Marine

Whatever your marine environment, you need a partner you can trust!
As the global specialist in energy management and automation, we create connected technologies that …..
ensuring that everywhere, for everyone and at every moment.
We have an opportunity to co-create the future

More ELECTRIC
2x faster growth of electricity compared to energy demand by 2040

More DIGITIZED
20x more connected devices than connected people by 2020

More DECARBONIZED
82% of the economic potential of energy efficiency in buildings and more than half in industry remains untapped, and

More DECENTRALIZED
70% of new capacity additions will be in renewables by 2040
<table>
<thead>
<tr>
<th>Connected Products</th>
<th>Edge Control</th>
<th>End-to-end Cybersecurity</th>
<th>Cloud and/or On Premise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vigilohm IM20 IM400</td>
<td>Enerlin’X Com’X</td>
<td>Continuous Process</td>
<td>Modicon, Foxboro, Triconex</td>
</tr>
<tr>
<td>TeSys T, TeSys U and TeSys D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable Speed Drives</td>
<td></td>
<td>Power Monitoring Expert</td>
<td></td>
</tr>
<tr>
<td>UPS Galaxy / Smart</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masterpact MTZ Compact NS &amp; NSX</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCset / PIX</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfo, MV/LV Trihal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Okken / MB301</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Apps, Analytics & Services**
- Planning & Scheduling
- Operations Management
- Information Management
- Asset Management
- Operations Control
- Line & Unit Performance Optimization
- Supply, Demand, Sustainability

**Marine**
- Connected Products
- Edge Control
- End-to-end Cybersecurity
- Cloud and/or On Premise

**Food & Beverage**
- Connected Products
- Edge Control
- End-to-end Cybersecurity
- Cloud and/or On Premise

**Water & Wastewater**
- Connected Products
- Edge Control
- End-to-end Cybersecurity
- Cloud and/or On Premise

**Mining, Metals & Minerals**
- Connected Products
- Edge Control
- End-to-end Cybersecurity
- Cloud and/or On Premise

**Oil & Gas**
- Connected Products
- Edge Control
- End-to-end Cybersecurity
- Cloud and/or On Premise
Schneider Electric,
the global specialist in energy management and automation

€24.7 billion
FY 2016 revenues

~5%
of FY revenues devoted to R&D

41%
of FY revenues in new economies

44%
of FY revenues as Solutions

Four integrated and synergetic businesses
– FY 2016 revenues

<table>
<thead>
<tr>
<th>Business</th>
<th>FY 2016 Revenues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building</td>
<td>43%</td>
</tr>
<tr>
<td>IT</td>
<td>15%</td>
</tr>
<tr>
<td>Industry</td>
<td>22%</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>20%</td>
</tr>
</tbody>
</table>

Balanced geographies – FY 2016 revenues

- 28% North America
- 27% Western Europe
- 27% Asia Pacific
- 18% Rest of World

~5% of FY revenues devoted to R&D

41% of FY revenues in new economies

44% of FY revenues as Solutions
Schneider Electric Global Business In over 100 Countries

North America
- 33,700 Employees³
- 38 Factories

Western Europe
- 47,600 Employees³
- 92 Factories

Rest of the World
- 34,100 Employees³
- 38 Factories

Asia Pacific
- 61,500 Employees³ Including JV
- 77 Factories Including JV

1: Published figures in billion € restated to reflect country-market view;
2: Billion € pro-forma basis including LTM Sep 2014 revenue for Invensys
3: Including Invensys, excluding Delixi and Fuji

2003¹  2014²
North America
2003¹  2014²
Western Europe
2003¹  2014²
Rest of the World
2003¹  2014²
Asia Pacific

Confidential Property of Schneider Electric | Page 8
Schneider Electric Marine
A partner you can trust for all your applications!
With 90+ years of proven experience

We provide advanced and innovative products, solutions & services making your energy & operations Safe, Reliable, Efficient, Connected, Sustainable.
### Merchant Marine
- Passengers
  - Cruise Liners
  - Yachts
  - Ferries
- Bulk & General Cargo
- Container & Ro-Ro Vessels
- Tankers/LPG/LNG
- Special Vessels:
  - Dredgers
  - Research

### Navy
- Surface
  - Frigates, corvettes
  - Patrol ships
  - Aircraft carriers
  - Troop landing ships
- Submarines

### Offshore Marine
- Offshore Production
  - FPSO/FSO
  - FLNG/FSRU
- Offshore Drilling
  - Semi-submersibles
  - Drillships
  - Jackup
- Offshore support vessels
  - AHTS
  - PSV
WE ARE WHERE YOU ARE!  420+ Services Centers

6200+ Schneider Electric Field Services Representatives certified (FSR)

Major sea ports where Schneider Electric can execute Marine Services jobs (any port on request)
A large range of solutions

• LV & MV Electrical Distribution
• Ship Automation
• LV Drives & Motor Control (E.P. & Thrusters)
• Secure Power and Security
• Machinery protection & control
Main marine products overview

- MCset
- PIX
- MV Switchboards

- Trihal
- MV/LV Transformers

- MB301M
- Okken
- LV Switchboards

- Masterpact
- Compact
- ACB
- MCCB

- Tesys T
- LC1
- Contactors

- Acti9
- Miniature CBs

- Galaxy
- SMART
- UPS

- Altivar
- Drives

- M340
- Magelis
- PLC/HMI

- AccuSine PFV/PFV+
- Harmonics filtering

- SF, S3D, SBM, Linergy TR
- Enclosures / Terminals
1. Integrated Control Alarm Monitoring System
A fully integrated monitoring and control system which provides a unique platform to monitor and/or control all other sub-systems on board.

