Engine Room Simulator

ERS Sulzer 12RTA 84(C)

Machinery & Operation

Part 2

Automation & Control

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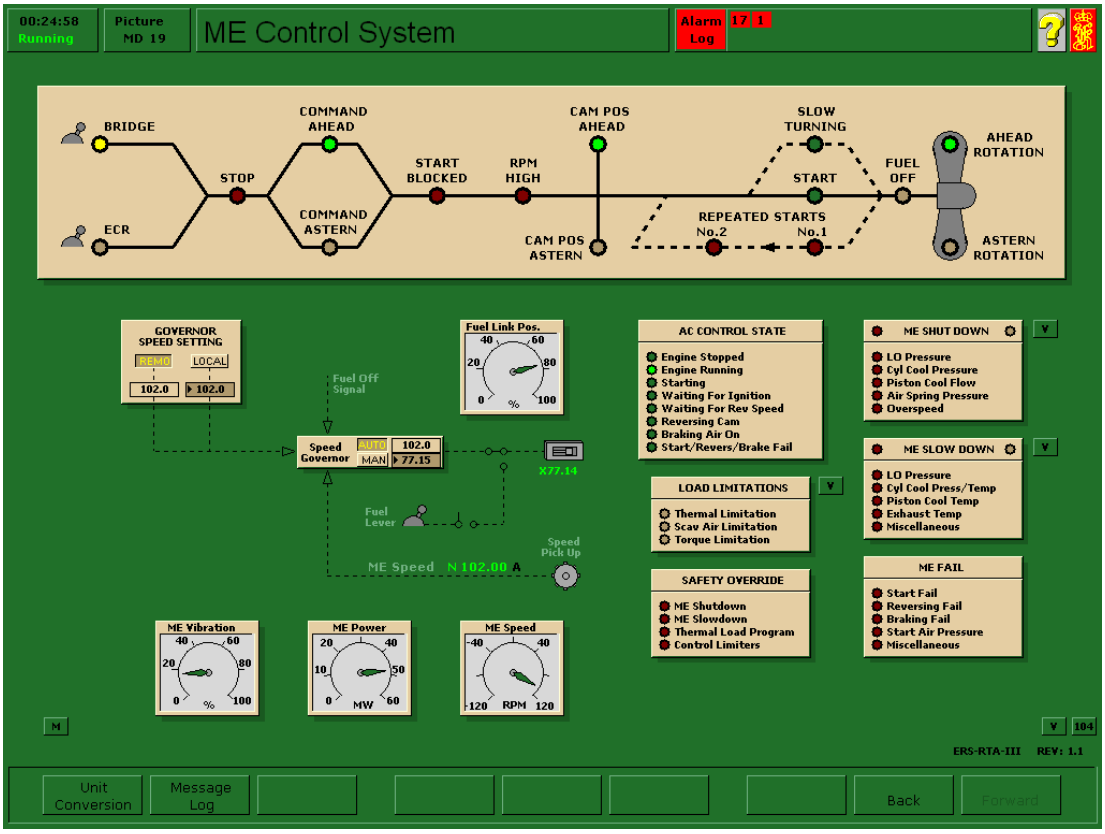
1 AUTOCHIEF CONTROL SYSTEM

1.1 AutoChief ME Control System



The main engine remote system is based on the KMSS AutoChief control system, which is installed onboard several hundred ships.

AutoChief is designed for remote control of both reversible and non reversible (CPP) engines.

The RTA-84 can be configured to operate as both FPP (Fixed Pitch Propeller) and CPP (Controllable Pitch Propeller).

The ME Control System has a mimic diagram that displays the following information on the diode panel:

- The command position (either bridge or engine control room)
- Stop command, when the fuel regulating lever is set to stop position
- Ahead, if the ahead direction is selected on the control panel
- Astern, if the astern direction is selected on the control panel
- Start blocked, if one or more of the following is activated:
    - Turning Gear engaged
    - Engine emergency stop activated
    - Engine shut down activated
- Indication that the fuel pump reversing mechanism is in either the ahead or astern position.

- Indication that the slow turning operation has been selected. This will delay the normal start of the engine, but ensures that cylinder damage is prevented from possible water ingress.
- Indication that the start command is active. This will activate the pneumatic valves within the manoeuvring system and should result in a successful engine start.
- Indication that a repeat start command has been initiated by the ME control system. A repeat start will be automatically activated if the main engine speed does not reach the start level RPM within a preset time. After three attempts the system will trip, producing a start failure alarm.
- Indication of fuel off
- Indication of direction of propeller rotation.

In addition to the main mimic diagram there are also a “pop-up” menu that provide additional information about the control state, activated by placing the cursor over AC CONTROL STATE and clicking.

AC CONTROL STATE
This panel will provide the operator with additional information, and the ability to adjust system parameters that are not present within the main mimic diagram.

Front panel indications
- Indication of Engine running/stopped
- Indication of starting command active (starting air should be supplied)
- Waiting for ignition
- Waiting for reversing speed (The engine speed must fall below 36rpm, before starting air can be admitted to brake or stall the engine)
- Reversing cam (camshaft is changing position)
- Braking air on (Indicates that the engine rpm is below 36 and that starting air is being admitted. Note when the Limits override button on MD104 or MD110 is pressed, or the repeated start is active this limit speed is raised to 39rpm.)
- Indication of Start/Reverse/Brake failure

Pop-up window:
- The governor’s PID settings are available. These parameters are also available when popping up the governor directly. Changes of parameters at one place will automatically update the other. (default settings are gain = 2.0, Int time = 5 secs, Derivative time = 1 sec)
- Start Air Off Speed (setting of engine rpm for starting air cut off and fuel pump suction valve closed, default setting = 20 rpm)
- Start air Time Limit (max. time for starting air supply, default setting = 16 seconds). If the engine is not started within 16 seconds, Start failure alarm is activated
- Brake Air Time Limit (max. time for braking air supply, default = 24 seconds. If the engine is not stopped within 24 seconds under air braking, Braking failure alarm is activated
- Reversing speed (normal – 36.6 rpm, once the engine slows to this speed, the braking air will be admitted)

- Reversing speed (emergency – 38.8 rpm, if the engine fails to start, then the limits are increased to enable braking air to be admitted earlier)
- Critical speed low and high filter limits (49 to 51 rpm – this will prevent the automatic control operating the engine within the critical speed range, which will result in very high torsional vibration of the crankshaft)

ME SHUT DOWN
The shut down panel provides the operator with the settings for the various main engine shut down trips. Indications of shut down are provided at the Bridge and Engine Control Room (ECR) stations.

Front panel indications
- LO Pressure
- Cylinder Cool Pressure
- Piston cooling Flow
- Air Spring Pressure
- Overspeed

Variables window
The active settings of the various shut down settings can be adjusted. A pre-shutdown warning is given, the duration of which may also be adjusted.

