Building a better future
Global Leader

MARINE
Switchgear & Console

HYUNDAI
HEAVY INDUSTRIES CO.,LTD.

Marine Switchgear & Console

Introduction

Hyundai has long been engaged in designing, engineering and manufacturing marine electrical equipment such as main switchboard, group starter panel, control console, alarm & monitoring system, generator, motor and transformer.

These products have been installed on a large number of ocean-going vessels and are recognized for their efficiency and outstanding performance. Hyundai technology is also utilized in navy vessels and offshore facilities such as frigates, submarines, FPSO, drilling rigs and special ships.

Hyundai marine electrical equipments have been widely recognized not only by major classification societies like LRS of UK, ABS of U. S. A., DNV of Norway, GL of Germany, BV of France, NK of Japan, KR of Korea, but also by leading shipowners around the world.

Having extensive know-how in marine power distribution and control systems, we take pride in our high quality design and standards, uncompromising quality control and reliability and research activities. These things enable us to maintain competitiveness successfully in quality, price and delivery in the world market.

C O N T E N T S

General

Rules and Regulations

Hyundai marine switchgear comply with the following classification societies and/or standards organizations.

- American Bureau of Shipping (USA)
- Bureau Veritas (France)
- Det Norske Veritas (Norway)
- Germanischer Lloyd (German)
- Korean Register of Shipping (Korea)
- Lloyd's Register of Shipping (UK)
- Nippon Kaiji Kyokai (Japan)
- Registro Italiano Navale (Italy)
- International Electrotechnical Commission
- Compliance with United States Coast Guard
- Regulations are also available upon request.
- Military Specifications(MIL) are also available upon request.

Service Conditions

Ambient temperature : 45℃, 50℃ (option)
Relative humidity : 95% at 45℃

Vibration

Frequency(Hz)	Displacement	Acceleration
2 ~ 13.2	±1.0mm	-
13.2 ~ 100		1.0g

World Wide Quality Marine Service

Hyundai, as a member of the ISES (International Ship Electrical and engineering Service association), also provides services and spare parts for marine servicing when required by customers.

High Voltage Switchboard

High voltage metal-clad switchboards with withdrawable circuit-breaker are of single(1)-tier or two(2)-tier, factory-assembled and suitable for a rated voltage of 7.2 kV up to 12 kV.

Design Concept

High voltage switchboards have been designed, manufactured and type tested in accordance with IEC 60298.

- Designed for maximum safety and reliability.
- Easy installation.
- Minimal maintenance, all parts easily accessible.
- Simplified but flexible design.

Ratings and Technical Specifications

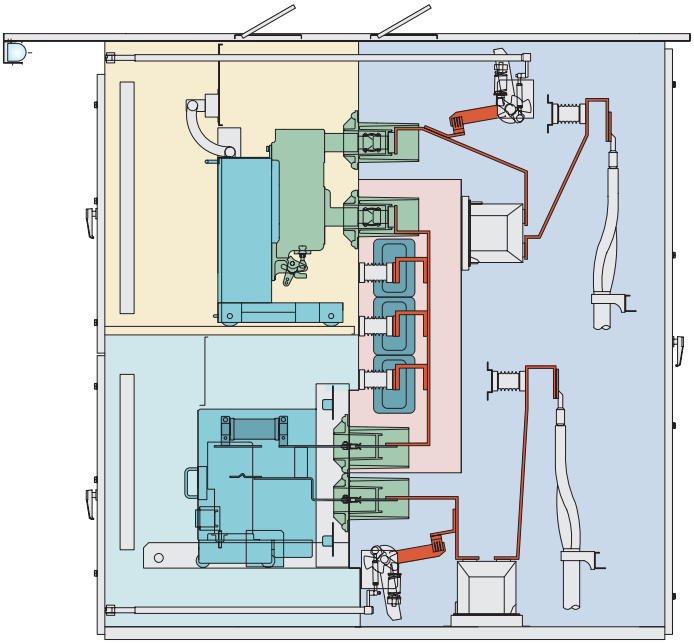
Type	Metal-clad
Rated voltage	7.2 kV, 12 kV
Rated current	1250 A, 2000 A, 3150 A
Rated frequency	50/60 Hz

Construction

Frame work	Formed sheet steel or substantial box-frame
Access	Front and rear
Protection degree	IP32
Handrail	Front and rear
Power line inlet	Bottom or upper part(upper part, option)

High Voltage Switchboard

HMS-107



Cubicle Dimension

Rated voltage (kV)	Rated current (A)	Width (mm)	Depth (mm)	Height (mm)
7.2	1250,2000	750, 850	2200	2350
	3150	1000		2450
12	1250,2000	750, 850	2200	2350
	3150	1000		2450

Electrical Characteristic

Rated voltage (kV)	Rated 1min power-frequency withstand voltage (kV rms)	Impulse withstand voltage (kV peak)	Rated current (A)	Short-time withstand current for 1s(1)	
				(kA rms)	(kA peak)
7.2	20	60	1250, 2000	40	104(2)
			3150(3)		
12	28	75	1250, 2000	40	104(2)
			3150(3)		

(1) For duration > 1s, consult us (2) 100 kA for 50 Hz (3) Single-tie construction, transition panel to be added.

HMS-112

Construction

HMS-112 switchboard is divided into compartments by means of the earthed metal partitions.

- Circuit-breaker compartment.
- Low voltage compartment.
- Busbar compartment.
- Cable connection compartment.