2. Power Monitoring System
Power monitoring system enables to monitor the power quality and all electricity parameters (voltage, current, power, energy, THD etc.) of ships generators and on board equipment in order to track energy consumption. It can support SEEMP plans in a Ships

3. Masterpact UR High Power LV Distribution
An unique solution to reduce the short-circuit current whenever high power is involved
- Safe: no blackouts and type-tested switchboard
- Compact: no MV/LV transformer
- OpEx optimization: easy installation and maintenance versus MV

4. MV Loop Distribution
Up to 30% Capex&Opex reduction with this Reliable & Energy Efficient Solution
- Reliable: energy supply redundancy
- Energy efficient: Power dissipation reduction
- Capex Optimization: Cable length reduction

5. MV Motor Control Centre
- Complete motor starting solution including soft starters
- Optimized footprint thanks to Sequential SmartStart
- Low maintenance cost (no rear access required)
- Thermal diagnosis system

6. Busways - LV Distribution
For Safe , Compact & Light Electrical Distribution
- Compact: No Bend Radius, High Power density
- Light: up to 30% lighter than cables
- CapEx reduction: Shorter installation time
- Safe: low combustible load and halogen free. Type Tested

7. Engine Room Cooling solution
A solution to optimize energy efficiency up to 40% for engine room fans and by more than 70% for sea water pumps
- Significant reduction of CO2 emissions
- Technical support/Spare parts is provided to the customer in more 100 countries by Schneider Electric

8. Scrubber solution
- Pre-engineered & pre-tested solution to save time & Capex.
- Scalable & customizable solution for more flexibility.
- Complete turnkey solution.

9. Deck machinery
Quickly built you winches solution with Test, Validated, Documented architectures

10. Ballast Water Treatment System
Benefit from the latest technological developments to guarantee the durable commercial success of your machines. From the actuators to the control systems, you are certain to find the solution for BWTS

11. Shore box
A solution to help reduce Carbone Dioxide (CO²), Sulfur Oxides (SOx) and Nitrogen Oxides (NOx) emissions and fuel saving during berthing for all type of vessels

12. Navy
Fully customized solution for demanding applications to secure fleet operation.
Expertise in customized electrical distribution and automation solutions in partnership with French or foreign navies and shipyards
Schneider Electric Marine offers

**Automation solutions**
Machinery automation protection and control products

**Electrical Distribution**

**Secure power & Power quality**

**Project management & Services**
Control and Alarm Monitoring System (CAMS)

Solution in brief

CAMS is an automation system to monitor the status and alarms of all machinery on board, and to extend the alarms from engine room to cabins during unmanned attended space. Specific process control can also be included.

Main features

- Alarm management
- Process monitoring
- Dead Man Alarm System
- Engineer call system
- Alarm extension
- Power Management

Main benefits

- Flexible architecture, can be easily customized
- Seamless integration into a global Ship Management System
- Ethernet architecture offering transparent access to assets
- DNV type approved solution
Power Management System (PMS)

Solution in brief

PMS is an automation system to control and monitor the power station on board.

Main features

- Generator priority management
- Load dependent start/stop of generator
- Heavy consumers management
- Black out management
- Generator failure management
- Generator shutdown management

Main benefits

Proven
- Installed on 100+ vessels

Flexible
- Standard design or customized to meet specific customer requirements
Power Monitoring System (PMgS)

Solution in brief

Power monitoring system enables to monitor the power quality and all electricity parameters (voltage, current, power, energy, THD etc.) of ships generators and on board equipment in order to track energy consumption. It supports Ship Energy Efficiency Management Plan (SEEMP).

Main Characteristics

- Energy Consumption Monitoring
- Energy Consumption Reporting
- Power Quality Monitoring
- Energy Consumption / Quality Alarming

Main benefits

- Access to information in Real Time
- Easy Reporting & communication with 3rd party systems
- Easy identification of Power, Energy Consumption and potential savings
- Performance Analysis for vessel & fleet
- Easy to install & to operate
Heating Ventilation and Air Conditioning (HVAC)

Solution in brief
Ship HVAC system ensures an optimal climate condition for people, goods and machinery on board

Main Characteristics
- Complete control solution including supervision, automation and motor control
- Functions covered:
  - Device management
  - Automatic temperature control
  - Automatic start/stop cycle
  - Monitoring status and alarms
  - Alarm management
  - Diagnostic management
  - Human / Machine interface
  - Report management

Main benefits

Savings
- Latest technology to reduce the numbers of cables, the labour cost, and saving space.

Flexibility
- Adaptable to function and architecture changes.

Reliability
- Well-proven solution to reduce the downtime of HVAC system and increase the availability of the system
Closed Circuit TeleVision (CCTV)

Solution in brief

CCTV system enables to assist the crew in their task both at sea and in the ports to enhance navigation safety and security:
• At sea: monitoring of restricted vision or areas unmanned (engine room, shaft, monitoring of bow and stern)
• At ports: monitoring to see access points to the ships and restricted areas that can not be seen from the bridge to ensure safe manoeuvring.

Main Characteristics

• Real-time video monitoring
• History recorder playback
• Web page access for IP cameras
• Interaction with AMS/SMS
• Video analytics
  • Intrusion Tracing
  • Directional Motion
  • Object Counting
  • Camera Sabotage, etc.

Main benefits

High definition imaging
• Provide clear, detailed and expansive images

Flexible and scalable
• Ethernet based
• Video streams through networks

Remote visiting
• Provide real-time video and audio stream
• Remote monitor and manage devices

Improved safety
• Motion detect, bordering
• Active detection
VSD control application: Engine room fan control

Solution in brief

Engine Room fan control solution aims at optimizing engine room fans operation thanks to smart control based on Variable Speed Drives

Main Characteristics

- Complete solution including VSD, PLC and local monitoring on HMI
- Control algorithm designed to manage 1 to 3 pumps (typical applications)
- Possible to mix VSD based solution with simple DOL starter for auxiliary pump
- Possible to increase availability of the sea water pump thanks to the bypass contactor

Main benefits

- Significantly reduces energy consumption
- Pre-engineered solution ready for fast integration
- Short ROI (typically < 12 months)
- High availability as the fans can be started with DOL or Star/Delta starters in case of VSD / PLC / sensor failure
VSD control application: Sea water pumps control

Solution in brief

Sea water pumps control solution aims at optimizing sea water pumps operation thanks to smart control based on Variable Speed Drives

Main Characteristics

- Complete solution including VSD, PLC and local monitoring on HMI
- Control algorithm designed to manage 1 to 3 pumps (typical applications)
- Possible to mix VSD based solution with simple DOL starter for auxiliary pump
- Possible to increase availability of the sea water pump thanks to the bypass contactor

Main benefits

- Significantly reduces energy consumption
- Pre-engineered solution ready for fast integration
- Short ROI (typically < 12 months)
- High availability as the fans can be started with DOL or Star/Delta starters in case of VSD / PLC / sensor failure
VSD control application
E.R. cooling for tankers

Customer

- An Aframax size tanker of a big Ships Management Inc.