SLOW DOWN
The slow down system is provided to limit damage on the main engine when the operating parameters are outside normal limits. The engine power is reduced, which should reduce the effects of the defect, whilst maintaining a level of main engine power for propulsion and electrical supply (via the shaft alternator). This slow down panel provides the operator with the settings for the various main engine slow downs. Indications of slow down are provided at the Bridge and Engine Control Room (ECR) stations.

Front panel indications
- LO Pressure
- Cylinder Cool Pressure/Temp
- Piston Cooling Temp
- Exhaust Temp
- Miscellaneous

Variables window
The active settings of the various slow down settings can be adjusted. A pre-slow down warning is given, the duration of which may also be adjusted.
The miscellaneous slowdown parameters are;
- Air Spring Pressure
- LO Inlet Temp
- Oil Mist
- Turbo-charger Bearing Temp
- Turbo-charger Cooling Temp
- Cylinder Oil Flow

- Air Cooler Outlet Temp
- Scavenge Air Temp
- Thrust Bearing Temp
- Turbo-charger vibration

ME FAIL
Main engine fail is caused by the inability to carry out an operator command. The various front panel indications are:

- Start Failure
- Reversing Failure
- Braking Failure
- Start Air Pressure
- Miscellaneous

LOAD LIMITATIONS
The load limitations are provided to limit the load placed on the engine usually during speed increases.

Front panel indications

- Thermal Limitation
- Scav Air Limitation
- Torque Limitation

The thermal limitation is provided to limit the heat load placed on the engine. The thermal limitation controls the speed at which the engine speeds up and slows down to minimise the thermal loading. The rate of speed change is time-dependant, but is also influenced by the temperature of the engine.

The thermal load parameters can be accessed on variable page 1913.

The thermal limitation provides the basic heat up control function on a time basis. The scavenge air and torque limitations will prevent thermal overloading of the engine caused by external factors, such as hull fouling, prevailing weather, etc.

The scavenge air limiter monitors the scavenge air pressure, which is dependent upon the load of the engine, and prevents admission of fuel that could result in dark exhaust smoke due to insufficient scavenge air being present.

The torque limiter monitors the engine speed and position of the fuel rack to prevent excess torque being developed by the engine, which would thermally overload the engine and hence increase combustion chamber stresses. This is achieved by limiting the max fuel link position dependant upon the engine speed.
From the relationship of Power = Engine Speed x Engine Torque ($P = \omega T$), the speed is monitored and compared to the fuel rack, which is proportional to the power output of the engine. Hence to maintain or limit a constant torque the relationship of fuel rack~engine speed is maintained.

Variables window
The variables for the scavenge air and torque limitation programs can be viewed and adjusted from the variables pages.

SAFETY OVERRIDES
Various overrides are provided at the Engine Control Room (ECR) or Bridge panel.

Overriding the load limitations will allow the engine to accelerate much quicker but the engine will suffer from thermal stress and overload.

Indication that a shut down and/or slow down is imminent is provided at these control panels. The operator can pre-empt the engine shut down or slowdown to enable the vessel to move away from a life threatening situation. The engines could be irreversibly damaged by using these overrides.

ME GOVERNOR
The speed control of the main engine is affected by the main engine governor. The governor control system compares the desired value from the active manoeuvring panel, with the actual or measured value of the engine speed. The governor is a three term PID controller, and the output is directly sent to the fuel linkage.
The governor control operation is similar to all controllers, in that the PID settings can be adjusted via the pop-up window. The governor can also be placed in local control, when the active manoeuvring panel is changed to Local.

Critical Speed Adjustment
The critical speed for this engine is between 49 and 51 rpm. The governor will not allow the engine to run within this rpm range. The AutoChief solves this by ignoring speed commands within the critical speed range. The AutoChief “waits” for a speed command outside the critical rpm range before carrying out the new speed setting. Refer to figure

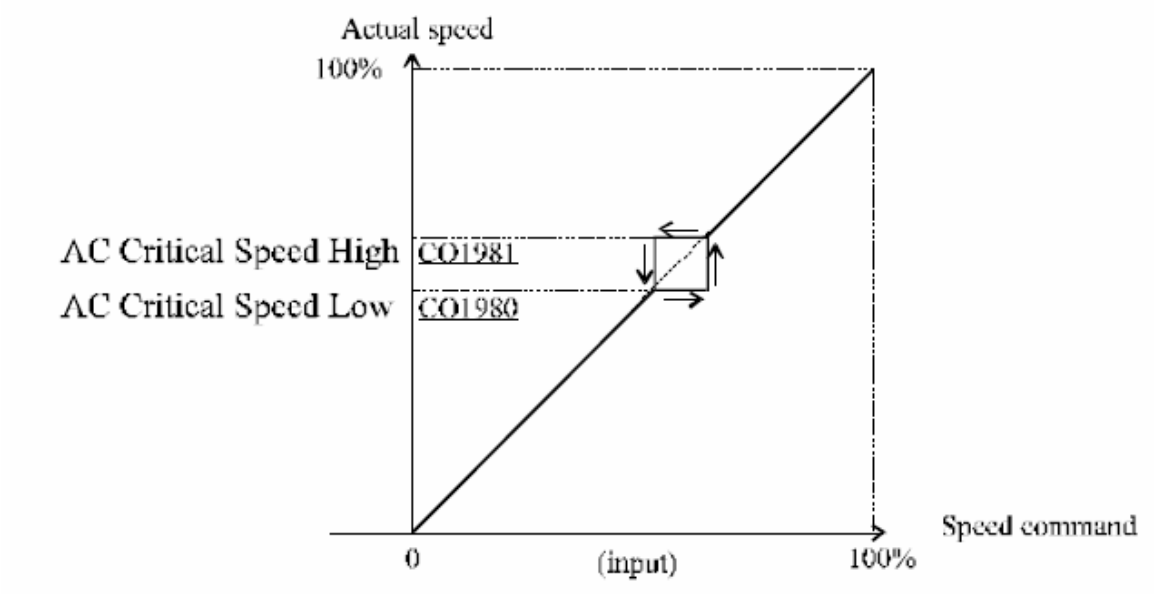
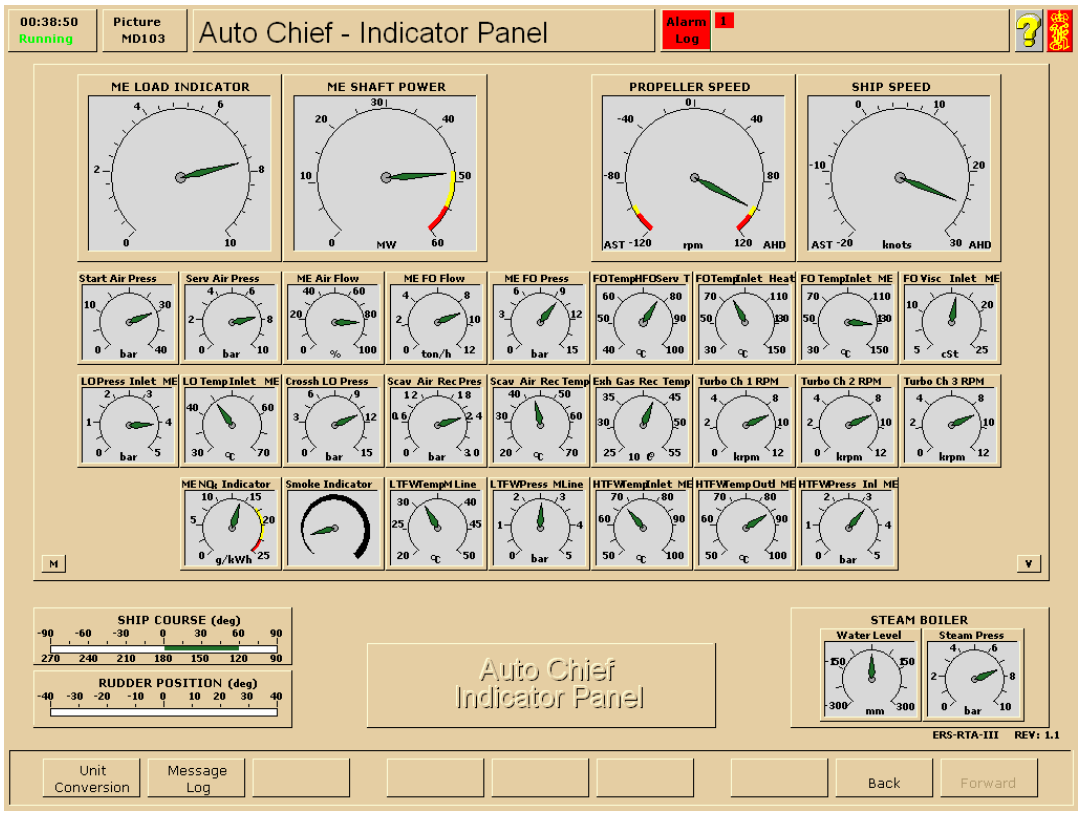


