Features of WME Marine Switchgear Systems Main, Auxiliary & Emergency Switchgear with Automation & Power Management

Enclosure
- Bulkhead mounting for smaller systems, IP22 or IP23 protection.
- Deck mounting, IP22 or IP23 protection.
- Aluminum (up to 2 meters (~80") wide) or steel enclosures.

AC Power Bus System
- Single, split or multi-bus systems.
- Split or multi-bus systems include tie breakers/switches with motor operators.

Input Circuit Breakers
- Input circuit breakers with electronic trip and motor operators.

AC Distribution Circuit Breakers
- AC distribution circuit breakers can be molded case and/or rail mounted in quantities and ampacities as required.

Metering
- Analog metering for each bus or each source to include:
  One (1) voltmeter w/ phase selector switch
  One (1) ammeter for each phase
  One (1) frequency meter
  One (1) kilowatt meter.
- Multi-function digital meter displays are included on each Protection and Power Management (PPM) module.
- The optional Touch Screen Interface shall also display digital and graphic metering for the power sources.
- Analog ground fault current meter for grounded systems. Analog insulation monitor for isolated systems.

Modes of Operation
All WME switchgear is manual first and automated second. An automation fault shall never prohibit a power source from being manually connected to the bus and providing electrical power to the vessel.
- Auto Mode. The Power Management System (PMS) provides all protection and operational control.
- Switchboard Mode. The PMS provides alarm indication only. Operational control is manual. Power source circuit breakers are safety interlocked with a manual rotary selector switch.

DC Control Power
WME Switchgear has inputs for three redundant sources of 24VDC control power. These inputs are to be supplied from three independent vessel battery banks, usually from two generator banks and a service bank.

Automated Control, Protection and Power Management System (PMS)
Using all off-the-shelf components, with no PLCs and nocustom or proprietary programming, the WME switchgear control, protection and power management system provides unsurpassed control and safety features, including:
- All automated control, protection and power management is accomplished using Deif PPM-3 digital integrated controllers, which combine individual synchronizers, load share modules, power factor/VAR controllers, reverse power and protective relay devices into a single device. These Deif controllers are less complicated and more reliable than multiple, individually mounted and wired components. The failure of any one Deif controller does not affect any other controller or power source. Deif PPM-3 controllers can be used with any make or size of generator or shore power connection and have approvals and/or certificates from the following agencies: ABS, BV, DNV, GL, LR, RINA, UL and others.
- A separate PPM-3 controller with operator/display panel is used for each power source and tie device.
- Seamless transfer to and from all power sources.
- Automatic parallel and load share between generators.
- Synchronization across open tie-device included (if fitted on multi-bus systems).
- Protection for O/U Voltage, O/U Frequency, Over Current, Reverse Power, Loss of Field, Fail to Start, Fail to Stop, Fail to Close, Fail to Open, Fail to Sync.
- Generator Priority Selection by manual selection, by settable time-period, by running hours or by “Fuel Optimization” which runs only those generators necessary to supply the load (suitable for systems with multiple, differently sized generators).
- Load-dependent operation adds or subtracts generators by load demand.
- Load dependent two-level non-essential load shedding and load reconnect.
- Blackout recovery from shore power to generator or between generators.
- "Heavy Consumer" mode adds generating capacity (if needed) in anticipation of on-coming high current loads (bow thruster, boat crane, etc.).
- "Fixed Power" mode runs generators in asymmetrical load share, rotating the heavier load between generators to keep each generator "hot" and prevent "wet stacking".
- "Secure" mode adds a generator to the bus for redundant safety during maneuvering or for other critical situations.
- Ability to use emergency generator (if fitted) as a “harbor” generator.
- Alarm and Event log.
- Intra-unit communication via redundant CANBUS.
- USB service port for easy setup and maintenance.
Other Optional Features Available:

- Additional status indication and pre-programmed control functions via Deif Additional Operator Panel (AOP). (16 status indicators, 8 control functions per AOP)
- Touch-Screen Operator Interface (TSI) for enhanced system control and monitoring (ABS, DNV, LR approved). The TSI is the interface between the operator and the control system and contains screens for the control, management, monitoring and setup of the vessels AC power distribution system. Soft keys are used to navigating the various screens and make finding data quick and easy. Intuitive on-screen help provides setup and operational instructions. The touch screen can be connected to the internet for remote alarm notification and monitoring.
- Shore Power Priority (available only with TSI) provides automatic transfer to shore power whenever shore power is available.
- Shore power converter communication (available only with A/Sea converter & TSI).
- Engine communication via J1939 CANBUS (if available).
- Ethernet port for remote communication via TCP/IP and SMS/email function.