Our solution

- Schneider provided the intelligent VSD control for sea cooling water pumps and engine room fans

Benefits

- Energy optimization by more than 65%
- Significant reduction of CO2 emissions
- ROI < 12 months

<table>
<thead>
<tr>
<th>Engine room fans</th>
<th>Sea Water pumps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>4 x 18.5kW</td>
</tr>
<tr>
<td>Annual Reduction of energy consumption</td>
<td>358MWh</td>
</tr>
<tr>
<td>Annual savings</td>
<td>~ $58.300</td>
</tr>
<tr>
<td>Reduction of CO2 emissions</td>
<td>~ 500 tons per year</td>
</tr>
</tbody>
</table>
The Scrubber Control Solution enables to power, control and automate the process of exhaust gas treatment for the different types of scrubber technologies.

**Main Characteristics**
- Standard hardware and architecture
- Fully integrated SCADA and automation system
- Can be configured for the 3 types of scrubbers
  - Open loop
  - Closed loop
  - Hybrid
- Pre-engineered software solution for easy and fast customization

**Main benefits**
- Global solution available worldwide
- Can be delivered as a turn-key solution or as a pre-engineered automation & electrical distribution package
- Includes built-in functionalities for alarming, trends and maintenance services
One unique range Mx80 to cover all applications

With common X80 I/O catalog and One Software

**One Family for Entire Plant**

- **Consistent** CPUs range from Small to High End Controllers
- **Same** IOs, Racks, Power Supplies
- **Same** Software

---

**Scalable Architectures**

- From small compact to large distributed and high available

---

![Modicon CPU](Image1)

![X80 IO range](Image2)

![EcostruXture Control Expert](Image3)

![Same IO system X80 IO range](Image4)

![Engineering](Image5)

![Commissioning](Image6)

![Maintenance](Image7)

![Operating costs](Image8)
Modicon M340 Programmable Automation Controller (PAC)

Main Characteristics

- No battery
- Exceeds IEC standards for shock and vibration
- Hardened modules available for use in extreme environments
- Compact size
- High density I/O
- Supports Ethernet/IP, Modbus TCP/IP and CanOpen, AS-i, and serial communication protocols
- Hot swap functionality
- Memory to store configurations and load them into replacement devices
- Data logging with time stamping
- Email/sms notifications
- Web server

Main benefits

- Reliability and performance to maintain operational stability
- Reduces panel size and costs
- Open and easily connectable for architecture flexibility
- Robust design and easy maintenance to minimize downtime and maintenance costs
- Accessibility of events/maintenance diagnosis/alarms by any convenient means
Modicon M580, the World’s First ePAC – Ethernet PAC

**Strong Foundation for plant of the future**

- **Continuous and Open Ethernet communication Backbone**
  - Transparent communication from sensor to Control room
  - Easily connect any device

- **Ethernet Infrastructure Integration**
  - Simplify your architecture
  - Save costs

- **Inherent Cybersecurity**
  - Simply secure your process
  - Comply to regulation

**Strong Modicon Heritage**

- **One Flexible Family for entire Plant automation needs**
  - Wide range of architecture
  - Portfolio simplification

- **Smooth modernization**
  - Easy migration with built in tools
  - Protect investment and know-how

Confidential Property of Schneider Electric | Page 29
# Optimized HMI

## Main Characteristics

### Small Panel : Magelis STU
- Unique Push Button Mounting system (Diam22mm)
- Modular product: Display and CPU modules
- Display TFT 64K colors, size 3”5 and 5”7
- Communication Serial or Ethernet
- USB ports Host & Device

### Optimum Panel : Magelis GTO
- Display TFT 64K colors available in 5 sizes: 3”5, 5”7, 7”5, 10”4 and 12”1
- Communication based on 2 Serial lines and Ethernet
- Removable storage unit with SD card
- USB port Host & Device
- Operating Temperature up to 55°C

## Main benefits

- Quick installation (tool free)
- Easy Maintenance
- Compact Touch Panel
- Basic communication available
- Peripherals connectivity (Barcode, Printer, USB keys…)
- Touch Panels with large screen size choice
- Link to all Automation Devices (PLCs, Drives, Scada…)
- Capability of Data logging
- Peripherals connectivity (Barcode, Printer, USB keys…)
- Good resistance to environment
Performance HMI

Main Characteristics

Universal Panel : Magelis GTU
- 6 sizes of high resolution displays ranging from 7” to 15”, either with modern 16:9 or standard 4:3 ratio and with 16 Millions colors
- 2 boxes, one with Real Time OS and one with fully open Windows 7 embedded
- Up to 2 separate Ethernet ports plus serial communication ports and Field bus
- Innovative industrial multi touch screen
- Large & all memory removable in complement of modular design with Display and Box
- Wireless LAN enabled display

Main benefits

- High quality of Visualization
- Choice between High performance HMI and Open HMI with PC functions
- Ideal product for IIOT with large and open connectivity
- Operator control efficiency with intuitive gesture
- The Best for Maintenance (PC free and spare part optimization) and for Data storage capability
- Easy Remote maintenance
Low voltage motor starters TeSys

Main Characteristics

- Wide offer in 1, 2 or 3 components architectures
- DOL, Star Delta, reverse
- Contactors range up to 800 A
- Motor circuit breaker and overload relays up to 630A
- Total coordination
- Communication according to most popular protocol

Main benefits

- Answers to any motor protection and control need from simple to most advanced
- Simplified design thanks to motor starters software and Apps for starter selection
- Easy installation thanks to the widest range of installation accessories available
- Continuity of service thanks to total coordination, communication and preventive maintenance
- Extend motor life-time thanks to High performance advanced protection
## Main Characteristics