A Low voltage compartment

1 Mounting plate for auxiliary devices

B Circuit-breaker compartment

2 Withdrawable breaker truck with HVF VCB
3 Plug and socket for auxiliary circuit of VCB
4 Metal shutter
5 Contact bushing

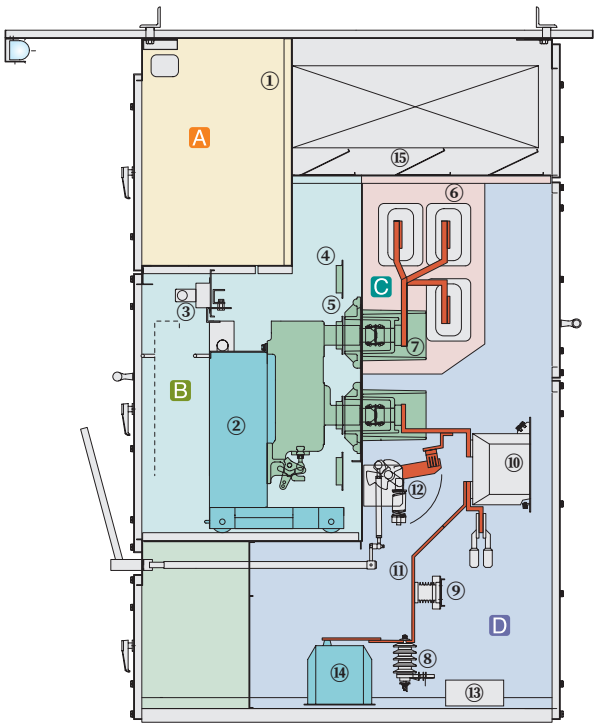
C Busbar compartment

6 Main busbar
7 Fixed disconnecting contact

D Cable connection compartment

8 Surge arrestor
9 Epoxy insulator
10 Block type current transformer
11 Branch busbar
12 Earthing switch
13 Zero phase current transformer
14 Potential transformer

15 Pressure-release flap



※ PT drawable track type (If requested)

Cubicle Dimension

Rated voltage (kV)	Rated current (A)	Width (mm)	Depth (mm)	Height (mm)
7.2	1250	650, 800	1500	2450
	2000			
12	1250	650, 800	1700	2450
	2000			

Electrical Characteristic

Rated voltage (kV)	Rated 1min power-frequency withstand voltage (kV rms)	Impulse withstand voltage (kV peak)	Rated current (A)	Short-time withstand current for 1s (1)	
				(kA rms)	(kA peak)
7.2	20	60	1250, 2000	25	63
12	28	75	1250, 2000	25	63

(1) For duration > 1s, consult us

High Voltage Switchboard

Generator Automatic Control (HIMAP-BCG)

HIMAP-BCG preforms automatic generator control functions and gives various protection functions.

Automatic Power Control

- Automatic synchronizing
- Automatic load sharing(Symmetrical/Asymmetrical)
- Load depending start/stop
- Automatic sequence control after alarm/fault
- Heavy consumer blocking

Diesel Engine Control

- Manual start/stop
- Automatic start/stop
- Remote start/stop via communication or binary input.
- Pre-lubrication pump control

Generator Status Monitoring

- Detailed start/stop monitoring
- PMS status/process monitoring
- Remote monitoring via communication(Modbus protocol)

Protection and Panel Automation

- Multi fault protection
- Fault wave recording
- Programmable logic function
- Self-diagnostic
- System operation debugging function
- Various metering function

HIMAP-FI, M, T

Microprocessor based intelligent measuring and protection device for switchboard.

Protection Function

- **HIMAP-FI** : Incoming / Feeder protection (27, 59, 64, 50/51, 50/51G, 67G, 47P, 47N)
- **HIMAP-M** : Motor protection (49, 51LR, 46, 50, 66, 50H, 50/51G, 67G)
- **HIMAP-T** : Transformer protection (87T, 50/51P, 50/51S, 50/51G, 67G)

Measuring Function

A, V, F, W, var, wh, varh, PF

Communication Function

RS-485(62.5Kbps)
DNP 3.0, HD-BUS

Special Function

- Self-diagnosis
- Power failure compensation
- SOE(1mS)
- Fault recording(36 Sampling/Cycle, 5sec)
- Event recording(100)
- Analog output(4Ch)
- Trip circuit supervision(TCS)
- Remote control

Main Switchboard

Main switchboard is a compact low-voltage board used for power distribution.
It has been specially developed for marine applications.

Ratings and Technical Specifications

Type	Dead front, totally enclosed
Rated voltage	500 V AC(690 V AC, option)
Rated current	Max. 9000 A(Asym.peak 330 kA)
Rated frequency	50/60 Hz

Construction

Frame work	Formed sheet steel or substantial box-frame
Access	Front and rear
Protection degree	IP21(IP22, option)
Handrail	Front and rear
Power line inlet	Bottom or upper part(upper part, option)

Main Switchboard

Generator Panel

The generator panel is normally located in the middle of the board and contains all the switching, protection and indicating equipment to be necessary for controlling and monitoring the generator.
The functions of a generator panel can be divided into two main groups.

Lower Part

The withdrawable circuit-breaker is installed in the lower half of the generator panel.

Upper Part

The instruments and switches are mounted on an upper door, and the auxiliary equipments are easily accessible from the mounting panel inside.

Cubicle Dimension

Generator rated current(A)	Type of ACB	Width	Height	Depth
800	HiAN 08	600	1980 2100 2220 2340	1000 ~ 1300
601 ~ 1250	HiAN 12			
1251 ~ 1600	HiAN 16			
1601 ~ 2000	HiAN 20	700		
2001 ~ 2500	HiAN 25	800		
2501 ~ 3000	HiAN 32	900		
3001 ~ 4000	HiAN 40	1000		1300 ~ 1800(1)
4001 ~ 5000	HiAN 50	1100		

(1) For more detailed dimension, please contact us.

