X SERIES

350X

ARESA

OPERATION MANUAL

MJP MARINE JET POWER

A FORCE TO TRUST

Marine Jet Power is not liable or bound by warranty if these instructions are not adhered to during installation, operation or maintenance, or if the equipment is modified without written consent from the manufacturer.

1 Introduction

1.1 About This Manual

1.1.1 General

This manual is a comprehensive handbook which has been developed to provide information on the equipment supplied by Marine Jet Power (MJP).

1.1.2 Intended Use

This manual is intended for crew and maintenance personnel. It can be used on board whenever detailed information about the equipment is required. It will serve as a guideline for operation of the MJP system and basic inspections.

1.1.3 How to Read This Manual

This manual contains operational tasks and has separate sub chapters for each task.

The tasks included in this manual cover maintenance and troubleshooting that can be handled by the vessel's own crew (see skill levels below). Note that maintenance tasks, which can only be performed by an Authorized Service Technician trained by Marine Jet Power, are not covered.

Instructions regarding installation of the equipment are described in the **Installation Manual** and instructions for service of the waterjet system are described in the **Service Manual**.

When the crew have performed qualified training by Marine Jet Power, a more extensive **Workshop Manual** covering also the qualified maintenance tasks, can be obtained from Marine Jet Power.

Maintenance Levels

For each task there are two levels specified, skill level and facility level. These two levels determine the maintenance level of a task.

1.1.4 Skill Level

The skill levels indicate the skill level required of the person undertaking for the maintenance task.

	Skill level	Description
A	Crew	General technical knowledge about the Marine Jet Power system.
B	Chief Engineer	Basic technical training on the Marine Jet Power system.
C	Task specialist	Specific technical training in a specific field: welder, painter, electrician etc. Could also be within mechanical, hydraulic, lubrication or control system.
D	Authorized Service Technician	Personnel trained on Marine Jet Power certified training course.

1.1.5 Facility Level

The facility indicates the recommended operational status of the vessel during the maintenance procedure. The facility levels are:

- On equipment / at sea
- Dockside
- Dock, workshop / dry dock
- MJP workshop

2 Safety

2.1 Safety Instructions

2.1.1 General

Read this manual thoroughly before starting activities.

This document contains personal safety information that applies when working with Marine Jet Power's products. These instructions are mandatory to keep personal safety.

Use all equipment in strict accordance with these instructions, or the instructions supplied by the equipment manufacturer.

2.1.2 Local Regulations

Local regulations, principally national regulations, override the information in this document. When no applicable local regulations are available, use the regulations in this document.

2.1.3 Symbol Levels

Warning!
A warning means that injury or death is possible if the instructions are not obeyed.

Caution!
A caution means that damage to equipment is possible.

Note!
Notes are added to give more information, usually in a procedure.

2.1.4 Symbols

Symbol	Type	Description
	General warning or caution	Risk to people or equipment (specified by a supplementary sign).
	Electrical hazard	Avoid potential injury or death from electric shock or burn.
	High pressure	Avoid exposure to hot oil or hot vapour.
	Burn risk	Avoid contact with hot surface.
	Rotating parts	Avoid being caught between rotating parts.
	Hanging loads	Avoid standing or walking under hanging loads.
	Environmental chemical hazard	Avoid pollution of the environment from chemicals. Read the material safety data sheets to find information of the products and contact the manufacturer for more information.
	Personal chemical hazard	Avoid potential injury or death from exposure to chemicals. Read the material safety data sheets to find information of the products and contact the manufacturer for more information.
	Corrosive substances	Avoid material damage and personal injury from exposure to corrosive substances. Read the material safety data sheets to find information of the products and contact the manufacturer for more information.
	Burn risk	–

	Pinch point hazard	Avoid being pinched between moving parts.
	ESD-sensitive electronic component.	Semiconductors and circuit boards can be damaged by electrostatic discharge (ESD). When handling, care must be taken so that the devices are not damaged.

2.1.5 Personal Safety Equipment

Personal safety equipment must be used when there is a risk involved.

	Wear hearing protection. Risk of hearing loss and accidental injury from loud noises.
	Wear eye protection. Risk of injury to eyes from flying sparks, metal splatter and slag chips.
	Use safety footwear. Risk of injury to feet from falling objects and heavy equipment.
	Use protective gloves. Risk of injury to hands from chemicals, corrosive substances and sharp edges.
	Wear hard hat. Risk of accidental head injury from falling objects, sharp edges and when working in narrow spaces.

2.1.6 Disposal

Discharge of hazardous substances must be done in accordance to local regulations.

	Please contact an authorized representative of the manufacturer for information concerning the decommissioning of equipment.

See also ***Equipment Disposal*** in ***Service Manual***

3 System Overview

3.1 Installation overview

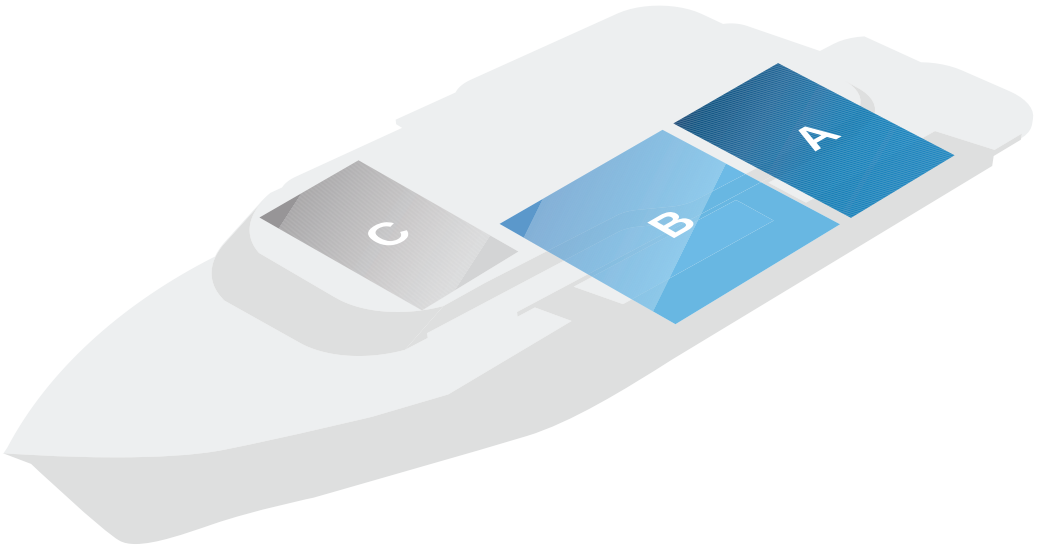

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Figure 1

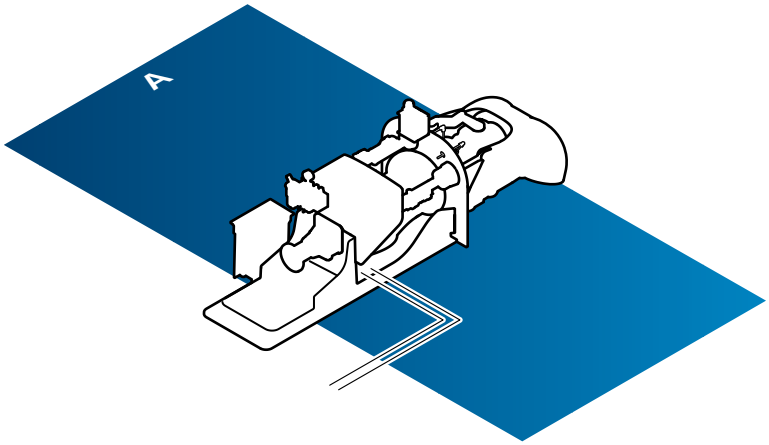

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Figure 2

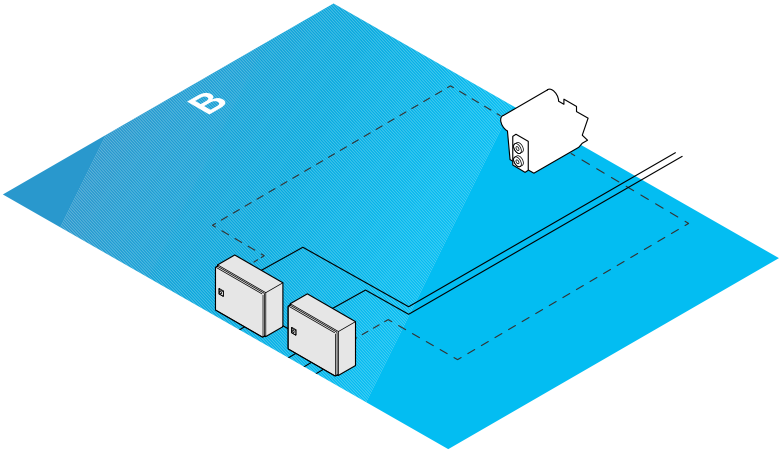

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Figure 3

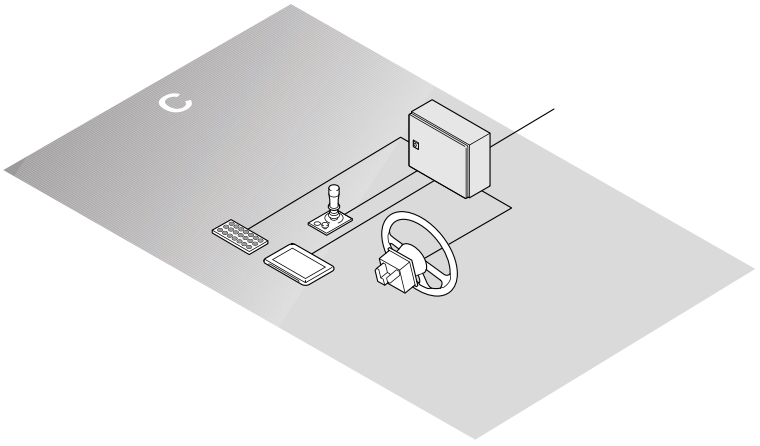

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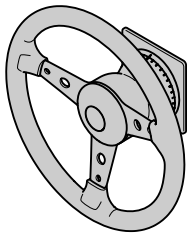
Figure 4

A	Waterjet
B	Engine Room
C	Wheel House

3.2 Control System

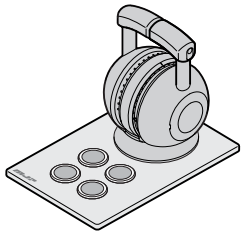
3.2.1 System Components

Steer Wheel



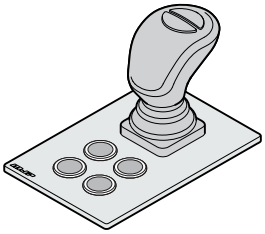
The steer wheel controls the nozzle direction of the waterjet(s).
For more information, see
4.7 *Combinator and Steer Wheel, Operate*.

Combinator Controller (BUS)



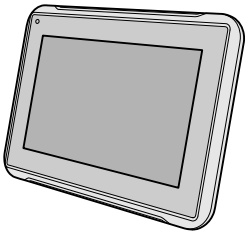
The combinator controller controls the bucket position and engine RPM.
A steer controller controls the nozzle direction.
For more information, see
4.7 *Combinator and Steer Wheel, Operate*.

VCS Panel (BUS) (three axis)



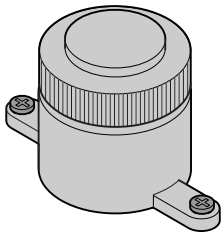
The VCS panel is used for low speed manoeuvring. The joystick on the panel controls the nozzle direction, bucket position, and engine RPM. The VCS panel is also used for rotational control.
For more information, see
4.8 *VCS, Operate*.

Display Panel



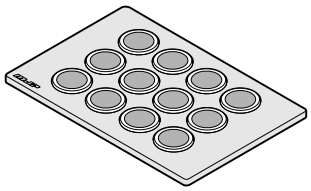
The display panel displays bucket position, nozzle position, alarms, system setup and calibration.
For more information, see
3.2.3 *Display Panel*
For information about Jet auto calibration, see 3.2.5 *Jet autocalibration*.

External Buzzer



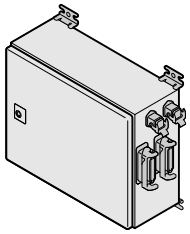
The external buzzer will sound if there is an alarm, it can be silenced with the alarm button.

Command Panel



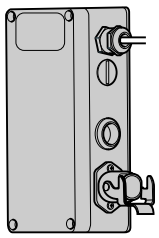
The command panel controls clutch, modes, and functions.
For more information, see
3.2.2 *Command Buttons*.