- **ATV600**: Variable Speed drive with variable torque for synchronous & asynchronous motors 0,75 to 315 kW, up to 690V
  - Pumps and Fans application

- **ATV900**: Variable Speed drive for maximum productivity with excellent motor control and connectivity capabilities 0,75 kW to 315 kW, up to 690V
  - Winch and Crane application

- Services Oriented Drive designed to reduce OPEX thanks to embedded digital services.
  - Connectivity to any fieldbus
  - Embedded process monitoring and control
  - Harmonics reduction integrated in the product

## Main benefits

- **Services Oriented Drives**:
  - Sustainable cost savings thanks to predictive condition-based maintenance
  - Up to 20% downtime reduction without additional investment

- **Energy Saving**:
  - Optimizes energy consumption
  - Accurate power measurement provides information for energy management

- **Real Time Intelligence, Web server & services**
  - Embedded Ethernet web server interface gives you process monitoring capabilities with your daily working tools
  - Local and remote access to energy use and customized dashboards - energy usage is visible anywhere, any time.

- **Custom Engineered Drives**
  - Schneider Electric’s expertise in design and application services delivers solution-specific design VSD dedicated to your requirements for seamless integration.
Schneider Electric Marine offers

- Automation solutions
- Machinery automation protection and control products
- Electrical Distribution
- Secure power & Power quality
- Project management & Services
Electrical Distribution Scope of supply

1. MV Main switchboard
2. MV Motor Control Center
3. MV/LV Switchboard
4. LV Switchboard
5. Busway
## Modular systems for MV power distribution: MCset and PIX

### Main Characteristics

- MCset SF6 technology, PIX Vacuum technology
- Rated voltage: 7.2 (MCset), 12, 17.5 kV
- Withdrawable Circuit Breaker or Contactor
- Internal arc classification: AFL(R) up to 50 kA 1s
- Possible to integrate manual synchro panel
- Thermal diagnostics (MCset)
- Degree of protection: IP32/IP42 on request
- Equipment protection index against mechanical impact is IK07

### Main benefits

- **Easy integration** during construction thanks to the skid option
- **Compactness** (MCset min width 570, PIX 650 mm)
- **Continuity of supply**
  - Safe access to compartments with power on thanks to separate busbar and cable compartments (LSC2B).
  - MV parts compartmentalized by earthed metal partitions (PM class).
- **Safe**
  - Protection of operators in the event of internal arc. Internal arc type tested, comply with 5 criteria. Mechanism discharge automatically when draw out (MCset)
- **Ease of operation**
  - MCset: 1 tool for all operations, intuitive operations
  - PIX: charging of mechanism through the door, practical door design
### Main Characteristics

- Complete protection for incomer, feeder, transformer, generators, motors including differential protection for generators and motors
- 42 logic inputs and 23 relay outputs
- Synchro-check
- Temperature data from 16 sensors, Pt100, Ni100, or Ni120.
- Parameters and protection settings saved on removable memory cartridge
- Customization programming of specific functions (Logipam)
- Functional safety at SIL 2 level

### Main benefits

- Protection functions covers all marine needs
- Measurement
  - Dynamic measurement of current & voltage
- Information display
  - Information on status of alarms, fault...
- Easy communication
  - Modbus and IEC61850 edition 2 with GOOSE messages to remote metering, control and communication between relays without wiring.
### Main Characteristics

- Used either stand-alone or governor for I/O extension units in LV and MV systems
- Operation on simultaneous current and light or on light only
- Sensors connected either directly or via I/O extension units
- Supports point, fiber and portable sensors
- High speed output, HSO, operation time <2 ms
- Trip contact, T, operation time 7 ms
- 8 independent arc protection stages
- Event logs, disturbance recording
- Various selection of communication protocols for SCADA,
- Programmable operation zones
- Continuous system self-supervision

### Main benefits

- Suits to basic and demanding applications
- Modular structure gives add-on flexibility for extended functionality
- User friendly multilingual HMI
- User-defined application legend for leds
- Modular structure
- Advanced post fault analysis
MV Motor Control Centre

Motorpact up to 400A and 7.2 kV (IEC, ANSI UL)

- Reduced footprint: 375 mm width, 950 mm depth
- Low maintenance cost (no rear access required)
- Designed to be associated with MCset or PIX
- Complete motor starting solution including soft starters
- Optimized footprint thanks to Sequential SmartStart
- Height dependability thanks to Redundant architecture
- Thermal diagnosis system
- Web Remote Monitoring
The conventional full voltage (star-delta or auto-transformer) starting methods induce current and torque peaks.

Most economical starting: maximum electrical & mechanical stress!

Down time; Loss of service continuity; High maintenance costs for Electrical equipment, MV motor, gear boxes, rotating parts…

The typical current is set at 2 to 4 x In during starting phase.

SoftStart motor starter provides smooth, stepless acceleration and deceleration regardless of the load.

This starting method lowers the starting current of the motor, reduces electrical stresses on the network and the motor.

Application: Cascading motor soft start & stop methods
Application: Cascading motor soft start & stop methods

Do you want to reduce the operating expenses of large thrusters, compressors, chillers and pumps driven by MV motors?

Motorpact S3

• High-performance cascading motor starting-solution
• Fully pre-engineered solution and integrated switchboard
• Allows to control the starting Torque
• Reduces peak starting torque stresses on both the motor and mechanical load components, thereby providing longer service life and less downtime.
Application MCset lined up with Motorpact Sequential SmartStart

Transition panel between MCset (or PIX) and Motorpact
MV/LV and LV/LV transformers

Main Characteristics

MV/LV transformer from 10kVA to 15MVA
- Primary voltage: 6-36kV
- Thermal insulation: Class F & Class H
- E2,C2,F1 or E3,C3,F1 certified
- Air cooled (AN) or Air Forced (AF)
- Up to IP44

MV/LV transformer from 100kVA to 30 MVA
- Primary voltage up to 52 kV
- Thermal insulation: Class F & Class H
- E2,C2,F1 certified
- Cooling AN/AF/AFWF (Heat exchanger)
- Up to IP55

