

Marine Switchgear Systems

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.
- Custom configurations using Elsteel components are available.

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 also displays 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 never prohibits 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.
- Manual Mode. Protection and operational control is manual. Power source circuit breakers are safety interlocked with a manual rotary selector switch.

DC Control Power

WME Switchgear uses three independent sources of 24VDC control power. These inputs are to be supplied from three separate 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 no custom 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 compact 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 or PPM-300 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 in response to a high-current request signal from equipment such as a bow thruster or deck crane.
- "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, to supply power to the main bus during low-power or nighttime operations.
- 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 navigate 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.

- Bi-directional communication with vessel's Alarm and Monitoring System.
- Manual generator starting and stopping.
- Manual generator speed adjustment.
- Manual generator voltage adjustment.
- Manual generator paralleling with independent reverse-power protection, sync scope, and sync check relay.
- Analog zero-crossing voltmeter for manual paralleling.
- Analog kWh meter for monitoring shore usage.
- Analog Power Factor meter.
- Analog kVAR meter.
- A digital multi-function meter is available to replace the analog meters.
- An AC-powered 24VDC power supply is available to allow manual control of the switchboard when all three 24VDC power sources have failed. A selector switch is used to select the power supply's AC power source from either the main bus or a switchboard input power source.

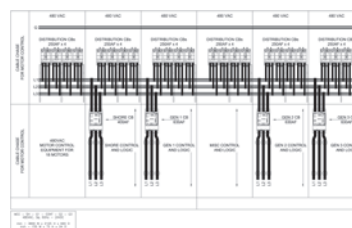
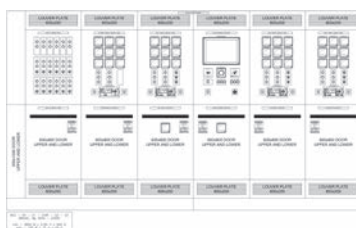
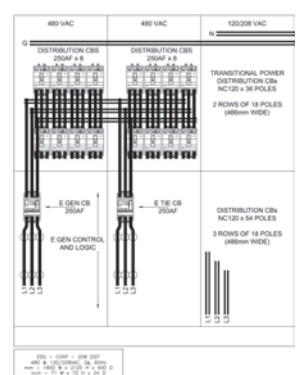
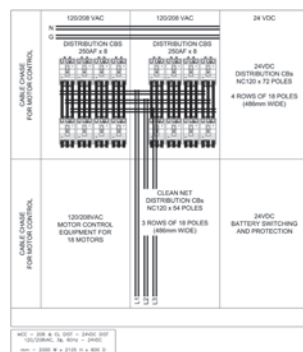
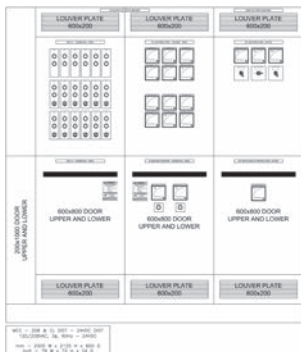
Arc Fault Protection System

- 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).