Main Control Unit



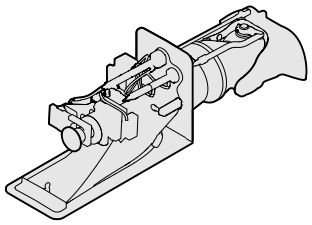
The MCU is the main controller, responsible for taking the command requests from the operator and safely operating the jet, engine, clutch and additional options.
In systems without a backup system the MCU connects directly to the jet, clutch and engine interface.

Hydraulic Connection Box



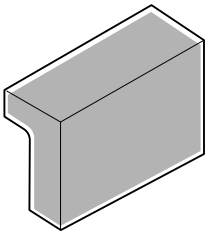
The hydraulic connection box provides a connection point between the waterjet and control system. There is one hydraulic connection box pre fitted to each waterjet unit.

Waterjet Unit



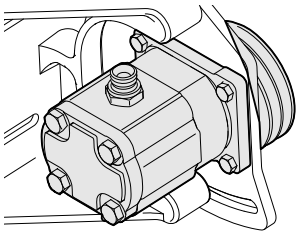
The waterjet converts engine power into thrust and direction. Water is drawn in from an intake in the hull and is then propelled at a higher speed through the nozzle. The thrust force is directed with a steering nozzle and a reversing bucket.

Hydraulic Tank



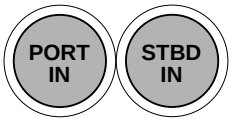
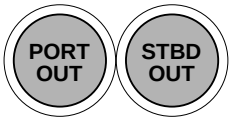
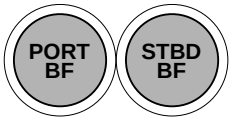
The hydraulic tank is mounted directly into the waterjet unit. It is connected to the hydraulic pump and the hydraulic cylinders and the oil is cooled by the water in the intake.

Hydraulic Pump



The hydraulic pump is driven by the main engine via belts from the drive shaft. It generates oil flow to the hydraulics.

3.2.2 Command Buttons

Button	Description	Indication
 PORT / STBD IN	Press this button to engage the gearbox in the normal direction, connecting the engine to the drive shaft.  **Caution!** Make sure that the engine is at idle RPM when you press the button. This will prevent damage to the equipment.	Lit if clutched in.
 PORT / STBD OUT	Press this button to disengage the gearbox, disconnecting the engine from the drive shaft.	Lit if clutched out.
 PORT / STBD BF	Backflush Press this button to engage the gearbox in the reverse direction. Used to backflush the jet in the event of blockage.	Lit if clutched in.
 COMMON	Press this button to operate in common mode. For more information, see 4.6.2 *Common Mode*.	Lit if active.
 SEPARATE	Press this button to operate in separate mode. For more information, see 4.6.1 *Separate Mode*.	Lit if active.
 LAMP TEST	Press this button to illuminate or light all lamps temporarily.	Lit if active.
 RPM BALANCE	In common mode, turn this balance dial to bias the RPM towards port or starboard engine.	N/A

 DIM +	Press this button to increase the illumination of all buttons.	N/A
 DIM –	Press this button to decrease the illumination of all buttons.	N/A
 ALARM	Press this button to silence alarm . The button will be lit until the alarm has been acknowledged and cleared. See 6.2.1 *Display Panel, Acknowledge Alarms*.	Lit if an alarm is present.

3.2.3 Display Panel

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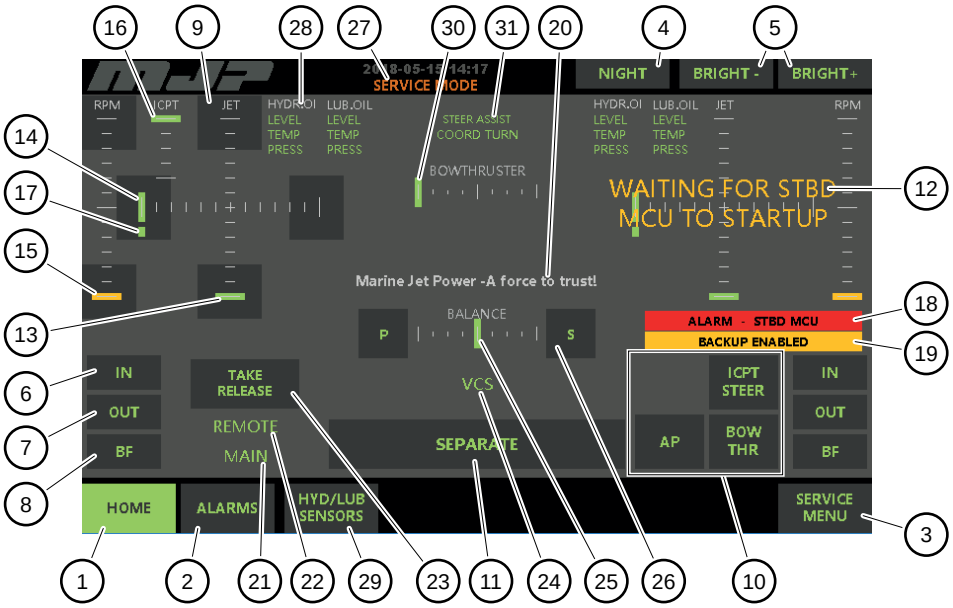
Figure 5

Depending on system configuration, the display may have different functions. All functions described in this section are configurable. Items that do not apply to a specific configuration do not appear on the display panel. Furthermore, some items referred to as buttons in this section may, in some configurations, only be used as an indication.

Home Screen



GEN-1708-01

Figure 6

The home screen is shown as the start screen. The hot key panel at the bottom of the screen is accessible at all times and allows the different screens to be opened. All indicators and buttons in the central area are only visible from the home screen. If this page is not currently displayed, pressing the HOME button (item 1) opens this page. The description of each item is detailed below.

Pos	Part	Description
1	HOME	Tap the HOME button to change back to the home screen from another active screen.
2	ALARMS	Tap the ALARMS button to change to the alarm screen. The background colour of the button also indicates whether there is an active alarm. Grey: No active alarm is present. (All alarms have been resolved)(Red: The alarm is currently active and has not been acknowledged. Yellow: The alarm has cleared but has not been acknowledged. Green: The alarm has been acknowledged.
3	SERVICE MENU	Tap the SERVICE MENU button to access the service screen for maintenance and setup.
4	NIGHT	The NIGHT button selects between the day and night colour palette. The night palette colours are less obtrusive for dark bridge conditions.
5	Brightness buttons	The brightness of the display can be decreased or increased with the BRIGHT+ and BRIGHT- buttons.
6	Clutch In	Tap IN button for 2 seconds to engage the gearbox in the forward direction. There are separate buttons for each jet. **Note!** The clutch does not engage if the clutch interlock is active.
7	Clutch Out	Tap OUT button for 2 seconds to clutch out the gearbox. There are separate buttons for each jet.
8	Clutch Backflush	Tap BF button to enable the backflush function by engaging the gearbox in reverse. It is only active while the button is held and drops back to clutch out when released. There are separate buttons for each jet.
9	Manual Control	Buttons to move bucket/nozzle and increase RPM demand in manual manoeuvring mode.
10	Auxiliary buttons / indicators	Auxiliary buttons/indicators. Dependent on system configuration, these can be either indication only or indication and control buttons. Examples: • AP – Autopilot • ICPT – Interceptor steer assist • BOW THR. – Bow thruster • DAP – Dynamic positioning autopilot.
11	Manoeuvring Mode	Dependent on system configuration, this can be either an indication only or indication with control. Tap the button to open a popup in which you can select another manoeuvring mode.
12	Communication Status	A text that appears during system startup and if communication to the MCU is lost.
13	Bucket position (feedback sensor)	The bucket position indicates the actual position of the bucket. Notice for classed vessels. The bucket feedback sensor is not an indication sensor.

Pos	Part	Description
14	Nozzle position (feedback sensor)	The nozzle position indicates the actual position of the nozzle. Notice for classed vessels. The nozzle feedback sensor is not an indication sensor.
15	Engine RPM demand	The engine RPM demand indicates the engine RPM requested by the waterjet control system. There are separate indicators for both jets. The indicator is yellow when the engine running signal is not present.
16	Interceptor position indication	If the vessel is equipped with an interceptor system interfaced to the Jetmaster 3 control system, the interceptor position is displayed.
17	Interceptor steering	If the vessel is equipped with an interceptor system interfaced to the Jetmaster 3 control system, the interceptor steering demand is shown.
18	Alarm lamp, active alarm in MCU.	Whenever an MCU has an active alarm, this bar is shown. There are separate indicators for both MCU's.
19	Backup Enabled	An indicator that indicates that the backup system is enabled.
20	Vessel information	Information for controlling the vessel is shown here. Typically, when an interlock is preventing a commanded action.
21	Station indication	If the active station is in a released state (it still has control but is waiting for another station to take over), it appears yellow.
22	Pending Station indication	When the requested station is not valid to take control, this indication is visible. Common reasons for this is that the levers are not matched or that the current manoeuvring mode is not applicable for the new station.
23	Take/Release	Dependant on system configuration a Take/Release button may be present. This is used in a multiple station system to take or release control.
24	Pending Manoeuvring mode indication	When a requested Manoeuvring mode is not valid to take over this indication is blinking.
25	RPM balance indication	Indication of the balance between the port and starboard RPM demand. Only used in Common Manoeuvring mode.
26	Balance buttons	Buttons to shift the balance in Common Manoeuvring mode. P for port and S for starboard.
27	Service mode indication	Indicates if service mode is active.
28	Hydraulic and Lubrication Alarms	Indicates if any hydraulic or lubrication oil alarms are present. These also appear in the alarm list.
29	Hydraulic and Lubrication sensors	Opens a page to display current values for hydraulic and lubrication sensors. Only visible if a sensor is present.
30	Bow thruster indication	Indication of the bow thruster setpoint.
31	Interceptor mode indication	If the vessel is equipped with an interceptor system interfaced to the Jetmaster 3 control system, an indication of the active interceptor mode is shown.

Manoeuvring Mode, Popup

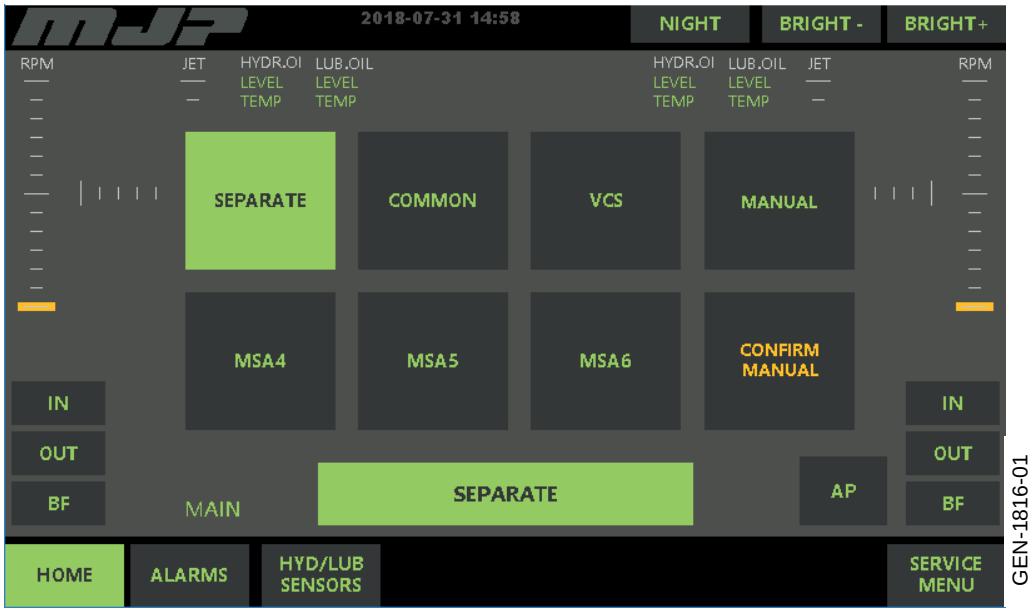


Figure 7

The Manoeuvring mode popup has several modes. One of the buttons is reserved for a manual mode which will need to be confirmed in order to select. The hyphenate all locations will disappear automatically if no button has been pressed.