Main benefits

- Guaranteed against fire hazards
- Totally insensitive to harsh environment- pollution or condensation
- Low noise
- Easy and quick to install with minimum maintenance
- Eco-friendly
- Non inflammable and self extinguishing
- Insensitive to harsh environment and areas with high electric disturbances
- Excellent load and short circuit performance
- Low noise
- Space optimization
- Eco-friendly
MV/LV and LV/LV transformers

**MV/LV transformer from 8 kVA to 5 MVA:**
- Primary voltage: up to 12 kV
- Cooling: AN, AF, WF, AFWF
- Enclosure: IP21 to IP65
- E2,C2,F1 certified
- Thermal insulation: Class B / F / H

**LV/LV transformer:**
- Primary voltage: 10 kVA to 400 kVA
- Cooling: AN, AF, **AFWF**
- Enclosure: IP21 to IP65
- Copper or Aluminium
- E2,C2,F1 certified
- Thermal insulation: Class B or F

**Main Characteristics**

**Main benefits**

- High level adaptation to the needs of power, voltage, application...
- Made In France quality (all routine tests before shipping + special tests possible)
- Efficient cooling with air, fan or/and water
- High reliability and low maintenance
- Long-life of 20 to 30 years
- Safety solution for harsh environmental conditions

- Robust with cast resin protection
- High protection (enclosure and paint)
- Easy connections
- Environmental friendly
- Auxiliary feeding
- Simple maintenance
Solution description

- Consists in distributing Power in MV instead of usual LV distribution
- MV distribution is done through 2 MV loops down to the reefer transformers
- In each loop, 3 Ring Main Units distribute the power
- Reefers transformers are connected to the RMUs outputs
MV Loop architecture
Application: Container ships

Solution benefits

- Up to 30% reduction of investment costs versus usual LV distribution design due to reduction on
  - Cable costs
  - MV and LV equipments
  - Labour costs

- Up to 35% power losses reduction versus usual LV design
  - Main losses are due to LV cables in standard design

- 47% weight reduction versus usual LV design
  - Mostly due to LV cables reduction

- 30% more reliable than standard design

RM6 for Marine (Ring Main Unit)
Rated Voltage: up to 24kV
Rated current: 630 A
ICW: 20 kA / 1s
Internal arc withstand: 20kA, 1s
Protection degree: IP32
Resistance to harsh environment: adapted to corrosive atmosphere
Type tested per IACS Marine standards

Dry-type transformer
6.6 kV / 440 V
400 / 630 / 800 kVA
Low voltage switchboard MB301M / MB401M

Main Characteristics

- Fixed and withdrawal Power Control Center and Motor Control Center
  - Rated operational voltage: 400/690V AC
  - Main busbar rated current: 7300A
  - Rated short-circuit current: up to 150 kA, 1s
  - Internal arc withstand: 65kA/0.3s @690V
  - Protection degree up to IP44

- Electrical characteristics for functional units
  - MCC up to 250kW
  - PCC up to 630A
  - Incomer ACB up to 6300 A

Main benefits

- Type tested switchboard (IEC61439)

- Safe
  - Internal arc according to IEC61641 V3
  - Thermal monitoring (IR sensors)

- Compactness:
  - from 600 mm width
  - High stacking density
  - Up to 30 pcs of 100/250A (MCCB) in one cubicle

- Flexible:
  - 2*ACB in one cubicle is possible
  - Mix of distribution feeder and group starter is possible
  - Available in form 2/3b/4b

- Easy to modify/expand
Low voltage switchboard OKKEN

Main Characteristics

- Withdrawal High Performance Power Control Center and Motor Control Center
  - Rated operational voltage: 400/690V AC
  - Rated current of main busbar: 7300A
  - Rated short circuit current: up to 150 kA, 1s
  - Internal arc withstand: 100kA/0.5s
  - Protection degree up to IP54

- Electrical characteristics for functional units
  - MCC up to 250kW
  - PCC up to 630A
  - Incomer ACB up to NW63 (6300 A ACB)

Main benefits

- Type tested switchboard (IEC61439)
- Safe
  - Active and passive Internal arc fault protection according to IEC61641 V3
  - Arc free zone with encapsulated active parts
  - Thermal monitoring
- Compactness:
  - from 600 mm width
  - High stacking density
  - Back to back configurations for double front access
- Smart
  - iPMCC intelligent Power and Motor Control Center, advanced solution for protection, automatic restarting: fault prevention, improved productivity
High Power Busways Canalis KT

Main Characteristics

• IP degree IP55, IPxxD, sprinkler resistant
• IK protection IK08
• Voltage Ui 1000V, Ue 1000V
• Current rating KTA 800-4000A
  KTC 1000-5000A
• Tap-off Intervals 0,5m / 1m / 1,5m
• Standard lengths 4m & 2m (0,5 – 3m MTO)
• IEC/EN 61439-1 & 6

Main benefits

• Modular and upgradeable system
• Quick and easy assembly
• Safe
  • Full type tested system (busway, tap-off unit, circuit breakers) providing maximum safety of goods and people
  • Live parts are totally inaccessible
• Green
  • Energy efficient thanks to less voltage drop
  • No toxic emission in case of fire (Halogen free)
  • Dismantled, re-used and entirely recyclable
High Power Busways I-Line II

**Main Characteristics**

- IP degree: IP40 / 41 / 54 / 55 / 65 / 66
- Voltage: $U_i = 1000V$, $U_e = 1000V$
- Frequency: 50/60Hz
- Current rating: 800-6300A
- Tap-off Intervals: 610mm/1220mm
- Standard lengths: 10 feet
- IEC/EN 60439-2 and UL standard

**Main benefits**

- **Light & Compact**: Up to 30% lighter and more compact than cables: no cable bending radius
- **Safe**: Totally type tested system (busway, tap-off unit, circuit breakers) provides maximum safety of goods and people
- **Green**: Energy efficient thanks to less voltage drop
  - No toxic emission in case of fire and contains no PVC.
  - Fully recyclable and reused possibility
Medium Power Busways Canalis KS / KN

