000 dwt 双船壳散货船(9&10th)	2004	DNV	1x Main Switchboard 主配电盘 1x Emergency Switchboard 应急配电盘 1Lot Individual / Group Starter Panel / PB Boxes 1套 单个 / 组合启动屏 / PB箱 1Lot Power / Lighting Distribution Boards 1套 动力 / 照明配电板 1x Battery Charging & Discharging Board 电池充电放电板 1x Shore Connection Box 岸电箱 1x Test Panel 电工试验板
Bohai Shipyard 渤海造船厂	Nanjing Changjiang Oil Transportation 南京长江油运	2x 46,000 dwt Oil Tanker 2x 46,000 dwt 油轮	2005	CCS	1x Main Switchboard 主配电盘 1x Emergency Switchboard 应急配电盘 1Lot Spares 1套 备件
Hudong Zhonghua Shipyard 沪东中华造船厂	Wagenborg Shipping B.V.	10 x 17,300 dwt MPC 10 x 17,300 dwt 多用途货轮	2005	LRS	1x Main Switchboard 主配电盘 1x Emergency Switchboard 应急配电盘 1Lot Local GSP and Individual Starter Panel 1套 组合启动屏和单体启动器 1Lot Power / Lighting Distribution Boards 1套 动力/照明配电盘 1x Battery Charging & Discharging Board 电池充电放电板 1x Shore Connection Box 岸电箱 1x Test panel 电工试验板 1Lot Spare Parts 1套 备件



## 参考项目案例 References



### 部分项目案例 Some Project References

船厂 Shipyard	船东 Owner	船号 Vessel / Hull NO.	年份 Year	船级社 Class	提供的设备/艘 Equipment Supplied (per Shipset)
ChengXi Shipyard 澄西造船厂	Canada	4 x 53,000 dwt Bulk Carrier (11 to 14th) 4 x 53,000 dwt 散货船	2005	BV	1x Main Switchboard 主配电盘 1x Emergency Switchboard 应急配电盘 1Lot Individual / Group Starter Panel / PB Boxes 1套 单个 / 组合启动屏 / PB箱 1Lot Power / Lighting Distribution Boards 1套 动力 / 照明配电盘 1x Battery Charging & Discharging Board 电池充电放电板 1x Shore Connection Box 岸电箱 1x Test Panel 电工试验板
Qin Dao 4808 Shipyard 青岛4808造船厂	Nordic Maritime	2 x 6500 dwt Oil Tanker 2 x 6500 dwt 油轮	2005	BV	1x Main Switchboard 主配电盘 1x Emergency Switchboard 应急配电盘 1Lot Individual Starter Panel 1套 单体启动器 1Lot Power / Lighting Distribution Boards 1套 动力/照明配电盘 1x Battery Charging & Discharging Board 电池充电放电板 1x Shore Connection Box 岸电箱 1x Test Panel 电工试验板
Hudong Zhonghua Shipyard 沪东中华造船厂	China Shipping 中海集团	4 x 8530 Teu Container Vessel 4 x 8530 Teu 集装箱船 H1381A / 82A / 83A / 84A	2005	GL&CCS	2x 3000 KVA Three-Phase Transformer, AFWF (BCV, 6600 / 460V, IP44, Impregnated Type) 3000 KVA三相变压器, 强风水冷却 (BCV, 6600/460V, IP44, 树脂浸渍式) 2x 4200 KVA Three-Phase Transformer, AN (BCV, 6600 / 460V, IP23, Impregnated Type) 4200 KVA三相变压器, 自然风冷却 (BCV, 6600 / 460V, IP23, 树脂浸渍式)
Yang Zi Jiang Shipyard 扬子江造船厂	Rickmers	2 x 1350 Teu Geared Reefer Container 2 x 1350 Teu 冷藏集装箱船	2005	BV	1x Main Switchboard 主配电盘 1x Emergency Switchboard 应急配电盘 1Lot Individual / Group Starter Panel 1套 单个 / 组合启动屏 1Lot Power / Lighting Distribution Boards 1套 动力/照明配电盘 1x Battery Charging & Discharging Board 电池充电放电板 1x Shore Connection Box 岸电箱 1x Test Panel 电工试验板 1Lot Emergency Switch OFF Panel



