MTU_Value*Service*
Technical Documentation

System Documentation
BlueLine
with Multi-Function Display DIS 14
for Series 4000 FPP
MDEC

Application. Marine

Functional Description
Operating Instructions
Workshop Manual
Installation and Commissioning Instructions
E532776/01E

This handbook is provided for use by maintenance and operating personnel in order to avoid malfunctions or damage during operation.
Subject to alterations and amendments.

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General Conditions

1 Safety

1.1 General conditions

General

In addition to the instructions in this publication, the applicable country-specific legislation and other compulsory regulations regarding accident prevention must be observed. This engine is a state-of-the art product and conforms with all applicable specifications and regulations. Nevertheless, persons and property may be at risk in the event of:

- Incorrect use
- Operation, maintenance and repair by unqualified personnel
- Modifications or conversions
- Non-compliance with the Safety Instructions

Correct use

The engine is intended exclusively for the application specified in the contract or defined at the time of delivery. Any other use is considered improper use. The manufacturer will accept no liability for any resultant damage. The responsibility is borne by the user alone.

Correct use also includes observation of and compliance with the maintenance specifications.

Modifications or Conversions

Modifications made by the customer to the engine may affect safety.

MTU will accept no liability or warranty claims for any damage caused by unauthorized modifications or conversions.

Spare parts

Only genuine MTU spare parts must be used to replace components or assemblies. In the event of any damage caused by the use of other spare parts, no liability nor warranty claims vis-à-vis the engine manufacturer will be accepted.

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1.2 Personnel and organizational requirements

Personnel

Work on the engine must only be carried out by properly qualified and instructed personnel.

The specified legal minimum age must be observed.

Responsibilities of the operating, maintenance and repair personnel must be specified.

Organization

This publication must be issued to all personnel involved in operation, maintenance, repair or transportation.

It must be kept at hand near the engine and accessible at any time to all personnel involved in operation, maintenance, repair or transportation.

The personnel must be instructed on engine operation and repair by means of this publication, and in particular the safety instructions must be explained.

This is especially important for personnel who work on the engine only on an occasional basis. Such personnel must be given instructions repeatedly.

Working clothes and protective equipment

Wear proper work clothing for all work.

Depending on the kind of work, use additional protective equipment, e.g. protective goggles, gloves, helmet, apron.

Work clothing must be tight fitting so that it does not catch on rotating or projecting components.

Do not wear jewelry (e.g. rings, chains etc.).

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1.3 Safety requirements when working on the engine

Safety precautions when putting the equipment into operation

Prior to initial operation, the product must have been installed correctly and approved according to MTU specifications.

Before putting the device or the system into operation, always ensure
- that all maintenance and repair work is completed
- that all loose components have been removed from rotating parts
- that nobody is standing in the danger zone of moving engine components.

Immediately after putting the device or system into operation, make sure that all control and display instruments as well as the signaling and alarm systems work properly.

Safety requirements for operators

Procedures for cases of emergency must be practiced regularly.

The operator must be familiar with the controls and displays.

The operator must know the consequences of each operation to be carried out.

The operator must carry out the individual operations according to the documentation.

During operation, the displays and monitoring units must be permanently observed with regard to present operating status, violation of limit values and warning or alarm messages.

The following steps must be taken if a malfunction of the system is recognized or reported by the system:
- notify the supervisory personnel in charge
- analyze the message
- if required, carry out emergency operations e.g. emergency engine stop.

Engine operation

When the engine is running, always wear ear protectors.

Ensure that the engine room is well ventilated.

Mop up any leaked or spilt fluids and lubricants immediately or soak up with a suitable bonding agent.

Exhaust gases from combustion engines are poisonous. Inhalation of poisonous exhaust gases is a health hazard. The exhaust pipework must be free of leaks and discharge the gases to atmosphere.

During engine operation, do not touch battery terminals, generator terminals or cables.

Inadequate protection of electrical components can lead to electric shocks and serious injuries.

When the engine is running, never release coolant, oil, fuel, compressed-air or hydraulic lines.

Maintenance and repair

Strict adherence to the maintenance and repair schedule is an essential safety factor.

Never carry out maintenance and repair work with the engine running unless expressly instructed to do so. Lock-out/tag-out the engine to preclude undesired starting. Disconnect the battery when electrical starters are fitted. Close the main valve on the compressed-air system and vent the compressed-air line when air starters are fitted. Post the "Do Not Start" sign in the operating room or affix it to the controlling device! Persons not involved must keep clear.

Never attempt to rectify faults or carry out repairs if you do not have the necessary experience or special tools required. Have maintenance and repair work carried out by qualified and authorized personnel only.

Use only proper, calibrated tools.

Do not work on engines or components which are only held by lifting equipment or crane. Always support by suitable means which conform with the applicable regulations before commencing maintenance or repair work.

Before barring the engine, make sure that nobody is standing in the danger zone. After completing work on the engine, check that all protective devices/safety guards have been installed and that all tools and loose parts have been removed from the engine.

Fluids emerging under high pressure can penetrate clothing and skin and may cause serious injury. Before starting work, relieve pressure in systems and compressed-air lines which are to be opened.

Never put lines to any use other than that for which they are intended. Never use lines for climbing.

Never bend a fuel line and do not install bent lines. Keep fuel injection lines and connections clean. Always seal connections with caps or covers if a line is removed or opened.

Take care not to damage fuel lines during maintenance and repair work. To tighten the connections when installing the lines, use the correct tightening torque and ensure that all retainers and dampers are installed correctly.

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Ensure that all fuel injection lines and pressurized oil lines have sufficient distance to other components to avoid contact with them. Do not place fuel or oil lines near hot components, except when necessary for design reasons during installation.

Elastomers (e.g. "Viton" sealing rings) are stable under normal operating conditions. The material decomposes when exposed to fire or temperatures exceeding 300 °C. Hydrogen fluoride vapors are released in this case. The resulting acid leads to serious burning if it contacts the skin. Do not touch elastomeric seals if they have carbonized or resinous appearance. Wear protective gloves!

Take care with hot fluids in lines, pipes and chambers ⇒ Risk of burning!

Note cooling period for components which are heated for installation or removal ⇒ Risk of burning!

Never touch hot parts of the compressor and exhaust system ⇒ Risk of burning!

Take special care when removing ventilation or plugs from engine. In order to avoid discharge of highly pressurized liquids, hold a cloth over the screw or plug. It is even more dangerous if the engine has recently been shut down, as the liquids can still be hot.

Take special care when draining hot fluids. ⇒ Risk of burning!

When draining, collect fluids in a suitable container, mop up any spilt fluids or wipe or soak them with a suitable binding agent.

When changing the engine oil or working on the fuel system, ensure that the engine room is adequately ventilated.

When working high on the engine, always use suitable ladders and work platforms. Make sure components are placed on stable surfaces.

In order to prevent back injuries when lifting heavy components adults, depending on age and sex, should only lift weights between max. 10 kg and 30 kg, therefore:
- Use lifting gear or seek assistance.
- Ensure that all chains, hooks, slings, etc. are tested and authorized, are sufficiently strong and that hooks are correctly positioned. Lifting eyes must not be unevenly loaded.

Observe special cleanness when conducting maintenance and repair work on the engine plant. After completion of maintenance and repair work, make sure that no loose objects are in/on the engine plant.

Welding work

Never carry out welding work on the engine or engine-mounted units. Cover the engine when welding in its vicinity!

Never use the engine as a ground connection. This prevents the welding current passing through the engine resulting in burnt/scorched bearings, sliding surfaces and tooth flanks which may lead to bearing seizure and/or other material damage.

Never route the welding lead over or near the wiring harnesses of MTU systems. The welding current may otherwise induce an interference voltage in the wiring harnesses which could conceivably damage the electrical system.

The welding unit ground connection must not be more than 60 cm from the weld point.

If components (e.g. exhaust manifold) are to be welded, they must be removed from the engine.

It is not necessary to remove the connector and the connections when carrying out welding operation on MTU electronics if the master switch for power supply is switched from "ON" to "OFF" and the wire is disconnected from the negative and positive poles on the battery.

Hydraulic installation and removal

Only the hydraulic installation and removal equipment specified in the work schedule and in the assembly instructions must be used.

The max. permissible push-on pressure specified for the equipment must not be exceeded.

The H.P. lines for hydraulic installation and removal are tested with 3800 bar.

Do not attempt to bend or apply force to lines.

Before starting work, pay attention to the following:
- Vent the hydraulic installation/removal tool, the pumps and the lines at the relevant points for the system to be used (e.g. open vent plugs, pump until bubble-free air emerges, close vent plugs).
- For hydraulic installation, screw on the tool with the piston retracted.
- For hydraulic removal, screw on the tool with the piston extended.

For a hydraulic installation/removal tool with central expansion pressure supply, screw spindle into shaft end until correct sealing is achieved.

During hydraulic installation and removal, ensure that nobody is standing in the immediate vicinity of the component to be installed/removed. As long as the system is under pressure, there is the risk that the component to be installed/removed may be suddenly released from the pressure connection.

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Before use, the tools must be checked at regular intervals (crack test).

Working on electrical/electronic assemblies

Always obtain the permission of the person in charge before commencing maintenance and repair work or switching off any part of the electronic system required to do so.

De-energize the appropriate areas prior to working on assemblies. Any measures requiring a power supply are expressly defined as such at the appropriate place in the manual.

Gases released from the battery are explosive. Avoid sparks and naked flames. Do not allow battery acids to come in contact with skin or clothing. Wear protective goggles. Do not place tools on the battery. Before connecting the cable to the battery, check battery polarity. Battery pole reversal may lead to injury through the sudden discharge of acid or bursting of the battery body.

Do not damage wiring during removal work and when reinstalling wiring and ensure that during operation it is not damaged by contact with sharp objects, by rubbing against other components or by a hot surface.

Do not secure wiring to fluid-carrying lines.

On completion of the maintenance and repair work, any cables which have become loose must be correctly connected and secured.

On completion of all repair work, the component and system must be subjected to a function check. Separate testing of the repaired component without system integration is insufficient.

If wires are installed beside mechanical components and there is a risk of chafing, use cable clamps to properly support the wires.

For this purpose, no cable binders must be used as, during maintenance and / or repair work, the binders can be removed but not installed a second time.

Spare parts shall be properly stored prior to replacement, i.e. particularly protected against moisture. Defective electronic components and assemblies must be suitably packed when dispatched for repair, i.e. particularly protected against moisture and impact and wrapped in antistatic foil if necessary.

Working with laser equipment

When working with laser equipment, always wear special laser-protection goggles.

Laser equipment can generate extremely intensive, concentrated radiation by the effect of stimulated emission in the range of visible light or in the infrared or ultraviolet spectral range. The photochemical, thermal and optomechanical effects of the laser can cause damage. The main danger is irreparable damage to the eyes.

Laser equipment must be fitted with the protective devices necessary for safe operation according to type and application.

For conducting light-beam procedures and measurement work, only the following laser devices must be used:

- Laser devices of classes 1, 2 or 3A,
- Laser devices of class 3B, which have maximum output in the visible wavelength range (400 to 700 nm), a maximum output of 5 mW, and in which the beam axis and surface are designed to prevent any risk to the eyes.

Operation of electrical equipment

When operating electrical equipment, certain components of this equipment are live.

Noncompliance with the warning instructions given for this equipment may result in serious injury or damage to property.

1.4 Auxiliary materials, fire prevention and environmental protection

Fire prevention

Rectify any fuel or oil leaks immediately; even splashes of oil or fuel on hot components can cause fires - therefore always keep the engine in a clean condition. Do not leave cloths soaked with fluids and lubricants lying around on the engine. Do not store combustible fluids near the engine.

Do not weld pipes and components carrying oil or fuel. Before welding, clean with a non-combustible fluid.

When starting the engine with a foreign power source, connect the ground lead last and remove it first. To avoid sparks in the vicinity of the battery, connect the ground lead from the foreign power source to the ground lead of the engine or to the ground terminal of the starter.

Always keep suitable fire-fighting equipment (fire extinguishers) at hand and familiarize yourself with their use.

Noise

Noise can lead to an increased risk of accident if acoustic signals, warning shouts or noises indicating danger are drowned.

At all workplaces with a sound pressure level over 85 dB(A), always wear ear protectors (protective wadding, plugs or capsules).

Environmental protection

Dispose of used fluids, lubricants and filters in accordance with local regulations.

Manipulation of the injection control system can influence the engine performance and exhaust emissions. As a result, compliance with environmental regulations may no longer be guaranteed.

Only fuels of the specified quality required to achieve emission limits must be used.

In Germany, the VAwS (=regulations governing the use of plants that may affect water quality) is applicable, which means work must only be carried out by authorized specialist companies (MTU is an authorized specialist company).

Auxiliary materials

Use only fluids and lubricants that have been tested and approved by MTU.

Fluids and lubricants must be kept in suitable, properly designated containers. When using fluids, lubricants and other chemical substances, follow the safety instructions applicable to the product. Take care when handling hot, chilled or caustic materials. When using inflammable materials, avoid sparks and do not smoke.

Lead

- When working with lead or lead-containing pastes, avoid direct contact with the skin and do not inhale lead vapors.
- Adopt suitable measures to avoid the formation of lead dust!
- Switch on fume extraction system.
- After coming into contact with lead or lead-containing materials, wash hands!

Acids and alkaline solutions

- When working with acids and alkalis, wear protective goggles or face mask, gloves and protective clothing.
- Immediately remove clothing wetted by acids and alkalis!
- Rinse injuries with plenty of water!
- Rinse eyes immediately with eyedrops or clean tap water.

Painting

- When painting in other than spray booths equipped with extractors, ensure good ventilation. Make sure that adjacent work areas are not affected.
- No naked flames!
- No smoking.
- Observe fire prevention regulations!
- It is absolutely necessary to wear masks providing protection against paint and solvent fumes.

Liquid nitrogen

- Store liquid nitrogen only in small quantities and always in regulation containers without fixed covers.
- Do not bring liquid nitrogen in contact with the body (eyes, hands), as this causes frostbite and numbing.
- Wear protective clothing, gloves, closed shoes and protective goggles!

- Ensure the room is well ventilated. 88% contamination of breathing air with nitrogen will result in suffocation.
- Avoid all knocks and jars to the containers, fixtures or workpieces.

Compressed air

Compressed air is air compressed at excess pressure and is stored in tanks from which it can be extracted.

The pressure at which the air is kept can be read off at pressure gauges which must be connected to the compressed air tanks and the compressed air lines.

When working with compressed air, safety precautions must be constantly observed:

- Pay special attention to the pressure level in the compressed air network and pressure vessel!
- Connecting devices and equipment must either be designed for this pressure or, if the permitted pressure for the connecting elements is lower than the pressure required, a pressure reducing valve and safety valve (set to permitted pressure) must form an intermediate connection. Hose coupling and connections must be securely attached!
- Always wear protective goggles when blowing off tools or extracting chips!
- The snout of the air nozzle is provided with a protective disc (e.g. rubber disc), which prevents air-borne particles being reflected and thereby prevents injury to eyes.
- First shut off compressed air lines before compressed air equipment is disconnected from the supply line or before equipment or tool is to be replaced!
- Unauthorized use of compressed air, e.g. forcing flammable liquids (danger class AI, AII and B) out of containers, results in a risk of explosion!
- Forcing compressed air into thin-walled containers (e.g. containers made of tin, plastic and glass) for drying purposes or to check for leaks, results in a risk of bursting!
- Do not blow dirty clothing with compressed air when being worn on the body.

Used oil

Used oil may contain health-threatening combustion residues.

Rub barrier cream into hands!

Wash hands after contact with used oil.

TIM ID: 0000000550 – 003

1.5 Standards for warning notices in the publication

DANGER	In the event of immediate danger. **Consequences: Death or serious injury.** • Preventive measures
WARNING	In the event of possibly dangerous situations. **Consequences: Death or serious injury.** • Preventive measures
CAUTION	In the event of dangerous situations. **Consequences: Slight injury or material damage.** • Preventive measures

Note: This publication contains especially emphasized safety instructions in accordance with the American standard ANSI Z535, which begin with one of the above signal words according to the degree of danger:

Warning notices

1. Read and become acquainted with all cautions and symbols before operating or repairing this product.
2. Pass on all safety instructions to your operating, maintenance, repair and transport personnel!

TIM ID: 0000008386 – 001

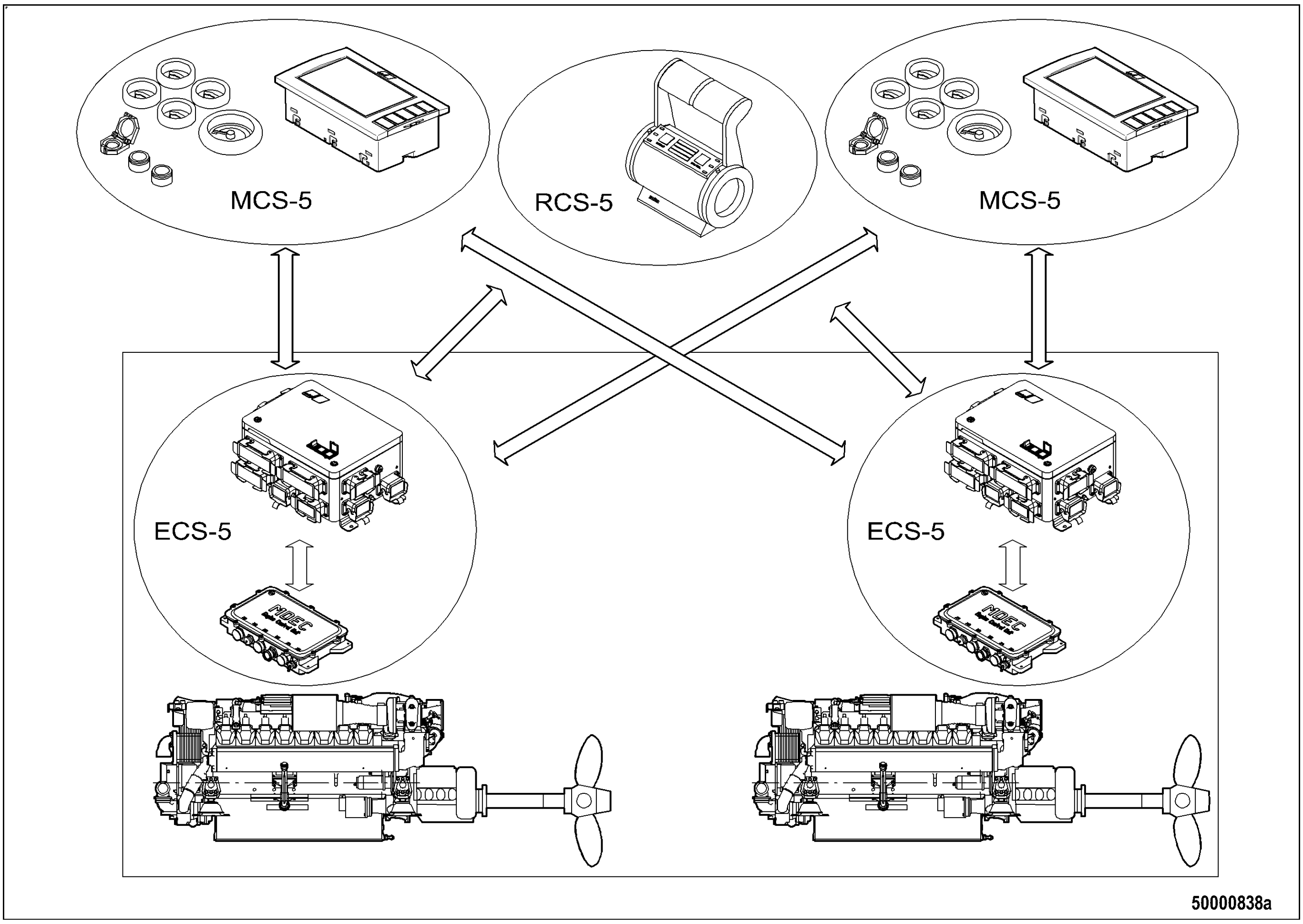
Functional Description

2 Product Summary

2.1 BlueLine system – Overview

Overview and subsystems

Version 1: One display per power train



The BlueLine system is used to operate, control and monitor a marine propulsion plant at up to four control stands. It may be used in fixed pitch propeller plants with between one and four shafts and is available in a number of different versions (e.g. with indicator lamps for single-point alarms, with display).

The BlueLine system comprises three subsystems the interaction of which is represented schematically in the figure.

Engine Control System ECS-5

- Sensors and actuators on and around the engine
- Devices for direct control of engine and gearbox
- The same hardware equipment for each power train
- All devices in the engine room or in its vicinity
- Not accessible to the operator under normal operating conditions

Remote Control System RCS-5

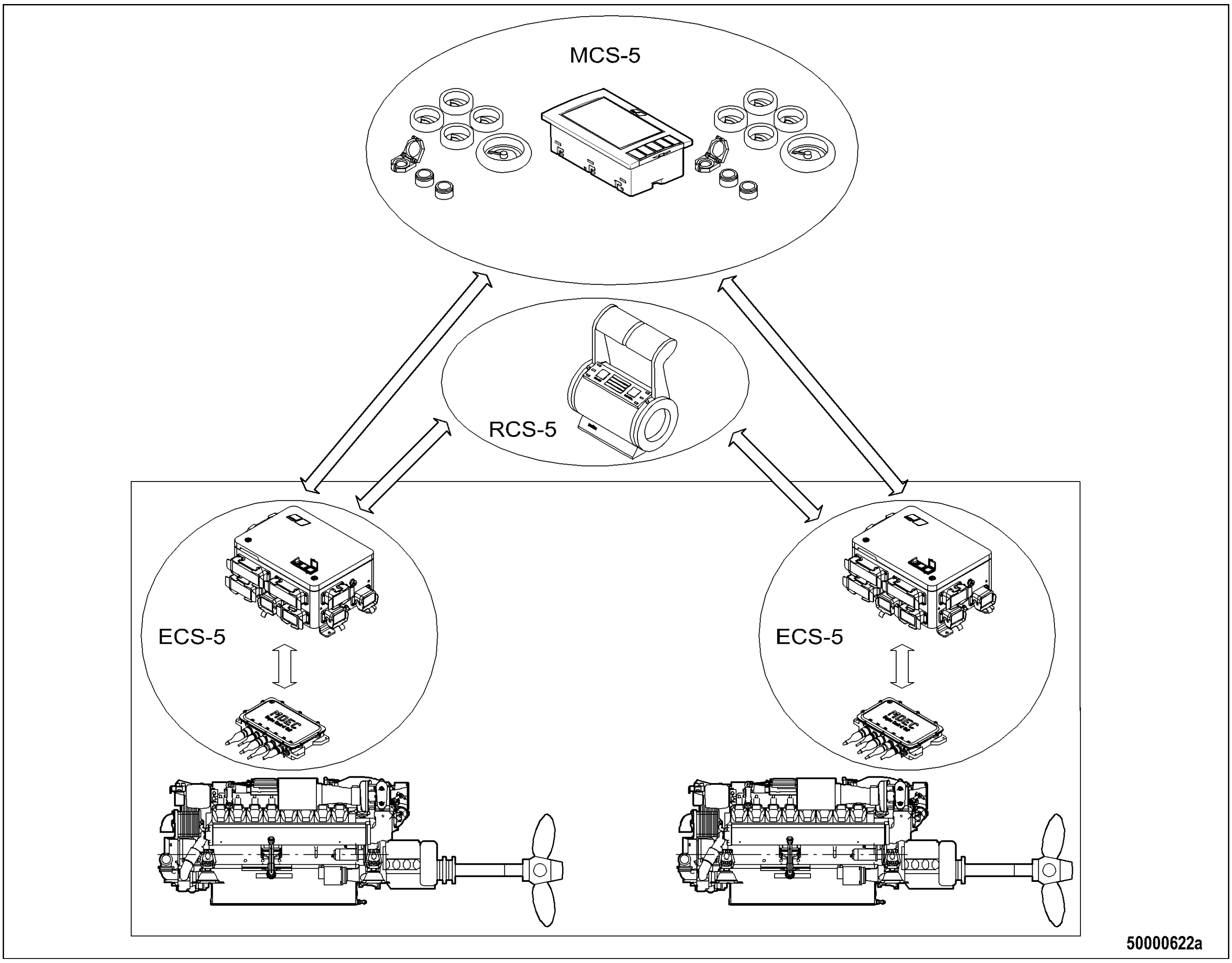
- Remote control of engine speed and gearbox state
- Command unit with propulsion control levers for control
- One command unit for two power trains respectively on each control stand

TIM ID: 0000006113 – 009

Monitoring and Control System MCS-5

- Remote monitoring of the propulsion plant
- Various controls and indicators on each control stand
- The same hardware equipment for each power train

Version 2: One display for two power trains



Engine Control System ECS-5

- Sensors and actuators on and around the engine
- Devices for direct control of engine and gearbox
- The same hardware equipment for each power train
- All devices in the engine room or in its vicinity
- Not accessible to the operator under normal operating conditions

Monitoring and Control System MCS-5

- Remote monitoring of the propulsion plant
- Various controls and indicators on each control stand
- One display per control stand for two power trains

Remote Control System

- Open-loop control of Waterjet propulsion by means of controls supplied by the shipyard or customer
- Display features by means of controls supplied by the shipyard or customer
- Speed and clutch setpoint to engine management system ECS-5 (Engine Control System)

TIM ID: 0000006113 – 009

Features

Structure and function

- Electronic engine control and monitoring to optimize consumption and performance
- Consideration of individual engine characteristics
- Digital data transmission
- Compact LSI devices
- Symmetrical port/starboard arrangement
- Graphic representation on optional color display
- Plain-text fault messages on optional display, language switching possible

Safety

- Integrated alarm system
- Integrated self-test features
- Redundant data bus
- Additional parallel wiring of safety-relevant signals

Operation

- Straightforward operation
- Optional user interface display for Local mode at the Local Operating Panel
- Shaft interlink features (Single Control Lever mode)

Installation

- Straightforward installation and startup
- Standardized electrical interfaces
- Possibility of connecting special propulsion control levers

2.2 BlueLine subsystems – Use

MCS-5

The displays/indicators of the Monitoring and Control System MCS-5 inform the operator about propulsion plant operating and alarm states.

The propulsion plant can be controlled using the MCS-5 controls. The inputs are transmitted to the Engine Control System ECS-5.

RCS-5

The Remote Control System RCS-5 has the task of controlling the engine speed and gearbox setting inputs.

The inputs from the control unit of the active control stand are transmitted to the Engine Control System ECS-5.

ECS-5

The Engine Control System ECS-5 is used to

- Control a power train (engine – gearbox – shaft – propeller)
- Control the engine
- Monitor power train operational data

Input values entered by the operator at the MCS-5 or RCS-5 are converted into control signals for the engine and gearbox.

Measured sensor values acquired by the ECS-5 and alarm signals are transmitted to the MCS-5 and/or RCS-5 where they are displayed.

The power train can also be controlled in Local mode depending on the scope of ECS-5.

TIM ID: 0000006153 – 003

3 Subsystems

3.1 Remote Control System RCS-5

3.1.1 RCS-5 BlueLine – Overview

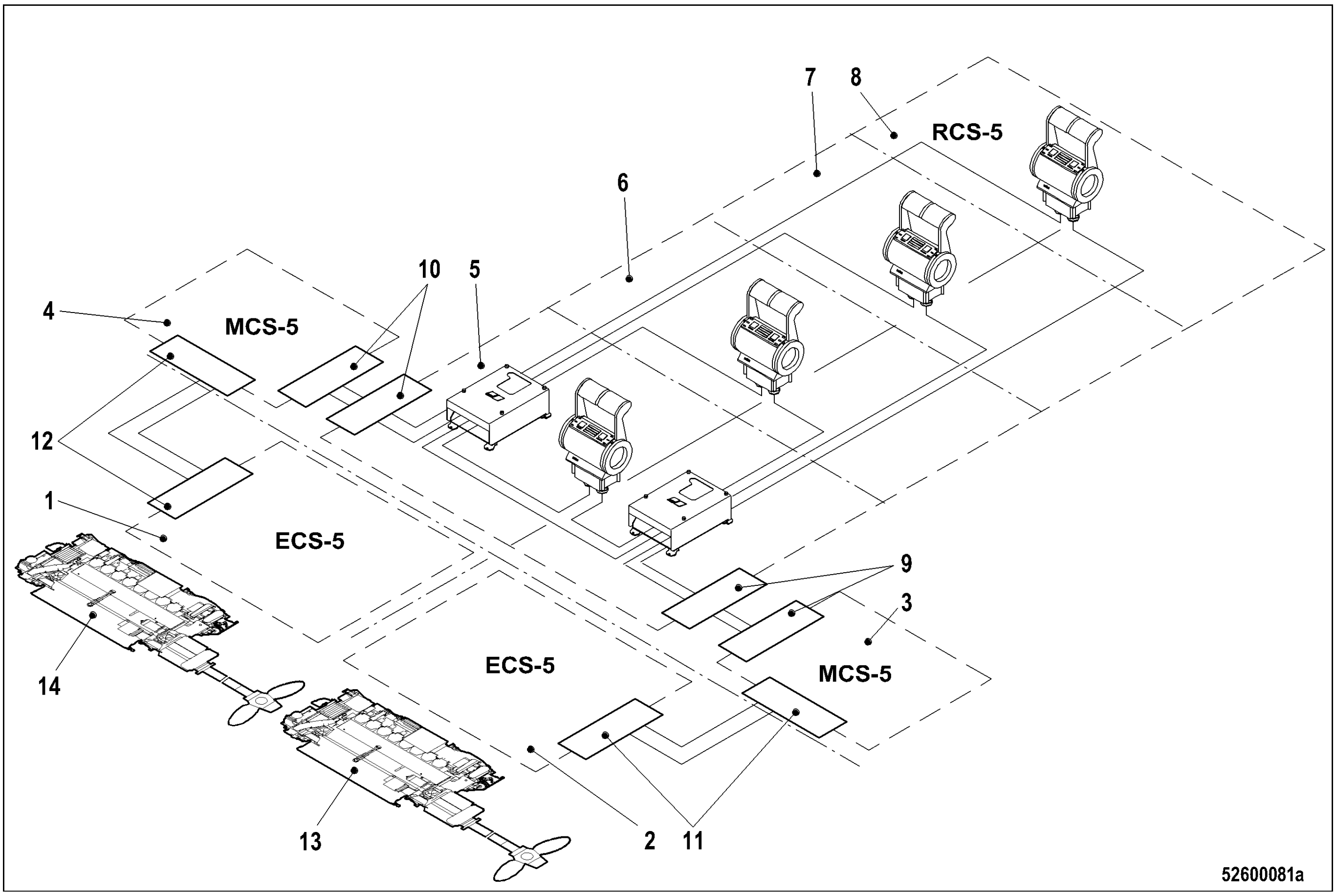
Features

The Remote Control System RCS-5 is configured to suit the requirements of the vessel. It can be extended in the BlueLine system for plants with

- one to four shafts,
- one to four control stands.

RCS-5 is connected to the propulsion plant via the MCS-5 subsystem of each power train.

Example: Twin-shaft plant with four control stands



No.	Designation	Explanation
1	ECS-5 system port	
2	ECS-5 system starboard	
3	MCS-5 system starboard	
4	MCS-5 system port	

TIM ID: 0000006137 – 002

No.	Designation	Explanation
5	Main control stand 1	(→ Page 31)
6	Main control stand 2	Optional (→ Page 34)
7	Slave control stand 1	Optional (→ Page 35)
8	Slave control stand 2	Optional (→ Page 35)
9	Interface	Between RCS-5 and MCS-5, starboard
10	Interface	Between RCS-5 and MCS-5, port
11	Interface	Between MCS-5 and ECS-5, starboard
12	Interface	Between MCS-5 and ECS-5, port
13	Power train starboard	
14	Power train port	

TIM ID: 0000006137 – 002

3.1.2 RCS-5 BlueLine – Use of the devices

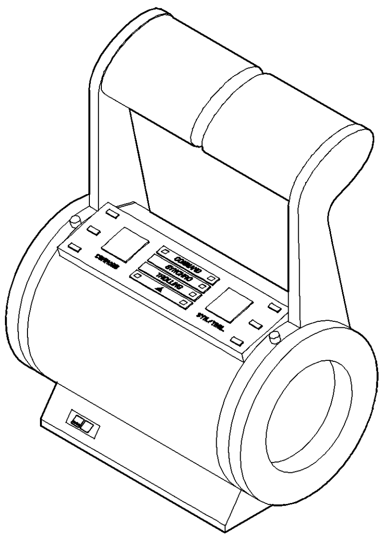
Control units

Command units

Different types of command unit are used depending on the number of power trains. All types have the following features in common:

- Control keys to transfer command, acknowledge alarms, select Single Control Lever mode and Trolling (option)
- Light emitting diodes to indicate operating states and faults
- Engagement locks to engage/disengage the clutch
- Integrated horn for signalling during operating procedures and in case of alarms

Command unit ROS 7



52600084b

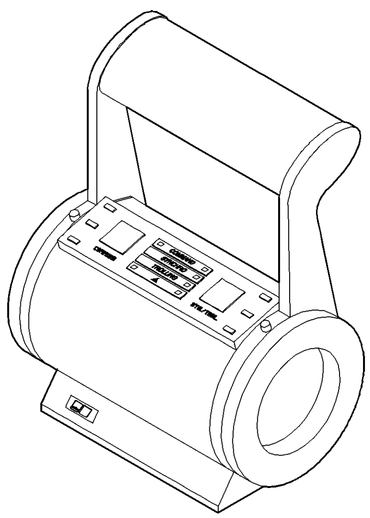
Central control unit of RCS-5 for twin-shaft plants:

- One propulsion control lever for each power train
- Gearbox state and engine speed can be set independently for each of the power trains.

The ROS 7-03 and ROS 7-04 versions differ only in regard of the length of their propulsion control levers.

Two ROS 7 command units may be used on each control stand on four-shaft plants.

Command unit ROS 9



52600089a

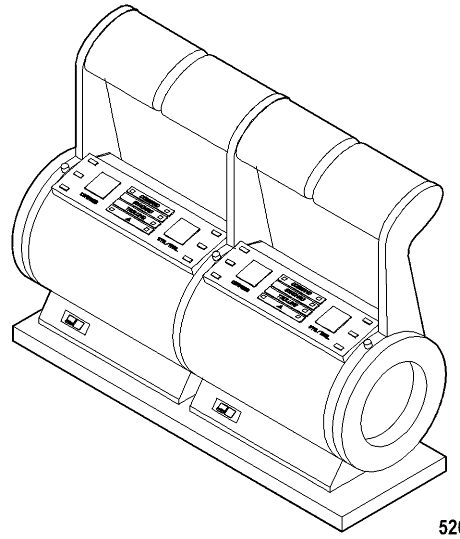
Central control unit of RCS-5 for single-shaft plants:

- The two propulsion control levers are mechanically coupled.
- Gearbox state and engine speed can be set.

The following combination is possible on triple-shaft plants (for each control stand):

- One ROS 10 rotary encoder module for each of the outer shafts;
- command unit ROS for the middle shaft.

Command unit ROS 11

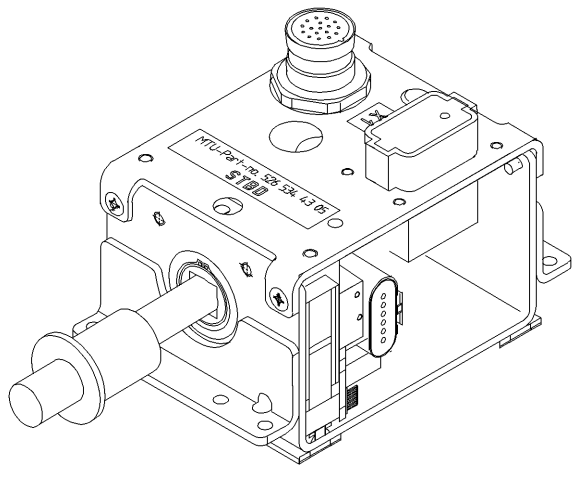


52600085b

Central control unit of RCS-5 for triple-shaft plants:

- The two middle propulsion control levers are mechanically coupled and control the middle power train.
- The two outer control levers control the two outer power trains.
- Gearbox state and engine speed can be set independently for each of the three power trains.

Rotary encoder modules ROS 10/S, ROS 10/P



52600079b

Alternative control unit for one shaft:

Each rotary encoder module allows a special or customized propulsion control lever to be installed in place of the propulsion control lever on the command unit, e.g. in a "helmsman’s seat".

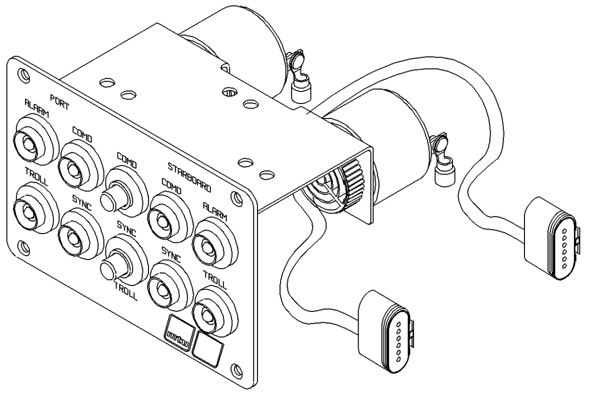
- ROS 10/S version for starboard propulsion control lever
- ROS 10/P version for port propulsion control lever

TIM ID: 0000006133 – 002

The gearbox state and the engine speed of the associated power train are set by the position of the shaft protruding from the rotary encoder module.

•

Control panel ROS 10/T



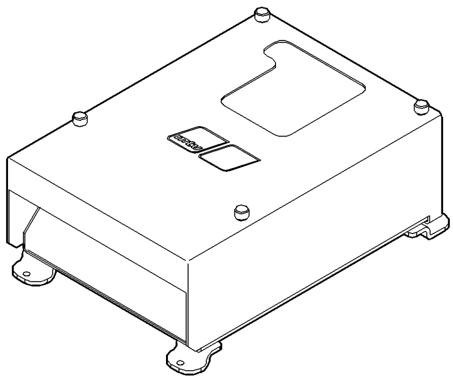
52600080b

Alternative control unit for one or two shafts:

The control panel must be installed in addition if the rotary encoder modules are used in place of the propulsion control lever on a command unit. It replaces the key and display features of the command unit:

- Control keys to transfer command, acknowledge alarms, select Single Control Lever mode and Trolling (option)
- Light emitting diodes to indicate operating states and faults
- Integrated horn for signalling during operating procedures and in case of alarms

Control unit PIM 4 RCS



51100406b

Central control unit of RCS-5 in the BlueLine system.

- Selection of the commanding control stand
- Evaluation of the propulsion control lever position of the commanding command unit or rotary encoder module
- Transmission of corresponding signals for gearbox state and engine speed to the ECS-5

One PIM 4 for each power train (on main control stand 1)

- Connection of the "associated side" (port, middle, starboard etc.) of all command units or all rotary encoder modules associated with the power train

- Standard version for up to two control stands
- Extended version for up to four control stands

Communication with the MCS-5 subsystem via CAN-Bus.

The PIM 4 RCS control units of the power trains also intercommunicate in Single Control Lever mode.

LC display for servicing and initial operation.

3.1.3 RCS-5 BlueLine – Main control stand 1

Located on main control stand 1 are
- The central control unit PIM 4
- The control unit(s) for this control stand

The following control configurations are possible depending on the number of power trains:

Single-shaft plant

Variant 1: Command unit ROS 9

Variant 2: Control panel ROS 10/T and one rotary encoder module (ROS 10/S or ROS 10/P)

Twin-shaft plant

Variant 1:One command unit ROS 7

Variant 2:One control panel ROS 10/T and two rotary encoder modules ROS 10/S and ROS 10/P

Triple-shaft plant

Variant 1:One command unit ROS 11

Variant 2:
- One command unit ROS 9 for the middle shaft
- One command unit ROS 7 for the outer shafts

Variant 3:
- One command unit ROS 9 for the middle shaft
- One common control panel ROS 10/T and two rotary encoder modules ROS 10/S and ROS 10/P for the outer shafts

Four-shaft plant

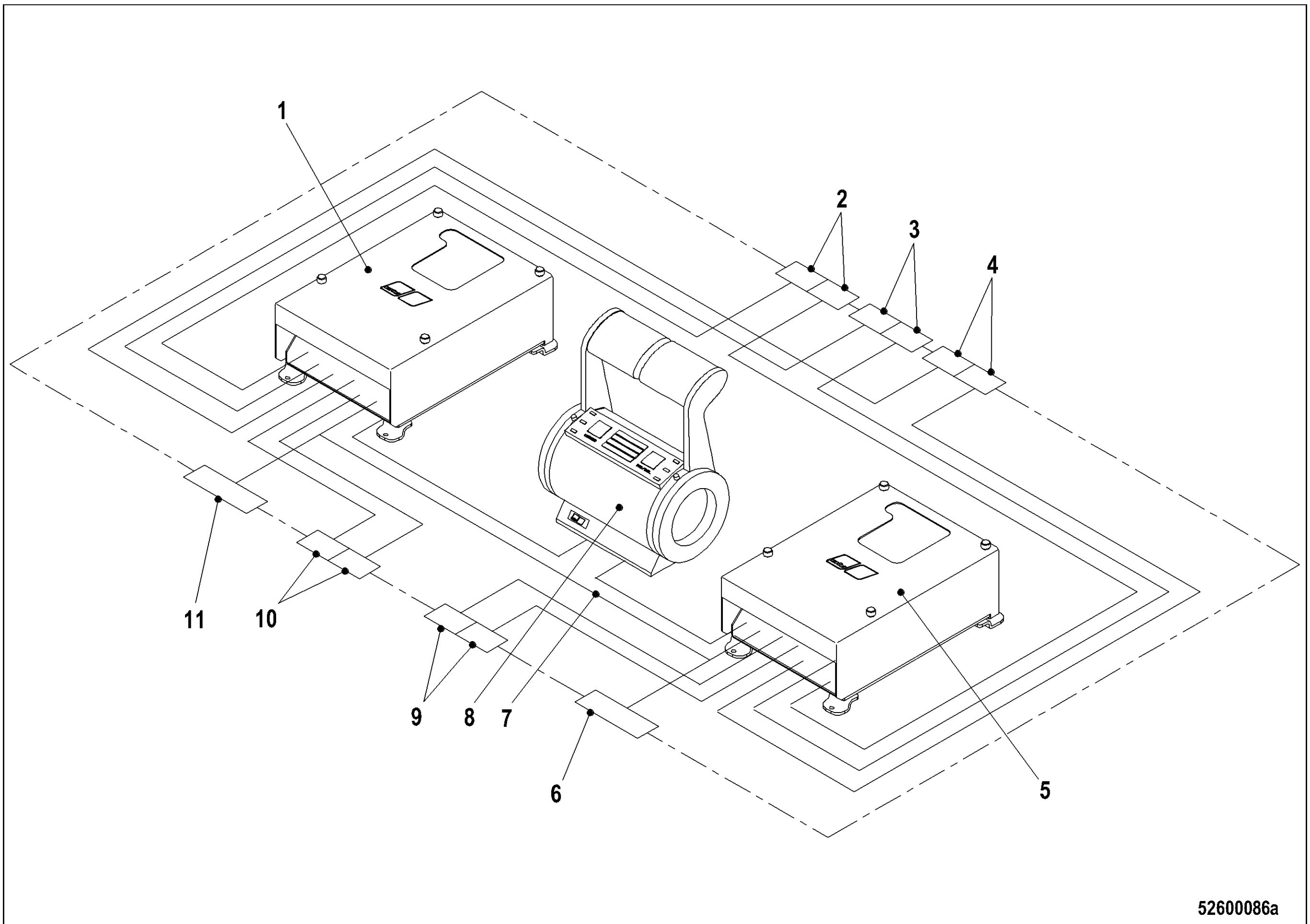
Variant 1:Two suitably configured and connected command units ROS 7

Variant 2:
- One command unit ROS 7 for the inner shafts
- One control panel ROS 10/T and two rotary encoder modules ROS 10/S and ROS 10/P for the outer shafts

Variant 3:
- One control panel ROS 10/T and two rotary encoder modules ROS 10/S and ROS 10/P for the inner shafts
- One control panel ROS 10/T and two rotary encoder modules ROS 10/S and ROS 10/P likewise for the outer shafts

TIM ID: 0000006141 – 002

Example: Twin-shaft plant with standard command unit



No.	Name	Explanation
1	Control unit PIM 4 port	For use during startup and servicing only
2	Interface	To main control stand 2; operating voltage and signals
3	Interface	To slave control stand 1; operating voltage and signals
4	Interface	To slave control stand 2; operating voltage and signals
5	Control unit PIM 4 starboard	For use during startup and servicing only
6	Interface	For connection of an optional portable controller (→Document no. E532089)
7	Coordination field bus	Interconnection of the control units for the port and starboard power trains; e.g. for Single Control Lever mode

TIM ID: 0000006141 – 002

No.	Name	Explanation
8	Command unit ROS 7	With one propulsion control lever for each power train
9	Interface	To MCS-5 and ECS-5, starboard; operating voltage and signals
10	Interface	To MCS-5 and ECS-5, port; operating voltage and signals
11	Interface	To the RCS-5 of the third and fourth power train (if applicable)

TIM ID: 0000006141 – 002

3.1.4 RCS-5 BlueLine – Main control stand 2

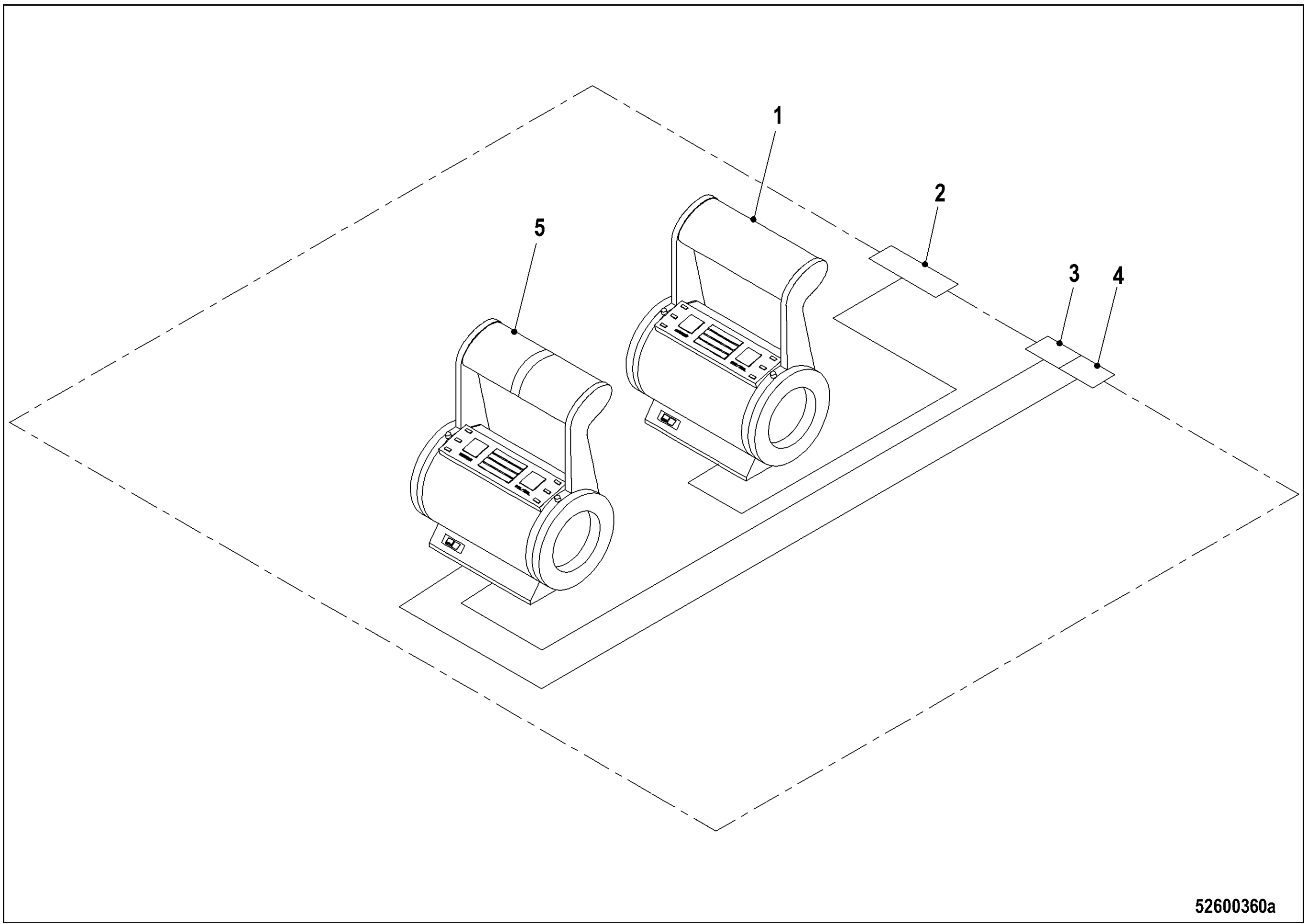
Main control stand 2 features the same RCS-5 devices as on each slave control stand (→ Page 35). The differentiation in terms between main control stand 1 and main control stand 2 is necessary in the BlueLine system due to the MCS-5.

TIM ID: 0000006145 – 002

3.1.5 RCS-5 BlueLine – Slave control stand

Only the RCS-5 control(s) are provided on each slave control stand but no control unit. The same variants as seen on main control stand 1 may be used depending on the number of power trains (→ Page 31).

Example: Triple-shaft plant with a combination of various propulsion control levers



Pos.	Designation	Explanation
1	Command unit ROS 9 with two coupled propulsion control levers	To control the middle power train and execute the RCS functions for the middle power train
2	Interface	To PIM 4 of the middle power train on main control stand 1; operating voltage and signals
3	Interface	To PIM 4 of the outer power train (port side) on main control stand 1; operating voltage and signals

TIM ID: 0000006149 – 003

Pos.	Designation	Explanation
4	Interface	To PIM 4 of the outer power train (starboard side) on main control stand 1; operating voltage and signals
5	Command unit ROS 7 with one propulsion control lever	To control the outer power trains and perform RCS functions for the outer power trains.

TIM ID: 0000006149 – 003

3.2 Monitoring and Control System MCS-5

3.2.1 MCS-5 BlueLine – Overview

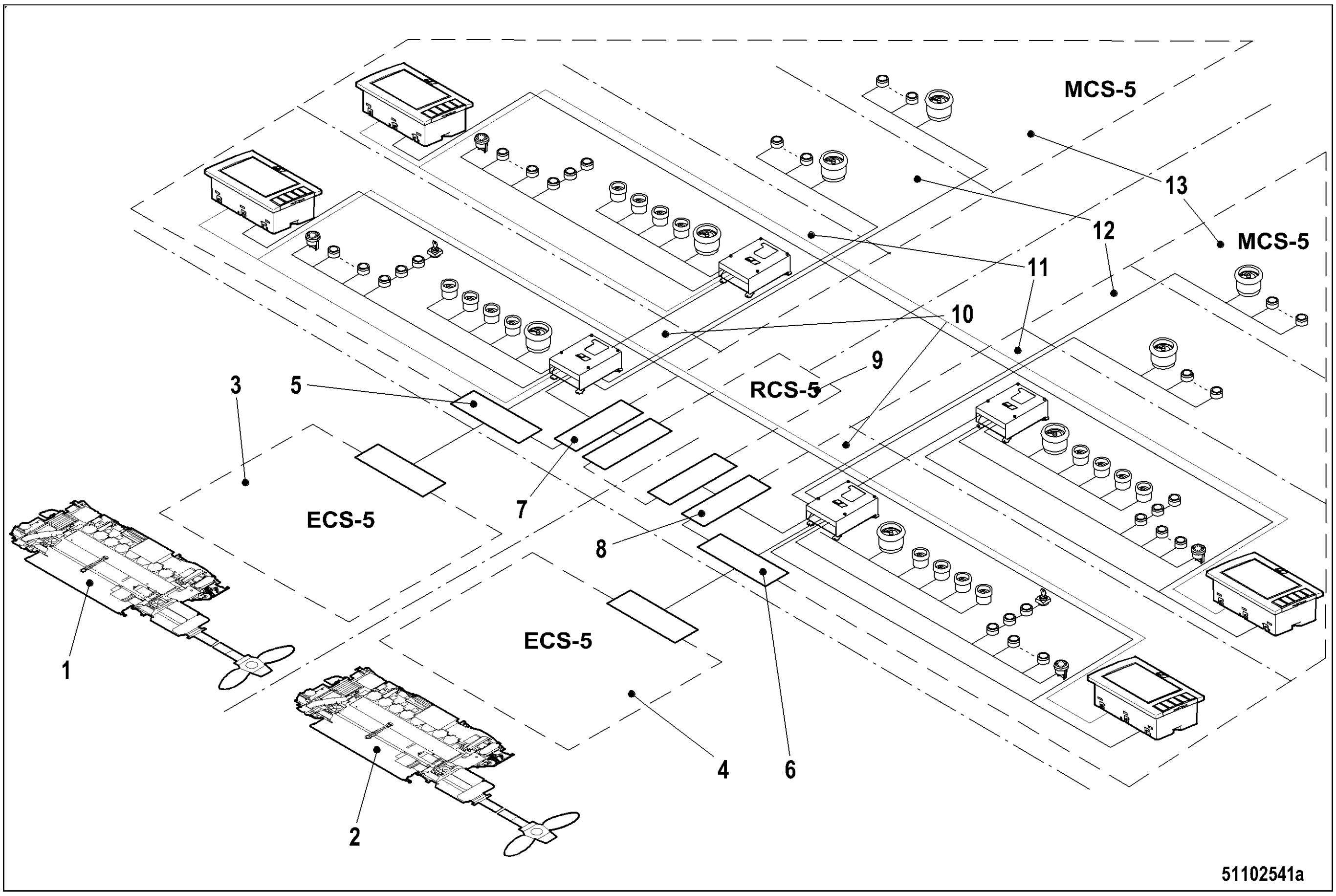
Features

The Monitoring and Control System MCS-5 is configured to suit the requirements of the vessel. It can be extended within the BlueLine system for plants with

- one to four shafts,
- one to four control stands.

MCS-5 is connected to the propulsion plant via the ECS-5 subsystem of each power train.

Example: Version with display in twin-shaft propulsion system with four control stands - one display per power train



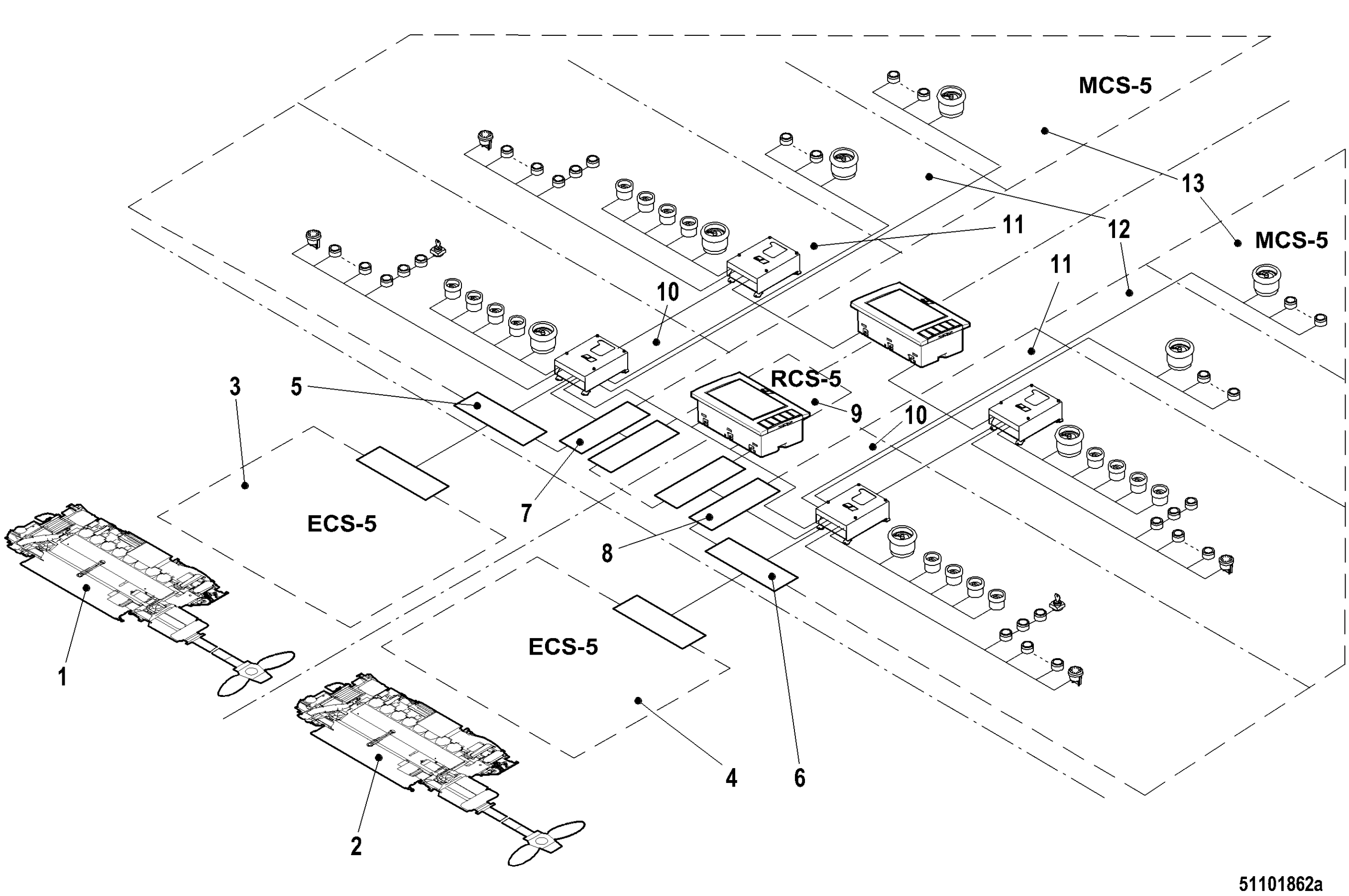
Pos.	Designation	Explanation
1	Power train port	
2	Power train starboard	
3	ECS-5 subsystem port	
4	ECS-5 subsystem starboard	
5	Interface	Of MCS-5 to ECS-5, port

TIM ID: 0000006121 – 006

Pos.	Designation	Explanation
6	Interface	Of MCS-5 to ECS-5, starboard
7	Interface	Of MCS-5 to RCS-5, port
8	Interface	Of MCS-5 to RCS-5, starboard
9	Subsystem RCS-5	
10	Main control stand 1	(→ Page 49)
11	Main control stand 2	Optional (→ Page 49)
12	Slave control stand 1	Optional (→ Page 53)
13	Slave control stand 2	Optional (→ Page 53)

TIM ID: 0000006121 – 006

Example: Version with display in twin-shaft propulsion system with four control stands - one display per control stand for two power trains each



Pos.	Designation	Explanation
1	Power train port	
2	Power train starboard	
3	ECS-5 subsystem port	
4	ECS-5 subsystem starboard	
5	Interface	Of MCS-5 to ECS-5, port
6	Interface	Of MCS-5 to ECS-5, starboard
7	Interface	Of MCS-5 to RCS-5, port
8	Interface	Of MCS-5 to RCS-5, starboard
9	Subsystem RCS-5	
10	Main control stand 1	(→ Page 49)
11	Main control stand 2	Optional (→ Page 49)

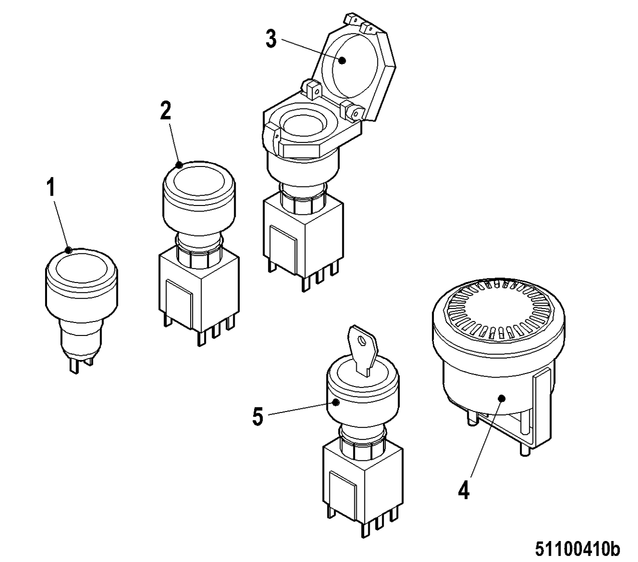
TIM ID: 0000006121 – 006

Pos.	Designation	Explanation
12	Slave control stand 1	Optional (→ Page 53)
13	Slave control stand 2	Optional (→ Page 53)

TIM ID: 0000006121 – 006

3.2.2 MCS-5 BlueLine – Use of the devices

Indicators and controls

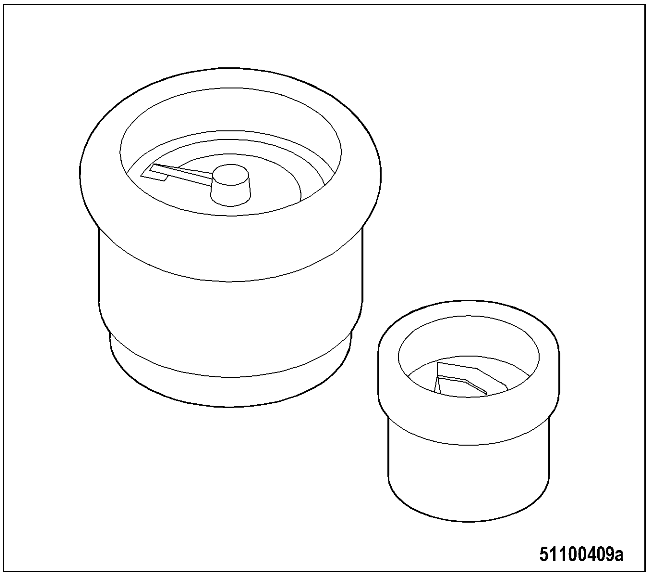


Key switch, illuminated pushbuttons and switches, indicator lamps, horn

- Key switch (5) to switch the overall BlueLine system of the power train concerned on/off
- Illuminated pushbuttons/switches (2), some featuring cover flaps (3), for
  - Engine start
  - Engine stop
  - Emergency engine stop
  - Start interlock override
  - Dimming
  - Acknowledgment of summary alarms
- Status indicator lamps (1)
- Alarm indicator lamps (1) for
  - Warnings when operating at limits
  - Alarms in case of inadmissible operating states
  - Alarms in case of system faults
- Horn (4) for
  - Warnings when operating at limits
  - Alarms in case of inadmissible operating states
  - Signaling inadmissible operator inputs

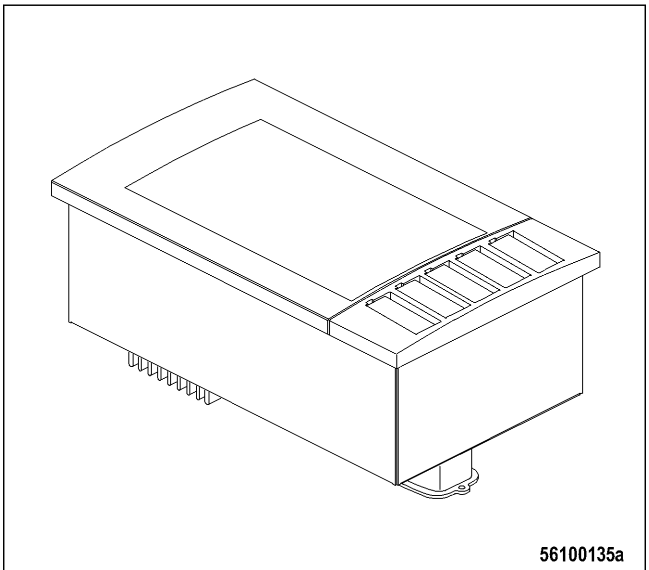
TIM ID: 0000006119 – 007

Display instruments


51100409a

Analog display instruments for
- Engine speed
- Engine coolant temperature
- Gearbox oil temperature
- Engine oil pressure
- Gearbox control oil pressure

Display (option)


56100135a

Decentralized information and monitoring device; displaying
- Engine and gearbox operating states;
- Single-point alarms
- System information
- Two power trains per display can be monitored

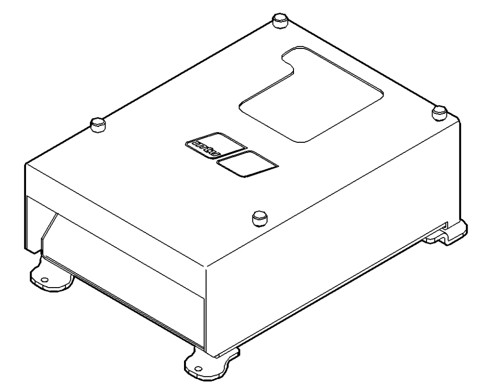
For use on main control stand 1 and main control stand 2 only.

Communication with the control unit PIM 4 MCS of the main control stand concerned via CAN bus.

Specific features
- 2x SD memory card slot

TIM ID: 0000006119 – 007

Control unit PIM 4 MCS



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Central control unit of MCS-5 in the BlueLine system.

One PIM 4 for each power train on main control stand 1 and on main control stand 2 (if applicable).

Connection

- Of all indicators, controls and devices related to the power train concerned at this control stand
- Of all indicators, controls and devices related to the power train concerned at (optional) slave control stands (up to two slave control stands per main control stand)

Communication via CAN bus with

- Subsystem ECS-5
- Subsystem RCS-5
- PIM 4 of the other main control stand (if applicable)

LCD (liquid-crystal display) for servicing and initial operation.

TIM ID: 0000006119 – 007

3.2.3 Serial interface RS422

The PIM 4 control unit features an RS422 standard serial interface to allow connection of an external monitoring system or an external microcomputer-controlled system.

Interface protocol

The PIM 4 control unit facilitates data interchange between the serial interface of the third-party system (RS422) and the CAN bus of the MTU devices.

The PIM 4 control unit supports full-duplex operation and features electrical isolation.

Data transmission

No initialization routine is required to start serial communication. No handshaking takes place. Serial data is transferred in full-duplex mode. The data transmission formats described in this chapter apply equally to the transmission and reception of data.

Serial communication (transmitting and receiving) is cyclical in an endless loop. The cycle times for transmission of all data blocks are predefined. The minimum interval observed between two data blocks is 70 ms.

Data block order in the data cycle is determined by the predefined block number.

Block 1:	100 measurands
Block 2:	100 measurands
Block 3:	50 measurands

Alarms change data block order.

The data stream is monitored by the relevant receiver. The receiver generates a fault message on detecting data transmission failure.

Data is transmitted in blocks, whereby three block types are differentiated (xxh - number in hexadecimal format).

Block type	**Block type identifier**
Analog measurand block	03h
Binary measurand block	02h
Request block	01h

2 bytes are reserved for block type identification (unsigned, Motorola memory format).

The data blocks are embedded in a data frame which has the same structure for every block type.

Data frame

Start_1	**Start_2**	**Block no.**	**Block type**	**Frame size**	**Mea-surand**	**...**	**Mea-surand**	**Check-sum**	**End_1**	**End_2**
1 byte	1 byte	2 byte	2 byte	4 byte	X byte		X byte	4 byte	1 byte	1 byte
					Data block					

Start and end of the data frame are identified by the following values:

Start_1	⇒	FAh
Start_2	⇒	F5h
End_1	⇒	AFh
End_2	⇒	5Fh

TIM ID: 0000016427 – 001

The block number (unsigned 2-byte integer value, Motorola memory format), an order-specific MTU setting, follows the start identifier. Block number “0” is reserved for the request block and is used both by the transmitter and the receiver.

The “Frame Size” entry (unsigned 4-byte integer value, Motorola memory format) contains the number of all bytes transmitted in the data frame, i.e. the number of bytes from Start_1 to End_2.

The PIM 4 control unit can receive max. 100 measurands as a data block and transmit max. 100 measurands.

The interface of the third-party system should be designed such as to allow receiving and processing of 100 measurands.

The minimum number of measurands in a data block is 4 (Block 1).

Transmitted data are assigned to the relevant measuring points in accordance with the measuring-point list created by MTU. The set order of the measurands must be strictly observed to ensure trouble-free data transmission.

A checksum (unsigned 4-byte integer value, Motorola memory format) is transmitted after the data block. The checksum is formed by addition of all bytes commencing with “Start_1” and ending with the last data byte before the checksum.

The data frame is terminated by the end identifier.

The end identifier can only be checked following reception of the number of bytes defined by “Frame Size” as the end identifier may appear in the data block when analog measurand blocks are transmitted.

Analog measurand block

Basic structure of an analog measurand block (X … max. number of measurands)

Start_1	**Start_2**	**Block no.**	**Block type**	**Frame size**	**Mea-surand**	**...**	**Mea-surand**	**Check-sum**	**End_1**	**End_2**
1 byte	1 byte	2 byte	2 byte	4 byte	X byte		X byte	4 byte	1 byte	1 byte
						Data block				

Analog measurands are transmitted by signed 4-byte integer values in Motorola memory format. The most-significant byte of the integer value is transmitted first in this memory format.

Analog measurand “15032” is equivalent to “3AB8h” in Motorola memory format

Byte 4 Most-significant byte	Byte 3	Byte 2	Byte 1 Least-significant byte
00h	00h	3Ah	B8h

Measurands must be normalized in accordance with the MTU measuring-point list.

The value 8000 0000h is transmitted in case of sensor failure. Missing data are identified by the value 7FFF FFFFh

“Missing Data” does not represent a critical value. Simply no information is available about the contents of the measuring point . The connected third-party system must assume a safe state on receiving a measuring point with “Missing Data”.

TIM ID: 0000016427 – 001

Binary measurand block

Basic structure of a binary measurand block (X … max. number of measurands)

Start_1	Start_2	Block no.	Block type	Frame size	Mea-surand	...	Mea-surand	Check-sum	End_1	End_2
1 byte	1 byte	2 byte	2 byte	4 byte	X byte		X byte	4 byte	1 byte	1 byte
					Data block					

Binary measurands are transmitted by signed 1-byte values. The binary measurand may assume the following values:

01h	⇒	True
00h	⇒	False
80h	⇒	Sensor failure
7Fh	⇒	Missing data

Alarm messages

Alarm block transmission in a data cycle depends on the interface coupler used.

Generally, the data cycle always commences with transmission of the alarm blocks (the number of alarm blocks depend on the order concerned). The remaining data blocks follow the alarm blocks in the conventional order.

Transmission is completed properly should an alarm occur during transmission of a data block. The data cycle is restarted following the pause.

The PIM 4 control unit responds immediately or after the pause if an alarm is activated in the period between the end of a data cycle and the start of the next data cycle.

Alarm acknowledgment and reset

General convention

General conventions for acknowledging and resetting alarms by the PIM 4 control unit when operating a third-party system in conjunction with MTU devices:

- All alarms generated by the external system are stored in the external system if necessary.
- Definition of terms
  - Horn off
    Switching off audible signaling equipment following an alarm. Any new alarm switches the horn back on.
  - Acknowledgment
    Acknowledgment of a signaled alarm. Flashing signal lamps turn steady. The signal lamps are switched of when alarm conditions are no longer fulfilled.
- Alarms are only acknowledged at the third-party system by the MTU system. The other way is not supported (third-party system acknowledges MTU system).

Sequence of functions

- Alarm transmission
  The appropriate binary measurand is set to 01h and transmitted according to the exchange convention for alarm messages when an alarm occurs.
  The binary value remains 01h as long as the alarm conditions are fulfilled or, in the case of stored alarms, until the alarm is reset.
  The third-party system and the PIM 4 control unit ensure that any alarm is transmitted at least once even when it has been acknowledged or reset prior to transmission.
- Acknowledgment of an alarm transmitted from the third-party system by the PIM 4 control unit
  The data protocol includes an order-dependent binary measurand block which is transmitted from the PIM 4 control unit to the third-party system to facilitate alarm acknowledgment using the pushbuttons connected to the PIM 4 control unit.

TIM ID: 0000016427 – 001

This binary measurand block contains the following measuring points depending on the order:
- Horn off
  The PIM 4 control unit outputs the “Horn off” command to the third-party system.
- Alarm acknowledgment
  The PIM 4 control unit acknowledges all active third-party system alarms. The alarm value is transmitted with 01h as long as the alarm conditions are fulfilled.

The value range for these measuring points is as specified for binary measurands.

Suitable measures must be adopted in the third-party system to ensure that acknowledgment at the PIM 4 control unit does not acknowledge or reset any alarms which have not yet been transmitted as an active alarm (with 01h).

Request block

Basic structure of the request block

Start_1	**Start_2**	**Block no.**	**Block type**	**Frame size**	**Check-sum**	**End_1**	**End_2**
1 byte	1 byte	2 byte	2 byte	4 byte	4 byte	1 byte	1 byte
FAh	F5h	00h	01h	10h	200h	AFh	5Fh

The request block is predefined. It is not a permanent feature of the data cycle.

The request block is used to request all data blocks after detecting faulty data transmission, i.e. on receiving a request block the receiver terminates the current data cycle and starts a new data cycle.

It is transmitted when no valid data blocks are received over a period of 1.25 s.

The minimum time between two request blocks is 500 ms. This mechanism applies both to the PIM 4 control unit and the third-party system.

The PIM 4 control unit transmits the request block cyclically every 500 ms for max. 10 s. This cycle is reinitiated after a 10 s pause if no valid data blocks are received. If no valid data is received after transmitting four request blocks, the PIM 4 control unit detects a timeout and generates a fault message.

Interface parameters

The PIM 4 control unit supports full-duplex operation and realizes electrical isolation.

The transmission parameters of the RS422 interface are:

Baud rate:	9600
Data bits:	8
Stop bit:	1
Parity:	No parity

Cycle times for measurands and data blocks

The data transmission cycle times are defined as follows (“transmitting” and “receiving” as seen from the PIM 4 control unit):
- Transmission block: 850 msec
- Receiving block: 100 msec
- Interval between individual data blocks: 70 msec

Codes and fault messages

Fault messages are transmitted in the first two data blocks. Each fault message line commences with a two-letter code followed by a blank. These codes have the following meanings:
- MG (Message):
  The information which follows indicates impaired engine operation (operator error, etc.).
- AL (Alarm):

The fault message which follows indicates a fault in the electronic system or engine,
or inadmissible engine operating values.

- HI (High) and LO (Low):
  Admissible limit values defined by MTU have been violated. This is usually the result of a mechanical fault at the engine. This type of fault must be rectified immediately.
- SS (Safety System):
  Indicates safety channels:
  The engine management system ECS takes measures to protect the engine if violation of admissible limit values continues. These measures may range between a request to reduce power and engine shutdown depending on the nature and severity of the limit value violation, .

Column “PV no.”, sub-column “Sys.”:

The number marked X in the column depends on the engine number.

Example: Engine start command engine 1: PV no.: 610901 — Engine start command engine 2: PV no.: 620901

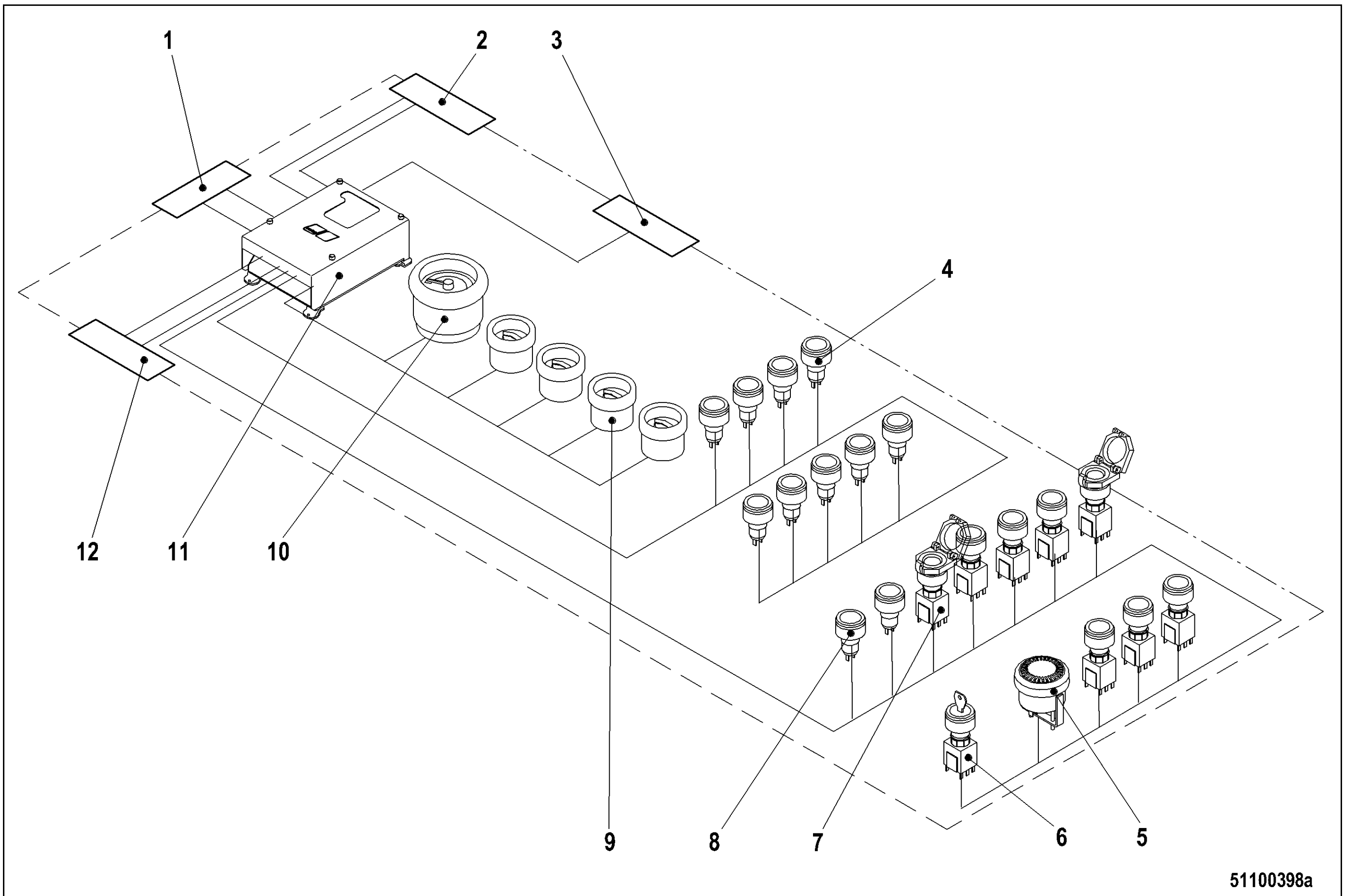
TIM ID: 0000016427 – 001

3.2.4 MCS-5 BlueLine – Main control stand

Up to two main control stands can be configured for the MCS-5 subsystem in the BlueLine system. The equipment for the operator is identical on both.

The difference between main control stand 1 and main control stand 2 is that optional slave control stands can only be connected to the PIM 4 control unit of main control stand 1.