Alarm List

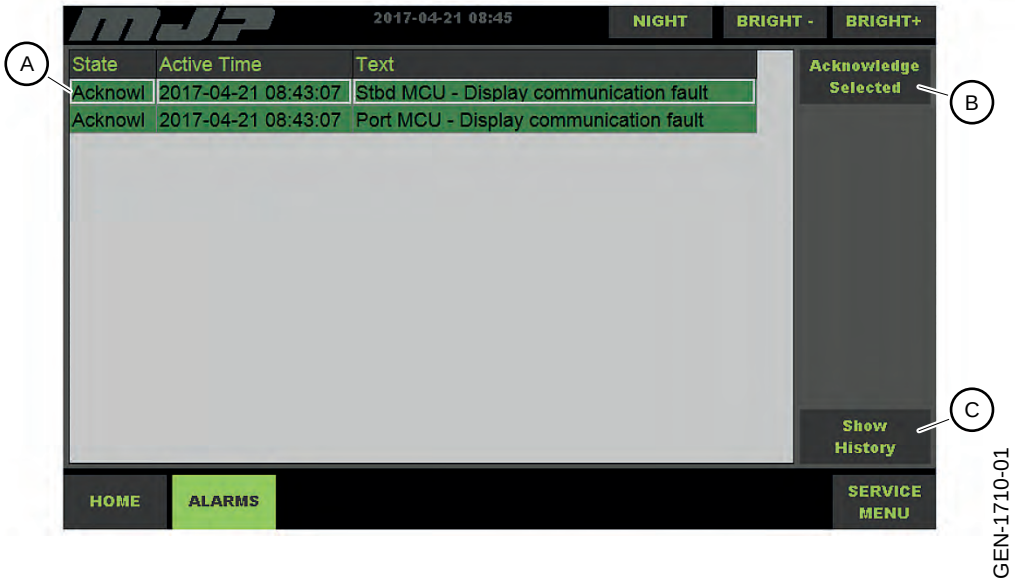


Figure 8

The display panel records all alarms which have been raised by the MJP control system.

Active alarms are shown on the list along with date and time of the event. The most recent alarm is shown at the top of the screen (A).

The background colour behind each alarm entry indicates the current state of the alarm.

- **Red:** The alarm is currently active and has not been acknowledged.

- **Yellow:** The alarm has cleared but has not been acknowledged.
- **Green:** The alarm has been acknowledged.

The alarm will only disappear from the alarm list when the fault has been cleared **and** the alarm has been acknowledged. Alarms that have cleared and been acknowledged can still be viewed by pressing show history (C).

Tap the Acknowledge button (B) to acknowledge the selected alarms. This will also silence the audible alarm.

For a complete alarm list and instructions on how to acknowledge alarms, see *6.2 Alarms*.

3.2.4 Display Panel, Service Menu

Figure 9

Task Summary

The task is to enter the control systems Service Menu.

Some changes can be done without Service Login, such as instrument brightness.

The service menu Service Login gives access to changes of the system parameters.

Warning!
Changes to the system parameters may adversely affect the control system or make it unsafe to operate.

Task Interval

Do this task during:

- Corrective maintenance

Prerequisites

Conditions

The system power is on.

Number of personnel	Skill level	Maintenance facility level	Estimated time
1	Authorized Service Technician or Chief Engineer with remote support	Dockside	10-60 minutes

Reference document

See Remote Support Setup in Service Manual.

Service Menu, General

Entering the service menu opens the Service Menu > General page. The items 4-8 are added to the tool bar at the bottom of the screen. These buttons are used to navigate between different service pages. At any time, tap HOME button to return to the home screen.

User Mode

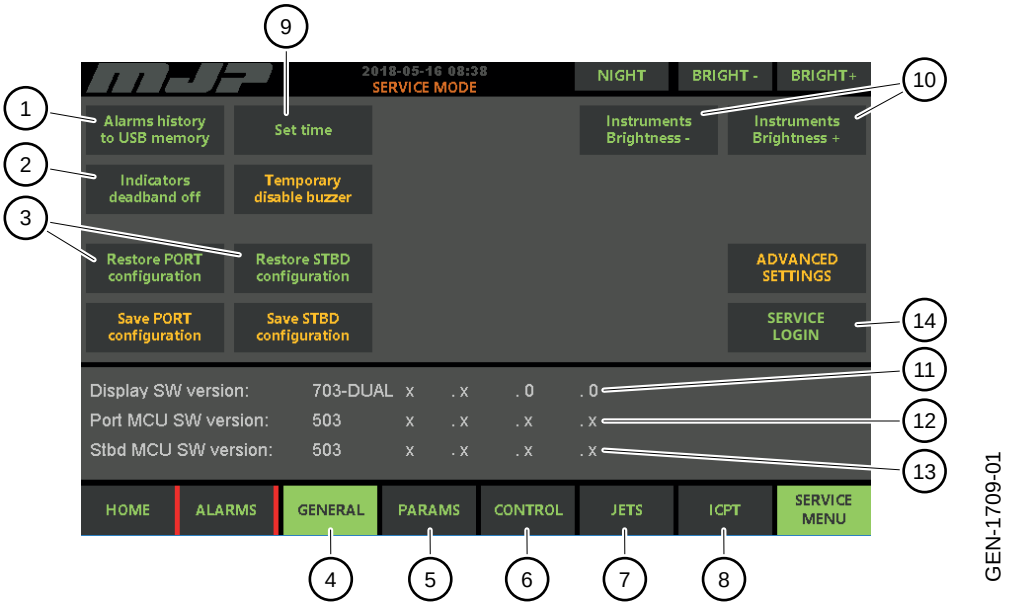


Figure 10

The display defaults to ‘user mode’ which prevents changing to the system parameters which may adversely affect the control system or make it unsafe to operate. The following options are available in ‘user mode’.

Pos	Part	Description
1	Alarm history to USB memory	Tap this button to download the alarm history to an attached USB memory stick.
2	Feedback indicators deadband off	Tap this button if an exact position of bucket and feedback is required. In this case, the indicators in the display may not appear centred when the port controls are in neutral.
3	Restore PORT Configuration	Allows the operator to restore the display configuration to the values stored in the control system PLC.
4	GENERAL	Tap to open the general information and setup page.
5	PARAMS	Tap to open the system parameter page.
6	CONTROL	Tap to open the control head information and setup page.
7	JETS	Tap to open the waterjet information and setup page.
8	ICPT	Tap to open the interceptor information and setup page.
9	Set Time	Tap to set the time and date in the display.
10	Instrument brightness	Adjusts the backlight brightness of control heads and instruments connected to the Jetmaster 3 control system.
11	Display SW version	The current software version running in the display unit software version, has five fields: • HW version supported

Pos	Part	Description
		• SW major version • SW minor version • SW project specific major version • SW project specific minor version.
12	Port MCU SW version	The current SW version running in the port MCU software version, has five fields: • HW version supported • SW major version • SW minor version • SW project specific major version • SW project specific minor version
13	Stbd MCU SW version	The current SW version running in the starboard MCU software version, has five fields: • HW version supported • SW major version • SW minor version • SW project specific major version • SW project specific minor version.
14	Service login / logout	Tap to login / logout of service mode.

Display Panel, Service Login

The complete procedure can be found in the **Workshop Manual**.

When the crew have performed qualified training by Marine Jet Power, a more extensive **Workshop Manual** covering also the qualified maintenance tasks, can be obtained from Marine Jet Power.

3.2.5 Jet autocalibration

GEN-2986-01

Figure 11

Task Summary

The task is to auto calibrate the Jet.

> **Note!**
> Adequately trained and certified personnel are required for this task.

Task Interval

Do this task during:

- First start-up
- Corrective maintenance

Prerequisites

Conditions

Main engine running

Number of personnel	Skill level	Maintenance facility level	Estimated time
1	Authorized Service Technician or Chief Engineer with remote support	Dockside	15 minutes

Reference document

See Remote Support Setup in Service Manual.

4 Operating Instructions

4.1 Start the Control System

The control system provides independent control for the port, centre and starboard propulsion lines. A propulsion line consists of jet, gearbox, and engine control.

1 Set all control heads to neutral position.

2 Set all power supplies to on.

> **Note!**
> Make sure that no alarm is present.

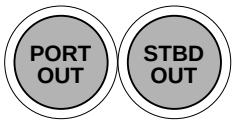


Figure 12

3 Set all clutches to out.

4 Start the engine.

4.2 Carry out a Preoperational Function Test

Before you do a preoperational function test, start the control system. See *4.1 Start the Control System*.

1 Move the control heads in any direction to make sure that the system is functional.

> **Note!**
> This may not be possible when the gearbox is clutched out with some hydraulic arrangement.

> **Caution!**
> Before you test the functionality of the system when the gearbox is clutched in, be aware of the vessel's surroundings.

2 Set all control heads to the neutral position again.

4.3 Stop the Control System

1 Set all control heads to neutral position.

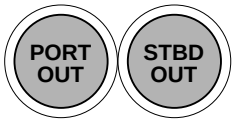


Figure 13

2 Set all clutches to out.

3 Stop the engine.

4.4 Clutch Control

1 Set all the control heads to neutral position.

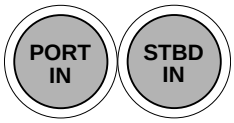


Figure 14

2 When clutched out, press and hold the clutch IN button for 2 seconds to engage the gearbox in the forward direction. The button will flash to indicate this. Assuming it is safe to do so, the control system will engage the clutch and the button will remain illuminated.

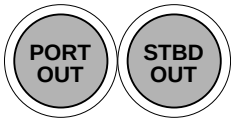


Figure 15

3 When clutched in, press and hold the clutch button for 2 seconds to disengage the clutch.

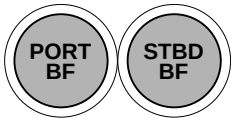


Figure 16

4 The backflush function is momentary only and must be held continuously for backflush to operate. Releasing the backflush button causes the system to return to clutch out.

4.5 Change Manoeuvring Mode

Multiple manoeuvring modes may be available for different situations. Some use the same control heads differently, while others use different control heads.

1 Make sure that the control heads are matched.

> **Note!**
> Some manoeuvring mode transfers require the control heads to be in the neutral position.

2 Press a manoeuvring mode button (for example SEPARATE COMMON)

> **Note!**
> The active manoeuvring mode button will be indicated by a steady light and is in control while the requested manoeuvring mode is indicated with a blinking light.

3 Make sure that the requested manoeuvring mode button is indicated by a steady light.

4.6 Modes

4.6.1 Separate Mode

Figure 17

The separate mode allows each jet to be independently controlled by its lever.

4.6.2 Common Mode

Figure 18

The common mode allows all jets to be controlled by a single lever. When in common mode, the jets are often controlled by the port side lever.

4.7 Combinator and Steer Wheel, Operate

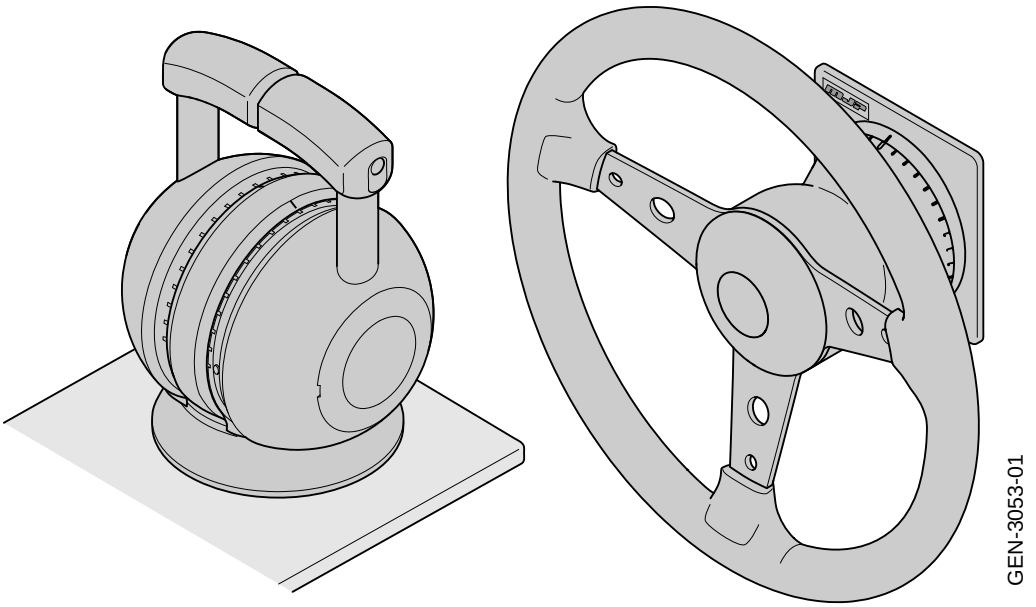


Figure 19 .

Example of combinator controller and steering wheel

The combinator controls the jet systems thrust. A single lever controls both the bucket position and engine RPM. Typically, a twin lever combinator is used although single handle options are available. Port side controls the port jet, and starboard side controls the starboard jet.