Fig. Critical Speed

1.2 Main engine - Remote control functions

1.2.1 Indicator panel description



The indicator panel provides the operator with an overview of the main parameters that influence the main engine. Each of the gauges readings can be located on their individual operating or control screens.

The AutoChief - Indicator Panel includes the following readings:

Main gauges

- Main Engine Load
- Shaft Power
- Propeller Speed
- Ship Speed

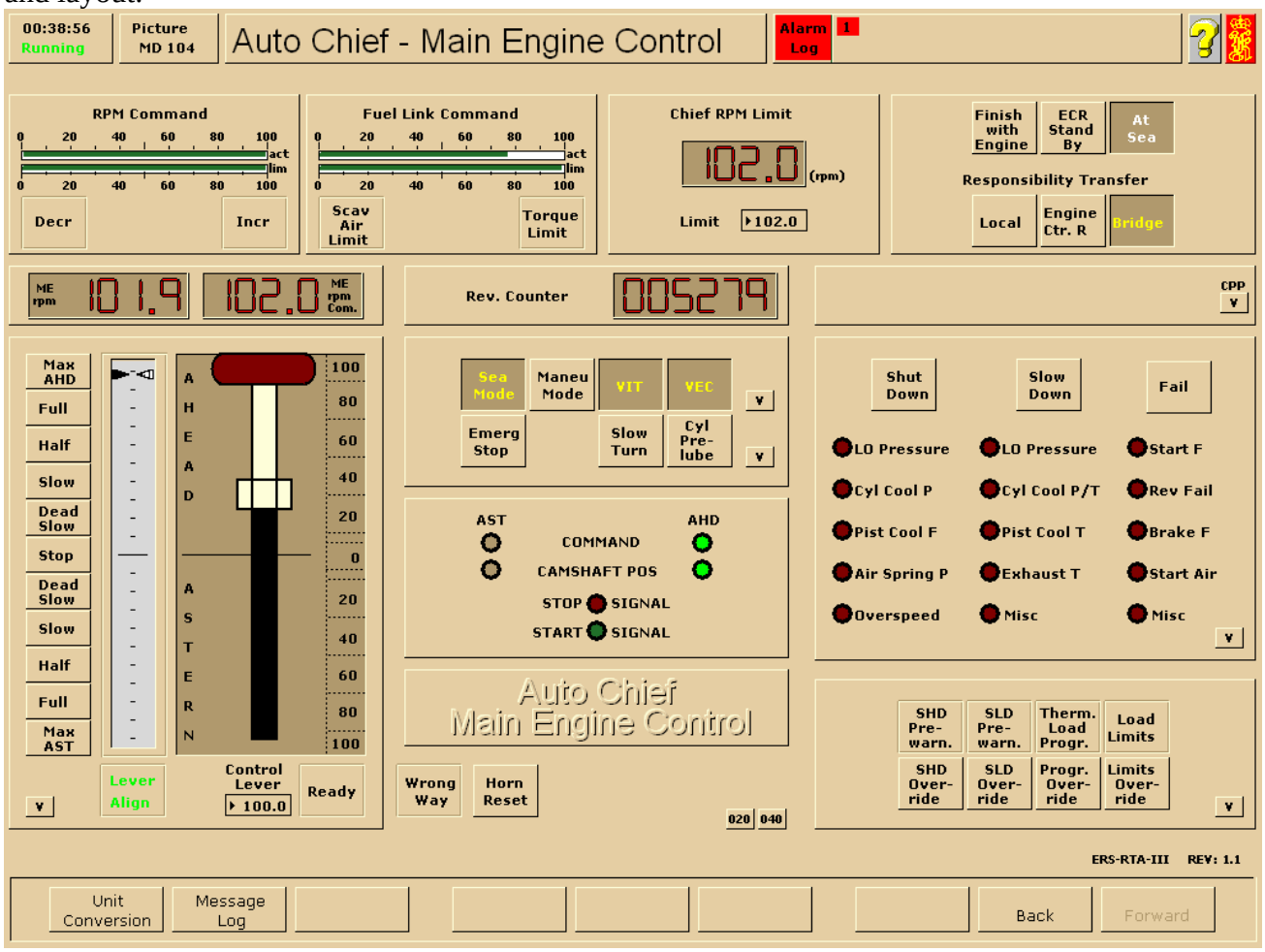
Panel gauges

- Start Air Pressure
- Service Air Pressure
- Main engine air flow
- Main engine fuel flow
- Main Engine Fuel Oil Pressure
- FO Temperature HFO Service Tank
- Fuel Oil Temperature inlet to the Heaters
- Main Engine inlet fuel oil temperature
- Main Engine Fuel Oil Viscosity