Synchronizing Panel

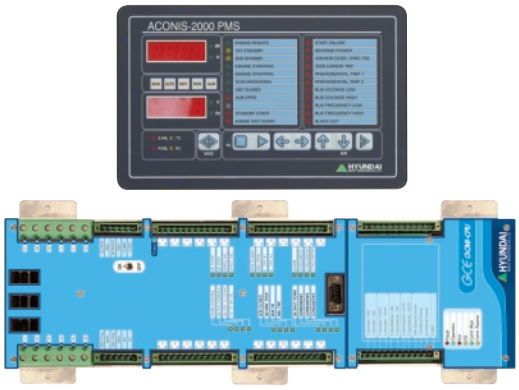
The synchronizing panel can be equipped with power management system.

Additional synchronizing equipment including automatic generator control equipment is also available.

Necessary instruments and control switches are also provided for monitoring and manually controlling of all generators.

Power Control and Management System (ACONIS-2000 PMS)

It has the features of distributed control architecture, available to set up diverse control with parameter variable logic for the control and I/O signal processing.



Control Function

- Manual & automatic load dependent start/stop
- Frequency regulation
- 3-phase power management
- Automatic synchronizing
- Symetric/asymetric load sharing
- Black-out monitoring/start
- Stand-by selection
- Generator monitoring of critical parameters
- Generator protection with circuit breaker trip
- Engine shutdown

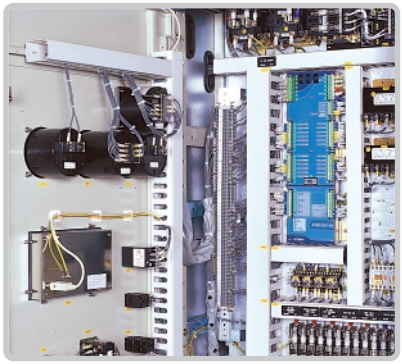
Status Monitoring

- PMS status/process monitoring
- Detailed start/stop monitoring

I/O Function

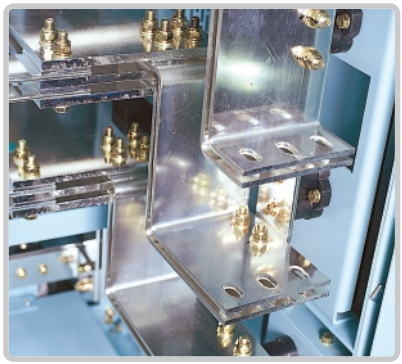
- Consumer blocking
- Preference tripping
- Sea and harbor mode
- Bus-tie breaker control
- Automatic voltage regulation

Major Inner Parts



Clamping Type

- Easy to separate door from panel for maintenance.
- Also Uses flame retardant hook band for wire protection.



Busbar Connection

- Nuts tested by KTL(Korea Testing Laboratory) of temperature cycles, vibration.
- Withstands any shocks and/or vibrations.

Group Starter Panel

HGS Starters are Designed and Manufactured for

- Easy installation
- High reliability and safety.
- Space-saving
- Easy operation.
- Easy inspection and maintenance.

Type

Fixed Type

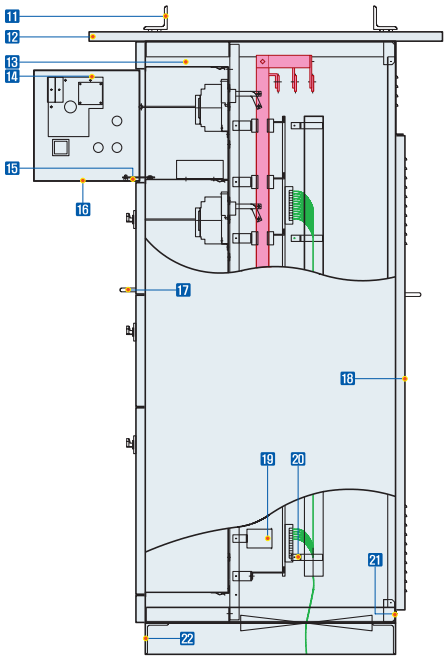
HGS&7BB	Rear access type
HGS&7BF	Front access type
HGS&7BD	Double access type
HGS&7BW	Wall mounting type

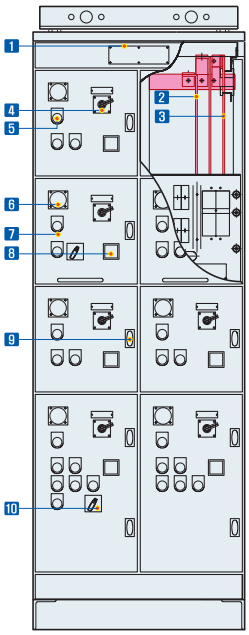
Withdrawable Type

HGS&7DB	Rear access type
HGS&7DF	Front access type

Construction of Fixed Type

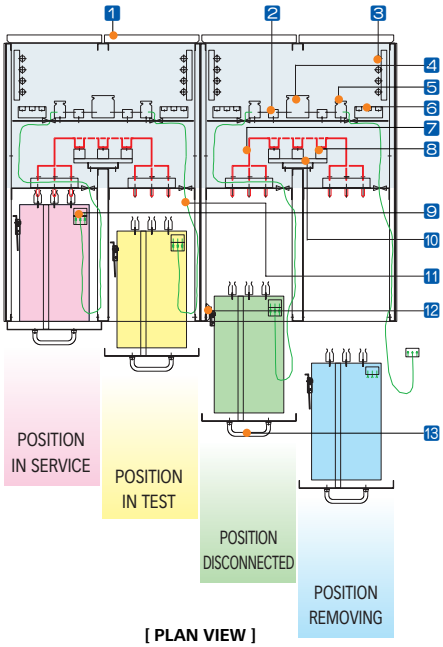
1 Name Plate
2 Main Bus Bar
3 Vertical Bus Bar
4 Operating Handle for MCCB
5 Indicating Lamp
6 Ammeter
7 Component Flange
8 Hour Meter
9 Door Locker
10 Selector Switch
11 Lifting Angle & Rolling Stay
12 Top Plate
13 Middle Plate
14 Unit Mounting Plate
15 Door Stopper
16 Control Unit Door
17 Hand Rail
18 Rear Door
19 Inter conn. Cable Plate
20 Control Terminal Block
21 Earth Bus Bar
22 Base Seat



