Power Plant Control System

**micro-PMS** for up to 3 generators

**mPMS205/215/305/315**

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**Micro-PMS205**

**Control Panel**

**MAG10x**

**KSQ104x**

**MXR845x**

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Norway
United Kingdom

[www.megacon.com](http://www.megacon.com)
**POWER PLANT CONTROL SYSTEM**

**micro PMS**

**For up to 3 generators**

**Product Description**

An important precondition for reliable shipboard operation is the availability of a dependable electric power supply, capable of meeting the demand under all operating conditions.

The basic design principle characterising the Megacon mPMS processing system is its combined use of the following:

- Hitachi micro PLC module EH-D64DR *(can be combined with other modules depending on the application)*
- Hitachi micro PLC module EH-D6EAN
- Uniop ETOP306 operator control panel.
- Megacon’s kW-meter KPW176A (or KCW176A)
- Megacon’s Hz-Transducer MCFB2
- Megacon’s Synchronoscope KCQ104F2 (or KSQ104F2)
- Synchronising Relays CA3KN40BD.

There are several application variation part numbers: *(contact us for other variations)*

**MPMS205**
- 2 Gensets
- 1 Busbar
- 5 Heavy Consumers

**MPMS215**
- 2 Gensets
- 2 Busbars
- 5 Heavy Consumers

**MPMS305**
- 3 Gensets
- 1 Busbar
- 5 Heavy Consumers

**MPMS315**
- 3 Gensets
- 2 Busbars
- 5 Heavy Consumers
**Product Presentation**

**User Friendly**
A fool proof and easy-to-use programme enables the operator to control the system in relaxed confidence, without fear of unexpected or uncontrolled consequences or plant malfunction to follow. The mPMS operational principles are NOT controlled by sequence but by course of real time spontaneous or predictable events, in order to optimise reliability and create a safe and functional man/machine interface.

Simple menu selection and procedures assure fast and safe programming, setting of parameters and access to all essential data on the Operator Panel back-lit LCD-screen, without the use of any separate programming device.

The operational parameters setting can be viewed and easily programmed (also during running of the plant) via the LCD-screen and its keyboard, using the password protected Parameter Setting Menu.

**Focus on the Core of Information**
mPMS’s LCD-screen presents to the operator all key information necessary to operate and programme the plant. The menus on the screen are also helpful guides for step by step verification of correct operation of system inputs during faultfinding and do it yourself installation and commissioning.

mPMS’s alarm system monitors and retains in an internal sequential event log the last 256 alarm messages. The event can be viewed on the LCD-screen.

**Power Demand Analysis**
Fast response precision RMS measurement of kW-load (unbalanced load configuration) makes mPMS unaffected of even heavily distorted wave-form, including superimposed interference from high power pulsedwidth-modulated frequency inverters. The measurements form an accurate basis for the systems power demand analysis.

**The Power "Reservoir" Concept**
mPMS uses the Constant Relative Power Reservoir principle for its standby system, a SAFETY START / ECONOMY STOP. The system will establish and maintain the required power reservoir level, based on calculations of the crossing point for the best power supply reliability.

**Frequency Priority**
mPMS performs simultaneous generator frequency regulation and load sharing control, but in order to maintain a high electricity supply quality the regulation of plant frequency has priority, if frequency due to load imbalance tends to exceed specified stability limits.

**Precision Directional Synchronisation**
In preference to the less accurate and less effective check synchronising method, mPMS uses the spot on-controlled synchronising principle, with dynamic compensation for the circuit breaker closing time. To prevent an incoming generator from entering into reverse power operation after synchronisation, the directional synchronising controller only allows synchronisation when incoming generator frequency is higher than the busbar frequency.

The "frequency differential" can be set to a high value if very fast synchronisation is a priority. mPMS will maintain an ELECTRICALLY perfect synchronisation over the full setting range (from between +0.1 to +2Hz), but a lower differential setting is often preferred to minimise the MECHANICAL impact on the prime mover-generator joint.

