

### Diagnostics, Maintenance and Trending

The vessel control system is designed to have a high fault tolerance and incorporates self-diagnostic routines to aid swift fault finding. The networked solution enables a high degree of web based diagnostic facilities, allowing the operator to view high level system network information as well as the ability to drill down to the I/O modules at plant level.

All modules have short circuit and loop monitoring to assist with swift fault detection in the field.

The system also provides features to assist in diagnosing plant-side faults through comprehensive on-line chart recording techniques and 'customised engineers' mimics' for monitoring any plant signal.

Recording can be triggered by individual events or may be selected to run continuously. Results may be downloaded and stored for further analysis onboard or transferred to an office-based location onshore.

### Remote Support

As an addition all vessel control systems can be equipped with a data historian workstation. This PC provides a black box logging facility that can record both vessel control & DP signal parameters for long periods of time. Data can then be transferred to removable media for further analysis.

Converteam's 'ViSoR', the Virtual Support Room, provides a remote window to system software that experts located anywhere in the world can view and advise operators accordingly on the actions they should take.

### After Sales Service and Support

Converteam offers a wide range of after-sales service and support packages tailored to meet individual customer requirements. These packages are supported via a world-wide network of support bases.

### Some of the many key benefits of a support package are:

- Single point of contact
- Reduced rates on man hours
- 24/7 support
- Mobilisation of engineers
- Regular maintenance visits
- Training
- Vessel health checks
- Spares management

Converteam also provide managed system upgrade paths for its 'legacy' systems.

### Standards and Certifications

The vessel control system meets all major class society & regulatory requirements such as Det Norske Veritas, Lloyd's Register, Bureau Veritas, American Bureau of Shipping, Norsok, US Coast Guard and International Maritime Organisation recommendations.

Where appropriate, type testing has been performed and systems can be custom-built to meet high level shock, vibration and temperature limits for special applications.

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Converteam can supply the most innovative and technologically advanced systems to its customers, with the Vessel Control System having benefited from extensive customer and industry research. Converteam's experience in the design and supply of integrated systems for automation, electric propulsion and dynamic positioning is unrivalled. In addition to technical excellence, it has extensive project management experience with proven skills in co-ordinating complex integration issues, both in-house and with key sub-contract or consortium partners.



### Hardware features include:

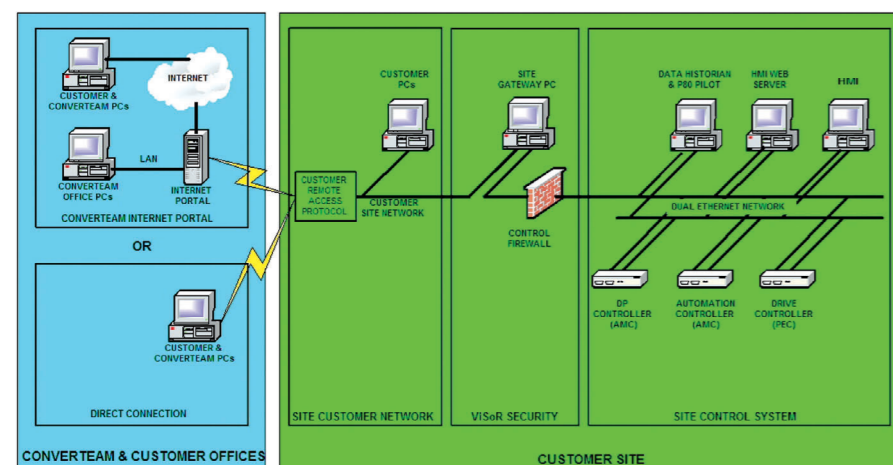
- Cable termination direct to the I/O module
- Terminations adequately sized to accept plant cabling
- Secure, anti-vibration, spring loaded termination system
- Rail mounted I/O system easily accommodates future expansion
- 2 channel I/O modules ensure high level of design flexibility
- Wide variety of signal types, interfaced direct (Pt100 RTD, thermocouple, potentiometers)
- Workstations can be Converteam C-Series, desktop or supplied as drop-in