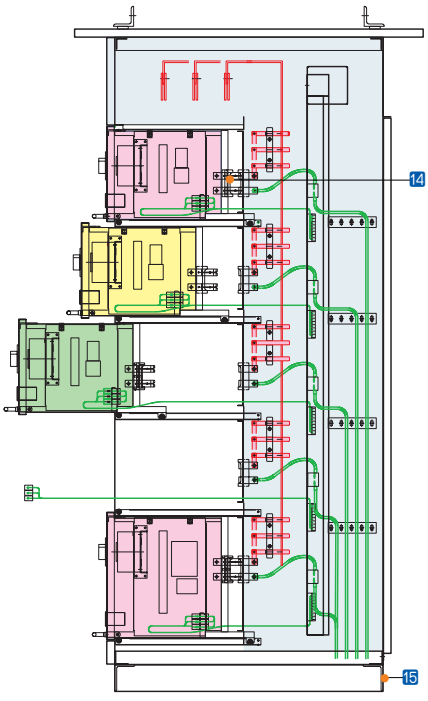


Construction of Withdrawable Type

1 Panel Door
2 Terminal Block for Control Cable
3 Power Cable to Motor (for Shipyard)
4 Duck for Control Cable
5 Duck for Control Cable (for Shipyard)
6 Terminal Block for Power Cable
7 Branch Bus Bar
8 Vertical Bus Bar
9 Control Cable Jack
10 Bus Holder
11 Interior Control Cable
12 Unit Stopper
13 Hand Rail for Starter Unit
14 Main Bus Bar
15 Earth Bus Bar



[PLAN VIEW]



[RIGHT SIDE SECTION VIEW]

Group Starter Panel

Outline View of Fixed Type

Front panel layout

Unit inside front panel

Outline View of Withdrawable Type

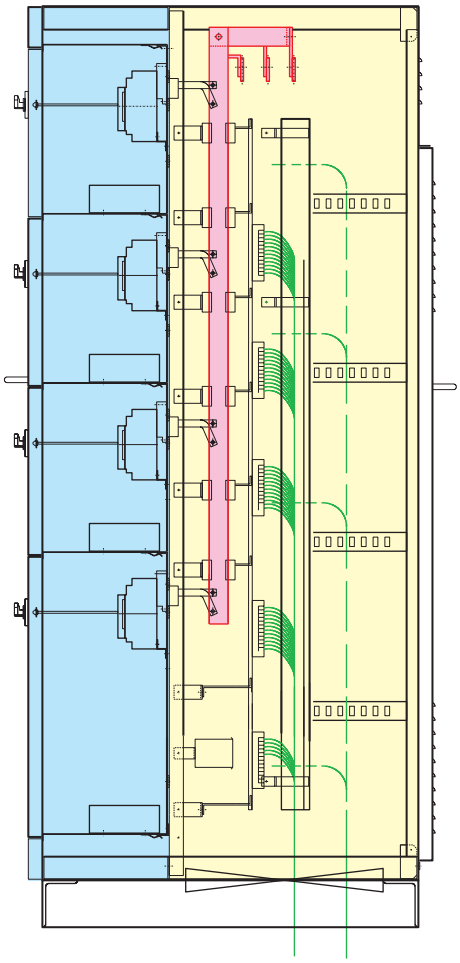
Withdrawable unit (Side view)

Withdrawable unit (Rear & control)

Front/Rear Access Type

Starter units are located on the front side of the cubicles. Busbars and terminals for power cables and control cables are located on the rear side of the cubicles. Front and rear access for cable connecting and maintenance is required.

Section Drawing

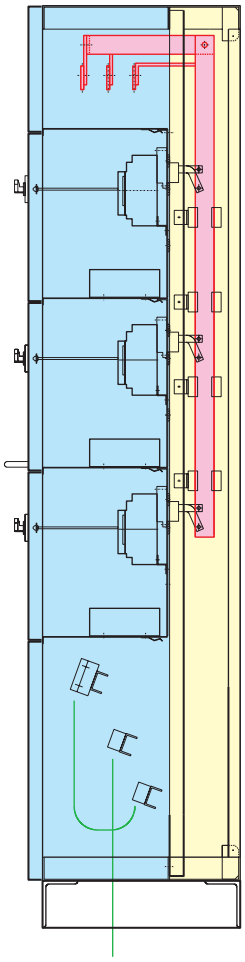


[HGS7BB]

Front Access Type

Starter units and all cable terminals are located on the front side of the cubicles. Front access only for cable connection and maintenance is required.

Section Drawing

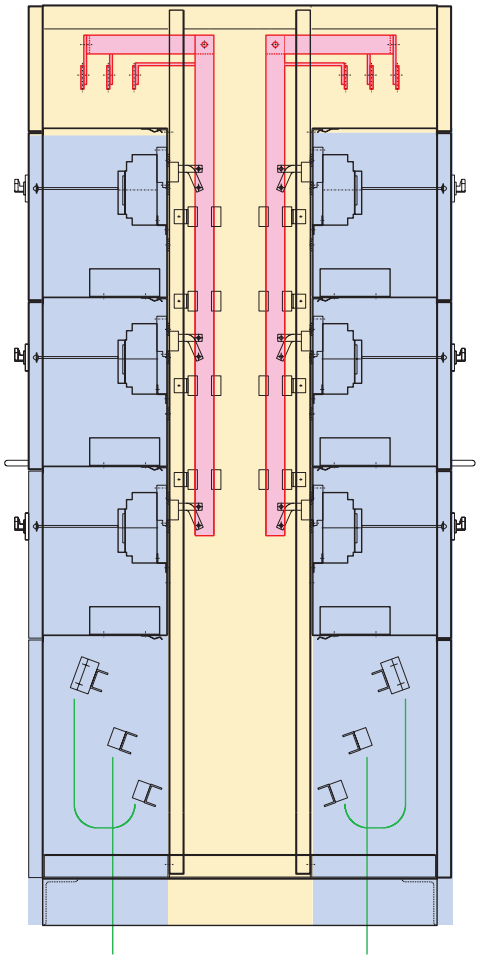


[HGS7BF]

Double Access Type

The double face type is a combination of the front access type starter joined to the back to back. Starter units and all cable terminals are located at the front and rear sides of the cubicles. Front and rear access for cable connecting and maintenance is required.