- Main Engine Lubricating Oil inlet Pressure
- Main Engine Lubricating Oil inlet Temperature
- Main Engine Cross-head Lubricating Oil Pressure
- Main Engine Scavenge Air Pressure
- Main Engine Scavenge Air Temperature
- Main Engine Exhaust Gas Receiver Temperature
- Main Engine Turbocharger 1 Speed
- Main Engine Turbocharger 2 Speed
- Main Engine Turbocharger 3 Speed
- Main Engine NOx indicator
- Main Engine Smoke Indicator
- Main Engine LTFW Temperature
- Main Engine LTFW Pressure
- Main Engine HTFW Inlet Temperature
- Main Engine HTFW Outlet Temperature
- Main Engine HTFW Pressure
- Ship Course
- Rudder Position
- Oil fired boiler drum level
- Oil fired boiler steam pressure

1.2.2 Control panel description

Note that equipment and layout on graphic panel may differ from HW console equipment and layout.



The following controls are present at the AutoChief - ME Control Panel:

Controls

- Fuel control lever (also the combined RPM/Pitch lever when in cpp mode)
- Emergency Stop
- Responsibility Transfer between Local/Engine Control Room/Bridge
- Status communication between Bridge and Engine Control Room for Finished with Engines/ECR Stand By/At Sea
- Control Mode between manoeuvring mode and sea mode
- Slow turn request button
- Cyl pre-lube
- VIT select
- VEC select

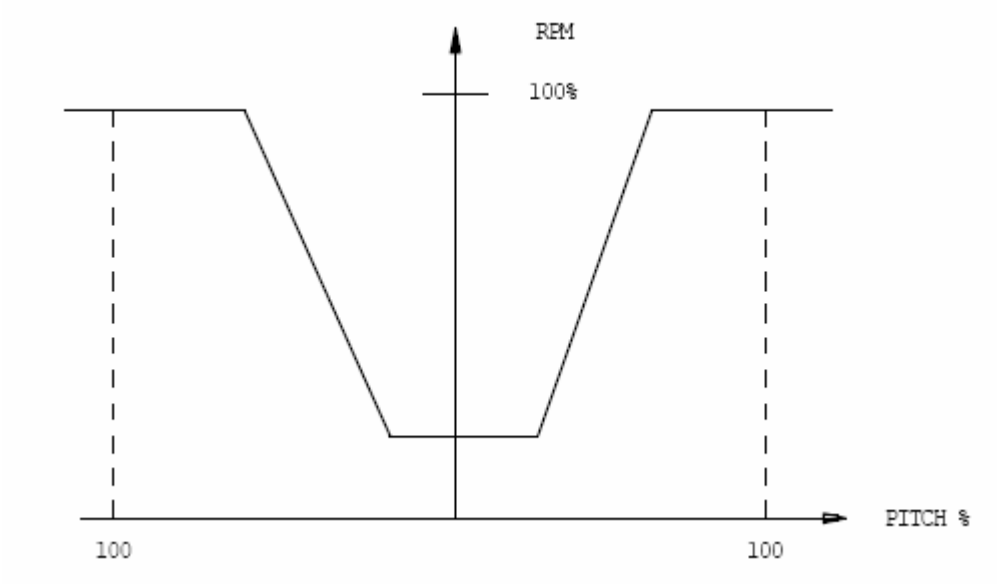
Status indication

- Fuel lever command request
- Bridge Telegraph

- Main Engine Shut Down
- Main Engine Slow Down
- Main Engine Fail Status
- Over-ride indicators for Shut Down/Slow Down/Thermal Load-Up programme/Load Limits
- Running hour
- Revolution counter
- ME RPM actual (digital and graphical display)
- ME RPM command (graphical display)
- ME RPM limit (graphical display)
- Bridge/ECR lever mis- match
- Fuel link command actual (graphical display)
- Fuel link command limit (graphical display)
- Fixed speed indication and set-point input

Controllable Pitch Propeller
To operate in CPP mode the variable on page 1940 must be set to 1. This will display the CPP panel which displays the pitch and from where the main engine may be stopped and started. Access is also allowed to page MD53

Combinator mode is used when the Controllable Pitch Propeller (CPP) function is selected. At zero pitch the engine speed is reduced to improve manoeuvrability, and as the fuel control lever is increased, then the pitch and engine speed increases until the engine is operating at full speed. The relationship between speed and pitch is fixed,



Emergency Stop
When this switch is activated, the engine is stopped as the fuel pump suction valves are opened, spilling the high-pressure fuel generated by the fuel pump.

Transfer of Responsibility

The responsibility buttons are provided to select the appropriate control station for the main engine. The options are:

Local – This control station would be selected when a problem or defect was present within the main engine control system, such as governor or control station hardware defect. Local control will not overcome a starting system malfunction, as the starting system is common to all control stations.

Engine Control Room – This control station would be selected for engine manoeuvring from the engine control room, such as engine testing, or in situations when specific engine control is required (such as when a shut down or slow down is over-ridden)

Bridge – This control station is normally the default control station and would be used under most operating conditions. Operating from the Bridge releases engine room personnel to monitor engine room operations.

Transfer from the ECR to Bridge

1. Check that the Bridge and ECR levers are matched by observing the indicators on the left of the fuel control lever, and the Lever mismatch light is unlit.
2. Press the push-button “BRIDGE” on AutoChief panel. The “BRIDGE” button then starts to flash.
3. When the Bridge accepts the transfer then the “BRIDGE” button turns to steady light.

Note the Bridge personnel may be engine operators manning the Bridge panel MD110.

The ship is now controlled from the Bridge, ref MD110 for details. The engine would start up in standby mode (SBE), see SBE entry data for details.

Transfer from the Bridge to ECR

1. Check that the Bridge and ECR levers are matched by observing the indicators on the left of the fuel control lever, and the Lever mismatch light is unlit.
2. Press the push-button “ECR” on Bridge panel on MD110
3. The “ECR” button then starts to flash.
4. The operator now accepts the transfer to ECR by pressing the “ECR” button
5. The “ECR” button turns to steady light.

The ECR now has control of the engine, and should utilise the engine control lever to match the requested speed and direction from the bridge.

In case of failure of the bridge control lever the Emergency Telegraph may be used to convey engine movement requests from the Bridge.