### Benefits

- Distributed architecture saves cabling
- 'I/O anywhere' philosophy
- Integration of hardware saves space and cost
- Network allows for easy future expansion
- Scalable architecture
- High level of system redundancy
- Hazardous area compatible
- Commonality of hardware throughout
- Reduced spares holding
- Common look and feel across systems
- High level diagnostic features
- Remote diagnostic capability



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ViSoR - The Virtual Support Room - System Architecture

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- I/O embedded into Converteam manufactured and third party equipment (motor control centres, valve cabinets)
- Commercial Off The Shelf (COTS) components
- Custom workstation and panel design
- Networks use industrial standard, dual ethernet

## Modes of Operation

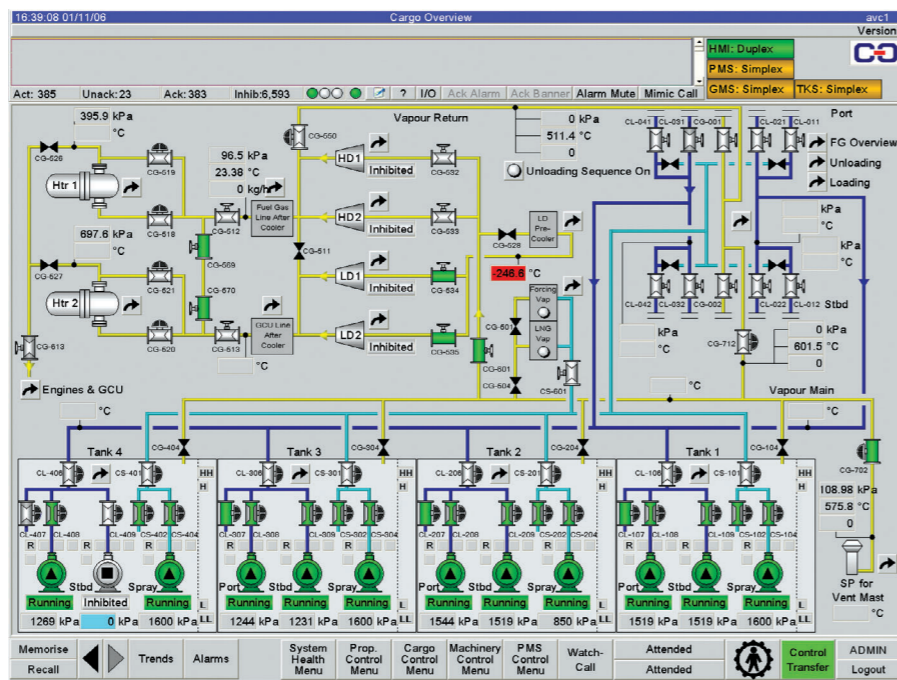
### Power Management

Converteam has many years' proven expertise in providing complex power management control. A major competence within Converteam is the design and supply of power generation and distribution systems, leading to a thorough understanding of power management control requirements.

Converteam's power management system can be used on a large range of vessels from small offshore support vessels through to large tankers and LNG vessels.

### Examples of functionality include:

- kW and kVAr load share
- Frequency and voltage control
- Load shed facilities
- Converter load phase back
- Start inhibit of large loads/blackout prevention



Cargo View Screen Shot

- Optimised power configuration
- Auto fuel selection (LNG dual fuel engines)
- Droop/Isoch load control
- Automatic blackout recovery
- Maintain control with open bus ties
- Gas turbine and diesel engine load share on same bus
- Gas turbine temperature dependent output de-rating
- Power resource share between subsea linked platforms
- Small offshore support vessels through to large tanker LNG vessels

### Alarms and Monitoring

Machinery surveillance is an important part of vessel operations. The vessel control system provides a comprehensive centralised alarm & monitoring system that can alert personnel to potentially hazardous conditions arising within the machinery spaces.