Arc Fault Protection System

- WME provides arc fault protection on all switchgear with voltages above 240VAC.
- An electrical arc fault can develop within milliseconds and produces temperatures easily exceeding 30,000°F — hotter than the surface of the sun! Arcing causes air to expand dramatically and metal conductors to vaporize. When copper is converted from solid to vapor, it expands to 67,000 times its original volume. This rapid expansion of air and metal vapor produce an intensely hot explosion that can damage equipment and jeopardize the safety of operating personnel.
- Generally, an arc will not cause any damage if eliminated within 35ms (~two cycles). If the arc is allowed to continue for 100ms, some damage may occur. An arc fault lasting 500ms may cause extensive damage to the switchgear.
- WME installs arc flash optical sensors at the main circuit breakers, the main bus bars and the distribution bus bars. These sensors are connected to an arc flash relay. If an arc flash is detected, the relay unit generates a tripping pulse in less than 1ms to the main circuit breakers. The total arcing time is thereby reduced to the mechanical opening time of these circuit breakers, typically 50-75ms. The arc is therefore extinguished with little or no damage to the switchgear or personnel and eliminates the need for “venting chimneys”.

Safety Warning Label

- WME provides a Safety Warning Labeling on all manufactured switchgear similar to the sample below, conforming to NEC 110-16 & NFPA 70E-2012, Section 130.5(C).

Bi-directional communication with vessel’s Alarm and Monitoring System.
- Manual starting and stopping of generators.
- Manual generator speed adjustment.
- Manual generator voltage adjustment.
- Manual paralleling of generators with independent reverse-power protection, sync scope and sync check relay.
- Analog Zero-Crossing voltmeter for manual paralleling.
- Analog Kilowatt-Hour meter for monitoring shore usage.
- Analog Power Factor meter.
- Analog KiloVAr meter.
- Digital, multi-function meter in place of analog meters.
- AC to 24VDC power supply. For manual, emergency operation of the switchboard when all vessel 24VDC control power sources are unavailable. A selector switch is used to select the AC source for the power supply (the switchboard input sources or the switchboard bus(es)).
WME Marine Switchgear Systems Manual Switchgear

Enclosure
- Bulkhead mounting for smaller systems, IP22 or IP23 protection.
- Deck mounting, IP22 or IP23 protection.
- Aluminum or steel enclosures.

AC Power Bus System
- Single, split or multi-bus systems.

Power Source Selection
- Input circuit breaker selection with slide bar interlock.
- Contactor selection.
- Rotary switch selection.
- Rotary switch local selection plus contactors for local & remote selection.

AC Distribution Circuit Breakers
- AC distribution circuit breakers can be molded case and/or rail mounted in quantities and ampacities as required.

Metering
- Analog metering for each bus or each source to include:
  - One (1) voltmeter w/ phase selector switch
  - One (1) ammeter for each phase
  - One (1) frequency meter
  - One (1) kilowatt meter (optional).
- Analog ground fault current meter for grounded systems. Analog insulation monitor for isolated systems.

Images are representative of products listed and may not be actual product.
Protection and Power Management, PPM-3

Unique Features

- DEIF’s Protection and Power Management 3 (PPM-3) is a market-leading Power Management System (PMS) standard suitable for a broad range of marine applications with up to 16 diesel generators, two shaft generators, two shore connections, eight bus tie breakers and two emergency/harbour generators including bus tie breaker control and the possibility for wrapped busbar applications.
- The versatile and fully redundant multi-master system has been developed with fuel-efficient engine operation in view, and is an efficient and cost-effective solution with up to three powerful microprocessors.
- Encompassing all necessary three-phase measuring circuits, values and alarms are displayed on a quality LCD screen.
- Using a separate engine interface card as a backup shutdown unit, the PPM-3 also provides extra safety for your engine with a separate microprocessor and separate power supply.
- Multiple display units and operator panels can be connected to each controller, making access to the system possible from any location on the ship. Dedicated to versatile application uses and intuitive configuration and operation installing, the redundant multi-master system is fast, easy, and requires limited space.
- DEIF’s Multi-line 2: utility software v.3 (USW-3) with programmable logic (M-Logic) allows for comprehensive customization, including dedicating specific functions or logic conditions to different inputs and outputs as well as tuning select sequences to suit your requirements. Applications with shaft generators, shore connections and bus tie breakers can be easily configured to the switchboard design itself. Operator-friendly one-touch sequences handle all automatic functions. Using the application tool, even complicated systems can be configured within a few minutes.
- Traditionally, power management system (PMS) tests have been performed on mounted systems: a time-consuming procedure that interrupts day-to-day operations and risks disturbing your application setup. Addressing those concerns, DEIF’s innovative Emulation Software Solution has been created to allow for safe PMS testing at your desk, revolutionizing the design and test of power management systems for multiple diesel gensets for instance. See page 97 for further information.
- Additional Operator Panels (AOP) can easily be installed and integrated for further levels of remote control, supervision and status indication. Both displays and panels feature a dimmer function for use on the ship’s bridge.
- With a range of additional hardware options available, as well as DEIF’s Multi-line 2: utility software v.3 (USW-3) with programmable logic (M-Logic), you can customize the application to suit your needs exactly: dedicate specific functions or logic conditions to different inputs and outputs and tune all sequences according to your requirements.

