Power Plant Control System

micro-PMS for up to 3 generators

mPMS205/215/305/315

Micro-PMS205
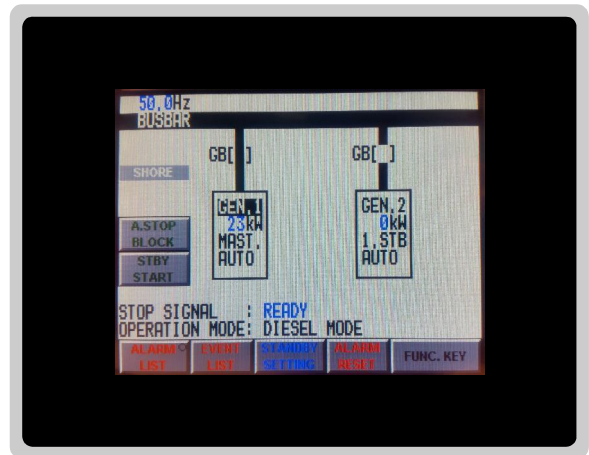
Control Panel

MAG10x

KSQ104x

MXR845x

Norway
United Kingdom
www.megacon.com

megacon

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.

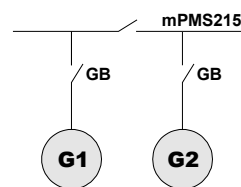There are several application variation part numbers: *(contact us for other variations)*

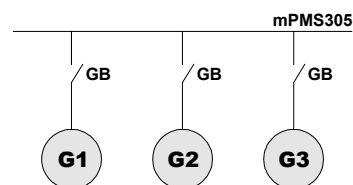**MPMS205**
- 2 Gensets
- 1 Busbar
- 5 Heavy Consumers
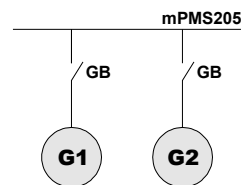
MPMS215
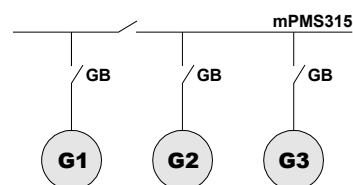- 2 Gensets
- 2 Busbars
- 5 Heavy Consumers

MPMS305
- 3 Gensets
- 1 Busbar
- 5 Heavy Consumers

MPMS315
- 3 Gensets
- 2 Busbars
- 5 Heavy Consumers

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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 pulsewidth-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.

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
                               Genrators
                               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.

Product Presentation

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 bustie
- 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 synhronizer)