Version with single-point alarm indicator lamps



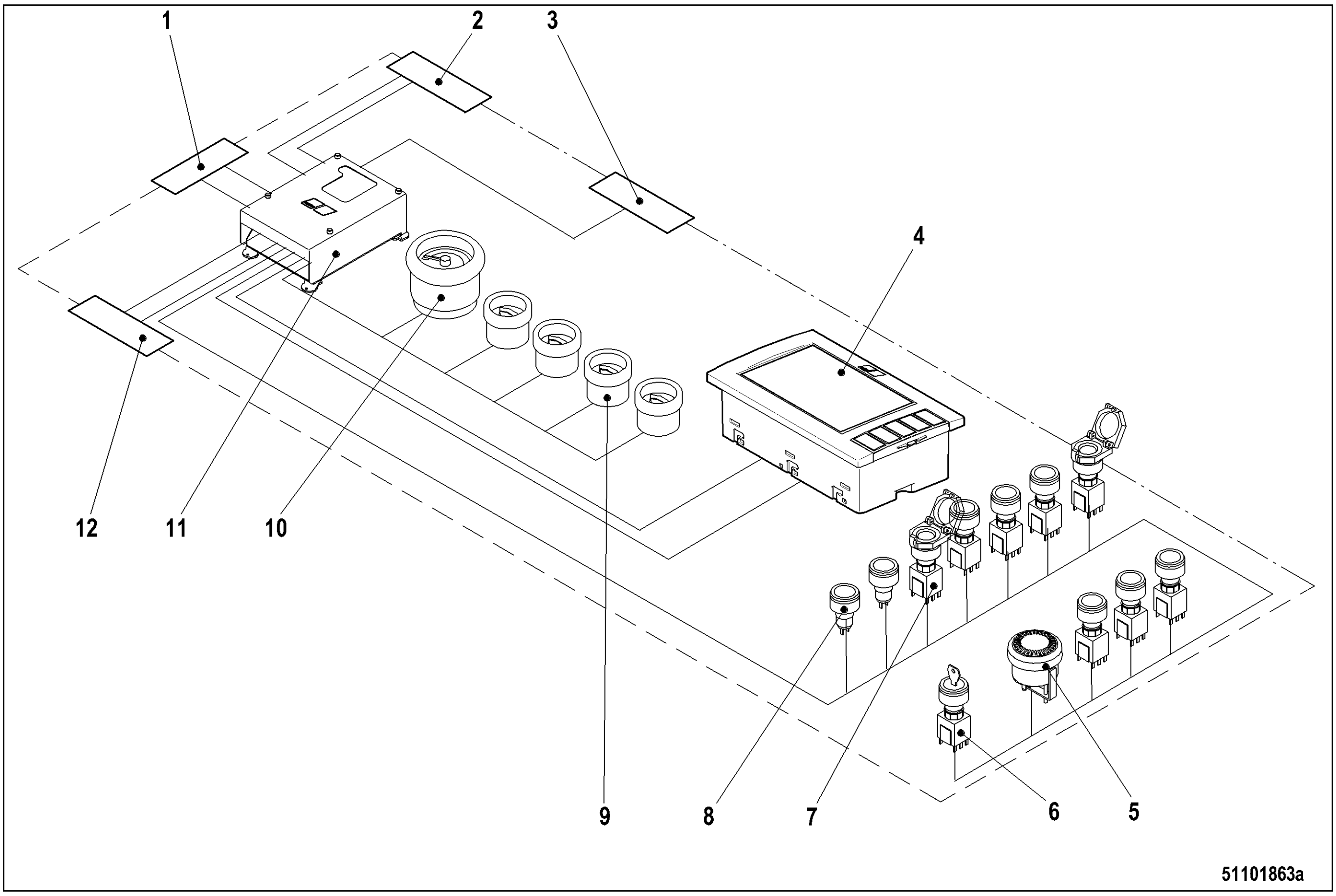
No.	Designation	Explanation
1	Interface	To the RCS-5 of the power train concerned; separate for operating voltage and signals
2	Interface	To max. 2 slave control stands (if applicable)
3	Interface	To other main control stand (if applicable)
4	Indicator lamps	For warnings and alarms; may be replaced by customized lamps if desired
5	Alarm horn	

TIM ID: 0000006123 – 006

No.	Designation	Explanation
6	Key switch	On main control stand 1 only
7	Illuminated pushbutton	For operation; some with, some without cover flap
8	Indicators	For operating states
9	Engine operating data display instruments	Analog; may be replaced by customized instruments if desired
10	Engine speed display instrument	Analog; with hour meter on main control stand 1; may be replaced by customized instruments if desired
11	Control unit PIM 4	For use during startup and servicing only
12	Interface	To the ECS-5 of the power train concerned; separate for operating voltage and signals

TIM ID: 0000006123 – 006

Version with display



No.	Designation	Explanation
1	Interface	To the RCS-5 of the power train concerned; separate for operating voltage and signals
2	Interface	To max. 2 slave control stands (if applicable)
3	Interface	To other main control stand (if applicable)
4	Multifunction display MFD	For operating states, warnings and alarms, system information
5	Alarm horn	
6	Key switch	On main control stand 1 only
7	Illuminated pushbutton	For operation; some with, some without cover flap
8	Indicators	For operating states

TIM ID: 0000006123 – 006

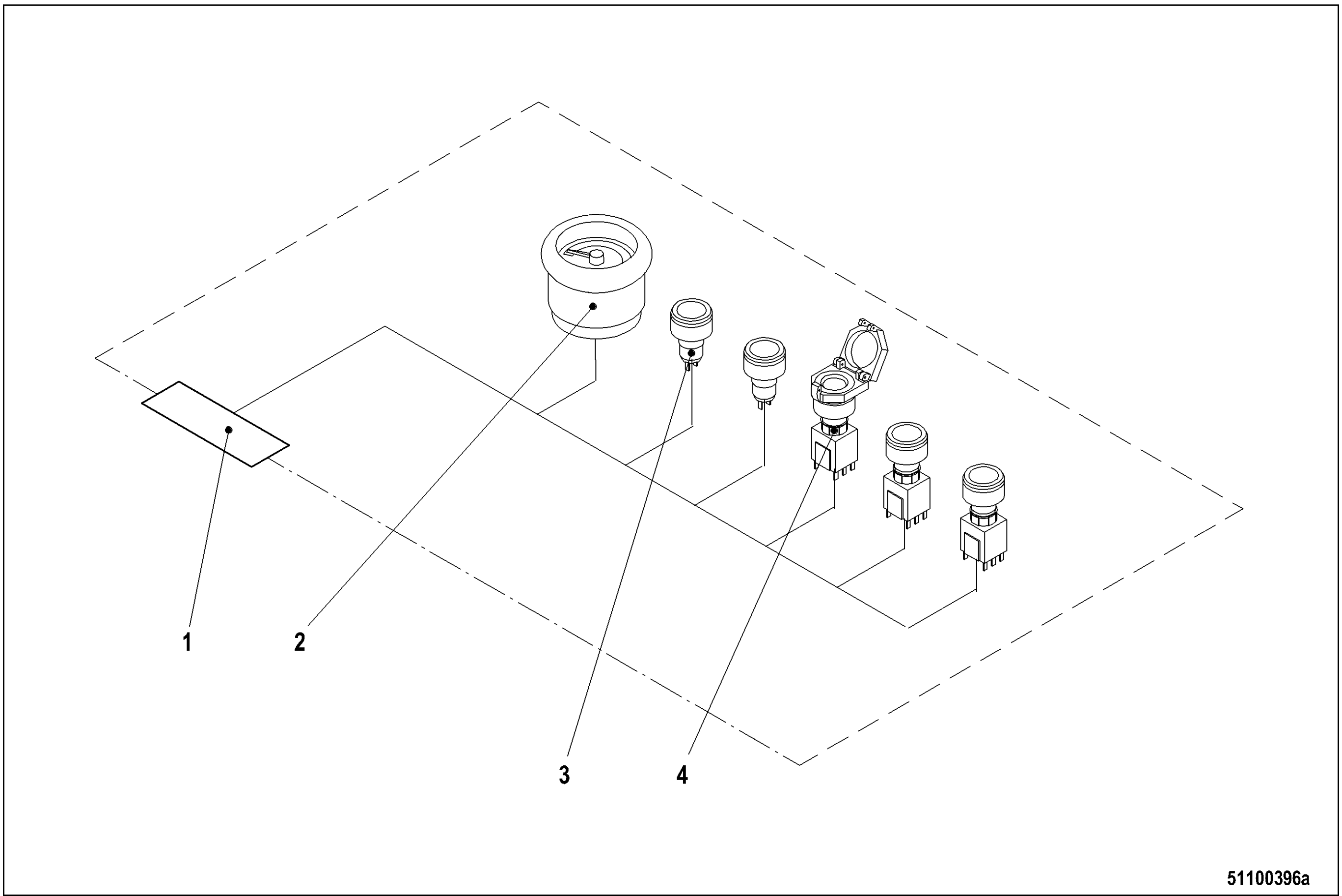
No.	Designation	Explanation
9	Engine operating data display instruments	Analog; may be replaced by customized instruments if desired
10	Engine speed display instrument	Analog; with hour meter on main control stand 1; may be replaced by customized instruments if desired
11	Control unit PIM 4	For use during startup and servicing only
12	Interface	To the ECS-5 of the power train concerned; separate for operating voltage and signals

TIM ID: 0000006123 – 006

3.2.5 MCS-5 BlueLine – Slave control stand

Several slave control stands can be configured for the MCS-5 subsystem in the BlueLine system. The equipment for the operator is identical on both.

Slave control stand



No.	Designation	Explanation
1	Interface	To main control stand
2	Engine speed display instrument	Analog; may be replaced by customized instrument if desired
3	Indicator lamps	For operating states; may be replaced by customized lamps if desired
4	Illuminated pushbutton	For operation; some with, some without protective flap

TIM ID: 0000006125 – 004

3.3 Engine Control System ECS-5

3.3.1 ECS-5 BlueLine – Overview

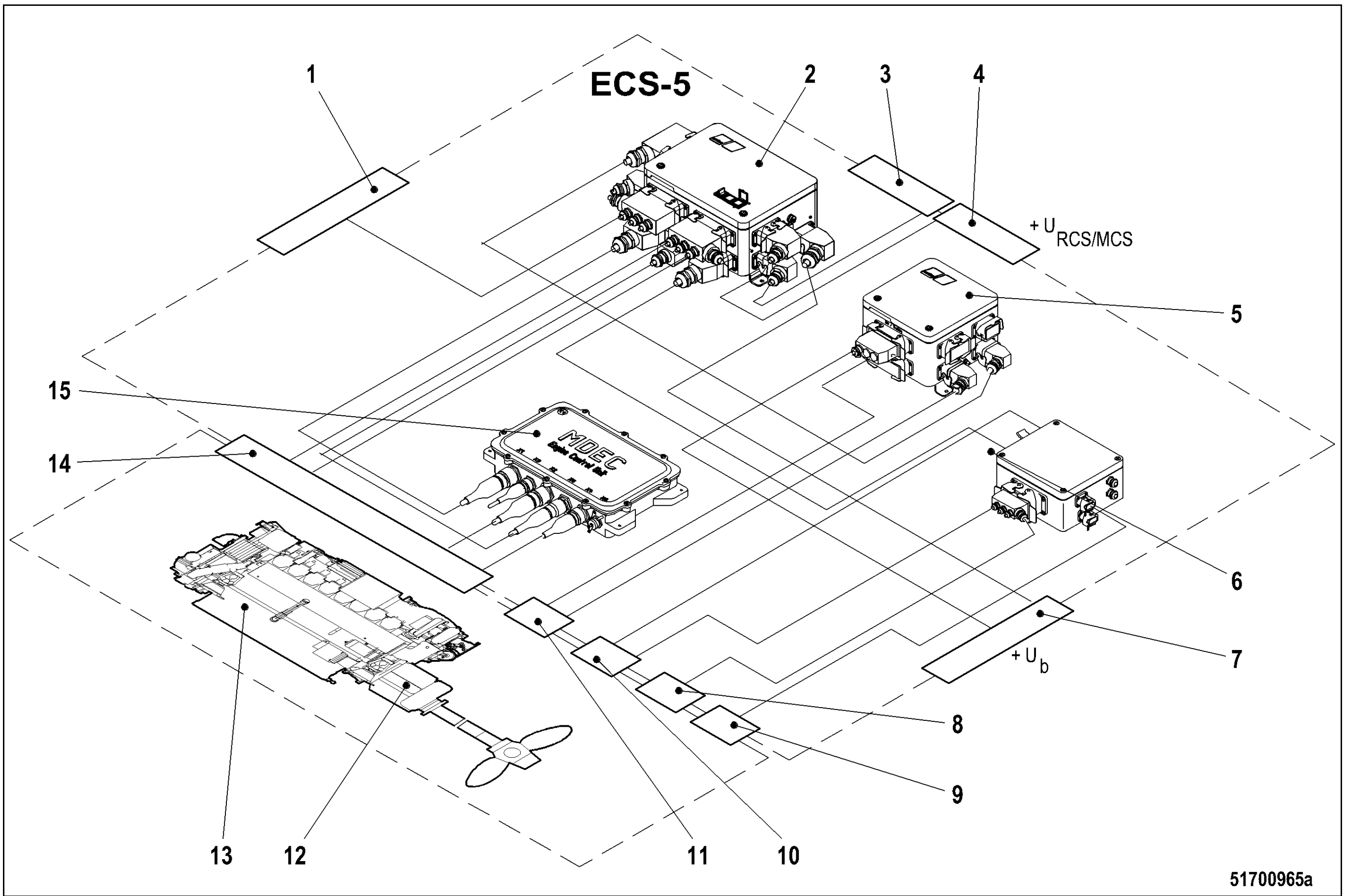
Variants

The Engine Control System ECS-5 for BlueLine is available in three variants. The differences lie in the type of local controls used in the engine room or its vicinity. The functionality of the ECS-5 is the same in all three cases.

- Basic scope
  One control unit: Local Operating Panel LOP with one rotary switch, illuminated pushbutton and indicator lamp respectively.
- LOS option
  Additional control unit: Local Operating Station LOS with flat-screen display and various illuminated pushbuttons and indicator lamps.
- LOP with DIS option
  One control unit: Local Operating Panel LOP with flat-screen display and various illuminated pushbuttons and indicator lamps;
  an additional optional LOS is not possible in this case.

TIM ID: 0000006887 – 003

Basic scope

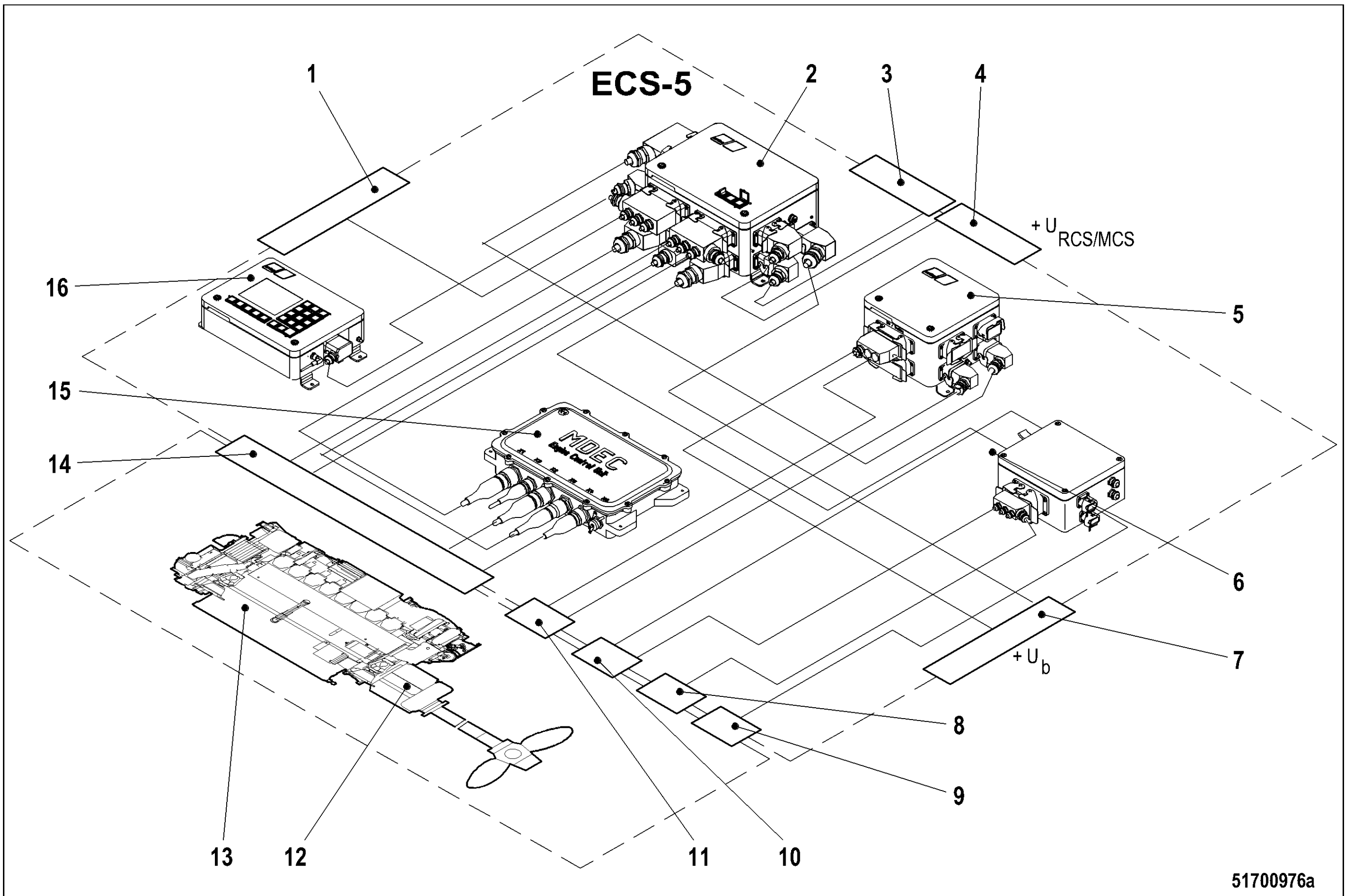


No.	Designation	Explanation
1	Interface	Between ECS-5 and the alarm signaling devices in the engine room (optional)
2	LOP	Local Operating Panel (→ Page 60); Serves only as a user interface in case of servicing
3	Interface	Between ECS-5 and MCS-5 / RCS-5
4	Power supply	Output for MCS-5 and RCS-5 devices
5	GCU	Transmission control; shown is type GCU 3 (→ Page 60)
6	X010	Auxiliary terminal box
7	Power supply	On-board voltage input
8	Interface	Between ECS-5 and starter
9	Interface	Between ECS-5 and barring gear
10	Interface	Between ECS-5 and battery-charging generator

TIM ID: 0000006887 – 003

No.	Designation	Explanation
11	Interface	Between ECS-5 and gearbox (wiring harness)
12	Transmission	
13	Engine	
14	Interface	Between ECS-5 and engine sensors/actuators (wiring harnesses)
15	ECU	Engine governor (→ Page 60)

LOS variant



No.	Designation	Explanation
1	Interface	Between ECS-5 and the alarm signaling devices in the engine room (optional)
2	LOP	Local Operating Panel (→ Page 60); Serves only as a user interface in case of servicing

TIM ID: 0000006887 – 003

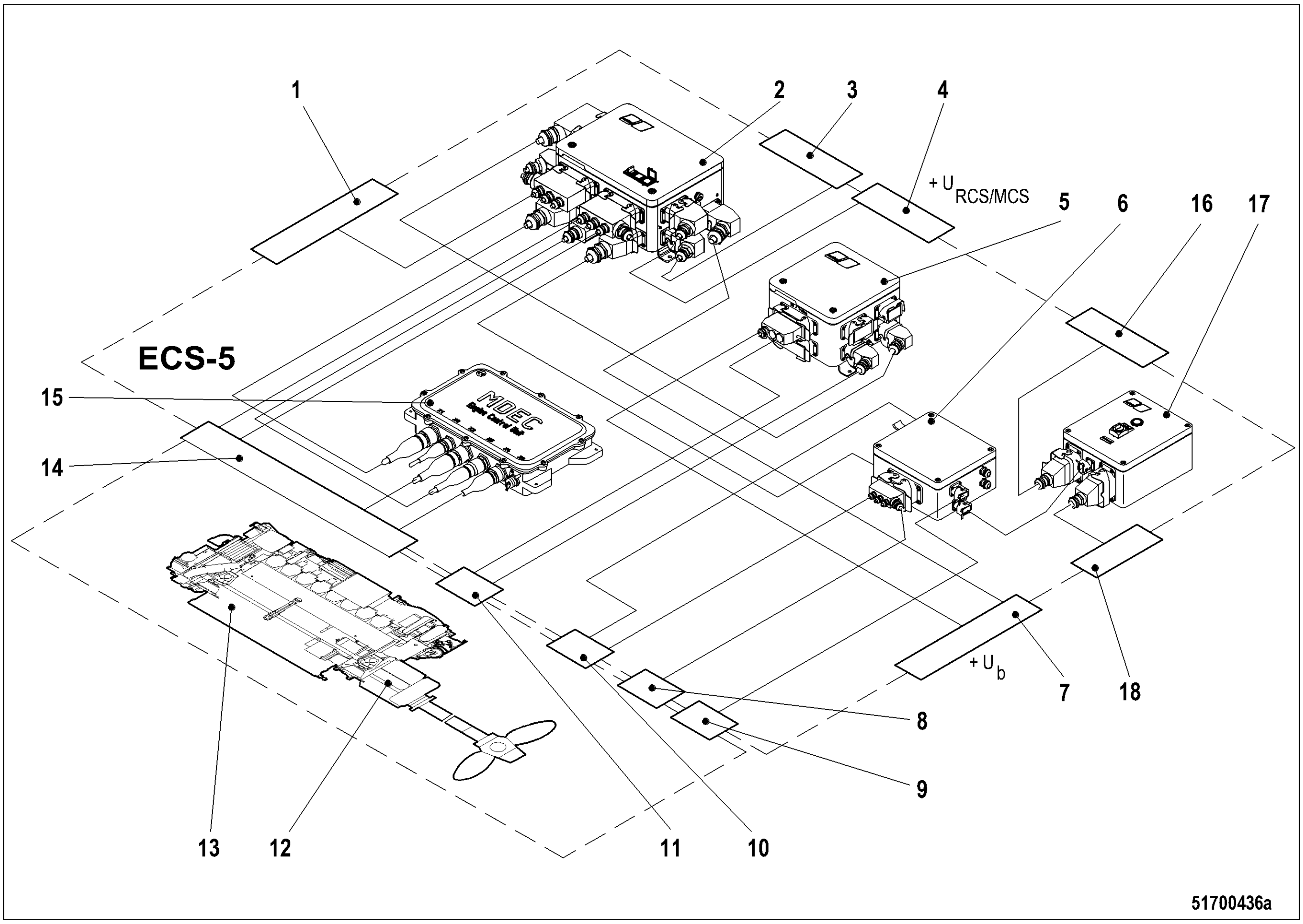
No.	Designation	Explanation
3	Interface	Between ECS-5 and MCS-5 / RCS-5
4	Power supply	Output for MCS-5 and RCS-5 devices
5	GCU	Transmission control; shown is type GCU 3 (→ Page 60)
6	X010	Auxiliary terminal box
7	Power supply	On-board voltage input
8	Interface	Between ECS-5 and starter
9	Interface	Between ECS-5 and barring gear
10	Interface	Between ECS-5 and battery-charging generator
11	Interface	Between ECS-5 and gearbox (wiring harness)
12	Transmission	
13	Engine	
14	Interface	Between ECS-5 and engine sensors/actuators (wiring harnesses)
15	ECU	Engine governor (→ Page 60)
16	LOS	Local Operating Station

LOP with DIS variant

Similar to basic scope, however, the same controls and displays are integrated in the cover of the Local Operating Panel LOP as in the Local Operating Station LOS.

Additional PPC

An additional Priming Pump Controller is available as an option for the three variants mentioned above. The basic scope with PPC is shown in the figure below.



No.	Designation	Explanation
1	Interface	Between ECS-5 and the alarm signaling devices in the engine room (optional)
2	LOP	Local Operating Panel (→ Page 60); Serves only as a user interface in case of servicing
3	Interface	Between ECS-5 and MCS-5 / RCS-5
4	Power supply	Output for MCS-5 and RCS-5 devices
5	GCU	Transmission control; shown is type GCU 3 (→ Page 60)
6	X010	Auxiliary terminal box
7	Power supply	On-board voltage input
8	Interface	Between ECS-5 and starter
9	Interface	Between ECS-5 and barring gear
10	Interface	Between ECS-5 and battery-charging generator

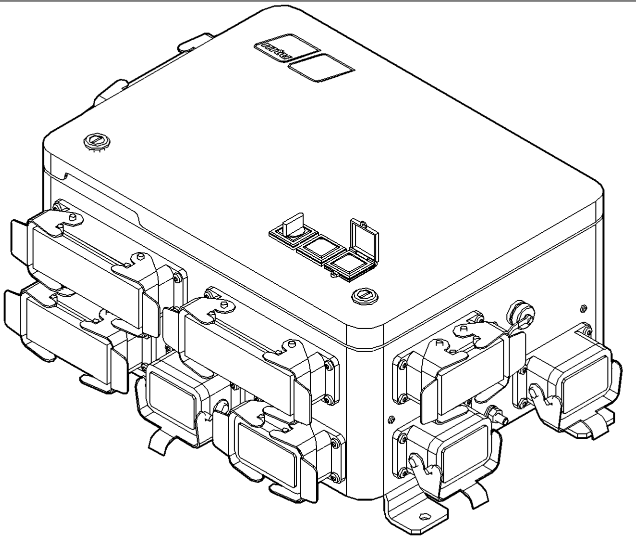
TIM ID: 0000006887 – 003

No.	Designation	Explanation
11	Interface	Between ECS-5 and gearbox (wiring harness)
12	Transmission	
13	Engine	
14	Interface	Between ECS-5 and engine sensors/actuators (wiring harnesses)
15	ECU	Engine governor (→ Page 60)
16	Power supply	Input voltage for Priming Pump Controller PPC
17	PPC	Priming Pump Controller PPC
18	Output voltage	Switched voltage for oil priming pump

TIM ID: 0000006887 – 003

3.3.2 ECS-5 BlueLine – Use of the devices

LOP



51700127a

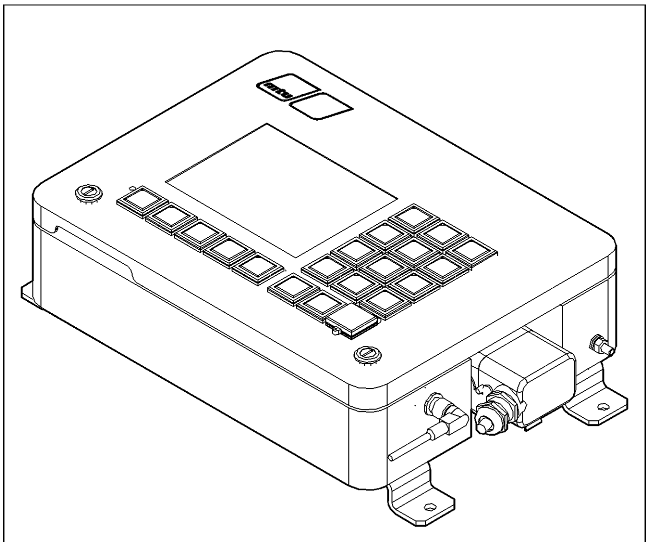
Central control unit of ECS-5

- Acquisition and evaluation of power train operating states
- Limit value monitoring
- In case of inadmissible states and limit value violations: Initiation of power reduction, engine stop or emergency engine stop (configurable)

Controls for servicing

Plant configuration and settings

Local Operating Station LOS



51700131a

In addition to LOP

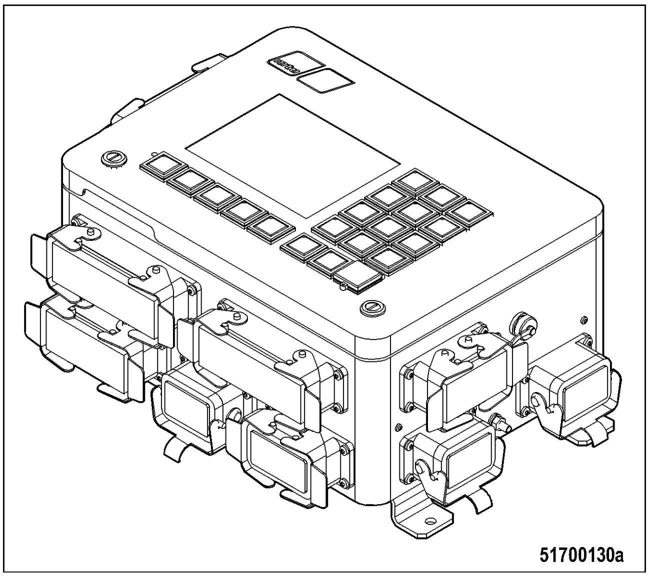
Control in Local mode via momentary-contact pushbuttons:

- Engine start, engine stop
- Speed control
- Gear Control Unit

TIM ID: 0000006873 – 001

On-screen display of:
- Operating states
- Fault information
- Help pages

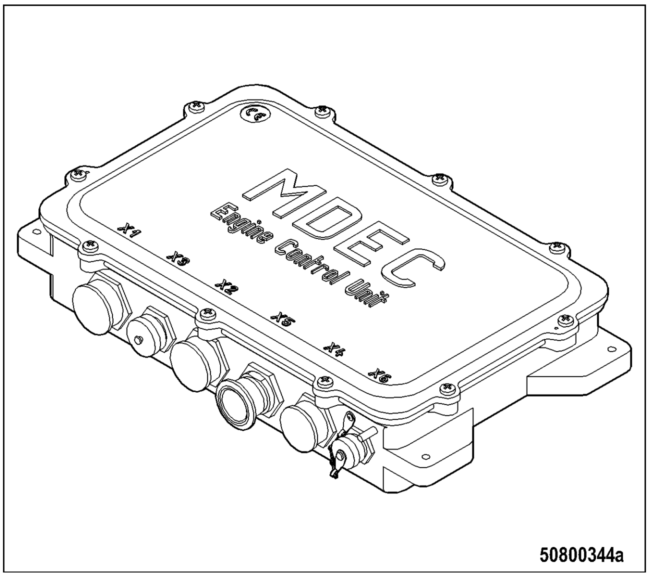
Local Operating Panel LOP with Display DIS



Central control unit of ECS-5, like LOP without DIS

Additional control options in Local mode like LOS

Engine Control Unit ECU



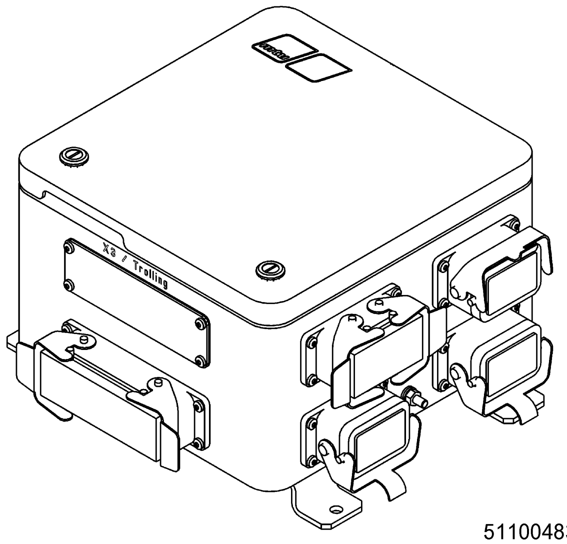
Central control unit for the engine
- Transfer of MCS-5 and RCS-5 inputs to the engine
- Control of the injection system
- Acquisition and evaluation of engine operating states
- Limit value monitoring
- In case of inadmissible states and limit value violations: Initiation of power reduction, engine stop or emergency engine stop (configurable)

Data relating to engine and plant settings in exchangeable memory modules

Self-monitoring

Diagnosis via serial interface for dialog unit

GCU 6



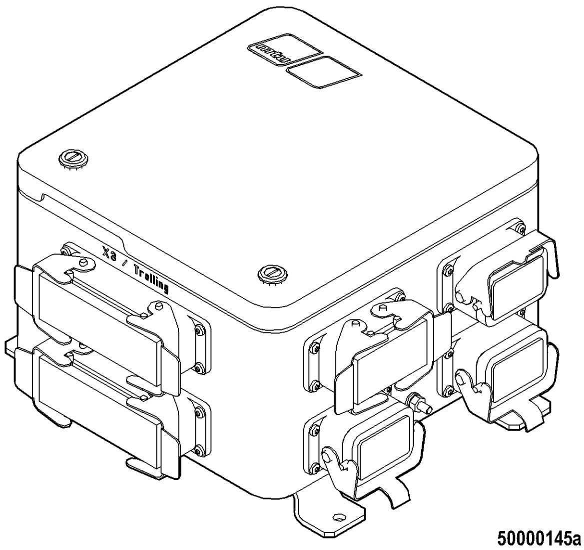
51100483a

Central control unit for the gearbox without Trolling feature

- Transfer of MCS-5 and RCS-5 inputs to the gearbox
- Control of actuators
- Acquisition of current gearbox state
- In case of inadmissible states: Initiation of alarms or engine stop

No controls or indicators of its own

Gear Control Unit GCU 3

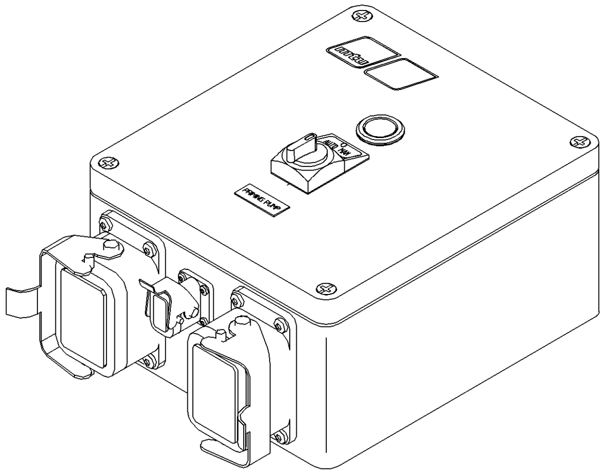


50000145a

Central control unit for the gearbox, like GCU 6

Additional control of a Trolling unit installed on the gearbox

Priming Pump Controller PPC

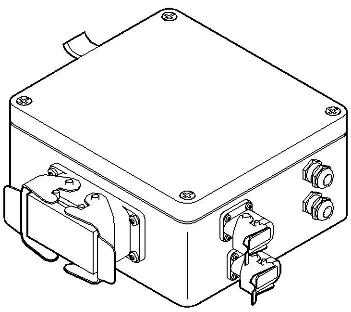


50800365a

Types PPC 5 to PPC 8, depending on AC input voltage peak value, frequency and number of phases
.
Switches the voltage for an oil priming pump via a contactor.

- Automatic or manual, depending on switch position
- Limits output voltage, e.g. in case of pump fault

Terminal box X010



50000221a

Connection of

- Battery-charging generator
- Starter
- Barring gear limit switch
- Priming Pump Controller

TIM ID: 0000006873 – 001

Operating Instructions

4 Monitoring and Control System MCS-5

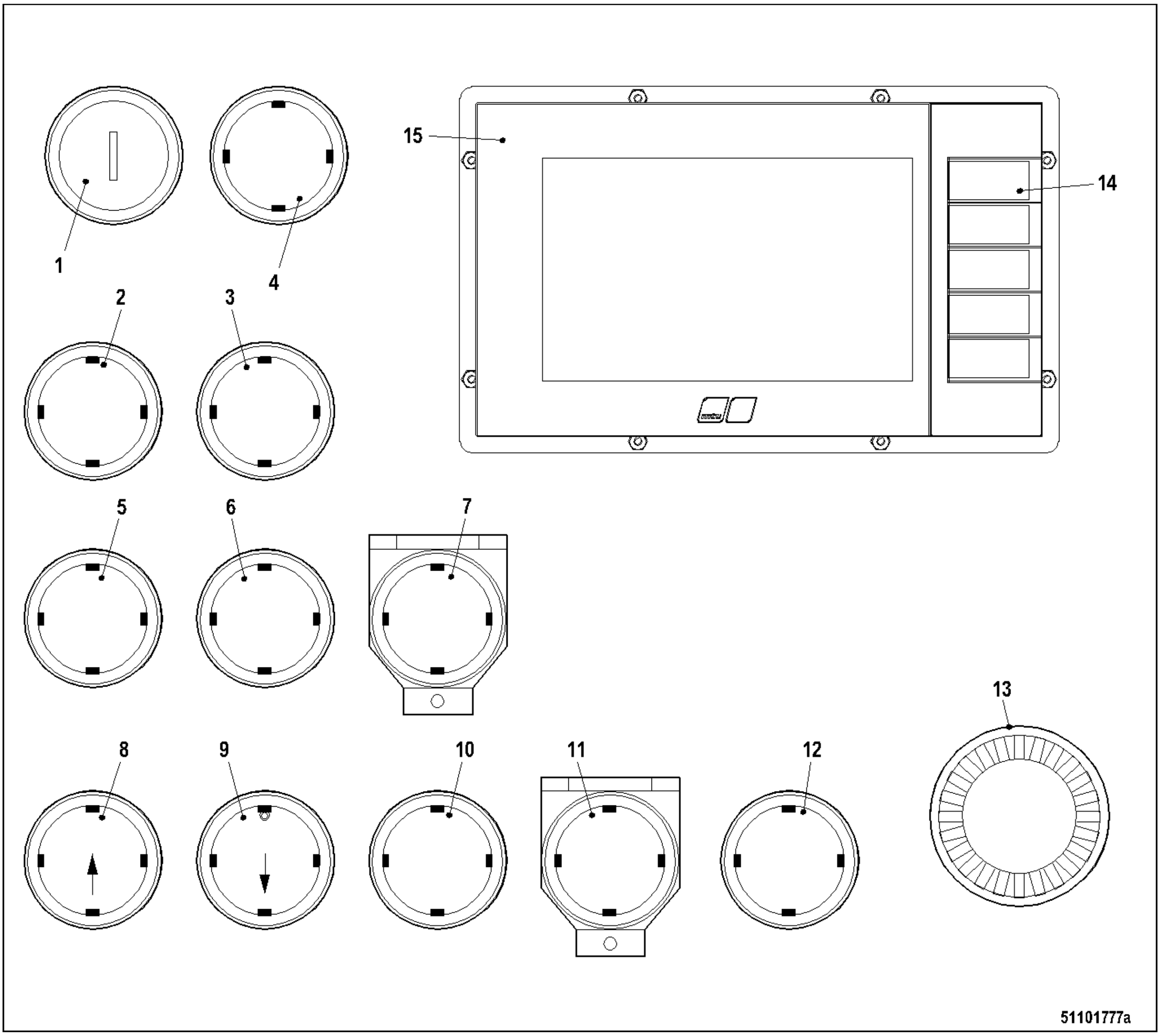
4.1 Controls and Displays

4.1.1 MCS-5 – Controls and displays

MCS-5 – Indicators and pushbuttons

The arrangement of the controls depends on the specific design of the control stand concerned.

TIM ID: 0000006233 – 007



No.	Inscription	Meaning / Function	Main control stand	Slave control stand
1		Key switch to switch the entire system on/off.	X	
2	ENGINE/GEAR Alarm	Lights up when the engine/gearbox assume an inadmissible operating state.	X	
3	READY FOR START/STOP	• Lights up when the engine is ready for starting. • Lights up when the engine can be stopped.	X	X
4	SENSOR/SYSTEM FAULT	Lights up when the electronic system is malfunctioning.	X	

TIM ID: 0000006233 – 007

No.	Inscription	Meaning / Function	Main control stand	Slave control stand
5	START	• Pressing the pushbutton initiates the automatic engine start sequence. • Lights up during the start sequence.	X	X
6	STOP	• Pressing the pushbutton initiates the stop sequence. • Lights up during the stop sequence.	X	X
7	EMERGENCY STOP	• Pressing the pushbutton initiates an emergency stop. • Lights up when an emergency stop has been initiated. • Lights up when the emergency air-shutoff flaps are closed.	X	X
8	DIM ↑	Holding down the button increases LCD background illumination.	X	
9	DIM ↓	Holding down the button decreases LCD background illumination.	X	
10	COMBINED ALARM/ACKN.	• Pressing the pushbutton switches alarm signaling off. • Pressing the pushbutton acknowledges an alarm. • Lights up when a summary alarm is signaled.	X	
11	OVERRIDE	• Pressing the pushbutton overrides the engine safety system. • Lights up when the Override function is active.	X	
12	COMBINED ALARM	Lights up when a summary alarm is signaled.		
13	(None)	Alarm horn used for audible signaling of a summary alarm.		
14	Function key 1 Function key 2 Function key 3 Function key 4 Function key 5	• Function keys may be used to operate the user interface. • Key functions vary and are represented graphically on the display.	X	
15	Display	Displays all power train operating states (version with display only).	X	

TIM ID: 0000006233 – 007

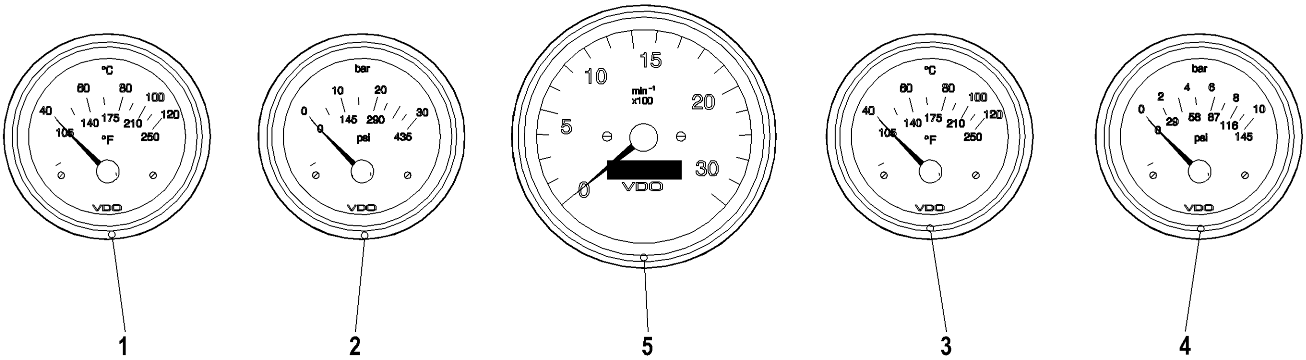
MCS-5 – Version with single-point alarm indicator lamps

This version features nine indicator lamps and two illuminated pushbuttons to provide information about power train operating states as the display is not included in the scope of supply.

Color	Inscription	Meaning / Function	Main control stand	Slave control stand
Red	AUTO STOP/REDUC-TION	• Lights up when the engine has been shut down automatically. • Lights up when the engine power has been reduced automatically.	X	
Red	OVERSPEED	Lights up when the engine has been shut down due to overspeeding.	X	
Red	LUBE OIL PRESSURE LOW	Lights up when lube oil pressure is too low.	X	
Red	COOLANT TEMPERATURE HIGH	Lights up when coolant temperature is too high.	X	
Red	GEAR OIL PRESSURE LOW	Lights up when gear control oil pressure is too low.	X	
Yellow	GEAR OIL TEMPERATURE HIGH	Lights up when gear control oil temperature is too high.	X	
Yellow	COOLANT LEVEL LOW	Lights up when insufficient coolant is detected.	X	
Yellow	LEAK FUEL LEVEL HIGH	Lights up when the fuel line is leaking.	X	
Yellow	WATER IN FUEL PREFILTER	Lights up when water is detected in the fuel prefilter.	X	
Red	ENGINE/GEAR ALARM	Lights up when a summary engine/gearbox alarm is signaled.	X	
Yellow	SENSOR/SYSTEM FAULT	Lights up when a summary alarm for an electronic fault is signaled.	X	

TIM ID: 0000006233 – 007

MCS-5 – Analog display instruments

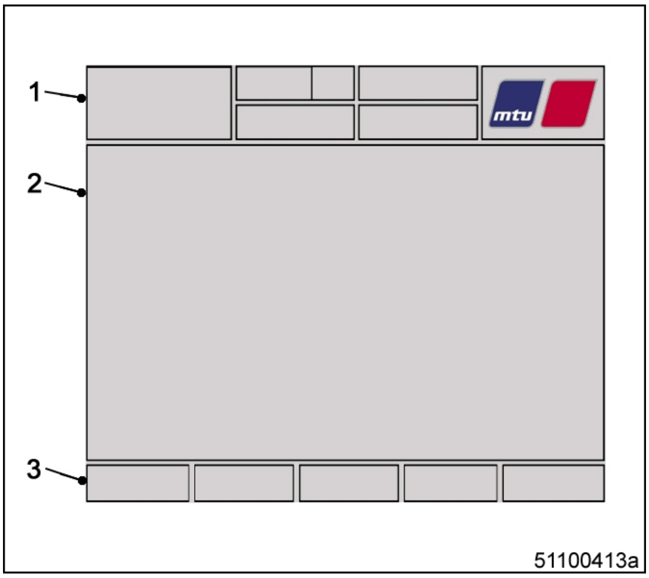


51100404a

No.	Inscription	Meaning / Function	Main control stand	Slave control stand
1	Gear oil temperature	Indicates gear oil temperature.	X	
2	Gear oil pressure	Indicates gear control oil pressure.	X	
3	Coolant temperature	Indicates coolant temperature.	X	X
4	Lube oil pressure	Indicates engine lube oil pressure.	X	
5	Engine speed	Indicates engine speed and engine operating hours*.	X	X
* An hour meter is only provided on the speed instrument on main control stand 1.				

4.1.2 LOP display – Overview of the screen pages

General structure of the screen pages



No.	Designation	Meaning / Function
1	Status bar	• Designation of the selected screen page. • Number of alarms pending. • Override display field: A message is displayed if Override is active, the field otherwise remains empty. • Combined alarm display field: “Combined alarm” is displayed in this field as soon as an alarm is pending, the field otherwise remains empty. • System status display field: A message is displayed when a system status is pending, the field otherwise remains empty. The following messages are displayed: - Initializing - Bus error - Boot-up - Download (loading project data) • MTU logo
2	Central display area	Displays the various pages (graphic or text).
3	Function key assignment F1 to F5	Displays function key assignment of the selected screen page.

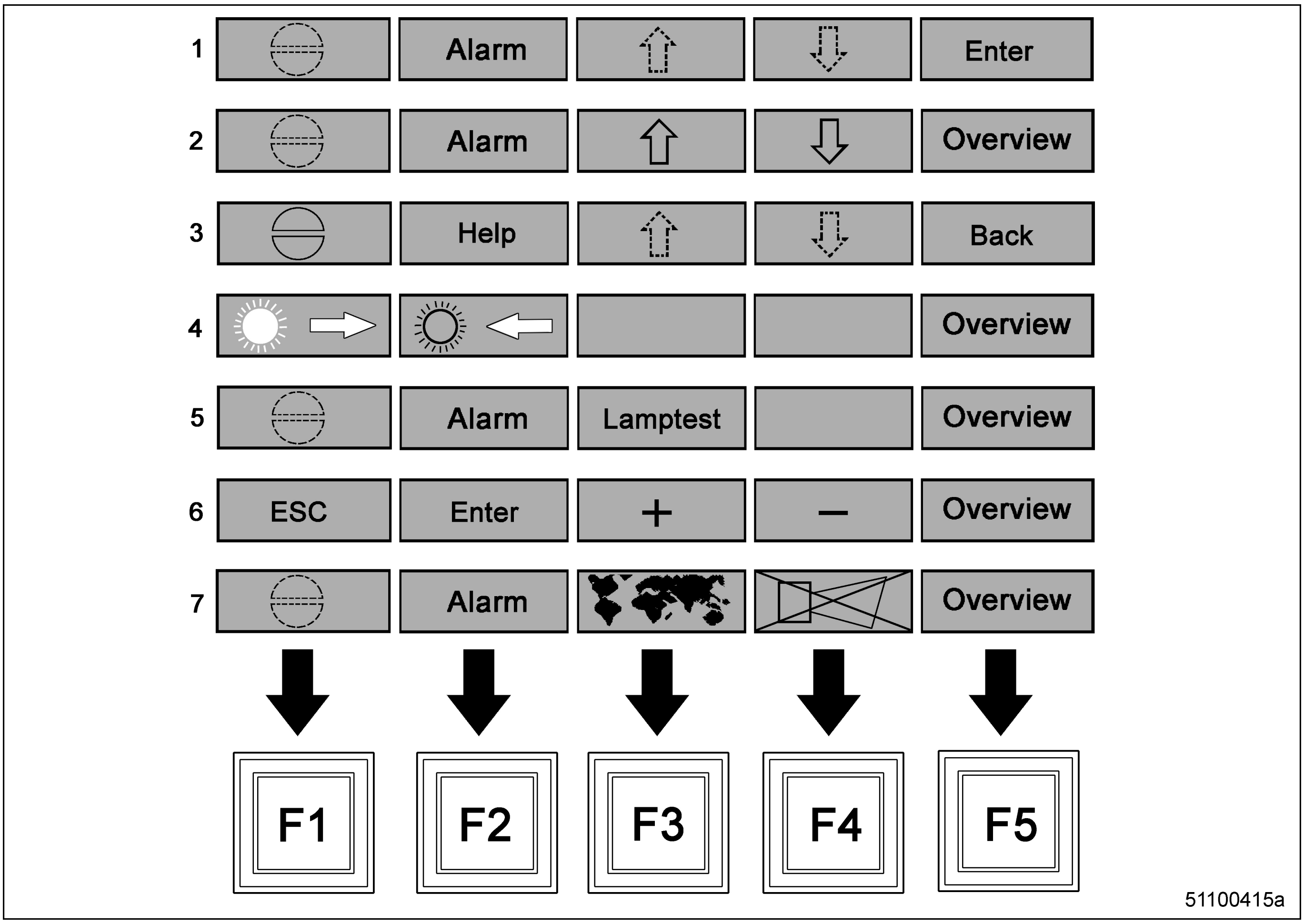
Operating function keys F1 to F5

Information about the operating states of the power train and the overall electronic system can be retrieved on various screen pages on the display.

The display is controlled by means of the five function keys F1 to F5 under the screen. Function assignment varies depending on the screen page displayed. Their current assignment is indicated by symbols on the bottom edge of the screen.

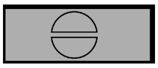
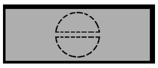
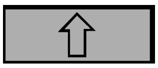
The figure below shows an overview of function key assignment on the various screen pages.

TIM ID: 0000007105 – 004

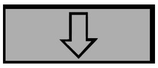
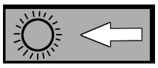
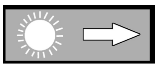


1 Overview page
2 Graphic page; Measuring point list; Help page
3 Alarm page
4 Contrast page
5 Service page in display mode
6 Service page in edit mode; Parameter page
7 System page; Status page

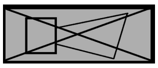
Meaning of the symbols

Symbol	Key	Meaning / Function
	F1	Alarm acknowledgment.
	-	Alarm acknowledgment not possible.
Alarm	F2	Retrieves the Alarm page.
	F3	• Navigate up: Selects a menu option on the Overview page. • Navigate up: Scrolls up page-by-page on graphic pages, Measuring point list, Help page and Alarm page. • The function key is inactive when the arrow is dotted.
	-	Uppermost level has been reached. Not possible to continue navigating up.

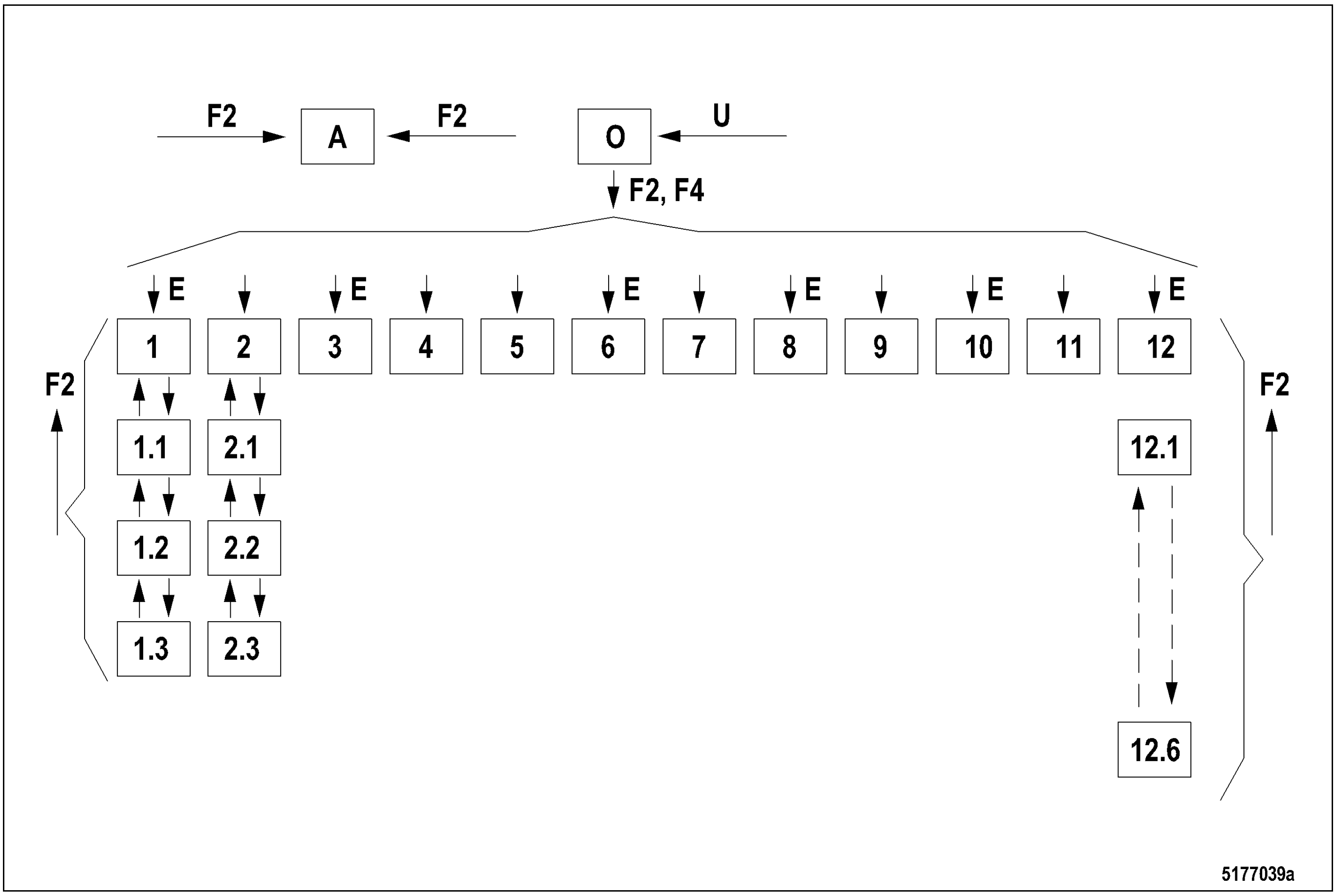
TIM ID: 0000007105 – 004

Symbol	Key	Meaning / Function
	F4	• Navigate down: Selects a menu option on the Overview page. • Navigate down: Scrolls down page-by-page on graphic pages, Measuring point list, Help page and Alarm page. • The function key is inactive when the arrow is dotted.
	-	Lowermost level has been reached. Not possible to continue navigating down.
Enter	F5	Overview page: retrieves the selected menu option.
	F2	Service page in edit mode: Selects the input fields. The selected input field is represented inversely. This indicates that the input value has been activated for processing.
Overview	F5	Retrieves the Overview page.
Help	F2	Retrieves the Help page.
Back	F5	Returns from the Alarm page to the previously selected page.
	F1	Increases brightness in stages: • LCD background illumination • Function key illumination • LED for operating status indication
	F2	Decreases brightness in stages: • LCD background illumination • Function key illumination • LED for operating status indication
ESC	F1	1. Changes made to active variables are not saved in the memory. 2. Exits the input field.
+	F3	Increases the input value.
–	F4	Decreases the input value.
Lamptest	F3	Lamp test: • All illuminated pushbuttons and indicator lamps on the LOP with display/LOS (if applicable) light up brightly. • All illuminated pushbuttons and indicator lamps on the control stand of the power train light up brightly.

TIM ID: 0000007105 – 004

Symbol	Key	Meaning / Function
	F3	Language selection
	F4	Silences the horn.

Menu structure of the screen pages



No.	Designation	Meaning / Function
O	Overview page	Overview of available screen pages
1	Propulsion	Graphic representation of measured values and operating mode of the propulsion plant
1.1	Maxi display	Alphanumeric representation of most important engine operating data
1.2	Consumption display l/h	• Current fuel consumption • Mean trip fuel consumption in liters per hour • Total trip fuel consumption in liters per hour
1.3	Consumption display gal/h	• Current fuel consumption • Mean trip fuel consumption in gallons per hour • Total trip fuel consumption in gallons per hour

No.	Designation	Meaning / Function
2	Engine overview	Graphic representation of measured values
2.1	Engine status	Graphic representation of measured values
2.2	Engine pressure	Graphic representation of measured values
2.3	Engine temperature	Graphic representation of measured values
3	Gearbox overview	Graphic representation of measured values
4	Extension page	Graphic representation of measured values
5	Toroidal-core fault memory page	Displays single-point alarms and alarm history
6	Measuring point list	Displays measured values in text form
7	Brightness page	To adjust the brightness
8	System page	System information
9	BDM page	Displays the memory
10	Service page	Displays system settings and allows modification
11	Alarm page	Displays alarms and their states.
12 to 12.6	Help pages 1 to 6	Explains the alarm messages

Screen pages in detail

Maxi display page

The most important engine operating data is represented in large letters in the display area of the Maxi display page:
- Engine speed (revolutions per minute)
- Injection quantity (percent)
- Coolant temperature (degrees Celsius)
- Lube oil pressure (bar)
- Exhaust turbocharger ETC 2: The field is green when the turbocharger is cut in.

Fuel consumption display page (Unit: Liters)

Fuel consumption data is represented in the display area of the Fuel consumption display page:
- Current fuel consumption (l/h):
  - Left: Alphanumeric display
  - Right: Bargraph display
- Mean trip fuel consumption (l/h):
  - Display is reset by pressing F1
  - Left: Alphanumeric display
  - Right: Bargraph display
- Overall fuel consumption (l/h)
- Overall trip fuel consumption (l/h)
  - Display is reset by pressing F1
- Trip duration (h)
- The time (in seconds) for which the F1 key must be held down in order to reset the mean and total fuel consumption displays is shown at the bottom of the screen page.

Fuel consumption display page (Unit: Gallons)

Fuel consumption data is represented in the display area of the Fuel consumption display page:
- Current fuel consumption (gal/h)
  - Left: Alphanumeric display
  - Right: Bargraph display

TIM ID: 0000007105 – 004

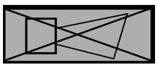
- Mean trip fuel consumption (gal./h)
  - Display is reset by pressing F1
  - Left: Alphanumeric display
  - Right: Bargraph display
- Overall fuel consumption (gal./h)
- Overall trip fuel consumption (gal./h)
- Trip duration (h)
- The time (in seconds) for which the F1 key must be held down in order to reset the mean and total fuel consumption displays is shown at the bottom of the screen page.

System page

The System page is retrieved automatically in case of a system fault.

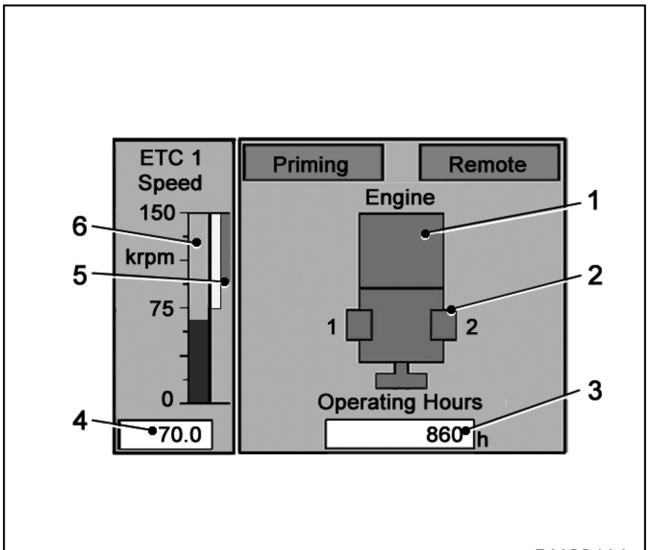
System status and software version are shown in the display area of the System page:
- Project Version: Internal counter
- Project Release: Internal counter
- Display Temperature: Internal display temperature
- Graphic Version: Version number of the order-specific user software developed with QVis
- Qvis Version: Version number of QVis with which the user software was developed
- Term Version: Version number of the function software of the Local Operating Station LOS
- State CAN 1: Operating state of the Default CAN bus
- State CAN 2: Operating state of the Redundant CAN bus
- System State: Operating state of the system
- Internal State: Internal message from the display
- Printer State: Operating state of the printer (not used for BlueLine)
- MEM State: Status of the memory for the Backup function (not required for BlueLine)
- BDM State: Status of the Backup function (not required for BlueLine)

The following operating functions are available on the System page:

Symbol	Key	Meaning / Function
	F3	The language used on the display pages can be selected here. The following eight languages are available for selection as standard: • English • German • French • Italian • Spanish • Dutch • Chinese (simplified character set) • Portuguese Note: Up to two additional languages may be implemented to meet customer requirements.
	F4	The horn associated with the display can be silenced when it is sounding by pressing this key.

Graphic pages

Current operational data of the plant such as engine speed, injection quantity, lube oil pressure and coolant temperature are shown in the display area of the graphic pages.



51100414a

No.	Designation	Meaning / Function
1	Graphic symbol engine	Represented in color when a certain part of the plant is active (e.g. engine block symbol turns green when the engine is running).
2	Graphic symbol exhaust turbocharger	Represented in color when the exhaust turbocharger concerned is cut in.
3	Text field	Text display (e.g. engine operating hours)
4	Numeric display field	Measured value is displayed as a number.
5	Bar chart for limit value	Bar indicates the limit value • Yellow: 1st limit value • Red: 2nd limit value
6	Bar chart for measured value	Bar grows in proportion to measured value increase.

One of the following messages is displayed in place of the numerical measured value if it is outside the valid measuring range:

- SD Sensor defect
- MD Missing data
- ## Measured value outside display range

The bar chart remains blank in such cases.

Extension page

Additional current operational data of a system (e.g. starting-air pressure) are shown in the display area of the Extension page in the same way as on the other graphic pages.

Toroidal-core fault memory page

The Toroidal-core fault memory page displays single-point alarms. It also displays alarm history.

Measuring point list

Configured measuring points which are not represented on the graphic pages are displayed alphanumerically in the display area of the Measuring point list.

- Left: Measuring point names
- Right: Measured values
  - Status of binary values (Yes, No)
  - Analog values with units of measure

Invalid measured values are identified as follows:

- SD Sensor defect

TIM ID: 0000007105 – 004

- MD Missing data
- ## Measured value outside display range

This state is displayed on the Alarm page.

Brightness page

A brightness bar chart is shown in the display area of the Brightness page.

Furthermore, the following information about additional settings is provided here:
- To reset the LCD to the factory default settings: Press function keys F1 and F5 simultaneously for three seconds.
- Local Operating Station LOS: The brightness of the keypad to the right of the display can be adjusted with the two function keys F1 and F2.
- Local Operating Panel LOP with display DIS: The brightness of the key pad to the right of the display can be adjusted via this page.

Service page

System settings are shown (in display mode) and can be modified (in edit mode) in the display area of the Service page.
- Opening the Service page in display mode:
  - Opens automatically ten seconds after booting.
- Opening the Service page in edit mode:
  - Open intentionally within ten seconds of booting.
- System variables on the Service page:
  - CAN Baud Rate
    - 125 Kbit/s (default)
    - 250 Kbit/s
  - CAN Node Number
    - 1 ... 31
  - Node Guarding
    - Off = Node guarding is inactive
    - Active = Node guarding is active
  - Horn
    - On = Internal horn off
    - Off = Internal horn on
  - Horn Test
    - On / Off = Activates / deactivates horn test
  - Printer Driver
    - On / Off = Activates / deactivates printer function
  - Printer Baud Rate
    - Sets the transmission rate of the printer interface

Service page in display mode

Lamp test:
- Press and hold down the F3 key.
- All illuminated pushbuttons and lamps are brightly lit as long as the F3 key is held down.

Service page in edit mode

The settings for CAN baud rate, CAN node number and node guarding must not be changed as this would result in display panel malfunction.

BDM page

The status of the Backup Data Module is shown in the display area of the BDM page.

BDM functions are not required for BlueLine. "Off" is always displayed next to BDM State.

Alarm page

The alarms are listed in chronological order of their occurrence in the display area of the Alarm page. The Alarm page is structured as follows:

The total number of pending alarms is shown in the status bar of the display.

1st column: Name of the alarms
2nd column: Alarm status
- UNACK (unacknowledged) for unacknowledged alarms
- ACK (acknowledged) for acknowledged alarms

3rd column:Alarm type (yellow, red)

- Each new alarm which is received is added as an unacknowledged alarm with the status UNACK at the bottom of the alarm list.
- The entry flashes in this state.
- The status changes to ACK. when the alarm is acknowledged.
- The flashing entry turns steady.
- The alarm remains in the list until it no longer applies.

Standardized abbreviations for alarm names (in column 1)

Entry	Meaning
AL...	Alarm: Warning or alarm due to a binary signal.
LO...	Low: Warning or alarm due to a limit value violation.
HI...	High: Warning or alarm due to a limit value violation.
TD...	Transmitter Deviation: Warning or alarm due to excessive deviation between the analog values of two complementary switches.
SD...	Sensor Defective: Warning or alarm due to a sensor fault.
SF...	Switch Fault: Warning or alarm due to an inadmissible combination of states of two complementary switches.
SS...	Security Shutdown: Alarm leading to an emergency engine shutdown.
MG...	Message: Message from an external system (e.g. ECU).
SE...	System Error: Warning due to node failure on the Default field bus.
DL...	Default Lost: Warning due to node failure on the Default field bus.
RL...	Redundancy Lost: Warning due to node failure on the redundant field bus.
PB...	Push Button: Status indication due to activation of certain control buttons.
Red	Alarm from MCS-5.

Standardized abbreviations for alarm names (in column 2)

Entry	Meaning
UNACK	Unacknowledged Alarm: Warning, alarm or message from an external system is active and unacknowledged.
UNACK-ALM (printout only)	Unacknowledged Alarm: Warning, alarm or message from an external system is active and unacknowledged.
UNACK-RTN (printout only)	Unacknowledged Return: Warning, alarm or message from an external system has disappeared without acknowledgment.
ACK	Acknowledged Alarm: Warning, alarm or message from an external system is active and acknowledged.

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Entry	Meaning
ACK-ALM (printout only)	Acknowledged Alarm: Warning, alarm or message from an external system is active and acknowledged.
ACK-RTN (printout only)	Acknowledged Return: Warning or alarm has disappeared after acknowledgment.

Standardized abbreviations for alarm names (in column 3)

Entry	Meaning
Yel	Yellow: Warning from MCS-5 or message from external system (e.g. ECU).
Red	Alarm from MCS-5.

Help pages

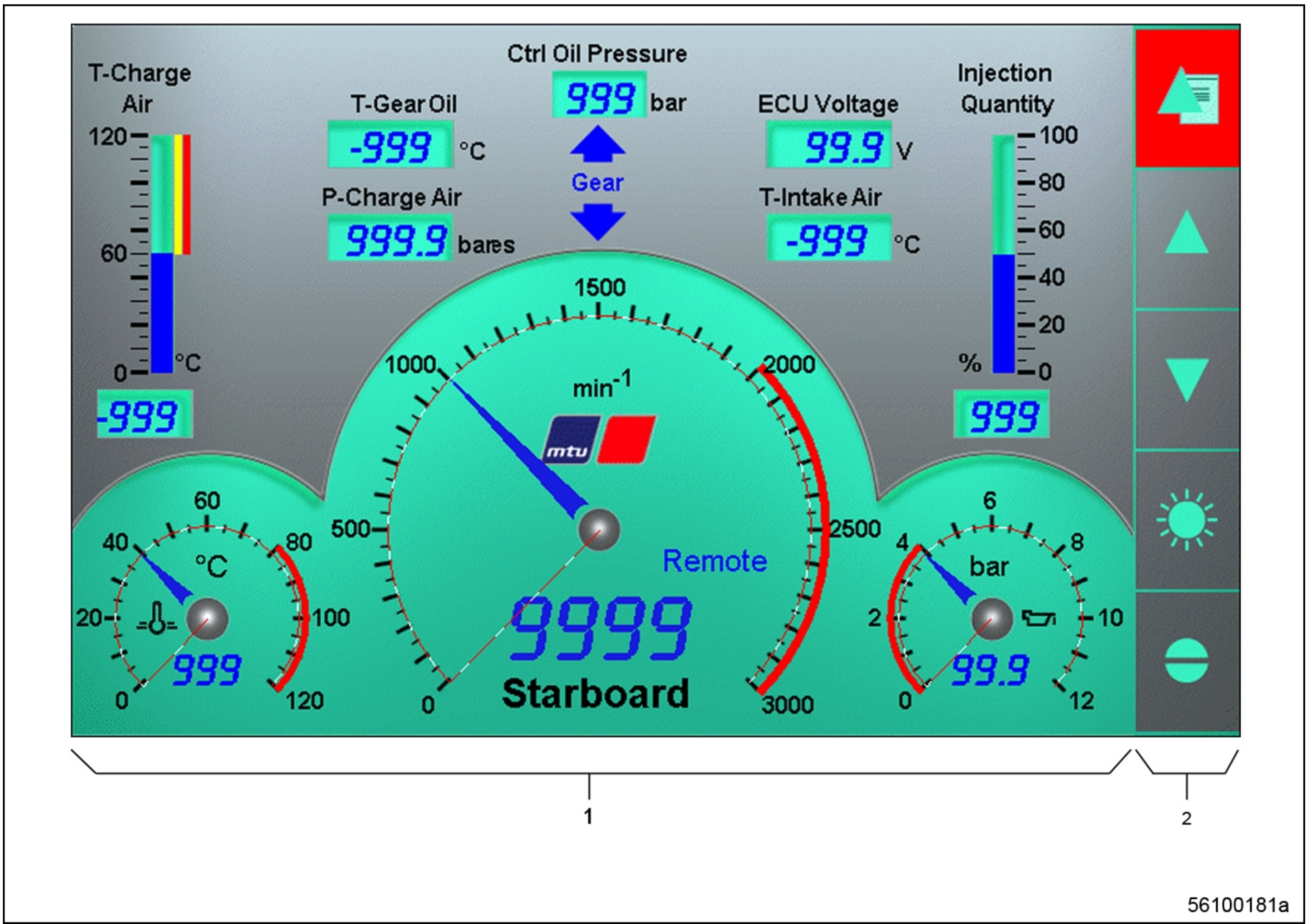
The structure of the alarm messages is explained in the display area on the Help pages:

- Help pages 1 to 4: System fault codes with the associated system fault designations.
- Help pages 5 and 6: Abbreviations and the associated descriptions of message types.

TIM ID: 0000007105 – 004

4.1.3 Display MFD – Overview of screen pages

Screen Page layout



No.	Designation	Meaning / Function
1	Central display area	Display of various screen pages
2	Function key 1 to 5 assignment	Indicates current key assignment of screen page on display.

Function key operation

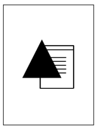
Information on the operating states of up to two power trains and the entire electronic system can be retrieved and edited on various screen pages on the display. The layout of the screen pages features a linear design.

The display is operated by means of five keys on the right of the display. Their respective functions vary depending on the screen pages.

Their present function is indicated by symbols on the right edge of the screen.

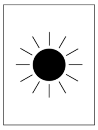
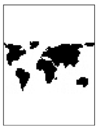
TIM ID: 0000029946 – 002

Symbol meanings

Symbol	Meaning / Function
	• Open Alarm Page • Close Alarm Page • Flashing yellow → unacknowledged yellow alarm pending • Flashing red → unacknowledged red alarm pending

▲
▼
	Navigates up and down
	• Propulsion Pages
	  • Engine operating data
	  • Measuring point list
	  • Propulsion pages with high contrast
	  • User settings
	  • Time and date setting
	  • Unit selection
	  • Language selection
	  • Reset trip consumption display (reset with “+” key)
	• User settings with high contrast
	• Fault ring memory
	• Fault ring memory with high contrast
	• System Page (information only – not configurable)
	  • Software information
	  • Bus – Configuration
	  • Ethernet – Configuration
	  • BDM – Information
	  • Hardware – Information
	  • System – Configuration
	• System Page with high contrast
	• Status of system variables
	  • Status of system variables
	• Status of system variables with high contrast

▲ + ▼	Press and hold down simultaneously: Open Overview.
🡅	• Navigate up: Select a menu option on the screen page. • Navigate up: Scroll up page-by-page in the measuring point list and Alarm Page.
🡇	• Navigate down: Select a menu option on the screen page. • Navigate down: Scroll down page-by-page in the measuring point list and Alarm Page.
⊖	• Alarm acknowledgment • Reset trip consumption display (hold down for 10 seconds).
Esc	• Change of present variable is not stored in the memory. • Exit input field.

Symbol	Meaning / Function
+	Increase input value.
−	Decrease input value.
	• Press short: Day/Night switching • Press long: Manual display illumination setting (dimming) opens. • Language selection possible
↵	• Overview Page: Open selected menu option. • Service Page in Edit mode: Select input fields • Save present variables
	Language selection • Pressing the button runs through the available languages.

Screen page representation

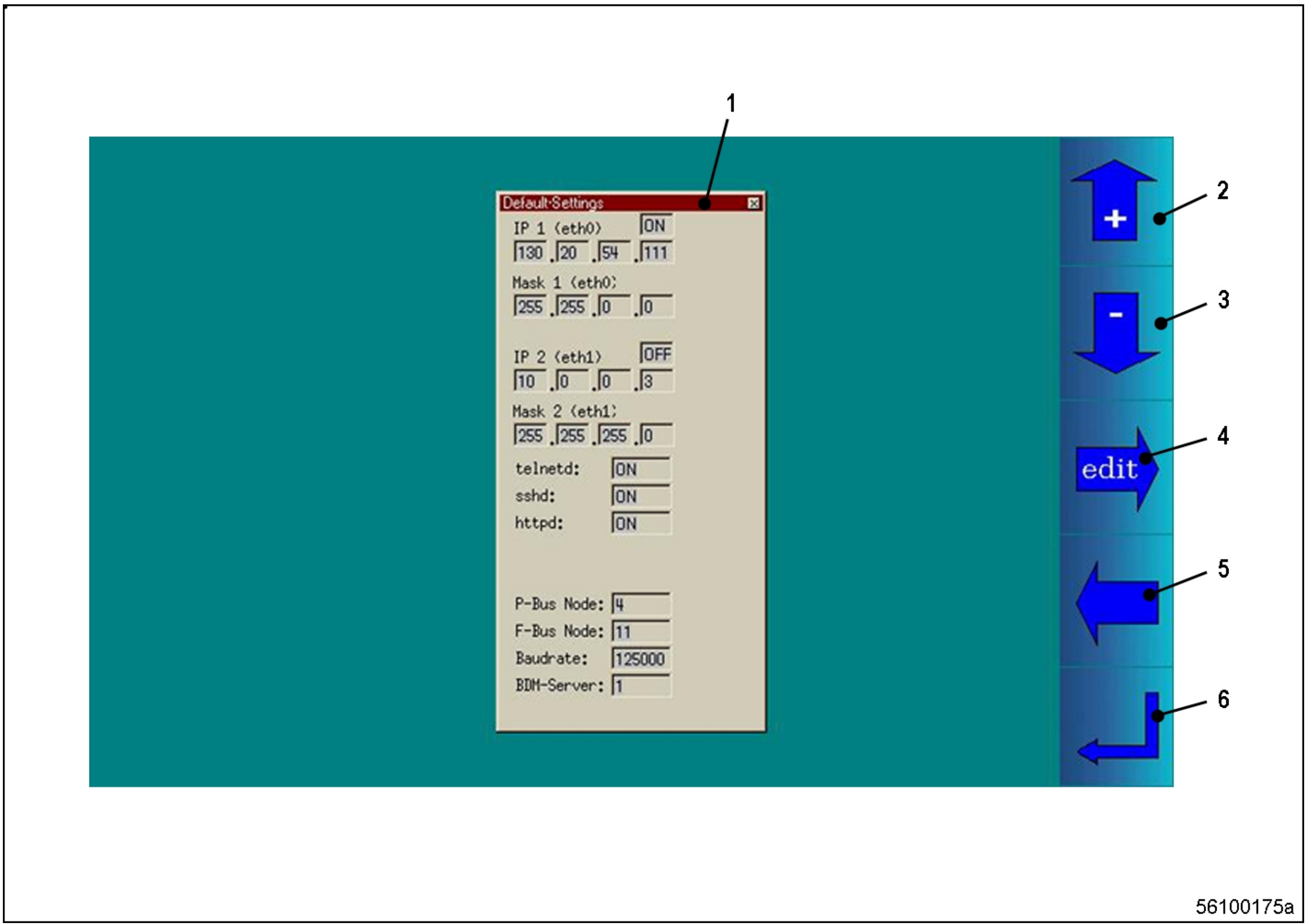
The screen pages can be represented individually. The values and operating states displayed depend on the respective configuration of the system.

Device configuration page

Display settings are made via the device configuration page. The device configuration page can be opened during system startup by simultaneously pressing function keys 1 and 2.

Two nodes and the baud rate must be set on the MFD display:
- Process bus node (P-Bus Node) to allocate the power train
  - Node no. 4 = Starboard
  - Node no. 5 = Port
- Field bus node (F-Bus Node) to allocate the control stand
  - Node no. 11 = Main control stand
  - Node no. 14 = Slave control stand
- Determine baud rate (see “Anlagen.txt”)

TIM ID: 0000029946 – 002



Pos.	Meaning
1	Adjustable values on the device configuration page
2	Set values in active input field • Increase values
3	Set values in active input field • Decrease values
4	Navigate between individual input fields • Navigate forwards
5	Navigate between individual input fields • Navigate backwards
6	• Adopt settings • Exit device configuration page

TIM ID: 0000029946 – 002

4.2 Operation

4.2.1 Switching on the overall BlueLine system

Preconditions

- The on-board power supply is switched on.

CAUTION	Damage to engine/plant. **Major material damage!** • Before switching on, ensure that the engine/plant is ready for operation. • Before switching on, ensure that all housings are closed. • Before switching on, ensure that no work is in progress anywhere on the entire system.

Switching on the overall BlueLine system

1. Insert the key into the key switch on the main control stand.
2. Turn the key clockwise in the key switch.

   Result:
   - The background illumination of the Monitoring and Control System MCS-5 is switched on.
   - All indicator lamps and illuminated pushbuttons light up briefly on all control stands (automatic lamp test).
   - The light emitting diodes (LED) in the keys on all command units glow.
   - The buzzers of the Remote Control System RCS-5 sound on all control stands capable of assuming initial command.
   - The COMMAND light emitting diodes flash on all control stands capable of assuming initial command.
   - The green ON illuminated pushbutton on Local Operating Panel LOP lights up for the power train.
   - The green READY FOR OPERATION illuminated pushbutton on the optional Local Operating Station (LOS) lights up for the power train.
3. Repeat the procedure for other power trains (if applicable).

   Result: Procedures are repeated in the same way as for the first power train.

TIM ID: 0000006235 – 002

4.2.2 Adjusting brightness of indicators / instruments

Preconditions

- Overall BlueLine system of the power train is switched on.

⚠ CAUTION	Wrong interpretation of display instruments. **Wrong action may cause major damage!** • Adjust contrast of display instruments and illuminated keys to suit ambient conditions.

Dimming instruments/indicators

Note: Slave control stands do not feature illuminated pushbuttons for dimming. The illumination is controlled from the main control stand. Each power train has dedicated illuminated pushbuttons for dimming.

1. Press and hold down one of the following illuminated pushbuttons as required:
   - DIMM UP: Increases illumination brightness.
   - DIMM DOWN: Decreases illumination brightness.
2. Release the illuminated pushbutton as soon as the desired setting has been reached.
   Result:
   - Background illumination of the analog display instruments is adjusted accordingly.
   - Illumination of indicator lamps which are on is adjusted accordingly.

Lamp test

1. Press DIMM UP and DIMM DOWN simultaneously.
   Result: All lamps light up.
2. Release DIMM UP and DIMM DOWN.

TIM ID: 0000006236 – 002

4.2.3 Starting the engine

Preconditions

- Engine has been prepared for startup (→ Engine Operating Instructions).
- Overall BlueLine system of the power train is switched on.
- Propulsion control lever on the command unit of the commanding control stand is set to NEUTRAL.
- Gearbox is in neutral position.
- No engagement request applied.
- Illuminated pushbutton LOCAL OPERATION on the Engine Control System ECS-5, when equipped with LOS or Local Operating Panel LOP with display, is dark.

⚠ **DANGER**	Unguarded rotating and moving engine components. **Risk of serious injury - danger to life!** • Before barring or starting the engine, ensure that nobody is in the danger zone. • After working on the engine, check that all protective devices have been reinstalled and all tools removed from the engine.

Starting the engine at the control stand

1. Briefly press illuminated pushbutton START.

   Result:
   - The illuminated pushbutton START lights up.
   - The automatic start sequence is executed.
   - The engine speed increases.
   - Current measured values are indicated on the display instruments.
   - The engine runs at idling speed on completion of the start sequence.
   - The illuminated pushbutton START goes out when the engine speed passes 300 rpm.
   - The power train is ready for engagement.
2. Repeat the procedure for other engines (if applicable).

   Result:
   - The start sequence is repeated in the same way as for the first engine.
   - The power train is ready for engagement.

Note: The engine can also be started at the following places:

Local Operating Station LOS (if applicable) (→ Page 124)**.**

Service interface of Local Operating Panel LOP (for servicing only) (→ Page 131)

TIM ID: 0000006238 – 002

4.2.4 Override function – Activation

CAUTION	Inadmissible operational condition. **Major material damage!** • Use override function only in hazardous situations to ensure full capability in case of engine malfunctions.

Note: The Override function involves a large number of operating states which would normally lead to automatic power reduction or engine shutdown being ignored by the overall system:
- With the engine at a standstill:
  Start interlocks are ignored, e.g. the engine can be started even with the gearbox engaged.
- With the engine running:
  Engine operating limit value violations no longer lead to power reduction or engine shutdown.
  Exception: Violation of the overspeed limit value still leads to shutdown.

Activating Override at the control stand

Note: MTU refuses to accept warranty claims for engine damage incurred when the Override function is active! Activation of the Override function is recorded in the engine governor.

1. Raise the protective flap on the illuminated pushbutton OVERRIDE.
2. Press illuminated pushbutton OVERRIDE.
3. Close the protective flap.
   Result:
   - The illuminated pushbutton OVERRIDE lights up.
   - The alarm horn sounds.
   - The illuminated pushbutton COMB. ALARM/ACK. flashes.
4. Press the illuminated pushbutton COMB. ALARM/ACK..
   Result:
   - The alarm horn is silenced.
   - The illuminated pushbutton COMB. ALARM/ACK. lights up.
   - The engine runs in Override mode.
   - Respond to any malfunctions and alarm messages manually.

TIM ID: 0000006239 – 003

4.2.5 Override function – Deactivation

Preconditions

- Operating mode Override is activated.

Deactivating Override

1. Raise the flap covering the illuminated pushbutton OVERRIDE on any control stand.
2. Press the illuminated pushbutton OVERRIDE.
   Result:
   - The illuminated pushbutton OVERRIDE is dark.
   - The operating mode Override is deactivated.
3. Close the protective flap.

TIM ID: 0000006241 – 001

4.2.6 Stopping the engine

Preconditions

- Propulsion control lever of the power train on the commanding control stand is set to NEUTRAL.
- Indicator lamp READY FOR START/STOP is lit.
- Engine is running at idling speed.

Stopping the engine at the control stand

1. Briefly press illuminated pushbutton STOP.
   Result:
   - The illuminated pushbutton STOP lights up.
   - The automatic stop sequence is executed.
   - The engine speed decreases.
   - Current measured values are indicated on the display instruments at all control stations.
   - The engine is at a standstill when the automatic stop sequence has been completed.
   - The illuminated pushbutton STOP goes out.
   - The gearbox is disengaged.
2. Repeat the procedure for other engines (if applicable).
   Result: The stop sequence is repeated in the same way as for the first engine.
3. Take all the necessary measures on the engine following shutdown (→Engine Operating Instructions)

Note: The engine can also be stopped at the following places:

Local Operating Station LOS (if applicable) (→ Page 127)

Service interface of Local Operating Panel LOP (for servicing only) (→ Page 132)**.**

TIM ID: 0000006240 – 003

4.2.7 Emergency engine stop

Preconditions

- Engine is running.

CAUTION	An emergency stop causes extreme stress to the engine. **Risk of overheating, damage to components!** • Initiate emergency stop only in emergency situations.