### Main Characteristics

- IP degree  IP52/54
- Voltage  $U_i$ 690V,  $U_e$ 690V
- Frequency 50/60Hz
- Current rating  
  - KS: 100-800A
  - KN : 40-100A
- Tap-off Intervals  1m on each side
- Conductor  Aluminium + copper contact
- IEC/EN 60439-1 & 2

### Main benefits

- Thanks to decentralized architecture:
  - Space saving
  - Weight savings
  - Cost savings.
- Easy dismantling and re-use in case of installation modification
- Line losses reduced up to 20% vs cables
Busway medium power application:
Cruise distribution

**Canalis KS & Canalis KN for:**
- Riser Busway Solution: connection to high power feeders
- Horizontal distribution for cabins
- Lighting distribution

**Benefits**
- Easier electrical distribution design
- Time & cost savings during installation
- Space saving
- Weight savings

Riser Busway solution installed in Cruise
Busway Small Power and Lighting Canalis KB

**Main Characteristics**

- IP degree: IP55
- Voltage: $U_{i} \ 690\text{V}$, $U_{e} \ 230 - 400\text{ V}$
- Frequency: 50/60Hz
- Current rating: 20-40A
- Tap-off Intervals: 500/1000 /1500 mm
- Standard length: 2/3 m
- IEC/EN 60439-1 & 2

**Main benefits**

- Easy installation
  - Components assembled in just a few clicks.
- Reliable
  - Operation guaranteed under vertically and horizontally sprayed water for 50 minutes (sprinkler test)
- Flexible
  - Easy adaptation to direction changes and detours around obstacles
- Green
  - Halogen free: no smoke nor toxic gas in case of fire
LV power distribution switchgears ready for communication

Advanced Measurement and communication

- Masterpact NT / NW / MTZ: the market reference of ACB
- NT reduced footprint up to 1600 A
- NW high breaking capacity up to 690V
- MTZ future ready

- Masterpact UR the alternative to stay in LV when high short circuit currents are involved
- High limiting capabilities: reduce the stress on the installation
- Fast breaking time 5 ms (vs 50ms for std ACB)

- MCB: Compact NS and NSX ranges
- Breaking capacity up to 100 kA / 690V
- Optimized selectivity
- Operation monitoring for maintenance optimization
Miniature Circuit Breakers: MCB and RCBO
The efficiency you deserve!

Main Characteristics

- Nominal current: 1 to 63 A (to 125A for PowerPact)
- Breaking capacities up to 100 kA and tripping curves: B, C, D,
- Compliance with IEC/EN 60898 or IEC/EN 60947-2
- Operating voltage: up to 440 VAC / 800 VDC
- Full coordination with Acti9 range Residual Current Devices (RCDs) and Compact NSX Moulded Case Circuit Breakers (MCCBs)

Main benefits

- Easy installation
  - Easy to install with quick, ergonomic & safe IP20B terminal shutters & robust connections
- Safe
  - Absolute safety of circuit protection with VisiSafe
  - Greater continuity of service with VisiTrip
- Green
  - Environmentally friendly with 100% recyclable & recoverable materials.
Insulation Monitoring
Vigilohm - IM10 / IM20 / IM400 / IFL12

Main Characteristics

IM10 / IM20
AC & DC Medium size network
Medium disturbance level
Large graphic, multi language display
IM20: Leakage capacitance and impedance display
IM20: Modbus communication port & Alarm log

IM400
LV & MV very large networks
High disturbance level
Leakage capacitance and impedance display
Modbus communication port
Very large display with trends and event log

IFL12 – Insulation Fault Locator
Alarm threshold settable per feeder
Insulation R & C metering per feeder
Modbus communication port & Event log
Transient Fault detection

Main benefits

• **Full range** of insulation monitoring devices & Insulation Fault Locators to answer all needs and type of networks

• **EcostruXture ready**: plug&play integration in Energy Management System

• **Improved electrical safety**
  - Alarm threshold and R & C metering per feeder

• **Simple installation**
  - No communication required between IMD & IFL DIN rail or flush mount

• **Standard compliance**
  - IEC 60364-4-41
  - IEC 61557-8 & 9

• **Multi languages** LCD display.
Insulation fault localization

Solution in brief

Solution for “ungrounded” networks to guarantee continuity of supply in case of earth fault and to reduce maintenance with IFL21 smart insulation fault locators.

Value Proposition

- Improved continuity of service and reduced operation costs
- EcostruXture ready: plug&play integration with Energy Management System, PME, Com’X510, Magelis
- Simple installation as no communication is required between IMD & IFL devices.
Schneider Electric Marine offers

- Automation solutions
- Machinery automation protection and control products
- Electrical Distribution
- Secure power & Power quality
- Project management & Services
Secure Power Application

UPS Main benefits

- Unique expertise: Unique supplier 100% Type approved
- Complete range: From 1 to 800 kVA
- Standard product: shorter delivery, WW spare parts availability
- Service: World wide presence.
**UPS**

**Smart UPS and Galaxy full range marine type approval**

- Double Conversion “On-Line”
- No breakdown
- Output voltage conditioning
- Frequency conversion
- Parallel up to 6 Modules
- Galaxy VM: ECOntersion™ up to 99% efficiency with voltage regulation

- -10 – 55°C, humidity (0 – 95%)
- 100% load up to 40°C
- Up to IP52
- Back up time: up to 12 h or more
- Case by case : marine certification
Single Phase Offer
Smart-UPS On-Line 1 to 6 kVA

Main Characteristics

- 1 – 6 kVA
- Type approved by DNV-GL
- Rack-mount (1 - 6 kVA)
- Rack-tower convertible Dry contact interface
- Embedded Ethernet (5-6kVA)
- Frequency conversion

Main benefits

- High density and performance suitable for any bridge, automation and accommodation applications
- Meets core maritime regulatory requirements
- Application versatility
- Seamless and flexible integration with ship automation systems
- Application flexibility
## Main Characteristics

- **G5500**: 20/40/60/80/100/120kVA parallel up to 6 units
- Galaxy VM 160/200 kVA parallel up to 5 units
- DNV type approval
- 3 points lock door, locked open position
- Marine accessories