The lever has a centre detent which indicates the neutral thrust position. In this position, engine RPM demand is set to idle, and the thrust is directed equally forwards and backwards.

The steer wheel controls the nozzle position directing the flow of water, leaving the waterjet. In a multiple jet system, the steer controller controls all jets, and the nozzles move in parallel.

The combinator is also available with integrated clutch control buttons. The integrated clutch control buttons are most suitable for vessels without a separate clutch panel.

- When clutched out, press and hold the clutch button for 3 seconds to engage the gearbox in the forward direction. The button blinks to indicate this. Assuming it is safe to do so, the control system engages the clutch, and the button remains illuminated.
- When clutched in, press and hold the clutch button for 3 seconds to disengage the clutch.

4.7.1 Maximum Forward Thrust

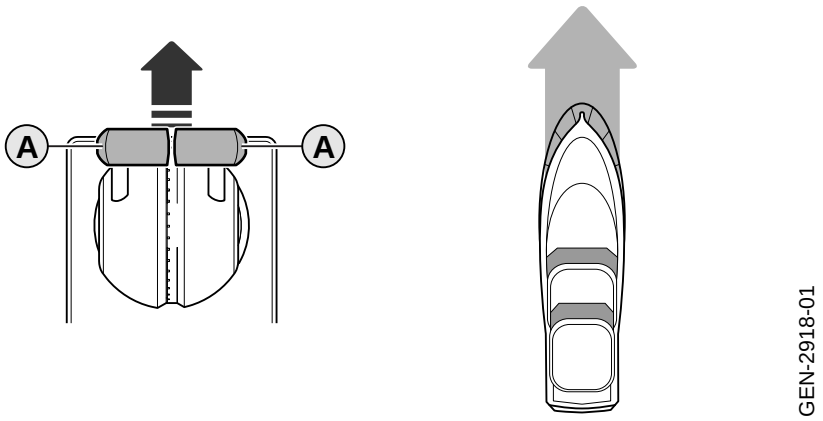


Figure 20

1 Move the lever (A) slowly forward to lift the bucket. Continuing to push the lever forwards increases engine RPM demand from idle to full ahead and moves the vessel forward.

4.7.2 Maximum Reverse Thrust

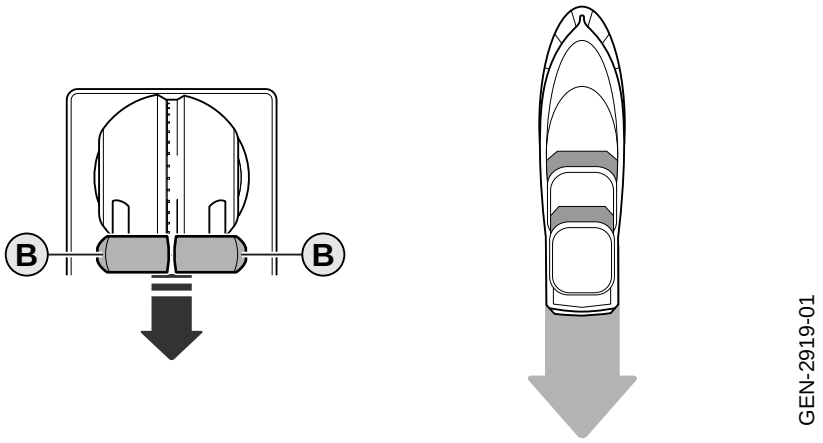


Figure 21

1 Move the lever (B) slowly backwards to lower the bucket. Continuing to push the lever backwards increases engine RPM demand from idle to full astern and moves the vessel backwards.

> **Note!**
> The reverse thrust is approximately 50% of forward thrust.

4.7.3 Steering Thrust

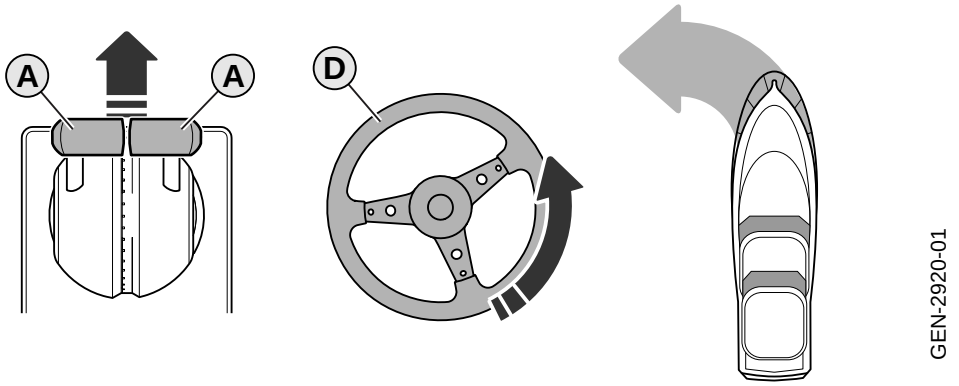


Figure 22

1 Move the lever (A) slowly forward to lift the bucket. Continuing to push the lever forwards increases engine RPM demand from idle to full ahead and moves the vessel forward.

- Turn the steer controller (D) to the port side to steer the vessel to port side.
- Turn the steer controller (D) to the starboard side to steer the vessel to starboard side.

Note!
A maximum steering angle will decrease the thrust with approximately 50%.

Note!
The steering thrust is proportional to the driving thrust.

4.7.4 Sideways Thrust

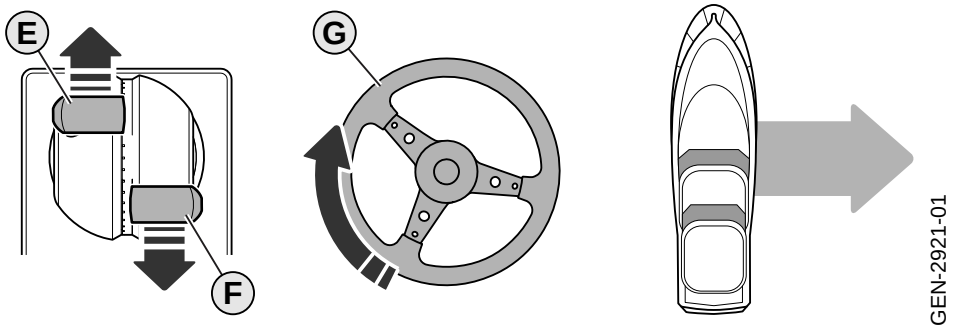


Figure 23

1 Move slowly and simultaneously port side lever (E) to forward position and starboard lever (F) to astern position.

- Adjust the controllers (E) and (F) to get zero combined thrust ahead/astern.
- Balance with steering angle (G) to avoid or achieve rotation of the vessel and to move vessel sideways to starboard side.
- Mirror all the movements to move the vessel to port side.

4.7.5 Crash Stop

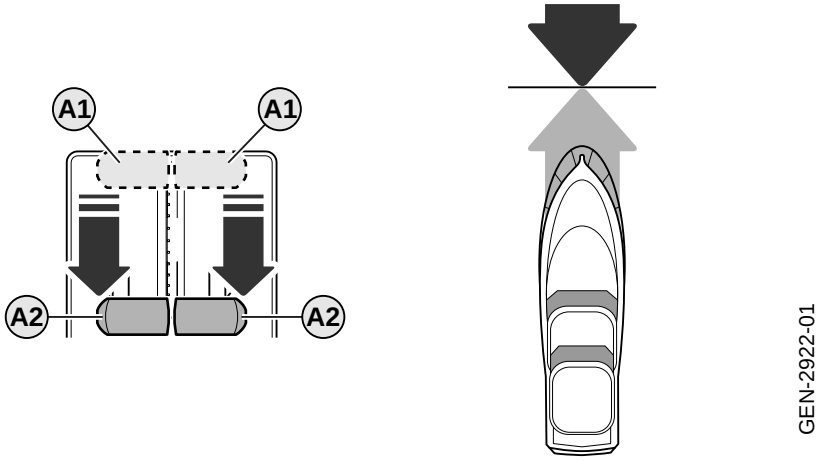
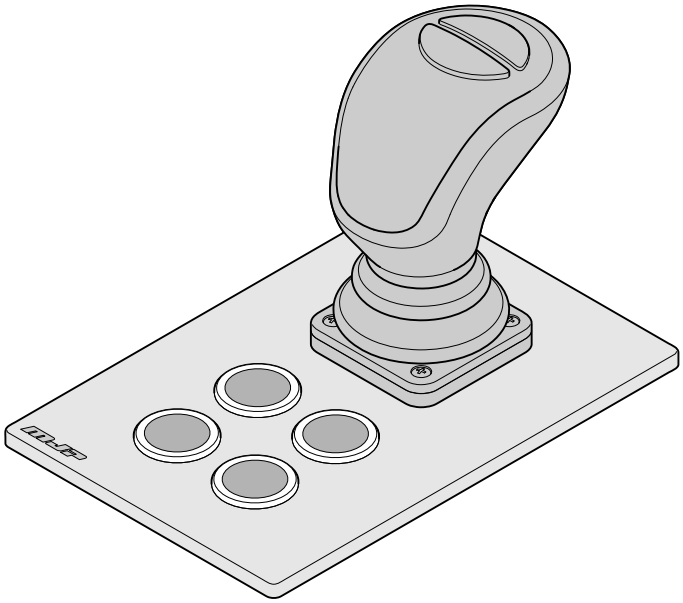


Figure 24

1 In an emergency, quickly move the lever from fully forwards (A1) to fully back (A2) to allow the vessel to crash stop. Full astern thrust is developed very quickly, allowing the vessel to stop quickly.

Warning!
A crash stop can result in injury to personnel and damage to the equipment.

4.8 VCS, Operate



GEN-1893-02

Figure 25

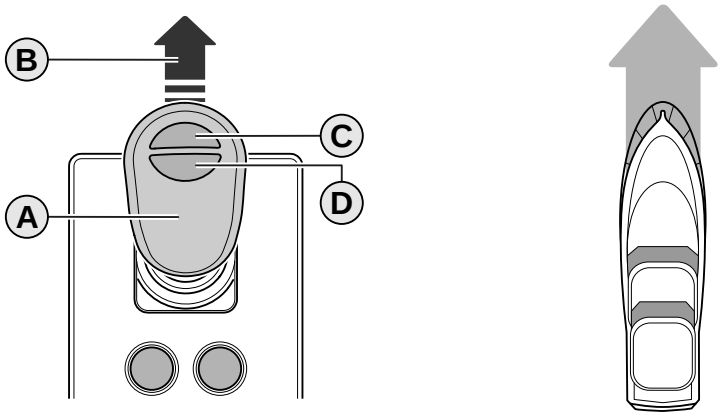
The VCS, vector control system, is an optional control and is designed for low speed harbour manoeuvring. It provides vector control movement of the vessel in the direction of the joystick.

Combining these motions allows the vessel to be manoeuvred during docking operations. The VCS control is not designed be used for general driving or high-speed manoeuvres.

The VCS panel (bus) has RPM increase and decrease buttons. These increase the idle engine RPM when using the VCS joystick. This can be used to reduce the response time on larger vessels or when operating conditions require.

The VCS panel (bus) can be used at the main station but on larger vessels is often mounted on port and starboard sides of the bridge allow the operator to have full view of docking activities.

4.8.1 Forward Thrust



GEN-1894-01

Figure 26

1 Move the controller (A) to ahead position (B).

2 Press the RPM+ button (C) to increase engine RPM.

3 Press the RPM– button (D) to decrease engine RPM.

4.8.2 Reverse Thrust

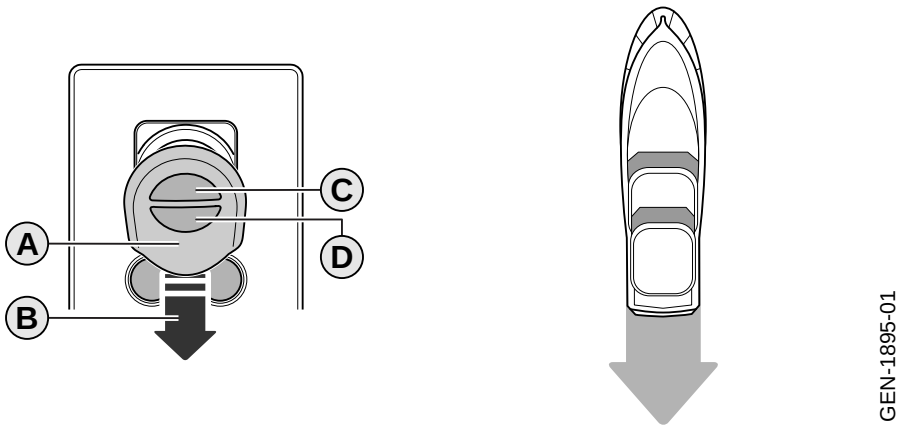


Figure 27

1 Move the controller (A) to astern position (B).
2 Press the RPM+ button (C) to increase engine RPM.
3 Press the RPM– button (D) to decrease engine RPM.