Emergency engine stop at the control stand

1. Raise the protective flap on the illuminated pushbutton EMERGENCY STOP.
2. Press illuminated pushbutton EMERGENCY STOP.
3. Close the protective flap.
   Result:
   - The illuminated pushbutton EMERGENCY STOP lights up.
   - The alarm horn sounds.
   - The illuminated pushbutton COMB. ALARM/ACK. flashes.
   - The alarm indicator lamp ENGINE/GEAR ALARM flashes.
   - Engines with emergency air-shut-off flaps: Flaps close.
   - The engine is stopped by shutting down fuel injection.
4. Press the illuminated pushbutton COMB. ALARM/ACK..
   Result:
   - The alarm horn is silenced.
   - The illuminated pushbutton COMB. ALARM/ACK. lights up.
5. Press the illuminated pushbutton COMB. ALARM/ACK. again.
   Result:
   - The alarm indicator lamp ENGINE/GEAR ALARM lights up.
   - The illuminated pushbutton COMB. ALARM/ACK. goes out.
   - The alarm has been acknowledged.
6. Determine and rectify the cause of the shutdown.
7. Open the flaps manually on engines equipped with emergency-air shutoff flaps.
   Result: Engine is ready for starting.

TIM ID: 0000006242 – 001

4.2.8 BlueLine System – Switching off

Preconditions

- Overall BlueLine system of the power train is switched on.
- The engine is at a standstill.

Switching off the overall BlueLine system at the main control stand

1. Turn the key anticlockwise in the key switch

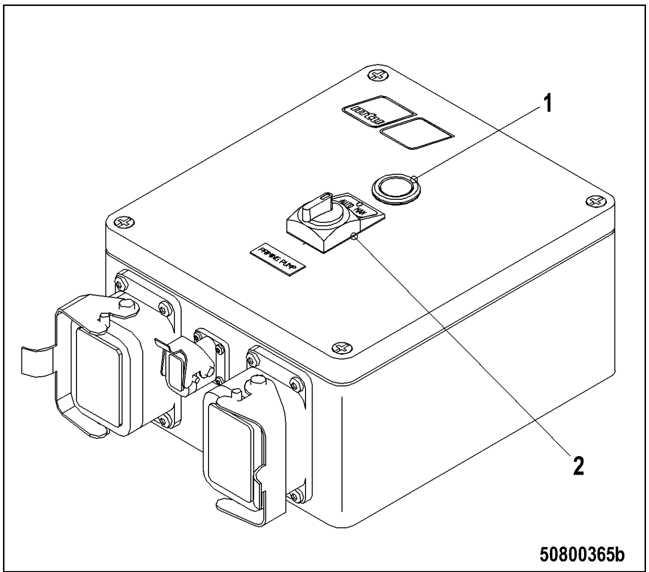
   Result:
   - The background illumination of the display instruments of the Monitoring and Control System MCS-5 is switched off.
   - The light emitting diodes in the keys go out on all command units.
   - The COMMAND light emitting diode on the command unit of the commanding control stand goes out.
   - The green indicator lamp on the Local Operating Panel LOP goes out.
   - The green READY FOR OPERATION illuminated pushbutton on ECS-5 Engine Control Systems featuring the optional LOS goes out.
   - The overall system of the power train is taken out of operation.
2. Repeat the procedure for other power trains (if applicable).

   Result: Procedures are repeated in the same way as for the first power train.

TIM ID: 0000006237 – 001

4.2.9 Priming Pump Controller PPC — Controls and displays

Controls and displays



1 Indicator lamp “oil priming pump ON”
2 Rotary switch for oil priming pump

Switch settings:
AUTO Automatic mode
0 Off
MAN Manual (manual mode)

TIM ID: 0000033312 – 001

4.2.10 Priming Pump Controller PPC – Function check

Preconditions

- Engine shut down and locked-out/tagged-out to preclude starting.

Checking PPC function

1. Turn selector switch on PPC (→ Page 94) to MAN position.

   Result:
   - Indicator lamp lights up
   - Oil priming pump running
2. Turn selector switch on PPC (→ Page 94) to AUTO position.

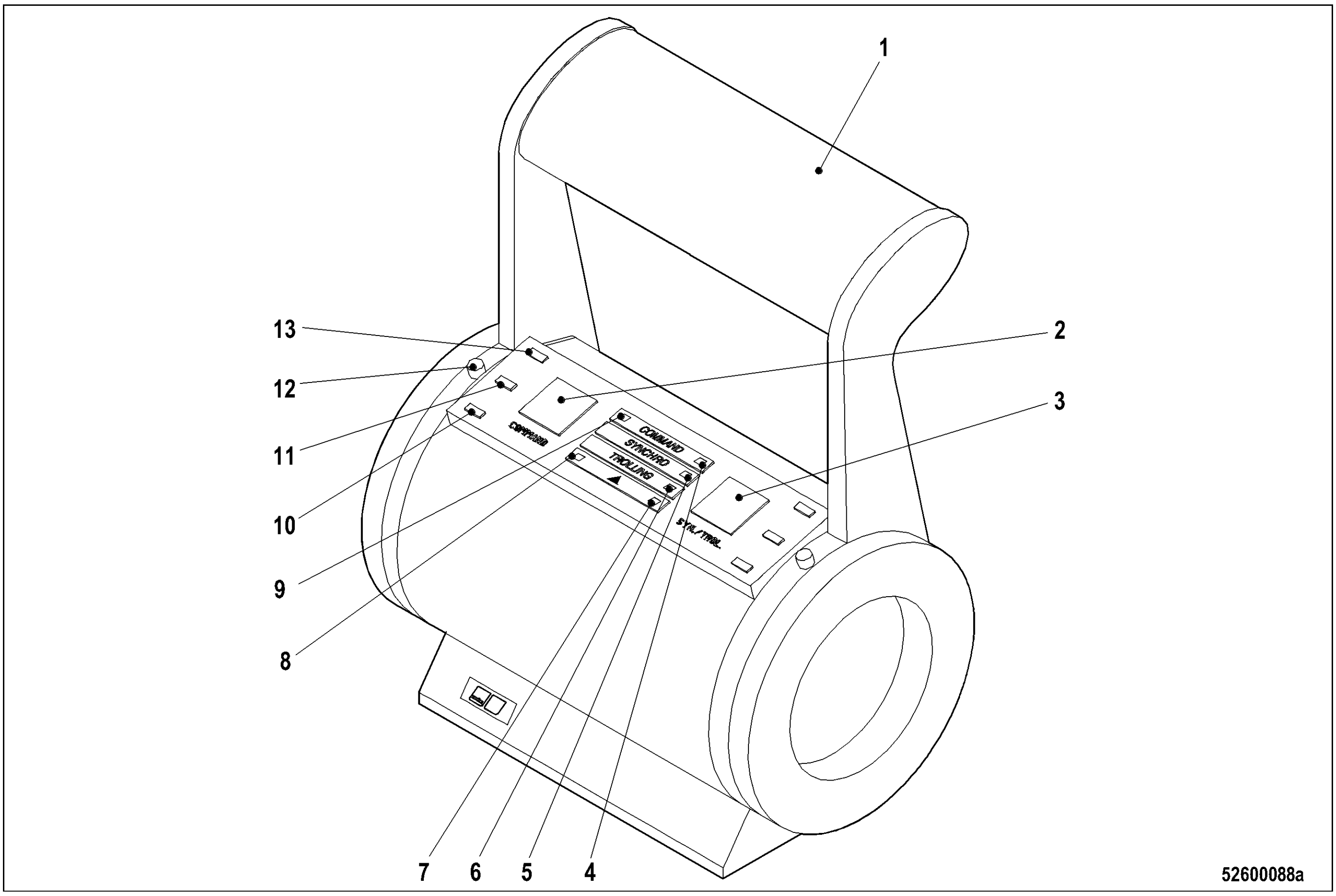
TIM ID: 0000007114 – 001

TIM ID: 0000007114 – 001

5 Remote Control System RCS-5

5.1 Controls and Displays (Standard Version)

5.1.1 Command unit for one shaft

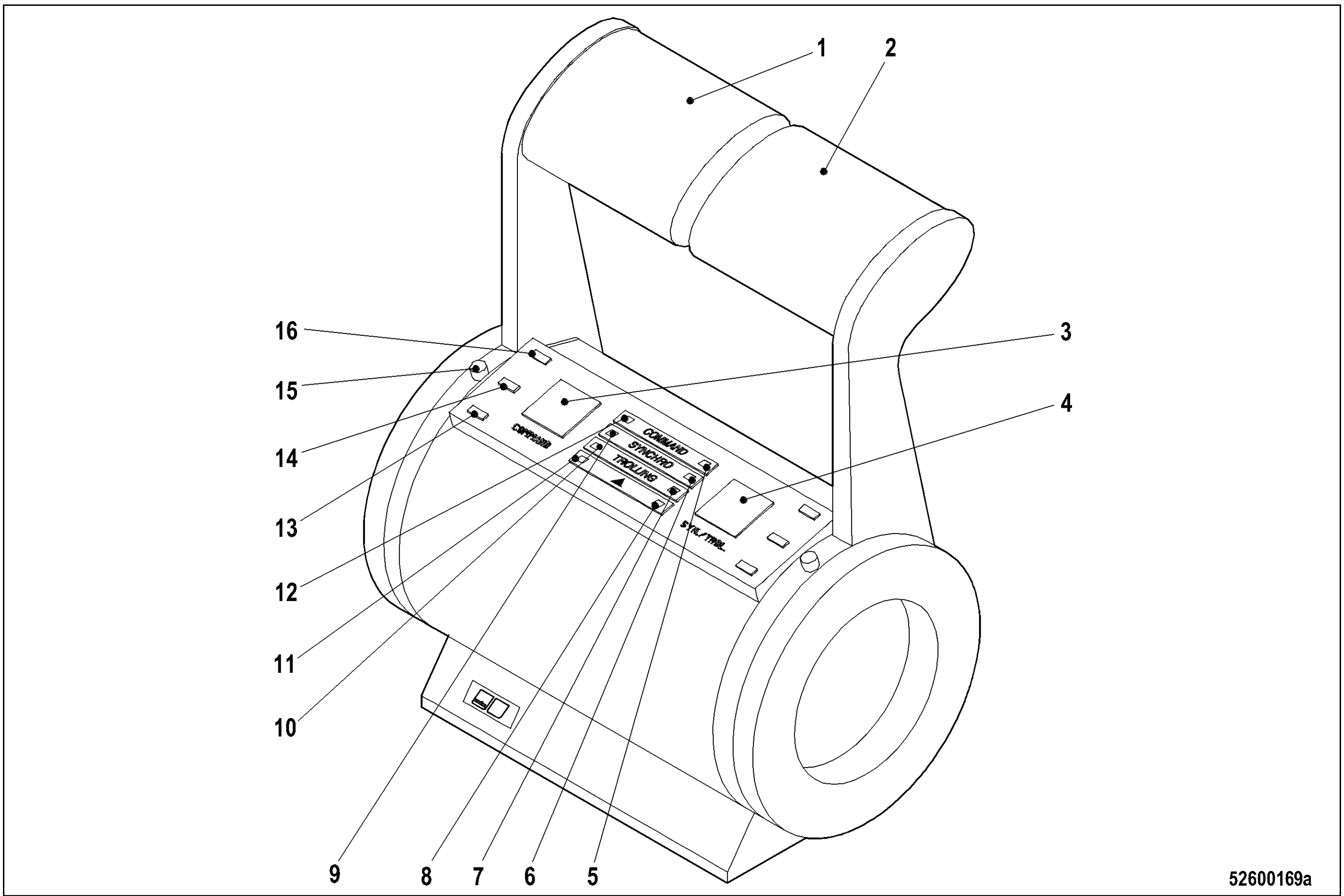


No.	Inscription / Name	Meaning / Function
1	Propulsion control lever	• Propulsion control lever to engage/disengage and set the engine speed. • Position indicates set gear state.
2	COMMAND	• Key to select the commanding control stand. • Key to acknowledge alarms from the Remote Control System.
3	SYN./TROL	Key to activate the optional Trolling mode.
4	COMMAND	• LED flashes when command of the power train can be assumed. • LED lights up when the propulsion control lever is in command of the power train.
5	SYNCHRO	This LED is not assigned on the command unit for one shaft (ROS 9).

No.	Inscription / Name	Meaning / Function
6	TROLLING	LED lights up when Trolling mode is active.
7	Alarm	• LED flashes when an unacknowledged combined alarm is received from RCS-5. • LED lights up when this alarm has been acknowledged.
8	Alarm	This LED is not assigned on the command unit for one shaft (ROS 9).
9	COMMAND	This LED is not assigned on the command unit for one shaft (ROS 9).
10	Astern mark	The gearbox is engaged astern when the pointer (13) is set at or below this mark.
11	Neutral mark	The gearbox is disengaged when the pointer (13) is set at this mark.
12	Pointer	The position of the pointer indicates the gearbox state.
13	Ahead mark	The gearbox is engaged ahead when the pointer (13) is set at or above this mark.

TIM ID: 0000006261 – 002

5.1.2 Command unit for two shafts



No.	Inscription/name	Meaning / Function
1	Port propulsion control lever	• Propulsion control lever to engage/disengage and set the engine speed for the port engine. • Position indicates set gear state of the port gearbox.
2	Starboard propulsion control lever	• Propulsion control lever to engage/disengage and set the engine speed for the starboard engine. • Position indicates set gear state of the starboard gearbox.
3	COMMAND	• Key to select the commanding control stand. • Key to acknowledge alarms from the Remote Control System.
4	SYN./TROL	• Key to activate Single Control Lever mode (SCL). • Key to activate the optional Trolling mode.
5	COMMAND starboard	• LED flashes when command of the starboard power train can be assumed. • LED lights up when the propulsion control lever is in command of the starboard power train.
6	SYNCHRO starboard	LED lights up when Single Control Lever mode (SCL) is active.

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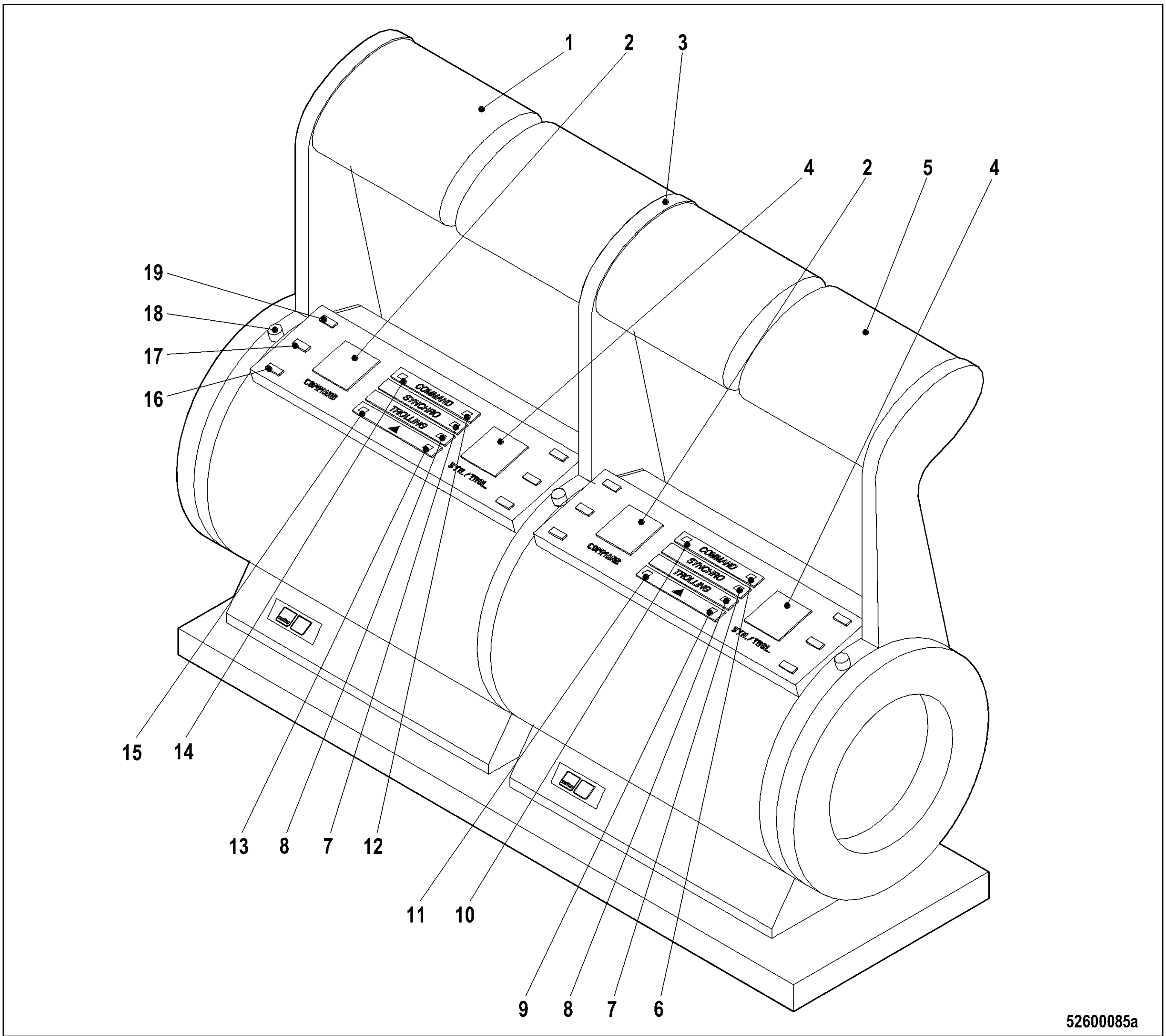
No.	Inscription/name	Meaning / Function
7	TROLLING starboard	LED lights up when Trolling mode is active.
8	Alarm starboard	• LED flashes when an unacknowledged combined alarm is received from the starboard RCS-5. • LED lights up when this alarm has been acknowledged.
9	SYNCHRO port	LED lights up when Single Control Lever mode (SCL) is active.
10	TROLLING port	LED lights up when Trolling mode is active.
11	Alarm port	• LED flashes when an unacknowledged combined alarm is received from the port RCS-5. • LED lights up when this alarm has been acknowledged.
12	COMMAND port	• LED flashes when command of the port power train can be assumed. • LED lights up when the propulsion control lever is in command of the port power train.
13	Astern mark	The gearbox is engaged astern when the pointer (13) is set at or below this mark.
14	Neutral mark	The gearbox is disengaged when the pointer (13) is set at this mark.
15	Pointer	The position of the pointer indicates the gearbox state.
16	Ahead mark	The gearbox is engaged ahead when the pointer (13) is set at or above this mark.

TIM ID: 0000006262 – 005

5.1.3 Command unit for three shafts



No.	Inscription / Name	Meaning / Function
1	Port propulsion control lever	• Propulsion control lever to engage/disengage and set the engine speed. • Position indicates gearbox state.
2	COMMAND	• Key to select the commanding control stand. • Key to acknowledge alarms from the Remote Control System. Function of both keys is identical.
3	Middle propulsion control lever	• Propulsion control lever to engage/disengage and set the engine speed. • Position indicates gearbox state.

No.	Inscription / Name	Meaning / Function
4	SYN./TROL	• Key to activate Single Control Lever mode (SCL). • Key to activate the optional Trolling mode. Function of both keys is identical.
5	Starboard propulsion control lever	• Propulsion control lever to engage/disengage and set the engine speed. • Position indicates gearbox state.
6	COMMAND starboard	• LED flashes when command of the starboard power train can be assumed • LED lights up when the propulsion control lever is in command of the starboard power train.
7	SYNCHRO	LED lights up when Single Control Lever mode (SCL) is active.
8	TROLLING	LED lights up when Trolling mode is active.
9	Alarm starboard	• LED flashes when an unacknowledged combined alarm is received from the starboard RCS-5. • LED lights up when this alarm has been acknowledged.
10	COMMAND	This LED is not assigned on the command unit for three shafts (ROS 11).
11	Alarm	This LED is not assigned on the command unit for three shafts (ROS 11).
12	COMMAND middle	• LED flashes when command of the middle power train can be assumed. • LED lights up when the propulsion control lever is in command of the middle power train.
13	Alarm middle	• LED flashes when an unacknowledged combined alarm is received from the RCS-5 of the middle power train. • LED lights up when this alarm has been acknowledged.
14	Alarm port	• LED flashes when an unacknowledged combined alarm is received from the port RCS-5. • LED lights up when this alarm has been acknowledged.
15	COMMAND port	• LED flashes when command of the port power train can be assumed. • LED lights up when the propulsion control lever is in command of the port power train.
16	Astern mark	The gearbox is engaged astern when the pointer (18) is set at or below this mark.
17	Neutral mark	The gearbox is disengaged when the pointer (18) is set at this mark.
18	Pointer	The position of the pointer indicates the gearbox state.

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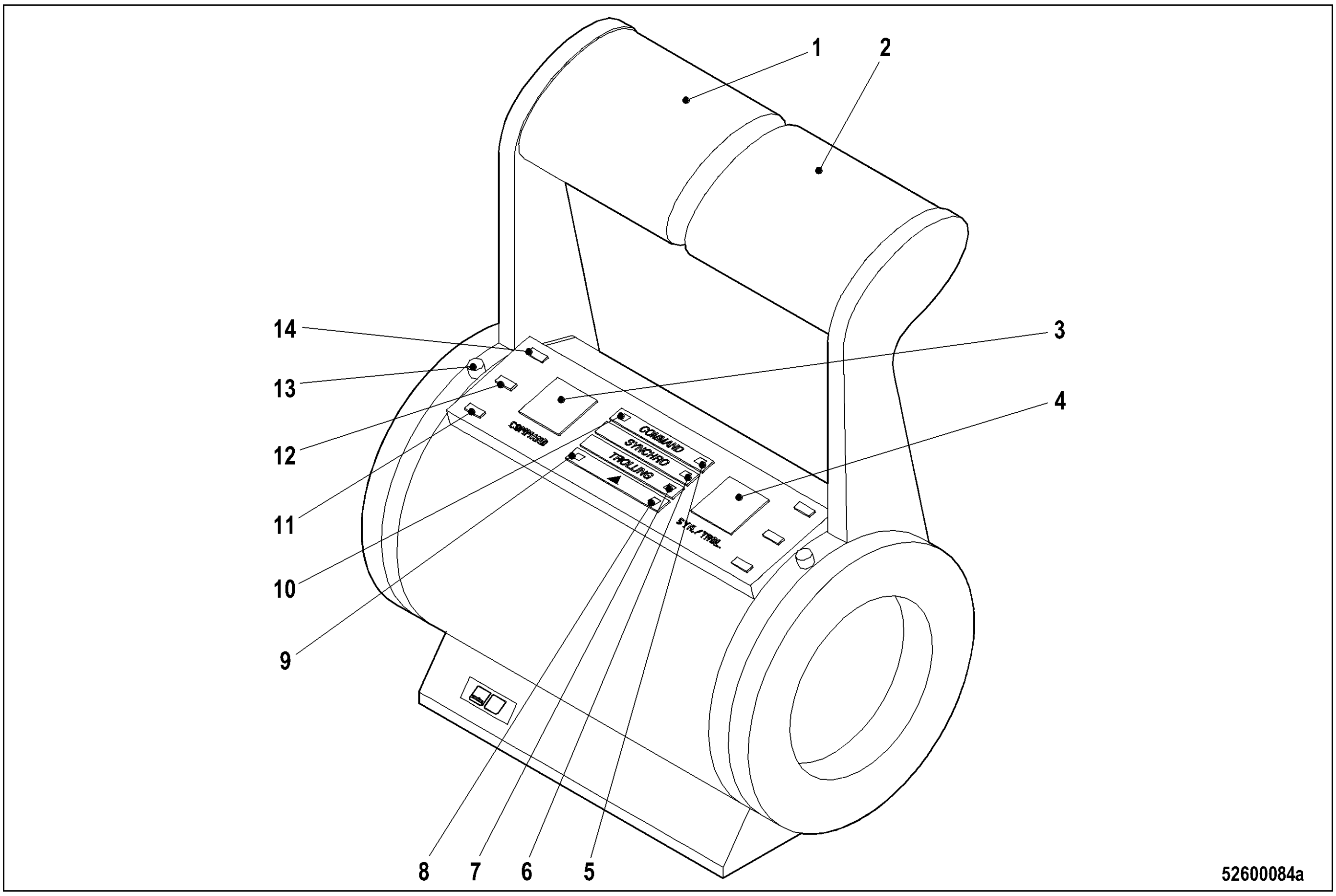
No.	Inscription / Name	Meaning / Function
19	Ahead mark	The gearbox is engaged ahead when the pointer (18) is set at or above this mark.

5.1.4 Command unit for four shafts

On four-shaft plants two ROS 7 command units are used thus doubling up the control keys (3) and (4). As they have the same function, operating one of these keys takes effect on both command units.

Exceptions:

- Initial command must be assumed separately on each of the command units after switching on.
- Alarms must be acknowledged separately on each of the command units.



No.	Inscription / Name	Meaning / Function
1	Port propulsion control lever	• Propulsion control lever to engage/disengage and set the engine speed. • Position indicates gearbox state.
2	Starboard propulsion control lever	• Propulsion control lever to engage/disengage and set the engine speed. • Position indicates gearbox state.
3	COMMAND	• Key to select the commanding control stand. • Key to acknowledge alarms from the Remote Control System.
4	SYN./TROL	• Key to activate Single Control Lever mode (SCL). • Key to activate the optional Trolling mode.
5	COMMAND starboard	• LED flashes when command of the starboard power train can be assumed. • LED lights up when the propulsion control lever is in command of the starboard power train.

TIM ID: 0000006264 – 001

No.	Inscription / Name	Meaning / Function
6	SYNCHRO	• LED lights up when Single Control Lever mode (SCL) is active.
7	TROLLING	LED lights up when Trolling mode is active.
8	Alarm starboard	• LED flashes when an unacknowledged combined alarm is received from the starboard RCS-5. • LED lights up when this alarm has been acknowledged.
9	Alarm port	• LED flashes when an unacknowledged combined alarm is received from the port RCS-5. • LED lights up when this alarm has been acknowledged.
10	COMMAND port	• LED flashes when command of the port power train can be assumed • LED lights up when the propulsion control lever is in command of the port power train
11	Astern mark	The gearbox is engaged astern when the pointer (13) is set at or below this mark.
12	Neutral mark	The gearbox is disengaged when the pointer (13) is set at this mark.
13	Pointer	The position of the pointer indicates the gearbox state.
14	Ahead mark	The gearbox is engaged ahead when the pointer (13) is set at or above this mark.

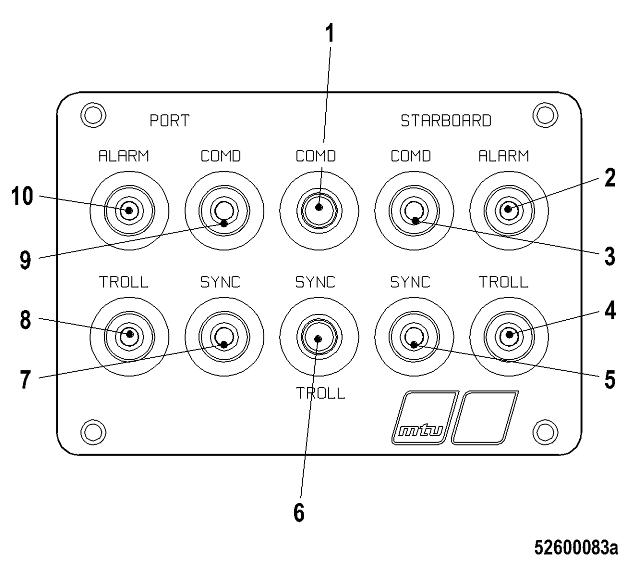
TIM ID: 0000006264 – 001

5.2 Controls and Displays (Special Version)

5.2.1 Operating station and rotary encoder modules

This operating station is only installed on control stands which feature rotary encoder modules.
In this case the propulsion control levers are designed to meet customer requirements.

TIM ID: 0000006273 – 002



No.	Inscription / Name	Meaning / Function
1	COMD	• Key to select the commanding control stand. • Key to acknowledge alarms from the Remote Control System.
2	ALARM STARBOARD	• LED flashes when an unacknowledged combined alarm is received from the starboard RCS-5. • LED lights up when this alarm has been acknowledged.
3	COMD STARBOARD	• LED flashes when command of the starboard power train can be assumed. • LED lights up when the propulsion control lever is in command of the starboard power train.
4	TROLL STARBOARD	LED lights up when Trolling mode is active on the starboard side.
5	SYNC STARBOARD	LED lights up when Single Control Lever mode (SCL) is active.
6	SYNC/TROLL	• Key to activate the optional Single Control Lever mode (SCL). • Key to activate the optional Trolling mode.
7	SYNC PORT	LED lights up when Single Control Lever mode (SCL) is active.
8	TROLL PORT	LED lights up when Trolling mode is active on the port side.
9	COMD PORT	• LED flashes when command of the port power train can be assumed. • LED lights up when the propulsion control lever is in command of the port power train.
10	ALARM PORT	• LED flashes when an unacknowledged combined alarm is received from the port RCS-5. • LED lights up when this alarm has been acknowledged.

TIM ID: 0000006273 – 002

Comparison, operating station – command unit (indicators and keys)

These instructions describe operation of the standard version of the Remote Control System where command units are used for control. The following points are relevant when rotary encoder modules and an operating station are used instead:

- Customized control levers on the rotary encoder modules are used for operation instead of the propulsion control levers on the command unit.
- The indicators and keys on the command unit and on the operating station are named differently, but have the same functions. The table below lists the equivalent names.

Key/LED on command unit	Meaning / Function	Key/LED on remote operating station
COMMAND	• Key to select the commanding control stand. • Key to acknowledge alarms from the Remote Control System.	COMD
SYN./TROL	• Key to activate the optional Single Control Lever mode (SCL). • Key to activate the optional Trolling mode.	SYNC/TROLL
COMMAND starboard	• LED flashes when command of the starboard power train can be assumed. • LED lights up when the propulsion control lever is in command of the starboard power train.	COMD STARBOARD
COMMAND port	• LED flashes when command of the port power train can be assumed. • LED lights up when the propulsion control lever is in command of the port power train.	COMD PORT
SYNCHRO starboard	LED lights up when Single Control Lever mode (SCL) is active.	SYNC STARBOARD
SYNCHRO port	LED lights up when Single Control Lever mode (SCL) is active.	SYNC PORT
TROLLING starboard	LED lights up when Trolling mode is active on the starboard side.	TROLL STARBOARD
TROLLING port	LED lights up when Trolling mode is active on the port side.	TROLL PORT

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5.3 Operation

5.3.1 Allocating initial command

Preconditions

- The on-board power supply is switched on.
- The overall BlueLine system is switched on.
- The COMMAND LED flashes on the command unit(s).

Allocating initial command

1. Set the propulsion control lever to the NEUTRAL position on the command unit of the control stand which is to receive command.
2. Press the COMMAND key on the command unit.

   Result:
   - The buzzers of the Remote Control System RCS-5 are silenced on all control stands.
   - The COMMAND LED lights up on the commanding control stand.
   - The indicator lamp READY FOR START/STOP is lit.
   - The selected control stand is in command.
   - The engine is ready for starting.
   - The gearbox is disengaged.

TIM ID: 0000006265 – 002

5.3.2 Command transfer

Preconditions

- Overall BlueLine systems are switched on.
- The propulsion control levers are in the NEUTRAL position on the control stand which is to assume command.

Note: On plants with just one shaft, please note that the BlueLine controls and displays are only equipped for one power train.

Assuming command at another control stand

1. Press the COMMAND key on the command unit of the control stand which is to assume command.
2. Set the propulsion control levers on the command unit in one of the following ways:
   2.1. Set to the same position as the propulsion control levers on the previously commanding control stand within two seconds.
   Result:
   - The COMMAND light emitting diodes on the previously commanding control stand go out.
   - The buzzer on the previously commanding control stand sounds for two seconds.
   - The COMMAND light emitting diodes on the newly selected control stand light up.
   - The newly selected control stand is in command.
   - The engine speed and vessel's speed are adapted to the settings of the commanding control stand.
   - The gearboxes remain engaged in the same direction.

   2.2. Leave the propulsion control levers in the NEUTRAL position.
   Result:
   - The COMMAND light emitting diodes on the previously commanding control stand go out.
   - The buzzer on the previously commanding control stand sounds for two seconds.
   - The COMMAND light emitting diodes on the newly selected control stand light up.
   - The newly selected control stand is in command.
   - The engines run at idling speed.
   - The gearboxes are disengaged.

Canceling command transfer

Note: Command transfer must be aborted within two seconds. The two-second period is signalled by a buzzer.

1. Take up position at the previously commanding control stand.
2. Press the COMMAND key on the command unit there.
   Result: Engine speed and gearbox state remain unchanged.

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5.3.3 Operation

Preconditions

- The engine is running at idling speed (only applies to the procedure: Engagement).
- Illuminated pushbutton LOCAL OPERATION on the Engine Control System ECS, when equipped with LOS or Local Operating Panel LOP with display, is dark.

Note: Several operating modes are possible depending on the settings made in the minidialog at initial operation (→Installation and Commissioning Instructions).

1. Normal Cruising Mode:
   - Ship's speed is increased in accordance with propulsion lever movement
   - Ship's speed is reduced in accordance with propulsion lever movement
2. Docking Mode (optional):
   - Depending on the given Docking Mode configuration (→Installation and Commissioning Instructions) the speed of the vessel in the control lever range around Neutral (slow ahead or slow astern) is controlled by engine speed and slip variation.
   - In the control lever area beyond the preset range (full ahead or full astern), slip is controlled by engine speed variation.
3. Trolling Mode (→ Page 117).

Engaging and changing engine speed

1. Move the propulsion control lever on the command unit of the commanding control stand slowly to the engagement lock (forwards or backwards).

   Result: Engagement takes place and thrust is exerted in the desired direction.
2. Move the propulsion control lever further.

   Result: The engine speed and the vessel's speed increase.
3. Leave the propulsion control lever in position when the desired speed has been reached.

   Result: The vessel runs in the predetermined direction with the set thrust and constant engine speed.

Reducing thrust and disengaging

1. Move the propulsion control lever on the command unit of the commanding control stand towards the NEUTRAL position.

   Result: The thrust decreases.
2. Lock the propulsion control lever in the NEUTRAL position.

   Result:
   - Thrust is no longer exerted.
   - Disengagement takes place on reaching idling speed.

TIM ID: 0000006266 – 002

5.3.4 Changing engine speed without engaging

Preconditions

- Engine running at idling speed.
- Illuminated pushbutton LOCAL OPERATION on the Engine Control System ECS-5, when equipped with LOS or Local Operating Panel LOP with display, is dark.
- Single Control Lever mode (SCL) not activated.

⚠ **WARNING**	Uncontrolled vessel movement. **Major material damage!** • Ensure proper operation of COMMAND key.
⚠ **CAUTION**	Sudden control-lever movement. **Engine emergency shutdown due to overspeed!** • Actuate control lever with caution.

Start engine (→ Page 88)**.**

Note: This function is intended to increase engine power without having to engage.
- Example: To warm up the engine after a longer lay period or at low ambient temperatures.

1. Press the COMMAND key on the command unit of the commanding control stand and hold it down.
   Result: Command LED flashes.
2. Move the propulsion control lever on the commanding control stand in the desired direction.
   Result:
   - The engine speed increases in accordance with the position of the propulsion control lever.
   - The gearbox remains in NEUTRAL.
   - Command LED flashes.
3. Move the propulsion control lever back into the NEUTRAL position after the desired time.
4. Release the COMMAND key.

TIM ID: 0000006272 – 001

5.3.5 Single Control Lever mode (SCL) – Activation

Preconditions

- Overall systems are switched on.
- All power trains are engaged in the same direction.
- The SYNCHRO light emitting diode is dark on all control stands.
- All COMMAND light emitting diodes on the commanding control stand are lit.

Note: Single Control Lever mode makes it possible to control all power trains together using just one of the propulsion control levers (SCL Master propulsion control lever). The gearbox and the speed of all the engines are synchronously controlled automatically in this operating mode which is also referred to as SCL (Single Control Lever mode).

Switching on Single Control Lever mode

1. Press the SYN/TROL key on the command unit of the commanding control stand.

   Result: The COMMAND light emitting diode of the power train for which the highest engine speed is set lights up.
2. Set the propulsion control lever of the power train which is also to be controlled by the SCL Master propulsion control lever (SCL Slave) to the NEUTRAL position within four seconds.

   Note: On propulsion systems with more than two shafts all the propulsion control levers which are to become SCL Slaves must be set to the NEUTRAL position within four seconds.
3. Leave the desired SCL Master propulsion control lever out of the NEUTRAL position.

   Result:
   - The speeds of all the engines are adapted to the setting at the SCL Master propulsion control lever.
   - The SYNCHRO light emitting diodes light up on all command units on all control stands.
   - The COMMAND light emitting diode associated with the SCL Master propulsion control lever lights up.
   - The COMMAND light emitting diodes of all other propulsion control levers are dark.
   - SCL mode is activated.
   - The engines all run at the same speed.

TIM ID: 0000006268 – 005

5.3.6 Single Control Lever mode (SCL) – Deactivation

Preconditions

- Single Control Lever mode is switched on.
- SCL Master propulsion control lever is not set to NEUTRAL.

Determining SCL mode setting.

1. Read off the setting at MPU 29 inside the LOP or
2. on printed circuit board MPU 29 in the LOP via Mini Dialog
   - 2.1. Press the ↑ or ↓ key on printed circuit board SAB 2 in the CCU repeatedly until the display shows “SCL Off Conf.”.
   - 2.2. Press the ENTER key.

     Result: The set value is indicated in the second line.
     - For Panic (Standard),
     - For Button+Panic+d,
     - For Button+delta,
     - For Panic (Classic)

Canceling SCL mode with Panic Standard

Note: There are two ways of canceling Single Control Lever mode (SCL) in this case.

1. Switching off Single Control Lever mode with disengagement:
   - 1.1. Press the SYN./TROL. key associated with the SCL Master propulsion control lever.

     Result:
     - The SYNCHRO LED flashes.
     - Canceling mode is initiated.
   - 1.2. Set the SCL Master propulsion control lever to the NEUTRAL position.

     Result:
     - SCL mode is canceled for all shafts.
     - The gearboxes are disengaged.
     - Gearboxes are ready for engagement.
2. Switching off Single Control Lever mode without disengagement
   - 2.1. Move an SCL Slave propulsion control lever out of the NEUTRAL position.

     Result:
     - The COMMAND LED associated with this propulsion control lever lights up.
     - The corresponding shaft is taken out of SCL mode and operates as normal again.
     - Canceling mode is initiated.
     - The SYNCHRO LED flashes until canceling mode has been completed.
     - The buzzer briefly sounds until canceling mode has been completed.
   - 2.2. Move all other propulsion control levers out of the NEUTRAL position as required.

     Result:
     - Canceling mode is completed.
     - The buzzer is silenced.
     - The SYNCHRO LED goes out.
     - SCL mode is canceled for all shafts.
     - The COMMAND LEDs light up.
     - The gearboxes remain engaged.

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Canceling SCL mode with Panic Classic

Note: There are two ways of canceling Single Control Lever mode (SCL) in this case.

1. Move SCL Slave propulsion control lever out of the NEUTRAL position.
   Result:
   - The COMMAND LED associated with this propulsion control lever lights up.
   - The corresponding shaft is taken out of SCL mode and operates as normal again.
   - Canceling mode is initiated.
   - The SYNCHRO LED flashes until canceling mode has been completed.
   - The buzzer briefly sounds until canceling mode has been completed.
2. Move all other propulsion control levers out of the NEUTRAL position as required.
   Result:
   - Canceling mode is completed.
   - The buzzer is silenced.
   - The SYNCHRO LED goes out.
   - SCL mode is canceled for all shafts.
   - The COMMAND LEDs light up.
   - The gearboxes remain engaged.

Canceling SCL mode with Button+Panic+Delta

Note: There are three ways of canceling Single Control Lever mode (SCL) in this case.

1. Switching off Single Control Lever mode with disengagement:
   1.1. Press the SYN./TROL. key associated with the SCL Master propulsion control lever.
   Result:
   - The SYNCHRO LED flashes.
   - Canceling mode is initiated.

   1.2. Set the SCL Master propulsion control lever to the NEUTRAL position.
   Result:
   - SCL mode is canceled for all shafts.
   - The gearboxes are disengaged.
   - Gearboxes are ready for engagement.
2. Move the SCL Slave propulsion control lever out of the NEUTRAL position and match to the setting at the SCL Master propulsion control lever. Vary and test Delta window.
   Result:
   - The SYNCHRO LED flashes until canceling mode has been completed.
   - The buzzer briefly sounds until canceling mode has been completed.
3. Press the SYN./TROL. key associated with the SCL Master propulsion control lever and move the SCL Slave propulsion control lever out of the NEUTRAL position and match it to the setting at the SCL Master propulsion control lever.
   Result:
   - The SYNCHRO LED flashes until canceling mode has been completed.
   - The buzzer briefly sounds until canceling mode has been completed.

Canceling SCL mode with Button+Delta

Note: There are three ways of canceling Single Control Lever mode (SCL) in this case.

1. Press the SYN./TROL. key associated with the SCL Master propulsion control lever and match the SCL Slave propulsion control lever to the setting at the SCL Master propulsion control lever (Delta window).
   Result:
   - The SYNCHRO LED flashes until canceling mode has been completed.
   - The buzzer briefly sounds until canceling mode has been completed.
2. Set the SCL Master propulsion control lever to the NEUTRAL position.
   Result:
   - SCL mode is canceled for all shafts.
   - The gearboxes are disengaged.
   - Gearboxes are ready for engagement.
3. Set the SCL Master propulsion control lever and SCL Slave propulsion control lever to the NEUTRAL position.
   Result: SCL mode is canceled.

TIM ID: 0000006269 – 005

5.3.7 Trolling mode – Activation

Preconditions

- The optional trolling unit is used.
- Overall system(s) is/are switched on.
- Engine(s) running at idling speed.
- The TROLLING light emitting diodes on all command units on all control stands are dark.
- The COMMAND light emitting diode on the command unit of the commanding control stand is lit.

Note:

- The optional Trolling mode offers more precise maneuverability for vessels which are capable of reaching relatively high speeds even when the engines are idling. This is realized by only partially engaging gearbox and propeller allowing a certain degree of clutch slip. This means that the shaft turns more slowly.
- Only the two outer shafts can be equipped with Trolling gearboxes on propulsion systems incorporating more than two shafts.
- Trolling mode is not possible in conjunction with active SCL mode on propulsion systems incorporating more than two shafts.

Trolling mode – Activation

Note: The control stand must be in SCL Mode Panic Classic.

1. Set the propulsion control lever on the command unit of the commanding control stand to NEUTRAL.
2. Press the SYN./TROL. key on the command unit of the commanding control stand.
3. Move the propulsion control lever on the command unit of the commanding control stand in the desired direction.
   Result:
   - The TROLLING LEDs light up on all command units on all control stands. Trolling is active.
   - The vessel runs in the predetermined direction with the set thrust.
   - The gearbox is engaged.
   - The engine speed increases.
   - The engine speed can only be adjusted within a limited speed range.

Trolling mode and SCL mode – Activation

Note: One of the following SCL modes is set in the Mini Dialog:
- Panic Standard
- Button+Panic+Delta
- Button+Delta

1. Set both propulsion control levers on the command unit of the commanding control stand to NEUTRAL.
2. Press the SYN./TROL. key on the command unit of the commanding control stand.
   Result: The TROLLING LEDs light up on all command units on all control stands. Trolling is active.
3. Move both propulsion control levers on the commanding control stand towards Ahead.
4. Press the SYN./TROL. key again to switch to SCL mode.
5. Reset the slave propulsion control lever on the commanding control stand to NEUTRAL.
   Result:
   - SCL and Trolling are active.

TIM ID: 0000006270 – 004

5.3.8 Trolling mode – Deactivation

Preconditions

- Propulsion control lever on the commanding control stand is not set to NEUTRAL.
- Engine running at increased idling speed.
- The TROLLING light emitting diode is lit on all control stands.
- Trolling mode is activated.

Trolling mode – Deactivation

Note: Trolling mode can only be canceled with the SCL Master propulsion control lever when Trolling mode and SCL mode are simultaneously active. SCL mode is automatically canceled when the active propulsion control lever is set to NEUTRAL.

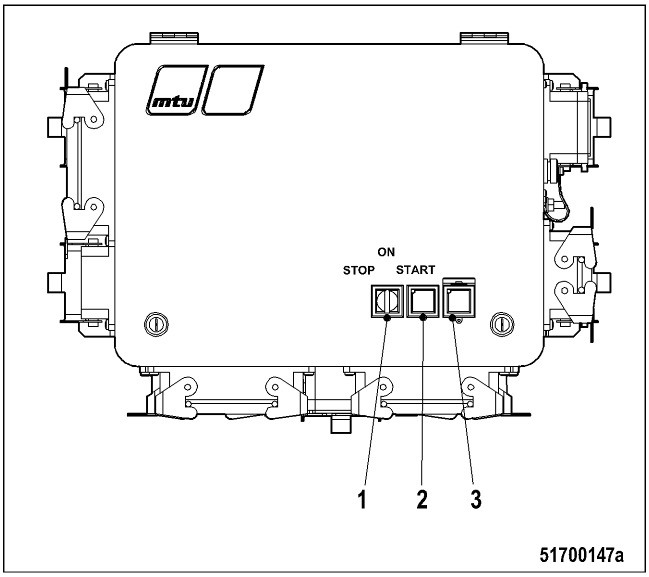
1. Move the propulsion control lever on the commanding control stand to the NEUTRAL position.
2. Press the SYN./TROL. key on the command unit of the commanding control stand.
   Result:
   - The TROLLING light emitting diodes go out on all control stands.
   - Gearbox(es) is/are disengaged.
   - The engine runs at idling speed.
   - Trolling mode is switched off.
   - The power train is ready for engagement.

TIM ID: 0000006271 – 002

6 ECS-5 Engine Control System

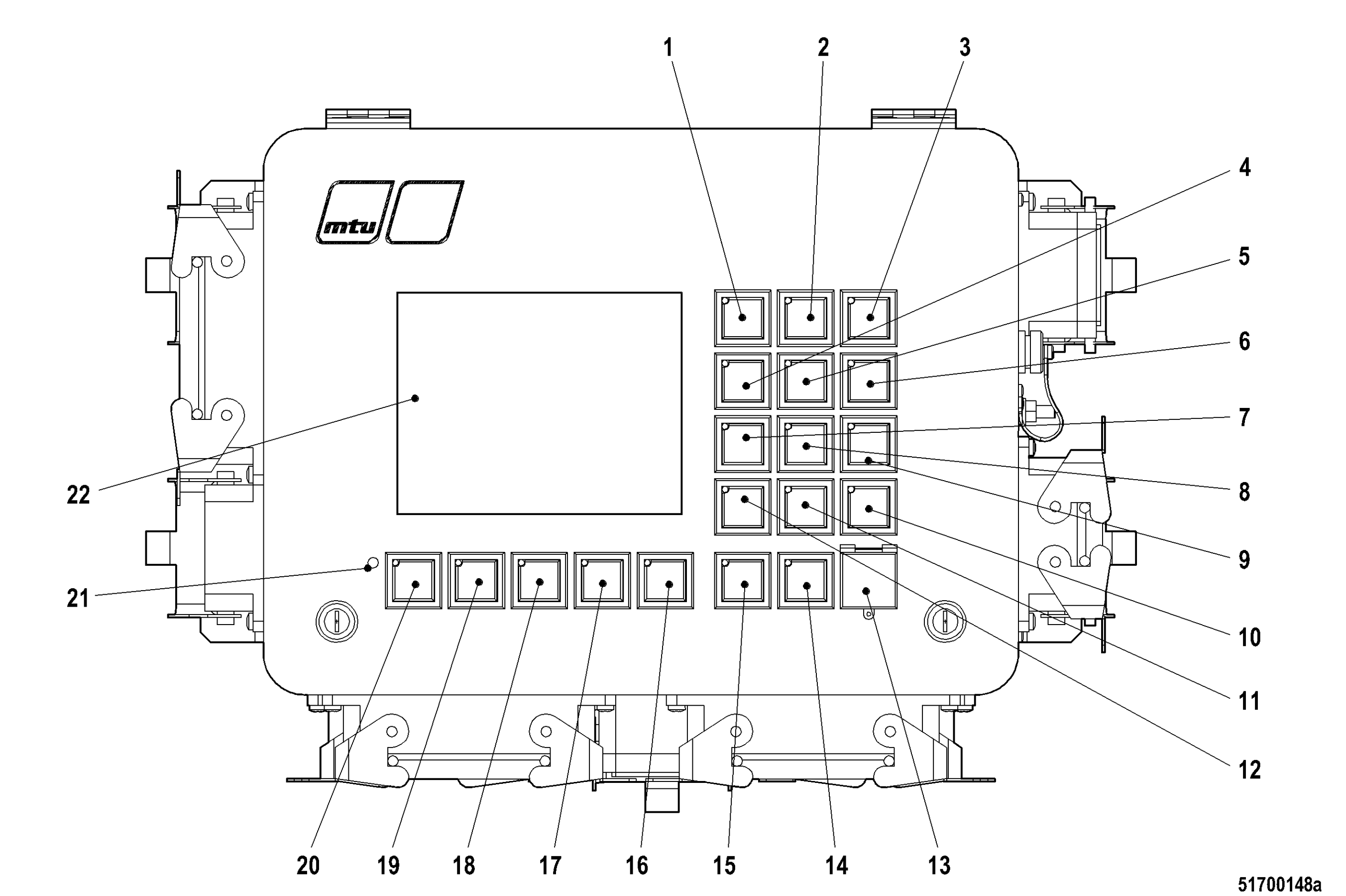
6.1 Controls and Displays

6.1.1 LOP



No.	Color	Inscription	Meaning / Function
1	–	STOP - ON - START	The rotary switch has the following functions: • To start: Turn clockwise. • To stop: Turn counter-clockwise.
2	Green	POWER ON	Lights up when the plant is switched on.
3	Red	EMERGENCY STOP	• An emergency stop is executed when the pushbutton is pressed. • Lights up when an emergency stop has been initiated.

6.1.2 Local Operating Station LOS and Local Operating Panel LOP – Controls and displays



No.	Color	Inscription	Meaning / Function
1	White	ENGINE SPEED INCREASE	• Holding down the momentary-contact pushbutton increases the speed. • Lights up as long as the momentary-contact pushbutton is held down.
2	White	ENGINE SPEED DECREASE	• Holding down the momentary-contact pushbutton decreases the speed. • Lights up as long as the momentary-contact pushbutton is held down.
3	White	–	–
4	Green	CLUTCH AHEAD	• Pressing the pushbutton engages the gearbox ahead. • Lights up when the gearbox is engaged ahead.
5	Green	CLUTCH NEUTRAL	• Pressing the pushbutton disengages the gearbox. • Lights up when the gearbox is disengaged.
6	Green	CLUTCH ASTERN	• Pressing the pushbutton engages the gearbox astern. • Lights up when the gearbox is engaged astern.
7	White	START	• Pressing the pushbutton initiates engine start. • Lights up during the start sequence.

TIM ID: 0000006244 – 002

No.	Color	Inscription	Meaning / Function
8	White	STOP	• Pressing the pushbutton initiates engine stop. • Lights up during the stop sequence.
9	White	–	–
10	Green	–	–
11	Green	LOCAL OPERATION	• Pressing the pushbutton activates Local mode. • Lights up when Local mode is activated.
12	Green	READY FOR OPERATION	• Pressing the pushbutton switches the propulsion plant ready for operation. • Lights up when the propulsion plant is switched ready for operation.
13	Red	EMERGENCY STOP	• Pressing the pushbutton initiates an emergency engine stop. • Lights up when an engine stop has been initiated.
14	White	–	–
15	White	–	–
16	White	F1	• Function keys F1 to F5 can be used for operating the display interface, acknowledging alarms and dimming. • Key functions vary and are represented graphically on the display. • Lights up as long as the momentary-contact pushbutton is held down.
17		F2	
18		F3	
19		F4	
20		F5	
21	Green	LED	Operating state of the display: • LED dark: Operating voltage missing. • LED lit: Normal operation, project data loaded, no fault detected. • LED flashes slowly: Communication on field bus disrupted or failed, the CAN buses have failed. The display panel has no project data. • LED flashes rapidly: Watchdog has been tripped. System in hardware-reset state.
22	–	Color display	• Displays detailed information about the propulsion plant. • The display can be controlled with the keys under screen.

TIM ID: 0000006244 – 002

6.2 Normal Operation: LOS or LOP with Display

6.2.1 Switching the engine ready for operation

Preconditions

- Overall system of the power train is switched on.
- The illuminated pushbutton READY FOR OPERATION is dark.

Switching the engine plant ready for operation

Note: The status of this function remains unchanged when the overall system is switched off at the key switch. The engine plant remains switched ready for operation when switched back on.

1. Check that individual propulsion components are ready for operation (plant operator).
2. Press the illuminated pushbutton READY FOR OPERATION.
   Result:
   - The illuminated pushbutton READY FOR OPERATION lights up green.
   - The start interlock is canceled.
   - The engine is ready for starting.

TIM ID: 0000006245 – 003

6.2.2 Local mode – Activation

Preconditions

- Overall system of the power train is switched on.
- The illuminated pushbutton LOCAL OPERATION is dark.

DANGER	Vessel is sailing blind. In Local Operation mode, the propulsion plant is controlled from the engine room. **Risk of accidents!** • Only execute vessel movements on the instructions of a person who has visual contact with the area outside the vessel.

WARNING	Control stations (RCS Remote Control System) deactivated. **Maneuverability, major material damage!** • Inform authorized control station before switching to local operation.

Activating Local mode

1. Press the illuminated pushbutton LOCAL OPERATION.
   Result:
   - The illuminated pushbutton LOCAL OPERATION lights up green.
   - The controls on the Local Operating Panel LOP are activated.
   - Operation of the power train via the Remote Control System RCS-5 and via the Monitoring and Control System MCS-5 is no longer possible.
   - Emergency engine stopping is still possible from all control stands (→ Page 92).
   - Local mode is activated.
2. Continue operation at the Local Operating Panel LOP/LOS.

6.2.3 Starting the engine

Preconditions

- Engine has been prepared for startup (→ Engine operating instructions).
- Overall system of the power train is switched on.
- Power train is switched ready for operation: Illuminated pushbutton READY FOR OPERATION lit (green).
- Gearbox is disengaged: Illuminated pushbutton CLUTCH OUT lit (green).
- Start interlock deactivated.
- PPC selector switch set to AUTO.

⚠ DANGER	Unguarded rotating and moving engine components. **Risk of serious injury – danger to life!** • Take special care when working on a running engine.

Starting the engine at LOP with display

1. Switch on Local mode (→ Page 123).
2. Briefly press illuminated pushbutton START.

   Result:
   - The illuminated pushbutton START lights up white.
   - Automatic starting sequence is executed.
   - The oil priming pump is switched on as necessary (no priming in case of repeated starting).
   - The starting sequence is represented on the control stand in the same way as for a normal engine start (→ Page 88).
   - The engine runs at idling speed on completion of the starting sequence.
   - The illuminated pushbutton START goes out.
   - The power train is ready for engagement.

TIM ID: 0000012066 – 001

6.2.4 Local mode – Engaging/disengaging the gearbox

Preconditions

- Overall system of the power train is switched on.
- Local mode is switched on: The illuminated pushbutton LOCAL OPERATION lights up green.
- The gearbox is disengaged: The illuminated pushbutton CLUTCH NEUTRAL lights up green (only for the "engagement" sequence).
- The gearbox is engaged: The illuminated pushbutton CLUTCH NEUTRAL is dark (only for the "disengagement" sequence).
- Engine speed is in the engagement window.

DANGER	Vessel is sailing blind. In Local Operation mode, the propulsion plant is controlled from the engine room. **Risk of accidents!** • Only execute vessel movements on the instructions of a person who has visual contact with the area outside the vessel.

Engaging the gearbox

1. Make contact with the control stand.
2. Press one of the following pushbuttons to engage as required:
   - To engage ahead: Illuminated pushbutton CLUTCH AHEAD
   - To engage astern: Illuminated pushbutton CLUTCH ASTERN

   Result:
   - The gearbox is engaged in accordance with the request.
   - The selected illuminated pushbutton lights up green.
   - The gearbox state is indicated on the display.

Disengaging the gearbox

1. Reduce the engine speed to idling (→ Page 126).
2. Press the illuminated pushbutton CLUTCH NEUTRAL.

   Result:
   - The illuminated pushbutton CLUTCH NEUTRAL lights up green.
   - The gearbox is disengaged.
   - The gearbox state is indicated on the display.

6.2.5 Local mode – Changing engine speed

Preconditions

- Overall system of the power train is switched on.
- Local mode is switched on: The illuminated pushbutton LOCAL OPERATION lights up green.
- Power train is switched ready for operation: The illuminated pushbutton READY FOR OPERATION lights up green.

Changing engine speed

1. Press and hold down one of the following illuminated pushbuttons as required:
   - To increase engine speed: Illuminated pushbutton ENGINE SPEED INCREASE
   - To decrease engine speed: Illuminated pushbutton ENGINE SPEED DECREASE

   Result:
   - The selected illuminated pushbutton lights up white when pressed.
   - The engine speed increases or decreases.
   - The current engine speed is indicated on the display.
2. Release the illuminated pushbutton as soon as the desired engine speed has been reached.

   Result: The engine speed remains constant.

TIM ID: 0000006254 – 002

6.2.6 Stopping the engine

Preconditions

- Overall system of the power train is switched on.
- Local mode is switched on: The illuminated pushbutton LOCAL OPERATION lights up green.
- Engine is running at idling speed.

⚠ WARNING	Control stations (RCS Remote Control System) deactivated. **Maneuverability, major material damage!** • Inform authorized control station before switching to local operation.

Stopping the engine at the Local Operating Station LOS or Local Operating Panel LOP with display

1. Briefly press illuminated pushbutton STOP.

   Result:
   - The illuminated pushbutton STOP lights up white.
   - The automatic stop sequence is executed.
   - The display indicates the currently changed engine operating data.
   - The engine is at a standstill when the automatic stop sequence has been completed.
   - The illuminated pushbutton STOP goes out.
   - The gearbox is disengaged.
2. Repeat the procedure for other engines (if applicable).

   Result:
   - The stop sequence is repeated in the same way as for the first engine.
3. Take all the necessary measures on the engine following shutdown (→Engine Operating Instructions).

TIM ID: 0000006247 – 004

6.2.7 Local mode – Deactivation

Preconditions

- Overall system of the power train is switched on.
- Local mode is activated.
- The illuminated pushbutton LOCAL OPERATION lights up.

Deactivating Local mode

1. Press the illuminated pushbutton LOCAL OPERATION.

   Result:
   - The illuminated pushbutton LOCAL OPERATION is dark.
   - Local mode is deactivated.
   - Operation of the power train via the Remote Control System RCS-5 and via the Monitoring and Control System MCS-5 is possible.
2. Select control stand (→ Page 110).

TIM ID: 0000006250 – 003

6.2.8 Interlocking engine start

Preconditions

- Overall system of the power train is switched on.
- The illuminated pushbutton READY FOR OPERATION lights up.

Interlocking engine start at Local Operating Panel LOP with display / at Local Operating Station LOS

Note: The status of this function remains unchanged when the overall system is switched off at the key switch. Engine start remains interlocked for this engine plant when the system is switched back on.

1. Press the illuminated pushbutton READY FOR OPERATION.
   Result:
   - Illuminated pushbutton READY FOR OPERATION goes out.
   - Illuminated pushbutton READY FOR START/STOP goes out on all control stands.
   - The engine cannot be started.
2. Repeat the procedure for other engines (if applicable).
   Result:
   - The sequence is repeated in the same way as for the first engine.

6.2.9 Emergency engine stop

Preconditions

- Engine running

CAUTION	An emergency stop causes extreme stress to the engine. **Risk of overheating, damage to components!** • Initiate emergency stop only in emergency situations.

Emergency engine stop at the Local Operating Panel LOP with display or at the Local Operating Station LOS

1. Raise the protective flap on the illuminated pushbutton EMERGENCY STOP.
2. Press illuminated pushbutton EMERGENCY STOP.
3. Close the protective flap.

   Result:
   - Alarms are signalled at the control stand in the same way as for an emergency stop from a control stand (→ Page 92).
   - Engines with emergency-air shutoff flaps: Flaps close.
   - The engine is stopped by shutting down fuel injection.
4. Acknowledge the alarm at the control stand (→ Page 142).
5. Determine and rectify the cause of the shutdown.
6. Open the flaps manually on engines equipped with emergency-air shutoff flaps.

   Result: Engine is ready for operation.

TIM ID: 0000006251 – 001

6.3 Operation during Servicing: LOP without Display

6.3.1 Starting the engine

Preconditions

- Engine has been prepared for startup (→ Engine operating instructions).
- Overall system of the power train is switched on.
- A control stand is in command.
- Propulsion control lever on the commanding control stand set to zero thrust
- The green indicator lamp POWER ON on the Local Operating Panel LOP is lit .
- PPC selector switch set to AUTO.

⚠ **DANGER**	Unguarded rotating and moving engine components. **Risk of serious injury – danger to life!** • Take special care when working on a running engine.

Starting the engine at Local Operating Panel LOP

Note: The service interface on Local Operating Panel LOP is only intended for starting and stopping the engine plant in the course of maintenance work.

1. Briefly turn the rotary switch clockwise to the START position.
2. Release the rotary switch.

   Result:
   - The switch returns automatically to the ON position.
   - Automatic starting sequence is executed.
   - The oil priming pump is switched on as necessary (no priming in case of repeated starting).
   - The starting sequence is represented on the control stand in the same way as for a normal engine start (→ Page 88).
   - The engine runs at idling speed on completion of the starting sequence.
   - The power train is ready for engagement.

TIM ID: 0000012067 – 001

6.3.2 Stopping the engine

Preconditions

- Propulsion control lever on the command unit of the commanding control stand is set to NEUTRAL.
- Engine is running at idling speed.

Stopping the engine at Local Operating Panel LOP

1. Turn the rotary switch counter-clockwise to the STOP position.
2. Turn the rotary switch clockwise back to the ON position.
   Result:
   - The automatic stop sequence is executed.
   - The stopping sequence is represented on the control stand in the same way as for a normal engine stop (→ Page 91).
   - The engine is at a standstill when the automatic stop sequence has been completed.
   - The gearbox is disengaged.
3. Take all the necessary measures on the engine following shutdown (→Engine Operating Instructions).

TIM ID: 0000006258 – 002

6.3.3 Interlocking engine start

Preconditions

- Engine is stopped.

Interlocking engine start at Local Operating Panel LOP

1. Turn the rotary switch counter-clockwise to the STOP position.
2. Leave the rotary switch in the STOP position.
   Result:
   - Engine starting from the control stands is interlocked.
   - The START pushbutton on all control stands has no effect on the power train.
   - The illuminated pushbuttons READY FOR START/STOP go out on all control stands.
   - The illuminated pushbutton READY FOR OPERATION goes out on the optional Local Operating Station LOS.

TIM ID: 0000006260 – 002

6.3.4 Emergency engine stop

Preconditions

- Engine is running.

⚠ CAUTION	An emergency stop causes extreme stress to the engine. **Risk of overheating, damage to components!** • Initiate emergency stop only in emergency situations.

Emergency engine stop at Local Operating Panel LOP

1. Raise the protective flap on the illuminated pushbutton EMERGENCY STOP.
2. Press the EMERGENCY STOP pushbutton.
3. Close the protective flap.
   Result:
   - Alarms are signalled at the control stand in the same way as for an emergency stop from a control stand (→ Page 92).
   - Engines with emergency-air shutoff flaps: Flaps close.
   - The engine is stopped by shutting down fuel injection.
4. Acknowledge the alarm at the control stand (→ Page 142).
5. Determine and rectify the cause of the shutdown.
6. Open the flaps manually on engines equipped with emergency-air shutoff flaps.
   Result: Engine is ready for starting.

TIM ID: 0000006259 – 001

7 Troubleshooting

7.1 Faults in the BlueLine system

General information about faults

Faults in the overall system and propulsion plant are displayed on devices of the various BlueLine subsystems as follows:

- Printed circuit board MPU 29: Fault code numbers are displayed together with abbreviated information on a two-line, alphanumeric display inside Local Operating Panel LOP.
- Local Operating Panel LOP with display / Local Operating Station (LOS): On-screen messages in plain text on the display.
- Main control stand: On-screen messages in plain text on the display.
- Remote Control System RCS-5 / Monitoring and Control System MCS-5: Fault indication by means of LEDs.
- Remote Control System RCS-5 / Monitoring and Control System MCS-5: Fault code numbers are displayed together with abbreviated information on a two-line, alphanumeric display of processor printed circuit board MPU 29.

Should a fault occur when the overall BlueLine system is switched on, first check:

- whether it is merely a phantom fault (e.g. because Local mode is switched on).
- whether all necessary prerequisites are fulfilled for the operating procedure in the course of which the fault occurred.
- whether the fault is indicated on a display or one of the devices described above. Should this be the case, check the fault code in the appropriate fault code table and take appropriate counteraction.

Proceed in accordance with the symptoms table if no fault message appears or if a fault occurs when switching on the overall BlueLine system.

Check all fuses and the power supply if entire subsystems are out of order.

Explanation of abbreviations used

The following abbreviations are used in the texts of the various fault messages:

Abbreviation	Meaning
DL <Number>	Default Lost: The device designated by <Number> is not connected to the default CAN bus.
RL <Number>	Redundant Lost: The device designated by <Number> is not connected to the redundant CAN bus.
SD <Sensor designation>	Sensor Defect: The sensor designated by <Sensor designation> does not supply a signal which can be evaluated.
MD	Missing Data: Data missing from a measuring point.
AL	Alarm: Alarm message
SS	Safety System: The safety system has responded in some way.
TD	Transmitter Deviation: Two sensors which acquire measured values of the same medium are supplying different measured values.
HI	High: Violation of the first upper limit value.
HIHI	High High: Violation of the second upper limit value.
LO	Low: Violation of the first lower limit value.
LOLO	Low Low: Violation of the second lower limit value.
MG	Message: General message
SE	System Error: Warning of node failure on the default field bus.
PB	Push Button: Status indication of activation of certain control pushbuttons.
AKR	Anti Knock Control GET

Recommended action in case of alarm

Yellow alarm:

The engine can still be operated providing that automatic engine shutdown to protect the engine has not been configured or is not tripped. Contact Service immediately/start fault rectification.

Red alarm:

Caution, the engine is running at its limits. Shut down manually without further delay if the engine does not shut itself down immediately after a red alarm is signaled.

Important information about the fault code tables

Appropriate MTU qualifications/training are a requirement for performing troubleshooting activities.

Contact Service if troubleshooting according to the information provided in the tables below proves unsuccessful.

Fault tables

- Symptoms (→ Page 137)
- Fault indication on the LOP display (→ Page 143)
- Fault indication on the MFD display of the main control stand (→ Page 150)
- Fault indication on printed circuit board MPU 29 (→ Page 158)
- Fault indication on the ECU (→ Page 163)

7.2 Troubleshooting

The troubleshooting table below allows faults which are not indicated by the display or alarm systems to be pinpointed.

Applicable to all symptoms:

- Various fuses always protect certain parts of the system. Check whether one of these fuses has been tripped before taking any further action.
- The overall system incorporates a great number of self-restoring fuses. Switch the system off and then back on after approx. five minutes before continuing with troubleshooting for this reason.

Symptom	Meaning	Action
One or more controls and indicators do not light up when the overall system is switched on.	A The light emitting diode faulty. B No electrical connection between the contacts of the light emitting diode and the element (oxidized, bent or coated with salt).	A Replace light emitting diode • For indicator lamps (→Contact Service) • For illuminated pushbuttons (→Contact Service) B Replace contact element on illuminated pushbuttons (→Contact Service)Replace entire lamp on indicator lamps (→Contact Service)
Illumination of individual analog instruments is off.	A Lamp faulty. B Plug-in base not plugged into the housing of the instrument concerned. C Connector on plug-in base of the instrument concerned misconnected or oxidized. D Wrong lamp inserted.	A Replace lamp (→Contact Service) B Insert plug-in base in the opening in the housing. C Connect connector correctly or disconnect and reconnect it several times to clean the contacts. D Insert right lamp.
All analog display instruments on a main control stand remain at zero.	A Printed circuit board INB 3 in the control unit concerned faulty. B Pins on the motherboard of the MCS-5 control unit twisted or bent.	A Replace printed circuit board INB 3 (→Contact Service) B Straighten any bent pins, replace MCS-5 control unit if pins are broken (→Contact Service)
One single analog instrument remains at zero.	A Connector at measuring input of the instrument concerned misconnected or oxidized. B Analog instrument faulty. C A channel on printed circuit board INB 3 in the control unit concerned faulty. D Jumpers J3 and J6 not inserted on MCS-5 control unit.	A Connect connector correctly or disconnect and reconnect it several times to clean the contacts. B Replace display instruments (→Contact Service) C Replace printed circuit board INB 3 (→Contact Service) D Replace jumpers (→Contact Service)
Illumination of all analog instruments is off.	A Dimming set to minimum. B Connector X14 incorrectly connected in control unit concerned. C Faulty cable.	A Increase brightness. B Connect connector X14 correctly and secure with locking screws (→Contact Service) C Replace cable.

TIM ID: 0000007104 – 002

Symptom	Meaning	Action
Individual illuminated pushbuttons out of order.	A Contact element faulty. B Connector of contact element concerned misconnected or oxidized. C Contact element not clipped onto actuator. D Faulty cable.	A Replace contact element. B Connect connector correctly or disconnect and reconnect it several times to clean the contacts. C Clip on contact element properly. D Replace cable.
All illuminated pushbuttons on a control stand for one power train out of order.	A With one main control stand: Connector X11/X12 incorrectly connected in control unit concerned. B On slave control stand 1: Connector X15 incorrectly connected in control unit of main control stand 1. C On slave control stand 2: Connector X16 incorrectly connected in control unit of main control stand 1. D Grounding lead disrupted.	A Connect both connectors X11/X12 correctly and secure with locking screws (→Contact Service). B Connect connector X15 correctly and secure with locking screws (→Contact Service) C Connect connector X16 correctly and secure with locking screws (→Contact Service) D Replace cable.
All indicator lamps on a main control stand for one power train out of order.	A Connector X13 incorrectly connected in control unit concerned. B Connector X11 incorrectly connected in control unit concerned. C Printed circuit board BOB 1 faulty: • One for lamps in illuminated pushbuttons. • One for alarm indicator lamps D Grounding lead disrupted	A Connect connector X13 correctly and secure with locking screws (→Contact Service) B Connect connector X111 correctly and secure with locking screws (→Contact Service) C Replace printed circuit board BOB 1 (→Contact Service) D Replace cable.
Problems with operation or indication on the display.	Display and/or illuminated pushbutton faulty.	Replace display (→Contact Service)
Display screen pressed in.	Display faulty.	Replace display (→Contact Service)
A propulsion control lever on a command unit is out of order.	A Single Control Lever mode is active. B The connector on the command unit is incorrectly connected or its contacts are oxidized. C Connector concerned incorrectly connected in control unit of Remote Control System: • X11 for main control stand 1 • X12 for main control stand 2 • X13 for slave control stand 1 • X14 for slave control stand 2 D Command unit faulty. E Printed circuit board MFB 2 faulty.	A Deactivate Single Control Lever mode. B Connect connector correctly or disconnect and reconnect it several times to clean the contacts. C Connect connector correctly and secure with locking screws (→Contact Service) D Replace command unit. E Replace printed circuit board MFB 2 (→Contact Service)

TIM ID: 0000007104 – 002

Symptom	Meaning	Action
Engine cannot be started.	A START - ON - STOP switch on Local Operating Panel set to STOP. B On ECS-5 with Local Operating Station LOS variant only: Local mode is activated. C Illuminated pushbutton not operational	A Set switch to ON. B Deactivate Local mode. C See symptom "Individual illuminated pushbuttons out of order" in this table.
Engine cannot be stopped.	A On ECS-5 with Local Operating Station LOS variant only: Local mode is activated. B Illuminated pushbutton not operational	A Deactivate Local mode. B See symptom "Individual illuminated pushbuttons out of order" in this table.
Speed cannot be set with any propulsion control lever.	A On ECS-5 with Local Operating Station LOS variant only: Local mode is activated. B Printed circuit board MPU 29 in control unit faulty. C Entire RCS-5 control unit faulty.	A Deactivate Local mode. B Replace printed circuit board MPU 29 (→Contact Service) C Replace RCS-5 control unit (→Contact Service)
On ECS-5 with Local Operating Station LOS variant only: • Problems with operation or indication on the display of LOS.	Display and/or illuminated pushbutton faulty.	Replace Local Operating Station LOS (→Contact Service)
On ECS-5 with Local Operating Station LOS variant only: • Display screen pressed in	Display faulty.	Replace Local Operating Station LOS (→Contact Service)
On ECS-5 with Local Operating Panel LOP with display DIS variant only: • Problems with operation or indication on the display	Display and/or illuminated pushbutton faulty: • Flat ribbon cable incorrectly connected	A Check that connector is locked in socket on motherboard in Local Operating Panel. B Replace front panel with display (→Contact Service)
On ECS-5 with Local Operating Panel LOP with display DIS variant only: • Display screen pressed in.	Display DIS faulty.	Replace front panel with display (→Contact Service)
On ECS-5 with Local Operating Panel LOP with display DIS variant only: • Pushbuttons jammed.	Pushbutton faulty.	Replace front panel with display (→Contact Service)

TIM ID: 0000007104 – 002

Symptom	Meaning	Action
On RCS-5 with rotary encoder module with Remote Operating Station variant only: • Pushbuttons on panel jammed.	Panel faulty.	Replace panel (→Contact Service)
On RCS-5 with rotary encoder module with Remote Operating Station variant only: • Propulsion control lever wobbles or has too much play.	A Shaft or bearing sleeve worn. B Square head in potentiometer of rotary encoder module worn, potentiometer faulty.	A Replace faulty component. B Replace rotary encoder module (→Contact Service)

TIM ID: 0000007104 – 002

7.3 Alarms – General information

Alarm handling

When an alarm is signaled, the skipper must determine the reason why the alarm was raised and respond accordingly on the basis of available information.

In some cases, for alarms which do not lead to automatic engine shutdown, it is sufficient to decrease engine power by reducing engine speed.

Alarms caused by an inadequate supply of fluids and lubricants to the engine must be cleared immediately by carrying out appropriate repair work on the engine.

Alarm signaling at control stands with the display version (option)

- The alarm horn of the power train concerned sounds.
- The illuminated pushbutton COMB. ALARM/ACK. flashes.
- The COMBINED ALARM indicator lamps flash on the slave control stands (if applicable).
- The alarm page appears on the display automatically (→ Page 72): One or more alarms are marked UNACK (→ Page 72).

Acknowledging alarms

(→ Page 142)

TIM ID: 0000006164 – 002

7.4 Acknowledgment of individual alarms

Preconditions

- Overall BlueLine system of the power train is switched on.
- An alarm has occurred.

Acknowledgment of individual alarms using the alarm window

1. Activate "Alarm window opens automatically" setting if required .
2. Press "Horn" button.
   Result: Horn is silenced.
3. Rectify cause for alarm, contact Service if required.
4. Mark unacknowledged alarm.
   Result: Alarm is shown in black on a cyan background.
5. Press "Alarm acknowledge" button in alarm window.
   Result: Alarm is shown in black on gray background following acknowledgment.

Acknowledgment of individual alarms on the alarm page

1. Press "Horn" button.
   Result: Horn is silenced.
2. If the alarm page is not open, press "Alarm page" button;
   Result: "Alarm page" opens.
3. Rectify cause for alarm, contact Service if required.
4. Mark unacknowledged alarm.
   Result: Alarm is shown in black on a cyan background.
5. Press "Alarm acknowledge" button.
   Result: Alarm is shown in black on gray background.

TIM ID: 0000006230 – 002

7.5 Fault indication on the LOP display

The Alarm page displaying detailed information about the fault is automatically retrieved whenever a fault occurs.

Display text	Meaning	Action
AL Barring Gear Engaged	Yellow alarm from Local Operating Panel LOP: Barring gear is engaged.	Disengage barring gear before engine start.
AL Battery Charger Failure	Yellow alarm from Local Operating Panel LOP: Charging check.	Contact Service • Check battery-charging generator.
AL Clutch interlock	Yellow alarm from Gear Control Unit GCU: Engagement interlock applied.	Cancel engagement interlock.
AL Clutch locked by shaft sp.	Yellow alarm from Gear Control Unit GCU: Engagement interlock applied as shaft is turning of its own accord.	Stop the vessel before engaging the second shaft.
AL Common Rail Leakage	Yellow alarm from Engine Control Unit ECU: Pressure loss in Common Rail.	Pinpoint source of leakage and seal off.
AL ECU Defect	Yellow alarm from Engine Control Unit ECU: An unspecified fault has occurred in Engine Control Unit ECU.	Contact Service • Replace ECU.
AL ECU Error/ Check Error code	Yellow alarm from Engine Control Unit ECU: Alarm messages received from Engine Control Unit ECU.	Check Engine Control Unit ECU fault code (→Engine Operating Instructions)
AL Emerg. power Supply Fail	Yellow alarm from Local Operating Panel LOP: Emergency power supply failure.	Check on-board power supply.
AL Emergency Disengage	Yellow alarm from Gear Control Unit GCU: Gearbox emergency disengagement.	Contact Service.
AL ETC 2 Cut in Fail	Yellow alarm from Engine Control Unit: Exhaust turbocharger 2 cannot be cut in.	Contact Service.
AL ETC 2 Idle Speed High	Yellow alarm from Engine Control Unit: Idling speed of exhaust turbocharger 2 is too high.	Reduce power.
AL Gear Oil Filter Clogged	Yellow alarm from Gear Control Unit GCU: Gear oil filter is clogged.	Clean/replace filter (→Gearbox documentation).
AL HSG Poti Lost	Red alarm from Remote Control System RCS-5: Total failure of the portable control unit RCS-HSG.	Disconnect portable control unit.
AL HSG Poti Red.Lost	Yellow alarm from Remote Control System RCS-5: Fault in portable control unit RCS-HSG.	Disconnect portable control unit.
AL Main Power Supply Fail	Yellow alarm from Local Operating Panel LOP: Main power supply failure.	Check on-board power supply.
AL MCC1 Lever Poti Lost	Red alarm from Remote Control System RCS-5: Total failure of the command unit on main control stand 1.	Replace command unit / rotary encoder module (→ Page 256).

TIM ID: 0000007107 – 004

Display text	Meaning	Action
AL MCC1 Lever Poti Red.Lost	Yellow alarm from Remote Control System RCS-5: Fault in command unit on main control stand 1.	Replace command unit / rotary encoder module (→ Page 256).
AL MCC2 Lever Poti Red.Lost	Yellow alarm from Remote Control System RCS-5: Fault in command unit on main control stand 2.	Replace command unit / rotary encoder module (→ Page 256).
AL MCC2 Lever Poti Lost	Red alarm from Remote Control System RCS-5: Total failure of the command unit on main control stand 2.	Replace command unit / rotary encoder module (→ Page 256).
AL Override Activated	Red alarm from Local Operating Panel LOP: The Override function has been activated.	-
AL Portable Ctrl. Lost	Red alarm from Remote Control System RCS-5: Total failure of the portable control unit RCS-HSG.	Disconnect portable control unit.
AL Power Amplifier 1 Failure	Yellow alarm from Local Operating Panel LOP: Fault at transistor outputs of Engine Control Unit ECU.	Contact Service • Replace ECU.
AL Power Amplifier 2 Failure	Yellow alarm from Local Operating Panel LOP: Fault at transistor outputs of Engine Control Unit ECU.	Contact Service • Replace ECU. .
AL Priming Pump Fail	Yellow alarm from Local Operating Panel LOP: Fault at the oil priming pump.	Check oil priming pump • Pump current too high • Motor protection switch tripped.
AL Priming Pump Overcurrent	Yellow alarm from Local Operating Panel LOP: Fault at the oil priming pump.	Check oil priming pump • Pump current too high • Motor protection switch tripped.
AL RCS Active Lever Lost	Red alarm from Remote Control System RCS-5: The active propulsion control lever is no longer detected.	Use other propulsion control lever.
AL RCS Combined Alarm	Red alarm from Remote Control System RCS-5: Summary alarm from Remote Control System RCS-5 pending.	Display on RCS-5 control unit.
AL RCS SCL Failure	Yellow alarm from Remote Control System RCS-5: Single Control Lever mode can no longer be activated.	1. Ensure correct operation; 2. Check for additional fault messages.
AL RCS Speed Demand Defect	Yellow alarm from Engine Control Unit ECU: No speed demand from RCS.	Display on RCS-5 control unit.
AL SCC1 Poti Lost	Red alarm from Remote Control System RCS-5: Total failure of the command unit on slave control stand 1.	Replace command unit / rotary encoder module (→ Page 256).
AL SCC1 Poti Red.Lost	Yellow alarm from Remote Control System RCS-5: Fault in command unit on slave control stand 1.	Replace command unit / rotary encoder module (→ Page 256).