Paralleling and Protection Unit, PPU-3

Unique Features

- Easy to operate and configure, DEIF’s PPU-3 control and protection unit is an ideal controller for PLC-based power management systems.
- Apart from generator protection and synchronization, the PPU-3 also features regulation modes including load sharing, fixed power, fixed frequency, etc. Serial communication enables easy interfacing with PLCs, SCADA-systems and more, and the unit features all necessary three-phase measuring circuits, displaying all values and alarms on a quality LCD screen.
- Turning the PPU-3 into an engine control unit featuring start/stop and protection functionalities, the optional engine interface card also has a separate power supply and an independent microprocessor.
- In cases of PPU-3 processor break-downs, the engine interface card will enter into back-up mode and ensure uninterrupted engine supervision.
- In cases of shutdown alarms, the engine shuts down automatically, making it a reliable solution for control and supervision of marine gensets.
- Additional Operator Panels (AOP) can easily be installed and integrated for further levels of remote control, supervision and status indication. Both displays and panels feature a dimmer function for use on the ship’s bridge.
- With a range of additional hardware options available, as well as DEIF’s Multi-line 2: utility software v.3 (USW-3) with programmable logic (M-Logic), you can customize the application to suit your needs exactly: dedicate specific functions or logic conditions to different inputs and outputs and tune all sequences according to your requirements.
**Protective Voltage Relay, RMV-112D**

**Unique Features**
- These uni-line protective voltage relays are applied for protection of generators, motors and transformers against adverse system voltage conditions. They are applicable to both marine- and land-based installations.

The following uni-line types are available:
- **Type RMV-112D** – undervoltage and overvoltage relay \((U_{<} + U_{>})\), 3º
- **Type RMV-122D** – overvoltage relay (2 levels: \(U_{>} + U_{>}\))
- **Type RMV-132D** – undervoltage relay (2 levels: \(U_{<} + U_{<}\))
- **Type RMV-142D** – undervoltage and overvoltage relay \((U_{<} + U_{>})\), 1º

**Double Overcurrent Relay, RMC-132D**

**Unique Features**
- This double overcurrent relay uni-line RMC-132D is applied in cases where protection against overcurrent at two levels is required \((I_{>} + I_{>})\).

**Reverse Power Relay, RMP-121D**

**Unique Features**
- The protective reverse power relay uni-line RMP-121D forms part of a complete DEIF series of relays for protection and control of generators, and is applicable to both marine and land-based installations.
- The RMP-121D is type-approved by major classification societies.

**Phase Sequence Relay, RMT-111Q96**

**Unique Features**
- The phase sequence relay with relay contacts type RMT-111Q96 is applied for check of the phase sequence of a power plant. A check of the phase sequence is required for connecting equipment to a new voltage source e.g. when changing from the mains supply of a vessel to the mains at harbor.
- The indicator can also be applied for alarm indication on phase breakage.
- The RMT-111Q96 is equipped with two LEDs on the front for indication of the phase condition.
Selectable AC-Transducer, TAS-311DG

**Unique Features**

- TAS-311DG is a micro-controller-based AC-transducer with 1 analogue output for measurement of RMS-voltages, RMS current, phase angle or frequency on an AC-network.
- The PC configuration software allows free choice of voltage, current, phase angle or frequency measurement including configuration of the measuring range and output range without any mechanical settings or adjustments inside the transducer.
- The transducer holds no mechanical moving parts like potentiometers and therefore the calibration stability is excellent. TAS-311DG can be delivered pre-configured or it can be delivered un-configured for customer configuration through the PC-interface.