Section Drawing

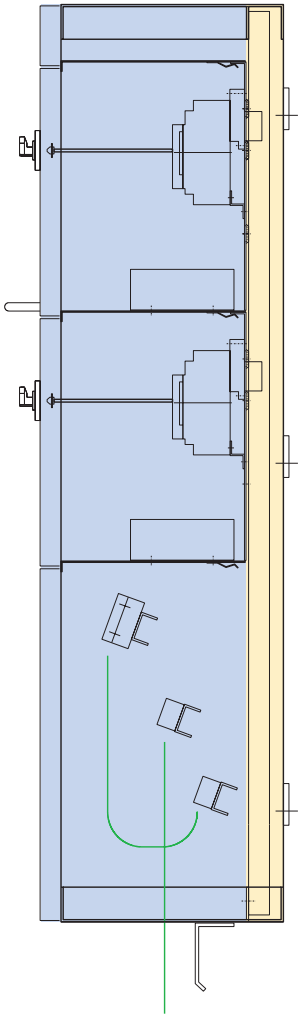


[HGS7BD]

Wall Mounting Type

The wall mounting type is used, in general, as a group starter for a few motors and front access type for cable connecting and maintenance.

Section Drawing



[HGS7BW]

Emergency Switchboard

The emergency switchboard consists of a generator panel, feeder panels, an emergency group starter panel (if provided, option) and a shore connection box (if provided, option).

Ratings and Technical Specifications

Type	Dead front, totally enclosed floor standing
Rated voltage	500 V AC (690 V AC, option)
Rated current	2500 A
Rated frequency	50/60 Hz

Construction

Frame work	Formed sheet steel or substantial box-frame
Access	Front and rear
Protection degree	IP22
Handrail	Front and rear
Power line inlet	Bottom or upper part (upper part, option)

Motor Control Center

The H5600 motor control center, a low-voltage switchboard of withdrawable design, is mainly used where a large number of motors have to be controlled by contactors or starters.

Design Concept

The design and construction of the motor control center H5600's vertical section and units are in accordance with all applicable NEMA standards.

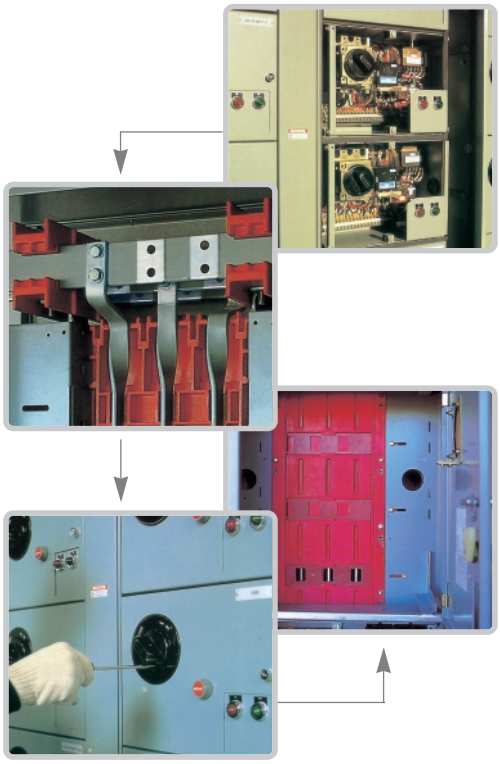
Major Inner Parts

A safety kit, available with all units, provides an insulating barrier on the side of the unit compartment adjacent to the vertical wireway, and a shelf-type flash barrier under the unit.

All bus bar joints are made with bolts and washers to insure permanent tightness.

The operating handle is interlocked with the door for basic safety. A screwdriver-operated defeater is provided.
The door cannot be opened with the circuit breaker ON, nor can the circuit-breaker be turned ON with the door open, unless a defeater is used.

A non-metallic barrier (fiber glass polyester) separates vertical bus bars.



Electrical Characteristics

Construction

Rated Voltage(V)	up to 600 V
Rated current(A)	up to 3000 A
Short-time current for 1s	up to 100 kA/1sec
Construction	Max. 6 tiers Back to back type, front only type Drawout
Standard	NEMA, ANSI, UL

Thruster Starter

Thruster starter panel is divided into two compartments (low voltage and high voltage) by means of flame retardant partition plate.

Following special tools and accessories are supplied in case of high voltage starter.

- Earthing clamp
- Earthing braid
- Earth hook connector
- Earthing bolt
- Earthing operation stick
- Attachment tool for operation stick
- Voltage detector

Ratings and Technical Specifications

Type	Dead front, totally enclosed
Rated voltage	up to 7.2 kV AC
Rated current	50/60 Hz
Rated frequency	110/220 V AC

Construction

Frame work	Formed sheet steel or substantial box-frame
Access	Front and rear
Protection degree	IP21, IP44 (option)
Handrail	Front and rear
Paint Color	RAL7032, other color can be applied (option)
Power line inlet	Bottom or upper part (upper part, option)

Distribution Board

Individual Starter

Power Distribution Board

Lighting Distribution Board

Engine Control Room Console

Easy Monitoring and Operation

- Grouped according to machine classification such as the main and auxiliary engines, the generator and auxiliary machinery.
- Controls below shoulder level.
- Devices to control in each group are arranged from the center according to the frequency of use and preventative measures to have normal operation sequence.
- To avoid possible misoperation has also been built in the console.