4.8.3 Steering Thrust

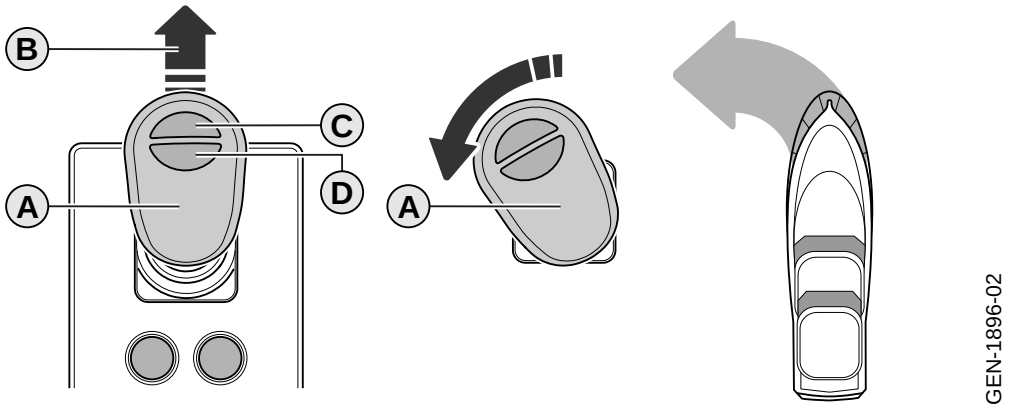


Figure 28

1 Move the controller (A) to ahead position (B).
2 Rotate the top of the controller (A) to control the steering.
3 Press the RPM+ button (C) to increase engine RPM.
4 Press the RPM– button (D) to decrease engine RPM.

4.8.4 Rotation Control

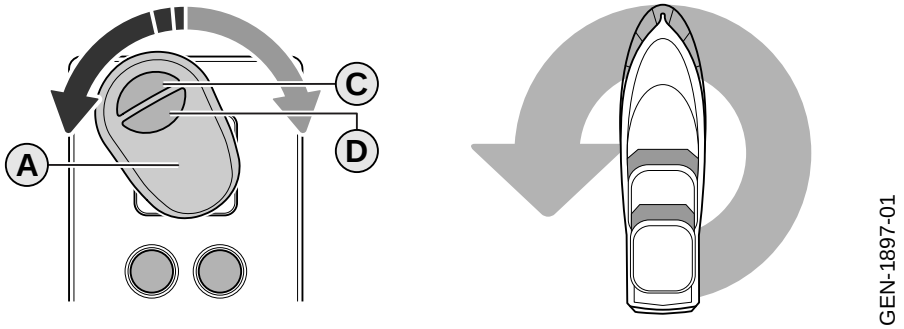


Figure 29

1 Rotate the controller (A) to control the rotation.
2 Press the RPM+ button (C) to increase engine RPM.
3 Press the RPM– button (D) to decrease engine RPM.

4.8.5 Sideways Thrust

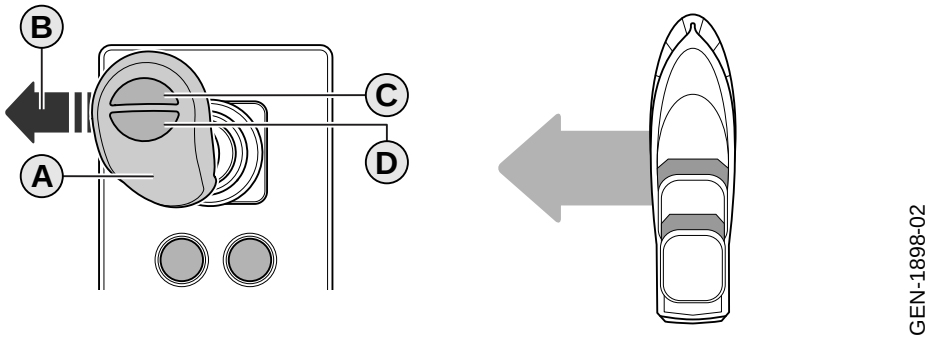


Figure 30

1 Move the controller (A) sideways (B).
2 Press the RPM+ button (C) to increase engine RPM.
3 Press the RPM– button (D) to decrease engine RPM.

Note!
To move forward or backward while going sideways, push or pull the controller slightly forward or backwards.

Note!
To rotate while going sideways, rotate the top of the controller.

4.9 Emergency Operation

4.9.1 Order of Emergency Operation

The emergency operation must be carried out at the following locations and in the following order:

1 At the bridge, on the main control system. If not possible, proceed to next step.

2 On the waterjet unit, the nozzle and bucket positions are controlled with the directional control valves on the valve block. For more information, see *4.9.2 Operate Directional Control Valve*.
The engine RPM is controlled at the engine's local backup panel.

4.9.2 Operate Directional Control Valve

1 Make sure to use headphones or similar to communicate with the bridge.

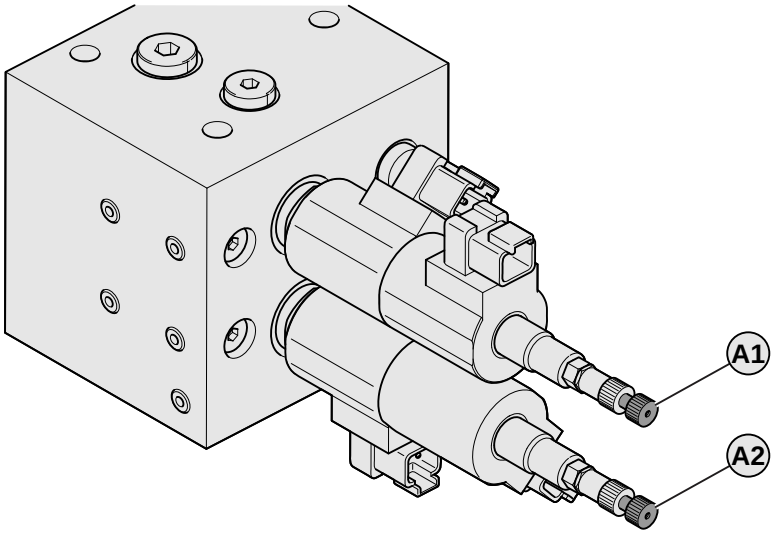


Figure 31

- Push or pull the control knob (A1) on the valve block to manoeuvre the nozzle.
  - Push: Port direction
  - Pull: Stbd direction
- Push or pull the control knob (A2) on the valve block to manoeuvre the bucket.
  - Push: Reverse direction
  - Pull: Forward direction

5 Inspections and Lubrications

5.1 Checklist

This checklist is intended to provide a general view of tasks carried out during daily, weekly and monthly inspection. This maintenance checklist can be printed and filled out for record keeping.

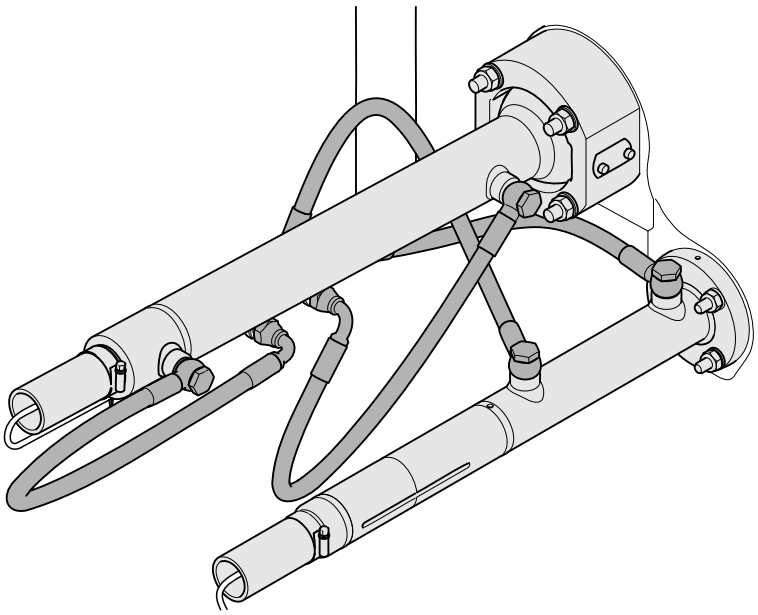
For a detailed description of the tasks, see tasks.

A complete task list and the preventive maintenance schedule is found in the service manual.

Daily inspections
Task description
5.2.1 *Hydraulic Cylinders and Hoses, Inspect*
5.2.2 *Hydraulic System, Inspect Oil Level*
5.2.3 *Hydraulic System, Inspect Oil Temperature*
5.2.4 *Hydraulic System, Inspect Working Pressure*
5.3.1 *Thrust Bearing and Shaft Seal, Inspect Leakage and Oil Level*
Monthly Cleaning
Task description
5.4.1 *Thrust Bearing, Drainage hole, Clean*

5.2 Hydraulics

5.2.1 Hydraulic Cylinders and Hoses, Inspect



GEN-2244-02

Figure 32

Task Summary

The task is to do a general inspection of the hydraulic cylinders and the hoses.

Task Interval

Do this task during:

- Preventive maintenance, during daily operation

Prerequisites

Conditions			
Main engine running.			
Number of personnel	**Skill level**	**Maintenance facility level**	**Estimated time**
2	Crew	On equipment / at sea	10 minutes
Reference document			
Hydraulic Hoses, Replace in Service Manual.			
Hydraulic Steering Cylinder, Replace in Service Manual.			
Hydraulic Reversing Cylinder, Replace in Service Manual.			

Procedure

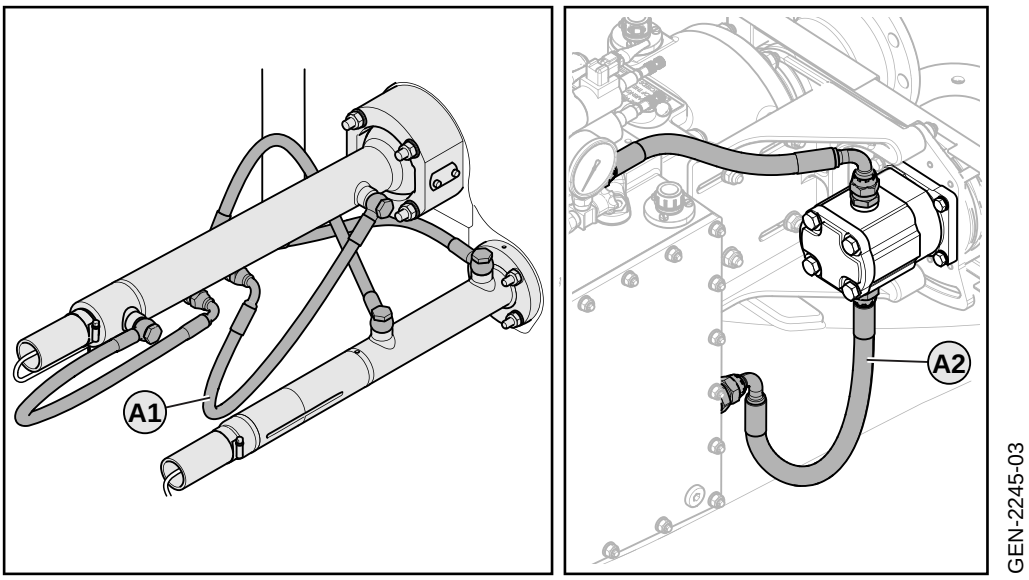


Figure 33

1 Inspect the bilge water for oil leaks from hoses and cylinders.

2 Inspect all connections for leakage. Repair any leakage immediately.

3 Inspect the hoses (A1-A2) for mechanical wear. Replace damaged hoses.

4 Operate the hydraulic system (steering and reversing) while inspecting all hoses for leakage. Replace damaged hoses. See *Hoses, Replace* in Service Manual.