## Main benefits

- High power quality to ensure optimum operation of applications
- Reduced footprint for easy installation in reduced space
- Standard product (WW availability spare & operation)
- Parallel capability
- Parallel up to 1000kVA in 50/60 Hz - without the need for a Static Switch Cabinet
Three Phase Offer
Gutor PXC

Main Characteristics

• 10 to 80kVA in 3:1 and 3:3 design
• 20 years design life
• IP42 and up to 52
• Seismic constraint F
• Full galvanic isolation on request
• NiCad battery
• Case by Case Marine certification

Main benefits

• Flexible interfacing Including freely programmable alarms and meters, web interface and various communication protocols
• Reliability High degree of built in redundancy and years of field experience
• Industrial design for harsh environment
• Modular architecture For easier serviceability and reduced spare part stock
Active harmonics filtering AccuSine PCS+

Main Characteristics

- Nominal voltage 380-480V and 600-690V
- Standard output rms current:
  - from 60 to 300A @380-480V
  - From 40 to 200A @600-690V
- CT secondary 1 amp or 5 Amp
- Up to 10 PCS+ per set of CT
- Harmonic cancellation from 2nd to 51st order fully selectable in magnitude for voltage and current
- Harmonic attenuation down to 3%
- Harmonic cancellation response time 2 cycles
- HMI with a lot of displayed parameters: Harmonic distortion, oscilloscope, currents, phasor diagram…

Main benefits

- Highly effective up to 51st harmonic order
- Fast response time
- Scalable parallel units as needed.
- Universal solution
  - Handles many loads
  - Many types of loads at same time
- Can be installed at anytime during the installation lifecycle
- Best cost for multiple loads
- Smallest footprint with standard VSD
  - No need for bulky 12/18/24 pulse transfo
- Lowest system heat loss versus usual solutions at each Drive level
- No risk of overload when the harmonics generating loads vary
Schneider Electric Marine offers

- Automation solutions
- Machinery automation protection and control products
- Electrical Distribution
- Secure power & Power quality

Project management & Services
Marine Installed base & Services
WE ARE WHERE SHIPOWNERS ARE!

6200+ Schneider Electric Field Services Representatives certified (FSR)

420+ Services Centers

Global Service Centers Marine expertise
marineservicecenter@schneider-electric.com
+33 (0) 4 91 039 864
Schneider Electric helps you optimize your Total Cost of Ownership (TCO) throughout the whole ship life cycle

**Ship after 10 or 15 operating years**

We help you define and implement the best solution against vessel obsolescence, while controlling the aging infrastructure associated costs

- Renewal, enhancement and upgrade: audit, study and solution design
- Retrofit of obsolete devices any brands (ECOFIT™)

**Ship after few operating years**

We give you proactive and tailored recommendations to reduce risk, improve solution performance and reliability

- Energy Efficiency & Power Quality: audit, study and solution design
- MP4: electrical network assessment, improvement and risk management program

**Ship in operation**

We help you maximise uptime and performance, with expenditure control

- Maintenance: preventive time-based, predictive and condition-based to avoid failure, corrective with on board troubleshooting
- Training for the crew, remote technical support by experts

- Spares parts: supply worldwide
- Service Plan: recurring contract or agreement
- Software: update and support

**Ship at engineering stage**

We help you plan, define and design the right solution for your vessel

- Architecture & application study
- Solution design
- Expert consultancy

**Ship at building stage**

We help you install efficient, reliable and safe solution on board

- Project execution management
- On board installation supervision, testing and commissioning
- Software installation and set-up

Confidential Property of Schneider Electric | Page 68
Schneider Electric can deliver parts WW
to optimize your spare parts stocks

A large network of ~100 Schneider Distribution Centers & thousands of official Distributors

Tailored Frame Agreement
1 WW point of contact, 1 WW price list, WW delivery

3 spare parts categories

« SECURE »
Critical stock
- Critical spare parts to replace in case of unexpected shutdowns due to unpredictable failures
- To store on board
- To use during corrective maintenance intervention

« PREVENT »
Recommended stock
- Spare parts difficult to be predicted out of preventive maintenance interventions
- It is recommended to stock them in customer's premises for faster and cost effective interventions

« LIFE EXTENSION »
Sourcing on needs
- Core parts necessary to extend the life of equipment
- Schneider Electric support you in scheduling their supply in accordance with equipment maintenance plans
- To use during on site condition maintenance

39 Distribution Centers
EMEA

39 Distribution Centers
APAC

9 Distribution Centers
South America

8 Distribution Centers
North America

Confidential Property of Schneider Electric | Page 69
Schneider support you to build an optimized maintenance plan

Frequency of intervention depends on criticality & environmental conditions

**Environmental conditions**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Normal environment conditions</th>
<th>Severe environment conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>Average annual temperature &lt; 25°C outside the switchboard (TA)</td>
<td>Average annual temperature between 35°C - 45°C around the switchboard (see IEC 60439-1)</td>
</tr>
<tr>
<td>Percent load</td>
<td>&lt;80% of In 24/24 hours</td>
<td>&gt;80% of In 8/24 hours or 24/24 hours</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>&lt;70%</td>
<td>&gt;80%</td>
</tr>
<tr>
<td>Corrosive atmosphere (IEC60721-3-3)</td>
<td>Device installed in environment category 3C1 or 3C2</td>
<td>Device installed in environment category 3C3 or 3C4 without any particular protection</td>
</tr>
<tr>
<td>Salt environment</td>
<td>No salt mist</td>
<td>Installation &lt;10 km from seaside and device without any particular protection</td>
</tr>
<tr>
<td>Dust</td>
<td>Low Level. Device protected in switchboard equipped with filters or ventilated IP54 enclosure</td>
<td>High Level. Device not protected</td>
</tr>
<tr>
<td>Vibration</td>
<td>Permanent vibration &lt; 0.2 g</td>
<td>Continuous vibration between 0.2 g and 0.5 g</td>
</tr>
</tbody>
</table>

**Criticality level depends on 2 factors**

- Operating conditions categorized by the **stress level**
- The level of contribution toward the reliability of the installation, measured by shutdowns, production losses, corrective intervention costs, process ramp-up costs, etc.