This is carried out by:

1. Bridge presses the button of the required movement (on screen MD110)

2. The selected button on the telegraph on the Bridge and ECR starts to flash
3. The ECR personnel confirms the engine request by pressing the flashing button on their panel (MD104)
4. The engine direction and speed should be adjusted to comply with the Bridge request.
5. Move handle to relevant engine speed by point and click on the interactive field (default settings are dead slow/slow/half and full positions) or by typing in desired command in the numeric window.

The engineer on duty can visually see the operation of the engine controls, with regard to ahead and astern command and actual camshaft position. The activation of both the stop and start signals can also be seen on this panel. If Wrong Way alarm is activated, the camshaft direction does not correspond with command from bridge.

Transfer from ECR to Local control

1. Press the push-button “Local” on AutoChief panel
2. The “Local” button then starts to flash.
3. On the Local Control screen MD20, the operator accepts the transfer then the “Local” button turns to steady light.

The ship is now controlled from the Local control station, ref MD20 for details.

The Local Control station personnel should utilise the telegraph system to convey engine movement requests from the Bridge.

This is carried out by:

1. Bridge presses the button of the required movement (on screen MD110)
2. The selected button on the telegraph on the Bridge and Local Control panel starts to flash
3. The Local Control personnel confirms the engine request by pressing the flashing button on their panel (MD20)
4. The engine direction and speed should be adjusted to comply with the Bridge request.

Transfer from the Local Control to EC R

1. Press the push-button “ECR” on the Local Control screen on MD20
2. The “ECR” button then starts to flash.
3. The operator now accepts the transfer to ECR by pressing the “ECR” button on screen MD104
4. The “ECR” button turns to steady light.

ME Status indication

The status lights are used as a communication between the Bridge and ECR as the request for engine readiness. The actual engine readiness would be discussed by verbal communications, but the status lights are used to convey a request by the Bridge and an acceptance by the ECR.

Finished with Engines – This would be selected when the main engine is no longer required. Finished with Engine (FWE) would be selected when the vessel is in port, or at a secure anchorage. When the FWE signal is received, the engine systems would be partly shut down, and possible heating introduced.

The following procedure could be instigated when FWE order is received:

1. Close the main engine start air isolation valve (MD60)
2. Place the Start air valve in the block position (MD20)
3. Engage the turning gear (MD20)
4. Open the Indicator Cocks on individual cylinders
5. Close the bypass valve of the HTFW Preheater, and open the steam inlet valve (MD10)

ECR Stand By – When standby (SBE) is selected, then the main engine should be ready for manoeuvring, up to and including full ahead or astern. The ECR should only accept SBE when the engine and its associated system are ready to provide full manoeuvring capabilities.

As a minimum preparation the following subsystems would be ready:

1. Two diesel generators connected to the 440V board
2. Oil fired boiler operating and on-line
3. Sea suction on high (unless in light ballast conditions)
4. Auxiliary blowers operating in automatic
5. Two steering gear motors operating
6. Check that start air block valve is open.
7. Check that start air distributor block valve is open.
8. Check that indicator cocks are closed.
9. Check that turning gear is disengaged.
10. Reset any slow down or shut down alarms. Note: the speed lever must be set to stop position to be able to reset any shut downs.
11. Check that no safety overrides are present.

At Sea – This button is selected to communicate that the Bridge no longer requires full manoeuvring of the engine as the vessel is in open water. This will allows the engineering staff to operate the engine room systems in economical mode. As such one or more of the diesel engine would be then shut down.

The speed and power of the engine would be increased up to the required full sea speed by pressing the button marked "S**ea Mode**" which ramps the engine up in a controlled manner from manoeuvring speed to full sea speed.

Sea Mode – this button is used when full sea speed is required and causes the engine speed to ramp up in a controlled manner from normal manoeuvring speed.
Manou Mode – this button is used while the vessel is manoeuvring and allows for a quicker response to speed while manoeuvring.

VIT – variable ignition timing selected when full away for more economic operation

VEC – variable exhaust valve closing selected when full away for more economic operation.

Slow Turn – manually initiates a slow turn. Note that slow turning should be performed if the main engine has stood still for more than 30 minutes. ME slow turning is carried out by manually pressing the Slow-Turn button.

Cyl Pre-Lub – manually initiates the pre-lubrication sequence.

Chief RPM Limit – allows the Chief Engineer Officer to set the maximum revolutions of the engine.

Engine Safety Panel
To operate the main engine safely, all critical parameters must be monitored in order to activate alarm and, if required, initiate automatic slowdown and/or shutdown of the engine.

The engine safety indicator panel will inform the operator that an engine failure has occurred and the parameters or channel that has triggered this failure. Classification Rules dictate that an engine failure requires a dedicated alarm, and that the failure should be manually reset. Adjustments of the actual failure set points can be adjusted within the ME Control System screen on MD19.

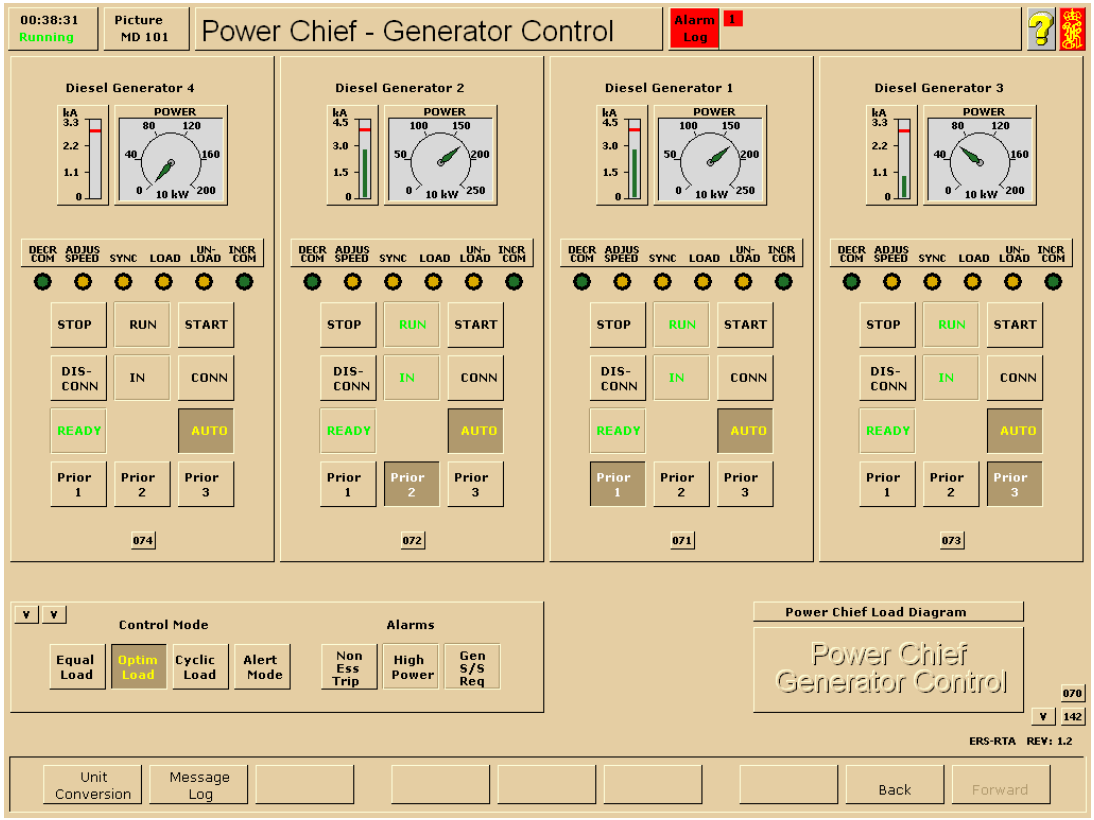
The various slowdown and shutdowns are monitored by the DataChief system, and transferred to AutoChief for initiation of the slowdown and /or shutdown. Each of the slowdown and shutdown parameters is grouped and represented by an indicator light on the AutoChief panel.