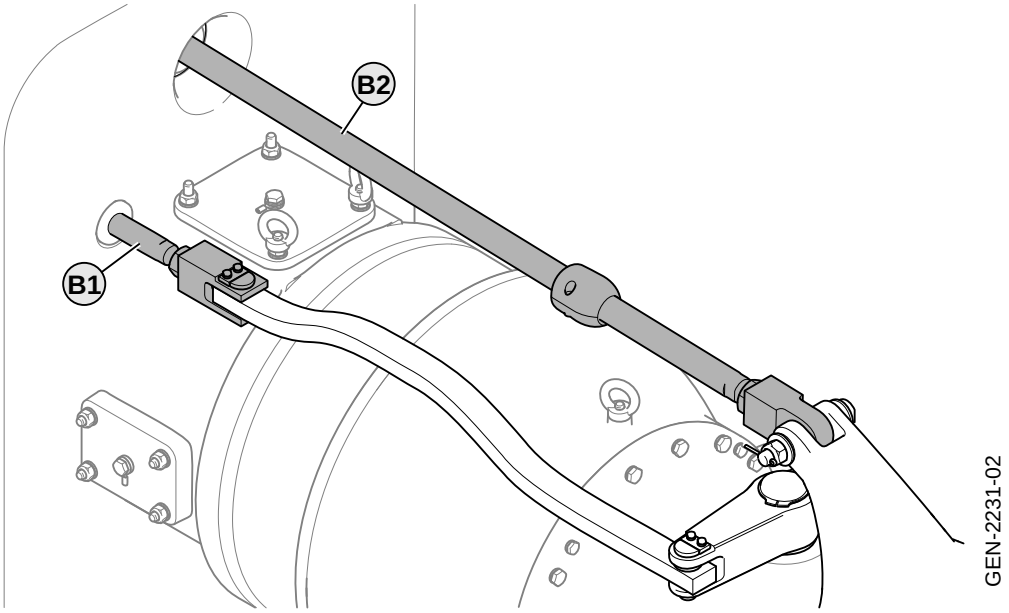


Figure 34

5 Inspect the piston rods (B1) and (B2) for leakage, visible damage and wear. Replace damaged cylinders. See *Hydraulic Steering Cylinder, Replace* and *Hydraulic Reversing Cylinder, Replace* in Service Manual.

6 Task complete.

5.2.2 Hydraulic System, Inspect Oil Level

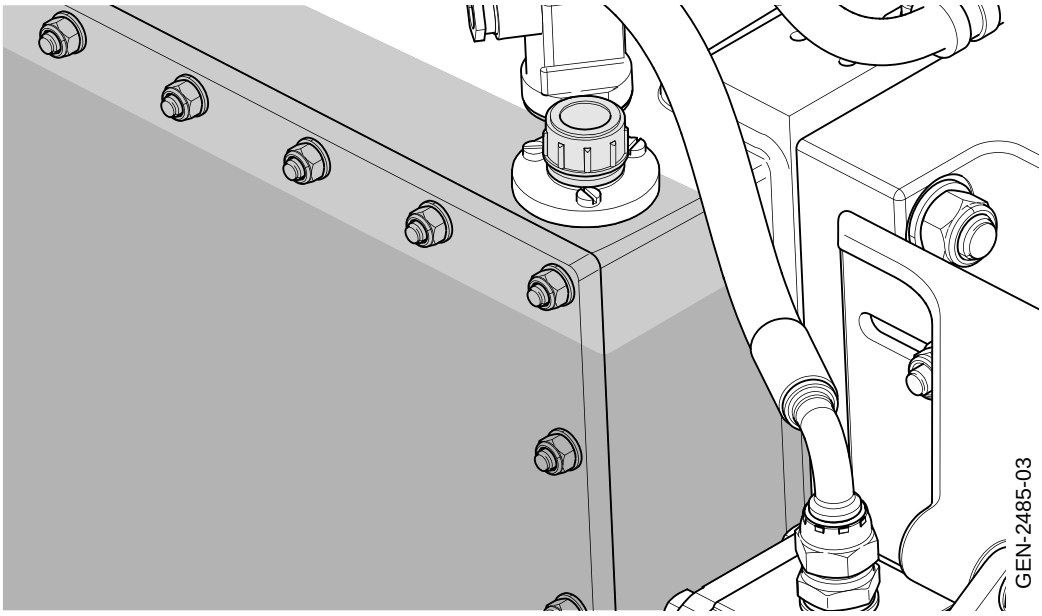


Figure 35

Task Summary

The task is to inspect the oil level on the hydraulic system (hydraulic tank).

Task Interval

Do this task during:

- Preventive maintenance, during operation daily
- Corrective maintenance

Prerequisites

Conditions			
None			
Number of personnel	**Skill level**	**Maintenance facility level**	**Estimated time**
1	Crew	On equipment / at sea	5 minutes

Procedure

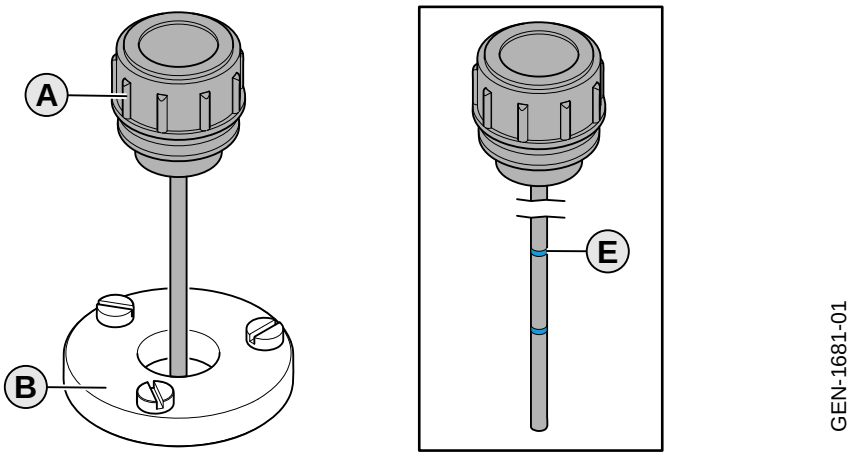


Figure 36

1 Check oil level
   1.1 Turn air filter (A) to loosen it.
   1.2 Lift air filter (A).
   1.3 Make sure that oil level is at top mark (E) on oil level stick under air filter (A). If necessary, fill oil through oil filter connection (B) to top mark (E) on oil level stick.
   1.4 Put air filter (A) in air filter connection (B) again.
   1.5 Firmly tighten air filter (A).
2 Task completed.

5.2.3 Hydraulic System, Inspect Oil Temperature

Task Summary

The task is to inspect the oil temperature on the hydraulic system (hydraulic tank).

Task Interval

Do this task during:

- During operation.

Prerequisites

Conditions			
System has reached working temperature.			
Number of personnel	**Skill level**	**Maintenance facility level**	**Estimated time**
1	Crew	On equipment / at sea	5 minutes

Procedure

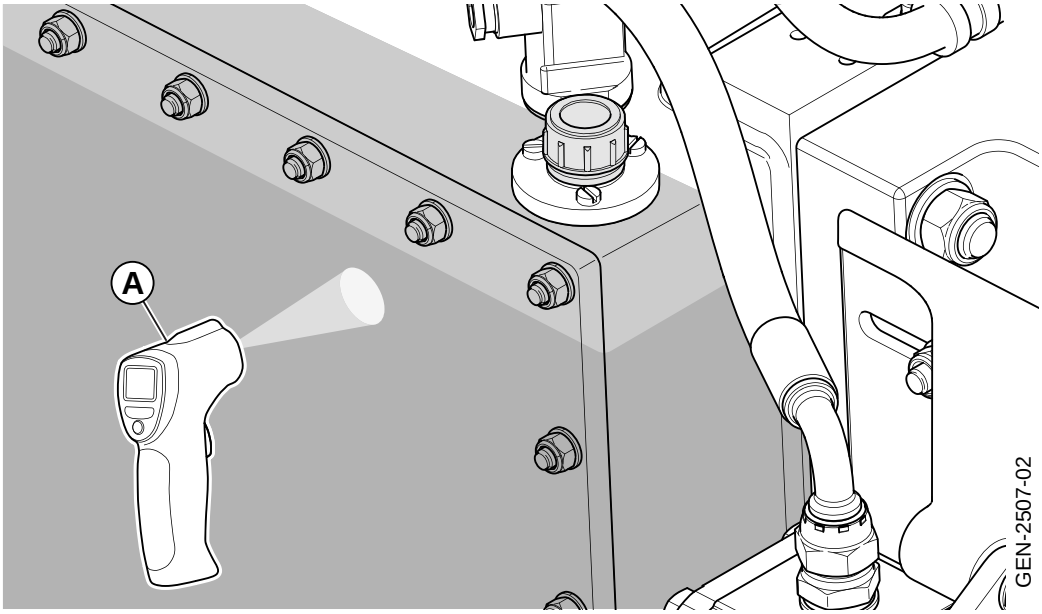


Figure 37

1 Use an IR-thermometer (A) to measure the oil temperature on the hydraulic tank, somewhere below the oil level. See *General Recommendations* in *Service Manual*.
If the oil temperature is too high (hot). See , in Troubleshooting section.

2 Task completed.

5.2.4 Hydraulic System, Inspect Working Pressure

Task Summary

The task is to inspect the hydraulic working pressure.

Task Interval

Do this task during:

- Preventive maintenance, daily.

Prerequisites

Conditions			
Main engine running.			
System has reached working temperature.			
Personnel number	**Skill level**	**Maintenance facility level**	**Estimated time**
1	Crew	On equipment / at sea	5 minutes

Procedure

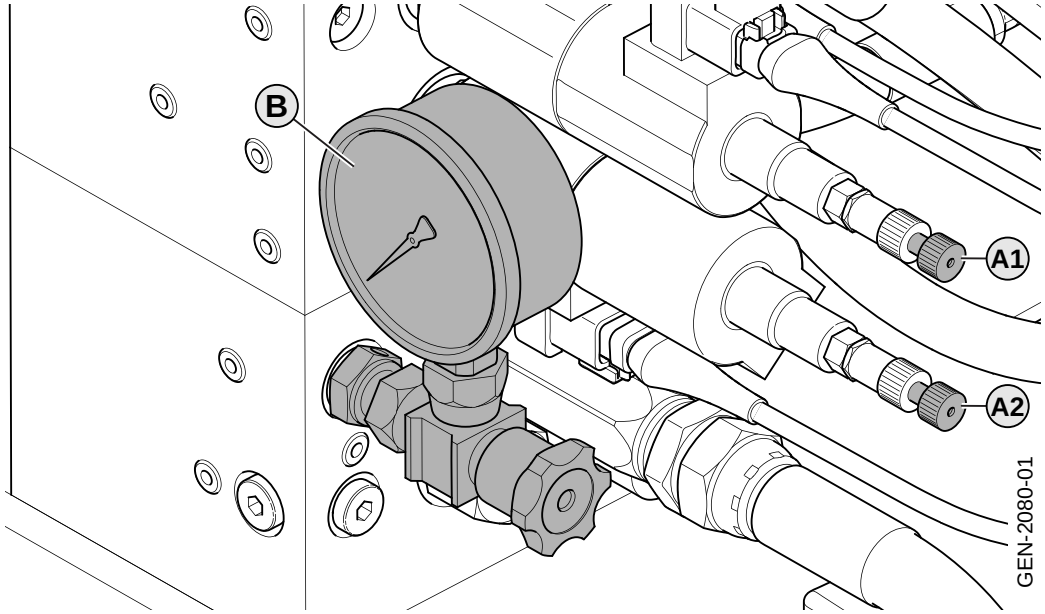


Figure 38

1 Activate one of the directional control valves (A1) or (A2) using the manual override. The hydraulic cylinder must be extended to full stroke (at end position).

2 The working pressure for the pump is indicated on the pressure gauge (B). Recommended pressure is 140 ± 5 bar. If the measured pressure deviates, see *Hydraulic Tank – Working Pressure, Adjust in Service Manual*.

3 Task completed.

5.3 Lubrication

5.3.1 Thrust Bearing and Shaft Seal, Inspect Leakage and Oil Level

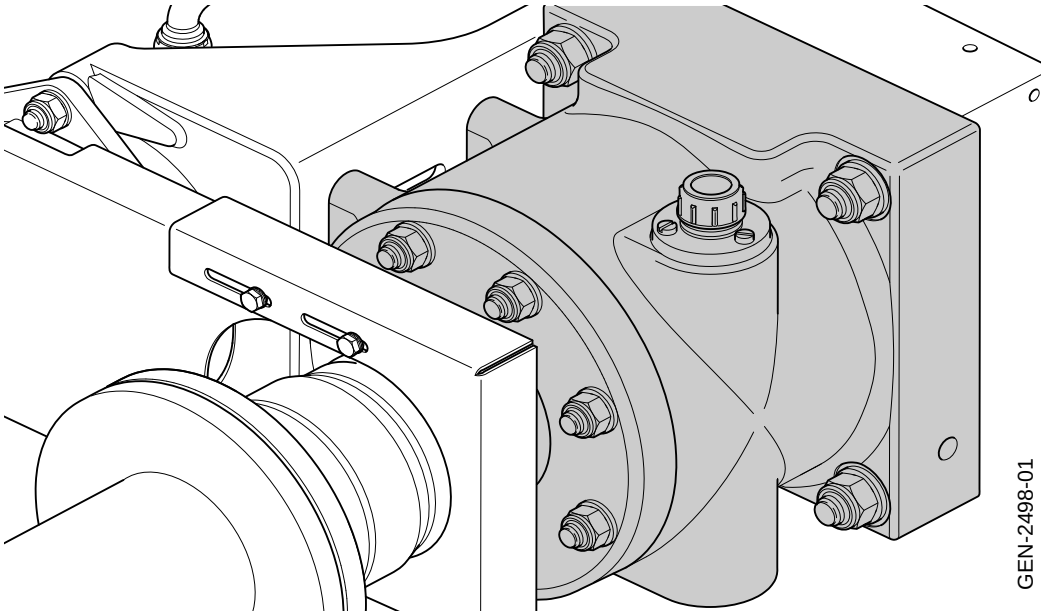


Figure 39

Task Summary

The task is to check the condition of the thrust bearing and shaft seal by inspection of leakage and oil level on the bearing housing assembly.