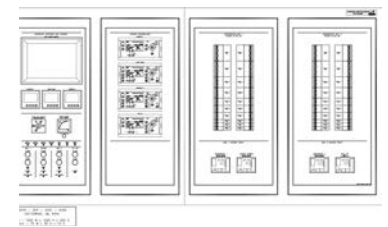
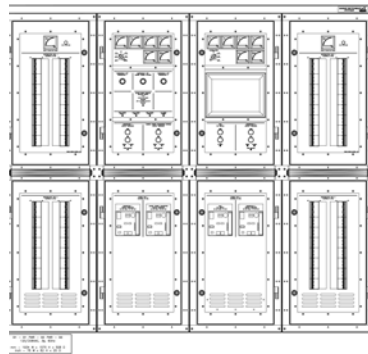
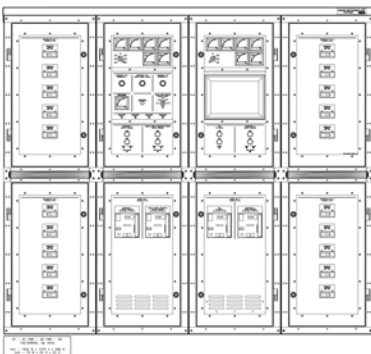
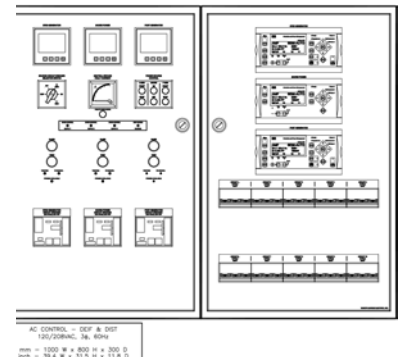
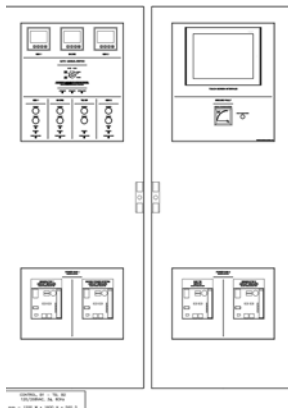
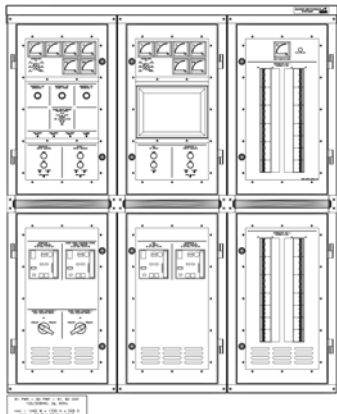
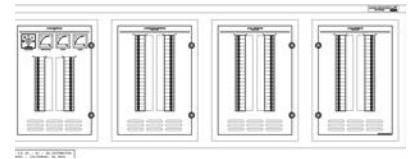
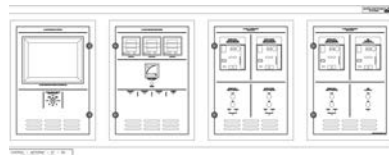
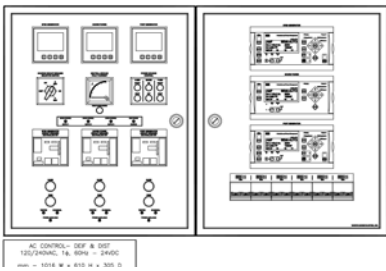
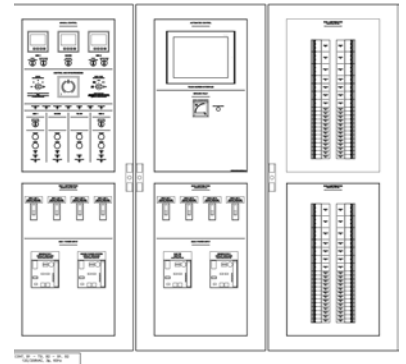
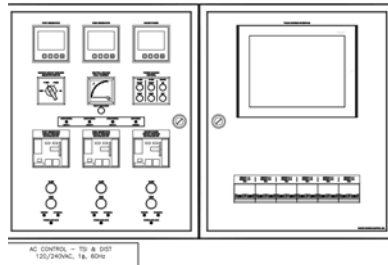
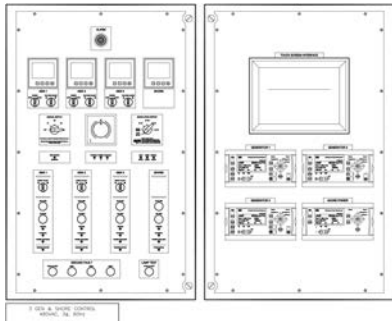
WARNING	
Arc Flash and Shock Hazard	
Appropriate PPE Required	
23 in	Flash Hazard Boundary
1.8 cal/cm²	Flash Hazard at 18 in
Level 1	Arc-rated shirt & pants or arc-rated coveralls
380 VAC	Shock Hazard when cover is removed
00	Glove Class
42 in	Limited Approach
12 in	Restricted Approach
1 in	Prohibited Approach
Location:	BUS-01, MAIN BUS
Ward's Marine Electric, Inc.	
617 SW 3rd Avenue Ft. Lauderdale, FL 33319 954-923-2815	
Job: 397352	Prepared on: 12/07/12 By: JDM
Warning: Changes in equipment settings or system configuration will invalidate the calculated values and PPE requirements	