船厂 Shipyard	船东 Owner	船号 Vessel / Hull NO.	年份 Year	船级社 Class	提供的设备/艘 Equipment Supplied (per Shipset)
					1套 应急停止屏 1Lot Spare Parts 1套 备件 1x Engine Control Console 集控台 1x Bridge Control Console 驾控台 2x Wing Consoles (Port & Stbd) 两翼控制台 (Port & Stbd) 2x Cold Chamber Alarm 冷舱报警系统 1x Hospital Call System 医院呼叫系统 1x Luminuous Call Column system 报警灯柱 1x General Alarm system 通用报警系统 1x Nautical Alarm system 航海报警系统 1x Watch alarm system 观测报警系统 1x Alarm Monitoring System 报警监控系统 1x Reefer container monitor System 冷藏集装箱监控系统
Jinling Shipyard 金陵造船厂	Nanjing Changjiang Oil Transportation 南京长江油运	4 x 46,000 dwt Oil Tanker 4 x 46,000 dwt 油轮	2005	CCS	1x Main Switchboard 主配电盘 1x Emergency Switchboard 应急配电盘 1Lot Spares 1套 备件
Wuchang Shipyard 武昌造船厂	Dalian Maritime University 大连海事大学	Training ship 训练船	2005	CCS	1x Main Switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1x Auto-start module of emergency generator 应急发电机自启动模块 1x Portable power monitor system 便携式功率监控系统 1lot 1lot spare PLC used for PMS 1套 用于PMS的备用PLC
ShangHai Wai Gao Qiao Shipyard 上海外高桥造船厂	ConocoPhillips	PL19-3 300000 dwt FPSO 蓬莱19-3 300000 dwt FPSO	2005	DNV	1x FWD LV Main Switchboard 前部低压主配电盘 1x AFT LV Main Switchboard 后部低压主配电盘 1x Emergency Switchboard 应急配电盘 1x Galley & Laundry Switchboard 厨房配电盘



## 参考项目案例 References



### 部分项目案例 Some Project References

船厂 Shipyard	船东 Owner	船号 Vessel / Hull NO.	年份 Year	船级社 Class	提供的设备/艘 Equipment Supplied (per Shipset)
JiangNan Shipyard 江南造船厂	NanJing Oil Transportation, China 南京油运	4 x 297,000 DWT VLCC (1#--4#)	2006	CCS	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1 Lot Individual / group starter panel / PB boxes 单个 / 组合启动屏 / PB箱 1Lot Power / lighting distribution board 动力 / 照明配电盘 1x Shore connection box 岸电箱 1x Test panel 电工试验板 1x Battery charging & discharging board 电池充电和放电板 1 Lot Emergency switch off panel 应急停止屏 1x Engine control console 集控台 1x Bridge control console 架控台 1Lot spares 备件
HuaRun DaDong Ship Engineering 华润大东船务工程	Zhen Hua Port Machinery Co Ltd 振华港机	7,000 T Full Revolving Ocean Engineering Crane 7,000 T 全旋转式海洋起重船	2006	CCS	1x Main switchgear (6.3kV, 630A) 中压配电盘 (6.3kV, 630A) 1x PMS unit 电站管理系统 1x DC 110V source supply panel 直流110V供电板
Jinling Shipyard 金陵造船厂	EE Shipping, Sweden	2 x 11,300 DWT Ro-Ro vessel 2 x 11,300 DWT 滚装船	2006	LRS	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1Lot Individual / group starter panel 单个 / 组合启动屏 1Lot Power / lighting distribution boards 动力 / 照明配电盘 1x Battery charging & discharging board 电池充电和放电板 1x Shore connection box 岸电箱 1x Test panel 电工试验板 1Lot Spares 备件
Jiangsu Yangzijiang Shipyard 江苏扬子江造船厂	Rickmers	6 x 1,350 TEU Geared Reffer Container 6 x 1,350 TEU 带装卸冷藏集装箱船	2006	BV	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1 Lot Individual & group starter panel boxes 单个 / 组合启动屏 1Lot Power & lighting distribution boards 动力 / 照明配电盘