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Display text	Meaning	Action
AL SCC2 Poti Lost	Red alarm from Remote Control System RCS-5: Total failure of the command unit on slave control stand 2.	Replace command unit / rotary encoder module (→ Page 256).
AL SCC2 Poti Red.Lost	Yellow alarm from Remote Control System RCS-5: Fault in command unit on slave control stand 2.	Replace command unit / rotary encoder module (→ Page 256).
AL Shut Down Air Flaps Closed	Red alarm from Local Operating Panel LOP: Emergency air-shutoff flaps are closed.	Open emergency air-shutoff flaps manually.
AL Status Transistor Outputs	Yellow alarm from Local Operating Panel LOP: Fault at transistor outputs of Engine Control Unit ECU.	Contact Service • Replace ECU.
AL Trolling On Failure	Yellow alarm from Gear Control Unit GCU: Trolling device cannot be activated.	(→Gearbox documentation)
AL Trolling System Fault	Yellow alarm from Gear Control Unit GCU: Trolling device signals fault.	(→Gearbox documentation)
AL WAGO Communication Lost	Yellow alarm from Remote Control System RCS-5: Communication with the control unit of the portable control unit (RIM) is disrupted.	Contact Service.
AL Water in Fuel Prefilter	Yellow alarm from Local Operating Panel LOP: Water in the fuel prefilter.	Clean filter (→Engine Operating Instructions).
HI ECU Power Supply Voltage	Yellow alarm from Engine Control Unit ECU: Supply voltage is too high.	Check on-board power supply.
HI ETC 1 Speed	Yellow alarm from Engine Control Unit ECU: Exhaust turbocharger speed limit value for charger 1 violated.	Reduce engine power.
HI ETC 2 Speed	Yellow alarm from Engine Control Unit ECU: Exhaust turbocharger speed limit value for charger 2 violated.	Reduce engine power.
HI Speed Difference	Yellow alarm from Engine Control Unit ECU: Difference in speed between the exhaust turbochargers is too high.	Reduce engine power.
HI Fuel Leakage	Yellow alarm from Engine Control Unit ECU: Leak-fuel level in the leak-fuel tank is too high.	Check fuel system.
HI P-Crankcase	Yellow alarm from Engine Control Unit ECU: Crankcase pressure is too high.	Contact Service.
HI P-Fuel (Common Rail)	Yellow alarm from Engine Control Unit ECU: Fuel pressure in Common Rail is too high.	Reduce engine power.
HI P-Oil Filter Difference	Yellow alarm from Engine Control Unit ECU: Difference in oil pressure before and after filter is too high.	Replace/clean engine oil filter (→Engine Operating Instructions).

Display text	Meaning	Action
HI T-Charge Air	Yellow alarm from Engine Control Unit ECU: Charge air temperature limit value has been violated.	Reduce engine power.
HI T-Coolant (ECU)	Yellow alarm from Engine Control Unit ECU: Coolant temperature limit value has been violated.	Reduce engine power.
HI T-ECU	Yellow alarm from Engine Control Unit ECU: Engine Control Unit is too hot.	Improve engine room ventilation, reduce engine power as necessary.
EH T-Exhaust Combined A	Yellow alarm from Engine Control Unit ECU: Exhaust bulk temperature limit value engine A side violated.	Reduce engine power (→Contact Service).
HI T-Exhaust Combined B	Yellow alarm from Engine Control Unit ECU: Exhaust bulk temperature limit value engine B side violated.	Reduce engine power (→Contact Service).
HI T-Fuel	Yellow alarm from Engine Control Unit ECU: Fuel temperature limit value has been violated.	Check fuel system.
HI T-Gear Oil	Yellow alarm from Gear Control Unit GCU: Gear oil temperature limit value has been violated.	Reduce propulsion power (→Contact Service).
HI T-Lube Oil	Yellow alarm from Engine Control Unit ECU: Lube oil temperature limit value has been violated.	Reduce engine power (→Contact Service).
HIHI ECU Power Supply Voltage	Red alarm from Engine Control Unit ECU: Safety system has shut the engine down due to high operating voltage.	Check on-board power supply.
HIHI T-Fuel	Red alarm from Engine Control Unit ECU: Fuel temperature limit value has been violated.	1. Reduce engine power; 2. Check fuel system.
LO Coolant Level	Yellow alarm from Engine Control Unit ECU: Coolant level too low.	Top up engine coolant (→Engine Operating Instructions).
LO ECU Power Supply Voltage	Yellow alarm from Engine Control Unit ECU: Supply voltage is too low.	Check on-board power supply.
LO P-Charge Air	Yellow alarm from Engine Control Unit ECU: Charge-air pressure limit value has been violated.	Contact Service.
LO P-Coolant	Yellow alarm from Engine Control Unit ECU: Coolant pressure limit value has been violated.	Contact Service.
LO P-Fuel	Yellow alarm from Engine Control Unit ECU: Fuel pressure limit value has been violated.	Reduce engine power.
LO P-Fuel (Common Rail)	Yellow alarm from Engine Control Unit ECU: Fuel pressure in Common Rail is too low.	1. Reduce engine power; 2. Contact Service.

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Display text	Meaning	Action
LO P-Gear Control Oil	Yellow alarm from Gear Control Unit GCU: Gear control oil pressure limit value has been violated.	Check gearbox oil system (→Contact Service).
LO P-Gear Lube Oil	Yellow alarm from Gear Control Unit GCU: Gear lube oil pressure limit value has been violated.	Check gearbox oil system (→Contact Service).
LO P-Lube Oil (ECU)	Yellow alarm from Engine Control Unit ECU: Engine lube oil pressure limit value has been violated.	1. Check engine oil level (→Engine Operating Instructions).
LO P-Start Air	Engines with air-starting only: Yellow alarm from Local Operating Panel LOP: Starting-air pressure is too low.	Check compressed air system.
LO TCU Power Supply Voltage	Alarm from Trolling Control Unit: Fault message can only appear when the ZF control unit ZF MTCU (EST-59) is set on the “Trolling Unit” page in the MPU 29 display minidialog in the Local Operating Panel. • Supply voltage at connector X3 on GCU 3 is too low.	Check on-board power supply.
LOLO ECU Power Supply Voltage	Red alarm from Engine Control Unit ECU: Safety system has shut the engine down due to low operating voltage.	Check on-board power supply.
MG Barring Gear Engaged	Status message from Local Operating Panel LOP: Barring gear is engaged.	Disengage barring gear.
MG Coordinating Bus fail	Status message: Fault on Coordination Field Bus of Remote Control System.	Check wiring.
MG Disengage Error	Status message from Gear Control Unit GCU: Gearbox cannot be disengaged.	Re-attempt to disengage.
MG Eng.Speed high/Low (Clutch)	Status message from Gear Control Unit GCU: Engine speed not in engagement window.	Reduce engine speed before attempting to engage.
MG Engage Error	Status message from Gear Control Unit GCU: Gearbox cannot be engaged.	Observe additional messages.
MG External Start Interlock	Status message from Local Operating Panel LOP: External start interlock applied.	Check external systems which may apply a start interlock.
MG Gear not Neutral	Status message from Local Operating Panel LOP: Gearbox is not disengaged.	-
MG Not Ready for Operation	Status message from Local Operating Panel LOP: ECS-5 is not switched ready for operation.	Press illuminated pushbutton READY FOR OPERATION on LOS.
MG SCL active (Troll. denied)	Single Control Lever mode is activated, Trolling mode cannot be selected.	Ensure correct operation.
MG SDAF closed	Status message from Local Operating Panel LOP: emergency air-shutoff flaps are closed.	Open emergency air-shutoff flaps manually.

Display text	Meaning	Action
MG System Testmode	Status message from Local Operating Panel LOP: Electronic system is in Test mode.	Deactivate Test mode manually on completion of the tests.
MG Trolling active (SCL. denied)	Trolling mode is activated, Single Control Lever mode cannot be selected.	Ensure correct operation.
MG Trolling config. Fault	Status message from Trolling Control Unit: • The settings on the two pages “Trolling Unit” and “Trolling Config.” in the minidialog on the MPU 29 display in the Local Operating Panel do not correlate. • Incorrect values have been programmed.	Correct settings.
SS Autom. Power Reduct. active	Red alarm from Engine Control Unit ECU: Automatic power reduction by the Engine Control Unit has been activated.	Reduce engine power.
SS Emergency Stop	Red alarm from Local Operating Panel LOP: An emergency stop has been initiated.	Observe additional messages.
SS Emergency Stop External	Red alarm from Local Operating Panel LOP: An external emergency stop has been initiated.	Check for additional messages at external systems.
SS Engine Speed too low	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to low engine speed.	Contact Service.
SS ETC1 Overspeed	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high speed of exhaust turbocharger 1.	Contact Service.
SS ETC2 Overspeed	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high speed of exhaust turbocharger 2.	Contact Service.
SS Overspeed (ECU)	Red alarm from Local Operating Panel LOP: The safety system has shut the engine down due to overspeeding.	Reduce engine power after restarting.
SS P-Coolant	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to low coolant pressure.	Contact Service.
SS P-Crankcase	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high crankcase pressure.	Contact Service.
SS P-Fuel	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to low fuel pressure.	Contact Service.
SS P-Gear Control Oil	Red alarm from Gear Control Unit GCU: The safety system has shut the engine down due to low gear control oil pressure.	Check gearbox oil system (→Gearbox documentation).

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Display text	Meaning	Action
SS P-Gear Lube Oil	Red alarm from Gear Control Unit GCU: The safety system has shut the engine down due to low gear lube oil pressure.	Reduce propulsion power (→Gearbox documentation).
SS P-Lube Oil (ECU)	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to low lube oil pressure.	Contact Service.
SS Security Shutdown	Red alarm from Local Operating Panel LOP: The safety system has shut the engine down.	Check for additional fault messages.
SS T-Charge Air	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high charge-air temperature.	Contact Service.
SS T-Charge Air Seq Ctrl Valve	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high charge-air temperature.	Contact Service.
SS T-Coolant (ECU)	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high coolant temperature.	Contact Service.
SS T-Exhaust Combined A	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high exhaust bulk temperature on engine side A.	Contact Service.
SS T-Exhaust Combined B	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high exhaust bulk temperature on engine side B.	Contact Service.
SS T-Lube Oil	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high lube oil temperature.	Contact Service.

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7.6 Fault indication on MFD display of main control stand

The Alarm page displaying detailed information about the fault is automatically retrieved whenever a fault occurs.

Display text	Meaning	Action
AL Barring Gear Engaged	Yellow alarm from Local Operating Panel LOP: Barring gear is engaged.	Disengage barring gear before engine start.
AL Battery Charger Failure	Yellow alarm from Local Operating Panel LOP: Charging check.	Contact Service • Check battery-charging generator.
AL Clutch interlock	Yellow alarm from Gear Control Unit GCU: Engagement interlock applied.	Cancel engagement interlock.
AL Clutch locked by shaft sp.	Yellow alarm from Gear Control Unit GCU: Engagement interlock applied as shaft is turning of its own accord.	Stop the vessel before engaging the second shaft.
AL Common Rail Leakage	Yellow alarm from Engine Control Unit ECU: Pressure loss in Common Rail.	Pinpoint source of leakage and seal off.
AL ECU Defect	Yellow alarm from Engine Control Unit ECU: An unspecified fault has occurred in Engine Control Unit ECU.	Contact Service • Replace ECU.
AL ECU Error/ Check Error code	Yellow alarm from Engine Control Unit ECU: Alarm messages received from Engine Control Unit ECU.	Check Engine Control Unit ECU fault code (→Engine Operating Instructions).
AL Emerg. power Supply Fail	Yellow alarm from Local Operating Panel LOP: Emergency power supply failure.	Check on-board power supply.
AL Emergency Disengage	Yellow alarm from Gear Control Unit GCU: Gearbox emergency disengagement.	Contact Service.
AL ETC 2 Cut in Fail	Yellow alarm from Engine Control Unit: Exhaust turbocharger 2 cannot be cut in.	Contact Service.
AL ETC 2 Idle Speed High	Yellow alarm from Engine Control Unit: Idling speed of exhaust turbocharger 2 is too high.	Reduce power.
AL Gear Oil Filter Clogged	Yellow alarm from Gear Control Unit GCU: Gear oil filter is clogged.	Clean/replace filter (→Gearbox documentation).
AL HSG Poti Lost	Red alarm from Remote Control System RCS-5: Total failure of the portable control unit RCS-HSG.	Disconnect portable control unit.
AL HSG Poti Red.Lost	Yellow alarm from Remote Control System RCS-5: Fault in portable control unit RCS-HSG.	Disconnect portable control unit.
AL Main Power Supply Fail	Yellow alarm from Local Operating Panel LOP: Main power supply failure.	Check on-board power supply.
AL Emerg.Power Supply Fail	Yellow alarm from Local Operating Panel LOP: Emergency power supply failure.	Check on-board power supply.

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Display text	Meaning	Action
AL MCC1 Lever Poti Lost	Red alarm from Remote Control System RCS-5: Total failure of the command unit on main control stand 1.	Replace command unit / rotary encoder module (→ Page 256).
AL MCC1 Lever Poti Red.Lost	Yellow alarm from Remote Control System RCS-5: Fault in command unit on main control stand 1.	Replace command unit / rotary encoder module (→ Page 256).
AL MCC2 Lever Poti Red.Lost	Yellow alarm from Remote Control System RCS-5: Fault in command unit on main control stand 2.	Replace command unit / rotary encoder module (→ Page 256).
AL MCC2 Lever Poti Lost	Red alarm from Remote Control System RCS-5: Total failure of the command unit on main control stand 2.	Replace command unit / rotary encoder module (→ Page 256).
AL MCR Overload	Yellow alarm from engine: Engine is overloaded.	Reduce power
AL Override Activated	Red alarm from Local Operating Panel LOP: The Override function has been activated.	-
AL Portable Ctrl. Lost	Red alarm from Remote Control System RCS-5: Total failure of the portable control unit RCS-HSG.	Disconnect portable control unit.
AL Power Amplifier 1 Failure	Yellow alarm from Local Operating Panel LOP: Fault at transistor outputs of Engine Control Unit ECU.	Contact Service • Replace ECU.
AL Power Amplifier 2 Failure	Yellow alarm from Local Operating Panel LOP: Fault at transistor outputs of Engine Control Unit ECU.	Contact Service • Replace ECU. .
AL Priming Pump Fail	Yellow alarm from Local Operating Panel LOP: Fault at the oil priming pump.	Check oil priming pump • Pump current too high • Motor protection switch tripped.
AL Priming Pump Overcurrent	Yellow alarm from Local Operating Panel LOP: Fault at the oil priming pump.	Check oil priming pump • Pump current too high • Motor protection switch tripped.
AL RCS Active Lever Lost	Red alarm from Remote Control System RCS-5: The active propulsion control lever is no longer detected.	Use other propulsion control lever.
AL RCS Combined Alarm	Red alarm from Remote Control System RCS-5: Summary alarm from Remote Control System RCS-5 pending.	Display on RCS-5 control unit.
AL RCS SCL Failure	Yellow alarm from Remote Control System RCS-5: Single Control Lever mode can no longer be activated.	1. Ensure correct operation; 2. Check for additional fault messages.
AL RCS Speed Demand Defect	Yellow alarm from Engine Control Unit ECU: No speed demand from RCS.	Display on RCS-5 control unit.

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Display text	Meaning	Action
AL SCC1 Poti Lost	Red alarm from Remote Control System RCS-5: Total failure of the command unit on slave control stand 1.	Replace command unit / rotary encoder module (→ Page 256).
AL SCC1 Poti Red.Lost	Yellow alarm from Remote Control System RCS-5: Fault in command unit on slave control stand 1.	Replace command unit / rotary encoder module (→ Page 256).
AL SCC2 Poti Lost	Red alarm from Remote Control System RCS-5: Total failure of the command unit on slave control stand 2.	Replace command unit / rotary encoder module (→ Page 256).
AL SCC2 Poti Red.Lost	Yellow alarm from Remote Control System RCS-5: Fault in command unit on slave control stand 2.	Replace command unit / rotary encoder module (→ Page 256).
AL Shut Down Air Flaps Closed	Red alarm from Local Operating Panel LOP: Emergency air-shutoff flaps are closed.	Open emergency air-shutoff flaps manually.
AL Status Transistor Outputs	Yellow alarm from Local Operating Panel LOP: Fault at transistor outputs of Engine Control Unit ECU.	Contact Service • Replace ECU.
AL Trolling On Failure	Yellow alarm from Gear Control Unit GCU: Trolling device cannot be activated.	(→Gearbox documentation)
AL Trolling System Fault	Yellow alarm from Gear Control Unit GCU: Trolling device signals fault.	(→Gearbox documentation)
AL WAGO Communication Lost	Yellow alarm from Remote Control System RCS-5: Communication with the control unit of the portable control unit (RIM) is disrupted.	Contact Service.
AL Water in Fuel Prefilter	Yellow alarm from Local Operating Panel LOP: Water in the fuel prefilter.	Clean filter (→Engine Operating Instructions).
HI ECU Power Supply Voltage	Yellow alarm from Engine Control Unit ECU: Supply voltage is too high.	Check on-board power supply.
HI ETC 1 Speed	Yellow alarm from Engine Control Unit ECU: Exhaust turbocharger speed limit value for charger 1 violated.	Reduce engine power.
HI ETC 2 Speed	Yellow alarm from Engine Control Unit ECU: Exhaust turbocharger speed limit value for charger 2 violated.	Reduce engine power.
HI ETC 3 Speed	Yellow alarm from Engine Control Unit ECU: Exhaust turbocharger speed limit value for charger 3 violated.	Reduce engine power.
HI ETC 4 Speed	Yellow alarm from Engine Control Unit ECU: Exhaust turbocharger speed limit value for charger 4 violated.	Reduce engine power.
HI Speed Difference	Yellow alarm from Engine Control Unit ECU: Difference in speed between the exhaust turbochargers is too high.	Reduce engine power.

TIM ID: 0000029947 – 002

Display text	Meaning	Action
HI Fuel Leakage	Yellow alarm from Engine Control Unit ECU: Leak-off-fuel level in the leak-fuel tank is too high.	Check fuel system.
HI P-Crankcase	Yellow alarm from Engine Control Unit ECU: Crankcase pressure is too high.	Contact Service.
HI P-Exhaust Back	Yellow alarm – exhaust back pressure is too high.	Check exhaust system
HI P-Fuel (Common Rail)	Yellow alarm from Engine Control Unit ECU: Fuel pressure in Common Rail is too high.	Reduce engine power.
HI P-Oil Filter Difference	Yellow alarm from Engine Control Unit ECU: Difference in oil pressure before and after filter is too high.	Replace/clean engine oil filter (→Engine Operating Instructions).
HI T-Charge Air	Yellow alarm from Engine Control Unit ECU: Charge air temperature limit value has been violated.	Reduce engine power.
HI T-Charge Air Seq Ctrl Valve	Yellow alarm – Temperature at air recirculation valve is too high.	Check air recirculation valve.
HI T-Coolant (ECU)	Yellow alarm from Engine Control Unit ECU: Coolant temperature limit value has been violated.	Reduce engine power.
HI T-ECU	Yellow alarm from Engine Control Unit ECU: Engine Control Unit is too hot.	Improve engine room ventilation, reduce engine power as necessary.
HI T-Exhaust Combined A	Yellow alarm from Engine Control Unit ECU: Exhaust bulk temperature limit value engine A side violated.	Reduce engine power (→Contact Service).
HI T-Exhaust Combined B	Yellow alarm from Engine Control Unit ECU: Exhaust bulk temperature limit value engine B side violated.	Reduce engine power (→Contact Service).
HI T-Exhaust Combined C	Yellow alarm from Engine Control Unit ECU: Exhaust bulk temperature limit value engine C side violated.	Reduce engine power (→Contact Service).
HI T-Exhaust Combined D	Yellow alarm from Engine Control Unit ECU: Exhaust bulk temperature limit value engine D side violated.	Reduce engine power (→Contact Service).
HI T-Fuel	Yellow alarm from Engine Control Unit ECU: Fuel temperature limit value has been violated.	Check fuel system.
HI T-Gear Oil	Yellow alarm from Gear Control Unit GCU: Gear oil temperature limit value has been violated.	Reduce propulsion power (→Contact Service).
HI T-Lube Oil	Yellow alarm from Engine Control Unit ECU: Lube oil temperature limit value has been violated.	Reduce engine power (→Contact Service).

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Display text	Meaning	Action
HI T-Riser	Yellow alarm – riser temperature is too high.	Check riser water injections.
HIHI ECU Power Supply Voltage	Red alarm from Engine Control Unit ECU: Safety system has shut the engine down due to high operating voltage.	Check on-board power supply.
HIHI T-Fuel	Red alarm from Engine Control Unit ECU: Fuel temperature limit value has been violated.	1. Reduce engine power; 2. Check fuel system.
LO Coolant Level	Yellow alarm from Engine Control Unit ECU: Coolant level too low.	Top up engine coolant (→Engine Operating Instructions).
LO ECU Power Supply Voltage	Yellow alarm from Engine Control Unit ECU: Supply voltage is too low.	Check on-board power supply.
LO P-Charge Air	Yellow alarm from Engine Control Unit ECU: Charge-air pressure limit value has been violated.	Contact Service.
LO P-Coolant	Yellow alarm from Engine Control Unit ECU: Coolant pressure limit value has been violated.	Contact Service.
LO P-Fuel	Yellow alarm from Engine Control Unit ECU: Fuel pressure limit value has been violated.	Reduce engine power.
LO P-Fuel (Common Rail)	Yellow alarm from Engine Control Unit ECU: Fuel pressure in Common Rail is too low.	1. Reduce engine power; 2. Contact Service.
LO P-Gear Control Oil	Yellow alarm from Gear Control Unit GCU: Gear control oil pressure limit value has been violated.	Check gearbox oil system (→Contact Service).
LO P-Gear Lube Oil	Yellow alarm from Gear Control Unit GCU: Gear lube oil pressure limit value has been violated.	Check gearbox oil system (→Contact Service).
LO P-Lube Oil (ECU)	Yellow alarm from Engine Control Unit ECU: Engine lube oil pressure limit value has been violated.	1. Check engine oil level (→Engine Operating Instructions).
LO P-Start Air	Engines with air-starting only: Yellow alarm from Local Operating Panel LOP: Starting-air pressure is too low.	Check compressed air system.
LO TCU Power Supply Voltage	Alarm from Trolling Control Unit: Fault message can only appear when the ZF control unit ZF MTCU (EST-59) is set on the “Trolling Unit” page in the MPU 29 display minidialog in the Local Operating Panel. • Supply voltage at connector X3 on GCU 3 is too low.	Check on-board power supply.
LOLO ECU Power Supply Voltage	Red alarm from Engine Control Unit ECU: Safety system has shut the engine down due to low operating voltage.	Check on-board power supply.

TIM ID: 0000029947 – 002

Display text	Meaning	Action
MG Barring Gear Engaged	Status message from Local Operating Panel LOP: Barring gear is engaged.	Disengage barring gear.
MG Coordinating Bus fail	Status message: Fault on Coordination Field Bus of Remote Control System.	Check wiring.
MG Disengage Error	Status message from Gear Control Unit GCU: Gearbox cannot be disengaged.	Re-attempt to disengage.
MG Eng.Speed high/Low (Clutch)	Status message from Gear Control Unit GCU: Engine speed not in engagement window.	Reduce engine speed before attempting to engage.
MG Engage Error	Status message from Gear Control Unit GCU: Gearbox cannot be engaged.	Observe additional messages.
MG External Start Interlock	Status message from Local Operating Panel LOP: External start interlock applied.	Check external systems which may apply a start interlock.
MG Gear not Neutral	Status message from Local Operating Panel LOP: Gearbox is not disengaged.	-
MG Not Ready for Operation	Status message from Local Operating Panel LOP: ECS-5 is not switched ready for operation.	Press illuminated pushbutton READY FOR OPERATION on LOS.
MG SCL active (Troll. denied)	Single Control Lever mode is activated, Trolling mode cannot be selected.	Ensure correct operation.
MG SDAF closed	Status message from Local Operating Panel LOP: Emergency air-shutoff flaps are closed.	Open emergency air-shutoff flaps manually.
MG System Testmode	Status message from Local Operating Panel LOP: Electronic system is in Test mode.	Deactivate Test mode manually on completion of the tests.
MG Trolling active (SCL. denied)	Trolling mode is activated, Single Control Lever mode cannot be selected.	Ensure correct operation.
MG Trolling config. Fault	Status message from Trolling Control Unit: • The settings on the two pages “Trolling Unit” and “Trolling Config.” in the minidialog on the MPU 29 display in the Local Operating Panel do not correlate. • Incorrect values have been programmed.	Correct settings.
SS Autom. Power Reduct. active	Red alarm from Engine Control Unit ECU: Automatic power reduction by the Engine Control Unit has been activated.	Reduce engine power.
SS Emergency Stop	Red alarm from Local Operating Panel LOP: An emergency stop has been initiated.	Observe additional messages.
SS Emergency Stop External	Red alarm from Local Operating Panel LOP: An external emergency stop has been initiated.	Check for additional messages at external systems.

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Display text	Meaning	Action
SS Engine Speed too low	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to low engine speed.	Contact Service.
SS ETC1 Overspeed	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high speed of exhaust turbocharger 1.	Contact Service.
SS ETC2 Overspeed	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high speed of exhaust turbocharger 2.	Contact Service.
SS ETC3 Overspeed	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high speed of exhaust turbocharger 3.	Contact Service.
SS ETC4 Overspeed	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high speed of exhaust turbocharger 4.	Contact Service.
SS Overspeed (ECU)	Red alarm from Local Operating Panel LOP: The safety system has shut the engine down due to overspeeding.	Reduce engine power after restarting.
SS P-Coolant	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to low coolant pressure.	Contact Service.
SS P-Crankcase	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high crankcase pressure.	Contact Service.
SS P-Fuel	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to low fuel pressure.	Contact Service.
SS P-Gear Control Oil	Red alarm from Gear Control Unit GCU: The safety system has shut the engine down due to low gear control oil pressure.	Check gearbox oil system (→Gearbox documentation).
SS P-Gear Lube Oil	Red alarm from Gear Control Unit GCU: The safety system has shut the engine down due to low gear lube oil pressure.	Reduce propulsion power (→Gearbox documentation).
SS P-Lube Oil (ECU)	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to low lube oil pressure.	Contact Service.
SS Security Shutdown	Red alarm from Local Operating Panel LOP: The safety system has shut the engine down.	Check for additional fault messages.
SS T-Charge Air	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high charge-air temperature.	Contact Service.

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Display text	Meaning	Action
SS T-Charge Air Seq Ctrl Valve	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high charge-air temperature.	Contact Service.
SS T-Coolant (ECU)	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high coolant temperature.	Contact Service.
SS T-Exhaust Combined A	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high exhaust bulk temperature on engine side A.	Contact Service.
SS T-Exhaust Combined B	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high exhaust bulk temperature on engine side B.	Contact Service.
SS T-Exhaust Combined C	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high exhaust bulk temperature on engine side C.	Contact Service.
SS T-Exhaust Combined D	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high exhaust bulk temperature on engine side D.	Contact Service.
SS T-Lube Oil	Red alarm from Engine Control Unit ECU: The safety system has shut the engine down due to high lube oil temperature.	Contact Service.

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7.7 Fault indication on printed circuit board MPU 29

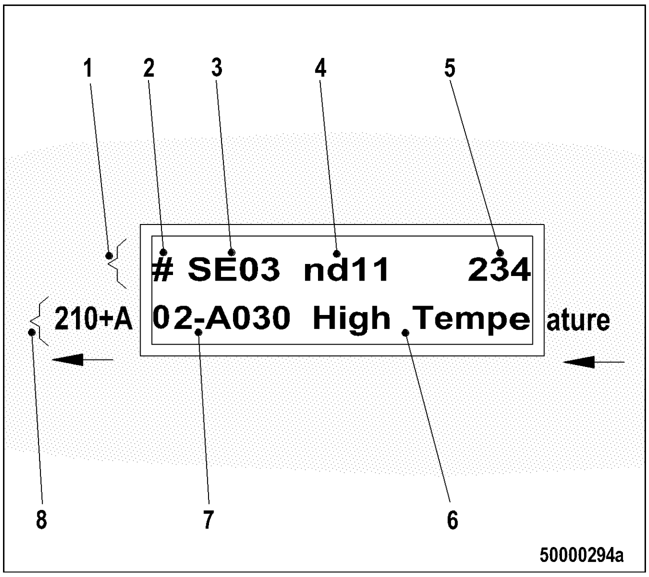
Basic principle of the display

All currently stored fault messages are constantly scrolled through, the first message is repeated once the last one has been displayed. Two lines of text appear in the display window for each message. A running text banner runs from right to left in the second (bottom) line. The next fault message appears as soon as the running text of the previous fault message has passed.

Stored fault messages may be scrolled manually with the keys to the right of the display window:

- Press the ↓ key to display the previous message.
- Press the ↑ key to display the next message.

Example of a fault message:



1 First line
2 Symbol for “fault no longer applies”
3 Fault type “System Error”
4 Node number of the device concerned
5 Fault code from engine governor ECU
6 Fault text
7 Equipment identifier of the device concerned
8 Second line (running text)

Applicability of the fault message displayed

The # symbol at the beginning of the first line indicates that the fault message concerned occurred after the system was last switched on but presently no longer applies.

Faults from Engine Control Unit ECU

Engine governor fault codes are always displayed at the end of the first line (→ Page 163).

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Faults from the propulsion plant

The measuring point number “123456” in table below is an example.

First line	Second line	Meaning	Action
RED 123456	Alarm message in plain text; similar to display message on LOS or LOP with DIS (→ Page 143)	Measuring point 123456 has signaled a red alarm.	Depending on the text message (→ Page 143)
YEL 123456	Alarm message in plain text; similar to display message on LOS or LOP with DIS (→ Page 143)	Measuring point 123456 has signaled a yellow alarm.	Depending on the text message (→ Page 143)
MG 123456	Message in plain text; similar to display message on LOS or LOP with DIS (→ Page 143)	Measuring point 123456 has sent a message.	Depending on the text message (→ Page 143)
SD 123456	Name of the measuring point	Measuring point 123456 has signaled a sensor defect.	(→Contact Service)

Faults in the electronic system

Equipment identifiers

Every device in the overall system is unambiguously identified by a dedicated equipment identifier.

The form is <System>+<Location>–<Device>, e.g. 210+A002–A030.

- System (or plant), e.g. “210”
  The third digit is 0 when the software does not depend on the power train. When installing the hardware (→Installation Instructions) however, a differentiation must be made between the power trains, e.g.
  - 1 = Port
  - 2 = Starboard
- Location (within the plant), e.g. “A002”
  This term indicates e.g. the control stand or a major unit.
- Device (or assembly), e.g. “ECU” or “A030”
  This term specifies either the device or refers in detail to the assembly in a unit.

Bus errors

The node number 07 in table below is an example.

First line	Second line	Meaning	Action
DL nd07	Equipment identifier of the affected device and the fault in plain text	Device with node number 07 is not available on the “normal” field bus.	(→Contact Service)
RL nd07	Equipment identifier of the affected device and the fault in plain text	Device with node number 07 is not available on the redundant field bus.	(→Contact Service)

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System fault

The node number 07 and the equipment identifier “123+A456–A789” in the table below are examples.

First line	Second line	Meaning	Action
SE01 nd07	123+A456–A789 Sensor Temperature Defect	The temperature sensor in device 123+A456–A789 is faulty.	Replace affected device. (→Workshop Manual)
SE02 nd07	123+A456–A789 High Temperature	The housing temperature in device 123+A456–A789 is too high.	Improve ventilation of the device concerned.
SE03 nd07	123+A456–A789 Sensor Voltage Defect	The voltage measuring sensor in device 123+A456–A789 is faulty.	Replace affected device. (→Workshop Manual)
SE04 nd07	123+A456–A789 High Voltage	The operating voltage in device 123+A456–A789 is too high.	Check on-board supply voltage (→ Page 420).
SE05 nd07	123+A456–A789 CAN Bus-1 Error/Bus Defect	CAN bus 1 at device 123+A456–A789 is faulty.	(→Contact Service).
SE06 nd07	123+A456–A789 CAN-Bus-1 Overrun	The data of CAN bus 1 cannot be evaluated in device 123+A456–A789.	Switch off overall system (→ Page 93) and switch back on (→ Page 86).
SE07 nd07	123+A456–A789 CAN Bus-2 Error/Bus Defect	CAN bus 2 at device 123+A456–A789 is faulty.	(→Contact Service).
SE08 nd07	123+A456–A789 CAN Bus-2 Overrun	The data of CAN bus 2 cannot be evaluated in device 123+A456–A789.	Switch off overall system (→ Page 93) and switch back on (→ Page 86).
SE09 nd07	123+A456–A789 Temperature Compensation Error	The temperature compensation in device 123+A456–A789 is faulty.	Replace affected device (→Workshop Manual)
SE10 nd07	123+A456–A789 I/O Module Slot 2 Defect	The printed circuit board in slot 2 in device 123+A456–A789 is faulty.	• For 210+A001–A010: Replace printed circuit board BIB 1 in Local Operating Panel LOP (→ Page 275) • For 210A110–A010: Replace printed circuit board BIB 2 in the MCS-5 control unit (→ Page 275) • For 210+A120–A010: Replace printed circuit board MFB 2 (2) in the RCS-5 control unit (→ Page 275)

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First line	Second line	Meaning	Action
SE11 nd07	123+A456–A789 I/O Module Slot 3 Defect	The printed circuit board in slot 3 in device 123+A456–A789 I/O is faulty.	• For 210+A001–A010: Replace printed circuit board BIB 1 in Local Operating Panel LOP (→ Page 275). • For 210+A110–A010: Replace printed circuit board BOB 2 (2) in the MCS-5 control unit (→ Page 275). • For 210+A120–A010: Replace printed circuit board MFB 2 (3) in the RCS-5 control unit (→ Page 275).
SE12 nd07	123+A456–A789 I/O Module Slot 4 Defect	The printed circuit board in slot 4 in device 123+A456–A789 I/O is faulty.	• For 210+A001–A010: Replace printed circuit board BIB 1 in Local Operating Panel LOP (→ Page 275). • For 210+A110–A010: Replace printed circuit board INB 3 in the MCS-5 control unit (→ Page 275). • For 210+A120–A010: Replace printed circuit board MFB 2 (4) in the RCS-5 control unit (→ Page 275).
SE13 nd07	123+A456–A789 Serial connection lost	• The serial interface in device 123+A456–A789 is faulty. • No data received.	• For 210+A001–A010: Check that jumper plug X17 in the MCS-5 control unit is properly seated (→Contact Service). • Check data communication at the connected external device.
SE14 nd07	123+A456–A789 CAN Bus-3 Error/Bus Defect	CAN bus 3 at device 123+A456–A789 is faulty.	(→Contact Service).
SE15 nd07	123+A456–A789 CAN Bus-3 Overrun	The data of CAN bus 3 cannot be evaluated in device 123+A456–A789.	Switch off overall system (→ Page 93) and switch back on (→ Page 86).

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First line	Second line	Meaning	Action
SE23 nd07	123+A456–A789 I/O Module Slot 1 Defect	The printed circuit board in slot 1 in device 123+A456–A789 is faulty.	• For 210+A001–A010: Replace printed circuit board AIB 1 in Local Operating Panel LOP (→ Page 275) • For 210A110–A010: Replace printed circuit board BOB 2 (1) in the MCS-5 control unit (→ Page 275) • For 210+A120–A010: Replace printed circuit board MFB 2 (1) in the RCS-5 control unit (→ Page 275)
SE24 nd07	210+A001–A01 I/O Module Slot 5 Defect	The printed circuit board in slot 5 in the Local Operating Panel is faulty.	Replace printed circuit board BOB 1 in Local Operating Panel LOP (→ Page 275).
SE25 nd07	210+A001–A01 I/O Module Slot 6 Defect.	The printed circuit board in slot 6 in the Local Operating Panel is faulty.	Replace printed circuit board BOB 1 in Local Operating Panel LOP (→ Page 275).
SE26 nd07	210+A001–A01 I/O Module Slot 7 Defect.	The printed circuit board in slot 7 in the Local Operating Panel is faulty.	Replace printed circuit board BOB 2 in Local Operating Panel LOP (→ Page 275).
SE27 nd07	123+A456–A789 I/O Module Slot 8 Defect	The printed circuit board in slot 8 in device 123+A456–A789 is faulty.	(→Contact Service).

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7.8 Fault messages – Engine Control Unit

003 – HI T-Fuel

Fuel temperature too high (limit value 1)

Yellow alarm from Engine Control Unit: Fuel temperature limit value 1 has been violated.

Cause	Corrective action
	1. Check fuel inlet temperature; 2. check fuel tank temperature; 3. check engine room temperature. Contact Service.

004 – SS T-Fuel

Fuel temperature too high (limit value 2)

Yellow alarm from Engine Control Unit: Fuel temperature limit value 2 has been violated.

Cause	Corrective action
	1. Check fuel inlet temperature; 2. check fuel tank temperature; 3. check engine room temperature. Contact Service.

005 – HI T-Charge Air

Charge-air temperature too high (limit value 1)

Prewarning, charge-air temperature limit value 1 too high.

Cause	Corrective action
	1. Reduce power. 2. Check intercooler.

006 – SS T-Charge Air

Charge-air temperature too high (limit value 2)

Main warning, charge-air temperature limit value 2 too high.

Cause	Corrective action
	1. Reduce power. 2. Check intercooler.

009 – HI T-Coolant Intercooler

Coolant temperature in intercooler too high (limit value 1)

Prewarning, coolant temperature in intercooler limit value 1 too high.

Cause	Corrective action
	► Reduce power.

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010 – SS T-Coolant Intercooler

Coolant temperature in intercooler too high (limit value 2)

Main warning, coolant temperature in intercooler limit value 2 too high; engine stop

Cause	Corrective action
	► Reduce power

015 – LO P-Lube Oil

Lube oil pressure too low (limit value 1)

Prewarning, lube oil pressure limit value 1 too low

Cause	Corrective action
	► Check oil level, top up as necessary (see Operating Instructions)

016 – SS P-Lube Oil

Lube oil pressure too low (limit value 2)

Main warning, lube oil pressure limit value 2 too low; engine is stopped.

Cause	Corrective action
	1. Check oil level, top up as necessary (see Operating Instructions) 2. Attempt to restart engine (see Operating Instructions)

019 – HI T-Exhaust A

Exhaust gas temperature (A side) too high (limit value 1)

Prewarning, exhaust gas temperature (A side) limit value 1 too high

Cause	Corrective action
	1. Reduce power. 2. Contact Service

020 – SS T-Exhaust A

Exhaust gas temperature (A side) too high (limit value 2)

Main warning, exhaust gas temperature (A side) limit value 2 too high; engine stop.

Cause	Corrective action
	1. Check wiring 2. Contact Service.

021 – HI T-Exhaust B

Exhaust gas temperature (B side) too high (limit value 1)

Prewarning, exhaust gas temperature (B side) limit value 1 too high

Cause	Corrective action
	1. Check wiring 2. Contact Service.

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022 – SS T-Exhaust B

Exhaust gas temperature (B side) too high (limit value 2)

Main warning, exhaust gas temperature (B side) limit value 2 too high; engine stop.

Cause	Corrective action
	1. Check wiring 2. Contact Service.

023 – LO Coolant Level

Coolant level too low (limit value 1)

Alarm configuration; coolant level limit value 1 too low.

Cause	Corrective action
	► Check coolant level in expansion tank

025 – HI P-Diff Lube Oil

Differential oil pressure at oil filter too high (limit value 1)

Prewarning, differential oil pressure at oil filter limit value 1 too high

Cause	Corrective action
	► Contact Service.

026 – SS P-Diff Lube Oil

Differential oil pressure at oil filter too high (limit value 2)

Main warning, differential oil pressure at oil filter limit value 2 too high

Cause	Corrective action
	► Contact Service.

027 – HI Fuel Leakage

Leak fuel level too high (limit value 1)

Alarm configuration; prewarning, fuel leakage level limit value 1 too high.

Cause	Corrective action
	1. Check fuel system 2. Contact Service

029 – HI ETC Idle Speed

Idle speed of one of the secondary turbochargers too high

Idle speed of ETC too high.

Cause	Corrective action
	► Contact Service.

030 – SS Engine Overspeed

Engine overspeed (limit value 2)

Alarm configuration limit value 2; engine overspeed; reduced fuel injection.

Cause	Corrective action
	1. Acknowledge alarm. 2. Attempt to restart engine.

031 – HI ETC1 Overspeed

Primary turbocharger speed too high (limit value 1)

Alarm configuration; prewarning, primary turbocharger speed limit value 1 too high.

Cause	Corrective action
	► Contact Service.

032 – SS ETC1 Overspeed

Primary turbocharger speed too high (limit value 2)

Alarm configuration; primary turbocharger speed limit value 2 too high.

Cause	Corrective action
	1. Automatic power reduction by engine control system. 2. Check air filters.

033 – HI P-Diff Fuel

Differential oil pressure at fuel filter too high (limit value 1)

Alarm configuration; differential pressure at fuel filter limit value 1 too high.

Cause	Corrective action
	► Replace fuel filter

034 – SS P-Diff Fuel

Differential oil pressure at fuel filter too high (limit value 2)

Alarm configuration; differential pressure at fuel filter limit value 2 too high.

Cause	Corrective action
	► Replace fuel filter

036 – HI ETC2 Overspeed

Speed of 1st secondary turbocharger too high (limit value 1).

Alarm configuration; prewarning, 1st secondary turbocharger speed limit value 1 too high.

Cause	Corrective action
	1. Reduce power. 2. Contact Service.

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037 – SS ETC2 Overspeed

Speed of 1st secondary turbocharger too high (limit value 2).

Alarm ; main warning speed of 1st secondary turbocharger limit value 2 too high; fuel injection limited to fixed value.

Cause	Corrective action
	1. Reduce power. 2. Contact Service.

038 – AL ETC Synch

Synchronizing error between primary turbocharger and one of the secondary turbochargers

Synchronization error between ETCs 1 and 2.

Cause	Corrective action
	1. Reduce power. 2. Contact Service.

039 – AL ETC2 Cut-in Error

ETC2 charger cut-in failure

ETC 2 failed to cut in

Cause	Corrective action
	1. Reduce power. 2. Contact Service.

044 – LO Coolant Level Intercool

Intercooler coolant level too low (limit value 1)

Prewarning, coolant level for intercooler limit value 1 too low

Cause	Corrective action
	►

051 – HI T-Lube Oil

Lube oil temperature too high (limit value 1)

Prewarning, lube oil temperature limit value 1 too high.

Cause	Corrective action
	► Reduce power.

052 – SS T-Lube Oil

Lube oil temperature too high (limit value 2)

Main warning, lube oil temperature (A side) limit value 2 too high; engine stop.

Cause	Corrective action
	1. Reduce power. 2. Check engine oil level.

057 – LO P-Coolant

Coolant pressure too low (limit value 1)

Prewarning, coolant pressure limit value 1 too low.

Cause	Corrective action
	► Check coolant circuit

058 – SS P-Coolant

Coolant pressure too low (limit value 2)

Main warning, coolant pressure limit value 2 too low. Engine stop or reduced injection quantity

Cause	Corrective action
	► Check coolant circuit

059 – SS T-Coolant L3

Coolant temperature too high/too low (limit value 3)

Main warning, coolant temperature limit value 3 too high/too low

Cause	Corrective action
	1. Allow engine to cool down; 2. check coolant cooler, clean if necessary. 3. Restart engine. 4. Contact Service

060 – SS T-Coolant L4

Coolant temperature too high/too low (limit value 4)

Main warning, coolant temperature limit value 4 too high/too low

Cause	Corrective action
	1. Allow engine to cool down; 2. check coolant cooler, clean if necessary. 3. Restart engine. 4. Contact Service.

063 – HI P-Crankcase

Crankcase pressure too high (limit value 1)

Prewarning, crankcase pressure limit value 1 too high.

Cause	Corrective action
	►

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064 – SS P-Crankcase

Crankcase pressure too high (limit value 2)

Main warning, crankcase pressure limit value 2 too high

Cause	Corrective action
	►

065 – LO P-Fuel

Fuel inlet pressure too low (limit value 1)

Prewarning, fuel inlet pressure limit value 1 too low

Cause	Corrective action
Fuel filter clogged, fuel line leaking	1. 2. Check filter, fuel low-pressure side 3. Check fuel lines for leaks. 4. Replace fuel filter

066 – SS P-Fuel

Fuel inlet pressure too low (limit value 2)

Main warning, fuel inlet pressure limit value 2 too low

Cause	Corrective action
Fuel filter clogged, fuel line leaking	► Check filter (low-pressure side)

067 – HI T-Coolant

Coolant temperature too high (limit value 1)

Prewarning, coolant temperature limit value 1 too high

Cause	Corrective action
	1. Check coolant circuit 2. Reduce power

068 – SS T-Coolant

Coolant temperature too high (limit value 2)

Main warning, coolant temperature limit value 2 too high

Cause	Corrective action
	1. Check coolant circuit 2. Allow engine to cool down; 3. check coolant cooler, clean if necessary. 4. Restart engine. 5. Contact Service

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081 – AL System Leak

Pressure gradient in rail is too low during starting or too high during stopping

Cause	Corrective action
HP system leaky, air in system	► Contact Service.

082 – HI P-Fuel (Common Rail)

Fuel pressure too high

Rail pressure > set value => DBR reduction, BOI delay

Cause	Corrective action
Suction restrictor of HP fuel block jamming or HP fuel control block wiring faulty	► Contact Service.

083 – LO P-Fuel (Common Rail)

Fuel pressure too low

Rail pressure < set value => DBR reduction

Cause	Corrective action
Suction restrictor of HP fuel control block faulty or leakage in HP fuel system	► Contact Service.

085 – HI T-Air Circulation

Charge-air temperature before air bypass valve two high (limit value 1).

Prewarning, charge-air temperature before air bypass valve limit value 1 too high

Cause	Corrective action
	► Reduce power

086 – SS T-Air Circulation

Charge-air temperature before air bypass valve two high (limit value 2).

Main warning, charge-air temperature before air bypass valve limit value 2 too high

Cause	Corrective action
	► Reduce power

089 – SS Engine Speed Too Low

Alarm configuration limit value; engine speed too low.

Engine stalls. Engine speed has fallen below the limit value set by parameter 2.2500.027 Speed Limit Stalling without stop signal output in normal operation. Engine is stopped for reasons of safety if this happens.

Cause	Corrective action
	► Observe additional messages

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090 – SS Idle Not Reached

Idling speed not reached

Start terminated

Cause	Corrective action
	► Check for additional messages, contact Service

091 – SS Disengage Speed Not Reached

Runup speed not reached

Start terminated

Cause	Corrective action
	1. Observe additional messages 2. Contact Service

092 – SS Starter Speed Not Reached

Starter speed not reached

Starter does not turn or turns slowly, start terminated

Cause	Corrective action
	► Contact Service.

093 – SS T-Preheat

Preheating temperature too low (limit value 2)

Coolant temperature too low for engine start, engine start interlock

Cause	Corrective action
	► Check preheater.

094 – LO T-Preheat

Preheating temperature too low (limit value 1)

Coolant temperature too low for engine start.

Cause	Corrective action
	► Check preheater.

095 – AL Priming Error

Priming error

Cause	Corrective action
	► Check oil priming system.

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102 – AL Consumption Meter Fault

Consumption meter faulty

Consumption meter faulty

Cause	Corrective action
	► Contact Service.

104 – AL Runtime Meter Fault

Run-time meter faulty

Run-time meter faulty.

Cause	Corrective action
	► Contact Service.

118 – LO ECU Supply Voltage

Supply voltage too low (limit value 1)

Prewarning, supply voltage limit value 1 too low

Cause	Corrective action
	1. Check batteries/generator 2. Check ECU supply voltage. 3. Contact Service.

119 – LOLO ECU Supply Voltage

Supply voltage too low (limit value 2)

Cause	Corrective action
	1. Check batteries/generator 2. Check ECU supply voltage. 3. Contact Service.

120 – HI ECU Supply Voltage

Supply voltage too high (limit value 1)

Prewarning, supply voltage limit value 1 too high

Cause	Corrective action
	1. Check batteries/generator 2. Check ECU supply voltage. 3. Contact Service.

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121 – HIHI ECU Supply Voltage

Supply voltage too high (limit value 2)

Cause	Corrective action
	1. Check batteries/generator 2. Check ECU supply voltage. 3. Contact Service.

122 – HI T-ECU

Temperature of electronics too high (limit value 1)

Prewarning, temperature of electronics limit value 1 too high.

Cause	Corrective action
	1. Reduce power. 2. Improve engine room ventilation.

141 – AL Power Too High

Alarm is triggered if the mean value of the power has exceeded the maximum value stipulated by PR1.1088.001 within the last 24 hours.

Cause	Corrective action
	► Reduce power.

142 – AL MCR 1 Hour Exceeded

Cause	Corrective action
The alarm is triggered if the MCR has been exceeded for more than 1 hour within the last 12 hours.	► Reduce power.

176 – AL LifeData Not Available

No (suitable) LifeData backup system available following timeout expiry after ECU reset. Backup system has no LifeData feature or CAN bus to backup system is disrupted.

Cause	Corrective action
	► Contact Service.

177 – AL LifeData Restore Incomplete

This fault message is generated in case of a faulty CRC during a restore data upload process (to ADEC) (output for each module) or if the upload is incomplete.

Cause	Corrective action
	► Contact Service.

180 – AL CAN1 Node Failure

Connection to a node on CAN bus 1 failed.

Cause	Corrective action
	1. Check devices connected to CAN 2. Contact Service.

181 – AL CAN2 Node Failure

Connection to a node on CAN bus 2 failed.

Cause	Corrective action
	1. Check devices connected to CAN 2. Contact Service.

182 – AL CAN Wrong Parameter

Incorrect parameter values entered in data record

Cause	Corrective action
	► Contact Service.

183 – AL CAN No PU Data

The selected CAN mode initializes communication by means of the PU data module. However, the required PU data module is not available or not valid.

Cause	Corrective action
	1. Check devices connected to CAN 2. Contact Service.

184 – AL CAN PU Data Flash Error

A programming error occurred when attempting to copy a received PU data module into the Flash module. ==>

Cause	Corrective action
	► Contact electronic Service.

186 – AL CAN1 Bus Off

CAN controller 1 is in “Bus-Off” state

Automatic switchover to CAN2.

Cause	Corrective action
Causes may be e.g. short circuit, massive disruption or baud rate incompatibility.	1. Inspect CAN bus for short circuit and rectify short circuit as necessary. 2. Check shielding, improve as necessary. 3. Contact Service.

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187 – AL CAN1 Error Passive

CAN controller 1 has issued a warning

Cause	Corrective action
Causes may be e.g. missing associated node, minor disruptions or temporary bus overload.	1. Inspect CAN bus for short circuit and rectify short circuit as necessary. 2. Check shielding, improve as necessary. 3. Contact Service.

188 – AL CAN2 Bus Off

CAN controller 2 is in “Bus-Off” state

Automatic changeover to CAN 1.

Cause	Corrective action
Causes may be e.g. short circuit, massive disruption or baud rate incompatibility.	1. Inspect CAN bus for short circuit and rectify short circuit as necessary. 2. Check shielding, improve as necessary. 3. Contact Service.

189 – AL CAN2 Error Passive

CAN controller 2 has issued a warning

Cause	Corrective action
Causes may be e.g. missing associated node, minor disruptions or temporary bus overload.	1. Inspect CAN bus for short circuit and rectify short circuit as necessary. 2. Check shielding, improve as necessary. 3. Contact Service.

190 – AL EMU Parameter Not Supported

EMU parameters are not supported.

Incompatibility

Cause	Corrective action
	► Contact Service.

201 – SD T-Coolant

Coolant temperature sensor faulty.

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B6), replace as necessary. 2. Error cleared after restarting the engine.

202 – SD T-Fuel

Fuel temperature sensor faulty.

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B33), replace as necessary. 2. Error cleared after restarting the engine.

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203 – SD T-Charge Air

Charge-air temperature sensor faulty.

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B9), replace as necessary. 2. Error cleared after restarting the engine.

204 – SD Lube Oil Level

Lube oil level sensor faulty.

Cause	Corrective action
Short circuit or wire break	►

205 – SD T-Coolant Intercooler

Intercooler coolant temperature sensor faulty.

Cause	Corrective action
Short circuit or wire break	► Check sensor and cabling (B26), replace as necessary.

206 – SD T-Exhaust A

Exhaust gas temperature sensor on A side faulty

Cause	Corrective action
Short circuit or wire break	► Check sensor and wiring (B4.21), replace as necessary.

207 – SD T-Exhaust B

Exhaust gas temperature sensor on B side faulty

Cause	Corrective action
Short circuit or wire break	► Check sensor and wiring (B4.22), replace as necessary.

208 – SD P-Charge Air

Charge-air pressure sensor faulty.

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B10), replace as necessary. 2. Error cleared after restarting the engine.

211 – SD P-Lube Oil

Lube oil pressure sensor faulty.

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B5), replace as necessary. 2. Error cleared after restarting the engine.

212 – SD P-Coolant

Coolant pressure sensor faulty.

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B16), replace as necessary. 2. Error cleared after restarting the engine.

213 – SD P-Coolant Intercooler

Intercooler coolant pressure sensor faulty.

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B43), replace as necessary. 2. Error cleared after restarting the engine.

214 – SD P-Crankcase

Crankcase pressure sensor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B50), replace as necessary. 2. Error cleared after restarting the engine.

215 – SD P-HP

Rail pressure sensor faulty

High-pressure governor emergency operation

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B48), replace as necessary. 2. Error cleared after restarting the engine.

216 – SD T-Lube Oil

Lube oil temperature sensor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B7), replace as necessary. 2. Error cleared after restarting the engine.

219 – SD T-Intake Air

Intake air temperature sensor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B3), replace as necessary. 2. Error cleared after restarting the engine.

220 – SD Coolant Level

Coolant level sensor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (F33), replace as necessary. 2. Error cleared after restarting the engine.

221 – SD P-Diff Lube Oil

Differential lube oil pressure sensor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (F25), replace as necessary. 2. Error cleared after restarting the engine.

222 – SD Leak Fuel Level

Leak fuel level sensor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (F46), replace as necessary. 2. Error cleared after restarting the engine.

223 – SD Intercooler Coolant Level

Sensor for intercooler coolant level faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (F57), replace as necessary. 2. Error cleared after restarting the engine.

227 – SD Oil Pressure Before Filter

Lube oil pressure before filter sensor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B5.3), replace as necessary. 2. Error cleared after restarting the engine.

228 – SD P-Fuel Before Filter

Fuel pressure sensor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B5.3), replace as necessary. 2. Error cleared after restarting the engine.

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229 – AL Stop Camshaft Sensor Defect

Engine stop due to camshaft sensor fault (and a prior crankshaft sensor fault in the same operating cycle).

Cause	Corrective action
	1. Check connector and wiring to sensor B1, replace as necessary. 2. Error cleared after restarting the engine.

230 – SD Crankshaft

Crankshaft sensor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B13), replace as necessary. 2. Fault is rectified when engine is restarted.

231 – SD Camshaft

Camshaft sensor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B1), replace as necessary. 2. Fault is rectified when engine is restarted.

232 – SD Charger Speed 1

Primary turbocharger speed sensor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B44.1), replace as necessary. 2. Error cleared after restarting the engine.

233 – SD Charger Speed 2

Secondary turbocharger speed sensor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B44.2), replace as necessary. 2. Error cleared after restarting the engine.

239 – SD P-Diff Fuel

Differential fuel pressure sensor faulty

only occurs in conjunction with SD-Alarm Fuel Before Filter or Fuel After Filter

Cause	Corrective action
Either pressure sensor before filter or pressure sensor after filter is defective	► Observe additional message.

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240 – SD P-Fuel

Fuel pressure sensor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (B34), replace as necessary. 2. Error cleared after restarting the engine.

241 – SD T-Air Circulation

Air bypass temperature sensor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring (F49), replace as necessary. 2. Error cleared after restarting the engine.

242 – SD T-Coolant (R)

Redundant coolant temperature sensor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring, replace as necessary. 2. Error cleared after restarting the engine.

244 – SD P-Lube Oil (R)

Redundant lube oil pressure sensor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring, replace as necessary. 2. Error cleared after restarting the engine.

245 – SD ECU Supply Voltage

Internal ECU fault. Electronics faulty.

Cause	Corrective action
	► Replace ECU.

266 – SD Speed Demand

Analog nominal speed setting faulty

Cause	Corrective action
Short circuit or wire break	1. Check speed demand sensor and wiring, replace as necessary. 2. Check speed demand signal.

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269 – SD Loadp. Analog Filt.

Filtered analog signal of load pulse missing

Cause	Corrective action
Short circuit or wire break	► Check sensor and wiring, replace as necessary.

270 – SD Frequency Input

Frequency input faulty

Cause	Corrective action
Short circuit or wire break	1. Check wiring. 2. Check setpoint speed transmitter. 3. Contact Service.

301 – AL Timing Cylinder A1

Injector time-of-flight fault, cylinder A1

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

302 – AL Timing Cylinder A2

Injector time-of-flight fault, cylinder A2

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

303 – AL Timing Cylinder A3

Injector time-of-flight fault, cylinder A3

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

304 – AL Timing Cylinder A4

Injector time-of-flight fault, cylinder A4

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

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305 – AL Timing Cylinder A5

Injector time-of-flight fault, cylinder A3

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

306 – AL Timing Cylinder A6

Injector time-of-flight fault, cylinder A6

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

307 – AL Timing Cylinder A7

Injector time-of-flight fault, cylinder A7

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

308 – AL Timing Cylinder A8

Injector time-of-flight fault, cylinder A8

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

309 – AL Timing Cylinder A9

Injector time-of-flight fault, cylinder A9

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

310 – AL Timing Cylinder A10

Injector time-of-flight fault, cylinder A10

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

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311 – AL Timing Cylinder B1

Injector time-of-flight fault, cylinder B1

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

312 – AL Timing Cylinder B2

Injector time-of-flight fault, cylinder B2

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

313 – AL Timing Cylinder B3

Injector time-of-flight fault, cylinder B3

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

314 – AL Timing Cylinder B4

Injector time-of-flight fault, cylinder B4

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

315 – AL Timing Cylinder B5

Injector time-of-flight fault, cylinder B5

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

316 – AL Timing Cylinder B6

Injector time-of-flight fault, cylinder B6

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

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317 – AL Timing Cylinder B7

Injector time-of-flight fault, cylinder B7

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

318 – AL Timing Cylinder B8

Injector time-of-flight fault, cylinder B8

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

319 – AL Timing Cylinder B9

Injector time-of-flight fault, cylinder B9

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

320 – AL Timing Cylinder B10

Injector time-of-flight fault, cylinder B10

Time-of flight measured value extremely low or extremely high.

Cause	Corrective action
	► Replace injector solenoid valve if this occurs frequently.

321 – AL Wiring Cylinder A1

Short circuit in injector wiring, cylinder A1

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

322 – AL Wiring Cylinder A2

Short circuit in injector wiring, cylinder A2

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

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323 – AL Wiring Cylinder A3

Short circuit in injector wiring, cylinder A3

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

324 – AL Wiring Cylinder A4

Short circuit in injector wiring, cylinder A4

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

325 – AL Wiring Cylinder A5

Short circuit in injector wiring, cylinder A5

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

326 – AL Wiring Cylinder A6

Short circuit in injector wiring, cylinder A6

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

327 – AL Wiring Cylinder A7

Short circuit in injector wiring, cylinder A7

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

328 – AL Wiring Cylinder A8

Short circuit in injector wiring, cylinder A8

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

329 – AL Wiring Cylinder A9

Short circuit in injector wiring, cylinder A9

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

330 – AL Wiring Cylinder A10

Short circuit in injector wiring, cylinder A10

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

331 – AL Wiring Cylinder B1

Short circuit in injector wiring, cylinder B1

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

332 – AL Wiring Cylinder B2

Short circuit in injector wiring, cylinder B2

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

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333 – AL Wiring Cylinder B3

Short circuit in injector wiring, cylinder B3

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

334 – AL Wiring Cylinder B4

Short circuit in injector wiring, cylinder B4

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

335 – AL Wiring Cylinder B5

Short circuit in injector wiring, cylinder B5

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

336 – AL Wiring Cylinder B6

Short circuit in injector wiring, cylinder B6

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

337 – AL Wiring Cylinder B7

Short circuit in injector wiring, cylinder B7

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

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338 – AL Wiring Cylinder B8

Short circuit in injector wiring, cylinder B8

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

339 – AL Wiring Cylinder B9

Short circuit in injector wiring, cylinder B9

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

340 – AL Wiring Cylinder B10

Short circuit in injector wiring, cylinder B10

Misfiring. Fault rectified when engine is restarted.

Cause	Corrective action
	1. Check injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). 2. Contact Service.

341 – AL Open Load Cylinder A1

Disruption in injector wiring, cylinder A1

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

342 – AL Open Load Cylinder A2

Disruption in injector wiring, cylinder A2

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

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343 – AL Open Load Cylinder A3

Disruption in injector wiring, cylinder A3

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

344 – AL Open Load Cylinder A4

Disruption in injector wiring, cylinder A4

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

345 – AL Open Load Cylinder A5

Disruption in injector wiring, cylinder A5

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

346 – AL Open Load Cylinder A6

Disruption in injector wiring, cylinder A6

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

347 – AL Open Load Cylinder A7

Disruption in injector wiring, cylinder A7

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

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348 – AL Open Load Cylinder A8

Disruption in injector wiring, cylinder A8

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

349 – AL Open Load Cylinder A9

Disruption in injector wiring, cylinder A9

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

350 – AL Open Load Cylinder A10

Disruption in injector wiring, cylinder A10

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

351 – AL Open Load Cylinder B1

Disruption in injector wiring, cylinder B1

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

352 – AL Open Load Cylinder B2

Disruption in injector wiring, cylinder B2

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

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353 – AL Open Load Cylinder B3

Disruption in injector wiring, cylinder B3

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

354 – AL Open Load Cylinder B4

Disruption in injector wiring, cylinder B4

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

355 – AL Open Load Cylinder B5

Disruption in injector wiring, cylinder B5

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

356 – AL Open Load Cylinder B6

Disruption in injector wiring, cylinder B6

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

357 – AL Open Load Cylinder B7

Disruption in injector wiring, cylinder B7

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

358 – AL Open Load Cylinder B8

Disruption in injector wiring, cylinder B8

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

359 – AL Open Load Cylinder B9

Disruption in injector wiring, cylinder B9

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

360 – AL Open Load Cylinder B10

Disruption in injector wiring, cylinder B10

Misfiring. Fault rectified after each working cycle.

Cause	Corrective action
	1. Check injector wiring for disruption or exclude possible solenoid valve fault (e.g. by replacing injector). 2. Contact Service.

361 – AL Injector Power Amp. Low

Internal electronic fault

Internal electronic fault if bit “1.1020.021” (Power Stage Failure: Stop Engine) is set, engine will be shut down as additional measure.

Cause	Corrective action
Electronics possibly faulty	1. start ITS). If the ITS diagnosis result is “electronics OK”, note further fault messages (e.g. cabling faults). 2. Check solenoid valve cabling. 3. Replace ECU.

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362 – AL Injector Power Amp. High

Internal electronic fault

Internal electronic fault if bit “1.1020.021” (Power Stage Failure: Stop Engine) is set, engine will be shut down as additional measure.

Cause	Corrective action
Electronics possibly faulty	1. start ITS). If the ITS diagnosis result is “electronics OK”, note further fault messages (e.g. cabling faults). 2. Check solenoid valve cabling. 3. Replace ECU.

363 – AL Stop Injector Power Amp.

Internal electronic fault

Internal electronic fault if bit “1.1020.021” (Power Stage Failure: Stop Engine) is set, engine will be shut down as additional measure.

Cause	Corrective action
Electronics possibly faulty	1. start ITS). If the ITS diagnosis result is “electronics OK”, note further fault messages (e.g. cabling faults). 2. Check wiring. 3. Attempt to restart engine.

365 – AL Stop SV Wiring Ground

Injector wiring fault.

If bit “1.1020.021” (Power Stage Failure: Stop Engine) is set, engine will be shut down as additional measure.

Cause	Corrective action
Causes: 1. Short circuit of positive connection of one or more injectors to ground 2. Short circuit of injector negative connection of one or more injectors to ground	1. Check wiring, replace wiring harness as necessary. 2. Attempt to restart engine.

371 – AL Wiring TO 1

Short circuit or line disruption at transistor output 1 (TO 1)

Cause	Corrective action
	1. Check turbocharger valve/cabling, repair as necessary. 2. Replace ECU.

372 – AL Wiring TO 2

Short circuit or line disruption at transistor output 2 (TO 2)

Cause	Corrective action
	1. Check recirculation valve/cabling, repair as necessary. 2. Replace ECU.

373 – AL Wiring TO 3

Short circuit or line disruption at transistor output 3 (TO 3)

Cause	Corrective action
	► Check cabling turbocharger valve 2 (marine engine), priming (C&I).

374 – AL Wiring TO 4

Short circuit or line disruption at transistor output 4 (TO 4)

Cause	Corrective action
	► Check cabling turbocharger valve 3 (marine engine).

381 – AL Wiring TOP 1

Short circuit or line disruption at transistor output 1, plant side (TOP 1)

Cause	Corrective action
	► Check cabling to plant.

382 – AL Wiring TOP 2

Short circuit or line disruption at transistor output 2, plant side (TOP 2)

Cause	Corrective action
	► Check cabling to plant.

383 – AL Wiring TOP 3

Short circuit or line disruption at transistor output 3, plant side (TOP 3)

Cause	Corrective action
	► Check cabling to plant.

384 – AL Wiring TOP 4

Short circuit or line disruption at transistor output 4, plant side (TOP 4)

Cause	Corrective action
	► Check cabling to plant.

390 – AL MCR Exceeded

DBR/MCR function: MCR (maximum continuous rate) was exceeded.

Cause	Corrective action
	1. If alarm is only temporary, no action required; 2. if alarm is continuously active, contact Service.

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392 – HI T-Coolant Red

Redundant coolant temperature too high (limit value 1)

Prewarning, redundant coolant temperature limit value 1 too high.

Cause	Corrective action
	1. Check coolant circuit 2. Check wiring. 3. Contact Service.

393 – SS T-Coolant Red

Redundant coolant temperature too high (limit value 2)

Main warning, redundant coolant temperature limit value 2 too high

Cause	Corrective action
	1. Check coolant circuit 2. Check cabling and sensor. 3. Contact Service.

394 – LO P-Lube Oil Red

Redundant lube oil pressure too low (limit value 1)

Prewarning, redundant lube oil pressure limit value 1 too low

Cause	Corrective action
	1. Check cabling and sensor. 2. Contact Service.

395 – SS P-Lube Oil Red

Redundant lube oil pressure too low (limit value 2)

Main warning, lube oil pressure limit value 2 too low

Cause	Corrective action
	1. Check cabling and sensor. 2. Contact Service.

396 – TD T-Coolant Sensor Deviation

Max. coolant sensor deviation

Cause	Corrective action
	1. Check cabling and sensor. 2. Contact Service.

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397 – TD P-Oil Sensor Deviation

Max. oil pressure sensor deviation

Cause	Corrective action
	1. Check cabling and sensor. 2. Contact Service.

400 – AL Open Load Digital Input 1

Line disruption at digital input 1

Cause	Corrective action
Cabling faulty or no resistance over switch	1. Check wiring. 2. Check input of target device. 3. Contact Service.

401 – AL Open Load Digital Input 2

Line disruption at digital input 2

Cause	Corrective action
Cabling faulty or no resistance over switch	1. Check wiring. 2. Check input of target device. 3. Contact Service.

402 – AL Open Load Digital Input 3

Line disruption at digital input 3

Cause	Corrective action
Cabling faulty or no resistance over switch	1. Check wiring. 2. Check input of target device. 3. Contact Service.

403 – AL Open Load Digital Input 4

Line disruption at digital input 4

Cause	Corrective action
Cabling faulty or no resistance over switch	1. Check wiring. 2. Check input of target device. 3. Contact Service.

404 – AL Open Load Digital Input 5

Line disruption at digital input 5

Cause	Corrective action
Cabling faulty or no resistance over switch	1. Check wiring. 2. Check input of target device. 3. Contact Service.

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405 – AL Open Load Digital Input 6

Line disruption at digital input 6

Cause	Corrective action
Cabling faulty or no resistance over switch	1. Check wiring. 2. Check input of target device. 3. Contact Service.

406 – AL Open Load Digital Input 7

Line disruption at digital input 7

Cause	Corrective action
Cabling faulty or no resistance over switch	1. Check wiring. 2. Check input of target device. 3. Contact Service.

407 – AL Open Load Digital Input 8

Line disruption at digital input 8

Cause	Corrective action
Cabling faulty or no resistance over switch	1. Check wiring. 2. Check input of target device. 3. Contact Service.

408 – AL Open Load Emerg. Stop Input ESI

Line disruption at emergency stop input

Cause	Corrective action
Cabling faulty or no resistance over switch	1. Check wiring. 2. Check input of target device. 3. Contact Service.

410 – LO U-PDU

Injector voltage too low (limit value 1)

Prewarning, injector voltage limit value 1 too low

Cause	Corrective action
	1. Check wiring. 2. Check power supply. 3. Contact Service.

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411 – LOLO U-PDU

Injector voltage too low (limit value 2)

Cause	Corrective action
	1. Check wiring. 2. Check power supply. 3. Contact Service.

412 – HI U-PDU

Injector voltage too high (limit value 1)

Prewarning, injector voltage limit value 1 too high

Cause	Corrective action
	1. Check wiring. 2. Check power supply. 3. Contact Service.

413 – HIHI U-PDU

Injector voltage too high (limit value 2)

Cause	Corrective action
	1. Check wiring. 2. Check power supply. 3. Contact Service.

414 – HI Lev. Water Fuel Prefilter

Water level in fuel prefilter too high (limit value 1)

Prewarning, water level in fuel prefilter limit value 1 too high

Cause	Corrective action
	► Empty fuel prefilter

415 – LO P-Coolant Intercooler

Coolant pressure in intercooler too low (limit value 1)

Prewarning, intercooler coolant pressure limit value 1 too low.

Cause	Corrective action
	► Contact Service.

416 – SS P-Coolant Intercooler

Coolant pressure in intercooler too low (limit value 2)

Main warning, intercooler coolant pressure limit value 2 too low. Engine stop or reduced injection quantity

Cause	Corrective action
	► Contact Service.

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417 – SD Level Water Fuel Prefilter

Sensor for fuel prefilter water level faulty.

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring, replace as necessary. 2. Error cleared after restarting the engine.

419 – SD T-Coolant Before Engine

Coolant inlet temperature sensor faulty

Cause	Corrective action
Short circuit or wire break	► Check sensor and wiring (B3), replace as necessary.

420 – AL L1 Aux 1

Input signal from AUX 1 has violated limit value 1

Cause	Corrective action
	► Determine and rectify reason for limit value violation.

421 – AL L2 Aux 1

Input signal from AUX 1 has violated limit value 2

Cause	Corrective action
	► Determine and rectify reason for limit value violation.

428 – AL L1 T-Aux 1

Temperature signal from AUX 1 has violated limit value 1

Cause	Corrective action
	► Determine and rectify reason for limit value violation.

430 – LO P-Coolant Before Engine

Coolant pressure too low (limit value 1)

Prewarning, coolant pressure before engine limit value 1 too low.

Cause	Corrective action
	► Check coolant circuit

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431 – SS P-Coolant Before Engine

Coolant pressure too low (limit value 2)

Main warning, coolant pressure before engine limit value 2 too low. Engine stop or reduced injection quantity

Cause	Corrective action
	▶ Check coolant circuit

434 – HI T-Coolant Before Engine

Coolant temperature too high (limit value 1)

Prewarning, coolant temperature before engine limit value 1 too high.

Cause	Corrective action
	▶ Check coolant circuit

435 – SS T-Coolant Before Engine

Coolant temperature too high (limit value 2)

Main warning, coolant temperature limit value 2 too high

Cause	Corrective action
	▶ Check coolant circuit

440 – AL L1 P-Aux 1

Pressure signal from AUX 1 has violated limit value 1

Cause	Corrective action
	▶ Determine and rectify reason for limit value violation.

442 – AL L2 P-Aux 1

Pressure signal from AUX 1 has violated limit value 2

Cause	Corrective action
	▶ Determine and rectify reason for limit value violation.

444 – SD U-PDU

Sensor fault at injector output stage

Internal fault in ECU7

Cause	Corrective action
	▶ Replace ECU7

TIM ID: 0000033999 – 001

445 – SD P-Ambient Air

Ambient air sensor faulty

Cause	Corrective action
	► Replace ECU.

448 – HI P-Charge Air

Charge-air pressure too high (limit value 1)

Prewarning, charge-air pressure limit value 1 too high

Cause	Corrective action
	► Contact Service.

449 – SS P-Charge Air

Charge-air pressure too high (limit value 2)

Main warning, charge-air pressure limit value 2 too high

Cause	Corrective action
	► Contact Service.

450 – SD Rack Percent

Input signal for beginning/end torque faulty.

Fault is rectified when engine is restarted.

Cause	Corrective action
Short circuit or wire break	1. Check signal transmitter and wiring, replace as necessary. 2. Error cleared after restarting the engine.

454 – SS Power Limitation Active

Power reduction is activated.

Cause	Corrective action
	1. Note further fault messages. 2. Determine and rectify cause of power reduction.

455 – AL L1 Aux1 Plant

Input signal from AUX 1 (plant side) has violated limit value 1

Cause	Corrective action
	► Determine and rectify reason for limit value violation.

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456 – AL L2 Aux1 Plant

Input signal from AUX 1 (plant side) has violated limit value 2

Cause	Corrective action
	► Determine and rectify reason for limit value violation.

460 – HI T-Exhaust EMU

Exhaust gas temperature of EMU too high (limit value 1)

Prewarning, exhaust temperature of EMU limit value 1 too high.

Cause	Corrective action
	1. Check wiring. 2. Contact Service.

461 – LO T-Exhaust EMU

Exhaust gas temperature of EMU too low (limit value 1)

Prewarning, exhaust temperature of EMU limit value 1 too low.

Cause	Corrective action
	1. Check wiring. 2. Contact Service.

462 – HI T-Coolant EMU

Coolant temperature of EMU has violated limit value 1.

Cause	Corrective action
	► Check configuration with DiaSys.

464 – SD P-AUX 1

Analog input signal for pressure Aux 1 faulty.

Cause	Corrective action
Short circuit or wire break	1. Check pressure transmitter and wiring, replace as necessary. 2. Error cleared after restarting the engine.

467 – AL L2 T-Aux 1

Temperature signal from AUX 1 has violated limit value 2

Cause	Corrective action
	► Determine and rectify reason for limit value violation.

TIM ID: 0000033999 – 001

468 – SD T-AUX 1

Analog input for temperature Aux 1 faulty

Cause	Corrective action
	► Replace ECU.

469 – SD AUX 1

Analog input signal for Aux 1 faulty

Cause	Corrective action
Short circuit or wire break	1. Check signal transmitter and wiring, replace as necessary. 2. Error cleared after restarting the engine.

470 – SD T-ECU

Temperature sensor for ECU faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring, replace as necessary. 2. Error cleared after restarting the engine.

471 – SD Suction Restrictor

HP fuel control block suction restrictor faulty

Cause	Corrective action
Short circuit or wire break	1. Check sensor and wiring, replace as necessary. 2. Error cleared after restarting the engine.

472 – AL Stop SD

Engine stop as shutdown channels receive “Sensor Defect”

Cause	Corrective action
	1. Check wiring. 2. Contact Service.

473 – AL Wiring PWM_CM2

Line disruption or short circuit at channel PWM_CM2.

Cause	Corrective action
	1. Check wiring. 2. Contact Service.

TIM ID: 0000033999 - 001

474 – AL Wiring FO
Line disruption or short circuit at channel FO

Cause	Corrective action
	1. Check wiring. 2. Contact Service.

475 – AL CR Engine Shutdown Trigger
Tripped when crash recorders triggered by engine shutdown

Cause	Corrective action
	▶ Determine and rectify cause of triggering / engine shutdown.

476 – AL Crash Rec. Init. Error
Crash recorder initialization error

Cause	Corrective action
	▶ Check setting with DiaSys.

478 – AL Common Alarm Yellow (Plant)
Summary YELLOW alarm from plant

Cause	Corrective action
	▶ Note further fault messages.

479 – AL Common Alarm Red (Plant)
Summary RED alarm from plant

Cause	Corrective action
	▶ Note further fault messages.

480 – AL Ext. Engine Prot.
External engine protection feature active

Cause	Corrective action
Plant signal monitoring by ECU active (system side).	▶ Check plant signal.

482 – SD T-Exhaust C
Exhaust gas temperature sensor on A side faulty

Cause	Corrective action
Short circuit or wire break	▶ Check sensor and wiring (B4.23), replace as necessary.

TIM ID: 0000033999 – 001

483 – SD T-Exhaust D

Exhaust gas temperature sensor on A side faulty

Cause	Corrective action
Short circuit or wire break	► Check sensor and wiring (B4.24), replace as necessary.

484 – HI T-Exhaust C

Exhaust gas temperature (C side) too high (limit value 1)

Prewarning, exhaust gas temperature (C side) limit value 1 too high

Cause	Corrective action
	1. Reduce power. 2. Contact Service.

485 – SS T-Exhaust C

Exhaust gas temperature (C side) too high (limit value 2)

Main warning, exhaust gas temperature (C side) limit value 2 too high; engine stop.

Cause	Corrective action
	1. Reduce power. 2. Contact Service.

486 – HI T-Exhaust D

Exhaust gas temperature (D side) too high (limit value 1)

Prewarning, exhaust gas temperature (D side) limit value 1 too high

Cause	Corrective action
	1. Reduce power. 2. Contact Service.

487 – SS T-Exhaust D

Exhaust gas temperature (D side) too high (limit value 2)

Main warning, exhaust gas temperature (D side) limit value 2 too high; engine stop.

Cause	Corrective action
	1. Reduce power. 2. Contact Service.

488 – HI ETC3 Overspeed

Speed of 2nd secondary turbocharger too high (limit value 1).

Alarm configuration; prewarning, 2nd secondary turbocharger speed limit value 1 too high.

Cause	Corrective action
	► Reduce power.

TIM ID: 0000033999 – 001

489 – SS ETC3 Overspeed

Speed of 3rd secondary turbocharger too high (limit value 2).

Cause	Corrective action
	► Reduce power.

490 – HI ETC4 Overspeed

Speed of 3rd secondary turbocharger too high (limit value 1).

Alarm configuration; prewarning, 3rd secondary turbocharger speed limit value 1 too high.

Cause	Corrective action
	► Reduce power.

491 – SS ETC4 Overspeed

Speed of 3rd secondary turbocharger too high (limit value 2).

Cause	Corrective action
	► Reduce power.

492 – AL ETC4 Cut-in Error

ETC4 charger cut-in failure

ETC 4 failed to cut in

Cause	Corrective action
	► Check control valve on ETC 4.

493 – AL ETC3 Cut-in Error

ETC3 charger cut-in failure

ETC 3 failed to cut in

Cause	Corrective action
	► Check control valve on ETC 3.

500 – AL Wiring POM Starter 1

Wiring fault in connection of CPM starter 1 detected

Cause	Corrective action
This may be due to a missing consumer, wire break or a short circuit	► Check connection between POM and starter.

TIM ID: 0000033999 – 001

501 – AL Wiring POM Starter 2

Wiring fault in connection of CPM starter 2 detected

Cause	Corrective action
This may be due to a missing consumer, wire break or a short circuit.	► Check connection between POM and starter.

502 – AL Open Load POM Generator

Line disruption at POM generator connection

Cause	Corrective action
	► Check connection between POM and generator

503 – AL No Battery Charge

Battery is not charged by generator

Cause	Corrective action
	► Check generator and wiring

504 – AL CAN POM Node Failure

POM missing on CAN bus.

Cause	Corrective action
	► Check connection and POM.

506 – AL Starter Voltage Low

Battery voltage is too low for a starting process

Cause	Corrective action
	► Check starter battery and wiring.

507 – AL POM Error

General POM fault

Cause	Corrective action
	► Replace POM

508 – AL Wrong POM-ID

POM transmit a different identification number to that which is expected

Cause	Corrective action
	► Check POM wiring harness

510 – AL Override Active

Override has been activated

Cause	Corrective action
	► Deactivate override pushbutton again.

515 – AL Starter Not Engaged

Starter on CPM / POM could not be engaged.

If the number of automatic start attempts from PR 2.1090.134 Number of Start Attempts is used up, then starting is terminated.

Cause	Corrective action
	1. Repeat start. 2. Check CPM, starter and wiring

519 – Oil Level Calibration Error

Fault writing calibration value into Flash or SD of level sensor

Cause	Corrective action
	►

521 – SS P-Lube Oil Mean

Mean oil pressure value from 3 sources, pressure too low (limit value 1).

Cause	Corrective action
	1. Check sensor and wiring, replace as necessary. 2. Contact Service.

523 – SS T-Coolant Mean

Mean coolant temperature value from 3 sources, temperature too high (limit value 2).

Cause	Corrective action
	► Reduce power.

524 – SS Engine Overspeed Mean

Mean engine overspeed value from 3 sources, speed too high (limit value 2).

Cause	Corrective action
	1. Acknowledge alarm. 2. Attempt to restart engine.

TIM ID: 0000033999 – 001

525 – SD P-Lube Oil (R2)

Redundant lube oil pressure sensor faulty

Cause	Corrective action
Short circuit or wire break	► Check sensor and wiring, replace as necessary.

526 – SD T-Coolant (R2)

Redundant coolant temperature sensor faulty

Cause	Corrective action
Short circuit or wire break	► Check sensor and wiring, replace as necessary.

527 – TD Engine Speed Sensor Dev.

Max. deviation for speed sensors

Cause	Corrective action
	1. Check speed sensor cabling. 2. Observe additional messages. 3. Contact Service.

528 – SD Engine Speed 3rd Sensor

Redundant crankshaft sensor faulty.

Cause	Corrective action
Short circuit or wire break	► Check sensor and wiring, replace as necessary.

529 – SS T-Coolant Red2

2nd redundant coolant temperature too high (limit value 2)

Main warning, second redundant coolant temperature limit value 2 too high

Cause	Corrective action
	► Check coolant circuit

530 – SS P-Lube Oil Red2

2nd redundant lube oil pressure too low (limit value 2)

Main warning, 2nd lube oil pressure limit value 2 too low

Cause	Corrective action
	► Check oil level, top up as necessary.

TIM ID: 0000033999 – 001

543 – AL More Than One FDH Slave

Cause	Corrective action
There is more than one device activated as backup medium for FDH.	► Contact Service.

544 – AL Configuration Changed

This fault becomes active in cases in which the system configuration has been changed, e.g. due to replacement of an ECU or a SAM.

Cause	Corrective action
	► The fault remains active until either the process has been revised or until data has been transferred by an active maintenance case. The fault is then automatically cleared.

549 – AL Voltage Interruption Detected

This is an alarm from the emergency stop counter function.

Cause	Corrective action
An ECU operating voltage has been disconnected with the engine still running. This can result in overpressure in the high-pressure system, whereby the engine may be damaged.	► Instruct the operator only to disconnect the power supply when the engine has stopped.