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Switchboards

MARINE SWITCHGEAR SYSTEM



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Manual Switchgear Systems

Enclosure

- Bulkhead mounting for smaller systems, IP22 or IP23 protection.
- Deck mounting, IP22 or IP23 protection.
- Aluminum or steel enclosures.
- Custom enclosures using Elsteel components are available.

AC Power Bus System

- Single, split or multi-bus systems.

Power Source Selection

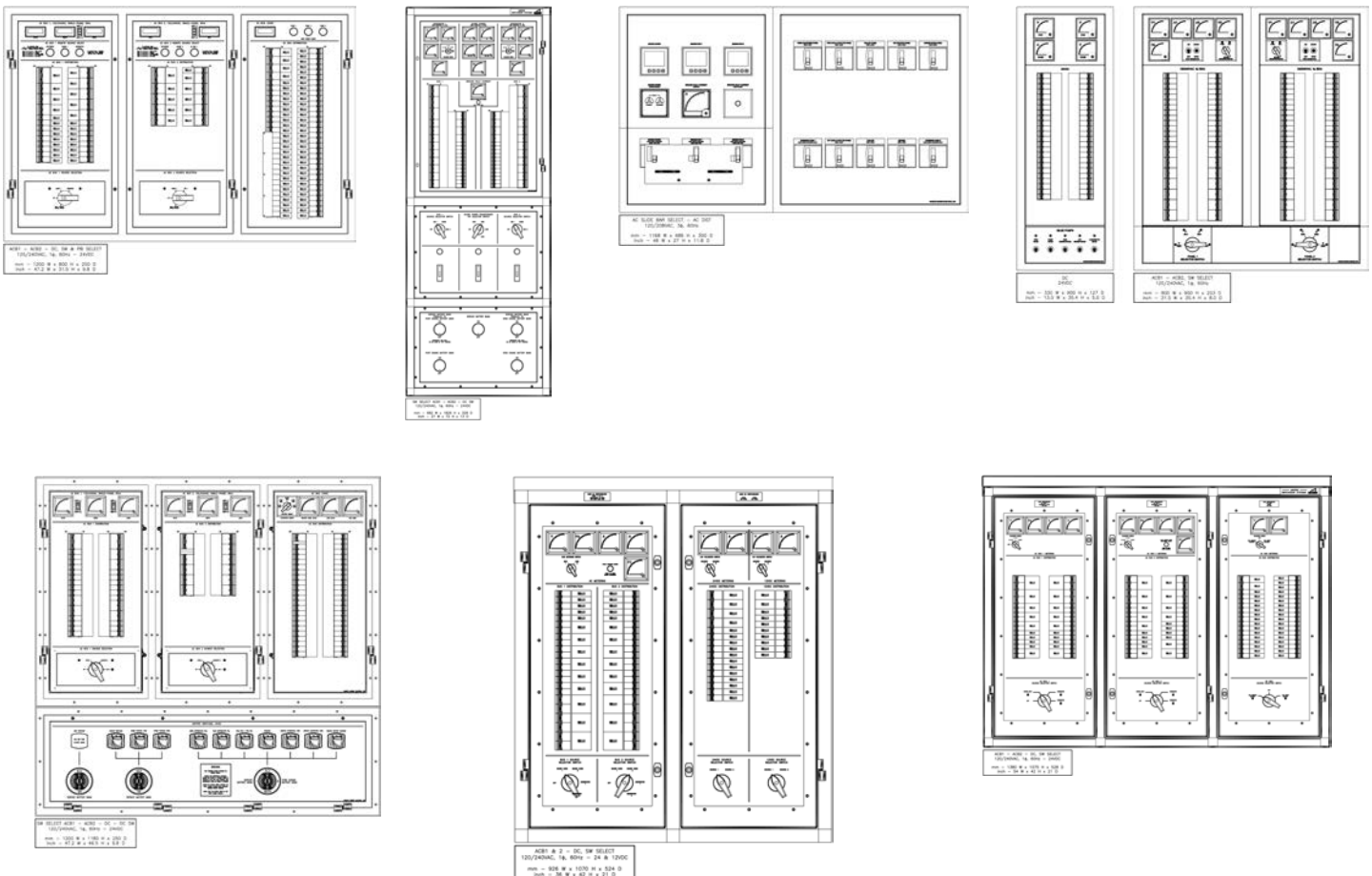
- Input circuit breaker selection with slide bar interlock.
- Contactor input source selection.
- Rotary switch input source selection.
- Rotary switch local input source selection plus contactors for local & remote input source selection.