船厂 Shipyard	船东 Owner	船号 Vessel / Hull NO.	年份 Year	船级社 Class	提供的设备/艘 Equipment Supplied (per Shipset)
					1x Battery charging & discharging board 电池充电和放电板 1x Shore connection box 岸电箱 1x Test panel 电工试验板 1Lot Emergency switch off panel 应急停止屏 1Lot Spare parts 备件 1x Engine control console 集控台 1x Bridge control console 架控台 2x Wing consoles (port & stbd) 两翼控制台 (port & stbd) 2x Cold chamber alarm 冷藏报警系统 1x Hospital call system 医院呼叫系统 1x Luminuous call column system 报警灯柱 1x General alarm system 通用报警系统 1x Nautical alarm system 航海报警系统 1x Watch alarm system 观测报警系统 1x Alarm monitoring system 报警监控系统 1x Reefer container monitoring system 冷藏集装箱监控系统
Shanghai Edward Shipyard 上海爱德华造船厂	2x17,300 DWT MPC 2x17,300 DWT 多用途船		2006	CCS	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1Lot Individual starter panel 单个启动屏 1Lot Power / lighting distribution boards 动力/照明配电盘 1x Battery charging & discharging board 电池充电和放电板 1x Shore connection box 岸电箱 1x Test panel 电工试验板
ZheJiang Shipyard 浙江造船厂	Cosco: China Ocean Shipping Corporation	2x 5,900 DWT Asphalt Carrier	2006		1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1Lot Spares 备件



## 参考项目案例 References



### 部分项目案例 Some Project References

船厂 Shipyard	船东 Owner	船号 Vessel / Hull NO.	年份 Year	船级社 Class	提供的设备/艘 Equipment Supplied (per Shipset)
New Century Shipbuilding 新世纪造船厂	Hanseatic Germany	4 x 4250 TEU container vessels 4 x 4250 TEU 集装箱船	2006	GL	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1Lot Individual / group starter panel 单个 / 组合启动屏 1Lot Power / lighting distribution boards 动力 / 照明配电盘 1x Battery charging & discharging board 电池充电和放电板 1x Shore connection box 岸电箱 1x Test panel 电工试验板 1Lot Spares 备件
JiangSu RongSheng Shipyard 江苏熔盛造船厂	Golden Ocean	4 x 75,500 DWT Bulk Carrier 4 x 75,500 DWT 散装船	2006	DNV	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1Lot Individual / group starter panel / PB boxes 单个 / 组合启动屏 / PB箱 1Lot Power / lighting distribution boards 动力 / 照明配电盘 1x Battery charging & discharging board 电池充电和放电板 1x Shore connection box 岸电箱 1x Test panel 电工试验板 1Lot Spares 备件
JiangNan Shipyard 江南造船厂	Berhard Schuller	2 x 22,000 DWT LPG 2 x 22,000 DWT 液化石油气船	2007	GL	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1Lot Individual / group starter panel / PB boxes 单个 / 组合启动屏 / PB箱 1Lot Power / lighting distribution boards 动力 / 照明配电盘 1x Battery charging & discharging board 电池充电和放电板 1x Shore connection box 岸电箱 1x Test panel 电工试验板
NanTong Mingde Shipyard 南通明德	Herning Shipping	4 x 8,000 DWT Oil Tanker 4 x 8,000 DWT 油船	2006	BV	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘





船厂 Shipyard	船东 Owner	船号 Vessel / Hull NO.	年份 Year	船级社 Class	提供的设备/艘 Equipment Supplied (per Shipset)
造船厂					1Lot Individual / group starter panel / PB boxes 单个/组合启动屏 / PB箱 1Lot Power / lighting distribution boards 动力 / 照明配电盘 1x Battery charging & discharging board 电池充电和放电板 1x Shore connection box 岸电箱 1x Test panel 电工试验板 1Lot Spares 备件
WaiGaoQiao Shipyard 外高桥造船厂	Ocean Tanker	6 x 316,000 DWT Oil Tanker (1# - 6#) 6 x 316,000 DWT 油船 (1# - 6#)	2006	LRS	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1Lot Individual / group starter panel / PB boxes 单个/组合启动屏 / PB箱 1Lot Power / lighting distribution boards 动力 / 照明配电盘 1x Battery charging & discharging board 电池充电和放电板 1x Shore connection box 岸电箱 1x Test panel 电工试验板
Jiangsu Yangzijiang Shipyard 江苏扬子江造船厂	Seaspan	8 x 2500 TEU Container (1# - 8#) 8 x 2500 TEU 集装箱船 (1# - 8#)	2006	LRS	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1Lot Individual / group starter panel / PB boxes 单个 / 组合启动屏 / PB箱 1Lot Power / lighting distribution boards 动力 / 照明配电盘 1x Battery charging & discharging board 电池充电和放电板 1x Shore connection box 岸电箱 1x Test panel 电工试验板 1Lot Spares 备件
ChengXi Shipyard 澄西造船厂	Time Shipping	4 x 53000 DWT Handymax Double Hull Bulk Carrier (#22-25#) 4 x 53000 DWT Handymax 双壳散货船 (#22-25#)	2006	CCS	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1Lot Individual / group starter panel / PB boxes 单个 / 组合启动屏 / PB箱 1Lot Power / lighting distribution boards 动力 / 照明配电盘



## 参考项目案例 References



### 部分项目案例 Some Project References

船厂 Shipyard	船东 Owner	船号 Vessel / Hull NO.	年份 Year	船级社 Class	提供的设备/艘 Equipment Supplied (per Shipset)
					1x Battery charging & discharging board 电池充电和放电板 1x Shore connection box 岸电箱 1x Test panel 电工试验板
ChengXi Shipyard 澄西造船厂	Hongkong Parakou Shipping	10 x 53000 DWT Handymax Double Hull Bulk Carrier (#17-#21, #26-#30) 10 x 53000 DWT Handymax 双壳散货船 (#17-#21, #26-#30)	2006	DNV	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1Lot Individual / group starter panel / PB boxes 单个 / 组合启动屏 / PB箱 1Lot Power / lighting distribution boards 动力 / 照明配电盘 1x Battery charging & discharging board 电池充电和放电板 1x Shore connection box 岸电箱 1x Test panel 电工试验板
DaLian Shipyard 大连造船厂	Cosco Dalian	3 x 110,000 DWT Oil Tank 3 x 110,000 DWT 油船	2006	CCS	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1Lot Individual / group starter panel / PB boxes 单个 / 组合启动屏 1Lot Power / lighting distribution boards 动力 / 照明配电盘 1x Battery charging & discharging board 电池充电和放电板 1x Shore connection box 岸电箱 1x Test panel 电工试验板 1Lot Spares 备件
BoHai Shipyard 渤海造船厂	Nanjing Changjiang Oil Transportation	2 x 298,000 DWT VLCC	2006	CCS	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1Lot Spares 备件



船厂 Shipyard	船东 Owner	船号 Vessel / Hull NO.	年份 Year	船级社 Class	提供的设备/艘 Equipment Supplied (per Shipset)
Tianjin XinHe Shipyard 天津新河船厂	Switzerland shipowner	4 x 6500 DWT Bulk 4 x 6500 DWT 散装船	2006	DNV	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1Lot Individual / group starter panel / PB boxes 单个 / 组合启动屏 1Lot Power / lighting distribution boards 动力 / 照明配电盘 1x Battery charging & discharging board 电池充电和放电板 1x Shore connection box 岸电箱 1x Test panel 电工试验板 1Lot Spares 备件
Jiangmen Nan Yang Shipyard 江门南洋船厂	HongKong Pacific Basie Company	6x 32500 DWT Bulk Carrier 6x 32500 DWT 散装船	2006	GL	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1Lot Spares 备件
Ma Wei Shipyard 马尾船厂		1x 70M Platform Supply Ship 1x 70M 平台供应船	2006	ABS	1x Main switchboard 主配电盘 1x Emergency switchboard 应急配电盘 1Lot Individual / group starter panel / PB boxes 单个 / 组合启动屏 1Lot Power / lighting distribution boards 动力 / 照明配电盘 1x Battery charging & discharging board 电池充电和放电板 1x Shore connection box 岸电箱 1x Test panel 电工试验板 1 Lot Spares 备件 1x Alarm & Monitoring System 报警监测系统 1x Automation System 自动化系统

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