An empirical estimate may be sufficient for simple cases
Asset Advisor – Remote condition based maintenance Service
Translating data into actionable maintenance recommendation to reduce downtime

Connect Electrical Assets

Capture Electrical critical data

Convert data into meaningful analytics

Identify abnormal conditions

Provide maintenance recommendation
EcoStruxure concept

No IoT without connected devices integrated into a smart architecture

Help turn data into actionable plans thanks to experts services

Help take informed decisions to secure uptime & operation efficiency thanks to advanced platforms

Get visibility on your electrical distribution by measuring, collecting, aggregating and communicating data

Cyber Security

Analytics & Services

EcoStruxure Asset Advisor

Cloud and/or on Premise

Edge / local Control

SCADA, Power Management (PSE, PME, PM)

Connected Devices

Circuit Breaker
LV smart panel
Transformer
MV switchgear
Power Meter
VSD
UPS
Smart architecture to connect to the Schneider DSP

New or upgraded ship

Digital Service Platform (DSP)

**PME not in place**

Device → Com'X → DSP

Modbus protocol, serial or over TCP

*May be required additional parts or modules: I/O, IFM, IFE*

**PME (7.2 or higher version) in place**

Device → PME /Pacis → DSP

Modbus protocol over TCP, with specific add-on and driver

*May be required additional parts or modules: EGX or ION*
Multi-Year Service Plan or Frame Agreement

WW & tailored service plan according to your needs

Your needs

• Focus on your core business
• Maximize availability, reliability & uptime
• Optimize your asset management cost
• Increase visibility regarding your asset management

Our Offer

• A single point of contact
• On board intervention for troubleshooting, diagnostics or preventive maintenance during operation or Dry Dock
• Spare parts stock management & delivery
• 24/7 hotline with expert assistance
• Conditioned Base Maintenance thanks to remote monitoring
Schneider Electric offer

Turned key project from audit to performance checking, we focus on ROI

Analyze & Quotation phase

Full study/audit order

Preliminary Audit/Study free of charge*
- Walkthrough audit of ≤1 day
- Partial data collection & analysis based on hypothesis (no measurement recording)
- Real potential savings identification & confirmation
- Preliminary new process control proposal
- Preliminary energy savings & ROI assessment
- No performance commitment
- Solution budget quote

Full Audit/Study
- Complete audit ≥3 days
- Full data collection & analysis with measurement implementation
- Propose new process control
- Energy savings calculation
- Performance commitment
- Solution firm quote

Solution Order

Solutions deployment
- Organize a dedicated project team
- Design the solution
- Build the hardware & software
- Deliver the solution on board
- Install & commission the system

Project delivery

Performance checking
- Energy consumption measurement with & w/o the solution activated
- Real energy savings deduction & comparison with calculation

Audit/Study budget
- France ~ 6k€
- Europe up to 9k€
- Rest of the World ~12k€

*out of travelling expenses
**Optimize process with a tailored project**

Summary: Energy Efficiency solution benefits with Schneider

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Marine applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Energy savings commitment (depends reference data)</td>
<td>• Sea water pumps</td>
</tr>
<tr>
<td>• ROI from few months to 2 years (reduce TCO)</td>
<td>• Engine room fans</td>
</tr>
<tr>
<td>• Process control improvement</td>
<td>• Air/gas combustion blower</td>
</tr>
<tr>
<td>• Reduce product environmental footprint</td>
<td>• Boiler feed pump</td>
</tr>
<tr>
<td>• Be compliant with environmental regulation</td>
<td>• All liquids/slurries distribution pumps</td>
</tr>
<tr>
<td>• Build a green image</td>
<td>• Reefer ventilation</td>
</tr>
<tr>
<td>• Turned key solution delivered by Schneider Electric</td>
<td>• Chiller</td>
</tr>
<tr>
<td></td>
<td>• HVAC</td>
</tr>
<tr>
<td></td>
<td>• Winches &amp; cranes</td>
</tr>
</tbody>
</table>
When shall we do an ECOFIT™?

3 major phases in the life of electrical distribution equipment

1. **ACTIVE**
   - Equipment or device inside are still commercialized
   - The spare parts offer is available

2. **DISCONTINUED**
   - End of commercialization of equipment or device cannot be used for new projects
   - The spare parts offer remains available for a period of:
     - 10 years for LV
     - 12 years for MV
   - The service for the existing installed base is secured

3. **LIMITED**
   - End of full spare parts availability, unless specific agreements exist
   - Shortage risk… This is the optimum time for solution modernization to be considered
Think ECOFIT™ MV, LV & Protection Relays
Modernization by Schneider Electric

Tested, validated and documented by Schneider Electric
Repetitive & industrialized under ECOFIT quality & safety directives
Made by ECOFIT Centres with Optimized cost and lead time

Reference centers manage the ECOFIT™ Offers
• Design and development using Schneider Offer Creation Process Methodology
• Industrialize, manufacture and optimize
• Test, validation and certification in compliance with international standards

ECOFIT™ regional centers: project engineering & workshop facilities

For many ECOFIT™ solutions exchange of their Original Equipment Trucks, no need to shutdown busbar
Schneider can ECOFIT™ every brands

But also on competitors legacies

- Siemens
- General Electric
- Terasaki
- Eaton
- ABB
- Mitsubishi
- Voltas limited
- Westinghouse
- REYROLLE
- Calor
- EMAG
- Cutler-Hammer
- Crompton Greaves
- Hawker Siddeley
- NGEF Ltd
- Klockner & Moeller
- Asea
- Unelec
- Brown Boveri
- Calor Emag
Schneider Electric Marine

• Over **90 years** of experience in marine and offshore & 20000 Ships

• **A complete range of solutions** in LV & MV Electrical Distribution, Ship Automation, Electrical Propulsion, Secure Power and Security on board

• **A Worldwide presence** in more than 100 Countries, always close to the main ports in Europe, North America, South America, Middle East and Asia

• A unique set of **competencies**: Consulting, Engineering & installation, maintenance, on-site operation, retrofit, spare parts, training
Energy is the base of life.

Life Is On

when energy is on…

We ensure energy is on, making it

• Safe
• Reliable
• Efficient
• Connected
• Sustainable