Selectable AC-Transducer, TAS-321DG

**Unique Features**

- TAS-321DG is a micro-controller-based AC-transducer with 1 analogue output for measurement of bi-directional current.
- The transducer can be used for measurement of active power or reactive power on a 3-phase network where only 2 phases are available for the measurement. TAS-321DG can be delivered pre-configured or it can be delivered un-configured for customer configuration through the PC-interface.

Selectable AC-Transducer, TAS-331DG

**Unique Features**

- TAS-331DG is a micro-controller-based AC-transducer with 1 analogue output for measurement of power or reactive power on an AC-network. The transducer holds no mechanical moving parts like potentiometers and therefore the calibration stability is excellent.
- TAS-331DG can be delivered pre-configured to the desired measuring value and range or it can be delivered un-configured for customer configuration through the PC-interface. The PC-configuration makes free adjustment of the full input range and output range possible without any mechanical settings or adjustments inside the transducer.
Enclosed Distribution Panelboards

Unique Features

- Panelboard enclosures are all aluminum and rated IP20. A drip shield for meeting IP22 applications may be added by the customer.
- Available in 125-amp or 250-amp bus capacity.
- AC single-phase (A1) or three-phase (A3) bus configurations are available.
- DC single-pole (D1) or two-pole (D2) bus configurations are available.
- The 125A panelboards come in 12, 24, 36 and 48 pole versions and have screw-fastened flat front panels or formed hinged doors.
- The 250A bus panelboards come in 24, 36, 48, 60 and 72 pole versions and have screw-fastened flat front panels.
- Circuit breakers are rail-mounted stationary to the enclosure, not to the front panel. Front panel is easily removed and replaced with no attached wires.
- Circuit breakers are front connectable, easily changeable and available in 1, 2 or 3-pole units in 3, 6, 10, 16, 20, 25, 32, 40, 50 or 63 amp capacity.

125A Bus Distribution Panel

Unique Features

- The enclosure and cover plate are precision formed and stamped. Any cover will fit any other enclosure of the same size. Hinged doors are also available, add 12.7mm (1/2 INCH) to enclosure H & W for door dimensions.
- Normal mounting is with the neutral (or DC negative) and grounding buses at the top with the supply cable entering from the bottom, as shown at right, but the enclosure may be inverted for supply cable top entry.
- The cover panel is symmetrical and may be mounted with overlay text up regardless of whether the enclosure is mounted buses up or buses down so the decision to mount buses up or down may be made in the field.
- The supply cable may be sized up to 1/0AWG [70mm²] maximum (2AWG [35mm²] max for 12-pole). The supply conductors connect directly to the line buses with ¼” bolts and captive nuts and directly to the neutral (or DC negative) and grounding buses with pressure terminals. The neutral bus (blue terminals) is raised so the grounding conductors pass under it to connect to the grounding bus (green terminals).
- Output cables may be up to 2AWG [35mm²], the maximum size conductor that will fit in the CB terminal, and may enter from either top or bottom, as required.
- Circuit breaker arrangement should be final before engraving the circuit breaker label strips.
- A drip shield for meeting IP22 applications may be added by the customer.
250A Bus Distribution Panel

Unique Features

- The enclosure and cover plate are precision formed and stamped. Any cover will fit any other enclosure of the same size.
- Normal mounting is with the circuit breakers at the top, as shown at right, with the supply cable entering from the bottom but the enclosure may be inverted for supply cable top entry.
- The cover panel is not symmetrical and may only be mounted one way. The decision of whether to mount the enclosure circuit breakers up or down must be made before the cover panel overlay text is engraved.
- The supply cable may be sized up to 4/0AWG (120mm²) conductors maximum. The supply conductors connect directly to the 10mm line bus studs with nuts and directly to the neutral (or DC negative) and grounding buses with pressure terminals. As this size conductor may be very difficult to bend, there is enough room within the enclosure to make a complete service loop before connecting to the power bus.
- Output cables may be up to 2AWG (35mm²), the maximum size conductor that will fit in the CB terminal, and may enter from either top or bottom, as required.
- Circuit breaker arrangement should be final before engraving the circuit breaker label strips.
- A drip shield for meeting IP22 applications may be added by the customer.

125A & 250A WME ENCLOSED DISTRIBUTION PANELBOARDS SIZE COMPARISON

Specifications subject to change without notice. Consult WME for latest configuration.

*1 for 125A enclosure door dimensions, add 12.7MM (1/2") to enclosure W & H.

*2 250A, 72-pole version available, special order, 6-8 week lead-time. 72-Pole Size, 1026MM (40.4")H x 500MM (19.7")W x 145MM (5.7")D

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