When the indicator light starts flashing, slowdown/shutdown procedures are initiated. The safety system gives the operator the possibility to override shutdowns and slowdowns by pressing the relevant override buttons.

The system will (depending on set-up) give the operator a warning on slow down and shut down. Within this warning period the operator may cancel the slow down. The actual diode will flash as long as the trigger or cause for slow down is present. The operator may also cancel the shut down. The actual diode will flash as long as the cause for shut down is present.

2 POWERCHIEF REMOTE CONTROL

2.1 Power Chief - Generator control



AUTO
In this mode the Power Chief will take care of starting and stopping, connecting and disconnecting and load sharing of the generators, provided that the READY lamp is lit. See the conditions related to the READY lamp. If the lamp is flashing, the Auto mode is cancelled because the READY conditions are no longer met.

The READY conditions are met when the generator has starting air pressure, is set for remote operation, the lubricating oil pump is set to Auto. The voltage control must be on for READY when the generator is running prior to connection.

If auto is not selected, and the READY light is on, the generators can be started and stopped, connected and disconnected (auto sychronising) by using the panel buttons.

Priority
Prior 1, Prior 2, Prior 3 select the start and stop order of the generators as the load changes. Prior 1 is the highest priority and will remain connected and running at all times. Prior 3 is the lowest priority and this will cause the generator to be ‘last in, first out’.

2.1.1 Control modes

The diesel generators may be operated in three different control modes, selected by pressing the dedicated push buttons at the Power Chief Generator Control panel.

- Equal load
- Optimal load
- Cyclic load
- Alert Mode

Equal load (symmetrical load sharing)
Providing the generators are in AUTO Equal load balances load evenly between generators, when two or more are running in parallel. Equal Load is normally selected when safety is the most important issue (during manoeuvring, loading, discharging etc.).
NOTE! In the first place the prime mover speed controller carries out the main control of the load sharing, while the Power Chief carries out the fine adjustment.
The settings for start and stop load can be read and changed at variable page.

Optimal load (asymmetrical load sharing)
Providing the generators are in AUTO, Optimal load provides maximum fuel economy and is usually selected during sea voyages. First priority takes “max load” while second priority takes the rest of the load.
The settings for start and stop load can be read and changed at Variable Page.

Cyclic load
Cyclic load is selected by pressing the CYCLIC LOAD push-button. This mode can only be used with Optimal Load. After a certain period of time generator 1 and 2 will change over, the generator that was on high load now becomes the generator taking the varying load. This mode will cycle the load between the engines in such way that one of the diesels is running at max. load while the other diesel handles the remaining load and thereby prevents carbonising of the cylinders, valves etc. Cyclic Load is selected when it is necessary to run more than one diesel on low power.
The cycling period can be read and changed at Variable Page.

Alert Mode.
Alert mode is selected when the automatic stopping of a generator is undesirable. Alert mode can only be used with Equal Load.
When ALERT MODE is selected the automatic disconnection and stopping of generators is inhibited. This mode is used when a large excess capacity is required, i.e. manoeuvring, or when sudden large power surges may occur, i.e. when using the bow thruster.

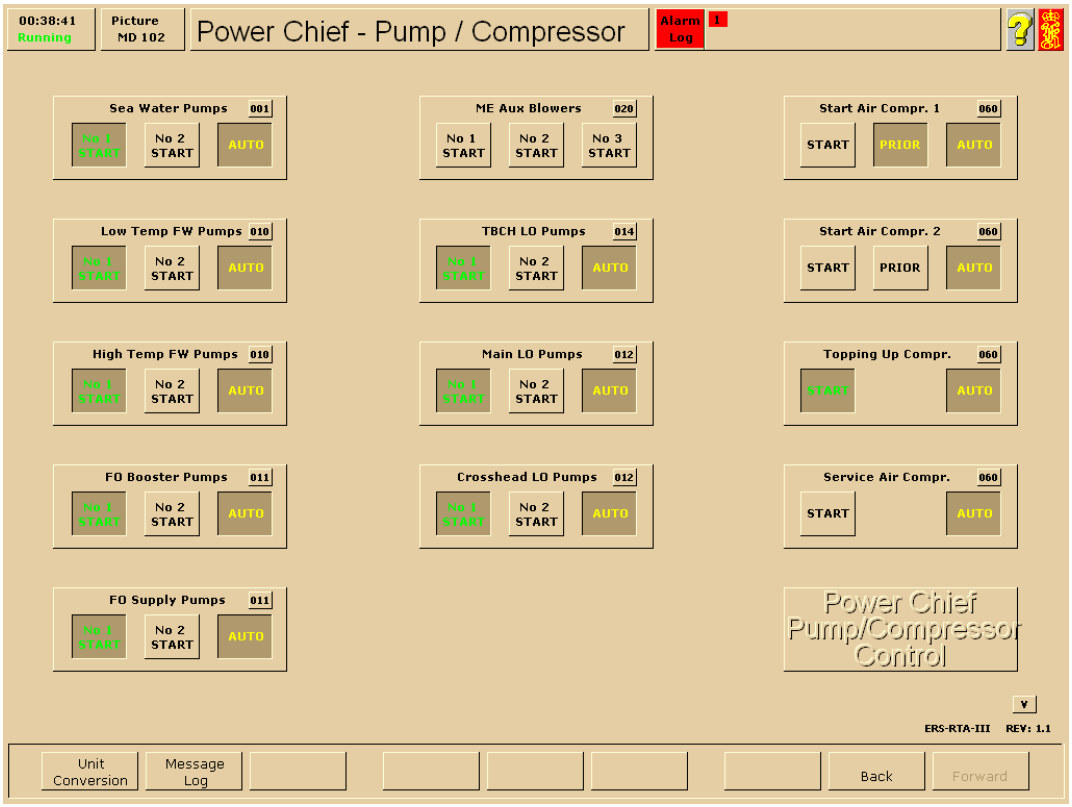
Non Ess Trip - Flashes when alternators have been overloaded and non-essentials are tripped. Reset function by clicking on button.