550 – SS Engine Overspeed Red2

Redundant engine overspeed (limit value 2)

Cause	Corrective action
	1. Acknowledge alarm. 2. Attempt to restart engine.

551 – SS Engine Overspeed Cam

Engine overspeed camshaft (limit value 2)

Cause	Corrective action
	1. Acknowledge alarm. 2. Attempt to restart engine.

TIM ID: 0000033999 – 001

555 – AL Call MTU Field Service

Cause	Corrective action
This fault becomes active if a maintenance case has been processed by the ECU Field Data Handling (FDH) feature that results in a change of engine parameters. This fault remains active, even after switching off and back on, until a valid release code has been entered via the display and pushbutton control of the SAM. This release code can be requested via the Internet using a special procedure.	► Request activation code via Internet.

576 – AL ESCM Override

Violation of corrected MCR or DBR/MCR curve. Engine overload!

Cause	Corrective action
	► Reduce power.

577 – SD T-Lube Oil Pan

Oil pan temperature sensor faulty.

Cause	Corrective action
Short circuit or wire break	►

582 – AL Emergency Stop Failure

Cause	Corrective action
The emergency stop failure alarm is raised if the engine fails to come to a standstill during a programmable time after the emergency stop signal is received. The delay from emergency stop to alarm signaling is set by parameter 1.1005.4.	►

596 – AL Test Parameters

The parameter set is used for trials. The alarm remains set until a series parameter set is loaded.

Cause	Corrective action
	►

TIM ID: 0000033999 - 001

7.9 Oil priming pump PPC – Troubleshooting

Oil priming pump (PPC) does not run in automatic mode

Component	Probable Cause	Action
PPC (green indicator lamp lit).	Contactor K001 defective.	Contact Service.
PPC (green indicator lamp not lit).	Excessive temperature of pump motor.	Contact Service.
	Wrong setting of motor protection relay.	Contact Service: • Adjust motor protection relay Q001.
	Motor protection relay defective.	Contact Service: • Replace motor protection relay Q001.
	Wiring defective.	Contact Service: • Check wiring (→ Page 213).
	Selector switch is not in AUTO position.	Turn selector switch to AUTO (→ Page 94).
	Switch S001 defective.	Contact Service: • Replace switch S001.
	No control signal from LOP	1. Check wiring (→ Page 213); 2. Contact Service.

Oil priming pump (PPC) does not run in manual mode

Component	Probable Cause	Action
PPC (green indicator lamp lit).	Fault in load circuit: No external power supply.	Contact Service.
	Wiring defective.	Check wiring (→ Page 213).
	Contacts or coil of contactor K001 defective.	Contact Service.
	Oil priming pump defective.	Contact Service.
PPC (green indicator lamp not lit).	Fault in control circuit: 24VDC not supplied to connector X1–3.	Contact Service.
	Switch S001 defective.	Contact Service.
	Motor protection relay Q001 has tripped.	1. Check wiring (→ Page 213); 2. Contact Service: • Check priming pump.

Oil priming pump (PPC) runs normally

Component	Probable Cause	Action
PPC (green indicator lamp not lit or only glowing dimly).	LED of indicator lamp defective.	Replace LED (→ Page 214).

TIM ID: 0000012087 – 001

8 Task Descriptions

8.1 General Wiring for Engine / Gearbox / Genset

8.1.1 Engine wiring – Check

Preconditions

- Engine is stopped and starting disabled.

Material

Designation / Use	Part No.	Qty.
Isopropyl alcohol	46181	1

Engine wiring – Check

1. Check securing screws of cable clamps on the engine and tighten loose screw connections.
2. Make sure that cables the are secured properly and cannot move freely.
3. Check that cable clamps are firm, tighten loose clamps.
4. Replace faulty cable clamps.
5. Check electrical components visually for damage:
   - connector housing;
   - contacts;
   - sockets;
   - cables and terminals;
   - plug-in contacts.
6. If cable cores are damaged (→contact Service.)
7. Clean soiled connector housing, sockets and contacts with isopropyl alcohol.
8. Make sure that all connectors for the sensors are plugged in correctly.

8.2 Displays and Controls, General

8.2.1 Indicator lamp - LED replacement

Special tools

Designation / Use	Part No.	Qty.
Cap puller	0015383730	1

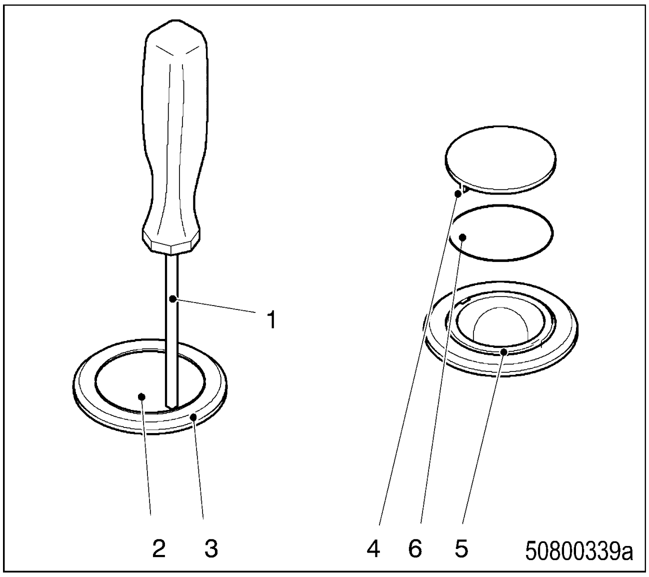
Spare parts

Designation / Use	Part No.	Qty.
LED, yellow		
LED, red		
LED, green		

CAUTION	Faulty LED installation can destroy contacts. **Damage to component!** • Fit LED with correct polarity.

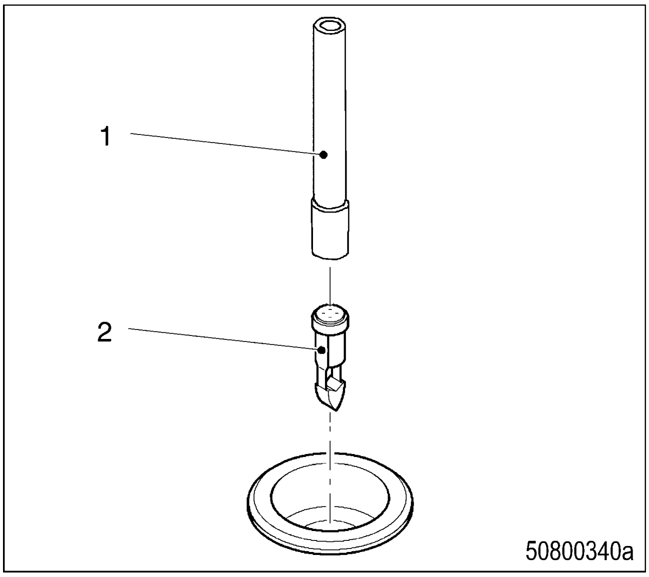
Removing LED

1. Insert small screwdriver (1) between glass cover (2) and lamp housing (3).
2. Pry out glass cover together with inscription label (6). Take care not to break lugs (4).
3. Insert screwdriver between lamp housing and edge of lens (5).
4. Carefully withdraw lens from lamp housing.
   Result: The LED is visible.



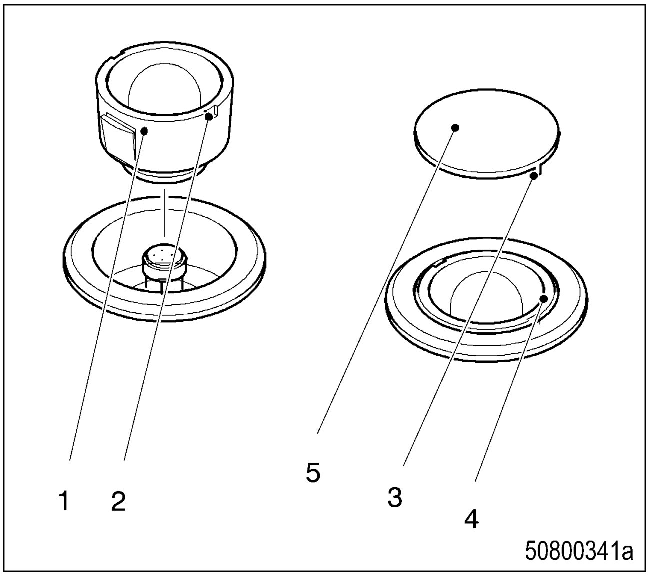
TIM ID: 0000007116 – 002

5. Apply cap puller (1) to LED and pull out LED. Record the direction the contact surface marked "+24V" (2) faces.



Installing LED

1. Insert new LED with correct polarization (note orientation of the contact surface marked "+24V").
2. Ensure LED latches in position.
3. Insert lens (1) into lamp housing. Recesses (2) must be positioned horizontally opposite one another.
4. Press inscription label onto lower side of glass cover (5) and set on both together, ensuring that lugs (3) engage in recesses (4) of the lens.
5. Press glass cover slightly to latch into position.



TIM ID: 0000007116 – 002

TIM ID: 0000007116 – 002

Workshop Manual

9 Task Descriptions

9.1 Operating Tests

9.1.1 BlueLine test mode – Execution

Preconditions

- Operating voltage is switched on.
- LOP is accessible.
- Engine is stopped.

Activating test mode

1. Open LOP.
2. Select the “Password page” on printed circuit board MPU 29 with the “Arrow ↑” / “Arrow ↓” keys.
3. Enter the password.
4. Confirm with the ENTER key.
   Result: The menu section for Service Personnel opens.
5. Select the “Parameter page” with the “Arrow ↑” / “Arrow ↓” keys.
6. Confirm with the ENTER key.
7. Select the “Test mode” page with the “Arrow ↑” / “Arrow ↓” keys.
8. Confirm with the ENTER key.
9. Change the setting from “Off” to “On” with the “Arrow ↑” / “Arrow ↓” keys.
10. Confirm with the ENTER key.
    Result: Test mode is switched on.

Instrument test

1. Press illuminated pushbutton “STOP”.
   Result: Instrument test is active. All instruments indicate full-scale deflection.
2. Press illuminated pushbutton “COMBINED ALARM/ACK.”.
   Result: The “Engine speed” display instrument indicates full-scale deflection, all other instruments indicate 0.
3. Press illuminated pushbutton “COMBINED ALARM/ACK.” several times.
   Result: The various instruments indicate full-scale deflection one after the other whereas the other instruments indicate 0. The order in which the instruments indicate full-scale deflection must be as follows: 1. Engine oil pressure, 2. Engine coolant temperature, 3. Gear oil pressure, 4. Gear oil temperature.

TIM ID: 0000007168 – 003

Lamp test

1. Press illuminated pushbutton “STOP” repeatedly until all indicator lamps are brightly lit.
   Result: Lamp test is activated.
2. Press illuminated pushbutton “COMBINED ALARM/ACK.” several times.
   Result: The various lights in the indicator lamps and illuminated pushbuttons come on one after the other whereas the other lights remain dark. The order in which the lights are switched on must be as follows:
   - 1. START
   - 2. STOP
   - 3. COMBINED ALARM/ACK.
   - 4. DIM ↑
   - 5. DIM ↓
   - 6. OVERRIDE
   - 7. ENGINE/GEAR ALARM
   - 8. SENSOR/SYSTEM FAULT
   - 9. EMERGENCY STOP
   - 10. READY FOR START/STOP
   - 11. ENGINE RUNNING*
   - 12. AUTO STOP/REDUCTION**
   - 13. OVERSPEED**
   - 14. LUBE OIL PRESSURE LOW**
   - 15. COOLANT TEMP. HIGH**
   - 16. GEAR OIL PRESSURE LOW**
   - 17. GEAR OIL TEMP HIGH**
   - 18 COOLANT LEVEL LOW**
   - 19. LEAK. FUEL LEVEL HIGH**
   - 20. WATER IN FUEL PREFILTER**
   - 21. Not used
   - 22. NEUTRAL*
   - 23. AHEAD*
   - 24. ASTERN*

   Indicator lamps marked * do not apply to BlueLine. Indicator lamps marked ** are only provided on the version with indicator lamps for single-point alarms.

RCS test

1. Press illuminated pushbutton “STOP”.
   Result: RCS test is activated.
2. Move a propulsion control lever on a command unit forwards to the stop and backwards to the stop.
   Result:
   - Associated speed display instrument indicates the changes.
3. Check the following:
   3.1. The display instrument of the starboard power train must be activated when the right-hand propulsion control lever is moved. The starboard cabling has otherwise been mixed up with the port cabling at some point:
      - At the control unit
      - At the command unit or
      - At the instrument connection

   3.2. The display must increase from 0 to 3000 rpm when the propulsion control lever is moved forwards (corresponding to the ahead direction of thrust).

   3.3. The display must increase from 0 to 1500 rpm when the propulsion control lever is moved backwards (corresponding to the astern direction of thrust).
4. Correct the cabling in accordance with the “Procedure in case of incorrect results” in the table below if the sides are mixed up.

TIM ID: 0000007168 – 003

5. Carry out the test in the same way when using rotary encoder modules with a remote operating station.
6. Check the following:
   6.1. Establish without any doubt that all controls actually do take effect on the side of the propulsion plant to which they are assigned (an additional potential fault source is the cabling between the rotary encoder modules and the operating station).
   6.2. Check carefully that the controls on the operating station are assigned to the correct side. (If the two connectors from the operating station to the rotary encoder modules are misconnected, and X1 and X2 leading to the RCS-5 control units are mixed up at the same time, the control levers take effect on the correct side, but the controls on the operating station are reversed).

Procedure in case of incorrect results

Position	Result	Action
Display instruments	One instrument always remains at 0.	Inspect cabling for disruption or loose connectors.
	Instruments mixed up.	Inspect cabling for misconnected connectors.
Indicator lamps/illuminated pushbuttons	One of the LEDs always remains dark.	Inspect cabling for disruption or loose connectors.
	Indicator lamps/illuminated pushbuttons are mixed up.	Inspect cabling for misconnected connectors.
Command unit/engine speed display instrument.	Propulsion plant sides mixed up.	Inspect cabling for misconnected connectors.

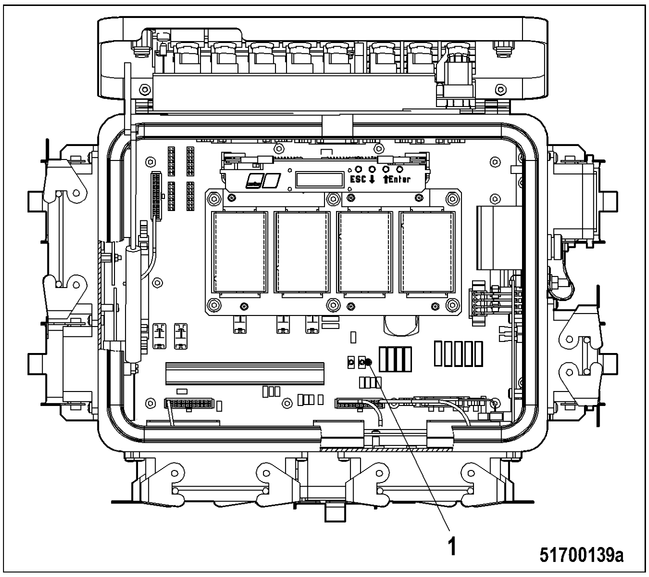
TIM ID: 0000007168 – 003

9.1.2 Overspeed test

Preconditions

- Operating voltage is switched on.
- LOP is accessible and open.

Overspeed test



1. Start the engine (at the service interface of the Local Operating Panel or in Local mode on a Local Operating Panel with DIS or LOS).
2. Run the engine up to idling speed.
3. Press the Overspeed pushbutton on the motherboard LMB in the Local Operating Panel

   Result: The engine is shut down by the emergency shutdown function when the Overspeed test is successful:
   - ECU is switched off
   - Emergency-air shutoff flaps close, if applicable

TIM ID: 0000006788 – 002

9.1.3 Emergency stop test

Preconditions

- Operating voltage is switched on.
- Emergency stop pushbutton is accessible.
- Engine is stopped.

Emergency stop test

1. Start the engine.
2. Run the engine up to idling speed.
3. Press any EMERGENCY STOP pushbutton (Local Operating Panel, control stands).

   Result: The engine is shut down by the emergency shutdown function
   - The ECU is de-energized
   - Emergency-air shutoff flaps close, if applicable
   - An appropriate alarm message is signalled

TIM ID: 0000007154 – 001

9.1.4 Barring the engine

Preconditions

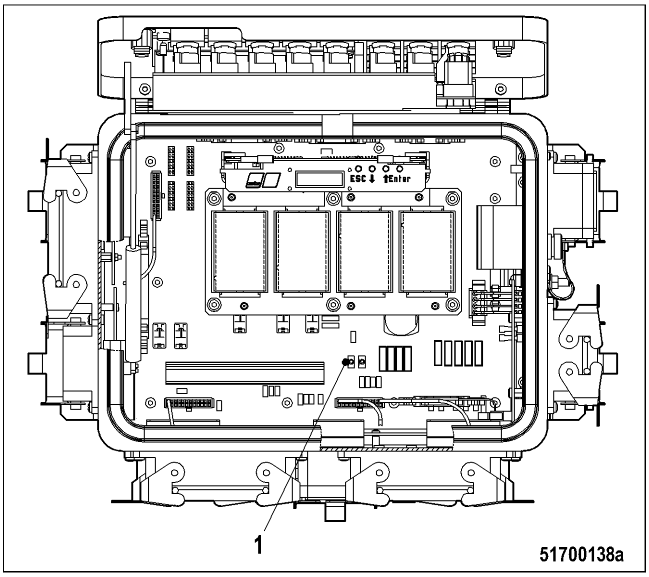
- Operating voltage is switched on.
- Engine is stopped and starting disabled.
- LOP is accessible and open.

DANGER	Unguarded rotating and moving engine components. **Risk of serious injury — danger to life!** • Before barring the engine, ensure that nobody is in the danger zone.

Barring procedure

1. Press and hold down the "Barring" pushbutton on the motherboard LMB of the LOP.

   Result: The engine turns on the starter for max. 20 seconds.
2. Release the "Barring" pushbutton.



TIM ID: 0000006791 – 001

9.2 Checks and Settings

9.2.1 LOP DIS settings – Check

Preconditions

- Operating voltage is present.
- Engine is stopped and starting disabled.

Preparation

1. Switch on the operating voltage.
2. Follow the booting sequence on the display. Select the graphic “Service page” within 10 s of booting sequence completion by pressing the keys F3 or F4 (“↑” or “↓”).
3. Press key F5 (Enter).
   Result: The Service page is opened in Edit mode.

Checking node number settings

1. Consult the configuration overview to determine the node number which the display DIS concerned must have (→ Page 251).
2. Press key F2 (Enter) repeatedly until the “CAN node number” input field is activated.
   Result: The set node number is displayed. Proceed as follows to correct an incorrect setting:

Position	**Result**	**Action**
Display DIS — “Service page”	Incorrect node number set	Set correct node number (→ Page 251)

Checking baud rate setting

1. Determine the baud rate (→ Page 251).
2. Press key F2 (Enter) repeatedly until the “CAN Baud Rate” input field is activated.
   Result: The set baud rate is displayed. Proceed as follows to correct an incorrect setting:

Position	**Result**	**Action**
Display DIS — “Service page”	Incorrect baud rate set	Set correct baud rate (→ Page 251).

TIM ID: 0000007166 – 004

9.2.2 LOP display DIS – Setting

Preconditions

- Operating voltage available
- Engine is stopped and starting disabled.

Preparation

1. Switch on the operating voltage.
2. Follow the booting sequence on the display. Select the graphic “Service page” within 10 s of booting sequence completion by pressing the keys F3 or F4 (“↑” or “↓”).
3. Press key F5 (Enter).

   Result: The Service page is opened in Edit mode.

Setting node number

1. Consult the configuration overview (→ Page 251) to determine the node number which the display DIS concerned must have.
2. Press key F2 (Enter) repeatedly until the “CAN node number” input field is activated.
3. Set the node number by pressing the F3 or F4 keys (“↑” or ”↓”).
4. Press key F2 (Enter) to confirm the input.

   Result: The new node number is displayed.

Setting baud rate

1. Determine the baud rate (→ Page 251).
2. Press key F2 (Enter) repeatedly until the “CAN Baud Rate” input field is activated.
3. Set the baud rate by pressing the F3 or F4 keys (“↑” or ”↓”).
4. Press key F2 (Enter) to confirm the input.

   Result: The new baud rate is displayed.

TIM ID: 0000007165 – 004

9.2.3 Display MFD settings – Check

Preconditions

- Operating voltage is present.
- Engine is stopped and starting disabled

Preparation

1. Switch on the operating voltage.
2. Press and hold down function key 1 and function key 2 (from the top) simultaneously when starting the system.
   Result: The device configuration menu appears.

Checking node number settings

1. Consult the configuration overview to determine the node numbers which the display DIS concerned must have (→ Page 251).
2. Press function key 3 or function key 4 repeatedly until the “P-Bus Node: ” input field is activated.
   Result: The set node number is displayed. Proceed as follows to correct an incorrect setting:

Position	Result	Action
Display MFD — “Device configuration page”	Incorrect node number set.	Set correct node number (→ Page 251)

3. Proceed in the same way as for “F-Bus Node”.

Checking baud rate setting

1. Determine the baud rate .
2. Press function key 3 or function key 4 repeatedly until the “Baud rate: ” input field is activated.
   Result: The set baud rate is displayed. Proceed as follows to correct an incorrect setting:

Position	Result	Action
Display MFD — “Device configuration page”	Incorrect baud rate set	Set correct baud rate .

Checking BDM server setting

1. Determine BDM server setting.
2. Press function key 3 or function key 4 repeatedly until the “BDM-Server: ” input field is activated.
   Result: The BDM server setting appears on the display. Proceed as follows to correct an incorrect setting:

Position	Result	Action
Display MFD — “Device configuration page”	Incorrect BDM server set	Set correct BDM server

TIM ID: 0000029982 – 001

9.2.4 Display MFD – Setting

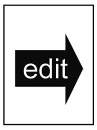
Preconditions

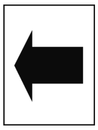
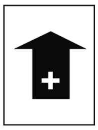
- Operating voltage available
- Engine is stopped and starting disabled.

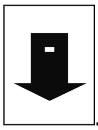
Preparation

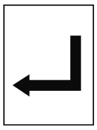
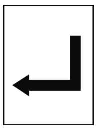
1. Switch on the operating voltage.
2. Press and hold down function key 1 and function key 2 (from the top) simultaneously when starting the system.
   Result: The device configuration menu appears.

Setting node number

1. Determine node number (→ Page 251).
2. Press function key 3 

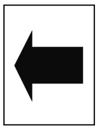
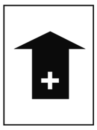
 or function key 4  repeatedly until the “P-Bus Node: ” input field is activated.
3. Set the node number using function key 1 

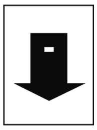
 and function key 2 

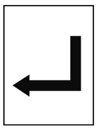
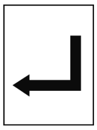
.
4. Press function key 5  to confirm the input.
   Result: The new node number is displayed.
5. Press function key 5  and exit device configuration.
6. Proceed in the same way to set the node number “F-Bus Node”.

Setting baud rate

1. Determine the baud rate .
2. Press function key 3 

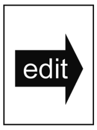
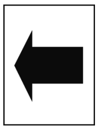
 or function key 4  repeatedly until the “Baud rate: ” input field is activated.
3. Set the baud rate using function key 1 

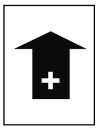
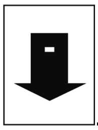
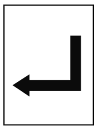
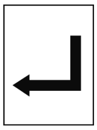
 and function key 2 

.
4. Press function key 5  to confirm the input.
   Result: The new baud rate is displayed.
5. Press function key 5  and exit device configuration.

TIM ID: 0000029981 – 001

Setting BDM server

1. Determine the BDM server number.
2. Press function key 3  or function key 4  repeatedly until the “BDM-Server: ” input field is activated.

3. Set the BDM server number using function key 1  and function key 2 .
4. Press function key 5  to confirm the input.
   Result: The new BDM server number appears on the display.
5. Press function key 5  and exit device configuration.

BDM server settings

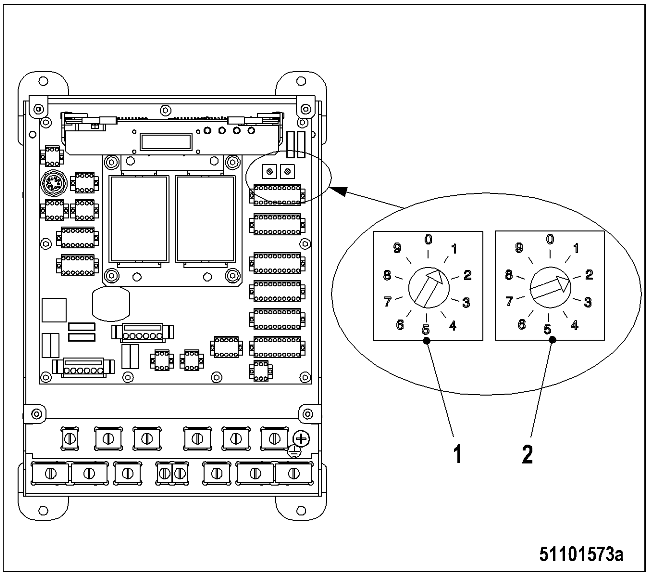
Setting	Meaning
1	BDM server function active • Display is BDM server • Display reads data from SD card • Display logs on to bus as “BDM server” (CAN-ID 1) • “Server collision” error if another device performs this function.
2	BDM server Local function active: • Display is not BDM server on the bus, however its data are read from the local SD card. • Display reads data from SD card • Check with help data CRC

9.2.5 PIM 4 node number – Check

Remove PIM 4 control unit cover (→ Page 253).

Checking rotary switch settings

1. Consult the configuration overview (→ Page 251) to determine the node number which the PIM 4 concerned must have (example: Node no. 12).
2. Check the rotary switch settings in accordance with the table below:



Position	Result	Action
Rotary switch tens (1)	Incorrect position (for example above: not in pos. 1)	Set the rotary switch to pos. 1 with a small screwdriver.
Rotary switch ones (2)	Incorrect position (for example above: not in pos. 2)	Set the rotary switch to pos. 2 with a small screwdriver.

Install PIM 4 control unit cover (→ Page 254).

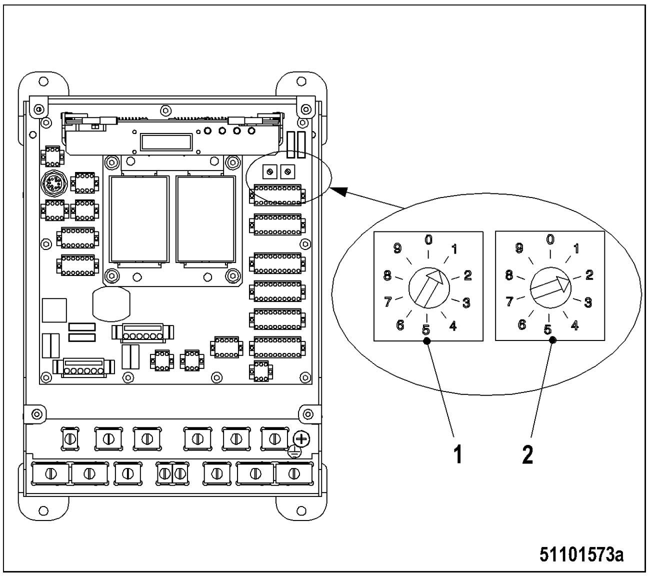
TIM ID: 0000007138 – 004

9.2.6 PIM 4 node number – Setting

Remove PIM 4 control unit cover (→ Page 253)**.**

Setting rotary switches

1. Consult the configuration overview (→ Page 251) to determine the node number which the PIM 4 concerned must have (example: Node no. 12).
2. Set the rotary switches:
   2.1. Set the tens with rotary switch (1) (set to 1 in the example above).
   2.2. Set the ones with rotary switch (2) (set to 2 in the example above).



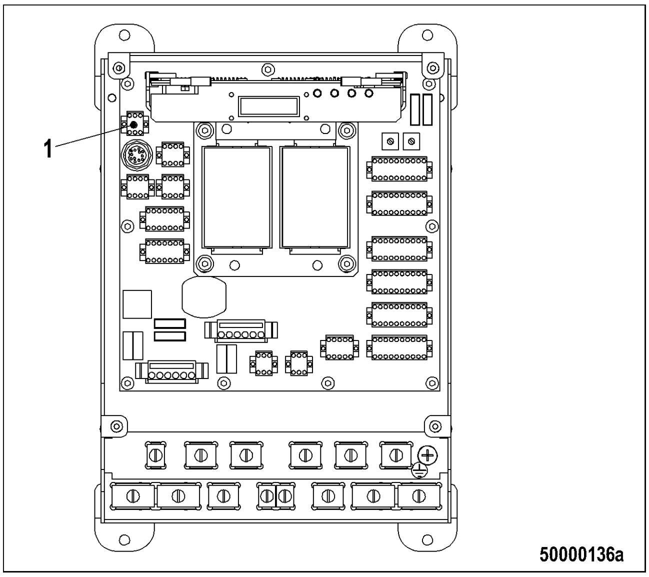
Install PIM 4 control unit cover (→ Page 254)**.**

TIM ID: 0000033313 – 001

9.2.7 Serial interface terminator plugs – Check

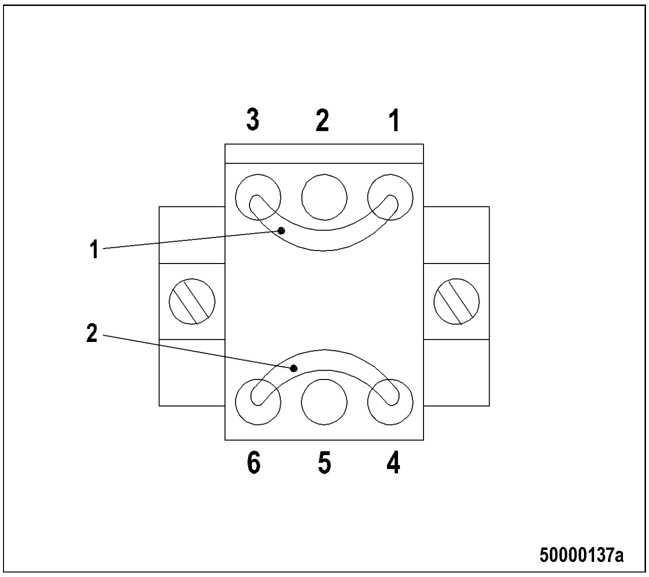
Remove PIM 4 control unit cover (→ Page 253)**.**

Connector X17



Position	Result	Action
Motherboard LMB of PIM 4 MCS control unit	Shorting plug X17 (1) missing.	Insert plug.

Wire jumpers X17



Position	Result	Action
Connector X17	Jumpers between pin 1 and pin 3 (1) and/or pin 4 and pin 6 (2) of shorting plug X17 missing.	Insert correct plug.

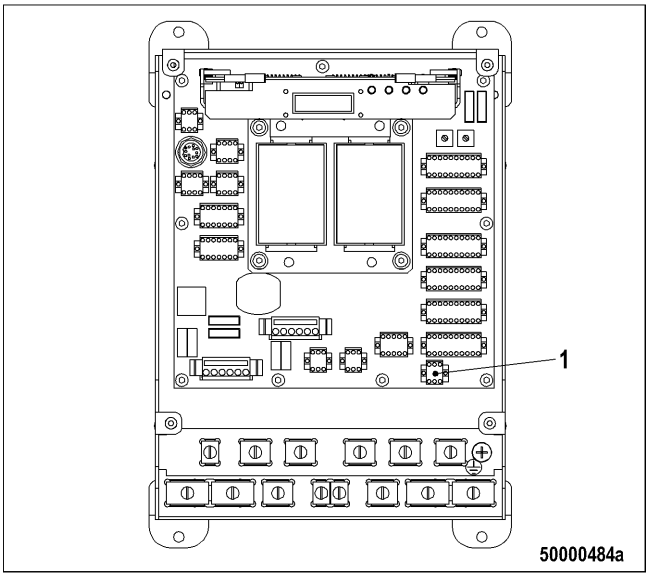
TIM ID: 0000007133 – 001

Install PIM 4 control unit cover (→ Page 254)**.**

9.2.8 Emergency stop shorting plug X18 – Check

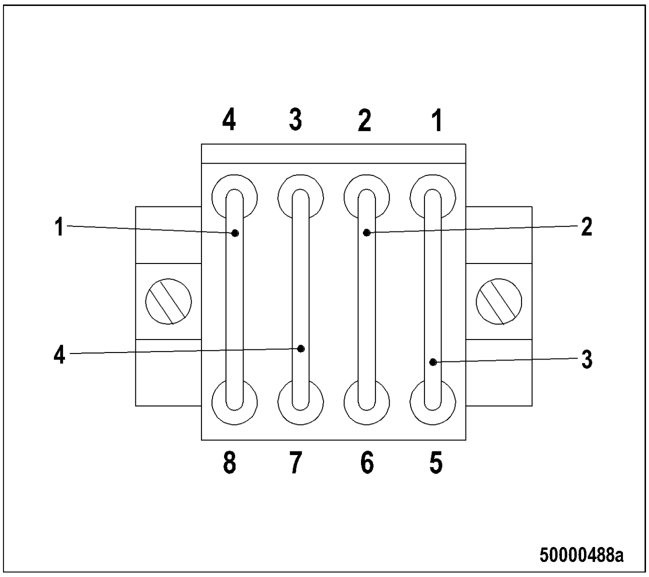
Remove PIM 4 control unit cover (→ Page 253)**.**

Shorting plug X18



Position	Result	Action
Motherboard LMB on PIM 4 MCS control unit	Shorting plug X18 (1) missing.	Insert male shorting plug.

Wire jumper X18



Position	Result	Action
Shorting plug X18	Jumpers between Pin 1 and Pin 5 (3) and/or Pin 2 and Pin 6 (2) and/or Pin 3 and Pin 7 (4) and/or Pin 4 and Pin 8 (1) on shorting plug X18 missing.	Insert correct plug.

Install PIM 4 control unit cover (→ Page 254)**.**

TIM ID: 0000031841 – 001

9.2.9 Jumper configuration of MCS-5 control unit – Check

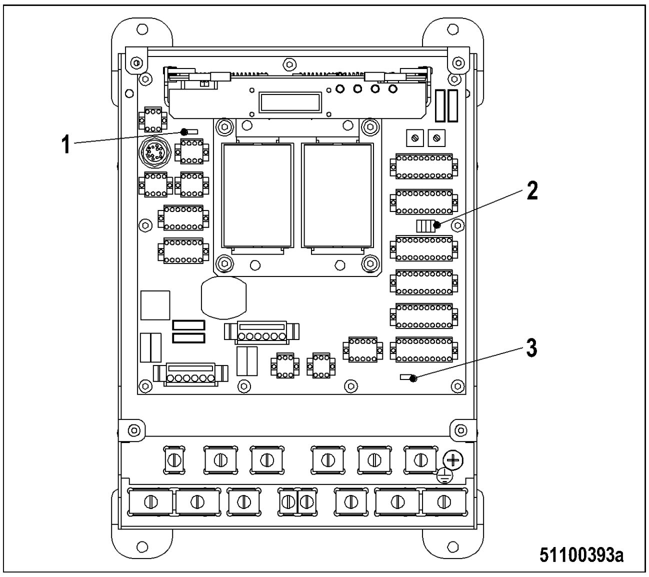
Preconditions

- Engine is stopped.
- Operating voltage is not present.

Remove PIM 4 control unit cover (→ Page 253)**.**

Note: These jumpers are inserted ex-works.

Jumpers on the motherboard of the MCS–5 control unit



Position	Result	Action
JP 1 (1)	Jumper missing	Insert jumper
JP 2 (2)	Jumper missing	Insert jumper
JP 3 to JP 6 (3): JP 3	Jumper missing	Insert jumper
JP 3 to JP 6 (3): JP 4	Jumper missing	Insert jumper
JP 3 to JP 6 (3): JP 5	Jumper missing	Insert jumper
JP 3 to JP 6 (3): JP 6	Jumper missing	Insert jumper

Install PIM 4 control unit cover (→ Page 254)**.**

TIM ID: 0000007156 – 001

9.2.10 CAN bus connections PIM 4 – Check

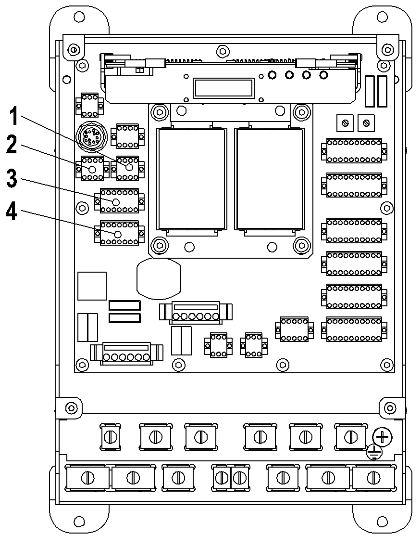
Preconditions

- Operating voltage is switched off

Remove PIM 4 control unit cover (→ Page 253)**.**

Connectors X3 to X6

1. Connectors X3 (4), X4 (3), X5 (2) and X6 (1) must be assigned in every control unit:
   1.1. To a cable leading to another control unit or
   1.2. To a bus terminator (discernible by two resistors) or
   1.3. To a jumper plug
2. The locations of the various connectors depend on the configuration of the overall system. Check connector assignment in accordance with the table below:



Yachts with one main control stand:

Control unit	Connector X3	Connector X4	Connector X5	Connector X6
MCS in main control stand	Cable to Local Operating Panel	Bus terminator	Cable to RCS-5 control unit	Cable to RCS-5 control unit
RCS in main control stand	Cable to MCS-5 control unit	Cable to MCSMCS-5 control unit	Cable to display*	Cable to display*
* If no display is present, a jumper must be fitted in this position between X5 and X6.				

Yachts with two main control stands:

Control unit	Connector X3	Connector X4	Connector X5	Connector X6
MCS-5 in main control stand 1	Cable to Local Operating Panel	Cable to MCS-5 control unit in main control stand 2	Cable to RCS-5 control unit	Cable to RCS-5 control unit
MCS-5 in main control stand 2	Cable to MCS-5 control unit in main control stand 1	Bus terminator	Cable to display* in main control stand 2	Cable to display* in main control stand 2
RCS-5 in main control stand	Cable to MCS-5 control unit in main control stand 1	Cable to MCS-5 control unit in main control stand 1	Cable to display* in main control stand 1	Cable to display* in main control stand 1
* If no display is present, a jumper must be fitted in this position between X5 and X6.				

TIM ID: 0000007155 – 004

Course of action in case of misconnection

Position	Result	Action
PIM 4 RCS, connectors X3 to X6	Assignment does not conform with table above.	Correct plug connections (→ Page 394).
PIM 4 MCS, connectors X3 to X6	Assignment does not conform with table above.	Correct plug connections (→ Page 362).

Install PIM 4 control unit cover (→ Page 254)**.**

TIM ID: 0000007155 – 004

9.2.11 CAN bus line resistance – Check

Preconditions

- Operating voltage is switched off.
- Engine is at a standstill.

Special tools

Designation / Use	Part No.	Qty.
Multimeter		

Control unit

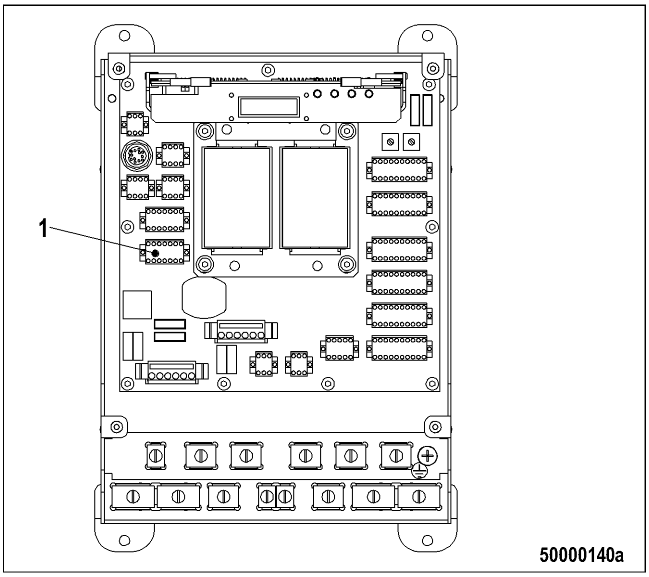
1. Make the control units accessible.
2. Determine the right control unit:
   2.1. On systems with one main control stand: Cover on MCS control unit
   2.2. On systems with two main control stands: Cover on MCS control unit of main control stand 2

Remove PIM 4 cover (→ Page 253)**.**

Connector X4

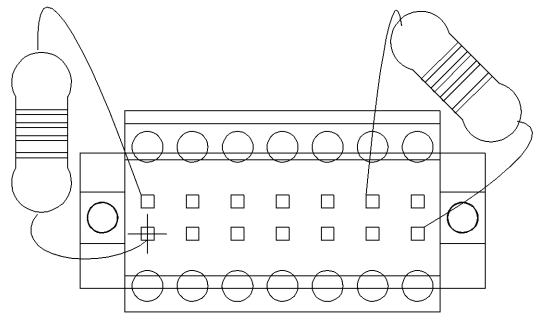
Note: Connector X4 (1) must always be assigned as a matter of principle, either with a bus terminator or with a cable leading to another device.

1. There is a bus terminator on connector X4 (1).
2. Prepare the multimeter for impedance measuring (connect leads to the appropriate jacks, set resistance measuring range to 1 kΩ).



TIM ID: 0000007157 – 001

3. 120 Ω resistors are located on the right and left of the bus terminator (between pins 1 and 8 and between pins 7 and 13).
4. Measure ohmic resistance at the connecting wires of each of the two resistors, it must be approx. 60 Ω.



50000141a

Position	Result	Action
120 Ω resistor on connector X4 pins 1 and 8	Resistance measures 120 Ω	Rectify bus cable disruption.
	Resistance measures 0 Ω	Rectify bus cable short circuit.
120 Ω resistor on connector X4 pins 7 and 13	Resistance measures 120 Ω	Rectify bus cable disruption.
	Resistance measures 0 Ω	Rectify bus cable short circuit.

Install PIM 4 control unit cover (→ Page 254)**.**

TIM ID: 0000007157 – 001

9.2.12 MPU 29 node address in LOP – Check

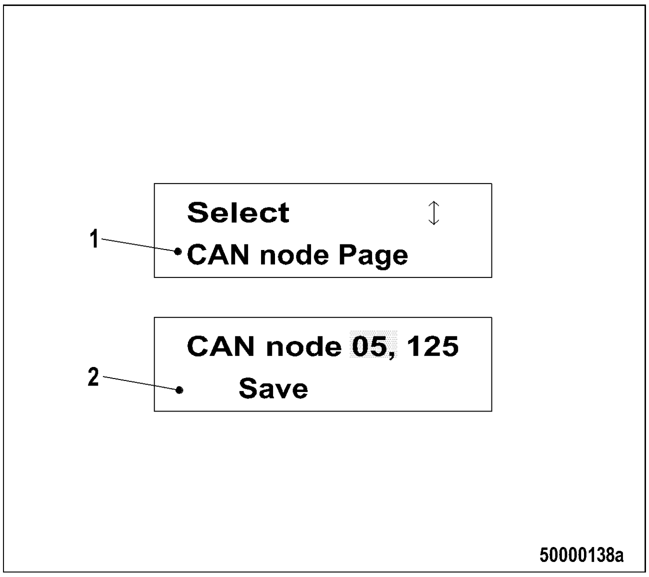
Preconditions

- Operating voltage is present.
- MPU 29 is accessible.
- Engine is stopped and starting disabled.

Mini Dialog MPU 29

1. Switch on the operating voltage.

   Result: Various texts appear on the display on processor printed circuit board MPU 29 during the booting sequence.
2. Watch the display on the MPU 29 and wait until the booting sequence has been completed.



Checking settings

1. Select the “Password page” on printed circuit board MPU 29 with the “Arrow ↑” / “Arrow ↓” keys.
2. Confirm with the ENTER key.
3. Enter the password.
4. Confirm with the ENTER key.
5. Select the “CAN node page” (1) with the “Arrow ↑” / “Arrow ↓” keys.
6. Confirm with the ENTER key.

   Result: The currently set node number appears on the display (2) on MPU 29 after the term “CAN node”, this is number 05 in the example shown in the figure. The transmission rate on the CAN bus appears after, in the example in the figure this is 125 kBd.

Position	Result	Action
Display MPU 29	Incorrect node number set.	Determine correct node number (→ Page 251). Set correct node number (→ Page 240).

TIM ID: 0000008682 – 002

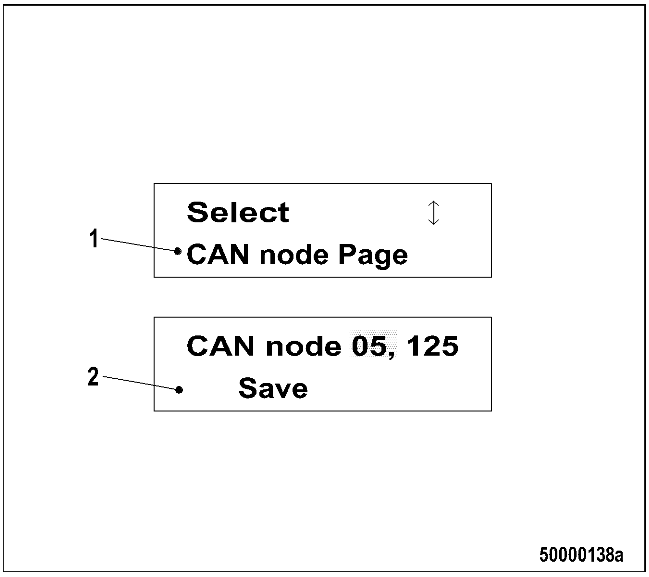
9.2.13 MPU 29 node address in LOP – Setting

Preconditions

- Operating voltage is present.
- MPU 29 is accessible.
- Engine is stopped and starting disabled.

Minidialog MPU 29

1. Switch on the operating voltage.
   Result: Various texts appear on the display on processor printed circuit board MPU 29 during the booting sequence.
2. Watch the display on the MPU 29 and wait until the booting sequence has been completed.



Making settings

1. Select the “Password page” on printed circuit board MPU 29 with the “Arrow ↑” / “Arrow ↓” keys.
2. Confirm with the ENTER key.
3. Enter the password.
4. Confirm with the ENTER key.
5. Select the “CAN node page” (1) with the “Arrow ↑” / “Arrow ↓” keys.
6. Confirm with the ENTER key.
   Result: The currently set node number appears on the display (2) on MPU 29 after the term “CAN node”, this is number 05 in the example shown in the figure.
7. Enter the correct node number with the “Arrow ↑” / “Arrow ↓” keys.
8. Confirm with the ENTER key.
   Result: Cursor jumps to “Save”.
9. Confirm with the ENTER key.
   Result: The new node number is saved.

TIM ID: 0000007171 – 002

9.2.14 Control stand configuration in Local Operating Panel LOP – Check

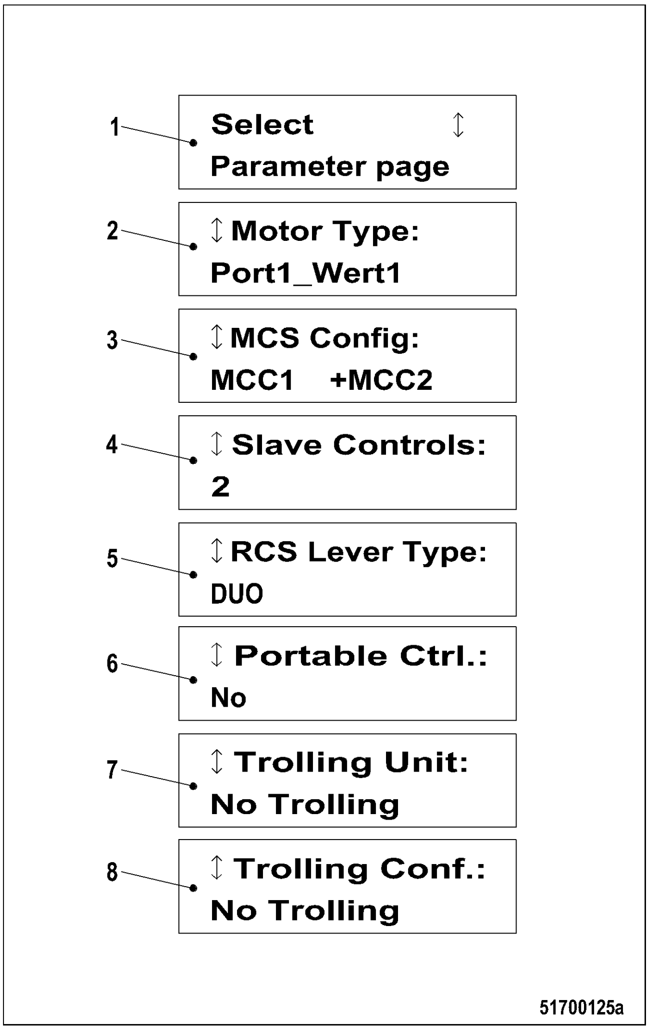
Preconditions

- Operating voltage is present.
- LOP is accessible and open.

Mini Dialog MPU 29

> **Note:** Appropriate changes must be made if the test reveals that incorrect settings have been programmed.

1. Switch on the operating voltage.
2. Watch the display on the MPU 29 processor printed circuit board: Wait until the booting sequence has been completed (various texts are displayed during the booting sequence).



Checking settings

1. Select the “Parameter page” (1) on printed circuit board MPU 29 with the “Arrow ↑” / “Arrow ↓” keys.
2. Confirm with the ENTER key.

   Result: A double arrow followed by the name of the currently displayed sub-page appears (example shows “Motor Type”).

TIM ID: 0000033585 – 001

3. Select the “MCS Config:” sub-page on printed circuit board MPU 29 with the “Arrow ↑” / “Arrow ↓” keys (3).
   Result: The 2nd line indicates which main control stands are programmed. The following settings must appear:
   - Not defined
   - MCC1: MCC without display
   - MCC1/DIS: MCC with display for each power train
   - MCC1/DualDIS: MCC with one display for both power trains
   - MCC1 +MCC2: MCC 1 and MCC 2 without display
   - MCC1/DIS+MCC2: MCC 1 with display for each power train + MCC 2 without display
   - MCC1/DualDIS+MCC2: MCC 1 with one display for both power trains + MCC 2 without display
   - MCC1+MCC2/DIS: MCC 1 without display + MCC 2 with display for each power train
   - MCC1+MCC2/DualDIS: MCC 1 without display + MCC 2 with one display for both power trains
   - MCC1/DIS+MCC2/DIS: MCC 1 with display for each power train + MCC 2 with display for each power train
   - MCC1/DIS+MCC2/DualDIS: MCC 1 with display for each power train + MCC 2 with one display for both power trains
   - MCC1/DualDIS+MCC2/DIS: MCC 1 with one display for both power trains + MCC 2 with display for each power train
   - MCC1/DualDIS+MCC2/DualDIS: MCC 1 with one display for both power trains + MCC 2 with one display for both power trains
4. Select the “Slave Controls” sub-page (4) with the “Arrow ↑” / “Arrow ↓” keys. The 2nd line indicates how many slave control stands are programmed. The following settings must appear:
   - 0, if no slave control stand is provided
   - 1, if a slave control stand is provided
   - 2, if two slave control stands are provided
   - etc.
5. Select the “RCS Lever Type:” sub-page with the “Arrow ↑” / “Arrow ↓” keys. Select (5).
   Result: The 2nd line must indicate the appropriate propulsion control lever used for this power train (NO MTU RCS must not appear):
   - UNO
   - DUO
   - TRIO
6. Select the “Portable Ctrl.” sub-page (6) with the “Arrow ↑” / “Arrow ↓” keys.
   Result: The 2nd line must indicate whether a portable control unit is used on the vessel or not (Yes or No).
7. Select the “Trolling Unit” sub-page (7) with the “Arrow ↑” / “Arrow ↓” keys.
   Result: The 2nd line must indicate whether the vessel has a trolling gearbox or not, and if so, which type of controller is installed (→Installation and Commissioning Instructions).
8. Select the “Trolling Conf.:” sub-page (8) with the “Arrow ↑” / “Arrow ↓” keys.
   Result: The 2nd line must indicate how the Trolling gearbox is controlled (→Installation and Commissioning Instructions).

TIM ID: 0000033585 – 001

9.2.15 Shaft number setting – Check

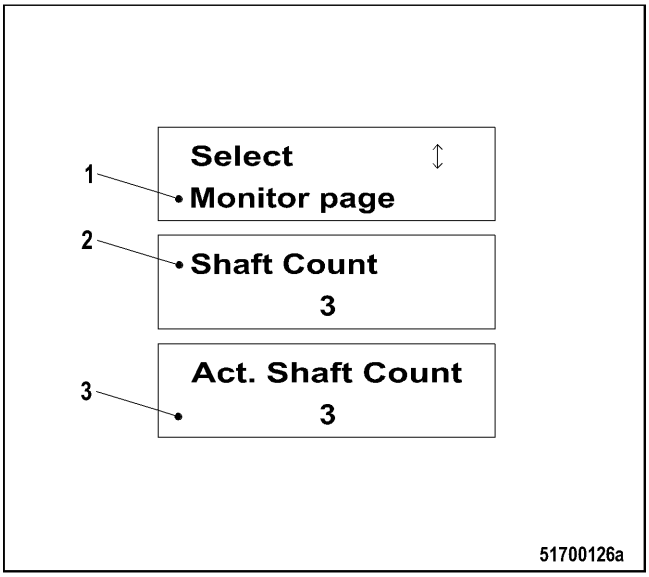
Preconditions

- Operating voltage is present.
- LOP is accessible and open.

Mini Dialog MPU 29

Note: Appropriate changes must be made if the test reveals that incorrect settings have been programmed (for details of programming see (→Installation and Commissioning Instructions)).

1. Switch on the operating voltage.
2. Watch the display on the MPU 29 processor printed circuit board: Wait until the booting sequence has been completed (various texts are displayed during the booting sequence).



Checking settings

1. Select the “Monitor page” (1) on printed circuit board MPU 29 with the “Arrow ↑” / “Arrow ↓” keys.
2. Confirm with the ENTER key. Subsequently select the “Shaft Count” page (2) with the “Arrow ↑” / “Arrow ↓” keys.
   Result: The number of shafts which must be present is indicated below.

Position	**Result**	**Action**
“Shaft Count” page	Vessel has more shafts than indicated here	Check coordination field bus: Cable W207, W270 (2 pcs. if necessary) and W222 (RCS-HSG only)
“Act. Shaft Count” page	Number of shafts displayed does not match the number indicated under “Shaft Count” (including this shaft).	Reset the system, but only when the actual number of shafts on the vessel is displayed under “Shaft Count”, (→ Page 271). Otherwise check coordination field bus: Cable W207, W270 (2 pcs. if necessary) and W222 (RCS-HSG only)

9.2.16 LOP power supply – Check

Preconditions

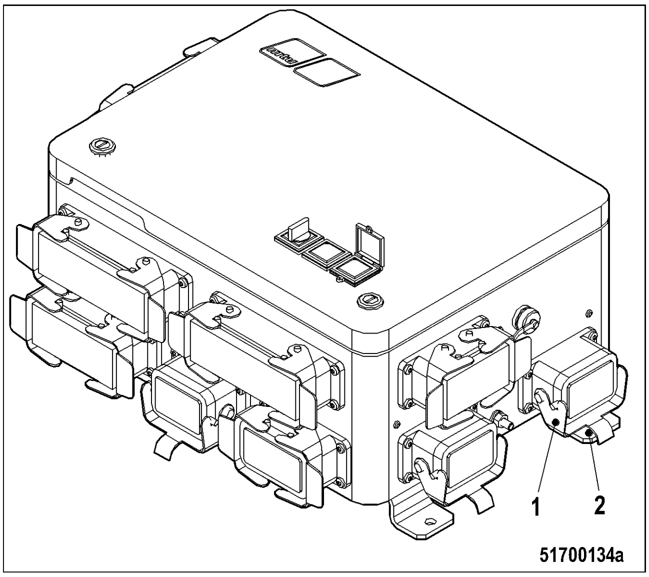
- Supply voltage is available.

Special tools

Designation / Use	Part No.	Qty.
Multimeter		
Set of test prods		

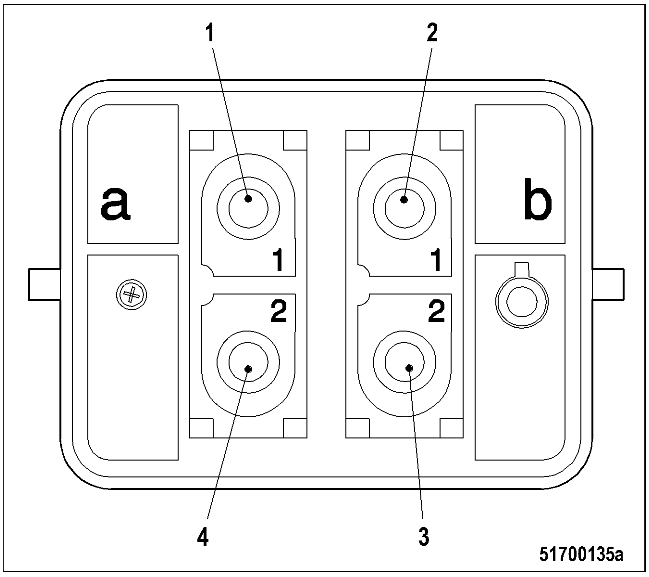
Check on-board supply voltage

1. Switch off on-board supply voltage.
2. Release the retaining clip (1) on connector X7 (2).
3. Disconnect Harting connector X7 from the LOP.
4. Prepare the multimeter for voltage measuring:
   4.1. Plug leads into the appropriate jacks.
   4.2. Set the voltage measuring range to min. 30 V.



TIM ID: 0000007170 – 003

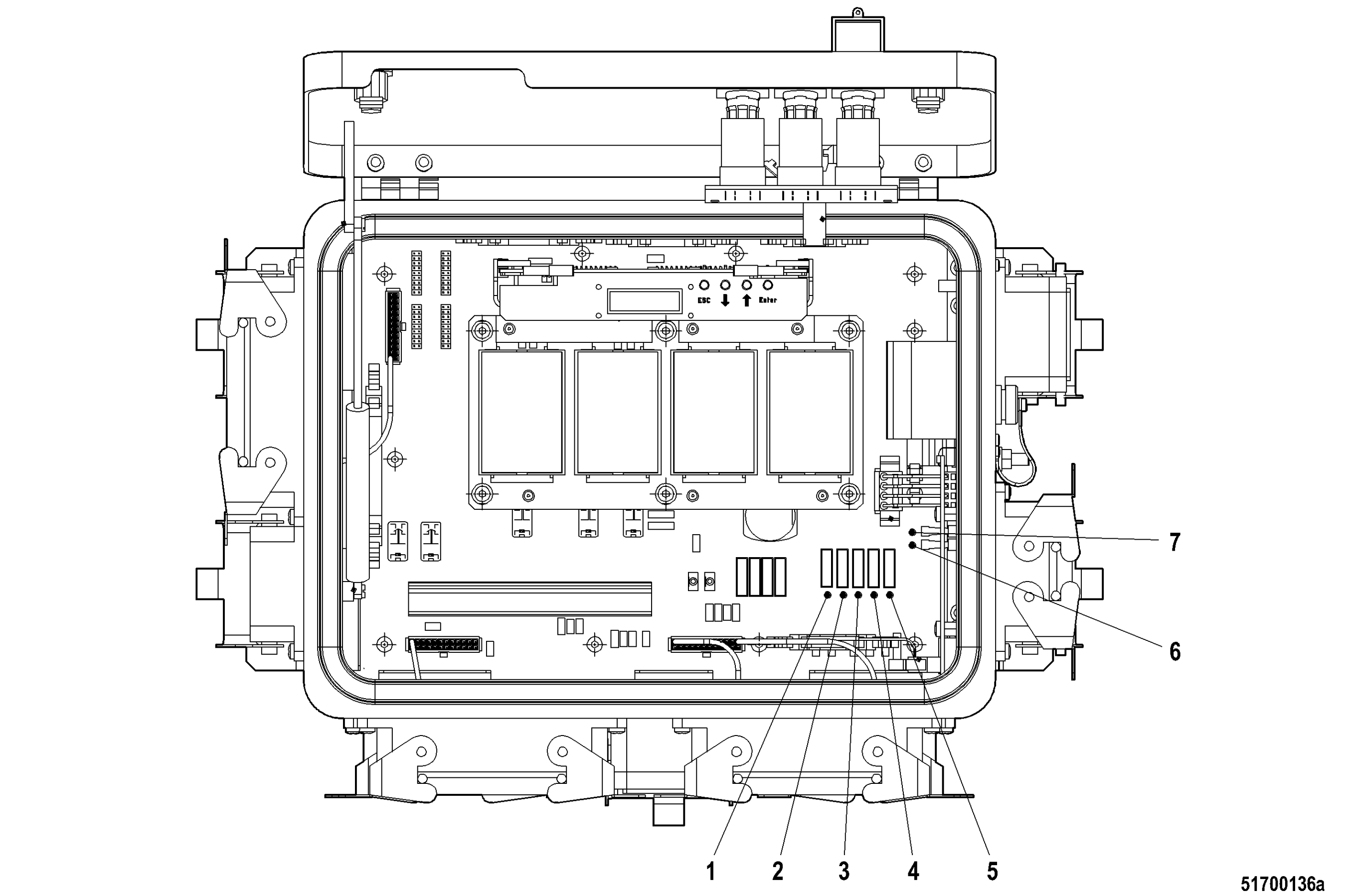
5. Switch on the main on-board supply voltage.
6. Measure the voltage between pins 1a (+) (1) and 2a (-) (4) on the Harting connector: It must be between 19.5 V and 30 V.
7. Measure the voltage between the pins 1b (+) (2) and 2b (-) (3) on the Harting connector: No voltage must be applied here.
8. Switch off the main on-board supply voltage.
9. Switch on the emergency on-board supply voltage.
10. Measure the voltage between the pins 1b (+) (2) and 2b (-) (3) on the Harting connector: It must be between 19.5 V and 30 V.
11. Measure the voltage between pins 1a (+) (1) and 2a (-) (4) on the Harting connector: No voltage must be applied here.
12. Switch off the emergency on-board supply voltage.



Position	Result	Action
Connector X07	Main and emergency supplies mixed up.	Correct cabling. (→Installation and Initial Operation)
	Measured voltage out of tolerated range.	Check on-board power supply.
	Main supply missing.	Check cabling. Check on-board power supply connection.
	Emergency supply missing.	Check cabling. Check on-board power supply connection.

13. Plug connector into socket X07 (2).
14. Engage the retaining clip (1) on the connector.
15. Switch on the on-board supply voltage.

TIM ID: 0000007170 – 003



Checking internal supply voltages

1. Open the flap on the LOP.
2. Check the LEDs in accordance with the table below:

Position	Result	Action
Motherboard V1 (1)	LED (green) supply voltage for external dialog unit dark.	Replace fuse F1 motherboard LMB (→ Page 283)
Motherboard V54 (2)	LED (green) LOP supply voltage dark.	Replace fuse F70 motherboard LMB (→ Page 283)
Motherboard V61 (3)	LED (green) GCU supply voltage dark.	Replace fuse F69 motherboard LMB (→ Page 283)
Motherboard V60 (4)	LED (green) safety system supply voltage dark.	Replace fuse F71 motherboard LMB (→ Page 283)
Motherboard V56 (5)	LED (green) ECU supply voltage dark.	Replace fuse F67 motherboard LMB (→ Page 283)
Motherboard V62 (6)	LED (green) control stands supply voltage dark.	Replace fuse F1 on PSB 4 (→ Page 283)
Motherboard V59 (7)	LED (green) Remote Control System RCS supply voltage dark.	Replace fuse F2 on PSB 4 (→ Page 283)

TIM ID: 0000007170 – 003

9.2.17 Jumper configuration of LOP – Check

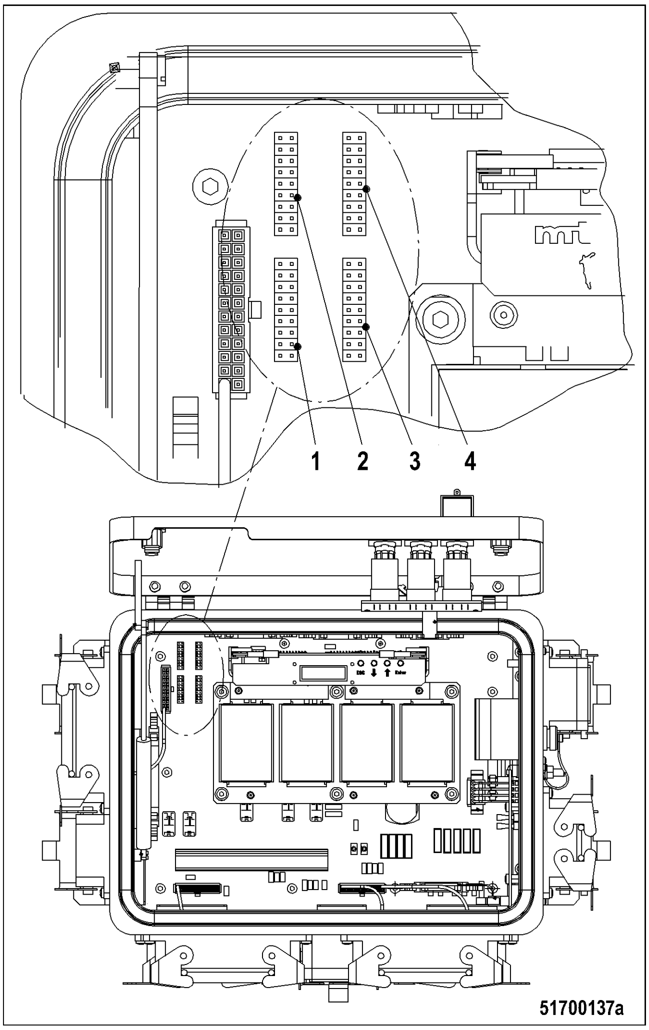
Preconditions

- LOP is accessible.

Note: The following settings must be made:
- GCU (regardless of GCU type).
- No EMU installed

These jumpers are inserted ex-works.

Jumper positions in the LOP



Jumper settings

Position	Result	Action
Jumper ST3A (1)	Jumper not inserted.	Insert jumper.
Jumper ST3B (2)	Jumper inserted.	Remove jumper.
Jumper ST4A (3)	Jumper inserted.	Remove jumper.
Jumper ST4B (4)	Jumper not inserted.	Insert jumper (GCU is installed).

TIM ID: 0000006794 – 001

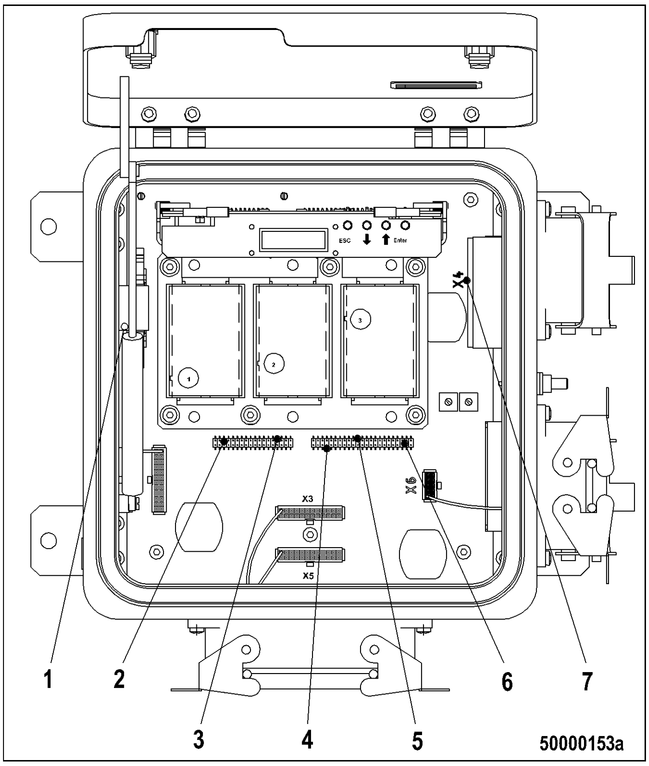
9.2.18 GCU 6 jumper configuration – Check

Preconditions

- Gear Control Unit GCU 6 accessible.
- Engine is stopped.
- Operating voltage is not present.

Note: The jumpers are factory-set. Pos. (1) does not exist on GCU 6.

Jumpers in GCU



Position	Result	Task
JP 6, 5x jumper, (7)	Jumper missing	Insert all jumpers
JP 5, 9x jumper, (6)	Jumper missing	Insert all jumpers
JP 4, 9x jumper, (5)	Jumper missing	Insert all jumpers
JP 3, 9x jumper, (4)	Jumper missing	Insert all jumpers
JP 2, 9x jumper, (3)	Jumper missing	Insert all jumpers
JP 1, 5x jumper, (2)	Jumper missing	Insert all jumpers

TIM ID: 0000006386 – 001

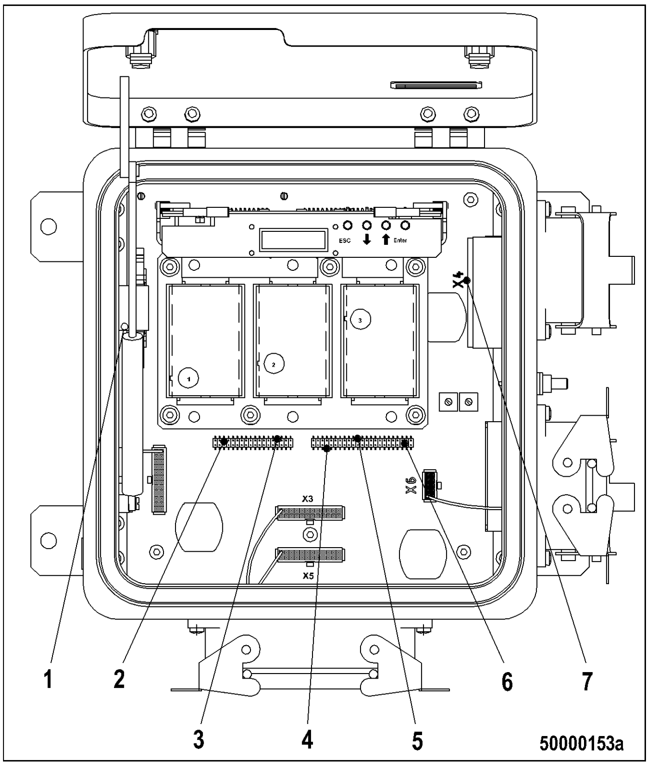
9.2.19 GCU 3 jumper configuration – Check

Preconditions

- GCU 3 is accessible.
- Engine is stopped.
- Operating voltage is not present.

Note: These jumpers are normally inserted appropriately ex-works.

Jumpers in GCU



Position	Result	Action
JP 6, 5x jumper, (7)	Jumper missing	Insert all jumpers
JP 5, 9x jumper, (6)	Jumper missing	Insert all jumpers
JP 4, 9x jumper, (5)	Jumper missing	Insert all jumpers
JP 3, 9x jumper, (4)	Jumper missing	Insert all jumpers
JP 2, 9x jumper, (3)	Jumper missing	Insert all jumpers
JP 1, 5x jumper, (2)	Jumper missing	Insert all jumpers
Printed circuit board MIB 1 (1): 1. JP 1, JP 2, JP 3 and JP 4 2. JP 9. JP 10, JP 11, JP 12 3. JP 17, JP 18 4. JP 19a, JP 20a, JP 21a, JP 22a	Jumper missing	Insert all jumpers

TIM ID: 0000007162 – 001

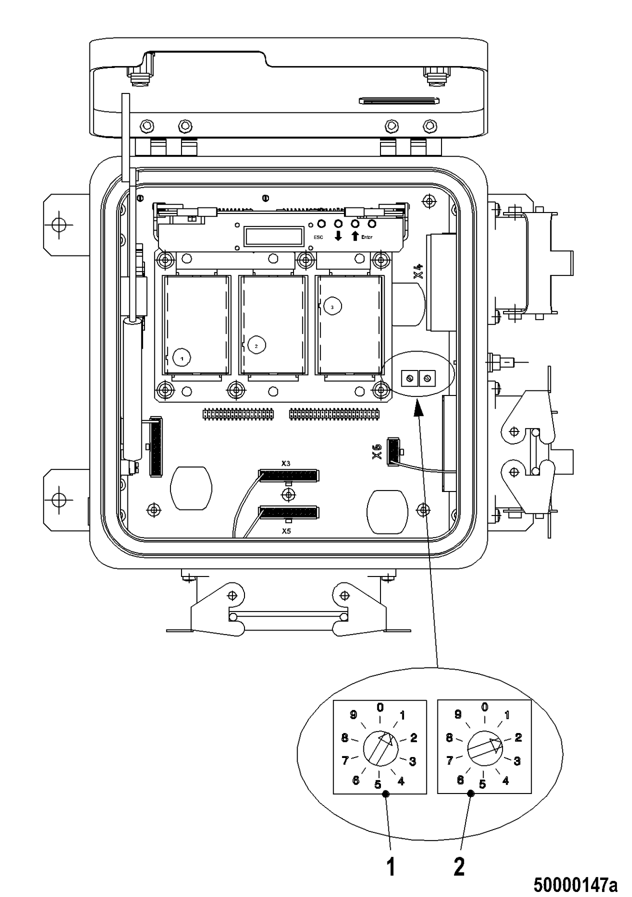
9.2.20 GCU node number – Check

Preconditions

- GCU is accessible and open

Checking rotary switch settings

1. Consult the configuration overview to determine the node number which the GCU must have (example: Node no. 12), (→ Page 251)
2. Check the rotary switch settings in accordance with the table below:



Position	Result	Action
Rotary switch tens (1)	Incorrect position (for example above: not in pos. 1)	Set the rotary switch to the appropriate position with a small screwdriver.
Rotary switch ones (2)	Incorrect position (for example above: not in pos. 2)	Set the rotary switch to the appropriate position with a small screwdriver.

TIM ID: 0000007163 – 003

9.2.21 Configuration

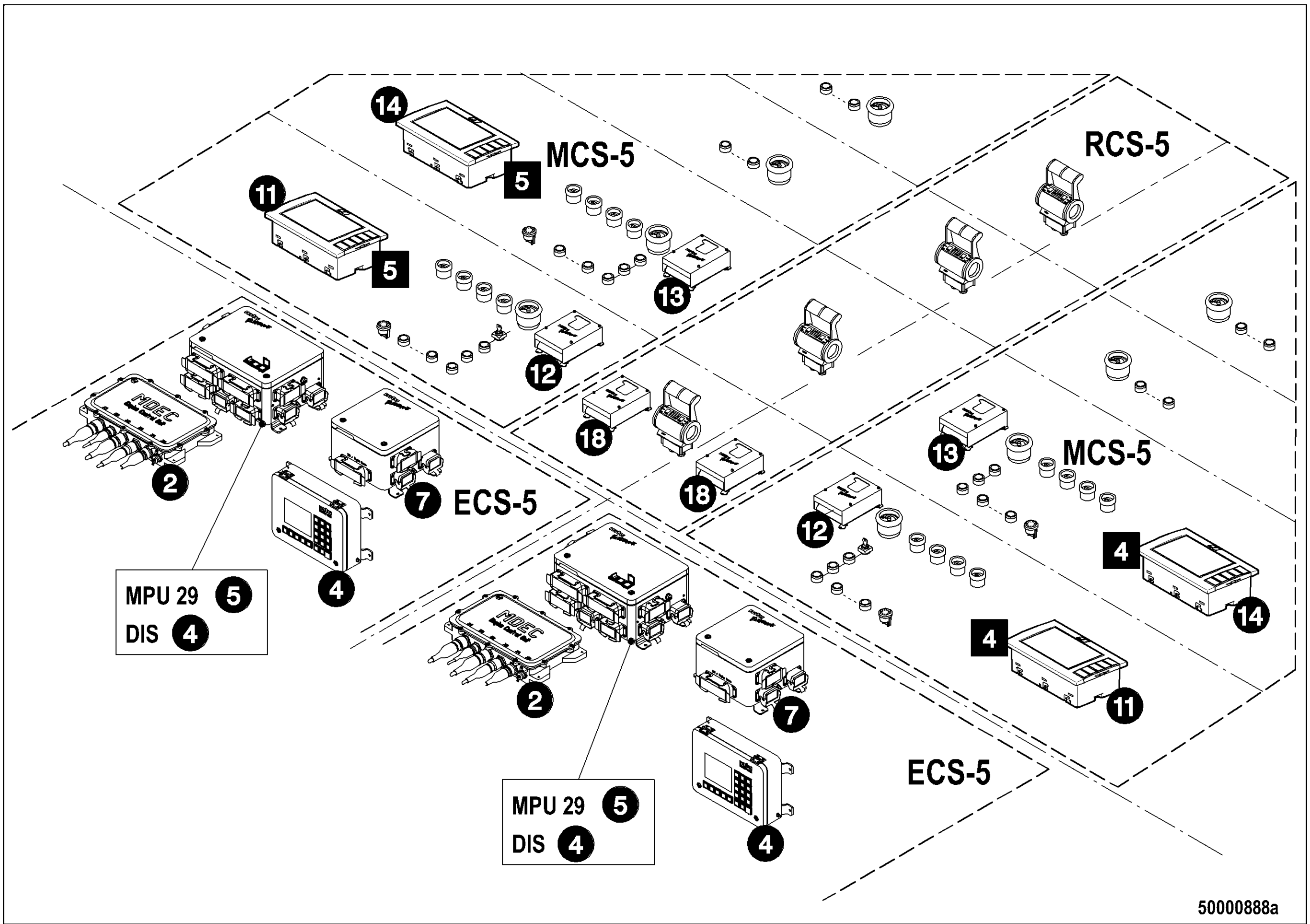
Devices with CAN connection

The following devices of every power train are equipped with a CAN interface and therefore have a CAN node:
- Local Operating Panel LOP: MPU29 and display (if present)
- ECU 4 engine governor
- Transmission control GCU
- Local Operating Station LOS (can only be used if the Local Operating Panel has no display)
- PIM 4 MCS control unit
- PIM 4 RCS control unit
- MFD display main control stand 1
- MFD display main control stand 2

The following illustrations contain the node numbers for each device.

Two nodes must be set at the MFD display whereby a differentiation must be made between process bus nodes and field bus nodes.
- Process bus node for the assignment to power train:
  Node no. 4: Starboard side
  Node no. 5: Port side
- Field bus nodes for the assignment to control console:
  Node no. 11: Main control stand
  Node no. 14: Slave control stand

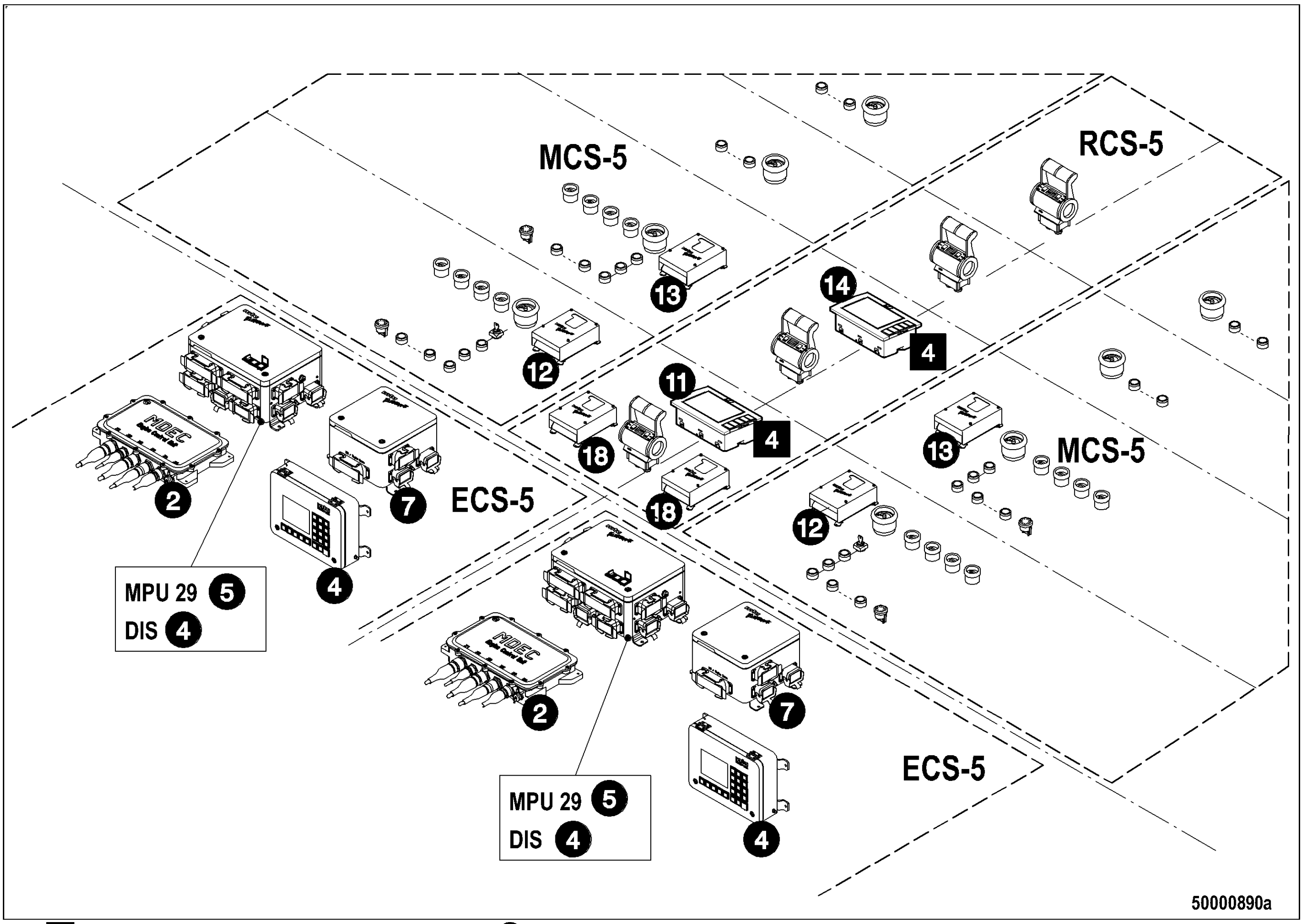
Version 1: One display per power train



■ Process bus node ● Field bus node

Version 2: One display for two power trains

TIM ID: 0000032266 – 002



■ Process bus node ● Field bus node

Node numbers

Each node number can be assigned to each power train only once. If a Local Operating Panel LOP with a DIS display is used, not Local Operating Station LOS can be connected. In this case the DIS display in the Local Operating Panel has the node number 4.