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.



Switchboards

DEIF AUTOMATION

Generator Protection Unit

Unique Features

- Each controller contains all the functions that are needed to protect electrical equipment with a breaker, for example, a diesel generator, a busbar, or a motor.
- Each controller includes processor technology and high-speed internal communication to provide fast protection functions.
- Processor, communication, measurement, and input/output hardware modules may be replaced or added in the field. The controller automatically recognises the new hardware modules.
- The controller display unit color graphic screen allows fast access to live data. The operator can use the screen to manage alarms. With the right authorization, the operator can also check and/or change the I/O and parameter configuration. The light indicators of the display unit

are visible over a long distance. The display processor can display all languages.

- You can connect several GPU 300 controllers to create one communication network. Redundant communication between the controllers is possible.



Protection & Power Management, PPM 300

Unique Features

- Incorporating an extensive range of control, protection and supervision functions, PPM 300 applications range from genset control and protection to engineered power management solutions developed for diesel generators (including emergency diesel generators), shaft generators, shore connections, and bus tie breakers.
- PPM 300 power management systems control and monitoring applications meet and maintain set power requirements and guarantee stable operation. PPM 300 power management systems also incorporate market leading fuel optimization technology.
- In multi-master solutions, the integrated PPM 300 controllers connect and communicate as a closed circuit to eradicate single point failures: in cases of unit fall-out, the master functionality automatically moves to another host, keeping the system not just operational but safe and reliable at all times.
- The PPM 300's modular build supports on-site replacement of processor, communication, measurement, and input-output modules with comprehensive class approvals. Changes to the unit at sea or in the field

are assisted with automatic recognition functionality facilitating fast, easy and cost-saving service, repairs, and upgrades.

- The controller display unit includes a 5" color graphic screen with intuitive sequences and icons for fast readout of live data, and easy access to alarms handling and controller setup. Functionality is defined and targeted according to user permission levels.



Paralleling & Protection Unit, PPU 300

Unique Features

- The controller contains the functions required to protect and control a generator and its breaker (specifically, a diesel generator, a shaft generator, a shore connection, or a bus tie breaker). You can connect up to 12 controllers to create one system, with load sharing sections.
- Typically, a PLC or operator will send commands to the PPU 300 to close or open the breaker. For a diesel generator, the PLC or operator can also send commands to start or stop the generator, change the regulation-mode, and change the regulation set points.
- The controller display unit can have push-buttons for the operator to change the controller mode, close and open the breaker, and start and stop a diesel generator. The color graphic screen shows status and info messages.

