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A Study on the Development of Control System for Low-Speed Diesel Engines for Ships

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Abstract : BMS & Governor System

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BMS & Governor System

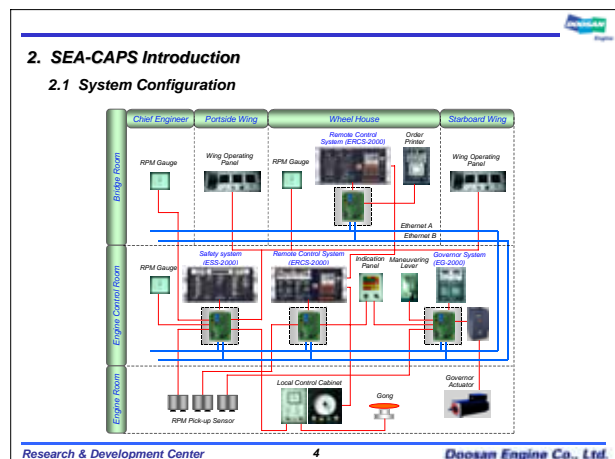
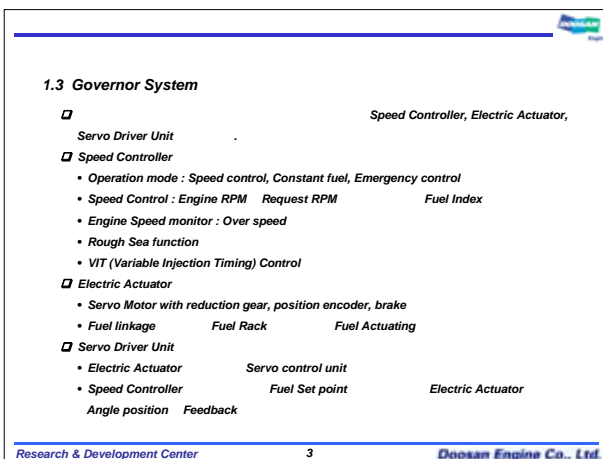
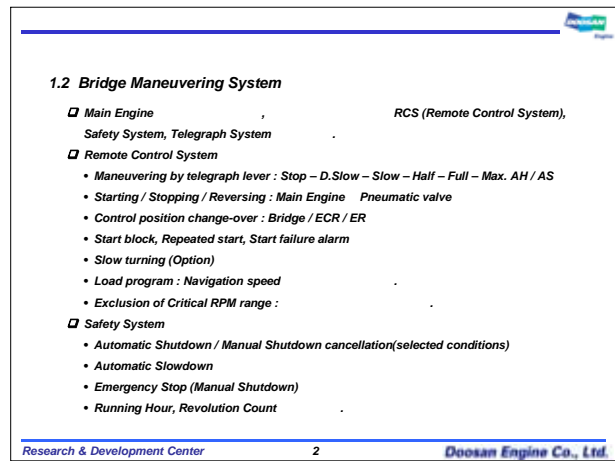
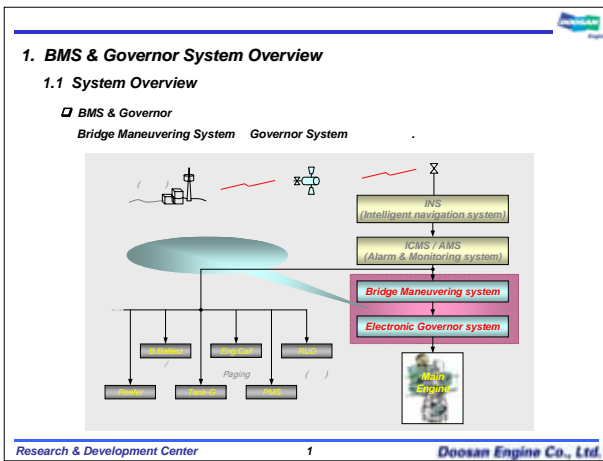
Governor System

SEA-CAPS

, SEA-CAPS

BMS &

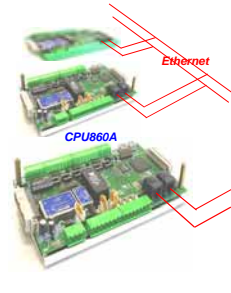
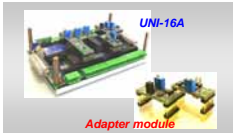
Key words : (Control System), BMS(Bridge Maneuvering System), Governor System



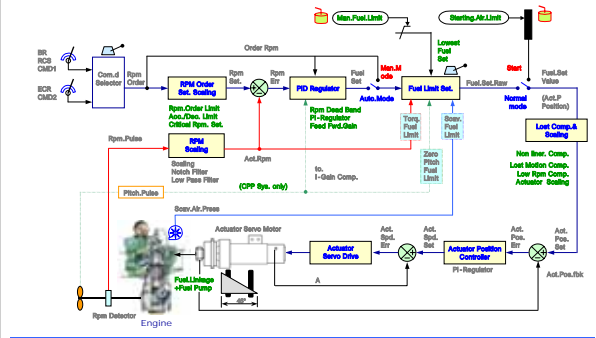
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2.2 System Hardware Components