**Back-up Synchronisation and Synchronisation to External Supply**
During an auxiliary engine cooling-down interval the running generator will re-closure in the event of increased power demand.

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Product Presentation

Fuel Control
mPMS can control several combination of fuel control regulators (pilotmotors, linear motors etc. and droop or i-synchronous operated electronically controlled magnetic, pneumatic or hydraulic actuators).

An advanced 3-level monitoring function continuously scans each governors speed of response, to provide uniform regulation even if the dynamic characteristic of paralleled generator greatly differs.

The pattern of regulation commands will automatically adapt to each generators response, allowing smooth loadsharing and frequency regulation.

The regulation “dead band” can be programmed to minimise governor wear-out.

Watchdog and Safety Functions
As a platform for the safety functions built into each software module, Megacon applies “safety first” and “fail-to-safety” design philosophy to assess “what if” scenarios.

These standard safety functions enable mPMS to determine the actions necessary to safeguard supply reliability under all predictable and controllable conditions.

A few of the mPMS's additional standard safety features included are:

- Safety Change of: Operational Mode
- Safety Blocking of: System Alarm Reset
- Safety Monitoring of: Generator Offloading
  Measuring Transducer Outputs
  Synchronising Process
  Circuit Breakers Operation
  Generators
  Busbar(s)
  Voltage
  etc.

If the system watchdog detects system malfunction and failure of internal or external functions, it instantly will transfer the running generator from AUTO to MANUAL control. During “system alarm” condition ALL the control and command outputs are disengaged and galvanically separated from the switchboard.

Transient Protection
The mPMS always softly unloads a generator to provide load-free disconnection of its circuit breaker. If a loaded generator in a 440V system is disconnected due to shut down conditions etc., the generator may worst case induce one-shot voltage transients exceeding 200kV. Such a “killer” transient may contain leading edge frequency components exceeding 1GHz.

Installation on each generator bus of a low cost Megacon TSU17 Transient Protection Unit (with over-voltage alarm), will effectively protect both the generator windings itself and any electronic equipment (AVR, protective guards etc.) connected directly to the generator bus.

Documentation
Comprehensive project documentation is available, in order to optimise a project cost efficiency and make life easy, by saving man-hours during all phases of planning, engineering, value analysis, testing, installation, commissioning etc.
Features

Here is a selection of the standard features included in the mPM-System:

- Load dependent start and stop of diesel generators
- Frequency control of diesel generators
- Directional spot-on synchronising with dynamic compensation of breakers closing time for generator breakers and bustle
- Generator off-loading prior to load free disconnection of generator breakers
- Easy standby selection
- Black-out start system
- Symmetrical kW load sharing between paralleled generators
- Supervision of power availability for 5 heavy consumers at individual kW-levels
- kW-monitoring and power reservation for one thruster load included
- Output for control of shaft generator excitation (magnetisation control)
- Adjustable load sharing dead zone, regulation speed and response
- Self-monitoring watchdog Systems for safety monitoring of internal and external functions and signals
- Alarm and event log
- Additional inputs for remote start of standby generator and blocking of load dependant stop

(See the last page for a typical mPMS system combines the central Logic Control Unit with a distributed system of Megacon panel mounted DIN96 Generator Protective Guards and synchronizer)

Also available are Megacon’s ranges of general switchboard instrumentation, current transformers and measuring transducers. In this way Megacon provides a one-stop-shop for a complete and cost efficient package for control, selective protection and instrumentation of a ship’s power generating system.

Megacon favours “see what is happening” in preference to a “black box” concept. Accordingly, to achieve instant plant overview in a glimpse, most Megacon protective guards for DYNAMIC parameters (A, V, Hz, W, VAr, kW etc.) have pointer type displays. Bold black print on a white scale and low reflection glass eases reading of the control instrument at a distance.