- Each controller includes processors and high-speed internal communication. This provides fast protection functions. The controller design is modular, and hardware modules may be replaced or added in the field.



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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.



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.



Switchboards

DEIF AUTOMATION

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 ($U< + U>$), 3°
- 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 ($U< + U>$), 1°



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 generator power to shore power.
- 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.



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Selectable AC-Transducer, TAS-311DG

Unique Features

- TAS-311DG is a micro-controller-based AC-transducer with 1 analog 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 analog 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 analog 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.



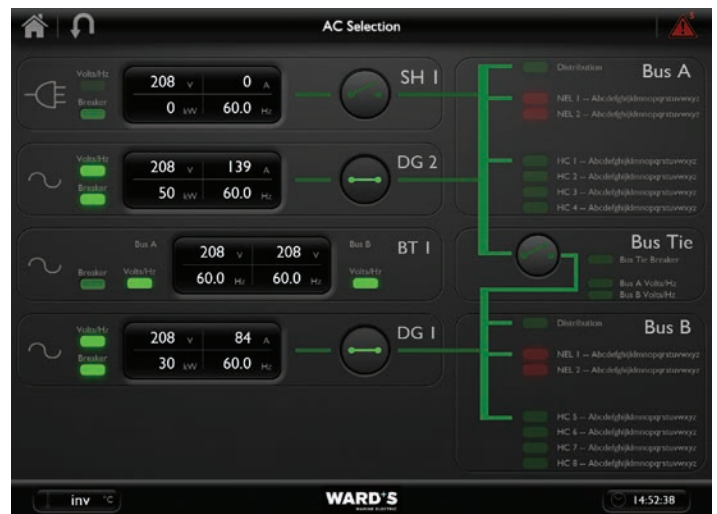
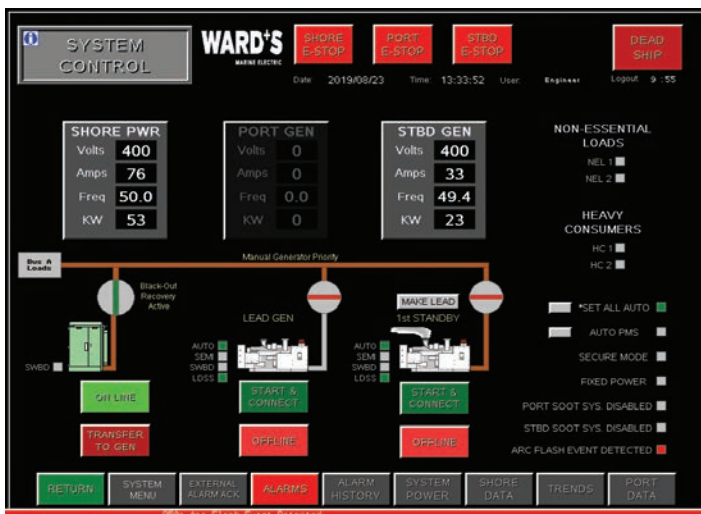
Switchboards

WARD'S MARINE ELECTRIC

Touch Screen Interface

The WME touchscreen interface is a convenient way to view and control all of the operations and data generated by the Deif PPM-3 or PPM-300 controllers. The TSI systems are interfaces only; all of the operational logic, alarms, and configuration is handled by the Deif processors. We offer two systems. One uses Schneider software installed on a MarineNav Microsoft Windows™-based integrated computer and touchscreen display that is mounted on the door of the switchboard cabinet. The other system uses Böning touchscreen equipment and is also mounted on one of the switchboard doors. Both systems come with the Deif configuration utility and TeamViewer remote access software, which allows our engineers to remotely log into the system for remote diagnosis and maintenance.

- Both systems offer SMS support that can send a text message with alarm data.
- The Schneider system also offers the ability to email log files and historical data.
- Since both systems are interfaces to the Deif processors, the same control and display data is available.
- The Schneider system with the MarineNav display has a 70°C rating.
- Böning systems are available with 10", 15", 19" and 24" displays.
- Schneider systems are available with 12.1", 15", and 19" displays.