Task Interval

Do this task during:

- Preventive maintenance, daily
- Corrective maintenance

Prerequisites

Conditions			
None			
Personnel number	**Skill level (choose one)**	**Maintenance facility level (choose one)**	**Estimated time**
1	Crew	Dock, workshop / dry dock	10 min
Reference document			

Procedure

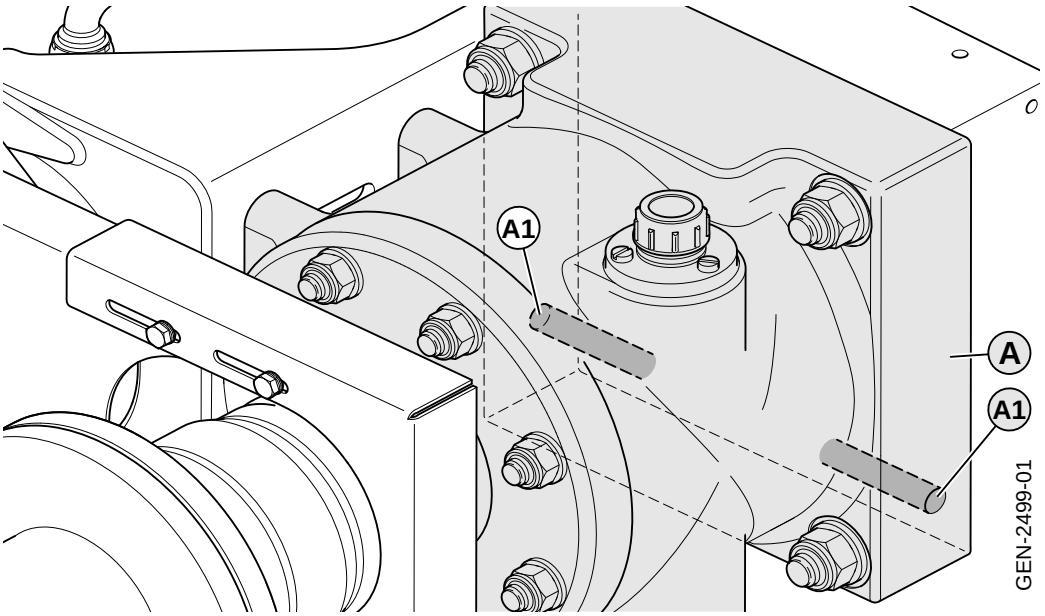


Figure 40

1 Make sure that the holes (A1) is clear and not clogged. If clogged see *5.4.1 Thrust Bearing, Drainage hole, Clean*

2 Inspect the area around the holes (A1) on the bearing housing assembly (A) for leakage.

a. If oil is leaking out of the holes (A1) on the bearing housing assembly (A) the thrust bearing or the radial seals may be damaged or worn out. Contact MJP.

b. If water is leaking out of the holes (A1) on the bearing housing assembly (A) the shaft seal may be damaged or worn out. Contact MJP.

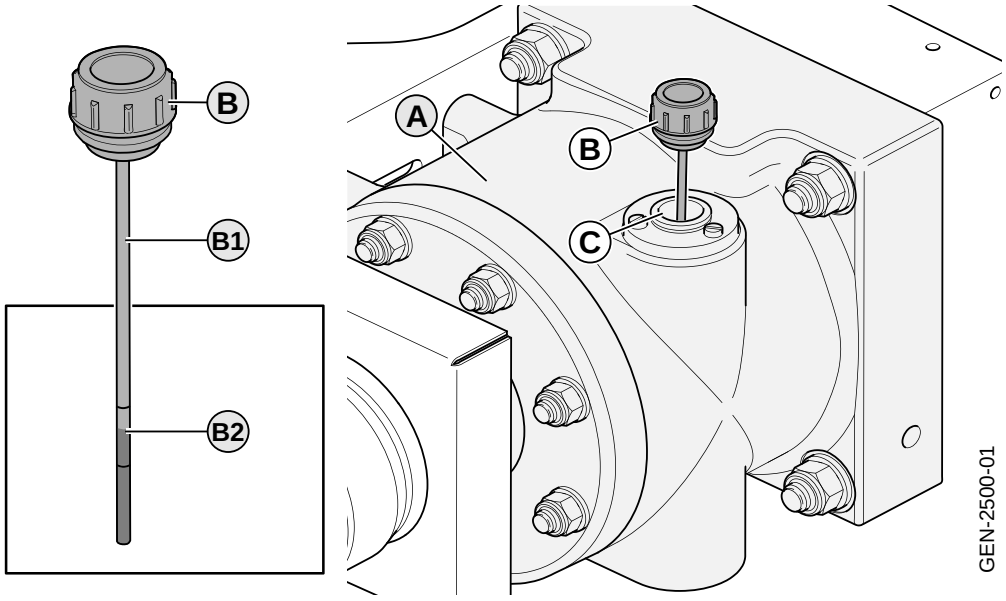


Figure 41

3 Remove the air filter (B) with the attached dipstick (B1) from the bearing housing assembly (A).

4 Inspect the oil on the dipstick (B1).

Caution!
If the oil is grey and dirty, contact MJP.

5 Wipe the dipstick (B1) clean.

6 Install the air filter (B) with the dipstick (B1) until it is fully seated.

7 Remove the air filter (B) with the dipstick (B1) again.

8 View the oil level (B2) on the dipstick (B1) to confirm that the oil level is within the safe operating range.

Note!
In V-shape hulls the actual oil level will be different with different mounting angles. This will be reflected in the dipstick markings.

9 Add oil if required. For more information, see procedure in .

10 Task completed.

5.4 Mechanics

5.4.1 Thrust Bearing, Drainage hole, Clean

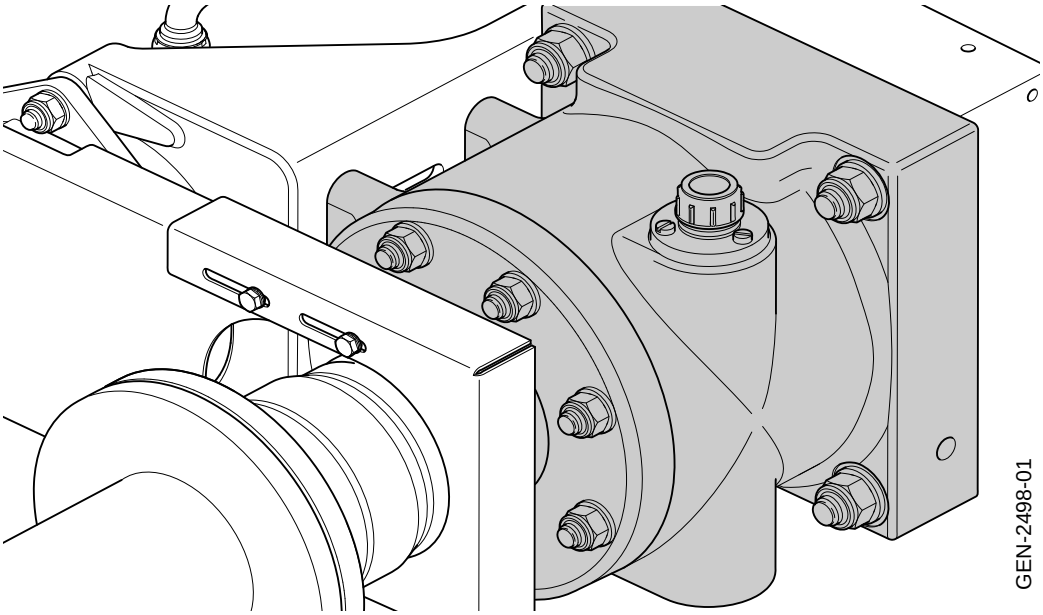


Figure 42

Task Summary

The task is to clean the drainage hole.

Task Interval

Do this task during:

- Preventive maintenance, monthly

Prerequisites

Conditions			
None			
Personnel number	**Skill level**	**Maintenance facility level**	**Estimated time**
1	Crew	Dockside	10 min

Consumables	Quantity	Part number
Bottle brush Ø10 mm	1	-

Procedure

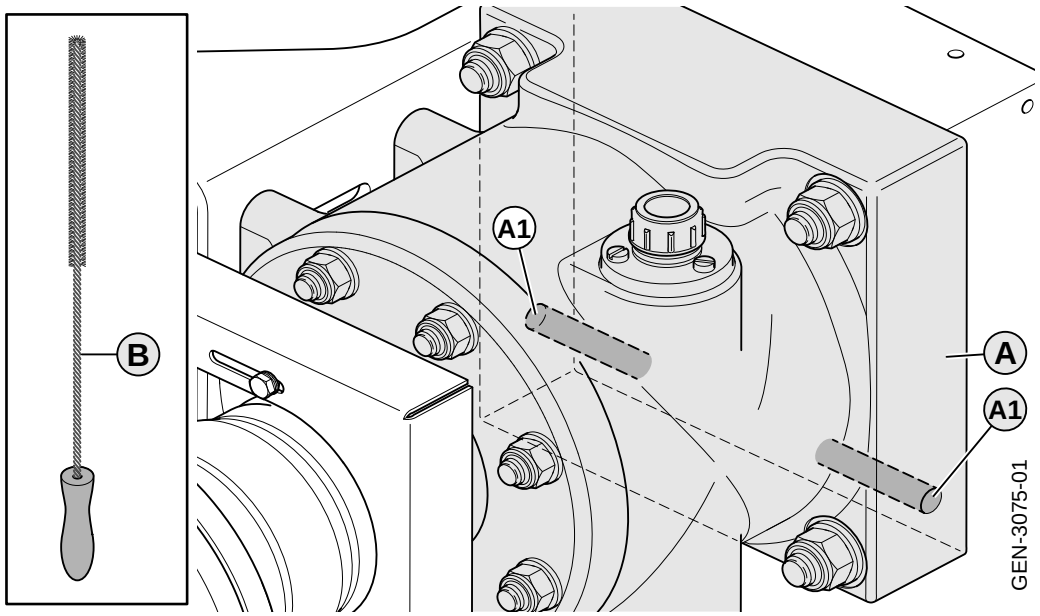


Figure 43

1 Clean the holes (A1) with a bottle brush (B) until they are clear and not clogged.

2 Task completed.

6 Fault Indication

6.1 Troubleshooting

Troubleshooting must be performed under controlled circumstances by authorised personnel. See the Service Manual for required skill level for each task.

6.1.1 How to Read

The action procedure is described in the flow chart.