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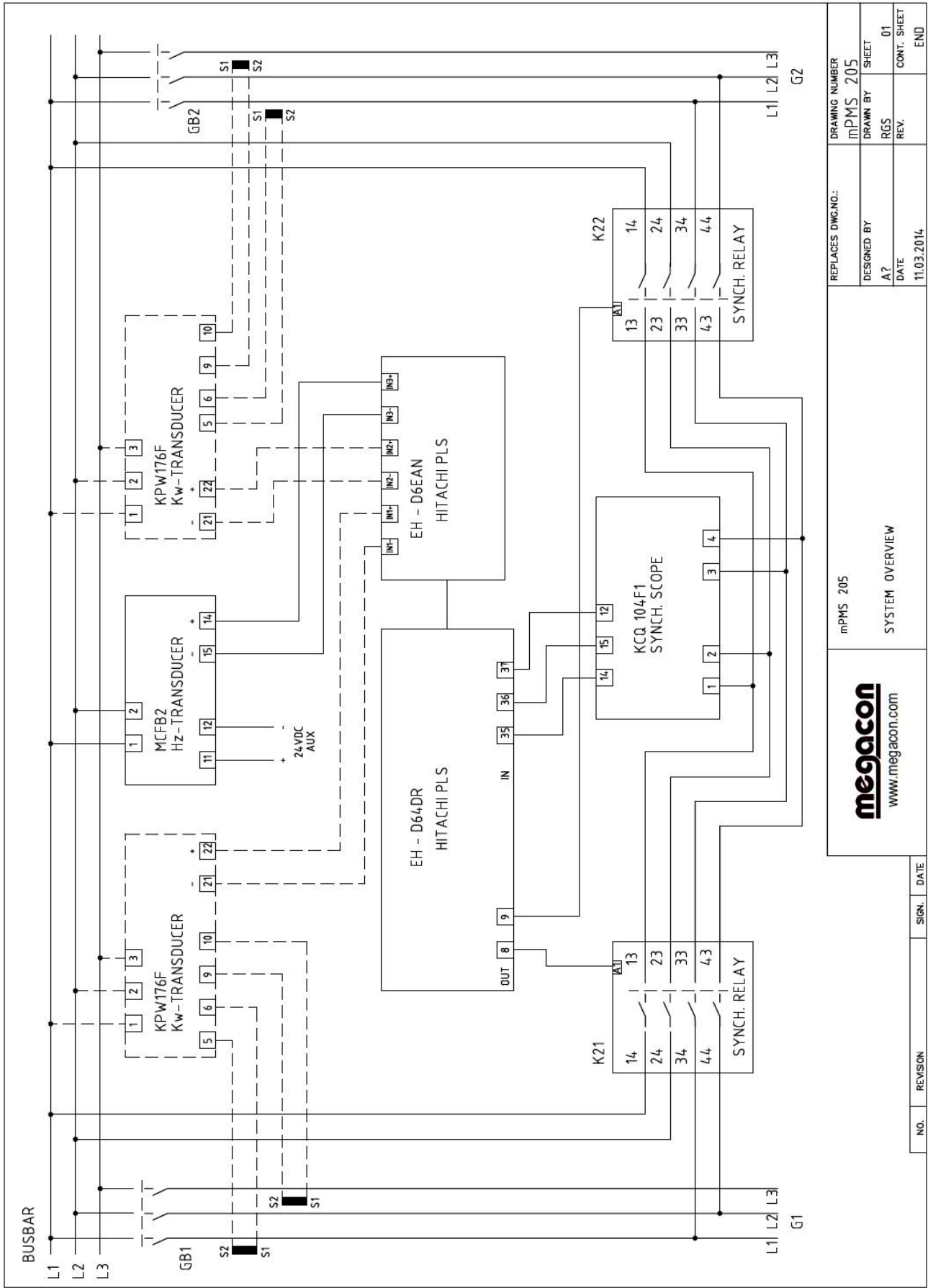
Using the keyboard the operator easily controls Plant operation, and can at any time view or alter (password protected) the setting of following system parameters:

Start Level Gen1	: 0000 kW	Pulse Width Gen1	: 0,0 Secs
Start Level Gen 2	: 0000 kW	Pulse Width Gen 2	: 0,0 Secs
Start Level Gen 3	: 0000 kW	Pulse Width Gen 3	: 0,0 Secs
Start Delay	: 00 Secs	Frequency	: 00,0 Hz
Selective Level	: 000 kW	Heavy Consumer Level 1	: 0000 kW
Stop Delay	: 0000 kW	Heavy Consumer Level 2	: 0000 kW
Cooling Delay	: 0000 Secs	Heavy Consumer Level 3	: 0000 kW
Regulation Mode	: 0	Heavy Consumer Level 4	: 0000 kW
Dead-Zone	: 0 %	Heavy Consumer Level 5	: 0000 kW

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Technical Data

Plant Voltage
: 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.

Plant Configuration
: Three phase 3- or 4-wire configuration. Floating or grounded neutral

Plant Frequency
: Nominal 50 or 60Hz +/- 5Hz

Current Transformer
: 1A or 5A secondary

CPC Auxiliary Voltage
: Battery nominal 24VDC (19,2-30VDC) externally fused (4A)

Analogue Inputs
: 4,3 to 20mADC

Output Relays
: 5-250VAC or 5-30VDC 2A max. contact rating (max 5A pr. Common)

Communication Port
: RS 232 Standard (for panel)

Temperature
: Operation 0 °C to +54 °C ambient
Storage -20 °C to 75 °C

Approvals
: No approvals

Operator Control Panel
: Various sized front-of-panel Operator Control Panel are available. The standard panel is the eTOP306.

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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 synhronizer.