SCHNEIDER

BÖNING

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Enclosed Distribution Panelboards

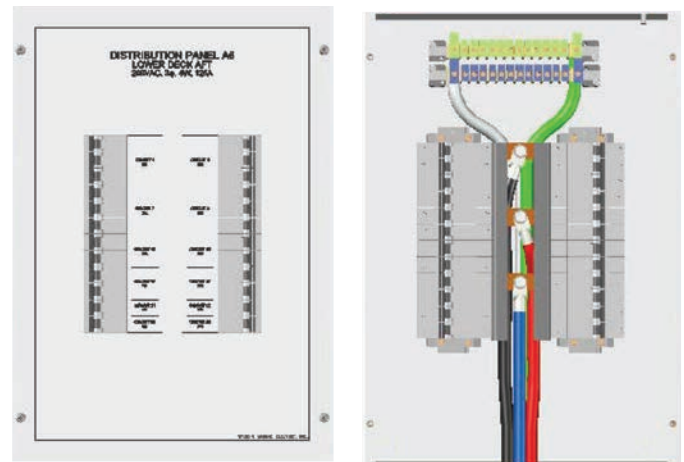
Unique Features

- 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 doors¹.
- The 250A bus panelboards come in 24, 36, 48, 60 and 72² pole versions and have screw-fastened flat front panels.
- Circuit breakers are rail-mounted stationary to the enclosure, not to the front panel. The front panel is easily removed for service.
- 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.
- Panelboards are configurable for either top or bottom cable entry. Cable entry penetrations and fittings are provided by customer.
- All AC panelboards are fitted with neutral and grounding buses.
- All DC panelboards are fitted with negative and grounding buses.
- Supply conductors are terminated directly to the power, neutral (or DC negative) and grounding buses.
- Branch circuit conductors are terminated directly to the circuit breakers and to the neutral (or DC negative) and grounding buses.
- Panelboards are painted with Awl Grip in "Matterhorn White".
- Panelboards are supplied with a face mounted reverse-engraved overlay with two circuit breaker label strips for displaying panelboard and circuit breaker identification.
- Various custom options are available, including metering and "Power Available" indicator lights. Please contact WME for additional details.

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. For hinged doors, please add 12.7mm (½") to enclosure height and width 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.



125A 24-POLE PANEL, SHOWN WITH AND WITHOUT COVER PLATE.