- CPU Board with 32-bit Microprocessor : CPU860A
 - Real-time OS : VxWorks
 - Control Network : Ethernet (Redundancy)
- I/O Board
 - UNI-16A : Universal Input/Output 16Channel
 - DI-16A : Digital Input 16 Channel
 - DO-16A : Digital Output 16 Channel
 - AI-16A : Analog Input 16 Channel
 - AO-8A : Analog Output 8 Channel



2.3 System Software Block Diagram



2.4 SEA-CAPS Features

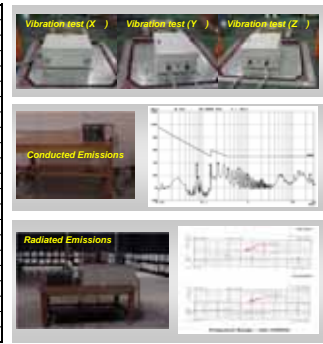
- Advanced processing unit & Real-time operating system contribute to a high level of reliability and flexibility.
- SEA-CAPS integrates the independent distributed subsystems that are connected to a high speed redundancy Ethernet network, and easily interfaces to other system via standard MODBUS.
- The independent subsystems contribute to fully distributed control. As its stand-alone capabilities, failure of one system will not influence operation of other subsystems.
- The modular design of DIN-rail mounting type and the using of universal I/O module and Auto ID setting of I/O board allow efficient and cost-effective configuration.
- On-line system monitoring/tuning with the network and device monitoring program
- SEA-CAPS provides Live Insertion function for CPU & I/O boards.
- SEA-CAPS is produced by using high quality electronic technique, like 10 layer printed circuit boards and integrated EMC filters.
- Any kinds of short circuit or earth problems rose in the local sensors or field cables can be protected by Earth & Short protection circuit designed in the I/O modules.



3. Test & Results

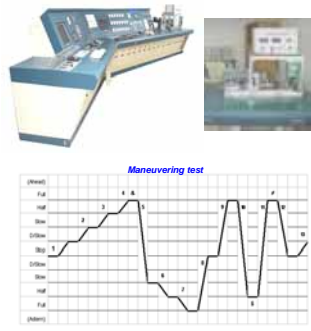
3.1 Environmental Test

| No. | Environmental Test |
|-----|------------------------------|
| 1 | Visual inspection |
| 2 | Vibration test |
| 3 | Dry heat test |
| 4 | Damp heat test |
| 5 | Low temperature test |
| 6 | High voltage test |
| 7 | Insulation resistance test |
| 8 | Inclination test |
| 9 | Enclosure test |
| 10 | Acoustic noise test |
| 11 | Compass safety distance test |
| 12 | Power supply variation test |
| 13 | Power supply failure test |
| 14 | Radiated emissions |
| 15 | Conducted emissions |
| 16 | Conducted low frequency |
| 17 | Conducted radio frequency |
| 18 | Electromagnetic field |
| 19 | Bursts |
| 20 | Susges |
| 21 | Electrostatic discharge |



3.2 Performance Test

| No. | Performance Test |
|-----|--|
| 1- | Lamp test of Bridge panel & ECR panel unit |
| 3- | Control position transfer test |
| 6 | Bridge panel failure |
| 7 | Starting test |
| 8- | Starting failure test for misfire & start impossible |
| 10 | 3 fails start test |
| 11 | Telegraph fail alarm test |
| 12- | Emergency slowdown/shutdown test |
| 14 | Manual shutdown test |
| 15 | Maneuvering test |
| 16 | Load program test |
| 17 | Crash astern |
| 18 | Wrong way alarm |
| 19 | Slow turning |
| 20 | Actuator behavior at governor power failure |
| 21 | Sub-telegraph |
| 22 | Ready for start |
| 23 | Start interlock |
| 24 | Speed skip at critical speed zone |
| 25 | Speed pick-up failure and automatic back-up |
| -27 | Output signal for speed & load |



3.3 Test Results

- Type Approval Certificates ;
 - SEA-CAPS has a major list of certificates for international use. These certificates are issued after the severe environmental tests and performance tests as well as EMC tests based on the IEC61000 series. This means SEA-CAPS is tested for reliability and quality simultaneously
- Classification society ;
 - Det Norske Veritas (DNV) Type Approval Certificate
 - Lloyd's Register of Shipping (LR) Type Approval Certificate
 - American Bureau of Shipping (ABS) Type Approval Certificate
 - Germanischer Lloyd (GL) Type Approval Certificate