Easy Monitoring and Maintenance

Through inspection and maintenance of wiring facilities.

Sturdy Construction and Clean Appearance

Front Access Type

- Swingable operation plate is provided for easy maintenance.
- Adequate ventilation louvers will be provided on the front door.
- If required, a ventilation fan can also be supplied.

Terminal board for external cable connections.

Copper pipe connections.

Bridge Console

The bridge console has been designed and manufactured to be;

- Specially compact.
- In harmony with other equipment such as the radar, auto pilot etc. installed together in the wheel house.
- In accordance with the various requirements of shipowners and shipyards.

Feature

- Easy operation.
- Easy installation.
- Maintenance free.
- All parts easily accessible.

Front and Rear Access

Front and rear access

Front Access Type

- Swingable operation plate with stopper.
- Adequate ventilation louver provided on the front door.

Front access type

Bridge Wing Console

Feature

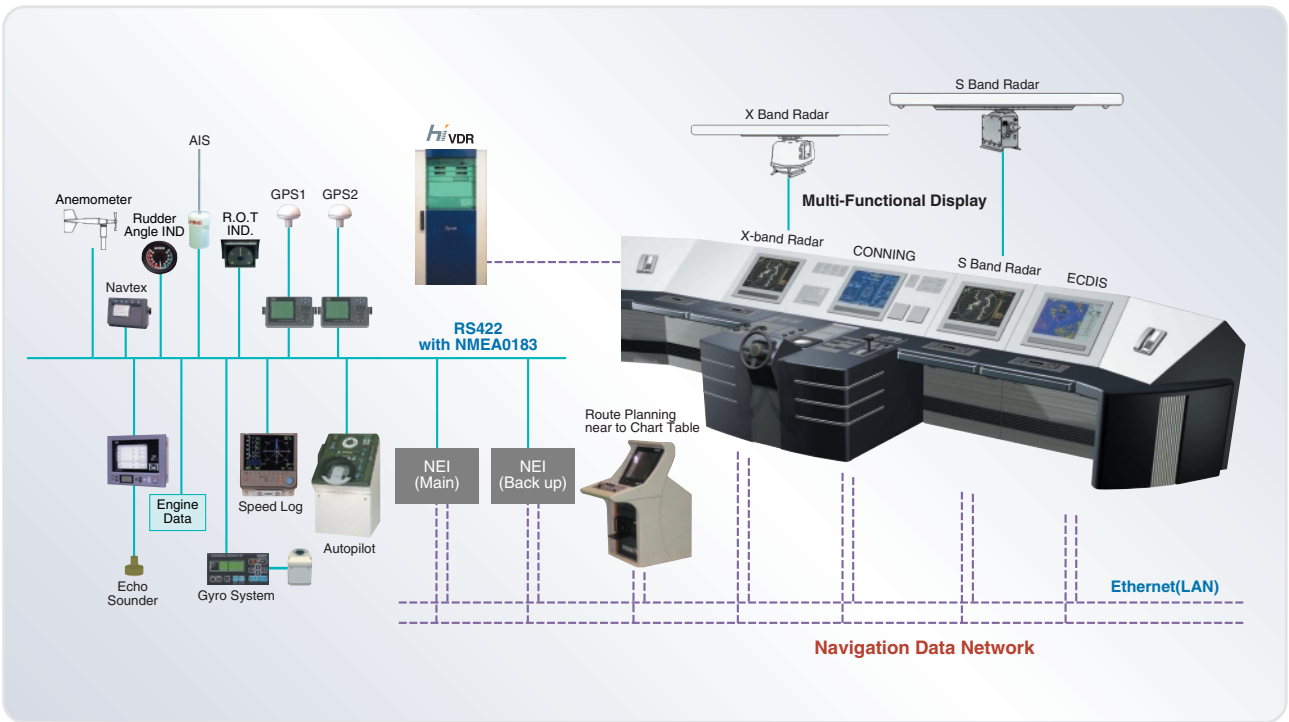
- Easy operation.
- Always considers environment conditions.
- Complies with rules of classification societies and requirements of shipowners and shipyards.

Hyundai Transas integrated Bridge System(HTiBS)

Feature

- Multi-functional display for navigational system on each workstation, comprising:
  - ECDIS (with track control system)
  - Radar / ARPA
  - Navigational information (conning display)
  - INS alarm management system
  - Route planning
- Functionality of master/slave
- Redundant navigational equipment integrator
- Interfaced with Voyage Data Recorder (HiVDR)
- Integration of AIS data into ECDIS and radar
- 19″/23.1″ TFT-LCD displays
- Designed in line with IEC requirements for INS (IEC61924)

Configuration



Hyundai intelligent Voyage Data Recorder-Excellent(HiVDR-E)

Standard Function

Data Management Unit(HiDMU-E) is a cabinet which includes Data Processor Unit (HiDPU), Navigational Equipment Integrator(HiNEI), audio and video signal collector, analog and digital signal collector and UPS.

- 16 NMEA Ports
- 16 Analogue Inputs(HiAI16)
- 16 Digital Inputs(HiDI16)
- Interface for One(1) Radar
- Interface for Two(2) VHF Radio Telephone
- Interface for Five(5) Microphones
- 2 Hours UPS(HiUPS-E)

Remote Alarm Module(HiRAM) provides audible and visual alarms for the faulty conditions in the VDR and a remote emergency data save functionality. Also it provides an external relay output for annunciator.