Also the following Megacon units may be a useful supplement to any Power Plant:

- Reactive Power (Var) Guard
- Field Excitation Guard
- “Loss of Mains” Relay
- Synchronising Guard
- Lamp Synchronoscope
- kWh Counter
- Temperature Guards
- etc.

LCD Screen

The LCD Screen presents updated information on the Plant operational status, alarm and event status, parameter settings and setting of operational mode and standby sequence etc.

Using the keyboard the operator easily controls Plant operation, and can at any time view or alter (password protected) the setting of following system parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Level Gen1</td>
<td>0000 kW</td>
</tr>
<tr>
<td>Start Level Gen2</td>
<td>0000 kW</td>
</tr>
<tr>
<td>Start Level Gen3</td>
<td>0000 kW</td>
</tr>
<tr>
<td>Start Delay</td>
<td>00 Secs</td>
</tr>
<tr>
<td>Selective Level</td>
<td>0000 kW</td>
</tr>
<tr>
<td>Stop Delay</td>
<td>00000 kW</td>
</tr>
<tr>
<td>Cooling Delay</td>
<td>00000 Secs</td>
</tr>
<tr>
<td>Regulation Mode</td>
<td>0 %</td>
</tr>
<tr>
<td>Pulse Width Gen1</td>
<td>0.0 Secs</td>
</tr>
<tr>
<td>Pulse Width Gen2</td>
<td>0.0 Secs</td>
</tr>
<tr>
<td>Pulse Width Gen3</td>
<td>0.0 Secs</td>
</tr>
<tr>
<td>Frequency</td>
<td>00.0 Hz</td>
</tr>
<tr>
<td>Heavy Consumer Level 1</td>
<td>0000 kW</td>
</tr>
<tr>
<td>Heavy Consumer Level 2</td>
<td>0000 kW</td>
</tr>
<tr>
<td>Heavy Consumer Level 3</td>
<td>00000 kW</td>
</tr>
<tr>
<td>Heavy Consumer Level 4</td>
<td>0000 kW</td>
</tr>
<tr>
<td>Heavy Consumer Level 5</td>
<td>0000 kW</td>
</tr>
</tbody>
</table>
## Technical Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plant Voltage</strong></td>
<td>Adaptable to any system voltage. For voltage above 440VAC, or for applications where use of voltage above 250VAC is restricted, a range of step-down isolation transformers for nominal 115VAC or 230VAC secondary is available.</td>
</tr>
<tr>
<td><strong>Plant Configuration</strong></td>
<td>Three phase 3- or 4-wire configuration. Floating or grounded neutral</td>
</tr>
<tr>
<td><strong>Plant Frequency</strong></td>
<td>Nominal 50 or 60Hz +/- 5Hz</td>
</tr>
<tr>
<td><strong>Current Transformer</strong></td>
<td>1A or 5A secondary</td>
</tr>
<tr>
<td><strong>CPC Auxiliary Voltage</strong></td>
<td>Battery nominal 24VDC (19.2-30VDC) externally fused (4A)</td>
</tr>
<tr>
<td><strong>Analogue Inputs</strong></td>
<td>4,3 to 20mADC</td>
</tr>
<tr>
<td><strong>Output Relays</strong></td>
<td>5-250VAC or 5-30VDC 2A max. contact rating (max 5A pr. Common)</td>
</tr>
<tr>
<td><strong>Communication Port</strong></td>
<td>RS 232 Standard (for panel)</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td>Operation 0 °C to +54 °C ambient Storage -20 °C to 75 °C</td>
</tr>
<tr>
<td><strong>Approvals</strong></td>
<td>No approvals</td>
</tr>
<tr>
<td><strong>Operator Control Panel</strong></td>
<td>Various sized front-of-panel Operator Control Panel are available. The standard panel is the eTOP306.</td>
</tr>
</tbody>
</table>

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A typical mPMS system combines the central Logic Control Unit with a distributed system of Megacon panel mounted DIN96 Generator Protective Guards and synchronezor.