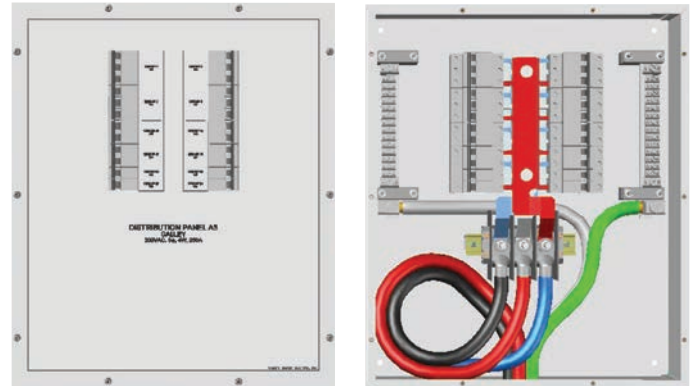
Switchboards

WARD'S MARINE ELECTRIC

250A Bus Distribution Panel

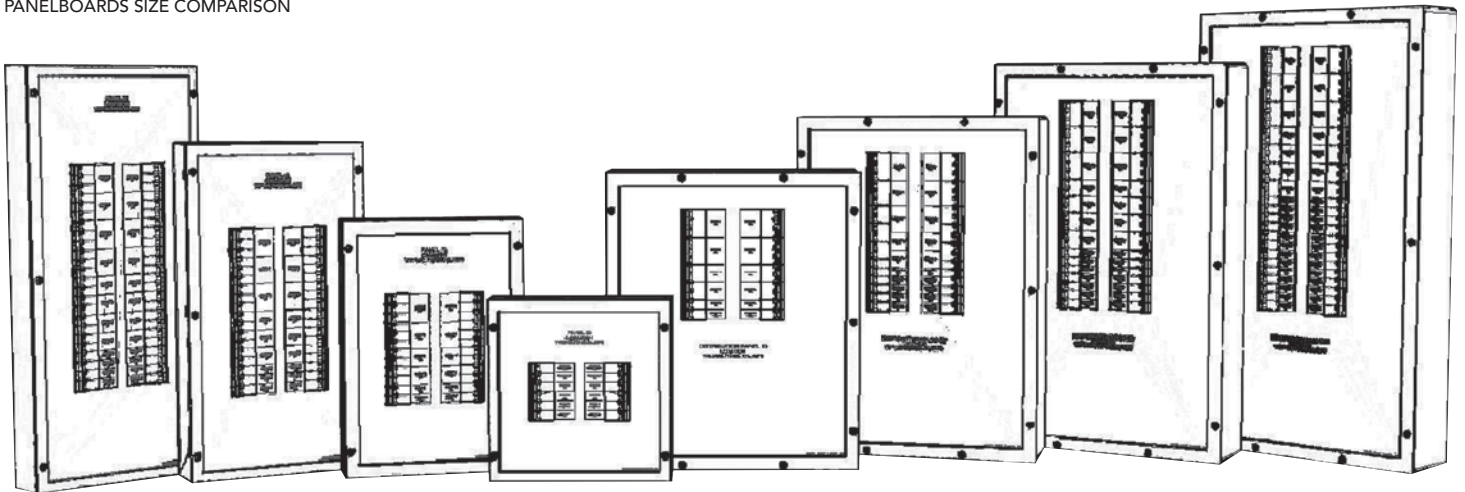
Unique Features

- 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.



250A 24-POLE PANEL, SHOWN WITH AND WITHOUT COVER PLATE.

125A & 250A WME ENCLOSED DISTRIBUTION PANELBOARDS SIZE COMPARISON



125A, 48-POLE

WME-125-48-A1
WME-125-48-A3
WME-125-48-D1
WME-125-48-D2

	MM	INCH
H	800	31.5
W	350	13.8
D	97	3.8

125A, 36-POLE

WME-125-36-A1
WME-125-36-A3
WME-125-36-D1
WME-125-36-D2

	MM	INCH
H	650	25.6
W	350	13.8
D	97	3.8

125A, 24-POLE

WME-125-24-A1
WME-125-24-A3
WME-125-24-D1
WME-125-24-D2

	MM	INCH
H	500	19.7
W	350	13.8
D	97	3.8

125A, 12-POLE

WME-125-12-A1
WME-125-12-A3
WME-125-12-D1
WME-125-12-D2

	MM	INCH
H	350	13.8
W	350	13.8
D	97	3.8

250A, 24-POLE

WME-250-24-A1
WME-250-24-A3
WME-250-24-D1
WME-250-24-D2

	MM	INCH
H	594	23.4
W	500	19.7
D	145	5.7

250A, 36-POLE

WME-250-36-A1
WME-250-36-A3
WME-250-36-D1
WME-250-36-D2

	MM	INCH
H	702	27.6
W	500	19.7
D	145	5.7

250A, 48-POLE

WME-250-48-A1
WME-250-48-A3
WME-250-48-D1
WME-250-48-D2

	MM	INCH
H	810	31.9
W	500	19.7
D	145	5.7

250A, 60-POLE

WME-250-60-A1
WME-250-60-A3
WME-250-60-D1
WME-250-60-D2

	MM	INCH
H	918	36.1
W	500	19.7
D	145	5.7

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

*1 for 125A enclosures with hinged doors, please 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

Images are representative of products listed and may not be actual product.