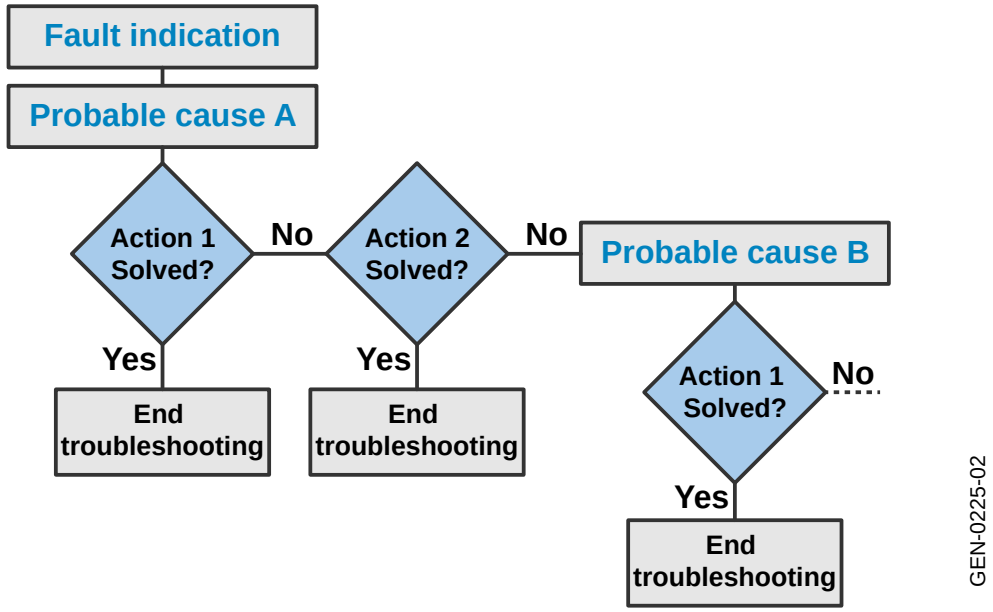


Figure 44

6.1.2 Lubrication Troubleshooting Procedure

Low Bearing Oil Level

Probable cause	Action
Bearing oil leakage inside hull.	1 Check if leakage is present under bearing housing. See 5.2.2 *Hydraulic System, Inspect Oil Level*, If level is low, fill it up and monitor oil level. 2 If bearing oil level is repeatedly low, contact MJP.

Water in Lubrication Oil

Probable cause	Action
Leaking mechanical seal, connections, pipes or hoses.	1 If working pressure is to low, water can enter the system. 2 If the working pressure is to low, adjust the pressure, see Lubrication Tank, Adjust Working Pressure in Service Manual. 3 When the pressure is adjusted, replace the oil, see Thrust Bearing, Replace Oil in Service Manual. 4 If water is still entering the Lubrication Oil - Contact MJP.

6.2 Alarms

6.2.1 Display Panel, Acknowledge Alarms

GEN-2986-01

Figure 45

Task Summary

The task is to correct alarms on display panel.

Prerequisites

Conditions			
None			
Number of personnel	**Skill level**	**Maintenance facility level**	**Estimated time**
1	Crew	On equipment / at sea	-

Procedure

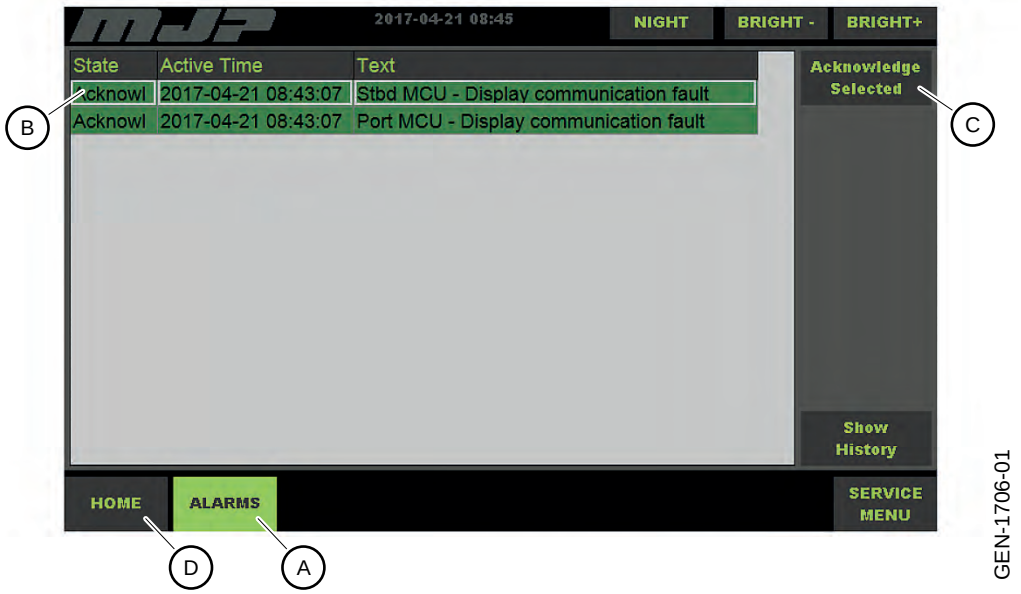


Figure 46

When a system alarm is raised, buzzer and display panels will sound. If a command panel is specified, alarm indicator will be blinking.

1 Tap ALARMS button (A) to change to alarm list.

2 Select active alarm (B) and tap ACKNOWLEDGE SELECTED button (C) to let system know that you have seen alarm.

> **Note!**
> If you tap ACKNOWLEDGE SELECTED button (C) without any alarm selected, buzzer will be silenced. All alarms in list will still be unacknowledged. If a new alarm is raised, alarm buzzer will start sounding again.

3 Identify alarm in software alarms list and follow “Operator Action” instruction details.

> **Note!**
> If an alarm is still active in system, ALARMS button (A) will indicate this by a steady red light.

4 Tap HOME button (D) to change screen to home screen.

5 Task completed.

6.2.2 Alarm List

The action procedure is described in flow chart.

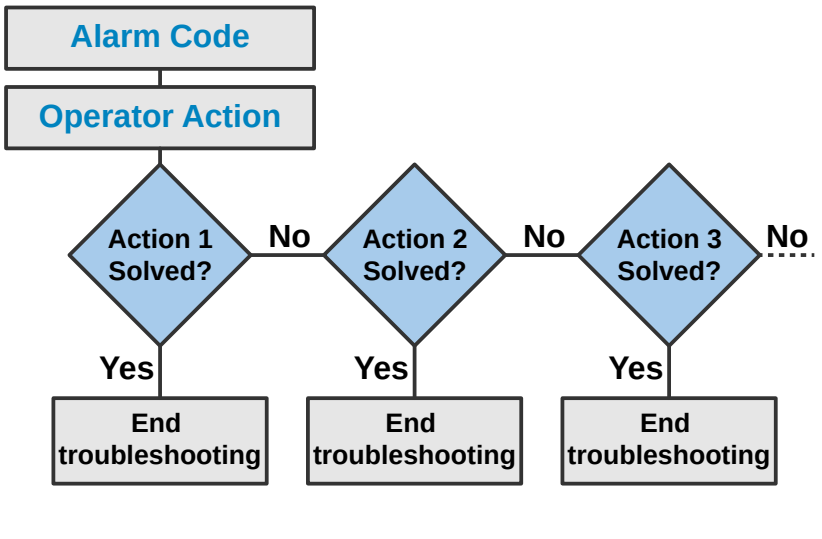


Figure 47

Severity Level

1	Critical alarm, stop the vessel and resolve.*
2	Minor alarm, resolve as soon as possible.*
3	Warning, smaller issue.*
* If not resolved it can escalate to other Warnings, Minor or Critical Alarms.	

Display Alarms

Alarm Code Port	Alarm Code Stbd	Alarm Description	Severity Level	Operator Action
Port Control System Fail to safe	Stbd Control System Fail to safe	The system has entered fail to safe mode.	1	1 Return all controls to neutral position, refer to alarm list for faults which need to be fixed. 2 Do a check of connected cable and connectors. 3 Return to harbour.
Port Controls not calibra-ted	Stbd Controls not calibra-ted	A control head has been detected which is not calibrated.	2	1 Return to harbour.
Port Steering pots out of sync	Stbd Steering pots out of sync	A mismatch has occurred between steering control head sensors.	3	1 Do a check of connected cable and connectors. 2 Return to harbour.

Display Alarms (cont'd.)

Alarm Code Port	Alarm Code Stbd	Alarm Description	Severity Level	Operator Action
Port Steering pots out of span	Stbd Steering pots out of span	A steering control head sensor has a fault.	1	1 Do a check of connected cable and connectors. 2 Return to harbour.
Port Thrust lever out of span	Stbd Thrust lever out of span	A thrust controller sensor has a fault.	1	1 Do a check of connected cable and connectors. 2 Return to harbour.
Port VCS out of span	Stbd VCS out of span	A VCS control sensor has a fault.	2	1 The VCS function must not be used. 2 Do a check of connected cable and connectors.
Port engine lost while clutched	Stbd engine lost while clutched	Engine Running signal for specified engine has been lost whilst clutched in.	2	1 Make sure that engine is running. 2 Do a check of connected cable and connectors. 3 Return to harbour.
Port RPM knob A out of span	Stbd RPM knob A out of span	A separate RPM dial has a fault.	2	1 Do a check of connected cable and connectors.
Port RPM knob B out of span	Stbd RPM knob B out of span	A separate RPM dial has a fault.	2	1 Do a check of connected cable and connectors.
Port Station out of sync	Stbd Station out of sync	Active station has been forced back to Main station because active station differed between MCU's.	2	-
Port MCU - Stbd MCU commu-nication fault	Stbd MCU - Port MCU commu-nication fault	A communication fault has occurred between MCU's.	1	1 Examine cross link cable.Note: Separate mode only is available on main controls. 2 Return to harbour.
Port MCU - Display commu-nication fault	Stbd MCU - Display commu-nication fault	A communication fault has occurred between display and MCU.	2	Do a check of Ethernet connections.
Port BCU - Port MCU commu-nication fault	Stbd BCU - Stbd MCU	A communication fault has occurred between display and MCU.	1	Do a check of Ethernet connections.

Display Alarms (cont'd.)

Alarm Code Port	Alarm Code Stbd	Alarm Description	Severity Level	Operator Action
	commu-nication fault			
Port Backup fault	Stbd Backup fault	The MCU does not receive Backup OK signal.	2	1 Do a check of power supply to Backup unit. 2 Do a check of connected cable and connectors. 3 Return to harbour.
Port clutch feedback fault	Stbd clutch feedback fault	Confirm that clutch is operational.	1	1 Do a check of connected cable and connectors. 2 Return to harbour.
Port hydraulic oil level	Stbd hydraulic oil level	Hydraulic oil is outside expected level.	1	1 Make sure oil level in level glass on tank is OK: 2 Do a check of connected cables and connectors.
Port hydraulic oil tempera-ture	Stbd hydraulic oil tempera-ture	Hydraulic oil is above expected temperature.	1	1 Check oil temperature on tank. If it is OK: 2 Do a check of connected cables and connectors.
Port hydraulic oil pressure	Stbd hydraulic oil pressure	Hydraulic oil is below expected pressure.	1	1 Make sure oil pressure on tank is OK: 2 Do a check of connected cables and connectors.
Port analogue sensor fault	Stbd analogue sensor fault	A fault has occurred with analogue sensors on tank.	2	1 Do a check of connected cable and connectors.
Port waterjet bucket not at setpoint	Stbd waterjet bucket not at setpoint	The reversing bucket is not in its expected position.	2	1 Do a check of connected cable and connectors. 2 Return to harbour.
Port waterjet bucket out of span	Stbd waterjet bucket out of span	The reversing bucket feedback sensor is not operational.	1	1 Do a check of connected cable and connectors. 2 Return to harbour.
Port waterjet nozzle not at setpoint	Stbd waterjet nozzle not at setpoint	The steering nozzle is not in its expected position.	2	1 Do a check of connected cable and connectors. 2 Return to harbour.
Port waterjet nozzle	Stbd waterjet nozzle	The steering nozzle feedback sensor is not operational.	1	1 Do a check of connected cable and connectors. 2 Return to harbour.

Display Alarms (cont'd.)

Alarm Code Port	Alarm Code Stbd	Alarm Description	Severity Level	Operator Action
out of span	out of span			
Port Configu-ration file fault	Stbd Configu-ration file fault	Unable to load configuration.	1	1 Contact authorized MJP support. 2 Return to harbour.
Port feedback fault	Stbd feedback fault	A feedback sensor of nozzle or bucket is not operational.	1	1 Do a check of connected cable and connectors. 2 Return to harbour.
Display - Port MCU commu-nication fault	Display - Stbd MCU commu-nication fault	The display has lost its connection to MCU.	2	1 Do a check of connected cable and connectors. 2 Return to harbour.

Ship Monitoring System Alarms

Location	Alarms	Alarm Description	Severity Level	Operator Action
All MCU and Backup Units	Primary Power Fault	A fault has occurred with primary supply to unit.	2	1 Make sure that power supply is present. If multiple units are affected it is most likely an external problem. 2 If a single unit is affected, make sure that both positive and negative fuses are OK and that power supply unit has a green light.
All MCU and Backup Units	Secon-dary Power Fault	A fault has occurred with secondary supply to unit.	2	1 Make sure that power supply is present. If multiple units are affected it is most likely an external problem. 2 If a single unit is affected, make sure that both positive and negative fuses are OK and that power supply unit has a green light.
All MCU and Backup Units	System OK	Confirm primary or secondary power is present at unit.	1	Make sure that PLC is set to run load and 'RUN' status light on PLC is green.

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