Settings for power limit values of the oil priming pump controller PPC

Power limits of the oil priming pump control unit must be set as follows:

- PPC 5: 3 x 400 VAC 50 Hz, 0.75 kW: 2 A
- PPC 6: 1 x 230 VAC 50 Hz, 1.1 kW: 7.5 A
- PPC 7: 3 x 230 VAC 60 Hz, 0.90 kW: 4 A
- PPC 8: 3 x 440 VAC 60 Hz, 0.90 kW: 2 A

TIM ID: 0000032266 – 002

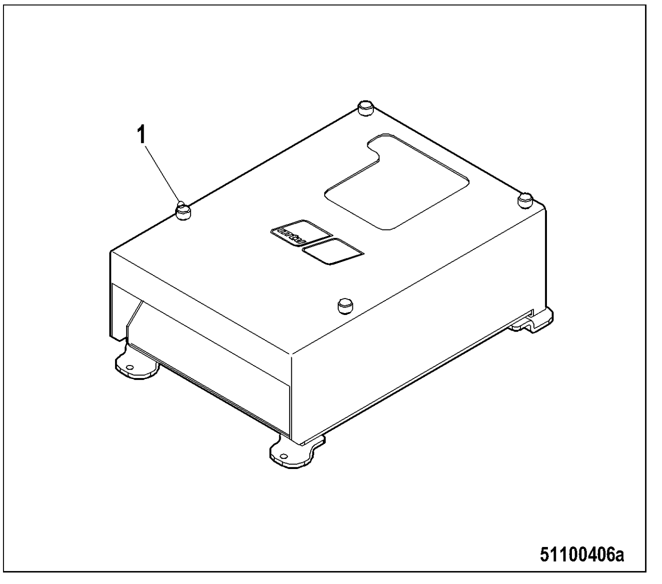
9.3 Repair Work

9.3.1 PIM 4 cover – Removal

CAUTION	Short circuit. **Risk of plant malfunction or breakdown!** • Ensure that no parts fall into the housing.

Removing PIM 4 cover

1. Undo the knurled screws (1).
2. Remove the cover.

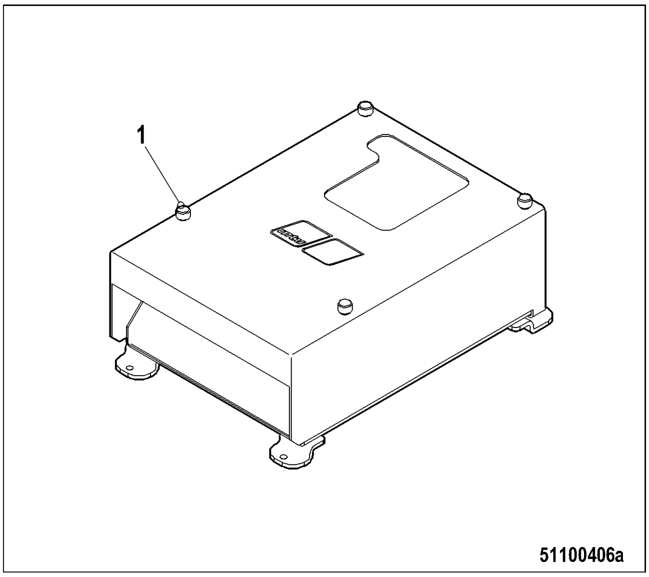


TIM ID: 0000007134 – 001

9.3.2 PIM 4 cover – Installation

Installing PIM 4 cover

1. Fit the cover on the lower part of the housing.
2. Ensure that the screws (1) bite in the threaded inserts in the lower part of the housing.
3. Tighten the screws finger-tight.



TIM ID: 0000007136 – 001

9.3.3 Command unit – Replacement

Preconditions

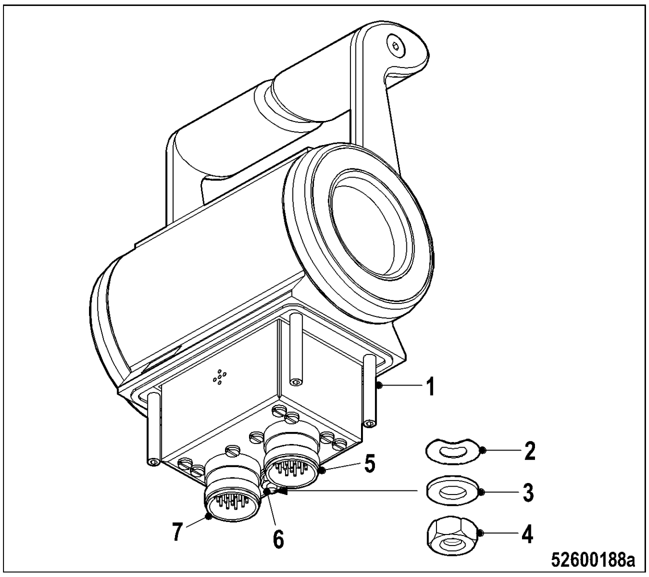
- Engine is stopped and starting disabled.
- Operating voltage is switched off.

Spare parts

Designation / Use	Part No.	Qty.
Propulsion control lever		

Removing command unit

1. Undo the nuts on the two cable connectors (5) and (7).
2. Disconnect both cables.
3. Undo the nuts on the threaded pins (1).
4. Remove nuts (4) washers (2 + 3) and grounding cable from ground connection.
5. Remove command unit from the console cutout.



1 Stud
2 Spring washer
3 Washer
4 Nut
5 Connector X1 (starboard)
6 Ground connection
7 Connector X2 (port)

Installing command unit

1. Install the new command unit in reverse order remembering to connect the grounding cable.
2. Connect cable X1 to connector (5) and X2 to connector (7).
3. Tighten the nuts on the two cable connectors.

TIM ID: 0000007174 – 002

9.3.4 Rotary encoder module – Replacement

Preconditions

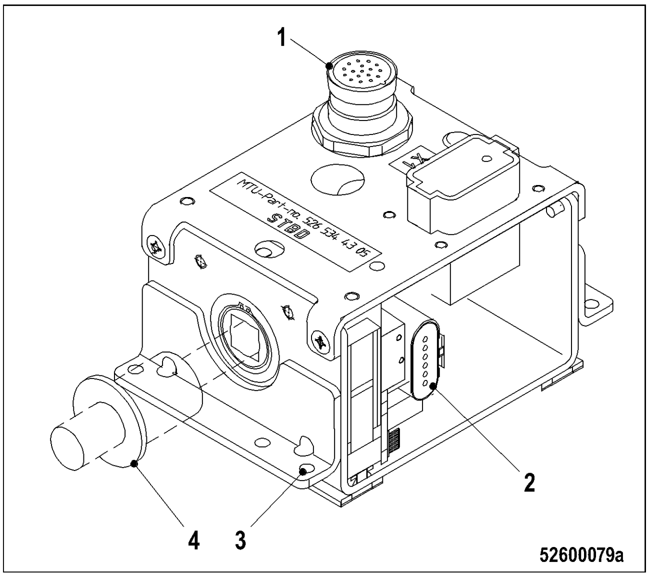
- Engine is stopped.
- Operating voltage is not present.

Spare parts

Designation / Use	Part No.	Qty.
Rotary encoder module		

Removing the faulty rotary encoder module

1. Undo the nut on the cable connector (1).
2. Disconnect the cable.
3. Disconnect the cable leading to the remote operating station from the connector (2).
4. Remove the propulsion control lever from the shaft (4).
5. Undo the four mounting points (3) (four screws, four nuts on threaded pins etc. depending on design).
6. Remove the rotary encoder module.



Installing the new rotary encoder module

1. Install the new rotary encoder module in reverse order.
2. Plug in the connector (1) and tighten the nut (port: "X2", starboard: "X1").
3. Connect the cable leading to the remote operating station to the connector (2). Clip must engage.
4. Mount the propulsion control lever on the shaft (4).

TIM ID: 0000007175 – 001

9.3.5 Operating panel – Replacement

Preconditions

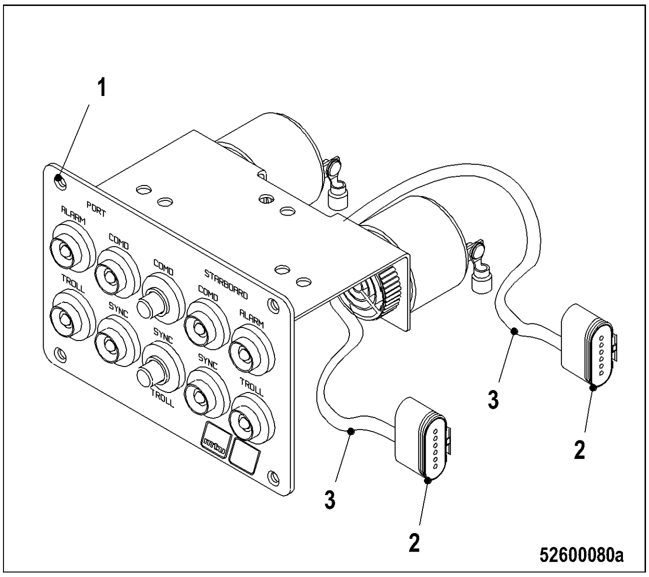
- Engine is stopped and starting disabled.
- Operating voltage is switched off

Spare parts

Designation / Use	Part No.	Qty.
Operating panel		

Removing the faulty operating panel

1. Disconnect both connectors (2) at the two rotary encoder modules.
2. Expose the cables (3).
3. Undo the screws (1).
4. Pull the operating panel forwards out of the console.



Installing the new operating panel

1. Install the new operating panel in reverse order ensuring tight sealing with the surface of the console.
2. Route the two cables (3) to the rotary encoder modules; check the sides: Route the STBD cable (identified by an appropriately inscribed tag) to the rotary encoder on the starboard side and plug it in, route the PORT cable to the rotary encoder on the port side and plug it in.
3. Secure the cables.

TIM ID: 0000007176 – 001

9.3.6 Analog display instrument VDO OceanLine – Replacement

Preconditions

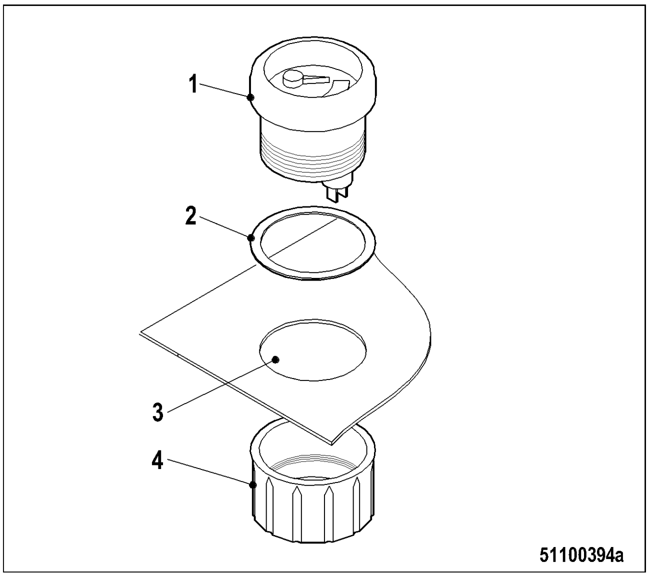
- Operating voltage is not present.
- Engine is stopped.

Spare parts

Designation / Use	Part No.	Qty.
Engine lube oil temperature, gearbox lube oil temperature: Instrument 0 — 120 degrees		
Engine lube oil pressure: Instrument 0 — 10 bar		
Gearbox control oil pressure: Instrument 0 — 30bar		
Engine speed main control stand 1: Instrument 0 — 3000 rpm with operating hours counter		
Engine speed main control stand 2 or slave control stands: Instrument 0 — 3000 rpm		

Removing an instrument

1. Note down cable to instrument connection assignment.
2. Disconnect all connectors at the back of the instrument.
3. Undo the knurled-head screw (4) by hand.
4. Pull the instrument (1) forwards out of the installation opening (3).



Installing a new instrument

1. Fit a seal (2) on the new instrument (1).
2. Insert the new instrument (1) into the installation opening (3). Ensure that the seal (2) is properly seated between the surface of the console and the lip of the instrument all the way round.
3. Tighten the knurled-head screw (4) finger-tight.
4. Insert the cables checking assignment against the notes made earlier.

TIM ID: 0000007149 – 001

9.3.7 Lamp in analog display instrument VDO OceanLine – Replacement

Preconditions

- Operating voltage is switched off.

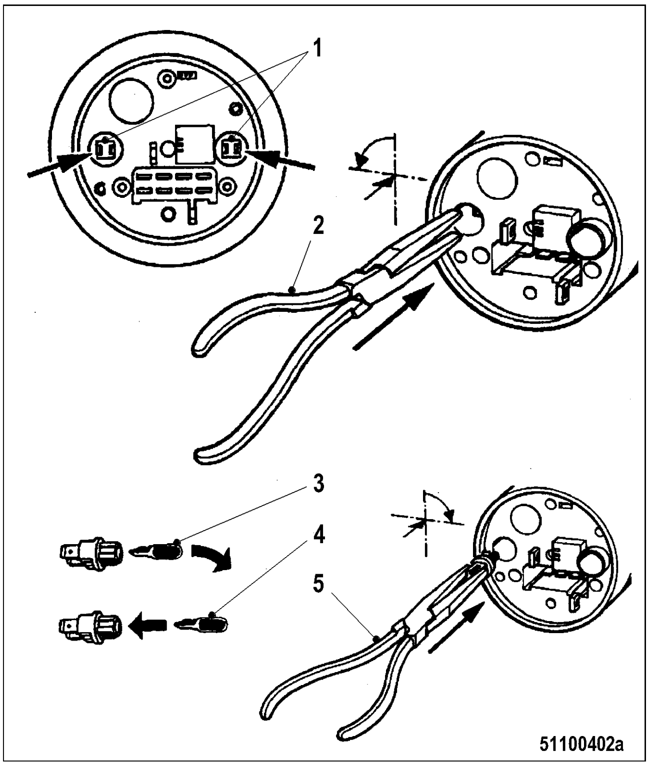
Spare parts

Designation / Use	Part No.	Qty.
Lamp 24 V DC		

Note: Lamp replacement is described using a speed display instrument as an example. The procedure is principally the same for the smaller instruments.

Removing a lamp

1. Disconnect all connectors at the back of the display instrument.
2. Turn the lampholder (1) of the faulty lamp with a pair of pointed pliers (2).
   Result: The lock is released
3. Pull out the lampholder (1).
4. Remove the faulty lamp (3) from the bayonet holder.



Installing a new lamp

1. Insert a new lamp (4).
2. Turn the lamp to lock it in the bayonet holder.
3. Insert the lampholder in the aperture (5).
4. Turn the lampholder with a pair of pointed pliers (2).
   Result: The lampholder is locked in the instrument housing.

TIM ID: 0000007150 – 001

9.3.8 Indicator lamp – Replacement

Remove indicator lamp (→ Page 261)**.**

Install new indicator lamp (→ Page 262)**.**

TIM ID: 0000008263 – 001

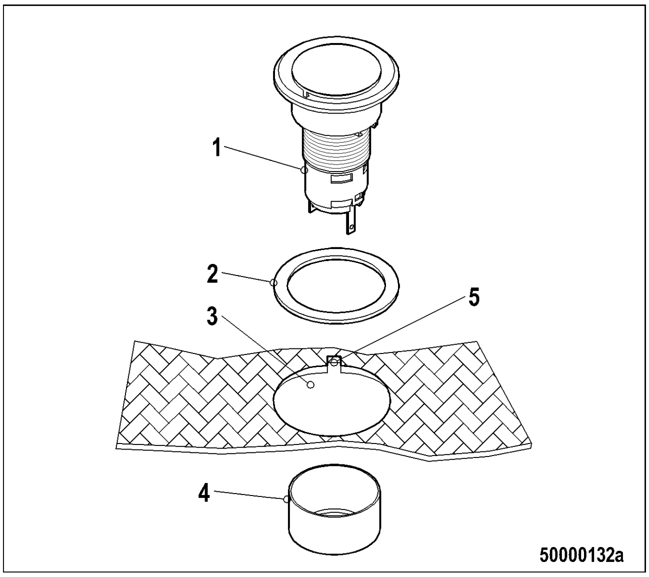
9.3.9 Indicator lamp – Removal

Preconditions

- Engine is stopped.
- Operating voltage is not present.

Removing the housing

1. Disconnect the connecting cables from the indicator lamp contacts.
2. Fit the socket wrench over the nut (4) from the back.
3. Undo the nut (4) and unscrew it by hand.
4. Pull the indicator lamp housing (1) forwards out of the installation opening (3).
5. Remove the seal (2).
6. Remove the sealing cap if applicable.



TIM ID: 0000007151 – 002

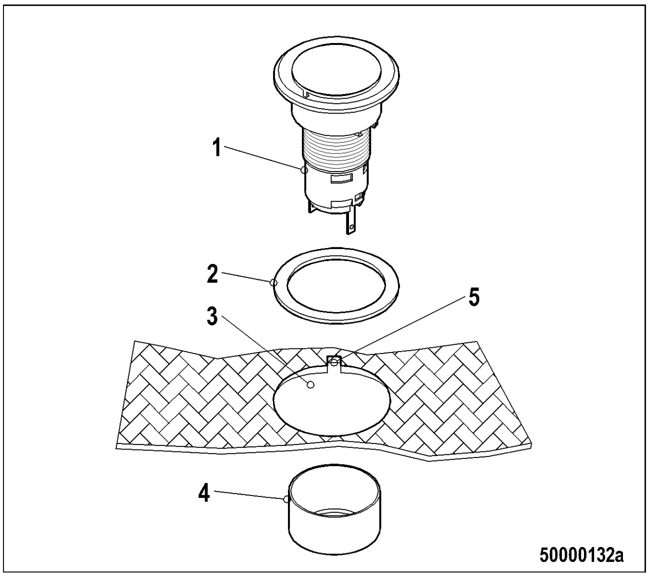
9.3.10 Indicator lamp – Installation

Preconditions

- Engine is stopped and starting disabled.
- Operating voltage is switched off.

Indicator lamp – Installation

1. Fit the seal (2) over the indicator lamp housing (1).
2. Fit a sealing cap over the indicator lamp if required.
3. Insert the indicator lamp (1) from the top through the installation opening (3).
4. Screw on nut (4) from below, ensuring that the lug of the indicator lamp (1) engages in the anti-rotation notch (5).
5. Tighten nut (4).
6. Plug the connector over the connector pins.



TIM ID: 0000007152 – 002

9.3.11 LED in indicator lamp – Replacement

Special tools

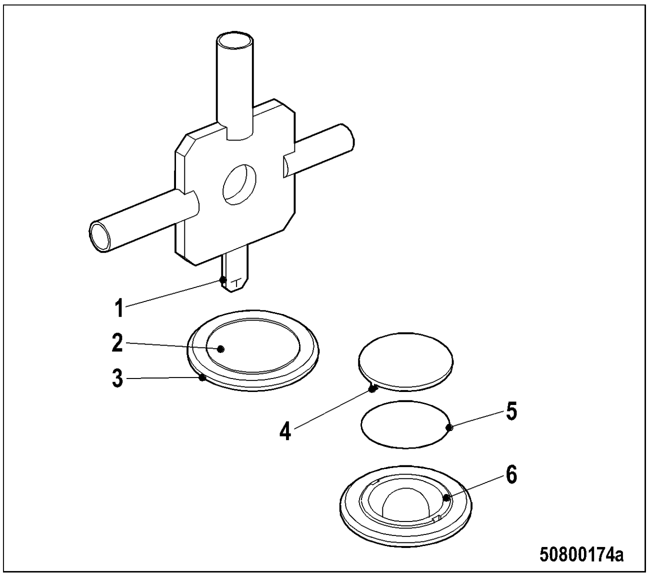
Designation / Use	Part No.	Qty.
Cap puller	0015383730	1

Spare parts

Designation / Use	Part No.	Qty.
LED, bipolar, green		
LED, bipolar, yellow		
LED, bipolar, red		

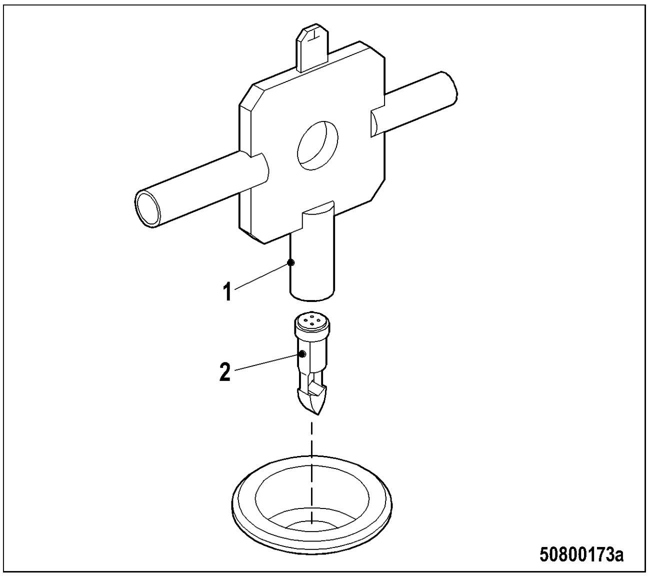
Removing an LED

1. For indicator lamps with sealing caps: Remove the entire indicator lamp prior to replacing the LED (→ Page 261) and pull off the sealing cap.
2. Insert the blade (1) of the cap puller between the cover glass (2) and the lamp housing (3).
3. Carefully prize out the cover glass together with the diffusing foil (5). Be careful not to break any of the lugs (4).
4. Insert the blade of the cap puller between the lamp housing and the edge of the lens (6).
5. Pull the lens out of the lamp housing.
   Result: LED visible.



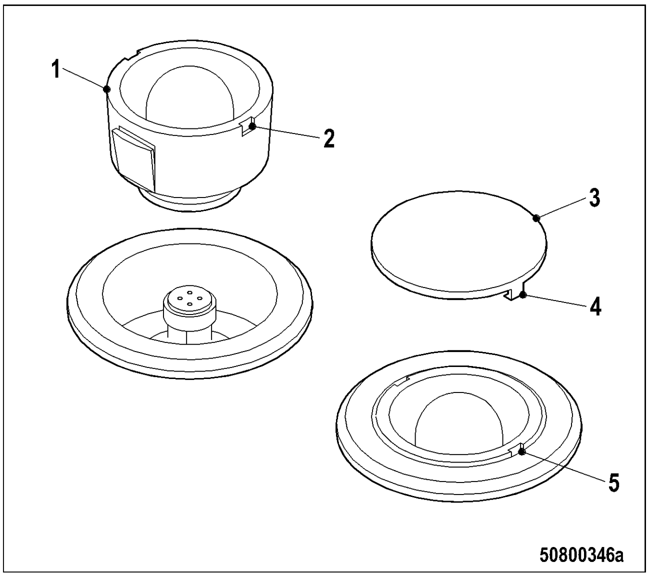
TIM ID: 0000007158 – 002

6. Fit the appropriate sleeve (1) of the cap puller over the LED (2) and pull the LED out of the socket.



Installing an LED

1. Insert a new LED.
2. Snap the LED into place.
3. Insert the lens (1) into the lamp housing. The recesses (2) must be aligned horizontally (Reason: Inscription on cover glass should be straight).
4. Place the diffusing foil under the cover glass (3) and fit both these parts such that the lugs (4) engage in the recesses (5) of the lens.
5. Snap on the cover glass exerting gentle pressure.
6. For indicator lamps with sealing caps: Install indicator lamp (→ Page 262).



TIM ID: 0000007158 – 002

9.3.12 Contactor – Replacement

Preconditions

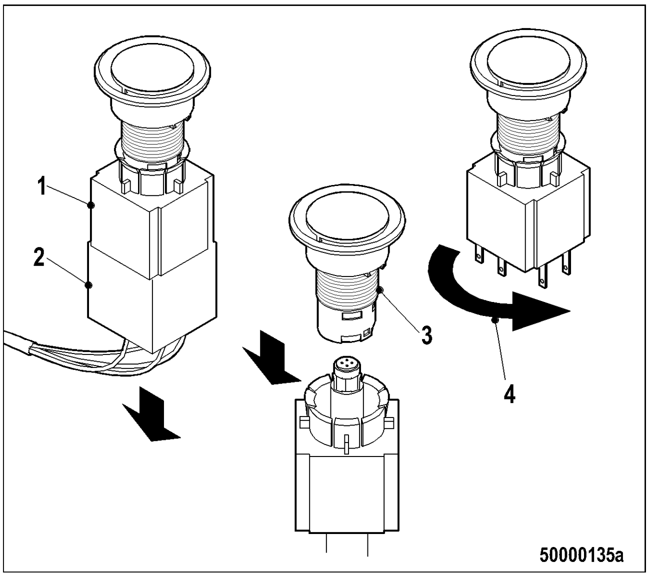
- Engine is stopped.
- Operating voltage is not present.

Spare parts

Designation / Use	Part No.	Qty.
Contactor		1

Removing a contactor

1. Pull the connector housing (2) off the contactor (1) holding the contactor with one hand in so doing.
2. Turn the contactor through 45° and pull it off the actuator (3) of the illuminated pushbutton.



Installing a contactor

1. Fit the connector housing on the new contactor. Check polarity! Each plug contact inside the housing must mate with a corresponding contactor pin.
2. Fit the connector housing together with the contactor turned through 45° on the housing of the illuminated pushbutton ensuring that the contactor is straight.
3. Press in the connector housing as far as it will go taking care not to damage the contactor!
4. Turn the connector housing together with the contactor through 45° (4) taking care not to break the lugs on the contactor.

   Result: The lugs on the contactor engage in the recesses in the connector housing.

TIM ID: 0000007153 – 001

9.3.13 LED in pushbutton/switch – Replacement

Preconditions

- Illuminated pushbutton must be accessible from behind.

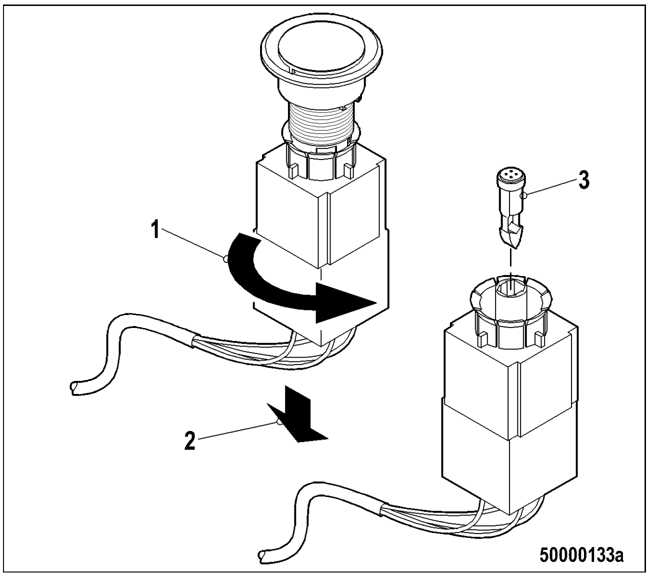
Spare parts

Designation / Use	Part No.	Qty.
LED, bipolar, red		
LED, bipolar, yellow		
LED, bipolar, green		

Open the console or remove the front panel as applicable.

Removing a contactor

1. Turn the connector housing together with the contactor through 45° (1) and pull them off the housing of the illuminated pushbutton (2).
2. Pull the light emitting diode (3) out of the socket.



Inserting a light emitting diode

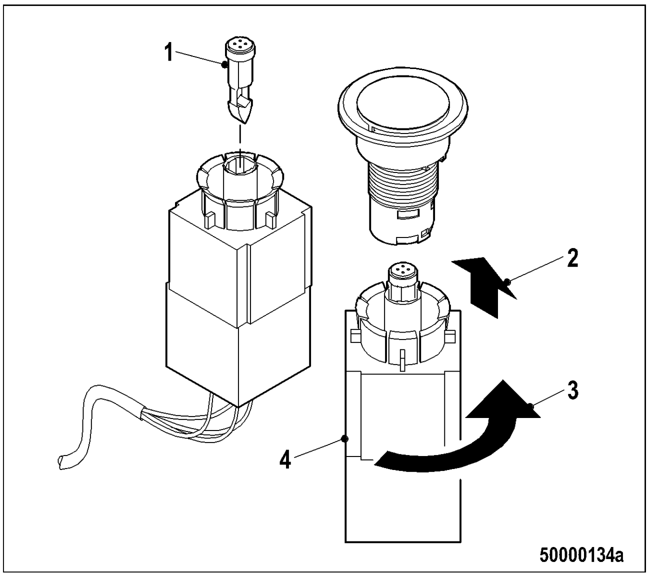
1. Insert a new light emitting diode (1) between the contacts.
2. Clip the light emitting diode into place exerting gentle pressure.

TIM ID: 0000007159 – 001

Inserting a contactor

1. Fit the connector housing together with the contactor turned through 45° on the housing of the illuminated pushbutton ensuring that the contactor is straight.
2. Press in the connector housing as far as it will go taking care not to damage the contactor!
3. Turn the connector housing together with the contactor through 45° (4) taking care not to break the lugs on the contactor.

   Result: The lugs on the contactor engage in the recesses in the connector housing.
4. Close the console or re-install the front panel as applicable.



TIM ID: 0000007159 - 001

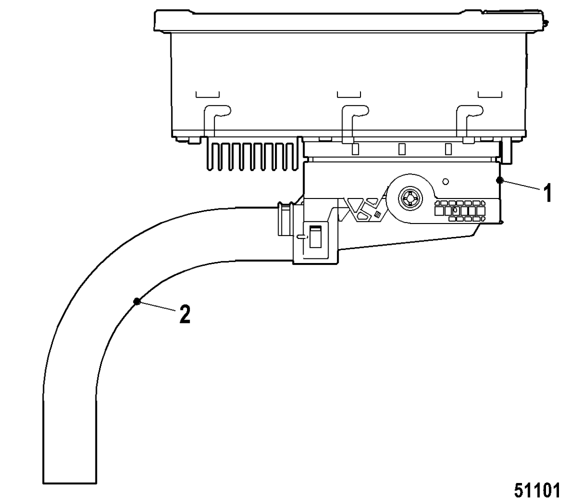
9.3.14 Display MFD – Replacement

Preconditions

- Engine is stopped.
- Operating voltage is not present.

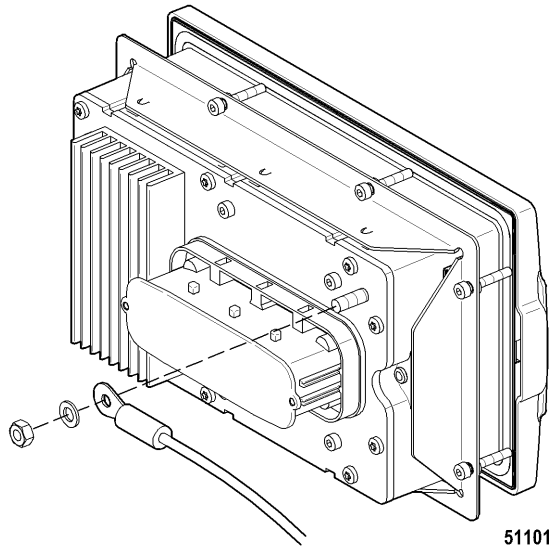
Removing a faulty display

1. Unplug connecting cable (2) from socket (1).



51101779a

2. Disconnect grounding cable.
3. Undo screws on mounting frame.
4. Slide the mounting frame to the left and remove the display forwards out of the control panel.



51101880a

Installing a new display

1. Check that a seal is fitted to the mating surface of the new display. Fit a seal as necessary.
2. Install the new display in reverse order.
3. Connect the socket.
4. Fit the grounding cable
5. Switch on the supply voltage.
   Result: Check that the LEDs flash at approx. 2 Hz (operating state indicators).
6. Set node number (→ Page 251).

TIM ID: 0000029951 – 001

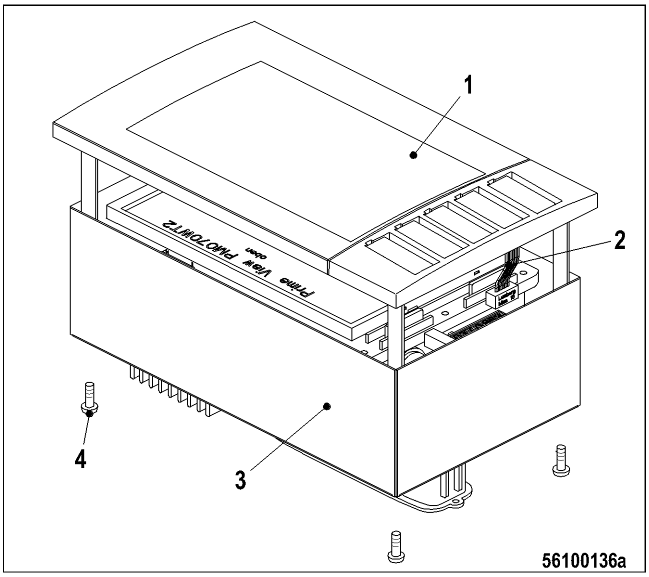
9.3.15 Battery in display MFD – Replacement

Preconditions

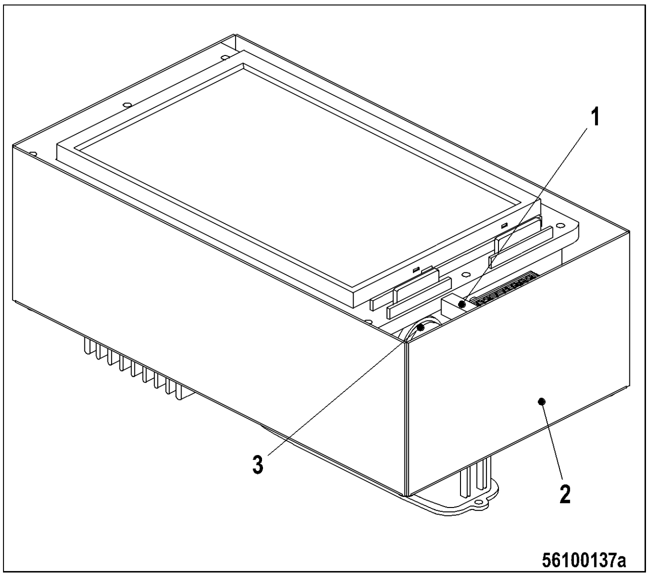
- Engine is stopped.
- Operating voltage is not present.

Removing the battery

1. Remove the display. (→ Page 268)
2. Undo the screws (4).
3. Carefully put the top of the display (1) out of the housing until the connector (2) of the ribbon cable is accessible.
4. Unplug the connector (2) on top of the display (1).
5. Remove the top of the display (1).



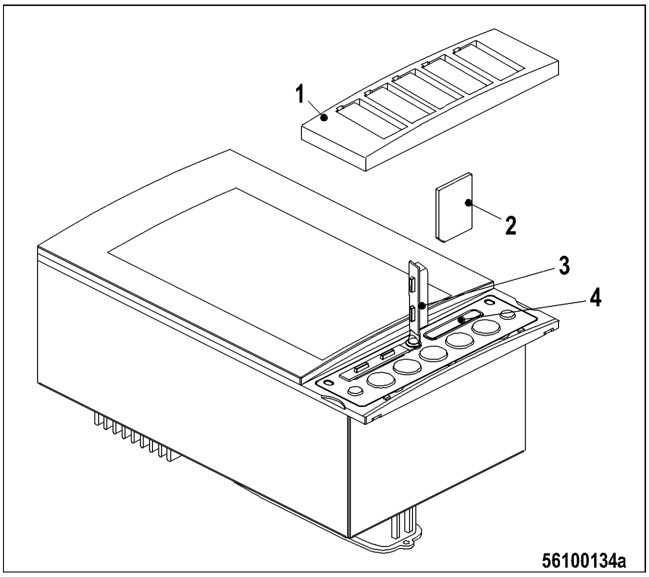
6. Carefully remove the battery (3) up out of its holder.
7. Install a new battery.
8. Carefully insert the top of the display (1) into the housing.
9. Plug in the connector (2) in its plug-in location on the top of the display (1).
10. Fully insert the top of the display (1) into the housing.
11. Tighten the screws (4).
12. Install the display. (→ Page 268)



9.3.16 SD memory card in display MFD – Replacement

Removing SD memory cards

1. Remove the key unit (1).
2. Open up the rubber cover (3).
3. Gently press in the SD memory card.
   Result: The memory card lock disengages (press/press lock/unlock).
4. Remove the SD memory card (2) from the slot (4).



Installing an SD memory card

1. Insert a new memory card in the slot.
2. Gently press in the SD memory card.
   Result: The memory card lock engages (press/press lock/unlock).
3. Press down the rubber cover (3).
4. Fit the key unit (1).

TIM ID: 0000029953 – 001

9.3.17 PIM 4 parameters – Reset

Preconditions

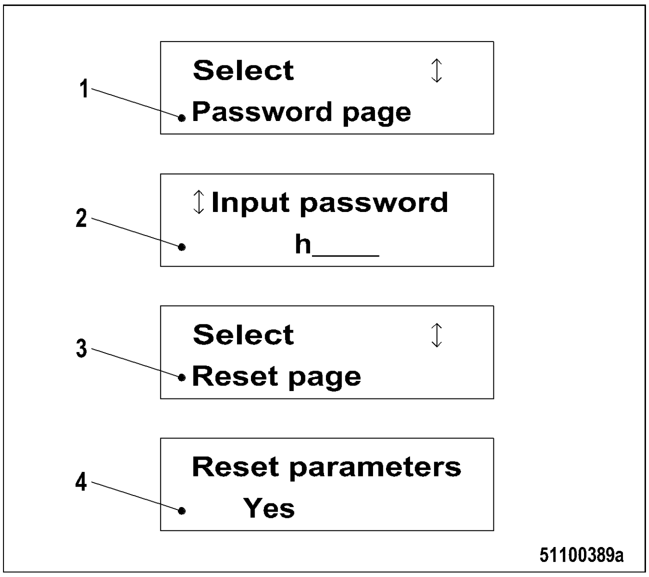
- Operating voltage is present..
- Engine is stopped and starting disabled.

Remove PIM 4 control unit cover (→ Page 253).

Remove PIM 4 cover (→ Page 253).

1. Select the “Password page” in the MPU 29 minidialog (1).
2. Enter the password with the “Arrow ↑” / “Arrow ↓” keys (2). Confirm with ENTER.
3. Select the “Reset page” (3) with the “Arrow ↑” / “Arrow ↓” keys.
4. Confirm with ENTER. The display shows (4). Confirm with ENTER again.

   Result:
   - All parameters are cleared.
   - Current parameters are automatically downloaded.



Install PIM 4 control unit cover (→ Page 254).

TIM ID: 0000007135 – 001

9.3.18 Fuse in control unit PIM 4 – Replacement

Preconditions

- Engine is stopped.
- Operating voltage is not present.

Spare parts

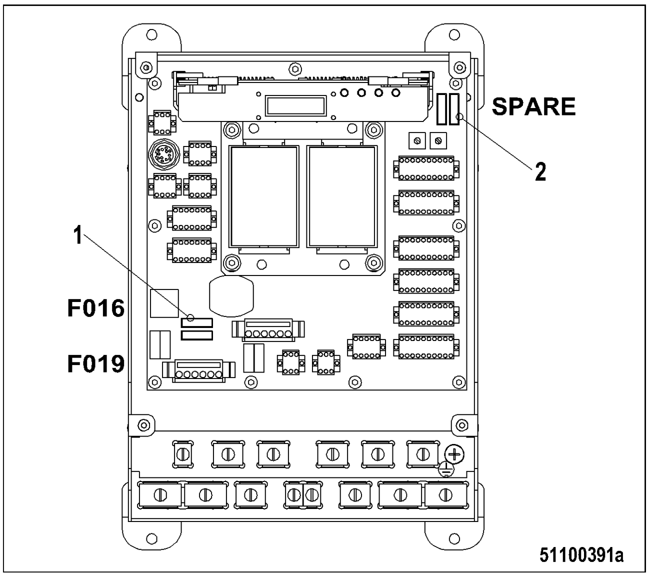
Designation / Use	Part No.	Qty.
Fuse 10 A		
Fuse 15 A		

CAUTION	Insufficiently protected electric circuits. **Risk of damage to electronic units or fire!** • Ensure that fuses are replaced by ones with the same electrical rating.

Remove PIM 4 control unit cover (→ Page 253)**.**

Replacing a blown fuse

1. Grasp the fuse with a pair of pointed pliers and pull it out.
2. Select a fuse with the correct electrical rating.
3. Place the fuse on the socket.
4. Press the fuse firmly into the socket with one finger.



1 Fuses
2 Spare fuses

Install PIM 4 control unit cover (→ Page 254)**.**

TIM ID: 0000007139 – 001

9.3.19 Control unit PIM 4 – Replacement

Preconditions

- Engine shut down.
- Operating voltage not applied.

Spare parts

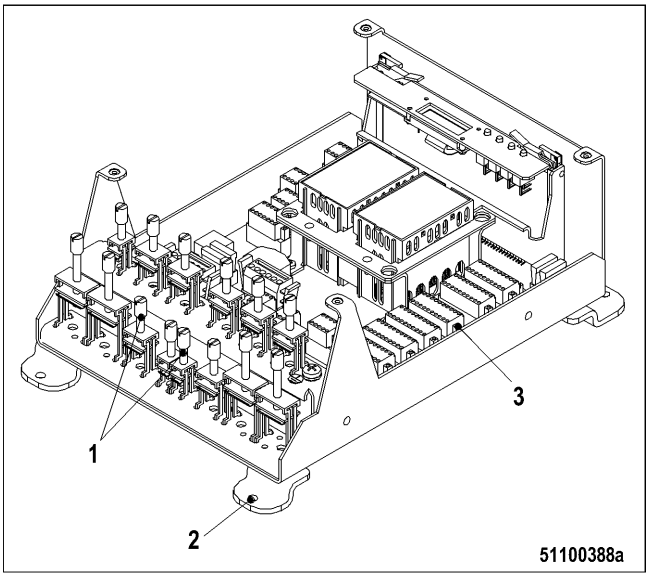
Designation / Use	Part No.	Qty.
Control unit PIM 4 without printed circuit boards		

CAUTION	Incorrect installation can lead to destruction of the device. **Damage to component!** • Ensure correct connector alignment.

Remove PIM 4 control unit cover (→ Page 253).

Removing the PIM 4 control unit

1. Undo the screws (1) on the fixing clamps as far as possible.
   Result: The clamping plate opens the fixing clamp allowing it to be removed.
2. Remove the fixing clamps.
3. Undo the screws (3) on the connectors.
4. Note down cable to socket assignment.
5. Pull the individual cables out of the sockets.
6. Pull out both cassettes containing the I/O printed circuit boards.
7. Undo and remove the fixtures on the four retaining brackets (2).
8. Remove the housing.

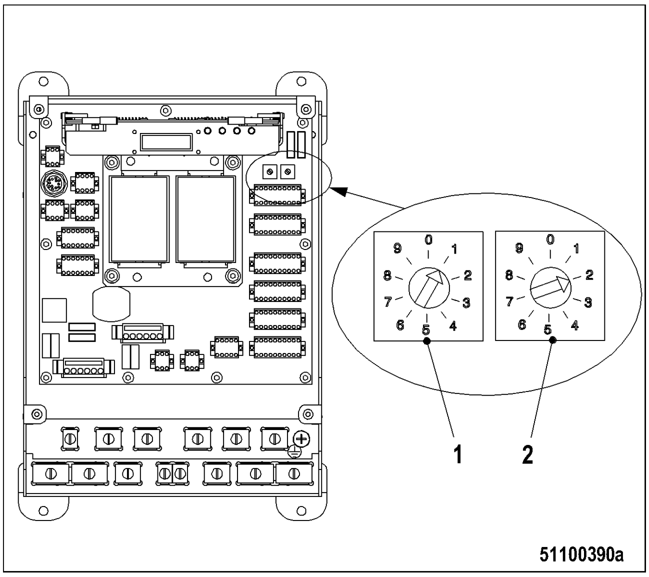


Installing the PIM 4 control unit

1. Align the new PIM 4 housing at the installation location ensuring it is straight.
2. Secure the housing.
3. Insert both cassettes containing the I/O printed circuit boards in the new PIM 4.
4. Insert the cables (check assignment against the notes made earlier!).
5. Tighten the screws on the connectors.

TIM ID: 0000007137 – 001

6. Set the node number by turning the rotary switches to the same positions as on the control unit which has been removed.
   - Tens (1)
   - Ones (2)
7. Switch on the operating voltage.
   Result:
   - Data is automatically downloaded in the control unit.
   - Successful downloading is indicated on the display (“Download completed!”).



Install PIM 4 control unit cover (→ Page 254)**.**

TIM ID: 0000007137 – 001

9.3.20 Printed circuit board in a PIM cassette – Replacement

Preconditions

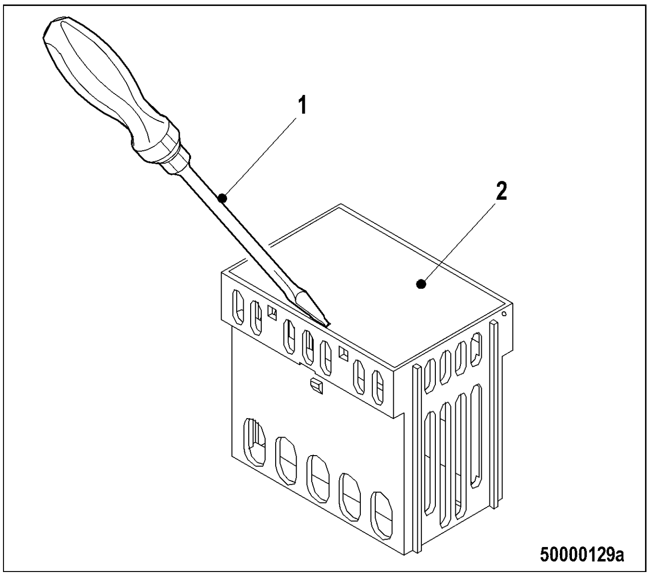
- Engine is stopped.
- Operating voltage is not present.

Spare parts

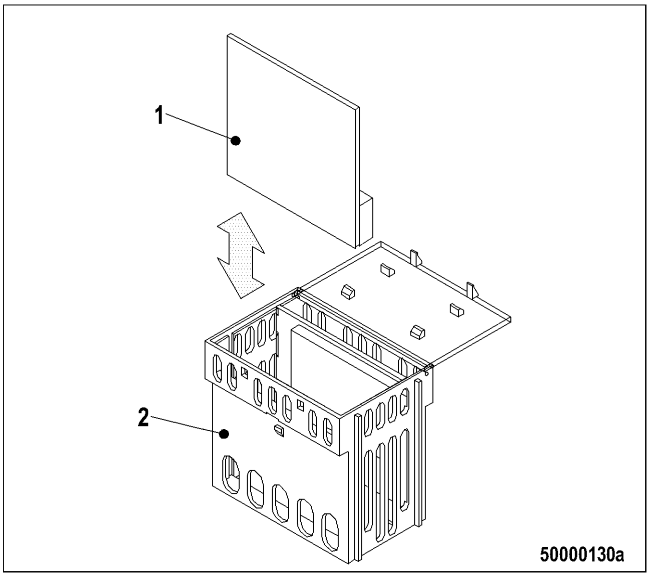
Designation / Use	Part No.	Qty.
Appropriate printed circuit board (check version)		

Removing a printed circuit board

1. Note down the installation position and pull out the module cassette.
2. Insert a small screwdriver (1) into the notch.
3. Prize open the cover (2).



4. Fully open the cover.
5. Pull the printed circuit board (1) up out of the module cassette (2).



TIM ID: 0000007140 – 002

Inserting a printed circuit board

1. Insert the printed circuit board into the module cassette (2) ensuring that the printed circuit board (1) is straight.
2. Close the cover.
3. Engage the cover properly in the module cassette housing (2).
4. Insert the module cassette as noted ensuring that it is straight.

9.3.21 Fuse on printed circuit board in a PIM cassette – Replacement

Preconditions
- Engine is stopped.
- Operating voltage is not present.

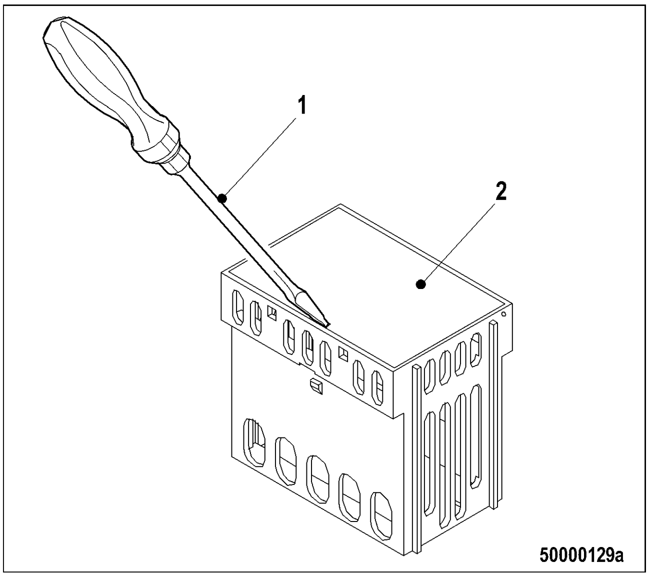
Spare parts

Designation / Use	Part No.	Qty.
Plug-in fuse 3.15 A		

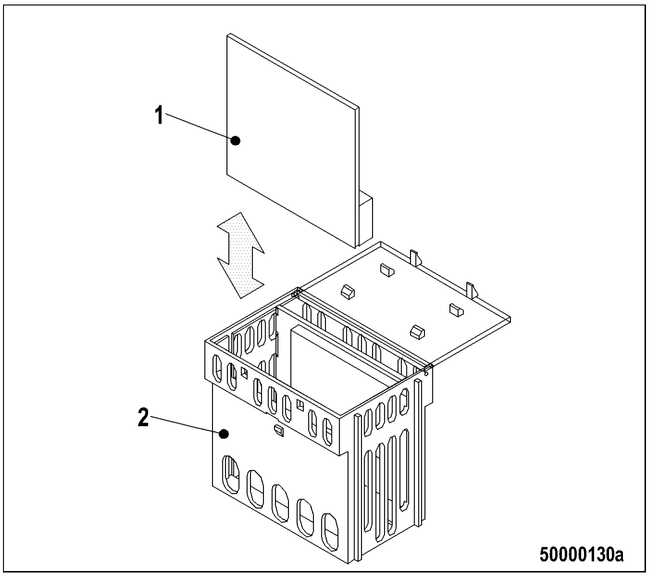
CAUTION	Insufficiently protected electric circuits. **Risk of damage to electronic units or fire!** • Ensure that fuses are replaced by ones with the same electrical rating.

Removing a printed circuit board

Note: Plug-in fuses are provided on the following printed circuit boards:
- Fault code display FCB 1
- Binary outputs BOB 1
- Binary outputs BOB 2
- Binary outputs BOB 3
- MFB 1
- SAB 1



1. Note down the installation position and pull out the module cassette.
2. Insert a small screwdriver (1) into the notch.
3. Prize open the cover (2).

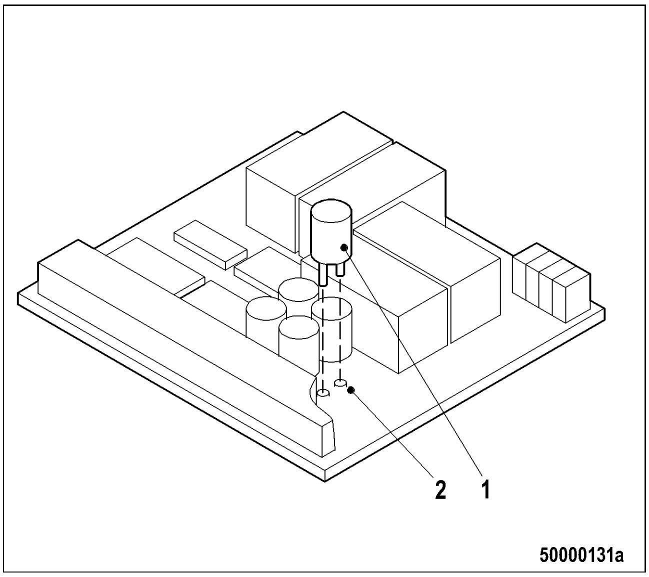


4. Fully open the cover.
5. Pull the printed circuit board (1) up out of the module cassette (2).

TIM ID: 0000007141 – 001

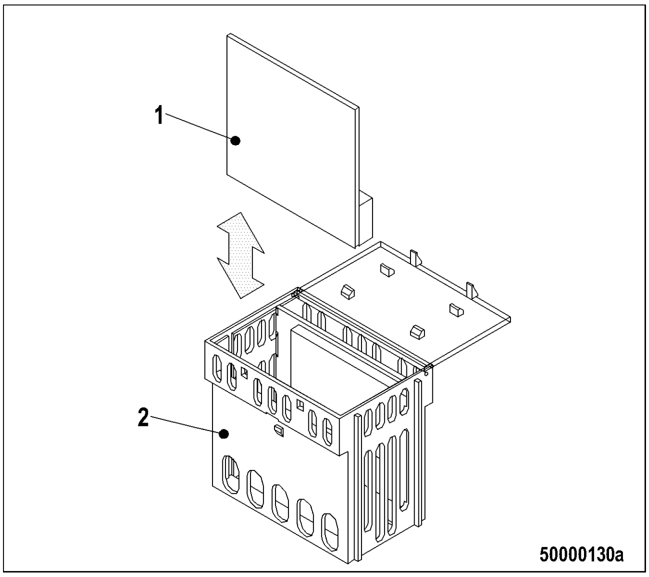
Replacing a plug-in fuse

1. Grasp the faulty plug-in fuse with a pair of pointed pliers and pull it out (there may be one or more plug-in fuses depending on the printed circuit board concerned).
2. Place a new plug-in fuse (1) with a rating of 3.15 A MT on the printed circuit board (2) and press it into the socket (2) ensuring that none of the connector pins are bent.



Inserting a printed circuit board

1. Insert the printed circuit board into the module cassette (2) ensuring that the printed circuit board (1) is straight.
2. Close the cover.
3. Engage the cover properly in the module cassette housing (2).
4. Insert the module cassette as noted ensuring that it is straight.



TIM ID: 0000007141 – 001

9.3.22 Printed circuit board MPU 29 – Removal

Preconditions

- Engine is stopped.
- Operating voltage is not present.

Spare parts

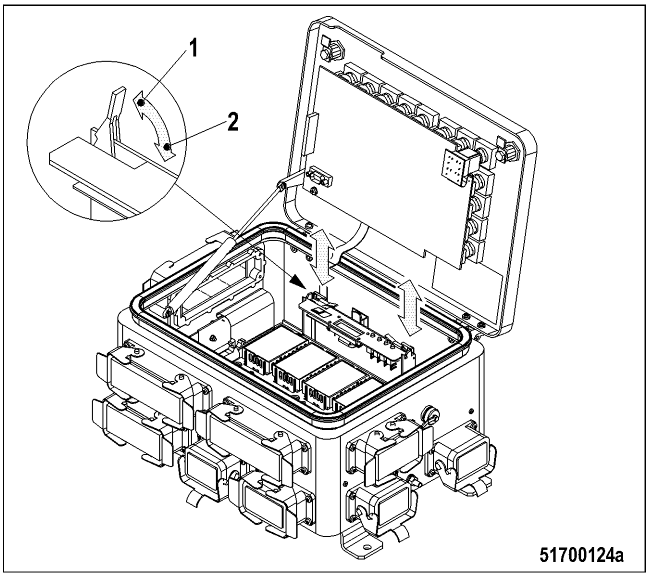
Designation / Use	Part No.	Qty.
Printed circuit board MPU 29		

CAUTION	Electrostatic discharge. **destruction of electronic parts or assemblies!** • Before touching electronic components: Electrostatically discharge and ground personnel, tools and working surfaces. • Avoid nonconductive materials from coming into contact with electronic components. • Do not replace electrical/electronic components while voltage is present.

Removing printed circuit board MPU 29

Note: Removal of the printed circuit board is described using Local Operating Panel LOP as an example. The procedure is principally the same for other devices.

1. Press out the two metal levers on the guide rails.
   Result: The printed circuit board fixture is released.
2. Press out the two ejector levers on the printed circuit board (in the direction indicated by arrow 1).
   Result: The printed circuit board is levered out of the connector
3. Pull the printed circuit board evenly along the guide rails on the left and right up out of the housing.



TIM ID: 0000007144 – 001

9.3.23 Printed circuit board MPU 29 – Installation

Preconditions

- Engine is stopped.
- Operating voltage is not present.

Spare parts

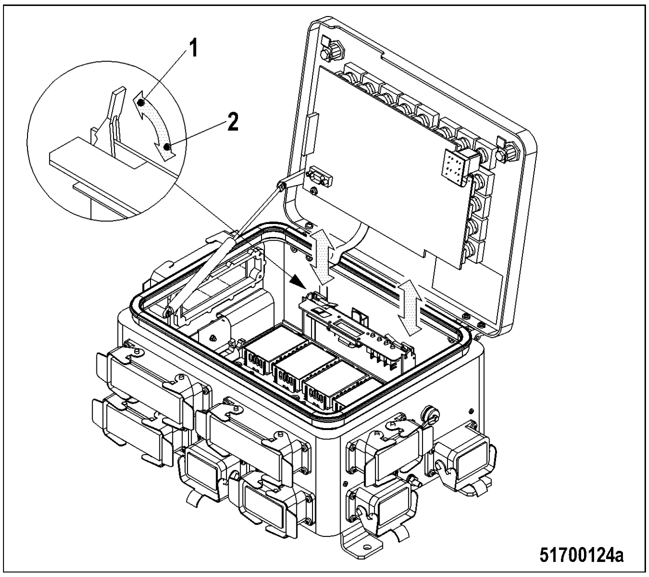
Designation / Use	Part No.	Qty.
Printed circuit board MPU 29		

CAUTION	Electrostatic discharge. **destruction of electronic parts or assemblies!** • Before touching electronic components: Electrostatically discharge and ground personnel, tools and working surfaces. • Avoid nonconductive materials from coming into contact with electronic components. • Do not replace electrical/electronic components while voltage is present.

Installing printed circuit board MPU 29

1. Insert the printed circuit board evenly along the guide rails on the left and right and press it down until the printed circuit board makes contact with the connectors. Keep the printed circuit board straight, it cannot be moved smoothly otherwise.
2. Press in the two ejector levers on the printed circuit board (in the direction indicated by arrow 2).
3. Insert the printed circuit board along the two rails up to the connector pins.
4. Ensure that the connector pins are precisely aligned in the plug-in sockets on the printed circuit board.
5. Press the printed circuit board in at the points indicated by the arrows as far as it will go, taking care not to apply pressure to any of the four control keys.
6. Press in the two metal levers on the guide rails.

   Result: The printed circuit board is secure.



9.3.24 Printed circuit board MPU 29 – Replacement

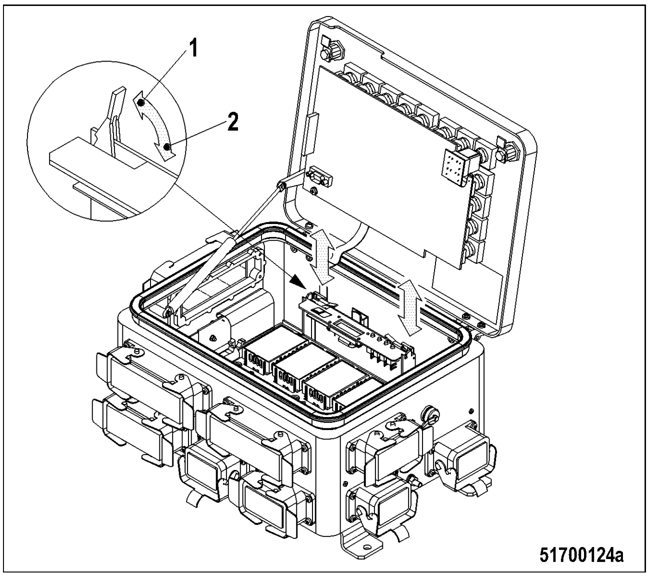
Preconditions

- Engine is stopped.
- Operating voltage is not present.

Spare parts

Designation / Use	Part No.	Qty.
Printed circuit board MPU 29		

Remove printed circuit board MPU 29 (→ Page 278)**.**



Install printed circuit board MPU 29 (→ Page 279)**.**

Transfer memory module (→ Page 282)

When replacing in Local Operating Panel LOP: Setting node number (→ Page 240)

TIM ID: 0000007146 – 002

9.3.25 Data module MEM on MPU 29 – Replacement

Preconditions

- “Invalid data record” fault message signaled.
- Engine is stopped.
- Operating voltage is not present.

Spare parts

Designation / Use	Part No.	Qty.
Programmed data module MEM for power train 1/3		
Programmed data module MEM for power train 2/4		

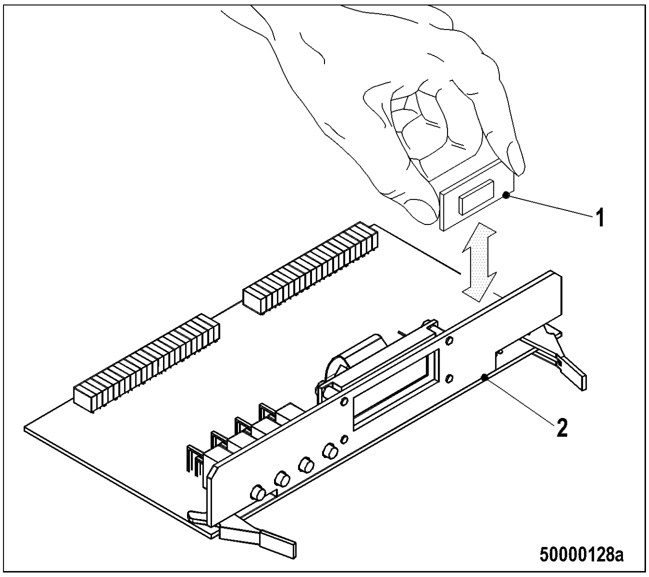
CAUTION	Electrostatic discharge. **destruction of electronic parts or assemblies!** • Before touching electronic components: Electrostatically discharge and ground personnel, tools and working surfaces. • Avoid nonconductive materials from coming into contact with electronic components. • Do not replace electrical/electronic components while voltage is present.

Remove printed circuit board MPU 29 (→ Page 278)**.**

Note: The MEM data modules of the power trains are not identical, it is therefore essential to assign the MEM data modules to the appropriate power train!

Replacing data module MEM

1. Pull data module MEM (1) carefully off printed circuit board MPU 29 (2) in the LOP.
2. Place the new data module MEM on printed circuit board MPU 29 in the LOP. Check polarity!
3. Press the data module firmly in until the data module connector makes full contact with the printed circuit board.



Install printed circuit board MPU 29 (→ Page 279)**.**

TIM ID: 0000007147 – 002

9.3.26 Data module MEM on MPU 29 – Transfer

Preconditions

- “Invalid data record” fault message not signaled.
- Engine is stopped.
- Operating voltage is not present.

Spare parts

Designation / Use	Part No.	Qty.
Programmed data module MEM for power train 1/3		
Programmed data module MEM for power train 2/4		

CAUTION

Electrostatic discharge.
destruction of electronic parts or assemblies!

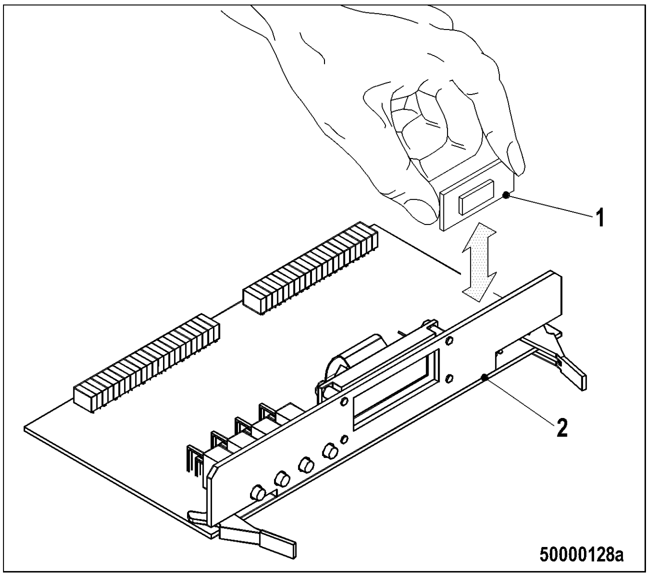
- Before touching electronic components: Electrostatically discharge and ground personnel, tools and working surfaces.
- Avoid nonconductive materials from coming into contact with electronic components.
- Do not replace electrical/electronic components while voltage is present.

Remove printed circuit board MPU 29 (→ Page 278)**.**

Note: The MEM data modules of the power trains are not identical, it is therefore essential to assign the MEM data modules to the appropriate power train!

Transferring a data module

1. Carefully pull out data module MEM (1).
2. Place the old MEM data module on the new printed circuit board MPU 29 (2) in the LOP. Check polarity!
3. Press the MEM data module firmly in until the data module connector makes full contact with the printed circuit board.



Install printed circuit board MPU 29 (→ Page 279)**.**

TIM ID: 0000007148 – 002

9.3.27 LOP fuse – Replacement

Preconditions

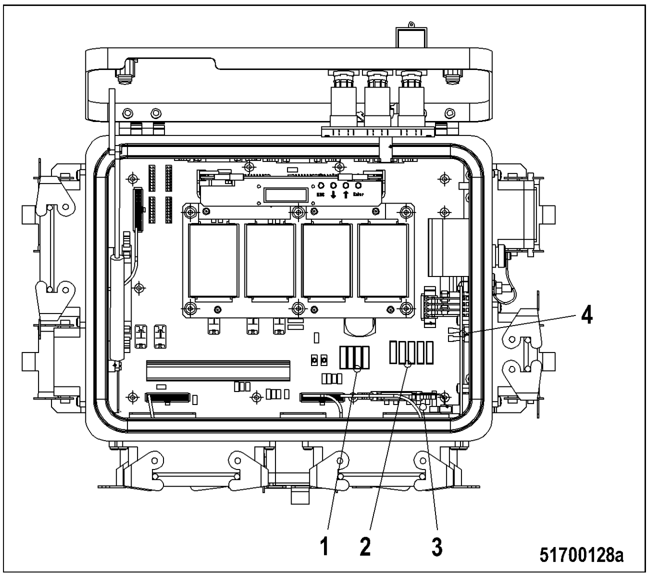
- Engine is stopped.
- Operating voltage is not present.

Spare parts

Designation / Use	Part No.	Qty.
Fuse 4.0 A		
Fuse 15.0 A		
Fuse 30.0 A		
Fuse 40.0 A		

Locating a fuse

1. Pinpoint the appropriate fuse.
2. Grasp the faulty fuse between finger and thumb and pull it out. A pair of pointed pliers are required for the fuses on printed circuit board PSB 4 mounted on the side.

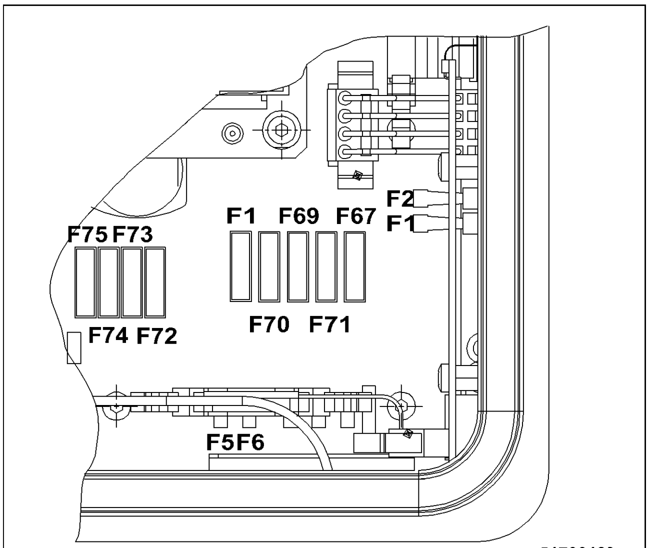


1 Fuse block 1 motherboard LMB: F72 ... F75
2 Fuse block 2 motherboard LMB: F1, F67, F69 ... F71
3 Fuse block 3 motherboard LMB: F5, F6
4 Printed circuit board PSB 4-01 (mounted on side): Fuse F1 and F2

TIM ID: 0000006797 – 001

Inserting a new fuse

1. Place the new fuse carefully on the socket.
2. Press the fuse into the socket with one finger as far as it will go.



51700129a

TIM ID: 0000006797 – 001

9.3.28 LOP with display front flap – Replacement

Preconditions

- Engine is stopped.
- Operating voltage is not present.

Spare parts

Designation / Use	Part No.	Qty.
Front flap with display		

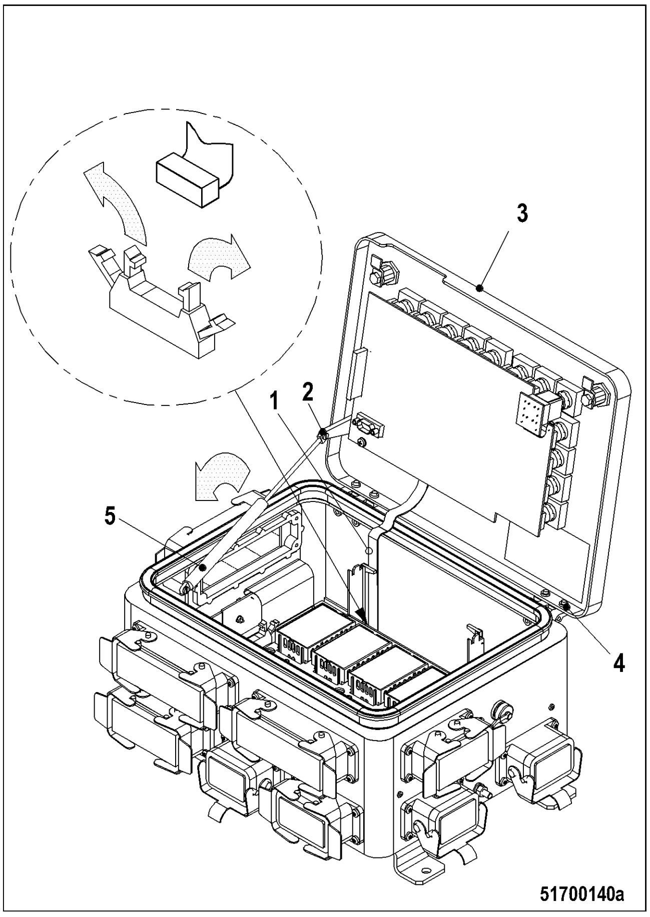
⚠ **CAUTION**	Short circuit. **Risk of plant malfunction or breakdown!** • Ensure that no parts fall into the housing.

Remove printed circuit board MPU 29 (→ Page 278)**.**

Removing the ribbon cable

Note: The ribbon cable (1) is plugged into the motherboard of the Local Operating Panel.

1. Press out both retaining levers on the socket (direction indicated by arrows), do not pull on the ribbon cable in so doing.
2. Pull the connector fully out of the socket.



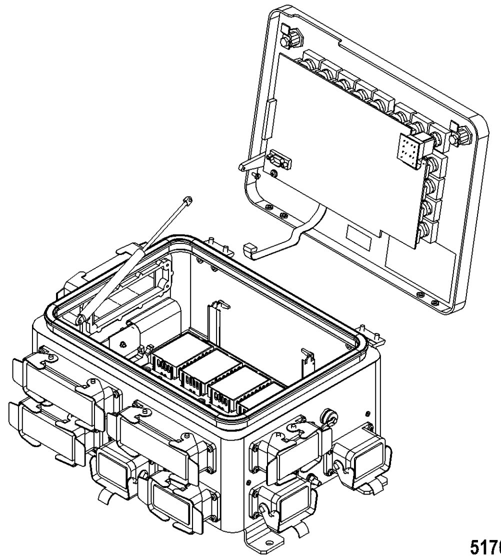
Disassembling the flap

1. Undo the screw (2).
2. Move the gas prop (5) forwards as far as possible.
3. Close the flap on the Local Operating Panel (3) as far as possible.
4. Remove the screws (4) at the two hinges securing the cover.
5. Remove the flap.

TIM ID: 0000007172 – 001

Installing a new flap

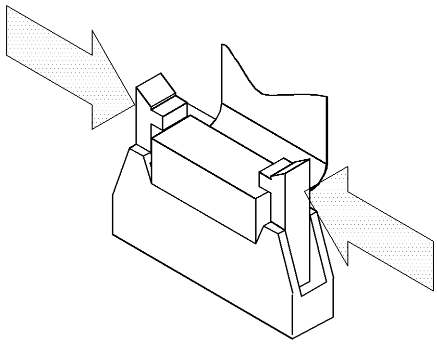
1. Place the new flap on the two hinges.
2. Secure the flap at the hinges.
3. Secure the gas prop to the lug on the flap on the side of the lug facing the printed circuit board of the display.



51700141a

Plugging in the ribbon cable

1. Plug the ribbon cable into the socket on the motherboard.
2. Press the connector in firmly until the two retaining levers engage.
3. Press the two retaining levers together in the direction indicated by the arrows if necessary.



50000149a

Install printed circuit board MPU 29 (→ Page 279)**.**

Set node number (→ Page 226)**.**

TIM ID: 0000007172 – 001

9.3.29 Local Operating Panel LOP – Replacement

Preconditions

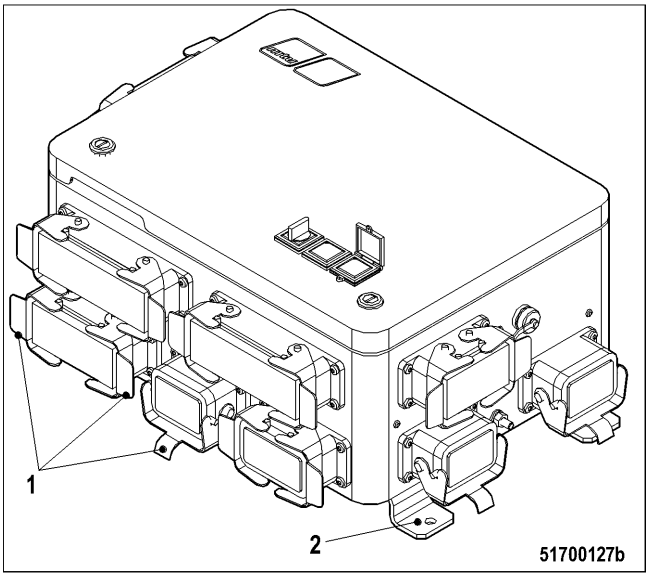
- Engine is stopped and starting disabled.
- Operating voltage is not present.

Spare parts

Designation / Use	Part No.	Qty.
LOP 6		
LOP 8		

Removing LOP

1. Undo the retaining clips (1) on the connectors.
2. Disconnect all connectors.
3. Undo and remove the fixtures on the four mounting brackets (2).
4. Remove the housing.



Installing LOP

1. Align the new LOP at the installation location ensuring it is straight.
2. Secure the housing.
3. Plug in the cables (check assignment, connectors are coded!).
4. Open the flap on LOP.

Remove MPU 29 (→ Page 278)**.**

Transfer MEM (→ Page 282)**.**

Install MPU 29 (→ Page 279)**.**

Final steps

1. Switch on the operating voltage.
2. Check MPU 29 node number and set as necessary. (→ Page 240)
3. Check configuration (→ Page 241).
4. Close the flap.
5. Set the node number and baud rate if the LOP features a large display in the flap (→ Page 226).

TIM ID: 0000007169 – 002

9.3.30 Local Operating Station LOS – Replacement

Preconditions

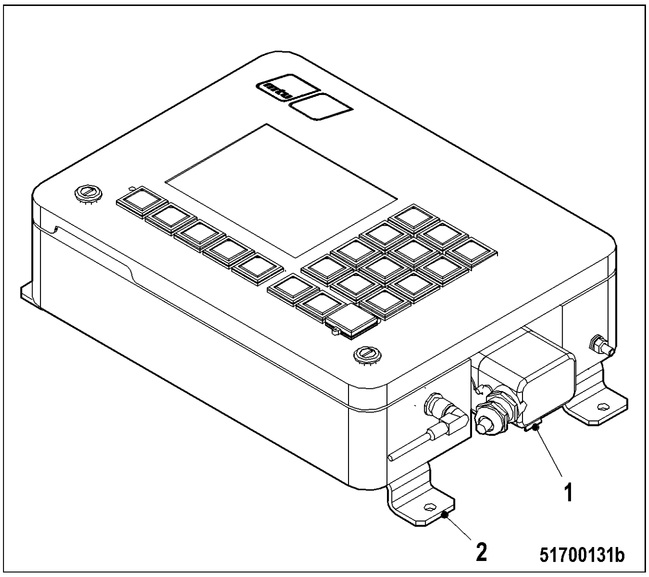
- Engine is stopped and starting disabled.
- Operating voltage is not present.

Spare parts

Designation / Use	Part No.	Qty.
LOS		

Removing LOS

1. Release the connector retaining clip (1).
2. Disconnect the connector.
3. Undo and remove the fixtures on the four mounting brackets (2).
4. Remove the housing.



Installing LOS

1. Align the new LOS at the installation location ensuring it is straight.
2. Secure the housing.
3. Connect the cable.

Final steps

1. Close the flap.
2. Switch on the operating voltage.
3. Check display node number and baud rate (→ Page 225).
   Result: Proceed with the next step if the settings are not correct.
4. Set node number and baud rate if necessary (→ Page 226).

TIM ID: 0000007173 – 001

9.3.31 Gear Control Unit GCU – Replacement

Preconditions

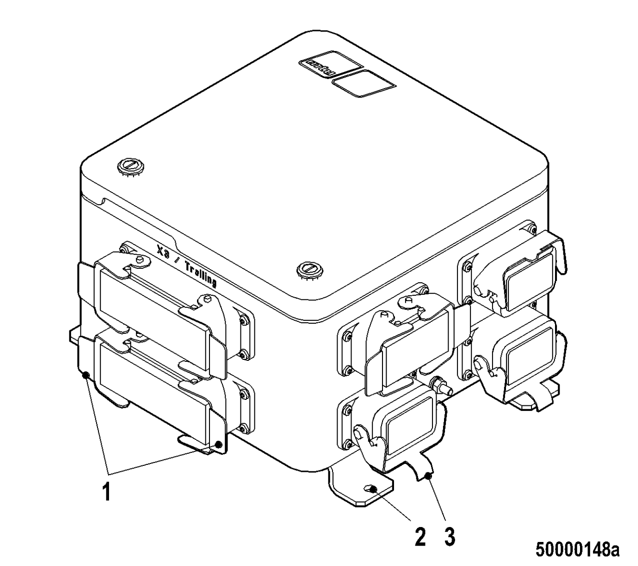
- Engine is stopped.
- Operating voltage is switched off.

Spare parts

Designation / Use	Part No.	Qty.
Gear Control Unit GCU 2		
Gear Control Unit GCU 3		
Gear Control Unit GCU 6		

Removing GCU

1. Release the retaining clips (1) and (3) securing the connectors.
2. Disconnect all connectors.
3. Undo and remove the fixtures on the four mounting brackets (2).
4. Remove the housing.

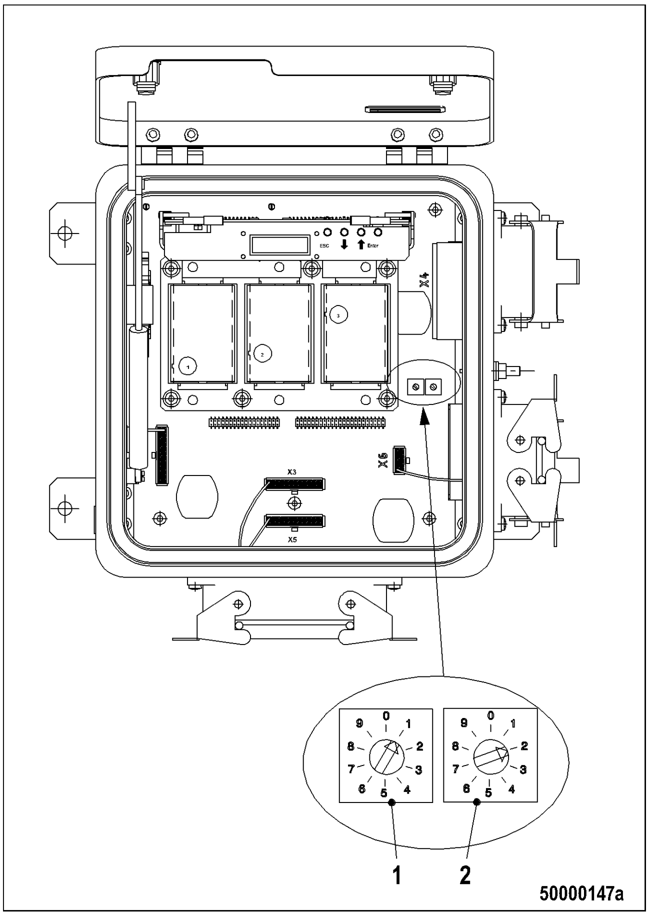


Installing GCU

1. Align the new GCU at the installation location ensuring it is straight.
2. Secure the housing.
3. Plug in the cables (check assignment, connectors are coded!).
4. Engage the retaining clips (1) and (3) securing the connectors.