High Power - Flashes when generator set reaches upper limit. To reset/acknowledge alarm, click flashing button.

Gen S/S Req - Flashing button indicates upper load limit is near for running set. If in automatic mode, next generator set is started and connected automatically, or disconnected and stopped depending on requirements.

Power Chief Load Diagram – gives a graphical view of the generator set up with indication of the load sharing and start/stop limits.

2.2 Power Chief – Pump and Compressor Control



General
The PowerChief – Pump and Compressor Control manages automatic and manual remote operation of the compressors and pumps.

All pumps can be started and stopped locally from the engine room independently of the AUTO/MANUAL setting on this panel.

If the automatic control is not active (AUTO lamp button is not lit) the pumps may be started and stopped manually from the panel.

In AUTO mode the pumps and compressors are automatically started and stopped by the control functions including:

- Stand-by start at low pressure
- Auto stop at high pressure
- Restart after black-out
- Power check (start inhibit at “High Power”) on generators
- Cyclic operation of units

If there has been a disturbance in the AUTO system, for instance, a local start/stop or an alarm has occurred, the auto lamp and the start lamp start flashing.

Each Main Engine pump with stand by function may be set in auto cycle mode via the variables page 7021. In this mode the pump in service is automatically changed between pump no 1 and no 2. The cycle time period can be changed from variable page 7021.

When pressure drops below the "stand-by start limits", the stand-by unit is started automatically. Most of the low-pressure alarms are subject to "Automatic alarm blocking".

The stand-by start function will be blocked as well during the same period of time.
The stand-by limits can be viewed and changed from variable page7020.

Both Main Engine auxiliary blowers will operate together in AUTO.

Each main air compressor can be selected as PRIOR. The selected compressor will then start and stop at higher pressures than the non-selected compressor.

Operation procedure

1. **Preparations before operating the compressors and pumps in remote or automatic**

1.1 All systems must be lined up and tested before remote or automatic management.

2. **MANUAL mode:**

2.1 Push START button.
2.2 When steady light, pump/compressor is running.
2.3 Push button on running pump/compressor to stop the pump/compressor.

3. **Pump AUTO mode:**

3.1 As in manual mode.
3.2 When first pump is running push AUTO.
3.3 Changing pumps in AUTO, deactivate AUTO and start selected pump and stop running pump.
3.4 Push button AUTO.

4. **Compressor AUTO mode:**

4.1 Ensure compressor is lined up.
4.2 Select Auto mode.
4.3 For main compressors select one to be PRIOR.

NOTE! If an object has developed faults, stand by pump/compressor will start.
Flashing light in start button indicates start of stand by object. To remedy condition, stop object. Locate problem and “repair”. After a repair attempt or rectifying of running condition, follow normal AUTO procedure.

3 ALARM / MONITORING SYSTEM

The central alarm system is integrated in the DataChief Section. The alarm system consists of 28 alarm groups with a corresponding red alarm indicator numbered from 1 through 28.

Normally, all alarm lamps are turned dark. As soon as an alarm occurs, one of the alarm lamps starts flashing. Additional information is obtained by selecting the corresponding alarm group, from the alarm page directory.

Each alarm group covers alarm points from dedicated subsystems. The alarm point exceeding the normal value turns into a flashing mode.

The Alarm point (displayed in the MD picture) turns to steady condition as soon as the operator moves the cursor to its location and resets the alarm by using the left hand side push-button of the tracker ball (mouse).

As soon as the measured value is within the alarm limit(s), the alarm indication turns off.

Measured values are displayed together with tag number, tag name, engineering units, and upper/lower limits for alarms. The limits can be altered from Instructor mode by point and click with centre tracker-ball button at limit and then type in new value, press “Enter” (Carriage Return).

The alarm log is displayed by pressing the F8 button on the keyboard, or if dedicated keyboard is a part of the delivery, the Alarm Log button.

4 PURIFIER CONTROL

The control of purifiers includes both automatic and manual control. The interval between each shooting sequence can be adjusted and the purifiers can be shot individually.
NOTE For Alcap purifier – please refer to instructions in the manual Machinery and Operation.

Start of the purifiers:
The purifiers are started and stopped from their local panels.

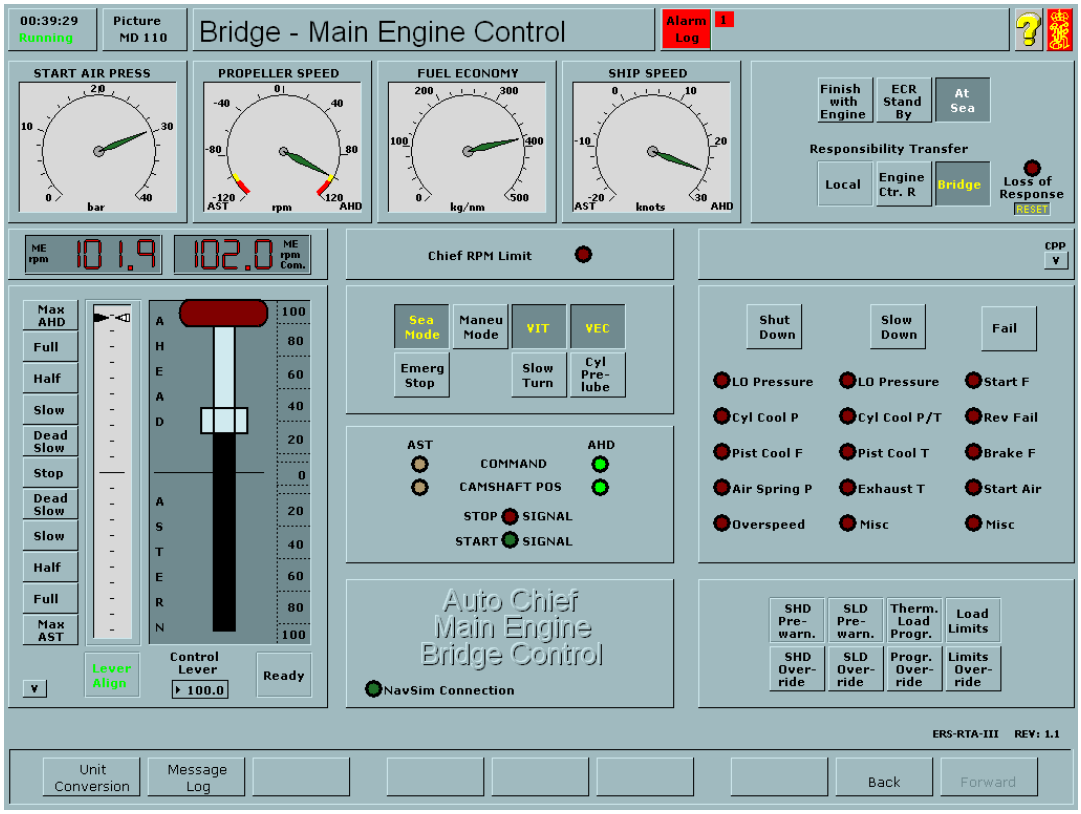
Modes of operation
The following modes of operation are selected by a mode selector on the local panels, MANUAL, and AUTO.