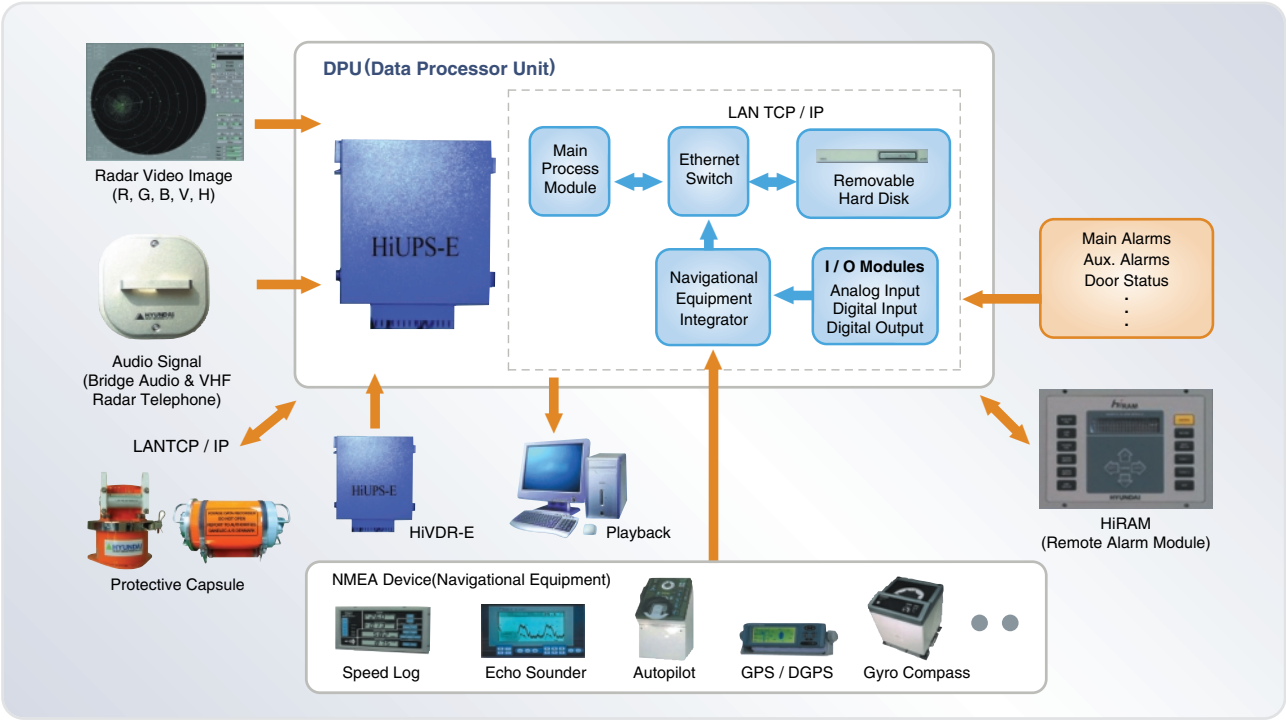
Five(5) Indoor Microphones(HiMIC)

Protective Capsule(12 Hours Recording) is a crash-survivable data storage medium, which is capable of retaining data for a period of at least 12 hours after the termination of recording.

Optional Function

- User-friendly playback software and PC
- Interface for second radar or ECDIS
- Interface for third VHF radio telephone
- Four(4) additional microphones including outdoor type(HiMIC-EX)
- Easy extendable analog / Digital input module(up to 64 inputs)

Configuration



Hyundai intelligent Watch Monitoring System(hiVDR)

HiWMS monitors recognition of operational status by an officer of the watch(OOW) and automatically alerts it to a master or other COW under the circumstances that the OOW fails to perform the duties properly.

Features

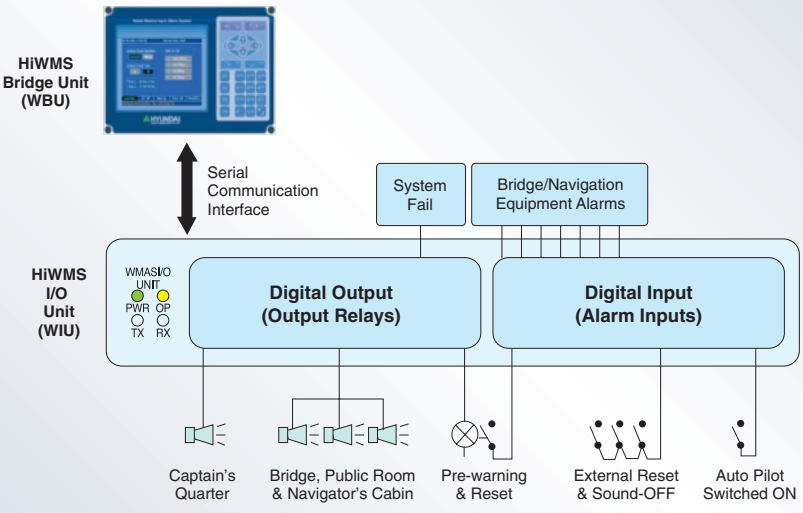
HiWMS serves the following purposes:

- Bridge Safety
  - Indicates that an alert officer of the navigational watch is present on the bridge
  - Alarms operation status on the bridge in the event of failures of the bridge navigation equipment and shipboard safety systems
  - Provides visual and audible alarms and warnings
- Officer of the Watch Alertness Check

  The system for periodic verification of an OOW's alertness can adjust time intervals by only a ship master who has access to the components for setting appropriate intervals
- Alarm Transfer

  Alarms can by transferred from the bridge to a master or a back-up navigator in case of officers' absence, lack of alertness or no response to other alarm/warning, etc. Alarm sequence without acknowledgements is followings
  - Visual Flashing Indication
  - First Stage Audible(Sound) Alarm
  - Second and Third Stage Remote Audible(Sound) Alarm
- Back-up Navigator Call
  - Call can be signaled at the bridge to call a master and a back-up navigator