5. Open the flap on the GCU.
6. Set the node number by turning the rotary switches to the same positions as on the GCU which has been removed.
   - Tens (1)
   - Ones (2)
7. Switch on the operating voltage.

   Result: Data is automatically downloaded into the GCU. Successful downloading is indicated on the display (“Download completed!”).
8. Close the flap.



TIM ID: 0000007161 – 002

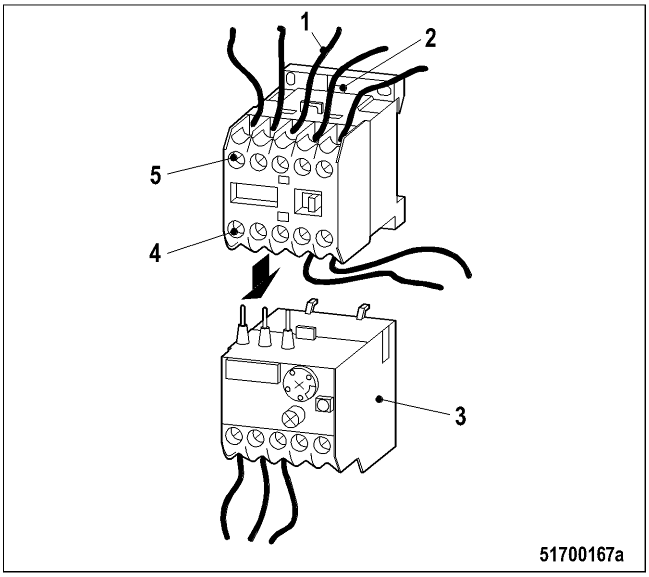
9.3.32 Priming Pump Controller PPC – Repair

Preconditions

- Pump type is known.
- Pump current limit value is known.

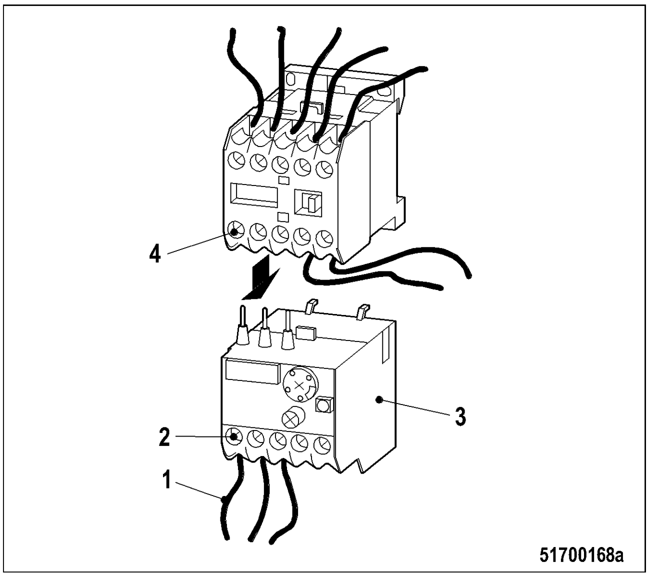
Replacing contactor K001

1. Undo the screws securing the cover.
2. Open the cover.
3. Note down the cable numbers/colors of the connecting cables at terminals 1, 3, 5, 13, 14, A1 and A2 (1).
4. Undo clamping screws (5) 1, 3, 5, 13, 14, A1 and A2.
5. Pull out the connecting cables.
6. Undo clamping screws 2, 4 and 6 (4).
7. Pull the motor protection switch (3) off the contactor.
8. Insert a screwdriver into the recess (2), release the spring, and remove the contactor from the top-hat rail.
9. Clip a new contactor onto the top-hat rail.
10. Install motor protection switch.
11. Connect up all cables as noted in step 3.
12. Close the cover and tighten all screws.



Replacing motor protection switch Q001

1. Undo the screws securing the cover.
2. Open the cover.
3. Note down the cable numbers/colors of the connecting cables (1) at terminals 2, 4 and 6 on the motor protection switch (3).
4. Undo clamping screws (2) 2, 4 and 6.
5. Pull out the connecting cables.
6. Undo clamping screws 2, 4 and 6 (4).
7. Pull the motor protection switch (3) off the contactor.
8. Install new motor protection switch.
9. Connect up all cables as noted in step 3.
10. Close the cover and tighten all screws (2).

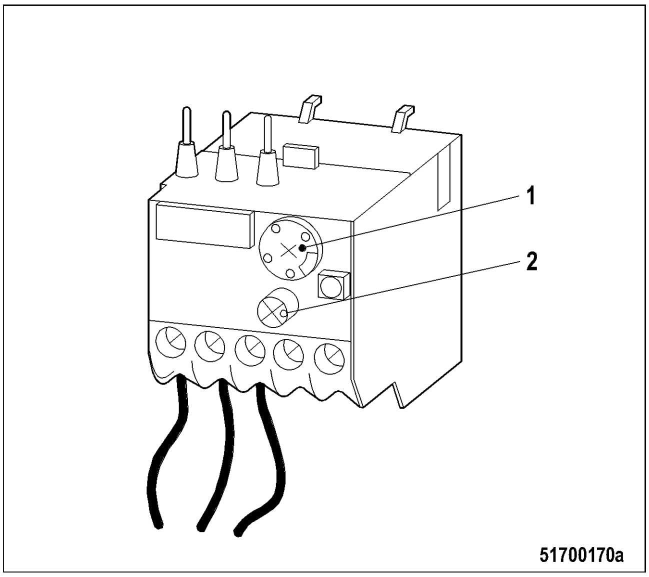


TIM ID: 0000007030 – 001

Setting the PPC

Note: Instructions apply to PPC 5 ... 8.

1. Set the operating mode switch (1) on the current limit value relay from position H to position A.
2. Set the current limit value adjusting wheel (2) to rated pump current.



TIM ID: 0000007030 – 001

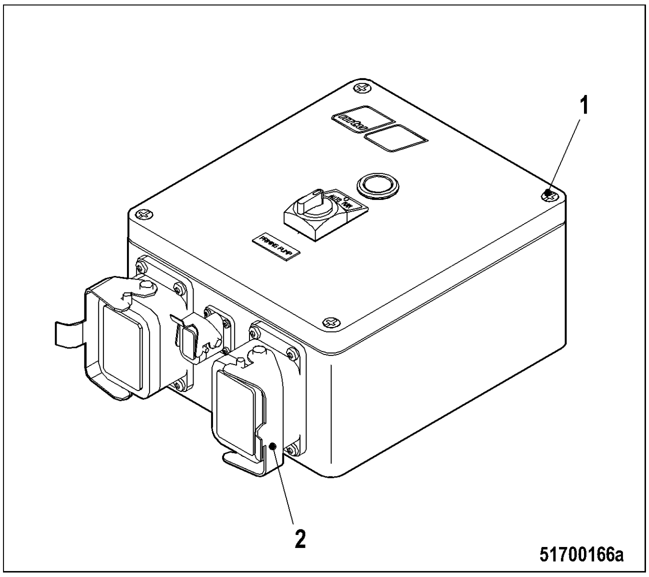
9.3.33 Priming Pump Controller PPC – Replacement

Preconditions

- Pump type is known.
- Pump current limit value is known.

Replacing PPC

1. Undo the retaining clips (1) on the connectors.
2. Pull out the cables. Mark the cables if necessary.
3. Undo the screws (2) securing the cover.
4. Open the cover.
5. Install the new PPC using the same mounting elements which were removed. Replace faulty elements with new elements of the same type.
6. Plug in the connectors and engage the retaining clips.

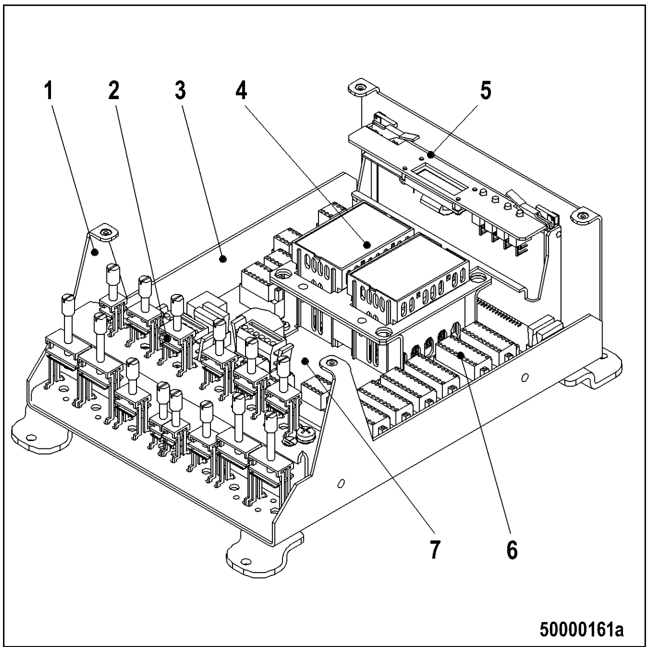


TIM ID: 0000007029 – 001

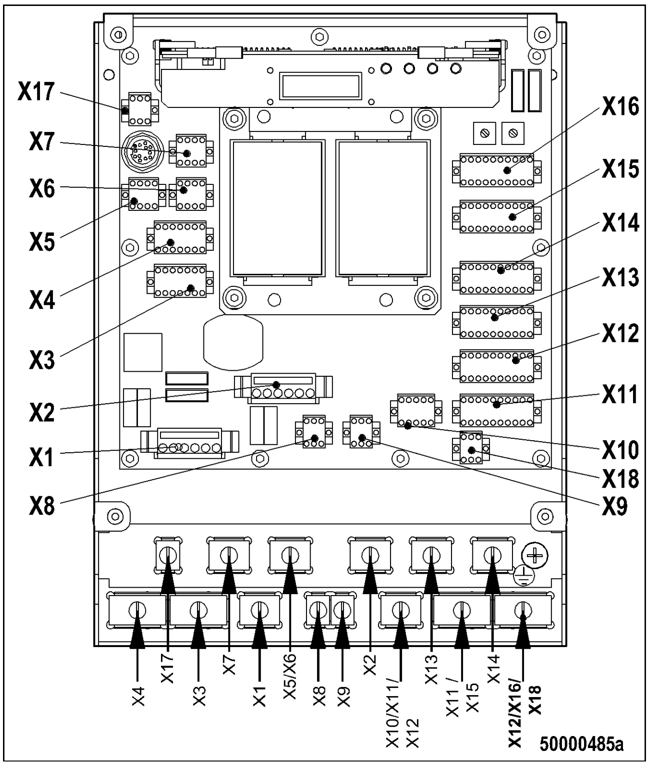
9.4 Supplementary Technical Information

9.4.1 PIM 4 RCS – Internal design

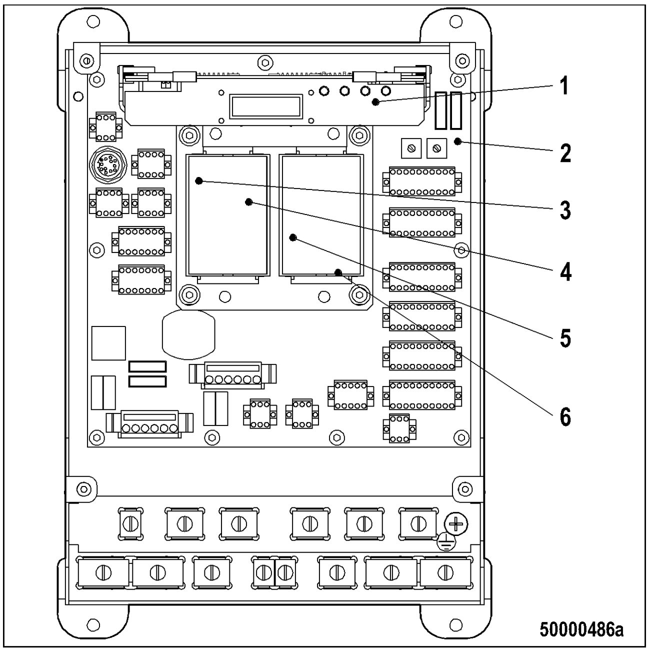
Arrangement of the assemblies



1 Cover mounting bracket
2 Cable entries with strain relief (screw fixture)
3 Housing base
4 Cassettes for printed circuit boards
5 Processor assembly MPU 29
6 Connectors for connection of all devices and assemblies
7 Motherboard



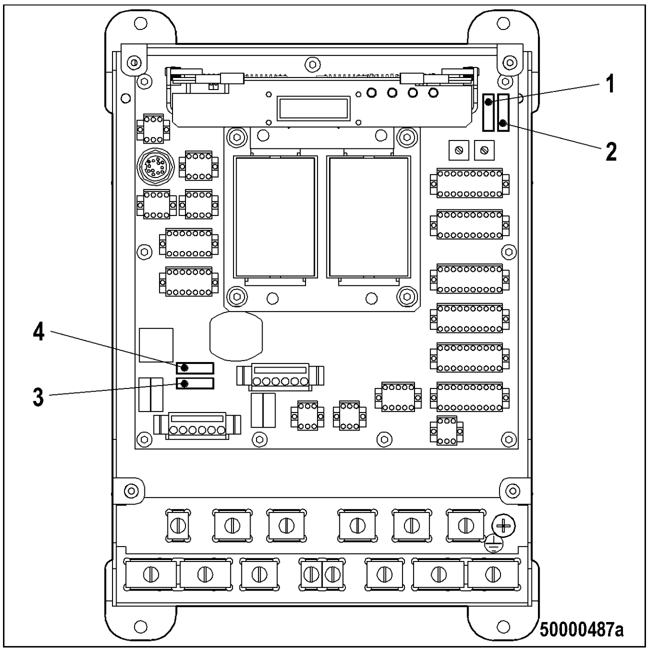
TIM ID: 0000007177 – 002



1 Printed circuit board MPU 29 -- Monitoring and Processing Unit, processor printed circuit board
2 Printed circuit board LMB 02 -- Local Monitoring Board, motherboard of the RCS-5 control unit
3 Printed circuit board MFB 2 -- Multi Function Board, printed circuit board for main control stand 1
4 Printed circuit board MFB 2 -- Multi Function Board, printed circuit board for main control stand 2
5 Printed circuit board MFB 2 -- Multi Function Board, printed circuit board for slave control stand 1*
6 Printed circuit board MFB 2 -- Multi Function Board, printed circuit board for slave control stand 2*
* Only when one or two slave control stands are installed (extension module)

The internal design of all control units for the Remote Control System RCS-5 depends on the number of different control stands installed. One MFB 2 printed circuit board is installed for each control stand. The two devices for the port and starboard sides do not differ.

Fuses

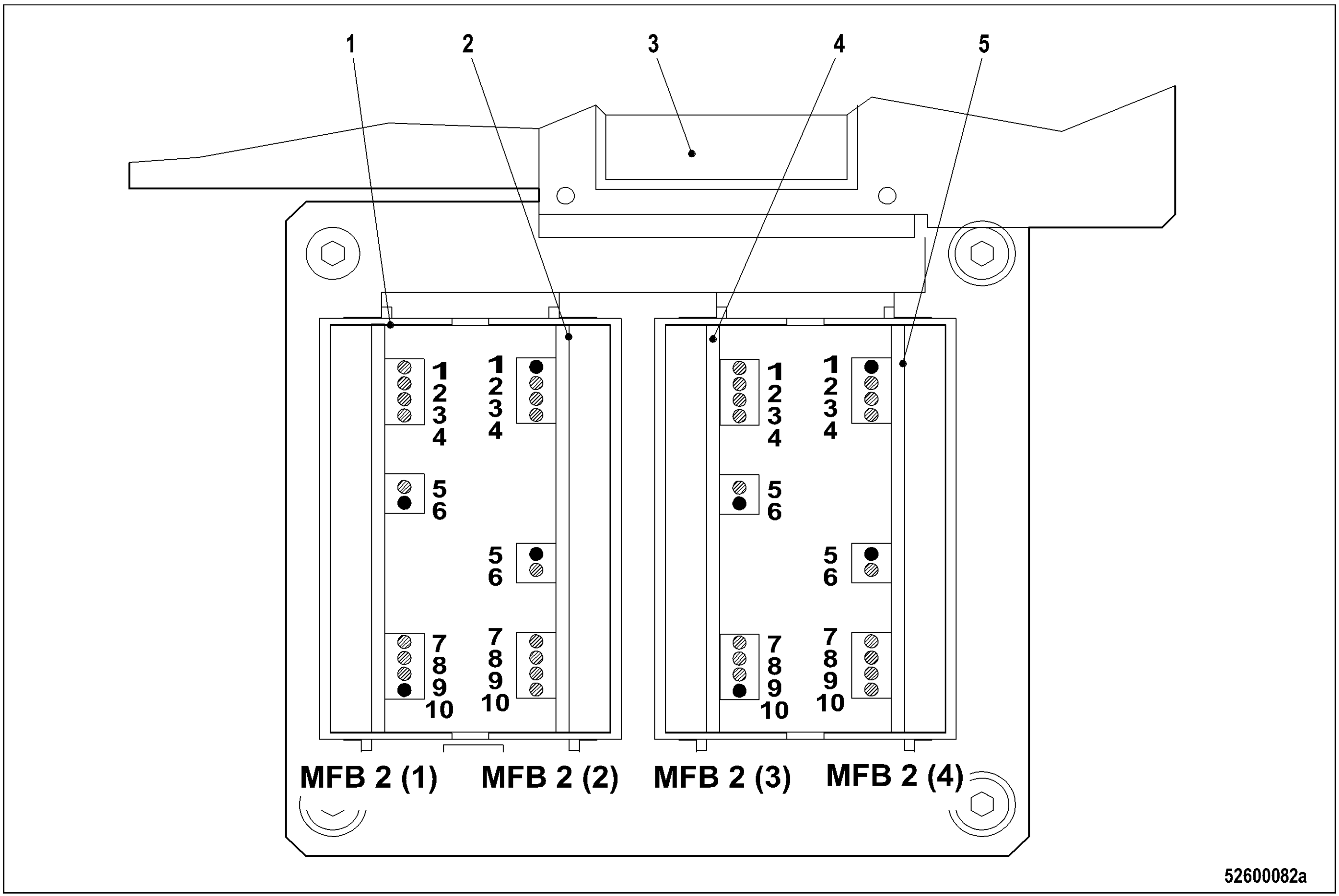


TIM ID: 0000007177 – 002

A PIM 4 control unit has 2 different fuses (the two fuses F17 (2) and F18, (1) in the holders are spares):

No.	Designation	Rating	Protection of
3	F19	10 A	Internal supply voltage
4	F16	15 A	Connected components

Internal indicators



TIM ID: 0000007177 – 002

The various light emitting diodes indicate the following states (LEDs indicating pushbutton states always light up at the control unit of the port and starboard side simultaneously when the appropriate pushbutton is actuated. The SYNCHRO LED also lights up at the control unit of the port and starboard side, likewise the LED for TROLLING. LEDs for COMMAND, ALARM and the buzzer are separate in each command unit for the respective power trains, the corresponding LEDs may indicate different states in the two control units).

On	No.	Color	Meaning
MFB 2 Slot 1 (1)	1	Yellow	On: RCS-5 buzzer on the command unit of main control stand 1 sounding
	2	Yellow	On: LED COMMAND on the command unit of main control stand 1 on
	3	Yellow	On: LED ALARM on the command unit of main control stand 1 on
	4	Yellow	On: LED SYNCHRO on the command unit of main control stand 1 on
	5	Yellow	On: LED TROLLING on the command unit of main control stand 1 on
	6	Yellow	On: Supply voltage applied to printed circuit board MFB 2 (1)
	7	Yellow	Not used (LED is always off)
	8	Yellow	On: Pushbutton COMMAND on the command unit of main control stand 1 pressed
	9	Yellow	On: Pushbutton SYN./TROL. on the command unit of main control stand 1 pressed
	10	Red	On: Printed circuit board MFB 2 in Reset state
MFB 2 Slot 2 (2)	1	Red	On: Printed circuit board MFB 2 in Reset state
	2	Yellow	On: Pushbutton SYN./TROL. on the command unit of main control stand 2 pressed
	3	Yellow	On: Pushbutton COMMAND on the command unit of main control stand 2 pressed
	4	Yellow	Not used (LED is always off)
	5	Yellow	On: Supply voltage applied to printed circuit board MFB 2 (2)
	6	Yellow	On: LED TROLLING on the command unit of main control stand 2 on
	7	Yellow	On: LED SYNCHRO on the command unit of main control stand 2 on
	8	Yellow	On: LED ALARM on the command unit of main control stand 2 on
	9	Yellow	On: LED COMMAND on the command unit of main control stand 2 on
	10	Yellow	On: RCS-5 buzzer on the command unit of main control stand 2 sounding

TIM ID: 0000007177 – 002

On	No.	Color	Meaning
MFB 2 Slot 3 (4)	1	Yellow	On: RCS-5 buzzer on the command unit of slave control stand 1 sounding
	2	Yellow	On: LED COMMAND on the command unit of slave control stand 1 on
	3	Yellow	On: LED ALARM on the command unit of slave control stand 1 on
	4	Yellow	On: LED SYNCHRO on the command unit of slave control stand 1 on
	5	Yellow	On: LED TROLLING on the command unit of slave control stand 1 on
	6	Yellow	On: Supply voltage applied to printed circuit board MFB 2 (4)
	7	Yellow	Not used (LED is always off)
	8	Yellow	On: Pushbutton COMMAND on the command unit of slave control stand 1 pressed
	9	Yellow	On: Pushbutton SYN./TROL. on the command unit of slave control stand 1 pressed
	10	Red	On: Printed circuit board MFB 2 in Reset state
MFB 2 Slot 4 (5)	1	Red	On: Printed circuit board MFB 2 in Reset state
	2	Yellow	On: Pushbutton SYN./TROL. on the command unit of slave control stand 2 pressed
	3	Yellow	On: Pushbutton COMMAND on the command unit of slave control stand 2 pressed
	4	Yellow	Not used (LED is always off)
	5	Yellow	On: Supply voltage applied to printed circuit board MFB 2 (5)
	6	Yellow	On: LED TROLLING on the command unit of slave control stand 2 on
	7	Yellow	On: LED SYNCHRO on the command unit of slave control stand 2 on
	8	Yellow	On: LED ALARM on the command unit of slave control stand 2 on
	9	Yellow	On: LED COMMAND on the command unit of slave control stand 2 on
	10	Yellow	On: RCS-5 buzzer on the command unit of slave control stand 2 sounding

An alphanumeric display (3) and several light emitting diodes make it possible to draw conclusions about the operating state of Remote Control System RCS-5 and also to pinpoint faults.

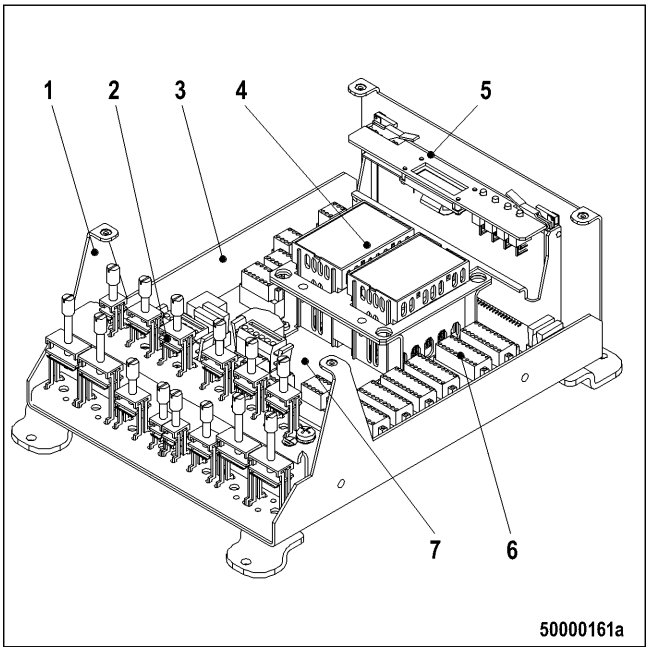
The fault code numbers and the associated texts which may appear on the display are explained in another section of the documentation (→Operating Instructions).

The LEDs on the individual printed circuit boards which connect the control stands indicate various current operating states. Red LEDs indicate that a fault has occurred. These should always be dark during normal operation. Their respective meanings make it possible for the user to draw conclusions and pinpoint faults in the course of troubleshooting.

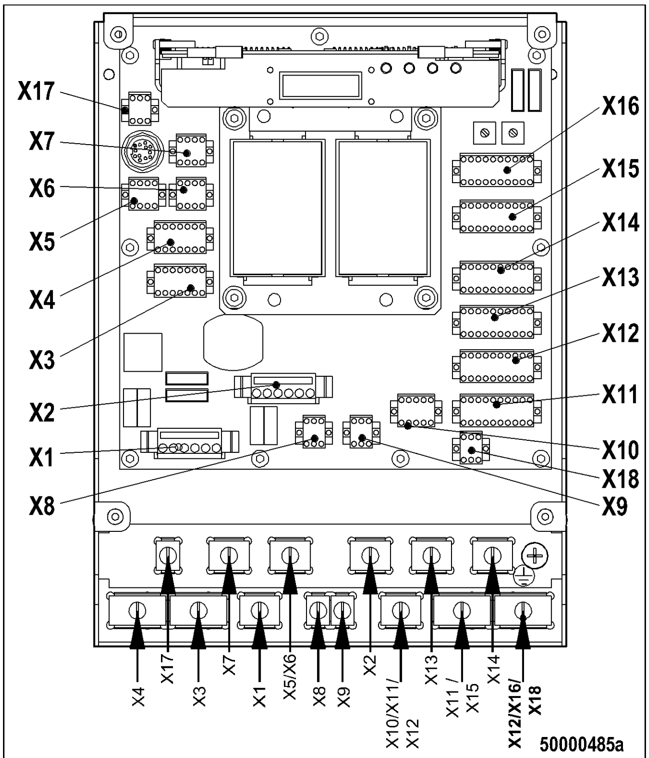
TIM ID: 0000007177 – 002

9.4.2 Control unit PIM 4 MCS – Internal design

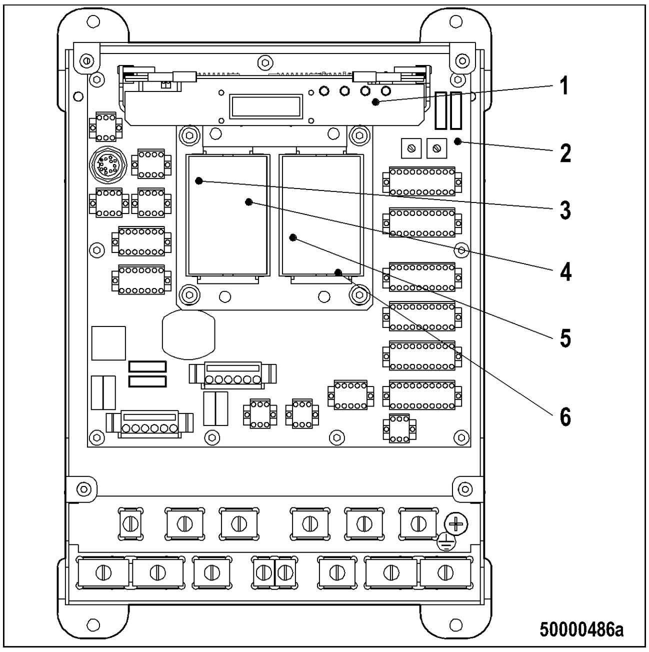
Arrangement of the assemblies



1 Cover mounting bracket
2 Cable entries with strain relief (screw fixture)
3 Housing base
4 Cassettes for printed circuit boards
5 Processor assembly MPU 29
6 Connectors for connection of all devices and assemblies
7 Motherboard

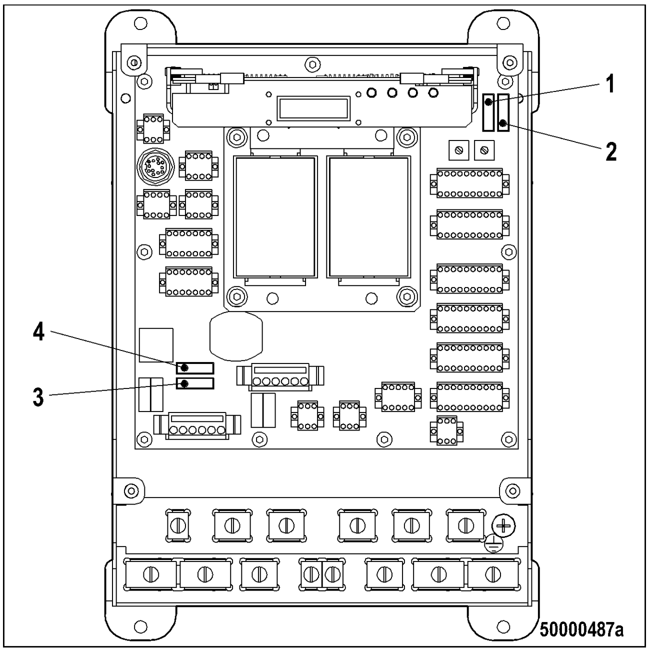


TIM ID: 0000007164 – 002



1 Printed circuit board MPU 29 -- Monitoring and Processing Unit, processor printed circuit board
2 Printed circuit board LMB 02 -- Local Monitoring Board, motherboard of the MCS-5 control unit
3 Printed circuit board BOB 2 -- Binary Output Board, switching signal output
4 Printed circuit board BIB 2 -- Binary Input Board, acquisition of binary signals
5 Printed circuit board BOB 2 -- Binary Output Board, switching signal output
6 Printed circuit board INB 3 -- Instrument Board, analog signal output

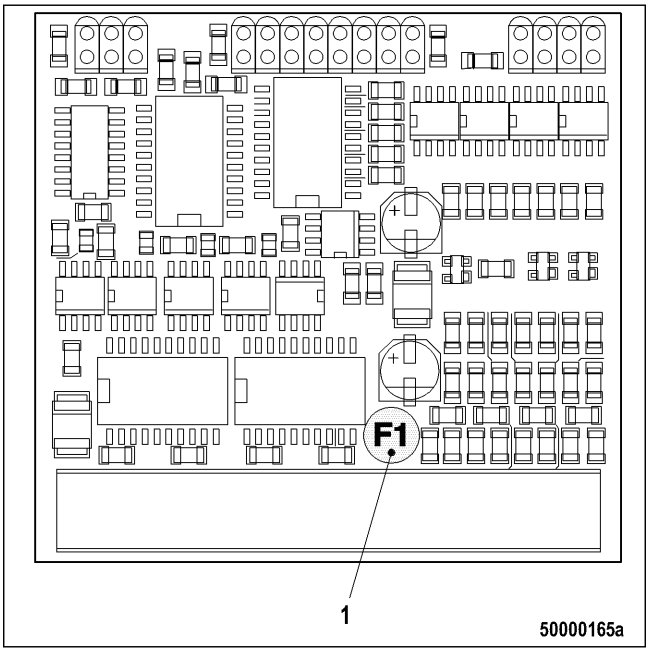
Fuses



TIM ID: 0000007164 – 002

A PIM 4 control unit has 2 different fuses (the two fuses F17 (2) and F18, (1) in the holders are spares):

No.	Designation	Rating	Protection of
3	F19	10 A	Internal supply voltage
4	F16	15 A	Connected components

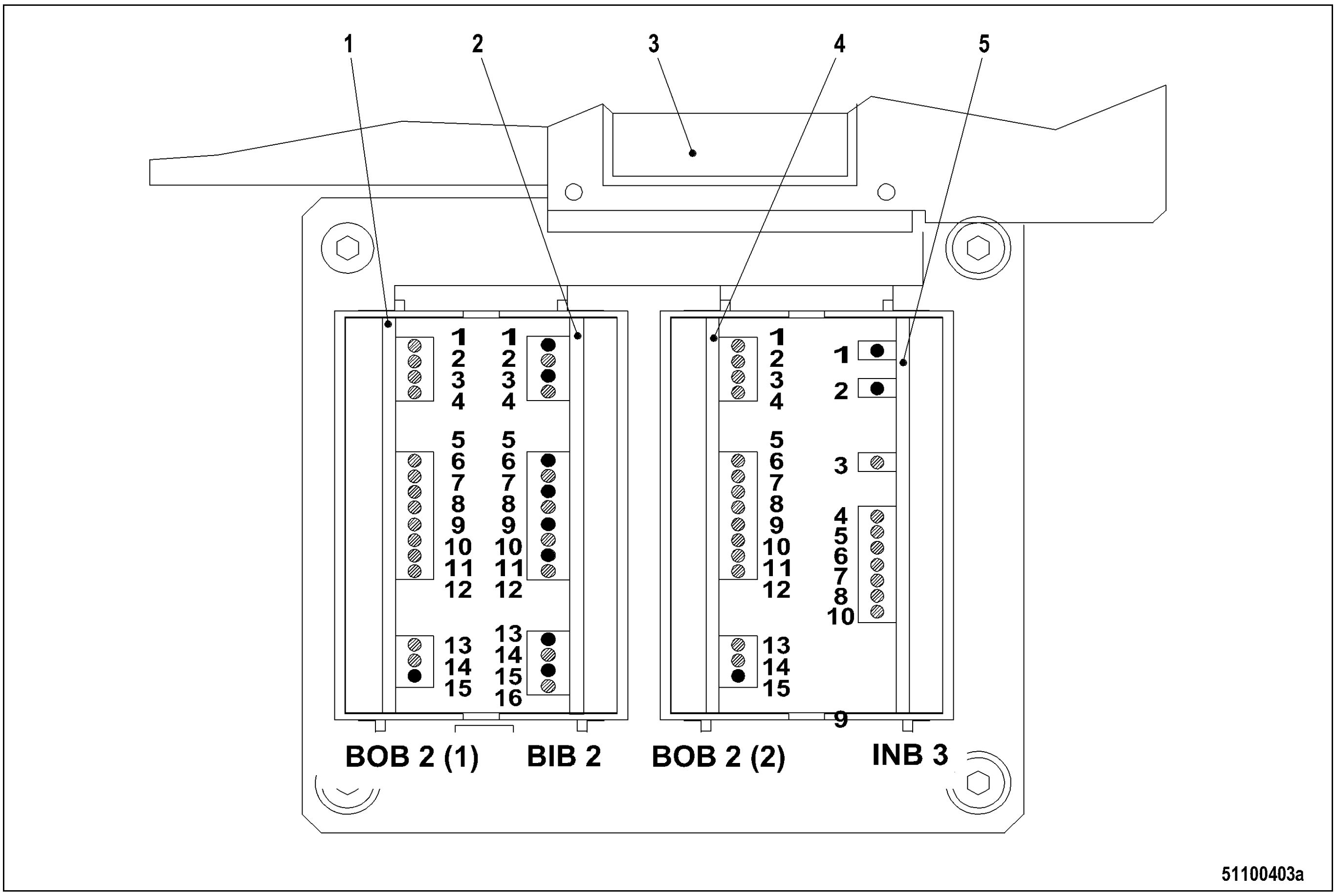


Each BOB 2 printed circuit board has one plug-in fuse F1 (1, printed circuit board removed, component side illustrated)

No.	Designation	Rating	Protection of
BOB 2 Slot 1	F1	3.15 A	Supply voltage for the light emitting diodes in the various illuminated pushbuttons
BOB 2 Slot 3	F1	3.15 A	Supply voltage for the light emitting diodes in the various indicator lamps for alarm signalling

TIM ID: 0000007164 – 002

Internal indicators



The various light emitting diodes signal the following states:

On	No.	Color	Meaning
BOB 2 Slot 1	1	Yellow	On: LED in START pushbutton on
	2	Yellow	On: LED in STOP pushbutton on
	3	Yellow	On: LED in COMBINED ALARM/ACKNOWLEDGE pushbutton on
	4	Yellow	On: LED in DIMM UP pushbutton on
	5	Yellow	On: LED in DIMM DOWN pushbutton on
	6	Yellow	On: LED in OVERRIDE pushbutton on
	7	Yellow	On: LED in ENGINE/GEAR ALARM pushbutton on
	8	Yellow	On: LED in SENSOR/SYSTEM FAULT pushbutton on
	9	Yellow	On: LED in EMERGENCY STOP pushbutton on
	10	Yellow	On: LED in READY FOR START/STOP indicator on
	11	Yellow	Not used (LED is always off)
	12	Yellow	On: When engine is running
	13	Yellow	Not used (LED is always off)
	14	Yellow	On: Horn sounding
	15	Green	On: Supply voltage applied to printed circuit board BOB 2 (1)

TIM ID: 0000007164 – 002

On	No.	Color	Meaning
BIB 2 Slot 2	1	Red	Not used (LED is always off)
	2	Yellow	Not used (LED is always off)
	3	Red	Not used (LED is always off)
	4	Yellow	Not used (LED is always off)
	5	Red	Not used (LED is always off)
	6	Yellow	On: OVERRIDE pushbutton pressed
	7	Red	Not used (LED is always off)
	8	Yellow	On: DIMM DOWN pushbutton pressed
	9	Red	Not used (LED is always off)
	10	Yellow	On: DIMM UP pushbutton pressed
	11	Red	Not used (LED is always off)
	12	Yellow	On: Pushbutton COMBINED ALARM/ACKNOWLEDGE on
	13	Red	Not used (LED is always off)
	14	Yellow	On: STOP pushbutton pressed
	15	Red	Not used (LED is always off)
	16	Yellow	On: START pushbutton pressed
BOB 2 Slot 3	1	Yellow	On: LED in AUTO STOP/REDUCTION indicator lamp on
	2	Yellow	On: LED in OVERSPEED indicator lamp on
	3	Yellow	On: LED in LUBE OIL PRESSURE LOW indicator lamp on
	4	Yellow	On: LED in COOLANT TEMP. HIGH indicator lamp on
	5	Yellow	Not used (LED is always off)
	6	Yellow	On: LED in GEAR OIL PRESSURE LOW indicator lamp on
	7	Yellow	On: LED in GEAR OIL TEMPERATURE HIGH indicator lamp on
	8	Yellow	On: LED in COOLANT LEVEL LOW indicator lamp on
	9	Yellow	On: LED in LEAK. FUEL LEVEL HIGH indicator lamp on
	10	Yellow	On: LED in WATER IN FUEL PREFILTER indicator lamp on
	11	Yellow	Spare**
	12	Yellow	On: LED in NEUTRAL indicator lamp on, gearbox in neutral*
	13	Yellow	On: LED in AHEAD indicator lamp on, gearbox engaged ahead*
	14	Yellow	On: LED in ASTERN indicator lamp on, gearbox engaged astern*
	15	Green	On: Supply voltage applied to printed circuit board BOB 2 (2)
INB 3 Slot 4	1	Red	On: Fault in the digital/analog converter of printed circuit board INB 3
	2	Yellow	On: Internal power supply applied to printed circuit board INB 3
	3	Yellow	On: ENGINE SPEED display instrument activated
	4	Yellow	On: LUBE OIL PRESSURE display instrument activated
	5	Yellow	On: COOLANT TEMPERATURE display instrument activated
	6	Yellow	On: GEAR OIL PRESSURE display instrument activated
	7	Yellow	On: GEAR OIL TEMPERATURE display instrument activated
	8	Yellow	Not used (LED is always off)
	9	Yellow	Not used (LED is always off)
	10	Yellow	Not used (LED is always off)

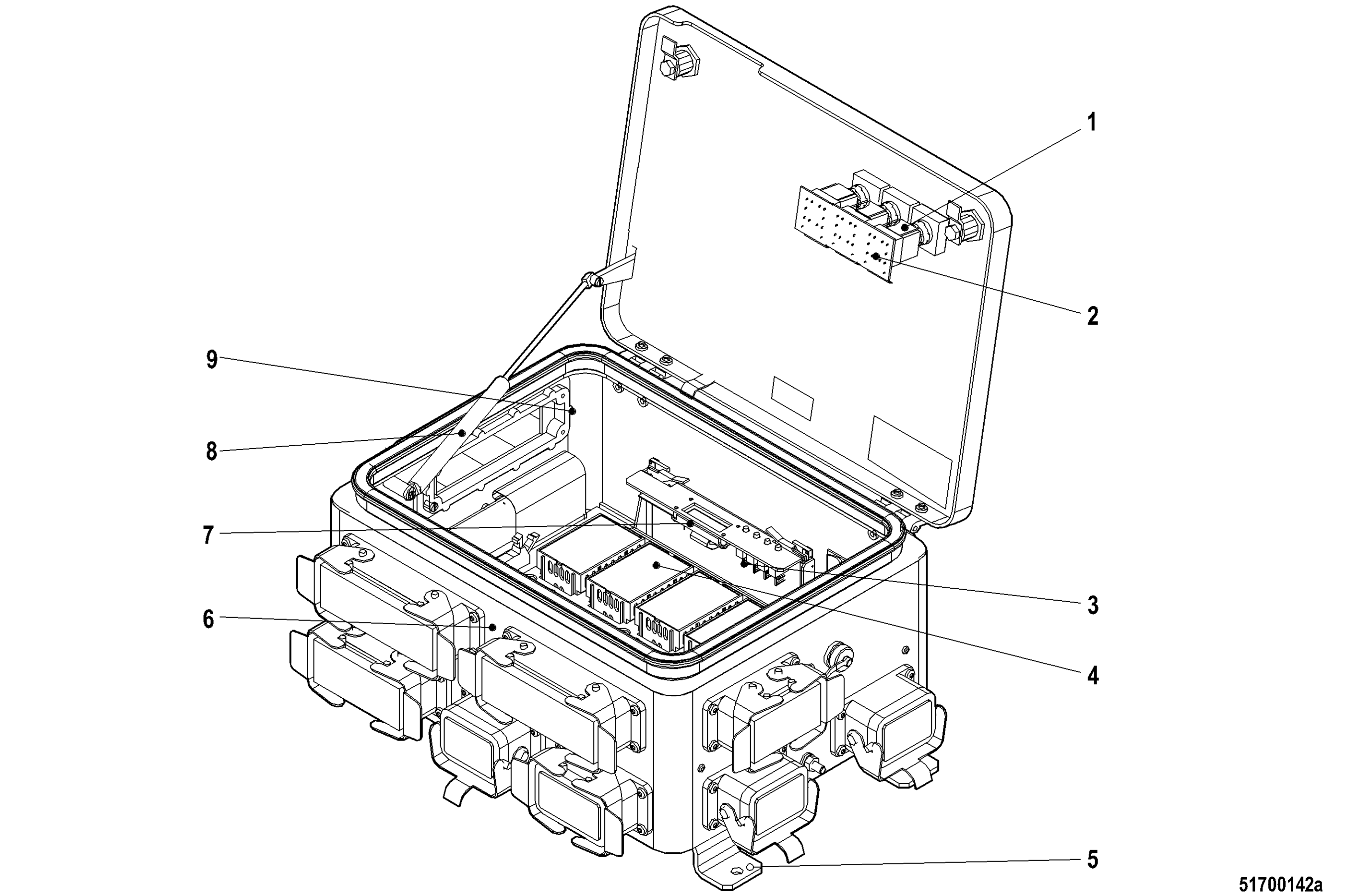
TIM ID: 0000007164 – 002

* Not used for series 2000 engines in conjunction with electronic systems from the MTU BlueLine range for marine propulsion plants (no indicator lamps in the control stands), however LEDs indicate clutch state and are activated during Test mode

** Not used at present, however LED is activated during Test mode.

9.4.3 Local Operating Panel LOP – Design

Internal design

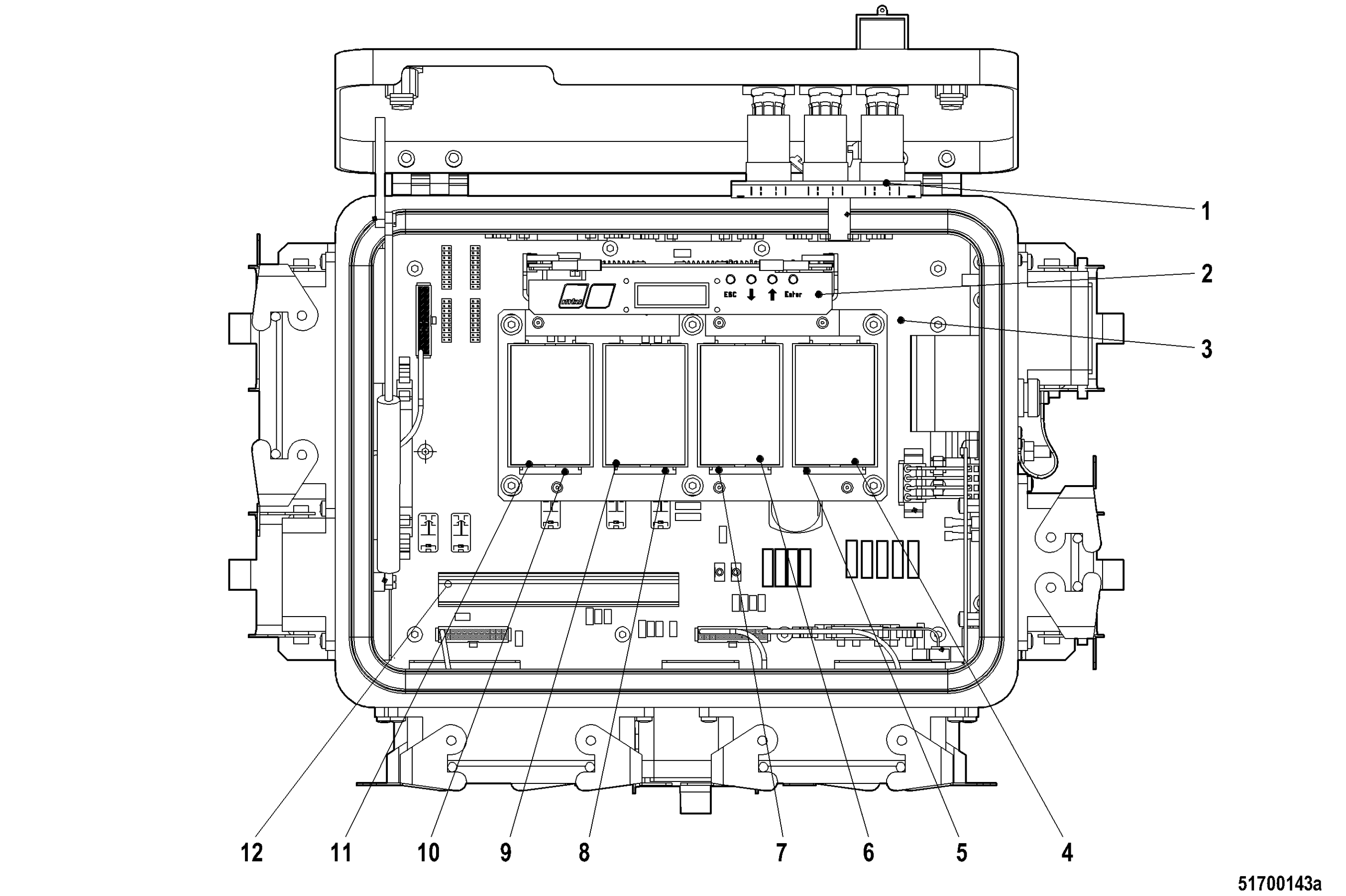


1 Switches and emergency stop button (LOP with service interface only)
2 Printed circuit board for connection of the two switches and the emergency stop button (LOP with service interface only, otherwise the printed circuit board of display DIS is located here)
3 Processor assembly MPU 29 with service interface controls
4 Cassettes (4 pcs.) for interface printed circuit boards
5 Bore
6 Housing with connectors and internal printed circuit board LMB
7 Display MPU 29 (for fault display etc.)
8 Gas prop
9 Internal design

Local Operating Panel LOP with display DIS features a large printed circuit board in the cover for the display and the illuminated pushbuttons instead of the service interface (3).

TIM ID: 0000006785 – 002

Printed circuit boards

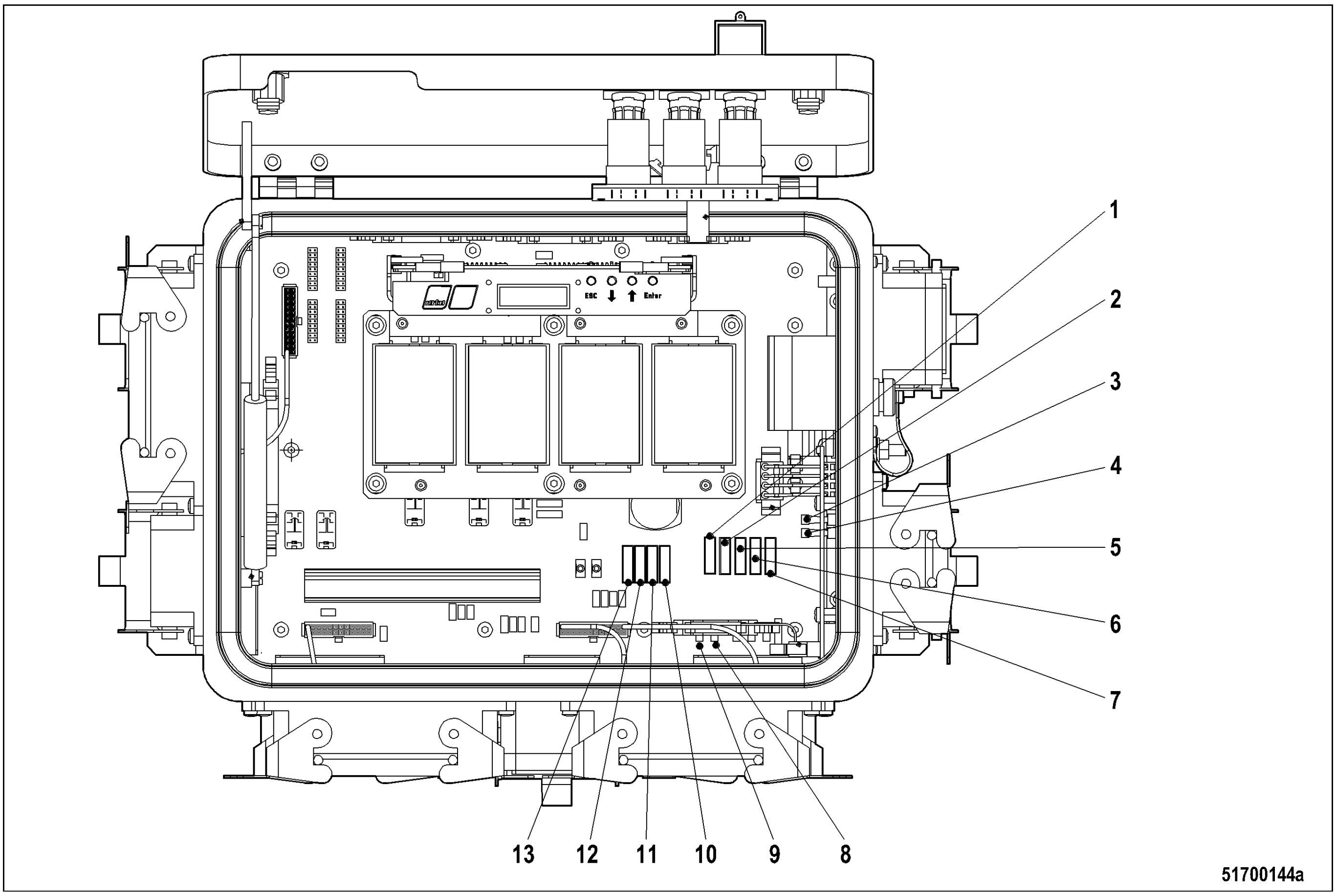


1 Printed circuit board SIB - Service Interface Board
2 Printed circuit board MPU 29 - Monitoring and Processing Unit, processor printed circuit board
3 Printed circuit board LMB - Local Monitoring Board, Local Operating Panel LOP motherboard
4 Not used
5 Printed circuit board BOB 2 - Binary Output Board, switching signal output
6 Printed circuit board BOB 1 - Binary Output Board, switching signal output
7 Printed circuit board BOB 1 - Binary Output Board, switching signal output
8 Printed circuit board BIB 1 - Binary Input Board, acquisition of binary signals
9 Printed circuit board BIB 1 - Binary Input Board, acquisition of binary signals
10 Printed circuit board BIB 1 - Binary Input Board, acquisition of binary signals
11 Printed circuit board AIB 1 - Analog Input Board, acquisition of analog signals
12 Distribution board (not equipped with electronic assemblies, used to distribute signals via jumpers only)

The figure above does not show printed circuit boards which are permanently installed in the Local Operating Panel housing and which cannot be replaced separately: PSB for X6 and X7 and fuses, CRB for X4) X1, X2, X5, X10 and X11 (at the bottom) and X3, X12 and X13 (on the right) are directly connected to the LMB, dialog socket X8 via a cable lead.

Fuses

Printed circuit boards housing



The Local Operating Panel is equipped with 13 fuses (11 on motherboard LMB, pos. (1) to pos. (9), 2 on printed circuit board PSB on the side, pos. (10) and pos. (11), another 10 on the BOB 1 printed circuit boards and one on printed circuit board BOB 2. They are used to protect the supply voltages for:

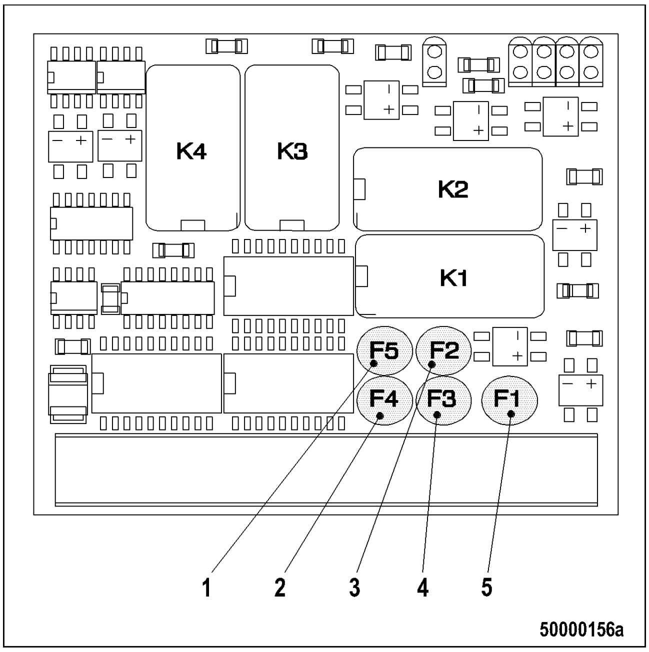
- The ECS-5 (Engine Control System ECS-5) subsystem assemblies installed in the Local Operating Panel
- The external devices associated with the ECS-5 subsystem connected at the Local Operating Panel

- The connected devices of the other subsystems (Remote Control System RCS-5 and Monitoring and Control System MCS-5)

Pos.	Designation	Rating	Protection of	For
LMB				
1	F1	4 A	External dialog unit (CAN dialog)	X8
2	F70	15 A	Supply of Local Operating Panel LOP, all I/O printed circuit boards of the Local Operating Panel (Slot 1 .. 8)	ECS
3	F69	4 A	Gear Control Unit	GCU
4	F71	4 A	Externally connectable safety system (not for BlueLine)	SiSy
5	F67	20 A	Engine Control Unit	ECU
6	F72	15 A	Spare	—
7	F73	20 A	Spare	—
8	F74	4 A	Spare	—
9	F75	4 A	Spare	—
PSB				
10	F1	15 A	Supply for control stands	—
11	F2	15 A	Supply for control stands RCS	—
Bottom of LOP				
12	F5	30 A	Starter	—
13	F6	30 A	Starter	—

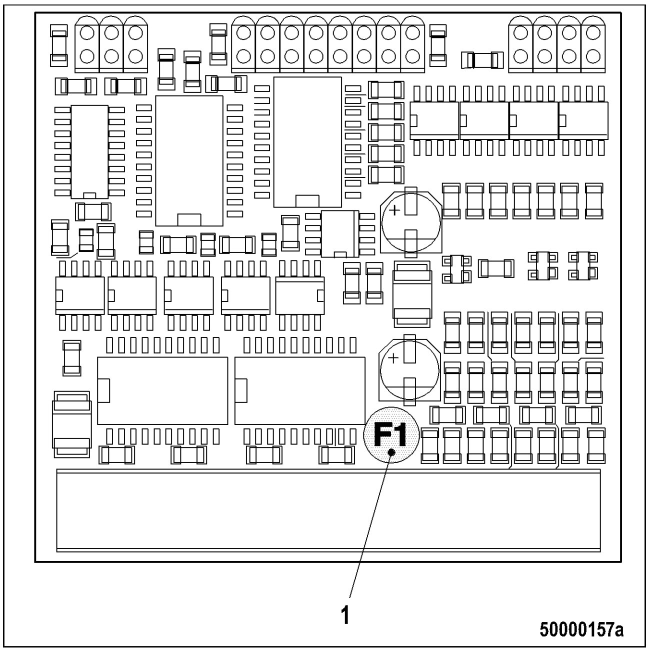
TIM ID: 0000006785 – 002

Fuse assignment: Interface printed circuit board



Pos.	Designation	Rating	Protection of	For
BOB 1 Slot 5				
1	F5	3.15 A	Engine running (contact level 2)	MCS-5
2	F4	3.15 A	Engine running (contact level 1)	MCS-5
3	F2	3.15 A	Summary alarm applied	MCS-5
4	F3	3.15 A	—	—
5	F1	3.15 A	Horn and/or flashing light in the engine room	MCS-5
BOB 1 Slot 6				
1	F5	3.15 A	Output signal “Emergency stop reset” (contact level 2)	MCS-5
2	F4	3.15 A	Output signal “Emergency stop reset” (contact level 1)	MCS-5
3	F2	3.15 A	Disengagement request	Third-party RCS
4	F3	3.15 A	Output signal “Engine speed in engagement window”	Third-party RCS
5	F1	3.15 A	Output signal “Local mode is active”	MCS-5

TIM ID: 0000006785 – 002

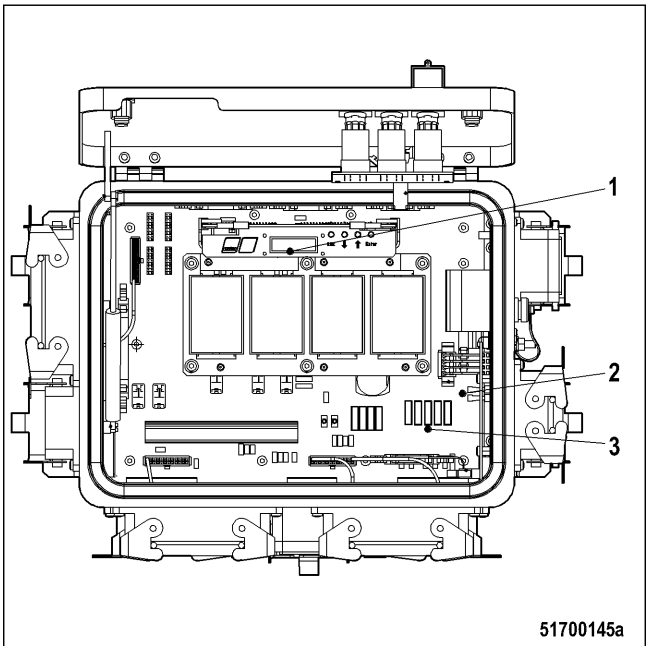


Pos.	Designation	Rating	Protection of	For
BOB 2 Slot 7				
1	F1	3.15 A	Output signals: “Starter is on” “Priming pump running” “Engine running”	MCS-5

TIM ID: 0000006785 – 002

Indicators

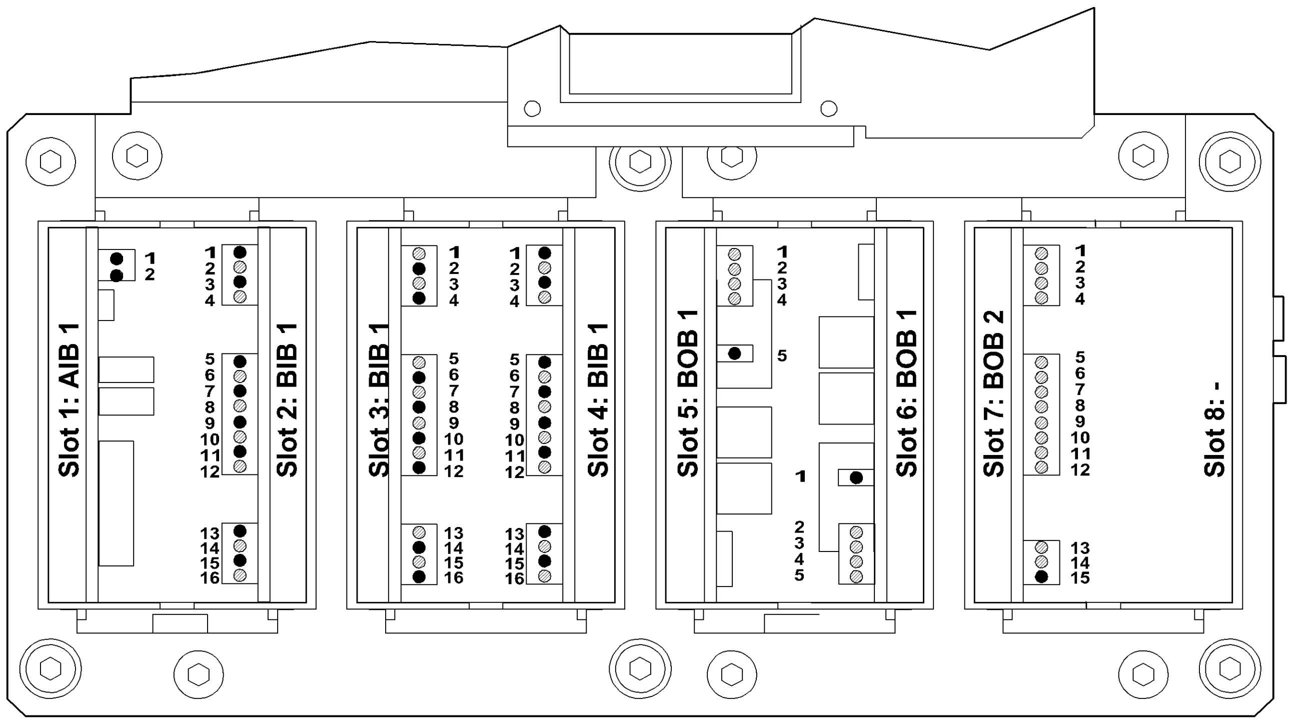
Display and LEDs motherboard



Pos.	On	Color	Meaning
1	MPU 29	Display	Messages (→Operating Instructions) 2 additional LEDs: Red: MPU in reset state Green: MPU is ready for operation
2	LMB	Green	5 LEDs (from left to right): V1 on: Operating voltage external dialog unit applied V54 on: Operating voltage Local Operating Panel applied V61 on: Operating voltage Gear Control Unit applied V60 on: Operating voltage SiSy applied V56 on: Operating voltage Engine Control Unit applied When off: Voltage missing
3	LMB	Green	2 LEDs (from top to bottom) V59 on: Operating voltage RCS-5 control unit applied V62 on: Operating voltage MCS-5 control unit(s) applied When off: Voltage missing

TIM ID: 0000006785 – 002

LEDs of the interface printed circuit boards



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On	No.	Color	Meaning
AIB 1 Slot 1	1	Green	Power supply +5V applied
	2	Red	Processor in Reset/Fault state
BIB Slot 2	1	Red	Not used (LED is always off)
	2	Yellow	Not used (LED is always off)
	3	Red	Not used (LED is always off)
	4	Yellow	Not used (LED is always off)
	5	Red	Not used (LED is always off)
	6	Yellow	On: Emergency air-shutoff flaps are closed
	7	Red	Not used (LED is always off)
	8	Yellow	On: Generator D+/B+ is active
	9	Red	Not used (LED is always off)
	10	Yellow	On: Engine turning (barring gear is active)
	11	Red	Not used (LED is always off)
	12	Yellow	Not used (LED is always off)
	13	Red	Not used (LED is always off)
	14	Yellow	On: Starter switched on
	15	Red	Not used (LED is always off)
	16	Yellow	On: Overspeed detected by ECU

On	No.	Color	Meaning
BIB 1 Slot 3	1	Yellow	Not used (LED is always off)
	2	Red	Not used (LED is always off)
	3	Yellow	Not used (LED is always off)
	4	Red	Not used (LED is always off)
	5	Yellow	On: Water in fuel prefilter (1)
	6	Red	Not used (LED is always off)
	7	Yellow	On: Water in fuel prefilter (2)
	8	Red	Not used (LED is always off)
	9	Yellow	Not used (LED is always off)
	10	Red	Not used (LED is always off)
	11	Yellow	On: External start interlock is active
	12	Red	Not used (LED is always off)
	13	Yellow	On: External engine stop is active
	14	Red	Not used (LED is always off)
	15	Yellow	Not used (LED is always off)
	16	Red	Not used (LED is always off)
BIB 1 Slot 4	1	Red	Not used (LED is always off)
	2	Yellow	Not used (LED is always off)
	3	Red	Not used (LED is always off)
	4	Yellow	On: Fault in emergency supply
	5	Red	Not used (LED is always off)
	6	Yellow	On: Fault in main supply
	7	Red	Not used (LED is always off)
	8	Yellow	On: “Overspeed test” pushbutton pressed in Local Operating Panel LOP
	9	Red	Not used (LED is always off)
	10	Yellow	On: Engine turning (barring gear is active)
	11	Red	Not used (LED is always off)
	12	Yellow	On: Safety system has stopped the engine
	13	Red	Not used (LED is always off)
	14	Yellow	On: Rotary switch on Local Operating Panel set to “Stop”
	15	Red	Not used (LED is always off)
	16	Yellow	On: Rotary switch on Local Operating Panel set to “Start”
BOB 1 Slot 5	1	Yellow	On: A malfunction has occurred on this printed circuit board
	2	Yellow	On: Emergency stop reset is active
	3	Yellow	On: Engine speed in engagement window**
	4	Yellow	On: Disengagement request**
	5	Red	On: Local mode is active
BOB 1 Slot 6	1	Red	On: A malfunction has occurred on this printed circuit board
	2	Yellow	On: Emergency stop reset is active
	3	Yellow	On: Engine speed in engagement window**
	4	Yellow	On: Disengagement request**
	5	Yellow	On: Local mode is active

TIM ID: 0000006785 – 002

On	No.	Color	Meaning
BOB 2 Slot 7	1	Yellow	On: Starter is switched on
	2	Yellow	On: Oil priming pump running
	3	Yellow	On: Engine running
	4	Yellow	Not used (LED is always off)
	5	Yellow	Not used (LED is always off)
	7	Yellow	Not used (LED is always off)
	9	Yellow	Not used (LED is always off)
	10	Yellow	Not used (LED is always off)
	11	Yellow	Not used (LED is always off)
	12	Yellow	Not used (LED is always off)
	13	Yellow	Not used (LED is always off)
	14	Yellow	Not used (LED is always off)
	15	Green	On: Supply voltage applied to printed circuit board BOB 2 (1)
— Slot 8	-	-	Not used

Footnotes:

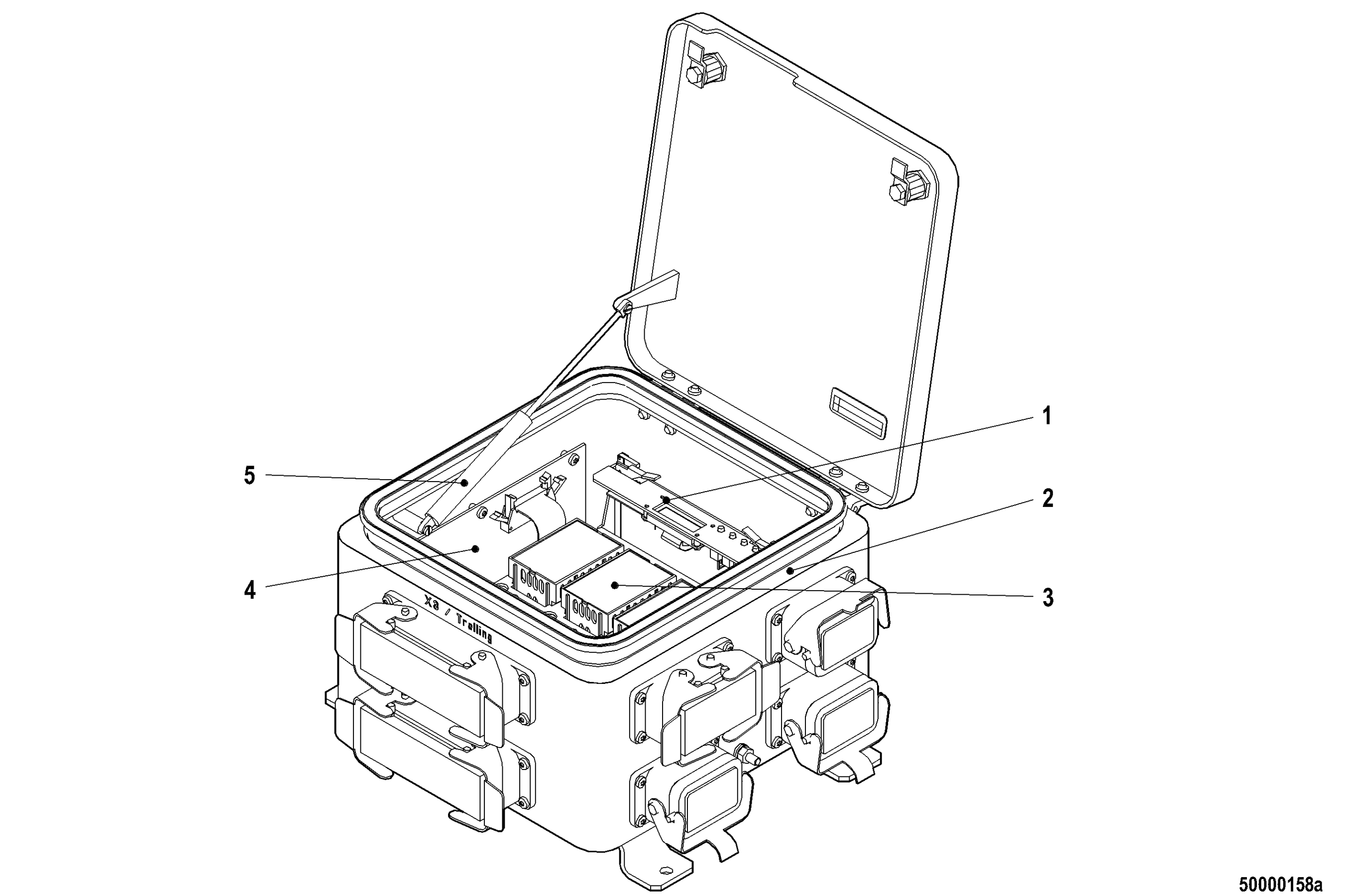
* Not used for series 2000 engines in conjunction with electronic systems from the MTU BlueLine range for yacht propulsion plants.

** Functions are only used in conjunction with use of a non-MTU remote control system; LEDs designated “for third-party RCS” indicate the respective states; LEDs designated “from third-party RCS” are always off.

*** Only when appropriate equipment is provided in the engine room.

9.4.4 Gear Control Unit GCU – Design

Internal design



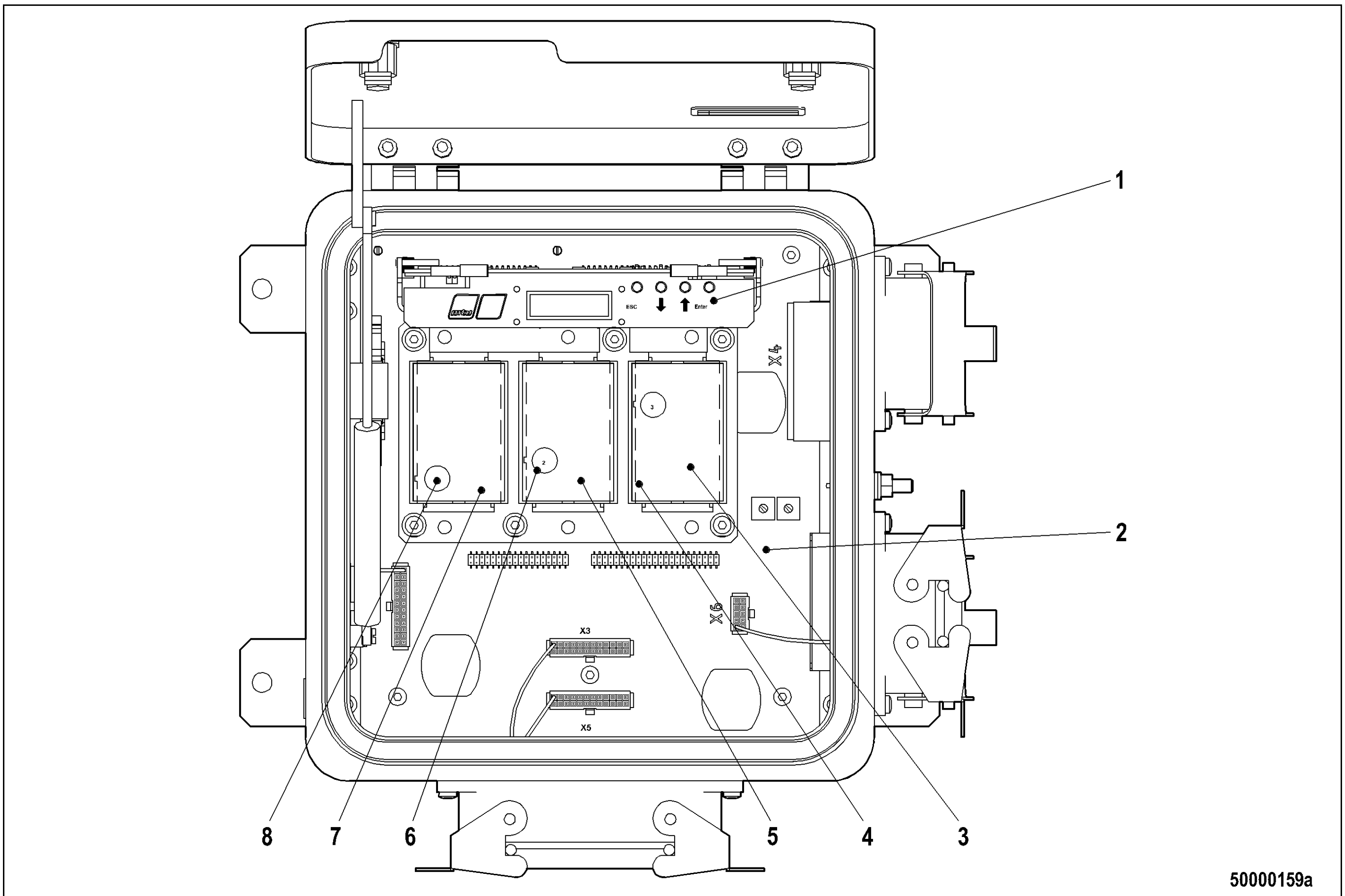
1 Processor assembly MPU 29
2 Housing with connectors and internal printed circuit board LMB
3 Cassettes (3 items) for interface printed circuit boards
4 Printed circuit board MIB 1 (in GCU 3 only)
5 Gas prop

The number and design of the connectors on the housing depend on the type of device (GCU 2, GCU 3 or GCU 6)

TIM ID: 0000007160 – 002

Printed circuit boards

Interface printed circuit boards



1 Printed circuit board MPU 29 - Monitoring and Processing Unit, processor printed circuit board
2 Printed circuit board LMB - Local Monitoring Board, gear control unit motherboard
3 Printed circuit board ROB 1- Relay Output Board, switching signal output
4 Printed circuit board BOB 1- Binary Output Board, switching signal output
5 Printed circuit board AIB 1 - Analog Input Board, acquisition of analog signals
6 Printed circuit board BIB 2 - Binary Input Board, acquisition of binary signals
7 Printed circuit board AIB 2 - Analog Input Board, acquisition of analog signals (GCU 3 only)
8 Printed circuit board BIB 1 - Binary Input Board, acquisition of binary signals

Housing printed circuit boards

All printed circuit boards which are permanently connected to the GCU housing and which cannot be replaced individually are not specified in the figure above.

Fuses

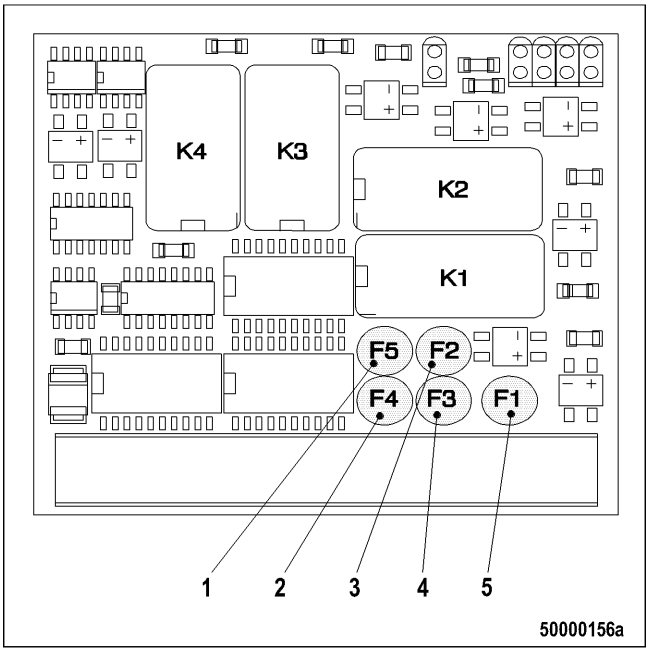
Fuses on housing printed circuit boards

There are no fuses on the printed circuit boards of the housing.

Fuses on interface printed circuit boards

BOB 1 is the only interface printed circuit board which incorporates fuses.

TIM ID: 0000007160 – 002



No.	Designation	Rating	Protection of	For
BOB 1 Slot 5				
1	F5	3.15 A		
2	F4	3.15 A		
3	F2	3.15 A		
4	F3	3.15 A		
5	F1	3.15 A		

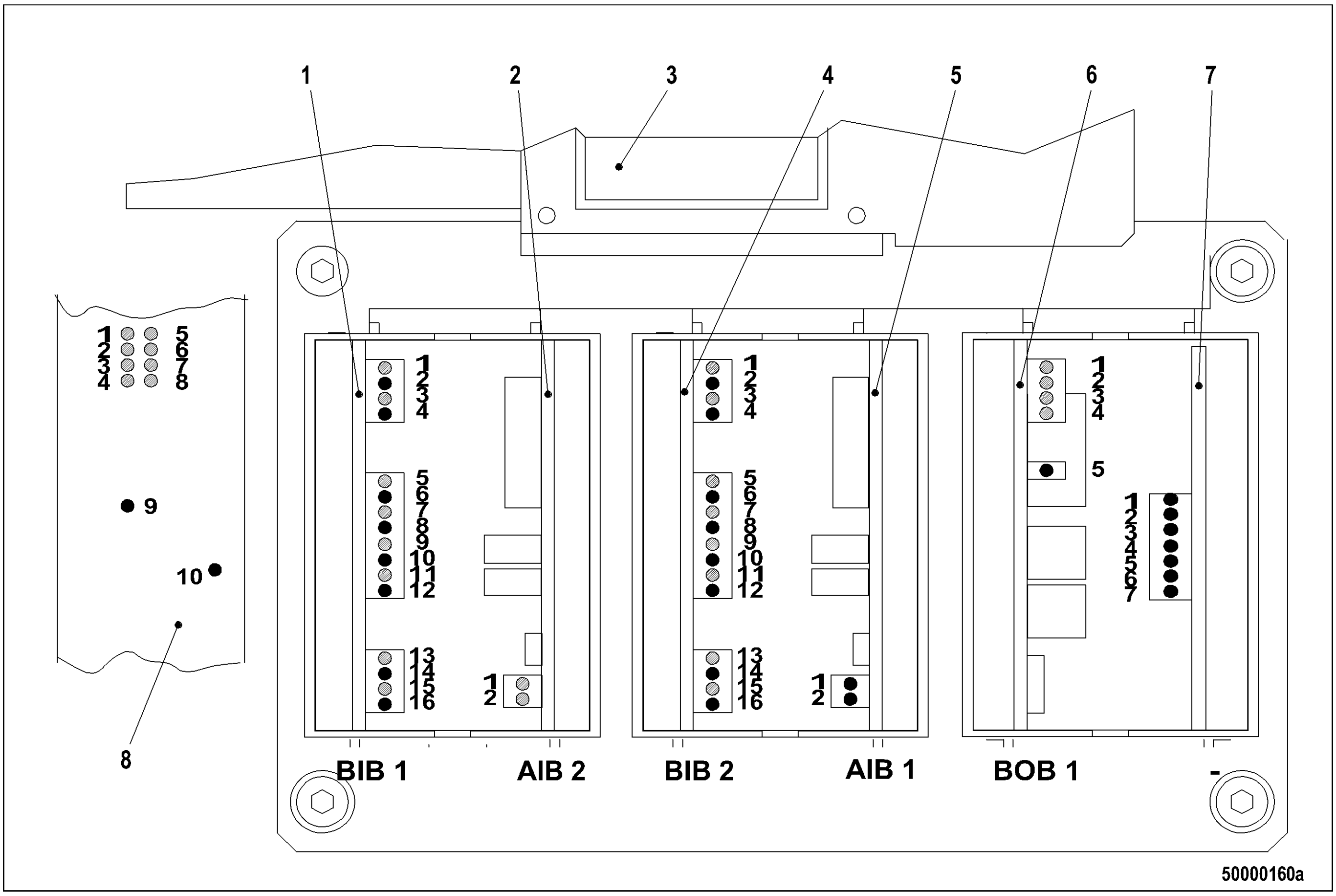
Indicators

LEDs on motherboard

There are no LEDs on the motherboard of the GCU.