Switching from "MANUAL" to "AUTO"
The purifier is shot periodically according to the shooting sequence recommended by the manufacturer. If the purifier is stopped in auto mode, the first part of a normal shooting sequence is performed immediately, and the bowl remains open; ready for later operation. The purifier has sufficient rotating moment of inertia to make this short shooting possible.

Switching from "AUTO" to "MANUAL"
Current shooting is interrupted immediately. The electrical connection to the control relays is broken. Alarms are reset. No monitoring or control functions are performed.

5 BRIDGE CONTROL PANELS

5.1 Main engine – Bridge control



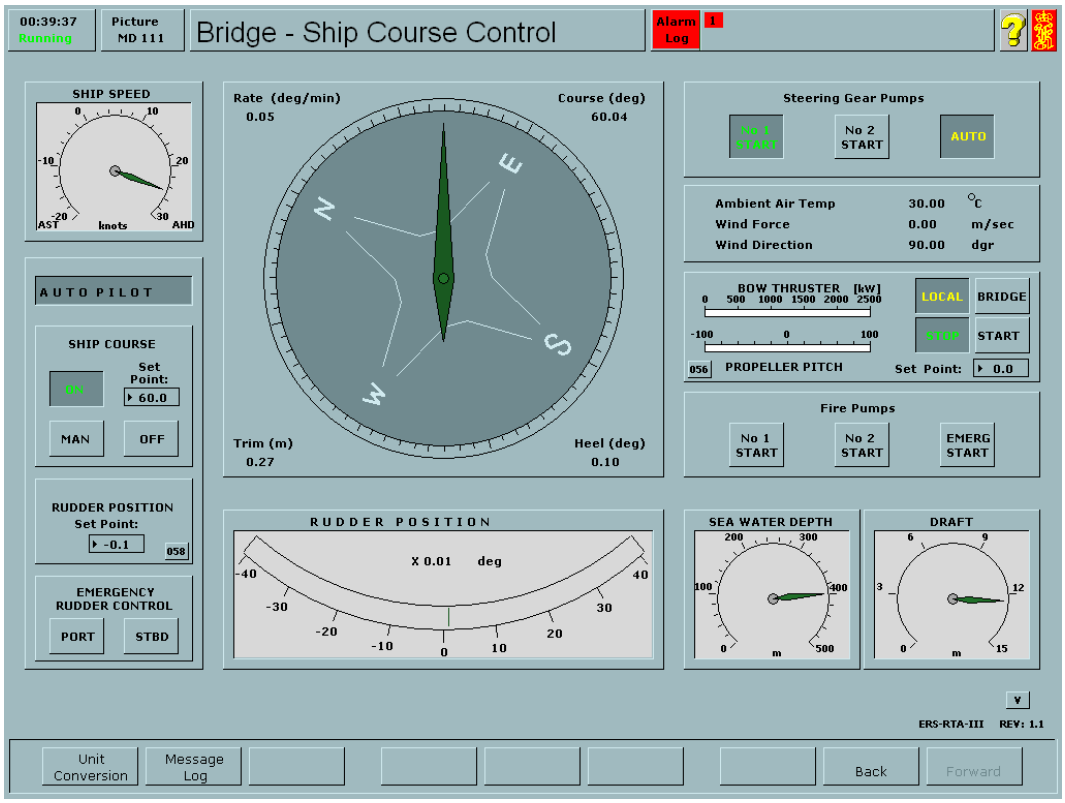
The control system fitted to the bridge is a mimic of that fitted within the Engine Control Room. Both panels have the same functionality, although some minor controls are different. Note that the Bridge has a starting air pressure gauge, which is mandatory for all engine manoeuvring positions.
The bridge does not have the Chief Engineer Officer's RPM limit adjustment, indication is given when the limit is reached.

Operations of the engine from the Bridge control station:

1. The Bridge panel must be selected. If not change over using the procedure listed within MD104 for responsibility transfer.
2. Ensure that the main engine and auxiliary systems are operational. The engineering staff would confirm this, and would allow the engine to be placed on ECR Stand By status.
3. The engine direction and speed should be adjusted by moving the fuel control handle to desired engine speed by point and click on the interactive field (default settings are dead slow/slow/half and full positions). Manual typing in of desired command in the numeric window can also be used if a non standard speed was required.
4. The mimic diodes will indicate the ahead and astern command and actual camshaft position.

The Bridge is able to over-ride shut downs and slow downs from their panel, although they should inform the ECR of this action.

5.2 Ship course control



This screen is used to control the vessel manoeuvring using the steering gear and bow thruster. The actual environmental conditions of air temperature, wind force, wind direction, sea water depth, and vessel draft are displayed. These can be adjusted using the Sim Control variables on page 9000.

The main and emergency fire pumps can be started using this panel. If the engine room was operating under UMS conditions, then the Bridge should activate the fire pump start upon fire alarm activation.

Under normal sea going conditions the following system should be operational:

1. One of the two steering gear pumps would be running, and the other placed in standby using the auto button
2. Autopilot set to ON, with the required course set point.
3. The rudder would be moved by the autopilot to achieve the desired course, with a maximum rudder angle of +/- 15o

Under standby engines (SBE) engines, the following systems should be operational:

1. Both steering gear pumps would be running.
2. The autopilot would be set to MANUAL, so that hand steering is possible.
3. Hand steering is accomplished by clicking the required rudder angle into numeric window of the rudder set-point. Note rudder angles to port are a negative input, -25° for port 25.

4. The bow thruster could be started after checking with the engineering staff that sufficient electrical generating capacity is present.
5. The bow thruster pitch is adjusted by clicking the required pitch setting into numeric window of the set-point. Note pitch settings to port are a negative input i.e. -5 for port 50% pitch.

Emergency Rudder Control.
In case of remote control failure the rudder can be controlled directly from the bridge using the Emergency Rudder control push buttons. These buttons operate the solenoids on the steering gear directional valves. Push the required button. When the rudder is at the desired angle, cancel the push button.