The alarms system provides unambiguous audio visual annunciation of alarms and warnings via a dedicated banner located at the top of each multifunction screen, irrespective of the systems being viewed at that time.

A watch and call system extends the central alarm system to engineers' cabins and public areas when machinery spaces/control rooms are unattended. Pager systems can be supplied to further enhance the watch and call functionality.

As personnel safety is of paramount importance, the vessel control system may be configured to include additional features. Prime examples are: multi-zone deadman/patrol man systems and pictograms/alarm columns providing much needed audio visual indication within noisy machinery spaces.

### The system software provides comprehensive facilities:

- Alarm displayed in colour-coded severity level
- User configurable alarm parameters
- Alarm message contains comprehensive description, time, date and tag
- High resolution time tagging
- Alarm banner visible at all times
- Alarm suppression, either manual or automatic
- Alarms logged for later analysis
- Historical sorting and filtering of data
- Operator events

- Direct access to associated mimic from alarm
- Parameter trending

The vessel control system offers monitoring of all commonly found engineering units eg, temperature, pressure, viscosity, weight, volts, ampere, frequency, etc. These parameters can be displayed in many forms such as in digital (numeric) format, analogue meter, bar or line graph. Data can be stored over long periods, retrieved and displayed for more detailed analysis via Data Historian workstation.

### Vessel Management: Auxiliary Systems

Auxiliary systems cover the basic processes necessary for vessel operation. The health and efficiency of these systems is vital and the vessel control system provides constant monitoring of parameters such as pressures, temperatures and tank levels. The system provides centralised status monitoring and control of machinery allowing regular routines such as fuel oil transfer to be performed from the bridge or control rooms.

### Typical systems include:

- Fresh/sea water cooling
- Propulsion, thruster & steering
- Fuel oil and lube oil
- Hydraulic systems
- Fire main
- Fire and gas detection



Ergonomically advanced

- Compressed air
- HVAC
- Watertight doors/water leak detection
- Machinery running hours

### Vessel Management: Fluid/Cargo Systems

Fluid management may vary from simple bilge level monitoring and manual control of ballast pumps and valves, to the more complex control of cargo pumps, calculation of load and stability information, etc.

### Features include:

- Pump and valve control
- Compressor control
- Standby start and lead-lag logic
- Ballast/bilge system
- Multi-product cargo loading and discharging
- Cargo unloading 'Green Line' interlocks
- Auto-fill/empty sequencing
- Cargo flow meter interface
- LNG cargo & fuel/gas handling
- Proportional integral derivative control
- Advanced process sequence control logic
- Tank gauging
- Draft, trim and list measurements
- Load and stability calculator
- Local operator control on touch-screen panels

## Fields of Application

The vessel control system covers a wide range of applications throughout the naval, offshore and merchant marine industry. Installations have included fleet auxiliary vessels, destroyers, fixed platforms, supply vessels, cruise liners, FPSOs, tankers, drill rigs, cable & pipe layers and LNG, providing control and data gathering from systems which require just a few hundred plant signals to complex applications with several thousand points.



LNG carrier

The vessel control system consists of a number of software modules, which may form stand-alone applications or which can be run together as a single entity.

## Integrated Solutions

Converteam's unique position as a leading supplier of dynamic positioning, vessel automation and electric propulsion is the perfect platform for providing a fully integrated solution. With a single point of responsibility, co-ordination of the dynamic positioning system with the propulsion drives and power management system is simpler, ensuring better performance and safe, efficient operation, benefiting both the shipyard and owner. Converteam's field station hardware can be embedded into the switchgear, variable speed drive cubicles and other plant equipment, significantly reducing cabling and the time required to install on site, the complete assembly being fully pretested at the factory stage. Modules can also be supplied for embedding in third party manufactured equipment such as valve control cabinets and Motor Control Centres.