Configuration

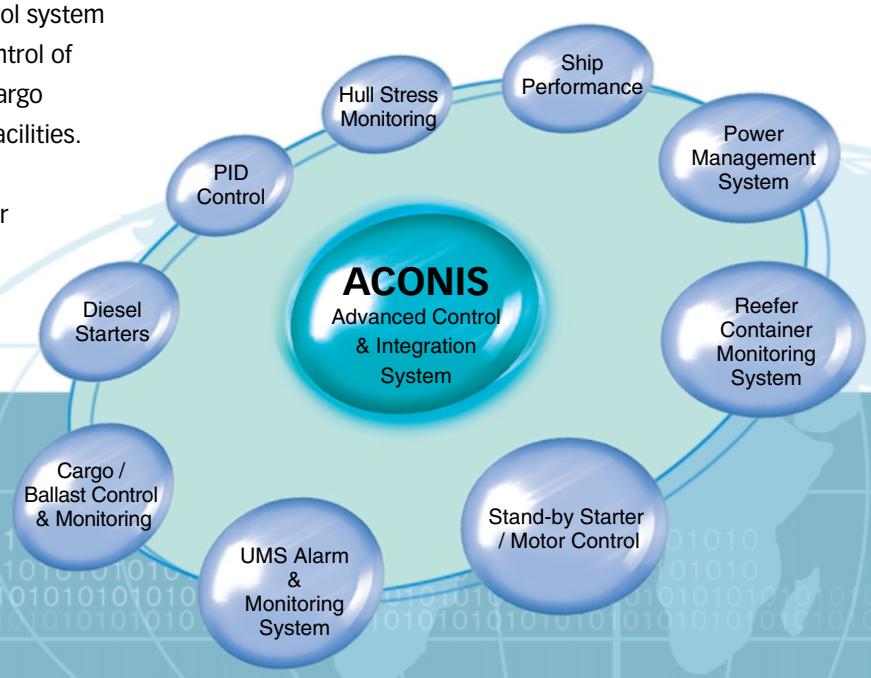


Intergrated Monitoring & Control System

System Overview

The ACONIS system is an alarm and control system in one hardware solution for optimum control of engine room functions and the ballast / cargo system on merchant ships and offshore facilities.

Based on fully distributed micro-processor technology, the ACONIS system features the various functions enumerated in the figure.



ACONIS 2000

Quality Assurance & Quality Control (QA/QC)

ISO 9001 REGISTERED
DNV
MGMT.SYS. RvA C024
DNV Certification B.V., The Netherlands

The Hyundai ACONIS monitoring & control system possesses type approval certificates for higher level requirements such as those of KR, ABS, LR, DNV, BV, NK, CCS and GL, and is thoroughly tested and certified against vibrations, dampness heat, and EMC. Another important part of the type approval procedure is proper documentation and software security. The QA / QC procedures cover all factors affecting the product so that the customer gets a high quality product at an economic price.

System Structure

- Open system architecture
- Fully distributed processing
- A flexible architecture
- Full redundancy (CPU, Network)
- Modular function design
- Integrated system design
- Web based display
- Windows 2000 server

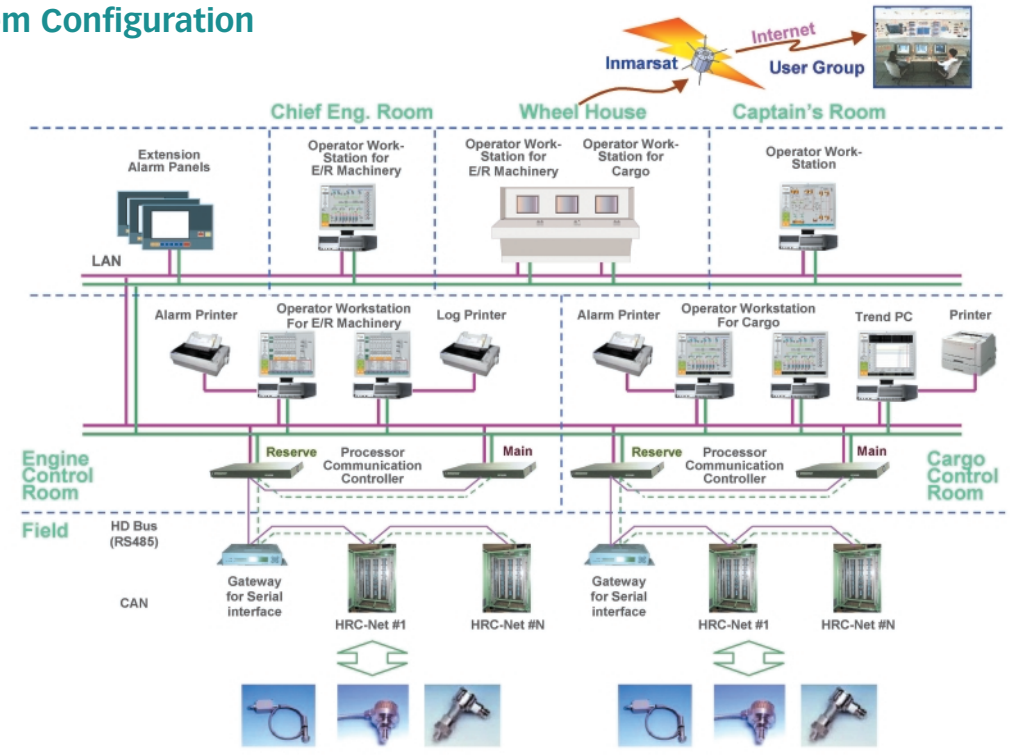
Operator Station

- Reliable user-friendly operator interface
- Redundant high speed network
- Windows mimic display
- Various monitoring functions
- A great control functions
- Historical logging and trend database
- Signal conditioning for any input
- Optimum reliability and redundancy for work station

Process Control & Communication

- Real time data processing
- Max. 1 Mbps CAN field-bus
- Full redundant network
- On-line data change
- On-line programming
- On-line data download
- On-line maintenance

System Configuration



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