TIM ID: 0000007160 – 002

LEDs on printed circuit boards



On	No.	Color	Meaning
BIB 1 Slot 1 (1)	1	Yellow	External start interlock active
	2	Red	Not used (LED is always off)
	3	Yellow	External disengagement request active
	4	Red	Not used (LED is always off)
	5	Yellow	Trolling mode switched on
	6	Red	Not used (LED is always off)
	7	Yellow	Trolling device fault
	8	Red	Not used (LED is always off)
	9	Yellow	Not used (LED is always off)
	10	Red	Not used (LED is always off)
	11	Yellow	Not used (LED is always off)
	12	Red	Not used (LED is always off)
	13	Yellow	Not used (LED is always off)
	14	Red	Not used (LED is always off)
	15	Yellow	Gear oil filter clogged
	16	Red	Not used (LED is always off)
AIB 2 slot 2 (2)	1	Yellow	Trolling setting signal 0 ... 10 V active
	2	Yellow	Trolling setting signal 4 ... 20 mA active

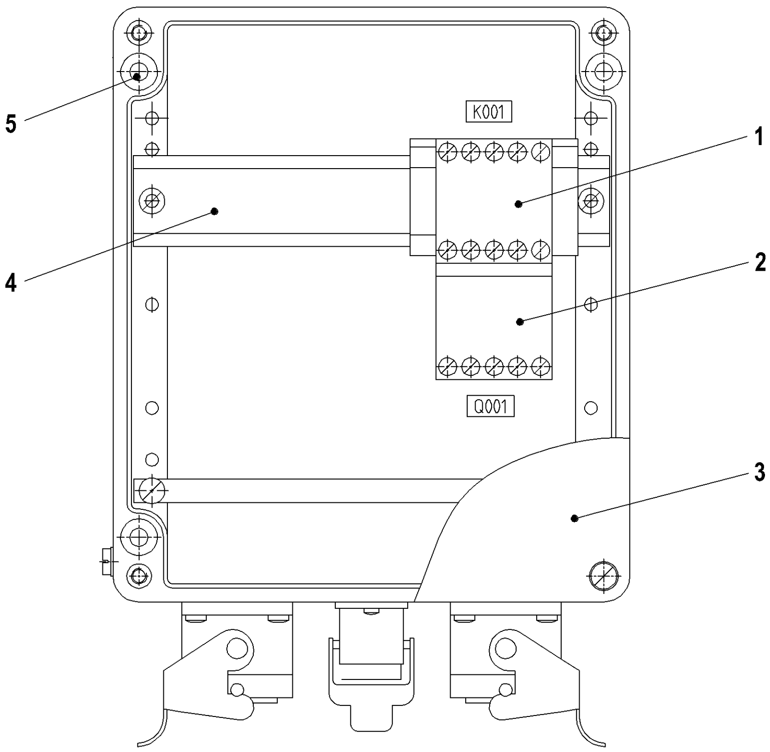
TIM ID: 0000007160 – 002

On	No.	Color	Meaning
MPU 29 (3)	–	Red Green Display	MPU in reset state MPU is ready for operation (→ Page 158)
BIB 2 slot 3 (4)	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Yellow Red Yellow Red Yellow Red Yellow Red Yellow Red Yellow Red Yellow Red Yellow Red	Feedback “Engaged ahead” / “Engaged” Not used (LED is always off) Feedback “Neutral” / “Disengaged” Not used (LED is always off) Feedback “Engaged astern” Not used (LED is always off) Electro mode on Not used (LED is always off) Feedback external–RCS is on (for third-party RCS) Not used (LED is always off) Engagement request “Ahead” / “Engage” Not used (LED is always off) Disengagement request “Neutral” / “Disengage” Not used (LED is always off) Engagement request “Astern” Not used (LED is always off)
AIB 1 slot 4 (5)	1 2	Green Red	Power supply +5V applied Processor in Reset/Fault state
BOB 1 Slot 5 (6)	1 2 3 4 5	Yellow Yellow Yellow Yellow Red	Solenoid valve “Engage in direction of engine rotation” activated Solenoid valve “Neutral” activated Solenoid valve “Engage against direction of engine rotation” activated Local mode switched on A malfunction has occurred on this printed circuit board
ROB 1 Slot 6 (7)	1 2 3 4 5 6 7	Green Green Green Green Green Green Green	Not used (LED is always off) Feedback NEUTRAL Feedback ENGAGED ASTERN Signal engage ASTERN Signal engage AHEAD Not used (LED is always off) Feedback ENGAGED AHEAD
MIB 1 (8)	1 2 3 4 5 6 7 8 9 10	Yellow Yellow Yellow Yellow Yellow Yellow Yellow Yellow Green Green	Not used (LED is always off) Trolling PWM output active Not used (LED is always off) Trolling active Not used (LED is always off) 2–stage High Speed Not used (LED is always off) 2–speed manual Supply voltage +15 VDC is available (stage 1) Supply voltage +15 VDC is available (stage 2)

TIM ID: 0000007160 – 002

9.4.5 Priming Pump Controller PPC – Design

Internal structure



1 Contactor
2 Motor protection switch
3 Housing
4 Top-hat rail
5 Mounting bores

TIM ID: 0000007028 – 001

TIM ID: 0000007028 – 001

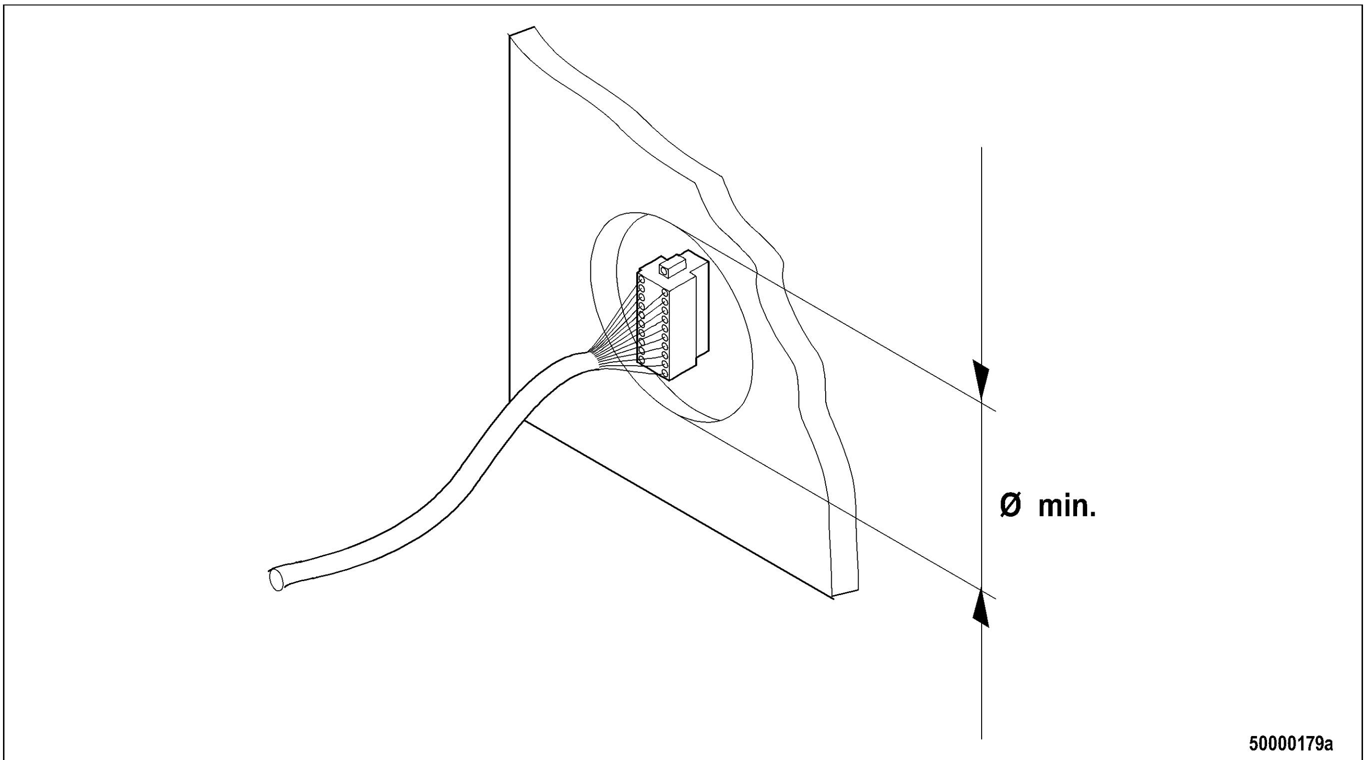
Installation and Commissioning Instructions

10 Installation

10.1 Preparatory Work

10.1.1 Cable routes and openings between all installation locations – Check

Defining cable routes



1. Define the cable route between engine room and main control stand 1.
2. Define the cable route between main control stand 1 and main control stand 2 (if applicable).
3. Define the cable route between main control stand 1 and slave control stand 1 (if applicable).
4. Define the cable route between main control stand 1 and slave control stand 2 (if applicable).
5. Define the cable routes between the control units and the positions in the console where the MTU BlueLine devices are to be located.

Checking cable routes

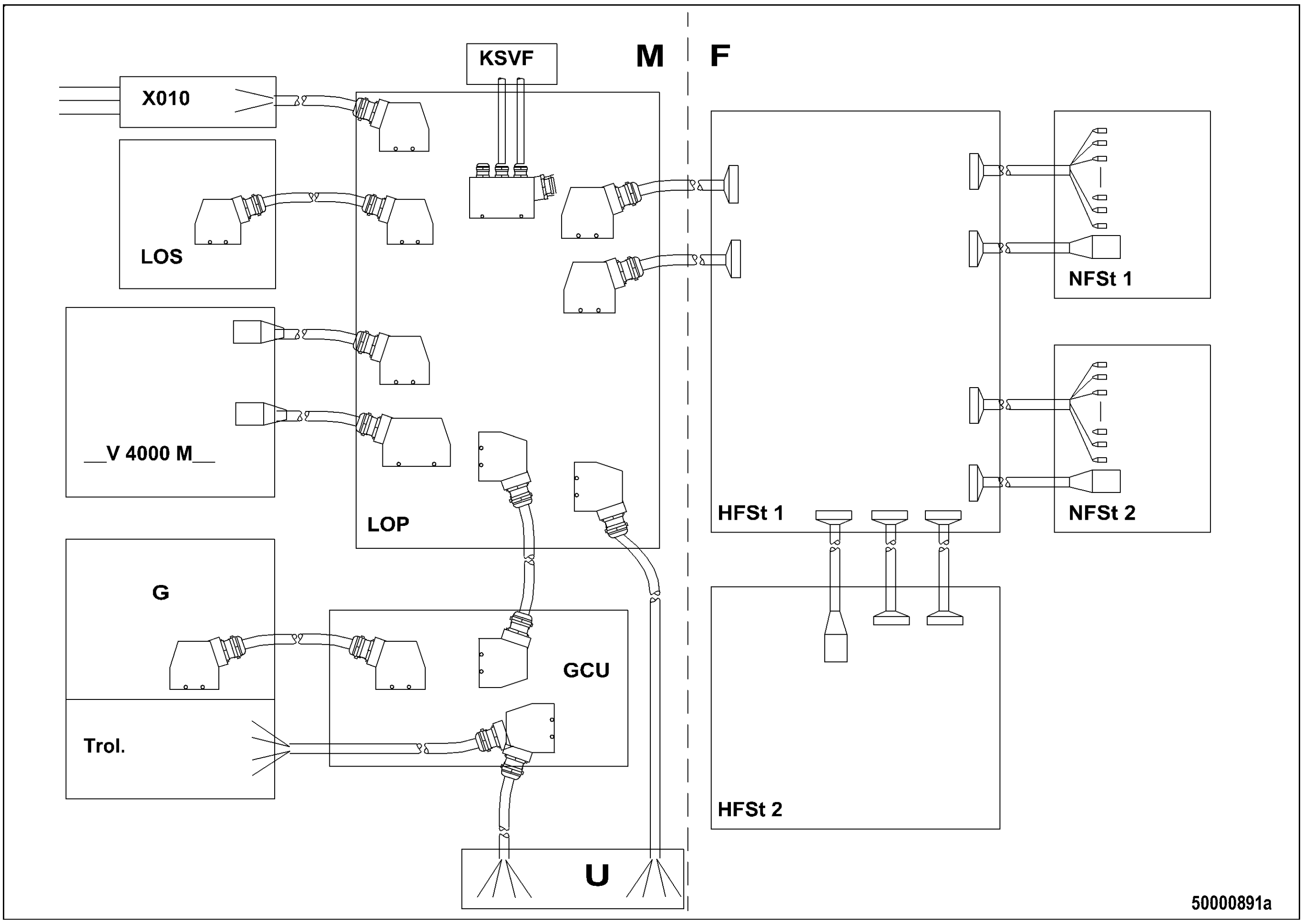
1. Check that the minimum opening diameters (see figure) through one or more partition walls over the course of these routes are no smaller than the dimensions specified below.
   1.1. Between LOS / LOP and machinery or engine room: min. 200 mm
   1.2. Between machinery or engine room and main control stand 1 (PIM 4): min. 100 mm
   1.3. Between main control stand 1 (PIM 4) and main control stand 1 (console front panel): min. 60 mm
   1.4. Between main control stand 1 (PIM 4) and slave control stand 1: min. 60 mm
   1.5. Between main control stand 1 (PIM 4) and slave control stand 2: min. 60 mm
   1.6. Between main control stand 1 (PIM 4) and main control stand 2 (PIM 4): min. 100 mm
   1.7. Between main control stand 2 (PIM 4) and main control stand 2 (console front panel): min. 60 mm
2. Change the cable route (check new cable lengths!) or increase the size of the openings if these specifications are not met.

TIM ID: 0000007188 – 001

10.1.2 Cables – Routing between installation locations

Preconditions

- Cable openings exist.
- Devices are not yet installed.



Cables between installation locations

Designation	Description	Comments
M	Engine room	Installation location for LOP, LOS (optional), GCU, X010
F	Control stands	Installation location for all control units, controls and indicators
__V 4000 M__	Engine 8/12/16V BR4000	
LOS	Local Operating Station	Optional
LOP	Local Operating Panel	
GCU	Gear Control Unit	GCU 6 or GCU 3
G	Gearbox	
Trol.	Trolling device on gearbox	

TIM ID: 0000033125 – 001

Designation	Description	Comments
KSVF	Fuel prefilter	
X010	Auxiliary terminal box	
HFSt1	Main control stand 1	Always included, two control units
HFSt2	Main control stand 2	Optional, one control unit
NFSt1	Slave control stand 1	Optional
NFSt2	Slave control stand 2	Optional
U	Power supply	

1. Route the two cables between Engine Control Unit ECU (installed on the top of the engine) and Local Operating Panel LOP.
2. Route the cable between Local Operating Panel LOP and Local Operating Station LOS (only when optional LOS is included).
3. Route the cable between Local Operating Panel LOP and the Gear Control Unit.
4. Route the cable from terminal box X010 to Local Operating Panel LOP.
5. Route the pre-wired cable W014 on the generator from the engine to terminal box X010.
6. Route the pre-wired cable W014.1 from terminal box X010 to the starter B.
7. Route the pre-wired cable W014.2 from terminal box X010 to the starter A.
8. Route the pre-wired cable W037 from terminal box X010 to the barring gear limit switch.
9. Route the cable from Gear Control Unit GCU to the gearbox.
10. GCU 3 only (Trolling option): Route the cable from Gear Control Unit GCU to the trolling device and to the starter batteries.
11. Route the cable from the Local Operating Panel to the “Water in fuel prefilter” sensor (to both sensors if applicable).
12. Route the cable between Local Operating Panel LOP and batteries.
13. Route the two cables between the engine room (Local Operating Panel LOP) and the control unit at main control stand 1.
14. Route the two cables between main control stand 1 and main control stand 2 and the cable for remote control (only if main control stand 2 is included).
15. Route the cable between main control stand 1 and slave control stand 1 and the cable for remote control (only if slave control stand 1 is included).
16. Route the cable between main control stand 1 and slave control stand 2 and the cable for remote control (only if slave control stand 2 is included).
17. All cables must be appropriately secured (e.g. cable clamps, cable ties) at suitable points on the vessel. Ensure that cables are routed neatly! Cover any sharp edges over which cables are routed (edge protectors, anti-kink protectors for cables).

TIM ID: 0000033125 – 001

10.2 Mechanical Installation

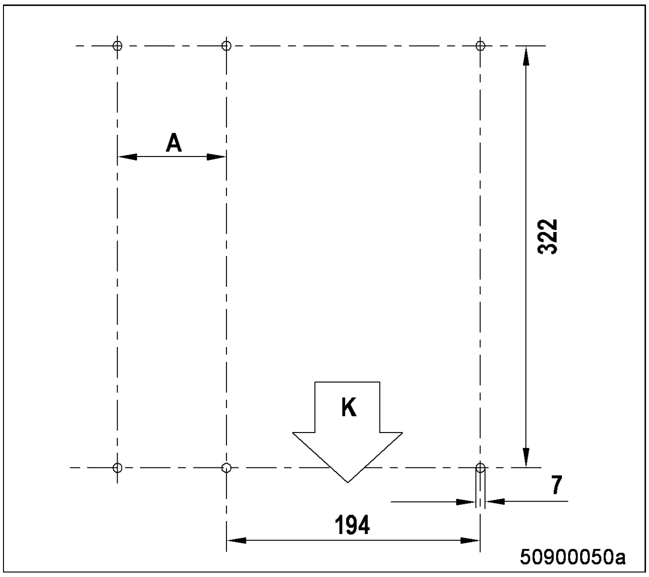
10.2.1 PIM 4 module housing – Installation

Preconditions

- Installation location protected against moisture (control units have an ingress protection rating of IP 54).
- Installation location allows access to devices from the front after opening a cover, flap etc. (display visible).
- Installation location offers adequate space from below.

Installing the housing

1. Mark out four mounting bores for the control unit on the wall inside a housing or console in accordance with the drilling pattern. Tolerance: ± 0.2 mm.
2. Ensure that adequate space is left to housing walls and floor:
   - Space between the two bores at the bottom and any bordering wall or floor: At least 130 mm
   - Distance A when several control units are mounted next to each other: At least 38 mm
3. Drill bores with a diameter of 6 mm.
4. Align the control unit straight on the wall and insert bolts through the mounting brackets and the bores in the wall.
5. Fit one washer, one spring washer and one nut on the other end of the four bolts, but only screw on finger-tight.
6. Tighten the bolts with a suitable tool ensuring that the control unit is aligned horizontally.



TIM ID: 0000007179 – 002

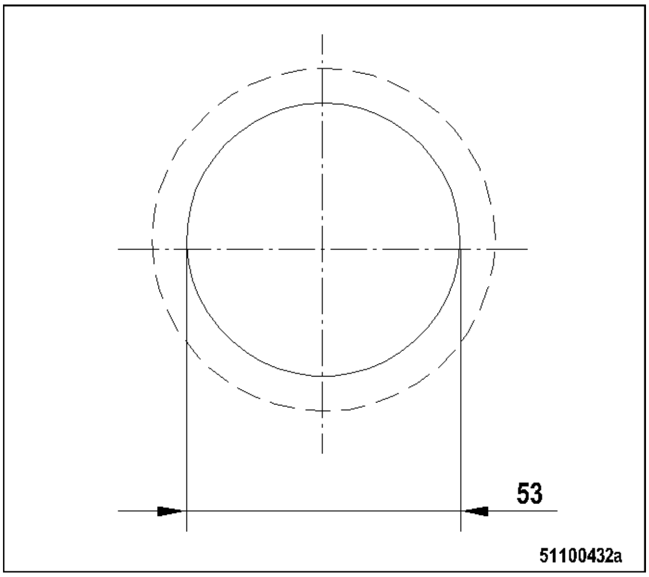
10.2.2 OceanLine analog display instruments – Installation

Preconditions

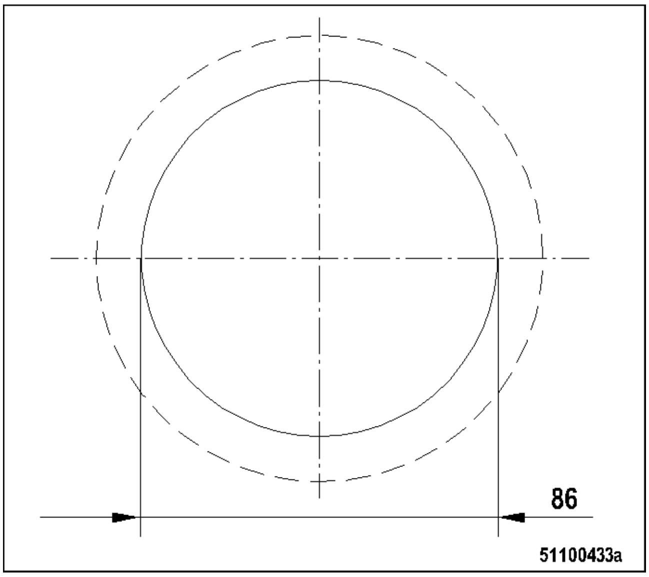
- Level contact area (broken line in figure below) of 120 mm and 62 mm in diameter is available.
- Minimum space between the center of the speed display instrument and the center of any other measuring instrument of at least 95 mm is provided.
- Minimum space between the center of any two small measuring instruments of at least 65 mm is provided.

Making the bore

1. Mark out the bore for the instrument concerned in accordance with the bore patterns (outside diameter of the bezel ring on a speed display instrument is 105 mm, outside diameter of the bezel ring on measuring instruments is 62.5 mm). The tolerance for the diameter of the mounting bores is ± 0.5 mm.



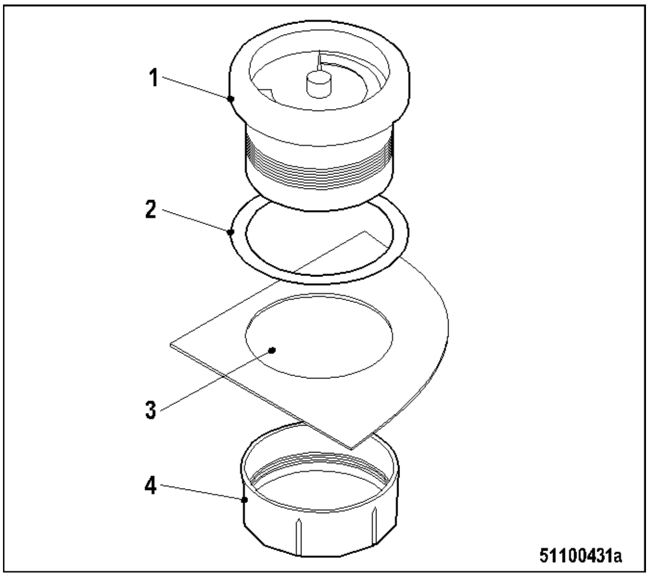
2. Make the bores with a suitable circular cutter.



TIM ID: 0000007182 – 002

Installing the instrument

1. Unscrew the ring (4) of display instrument (1).
2. Insert instrument (1) with seal (2) into the installation opening (3) from the top.
3. Fit the ring (4) on the back of the instrument.
   - 3.1. If the thread bites, screw the ring on a few turns; ensure that the ring is not cross-threaded.
   - 3.2. If the thread fails to bite (e.g. due to console front plate thickness > 5 mm), turn the ring over and fit.
   - 3.3. Screw the ring on a few turns; ensure that the ring is not cross-threaded.
4. Adjust instrument (1) from the top (scale / inscription horizontal) and hold it in place.
5. Tighten ring (4) by hand.



TIM ID: 0000007182 – 002

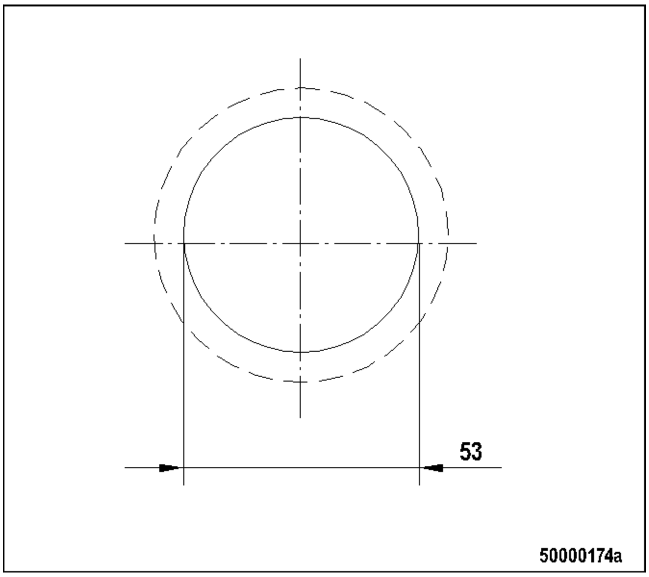
10.2.3 VDO horn – Installation

Preconditions

- The seating surface (broken line in figure) of 63 mm in diameter must be level to ensure tight sealing between the horn and the surface.

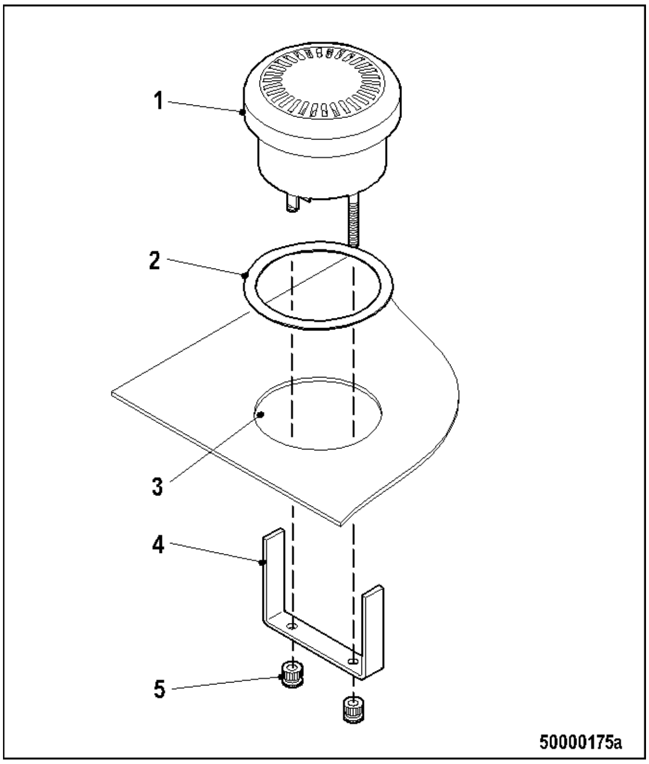
Making bore

1. Mark out the bore for the horn in accordance with the bore pattern. Tolerance for the diameter of the bore is ± 0.5 mm.
2. Make the bores with a suitable circular cutter.



Installing horn

1. Unscrew the horn retaining bracket.
2. Insert the horn (1) and rubber seal (2) into the appropriate installation opening (3) from the top.
3. Fit the retaining bracket (4) onto the back of the horn. Screw on the two knurled-head screws (5) a few turns.
4. Adjust the horn (1) from the top (inscription horizontal) and hold it in place.
5. Tighten both knurled-head screws (5) firmly by hand.



TIM ID: 0000007183 – 001

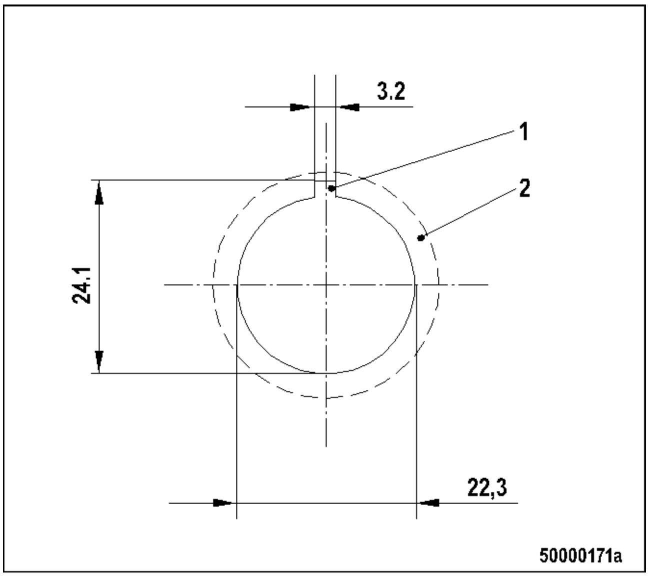
10.2.4 Installing an indicator lamp

Preconditions

- The mating surface (broken line in figure) of 28 mm in diameter for each indicator lamp must be level to ensure tight sealing between the indicator lamp and the surface.
- The minimum horizontal distance between the center of any two illuminated pushbuttons / indicator lamps is at least 31 mm.

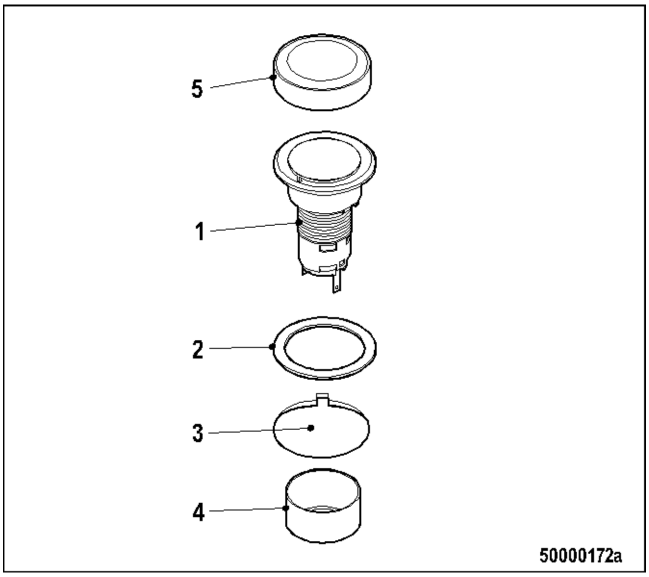
Making bores

1. Mark out bores for all the indicator lamps at their intended locations in accordance with the hole pattern. Tolerance for all dimensions and distances between bores: + 0.3 mm.
2. Make 22 mm bores with a circular cutter.
3. Make an anti-rotation notch (1) in each bore (e.g. with a key file). It must be on the side of the bores facing away from the operator.



Installing the housing

1. Insert the housing (1) through the bore (3) from the top.
2. Insert the right indicator lamp (with the appropriate inscription). Ensure that the indicators lamps are installed in the right order.
   2.1. Enclosed control stands: The seal (2) must be fitted between the console surface and the edge of the housing.
   2.2. Exposed control stands: Fit the sealing cap (5) over the edge of the indicator lamp (1). Seal (2) is not required.
3. Screw on the central nut (4) from below by hand.
4. Tighten the central nut (4) taking care not to overtighten.



TIM ID: 0000007184 – 002

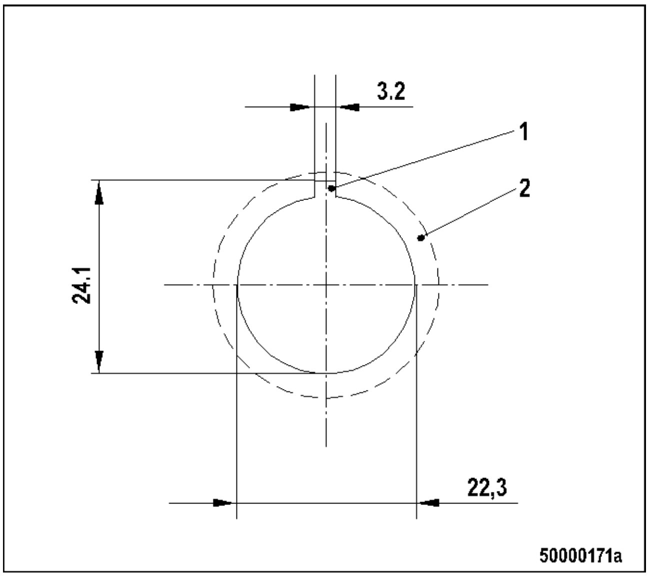
10.2.5 Illuminated pushbutton / key switch – Installation

Preconditions

- The seating surface (2, broken line in figure) of 28 mm in diameter for each illuminated pushbutton must be level to ensure tight sealing between the illuminated pushbutton and the surface.
- The minimum horizontal distance between the centers of any two illuminated pushbuttons / indicator lamps is at least 31 mm.

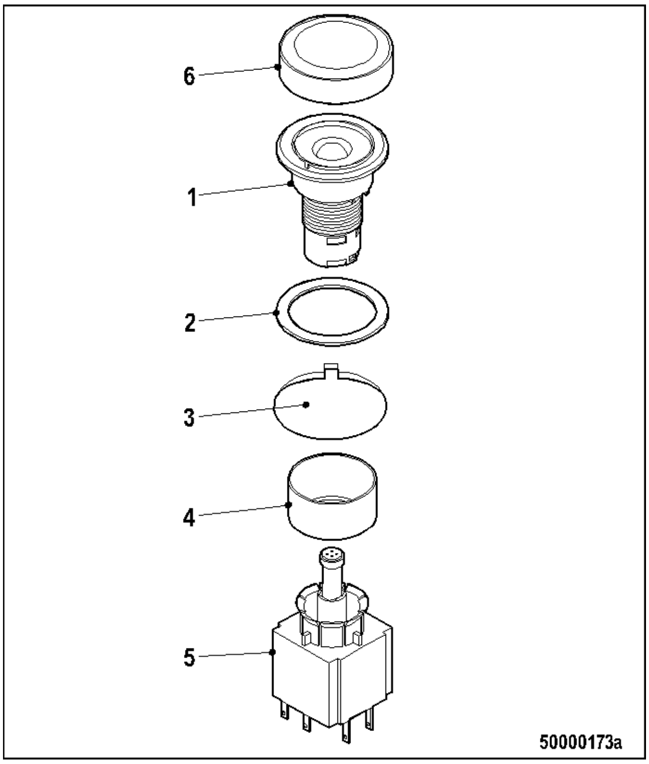
Making bores

1. Mark out bores for all the illuminated pushbuttons at their intended locations in accordance with the bore pattern. Tolerance for all dimensions and the distances between bores: + 0.3 mm.
2. Make 22 mm bores with a circular cutter.
3. Make an anti-rotation notch (1) in each bore (e.g. with a key file). It must be made on the side of the bore facing away from the operator.



Installing actuator

1. Insert the right actuator (with the appropriate inscription). Ensure that the actuators are installed in the right order.
   1.1. Enclosed control stands: The seal (2) must be fitted between the console surface and the edge of the housing.
   1.2. Exposed control stands: Fit the sealing cap (5) over the edge of the indicator lamp (1). Seal (2) is not required.
2. Screw on the central nut (4) from below by hand.
3. Tighten the central nut (4) taking care not to overtighten it.
4. Clip on the corresponding contact unit (5) with the LED inserted.



Installing key switch

1. Insert the key switch actuator through the bore (3) from the top.
2. Screw on the central nut (4) from below by hand.
3. Tighten the central nut taking care not to overtighten it.
4. Clip on the contact unit without LED.

TIM ID: 0000007185 – 001

10.2.6 GCU – Installation

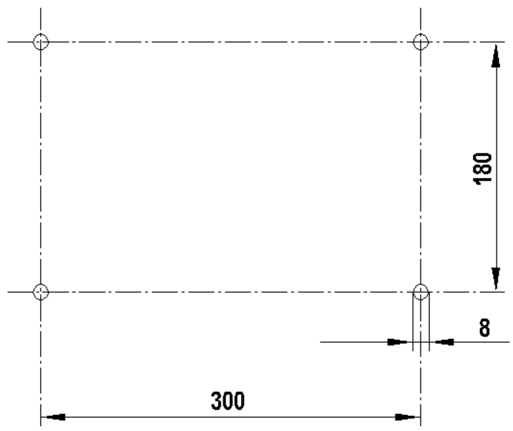
Preconditions

- The Gear Control Unit must be located in the engine room in the immediate vicinity of the gearbox. Ensure that adequate space is available in front of and next to the housing.
- Position the Gear Control Units such that it is perfectly clear which Gear Control Unit controls which power train.
- Allow space for disconnection! Ensure that adequate space is left at the bottom and at the sides to allow disconnection. Leave at least 200 mm of space on each side between the two bores on the right and left and any bordering wall. The space between the two bores at the bottom and a floor must be at least 300 mm.
- The front panel of the Gear Control Unit must be easy to open at the front.

Making bores

Note: The installation procedure described here applies to GCU 2, GCU 3 and GCU 6.

1. Mark out the four mounting bores for the Gear Control Unit on the designated wall in accordance with the drilling pattern. Tolerance: ± 0.5 mm.
2. Drill bores with a diameter of 8 mm.



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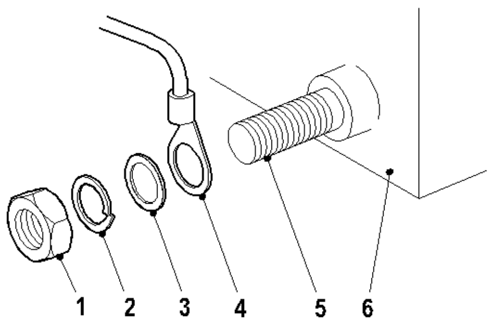
Installing GCU

1. Hold the Gear Control Unit GCU against the wall and fit the bolts.
2. Tighten the bolts. Ensure that Gear Control Unit GCU is aligned horizontally.

Fitting grounding cable

1. Route a cable with a cross-section of at least 2.5 mm^2 to the grounding point.
2. Fit a ring terminal (4) with a diameter of 6 mm onto the cable.
3. Fit the ring terminal (4) over the grounding stud (5) on the device (6).
4. Fit a plain washer (3) and a spring washer (2) over the grounding stud (5).
5. Tighten the nut (1).
6. Secure the grounding cable such as to establish an electrical connection at the common grounding point (specifics vary from case to case).



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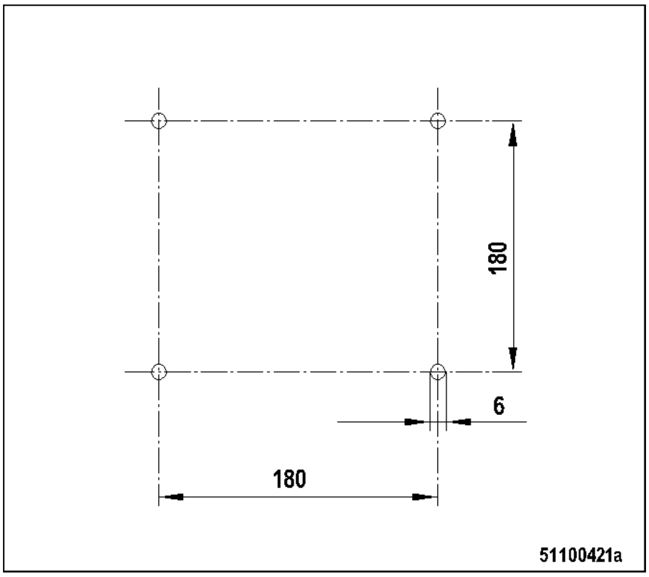
10.2.7 Priming Pump Controller PPC – Installation

Preconditions

- Space to next wall or other device below the housing at least 150 mm.
- At least 20 mm space on left and right.
- Front door of PPC can be opened at front when installed.

Making the bores

1. Mark out the four mounting bores for the housing on the designated wall in accordance with the drilling pattern, tolerance ±0.5.
2. Drill bores with a diameter of 6 mm.



Installing PPC

1. Open housing door.
2. Insert a screw through one of the mounting bores.
3. Push the screw through the bore in the wall.
4. Fit washer, spring washer and nut on other side and tighten fingertight.
5. Proceed with other screws in the same way.
6. Align housing horizontally.
7. Tighten screws.
8. Close door.

Fitting the grounding cable

1. Route a cable with a cross-section of at least 2.5 mm ^{2} to the ground connection.
2. Fit wire-tip sleeve on device end.
3. Undo ground strap screws, slide grounding cable under and tighten screws.
4. Secure grounding cable to common ground connection.

TIM ID: 0000016219 – 001

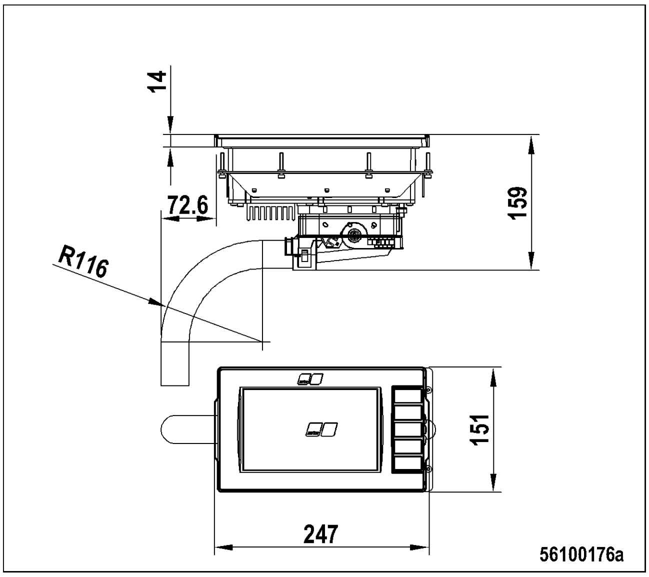
10.2.8 Display MFD – Installation

Preconditions

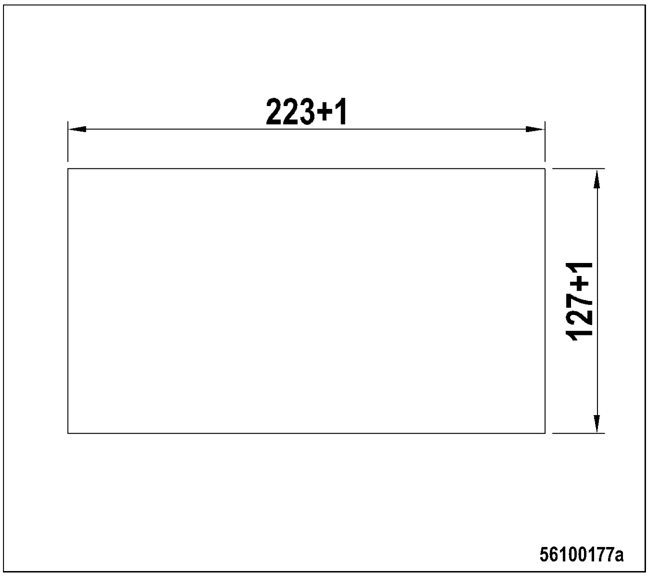
- Ensure that the mating surface is flat to establish a tight connection between the display and the surface of the console. The surface may have to be sealed with silicone.
- Max. console panel thickness 24 mm.
- Note installation position – from 0° to 90°.
- At least 170 mm of space under the display in the console.
- Maintain compass safety distance.

Making an installation opening

1. Select a suitable installation location in accordance with the dimensions in the figure.



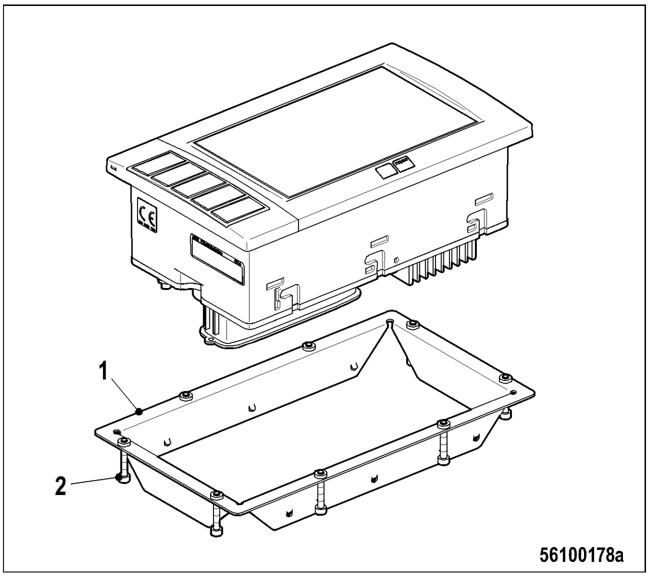
2. Mark out the installation opening for fixing the display in the desired control stand or console as shown in the figure.
3. Cut out the installation opening with a compass saw.



TIM ID: 0000030410 – 001

Installing the display

1. Insert the display into the installation opening from above.
2. Fit the mounting frame (1) on the display from below such that the control panel is clamped between the display and the mounting frame.
3. Slide the display to the right until it engages in the mounting frame.
4. Tight screws (2) finger-tight.
5. Tighten the bolts. Ensure that the display is aligned straight.



Fitting the grounding cable

1. Route a cable with a cross-section of at least 2.5 mm^2 from each display to the ground connection.
2. Fit a cable ring on the device end.
3. Fix the cable ring to the display with a washer and nut.
4. Secure the grounding cable such as to establish an electrical connection at the common ground connection (specifics vary from case to case).

TIM ID: 0000030410 – 001

10.2.9 LOP – Installation

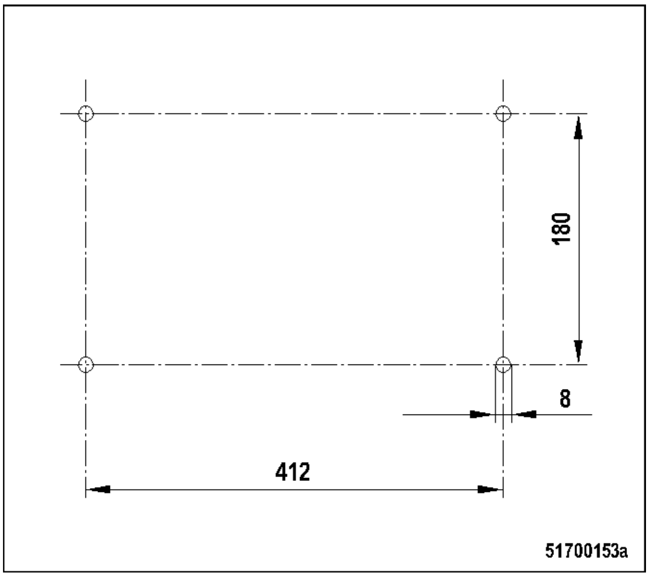
Preconditions

- The Local Operating Panel should be located in the engine room in the immediate vicinity of the engine. Ensure that adequate space is available in front of and next to the housing.
- Position the Local Operating Panels of the power trains such that it is perfectly clear which Local Operating Panel controls which power train.
- The Local Operating Panel can be installed in extremely confined engine rooms provided that it can still be operated properly.
- If the Local Operating Panel LOP features a display it must be installed in an easily accessible location in the engine room. A wide range of control functions and detailed information about the operating states of the engines and the overall electronic system are provided here.
- Allow space for disconnection! Ensure that adequate space is left at the bottom and at the sides to allow disconnection. Leave at least 200 mm of space on each side between the two bores on the right and left and any bordering wall. The space between the two bores at the bottom and a floor must be at least 300 mm.
- The front panel of the Local Operating Panel must be easy to open at the front when mounted in the installation location.

Making the bores

Note: Installation of the Local Operating Panel as described here applies to Local Operating Panel LOP and the Local Operating Panel LOP with display.

1. Mark out the four mounting bores for the Local Operating Panel LOP on the designated wall in accordance with the drilling pattern. The tolerance is ± 0.5 mm.
2. Drill bores with a diameter of 8 mm.



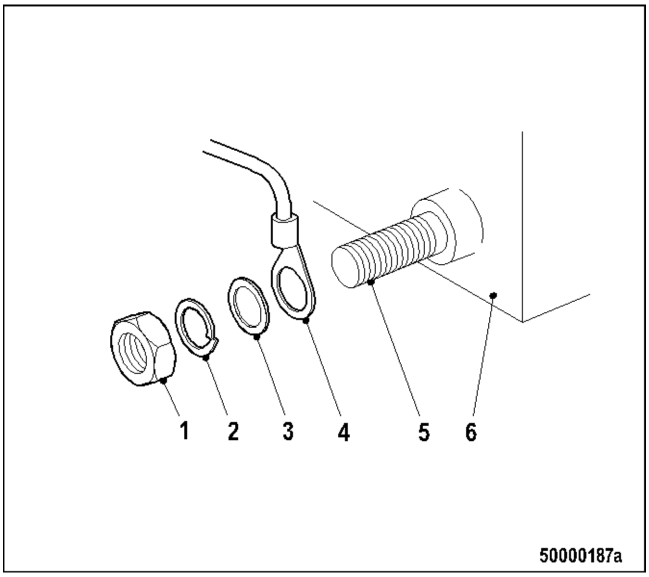
Installing LOP

1. Hold the Local Operating Panel LOP against the wall and insert bolts through the mounting brackets and the bores in the wall.
2. Screw a nut with a plain washer and a spring washer on the other side of each of the four bolts and tighten by hand.
3. Tighten the bolts. Ensure that the Local Operating Panel LOP is aligned horizontally in so doing.

TIM ID: 0000007205 – 002

Fitting the grounding cable

1. Route a cable with a cross-section of at least 2.5 mm^2 to the ground connection.
2. Fit a ring lug (diameter 6 mm) on the device end.
3. Secure the ring lug at the grounding stud on the device as shown in the figure: Nut (1) -- spring washer (2) -- washer (3) -- ring lug (4) -- grounding stud (5) -- housing (6)
4. Secure the grounding cable such as to establish an electrical connection at the common ground connection (specifics vary from case to case).



TIM ID: 0000007205 – 002

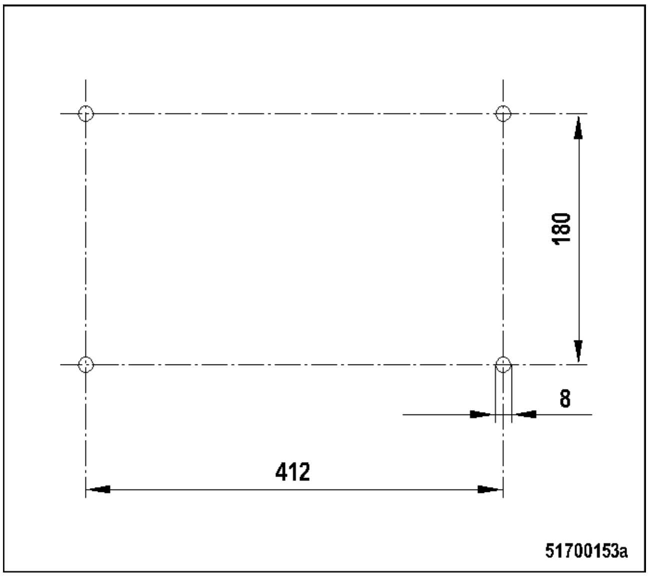
10.2.10 LOS – Installation

Preconditions

- The Local Operating Station LOS should be installed on-board the vessel in an easily accessible location in the vicinity of the engine room (possibly in the companionway).
- Ensure that adequate space is available in front of and next to the housing. A wide range of control functions and detailed information about the operating states of the engines and the overall electronic system are provided here.
- Allow space for disconnection! Check that space has been allowed for disconnection at the bottom. Leave at least 255 mm of space between the two bores on the right and any bordering wall.
- The Local Operating Station must be easy to open at the front when mounted in the installation location.

Making bores

1. Mark out the four mounting bores for the Local Operating Station LOS on the designated wall in accordance with the drilling pattern. The tolerance is ± 0.5 mm.
2. Drill bores with a diameter of 8 mm.



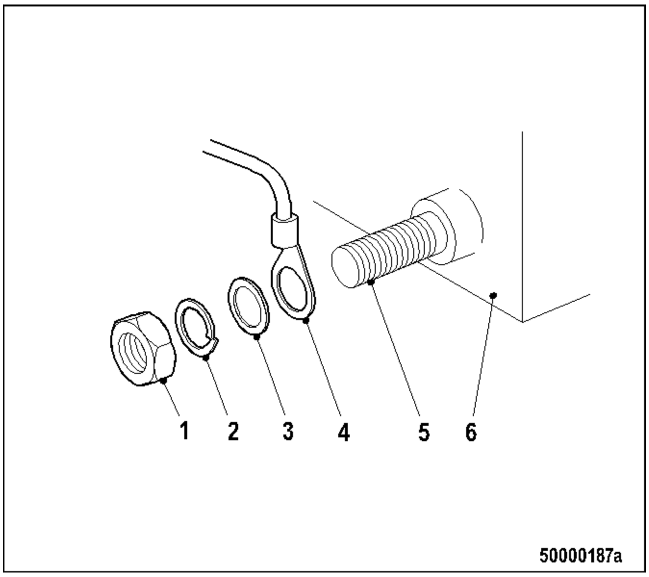
Installing LOS

1. Hold the Local Operating Station LOS against the wall and insert bolts through the mounting brackets and the bores in the wall.
2. Screw a nut with a plain washer and a spring washer on the other side of each of the four bolts and tighten by hand.
3. Tighten the bolts. Ensure that Local Operating Station LOS is aligned horizontally.

TIM ID: 0000007206 – 001

Fitting grounding cable

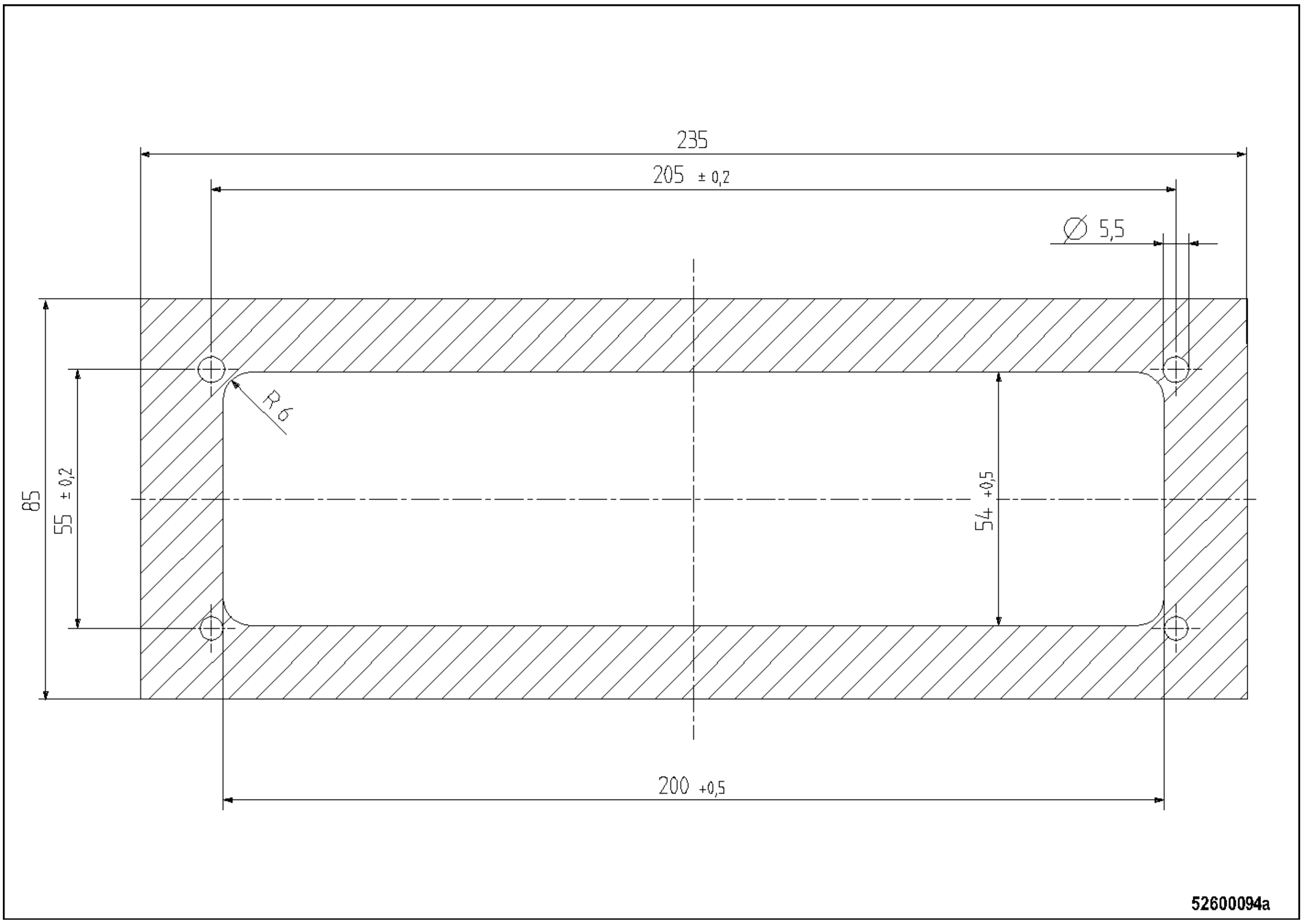
1. Route a cable with a cross-section of at least 2.5 mm^2 to the grounding point.
2. Fit a terminal ring (diameter 6 mm) on the device end.
3. Secure the terminal ring at the grounding stud on the device as shown in the figure: Nut (1) -- spring washer (2) -- washer (3) -- terminal ring (4) -- grounding stud (5) -- housing (6)
4. Secure the grounding cable such as to establish an electrical connection at the common grounding point (specifics vary from case to case).



10.2.11 Installing command unit ROS 11

Preconditions

- Level seating surfaces, 235 mm x 85 mm
- Adequate space for connectors underneath the command unit is provided.



Making cutout and bores (one command unit on each control stand, 3- and 4-shaft plants)

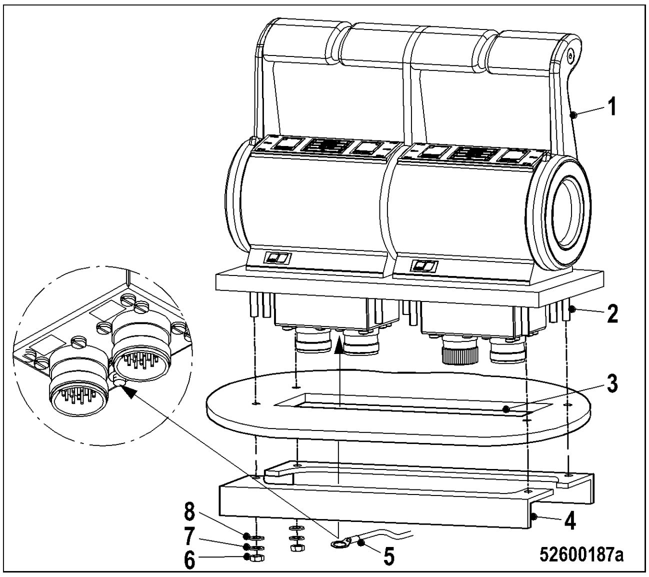
1. Mark the bores in accordance with the drilling and hole pattern. Observe tolerances.
2. Make 5.5 mm bores with a drill.
3. Make the opening with a jigsaw.

Installing ROS

1. Insert command unit (1) in installation opening (3).

   Note: Mounting brackets (4) are required for reinforcement if the console is too weak.

2. Fit the two mounting brackets (4) over the studs (2).
3. Fit nut (6) washer (7) and spring washer (8) on studs (2) and tighten.



1 Command unit
2 Stud
3 Installation opening
4 Mounting bracket
5 Grounding cable
6 Nut
7 Washer
8 Spring washer

Fitting the grounding cable

1. Fit cable ring of the grounding cable (5) (minimum 2.5 mm^2 cross-section) on the grounding point of each command unit.
2. Tighten connection of grounding cable (5) with nut (6), washer (7) and spring washer (8).

TIM ID: 0000007208 – 003

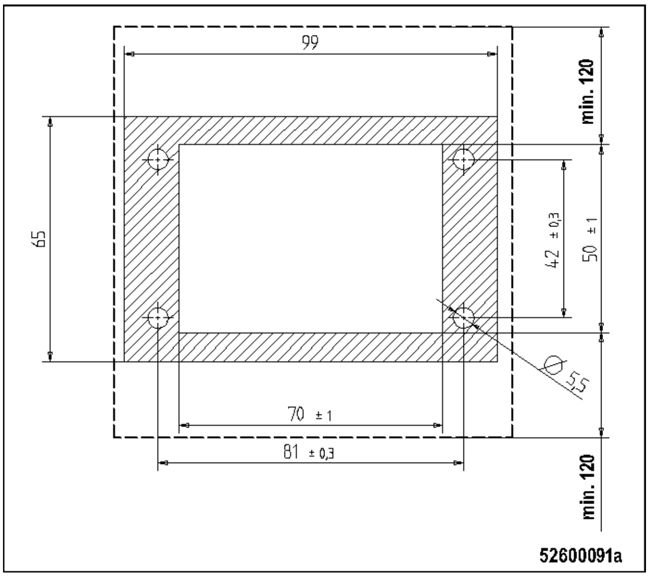
10.2.12 Installing command unit ROS 7 / ROS 9

Preconditions

- Level seating surfaces 99 mm x 65 mm and 229 mm x 65 mm are provided.
- Adequate space for connectors underneath the command unit is provided.
- A recess of at least 130 mm for short-lever version when covered.

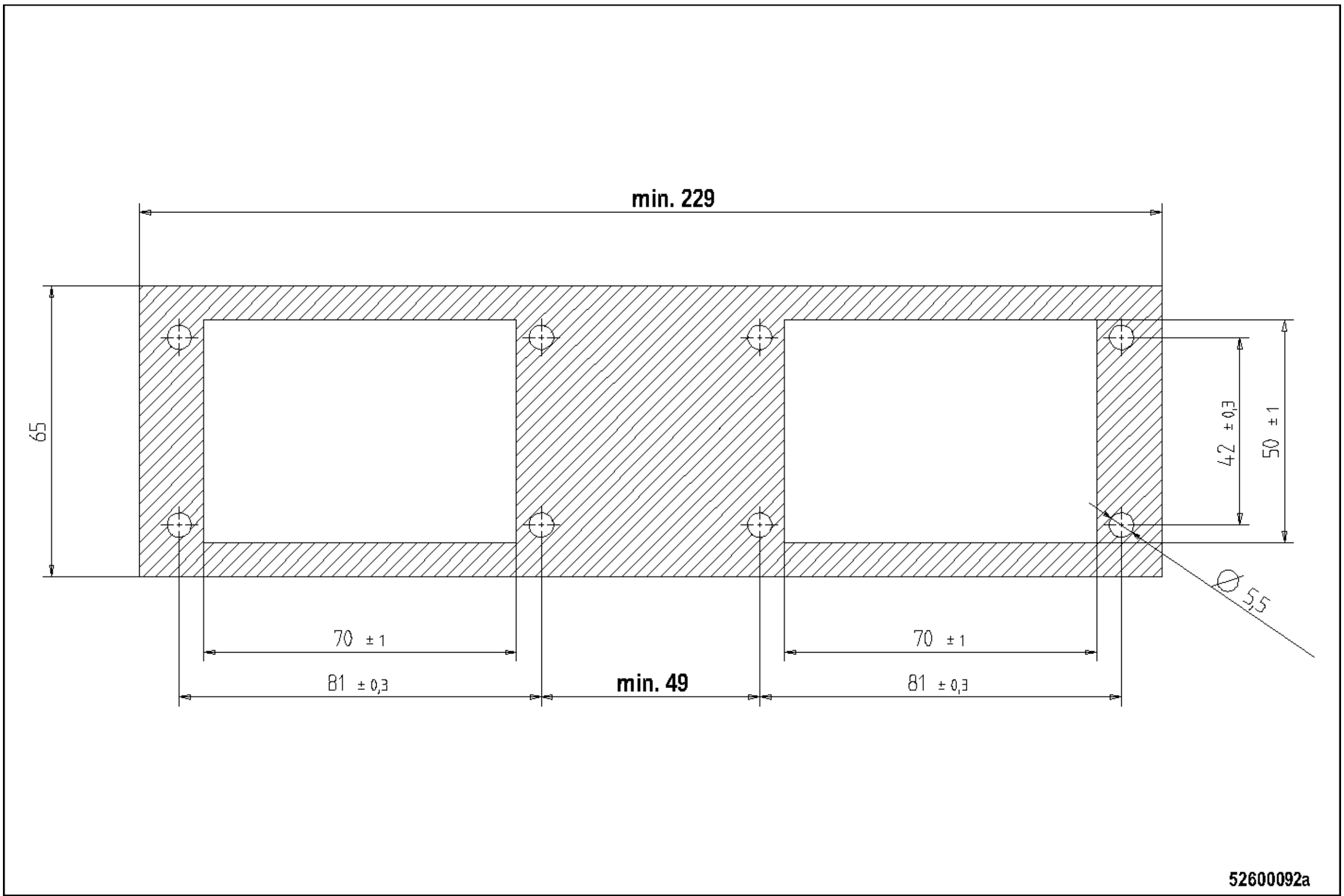
Making cutout and bores for one command unit on each control stand

1. Mark the bores in accordance with the drilling and hole pattern. Observe tolerances.
2. Make 5.5 mm bores with a drill.
3. Make the opening with a jigsaw.



TIM ID: 0000007211 – 003

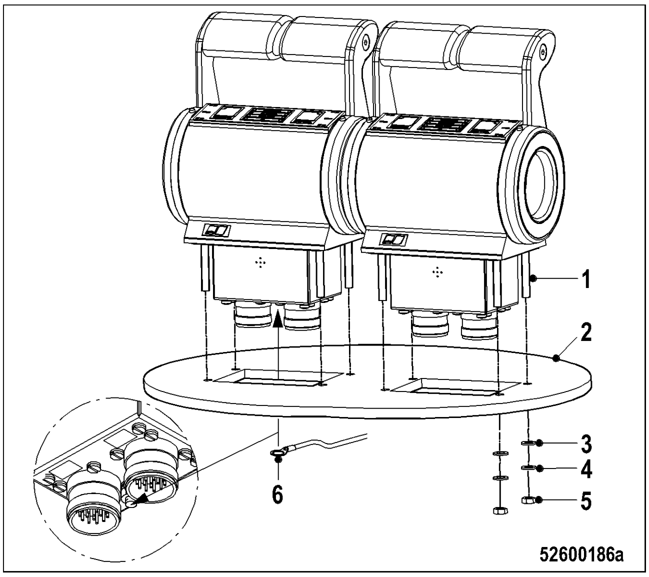
Making cutout and bores for two command units on each control stand (4-shaft plants)



1. Mark the bores in accordance with the drilling and hole pattern. Observe tolerances.
2. Make 5.5 mm bores with a drill.
3. Make the openings with a jigsaw.

Installing ROS

1. Insert command unit in installation opening.
2. Fit nut (5), washer (4) and spring washer (3) on stud (1) and tighten.



1 Stud
2 Securing plate
3 Spring washer
4 Washer
5 Nut
6 Grounding cable

Fitting the grounding cable

1. Fit cable ring of the grounding cable (6) (minimum 2.5 mm^2 cross-section) on the grounding point of each command unit.
2. Tighten connection of grounding cable (6) with nut (5), washer (4) and spring washer (3).

TIM ID: 0000007211 – 003

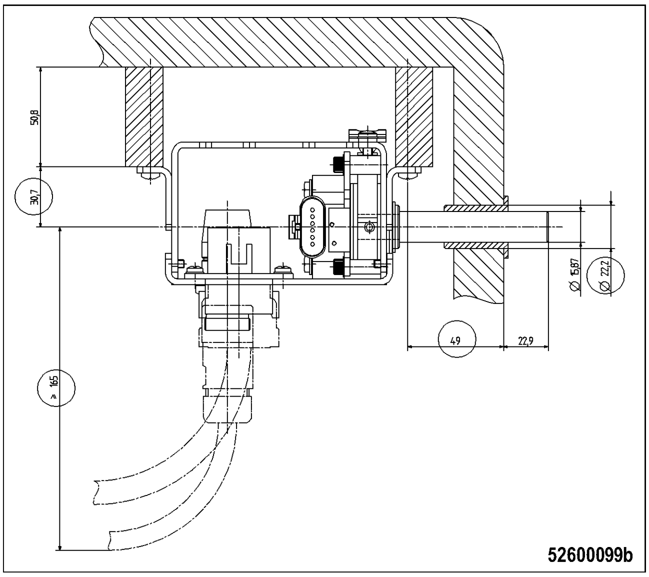
10.2.13 Installing rotary encoder modules ROS 10/P and ROS 10/S

Preconditions

- Contact surface for mounting lugs to middle of shaft: 30.7 mm
- Maximum distance between shaft-side mounting bracket bore and console outer wall: 49 mm
- Bore diameter for bearing sleeve: 22.2 mm
- Bearing sleeve bore dead center between the two shaft-side mounting bracket bores
- Distance between mounting bracket surface and bordering wall: Greater than 195 mm

Installing rotary encoder module (schematic)

1. Install rotary encoder module.
2. Press the bearing sleeve into the bore.
3. Insert the shaft through the bearing sleeve until it engages in the square.



Connecting the grounding cable

1. Route a cable with a cross-section of at least 2.5 mm^2 from each rotary encoder module to the grounding point.
2. Fit a cable ring (diameter 5 mm) on the device end.
3. Unscrew one of the screws securing the rotary encoder module.
4. Fit cable ring over screw.
5. Screw the screw back in together with the grounding cable and tighten it.

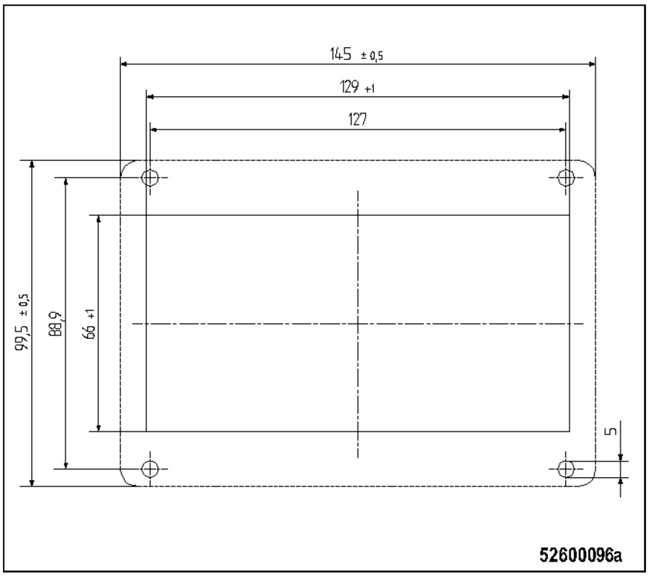
10.2.14 ROS 10/T Remote Operating Station – Installation

Preconditions

- Ensure that the seating surface (hatched area in drilling pattern below) of 145 mm x 99.5 mm is level to ensure tight sealing between operating station and console surface.
- Select an installation location in the console which offers adequate space underneath the operating station (approx. 130 mm).
- The maximum distance between rotary encoders and operating station must not exceed 2 m (length of cable route).

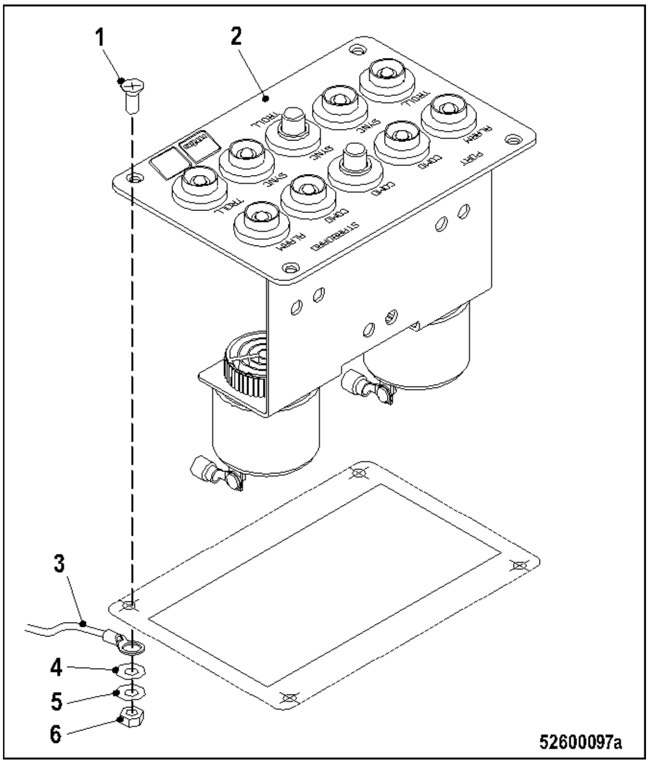
Making installation opening and bores

1. Mark out the four bores and the installation opening for the operating station at the appropriate place on the control stand or console in accordance with the drilling and cutout pattern. Tolerance for the distances between mounting bores: ± 0.3 mm, ± 1 mm for the opening.
2. Make 5 mm bores with a drill.
3. Cut out the opening with a jigsaw.



Installing operating station

1. Insert the operating station (2) into the installation opening from the top.
2. Insert four screws (1).
3. Screw a nut (6) with a plain washer (4) and a spring washer (5) on the bottom of three of the four screws (1) and tighten by hand.



Fitting grounding cable

1. Route a cable with a cross-section of at least 2.5 mm^2 from the operating station to the grounding point.
2. Fit a cable ring (diameter 5 mm) on the device end.
3. Fit the cable ring (3) over the fourth screw.
4. Screw on the nut (6) with a plain washer (4) and spring washer (5) and tighten by hand.

Final steps

1. Tighten all nuts. Ensure that the operating station is aligned straight in so doing.
2. Secure the grounding cable such as to establish an electrical connection at the common grounding point (specifics vary from case to case).

TIM ID: 0000007217 – 001

10.2.15 Terminal box X010 – Installation

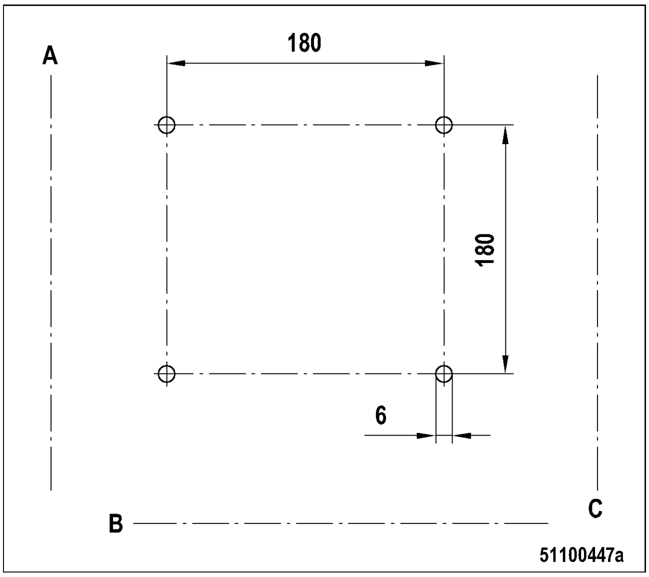
Determining an installation location

1. Determine the installation location such that:
   1.1. Terminal box X010 is positioned within reach of the prefabricated wiring harnesses W014 (10m) from the battery-charging generator and the starter(s)
   1.2. Terminal box X010 is close enough to the Local Operating Panel to allow the cable W002 to be plugged in at the Local Operating Panel
   1.3. Enough space is afforded between walls or other devices next to the terminal box (see figure); leave the following spaces:
   - Left (to A): Min. 115 mm
   - Bottom (to B): 156 mm
   - Right (to C): Min. 108 mm

   1.4. Screws securing the cover are easily accessible once the housing has been installed
2. Check that installation is possible at the intended location in that the minimum dimensions specified are observed.

Making bores

1. Mark out the four mounting bores for the terminal box on the designated wall in accordance with the drilling pattern. The tolerance is ± 0.5 mm.
2. Drill bores with a diameter of 6 mm.



Installing X010

1. Remove the cover on the terminal box.
2. Insert a bolt through one of the mounting bores; then put the bolt through the appropriate bore in the wall.
3. Fit a plain washer, a spring washer and a nut on this bolt from the other side; tighten by hand only.
4. Insert three more bolts through the other bores in the same way and fit plain washers, spring washers and nuts.
5. Tighten the bolts with a suitable tool. Ensure that the terminal box is aligned horizontally.
6. Screw the cover back on loosely.

Fitting grounding cable

1. Route a cable with a cross-section of at least 2.5 mm^2 to the grounding point.
2. Fit wire-end ferrules on the device end.
3. Undo the two screws on the grounding lug, push the grounding cable underneath and tighten the two screws again. Subsequently ensure that the cable is firmly seated.
4. Secure the grounding cable such as to establish an electrical connection at the common grounding point (specifics vary from case to case).

10.3 Electrical Installation

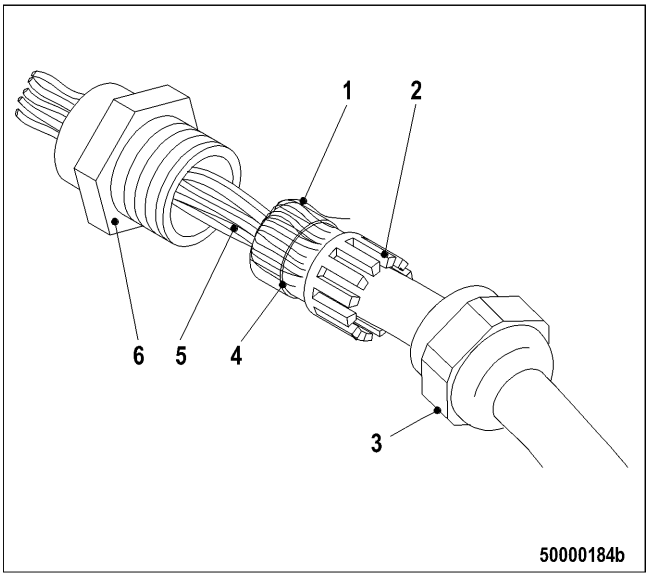
10.3.1 HSK cable gland – Preparation

Preconditions

- Cables are properly routed.
- Cables are long enough.

Fitting the gland and stripping cables

1. Slide the union nut (3) and clamping insert (2) over the cable.
2. Strip back the outer sheath of the cable such that
   - it reaches far enough into the screw fixture (6) after assembly, and
   - all cable cores (5) reach the relevant connecting points.
3. Slide the clamping insert (2) up to the end of the outer sheath.



Installing the cables

1. Cut back excess shielding braid (1) to approx. 1 cm.
2. Fold shielding braid (1) back over the O-ring (4) of the clamping insert (2).
3. Pass individual cores (5) through the screw fixture (6).
4. Slide the cable with the clamping insert(2) up to the stop in the screw fixture (6).
5. Slide the union nut (3) over the clamping insert (2) and tighten the screw fixture (6).

TIM ID: 0000007180 – 002

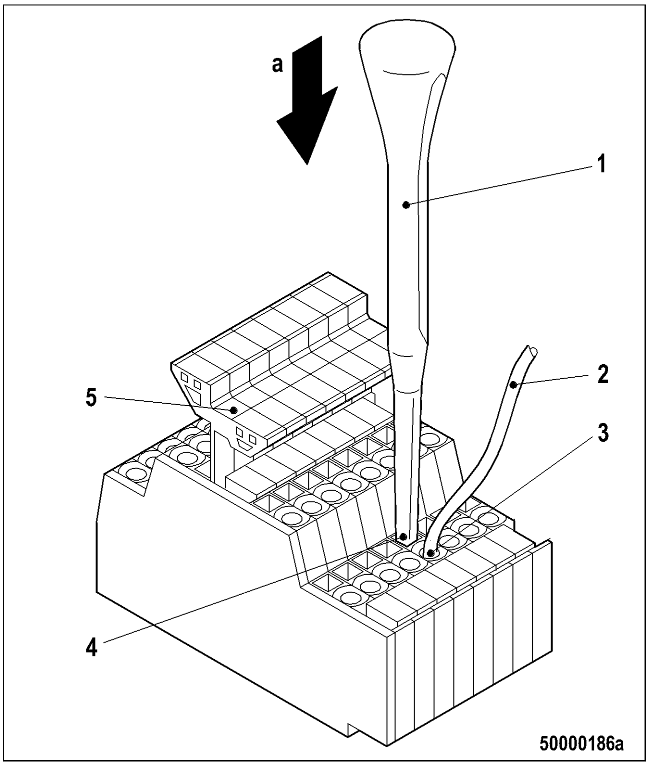
10.3.2 Terminal strip – Preparation

Preconditions

- Cables are properly routed.
- Cables are long enough.

Cutting individual wires to length

1. Determine the terminal to which the wire concerned is to be connected (see connection or wiring diagram).
2. Cut each wire to the suitable length.



Connecting the cables

1. Strip approx 8 mm of insulation off the first wire to be connected.
2. Do not fit wire-end ferrules.
3. Determine the terminal to which this wire is to be connected (see connection or wiring diagram).
4. Press the actuator tool (1) firmly into the square hole (4) in the direction indicated by the arrow; move the inscription tag (5) to one side if necessary.
5. Insert the wire (2) into the corresponding round hole (3).
6. Pull out the actuator tool.
7. Connect up all the other wires in the same way.

Final steps

1. Bundle the individual wires suitably using cable tie(s).
2. Remove all foreign bodies (bits of cable, bits of cable tie etc.) from the housing.
3. Subsequently check that all connections have been established correctly and are firmly seated.

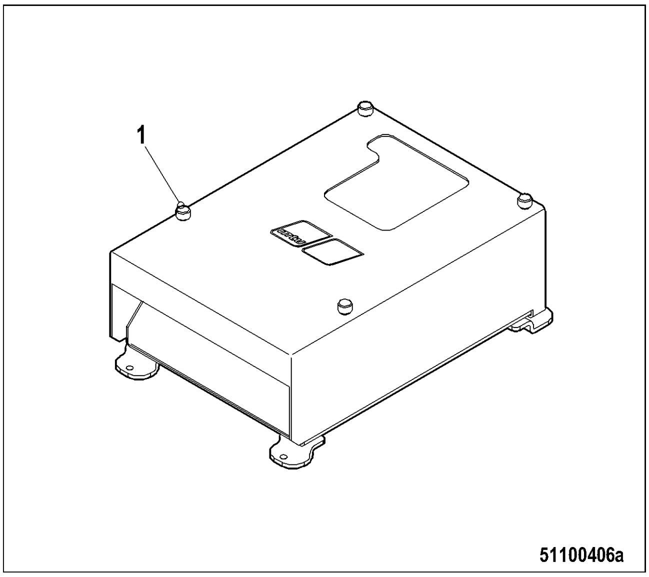
TIM ID: 0000007181 – 001

10.3.3 PIM 4 cover – Removal

CAUTION	Short circuit. **Risk of plant malfunction or breakdown!** • Ensure that no parts fall into the housing.

PIM 4 cover – Removal

1. Undo the knurled-head screws (1) by hand (screws are self-locking). Use a screwdriver to undo them if necessary.
2. Remove the cover.

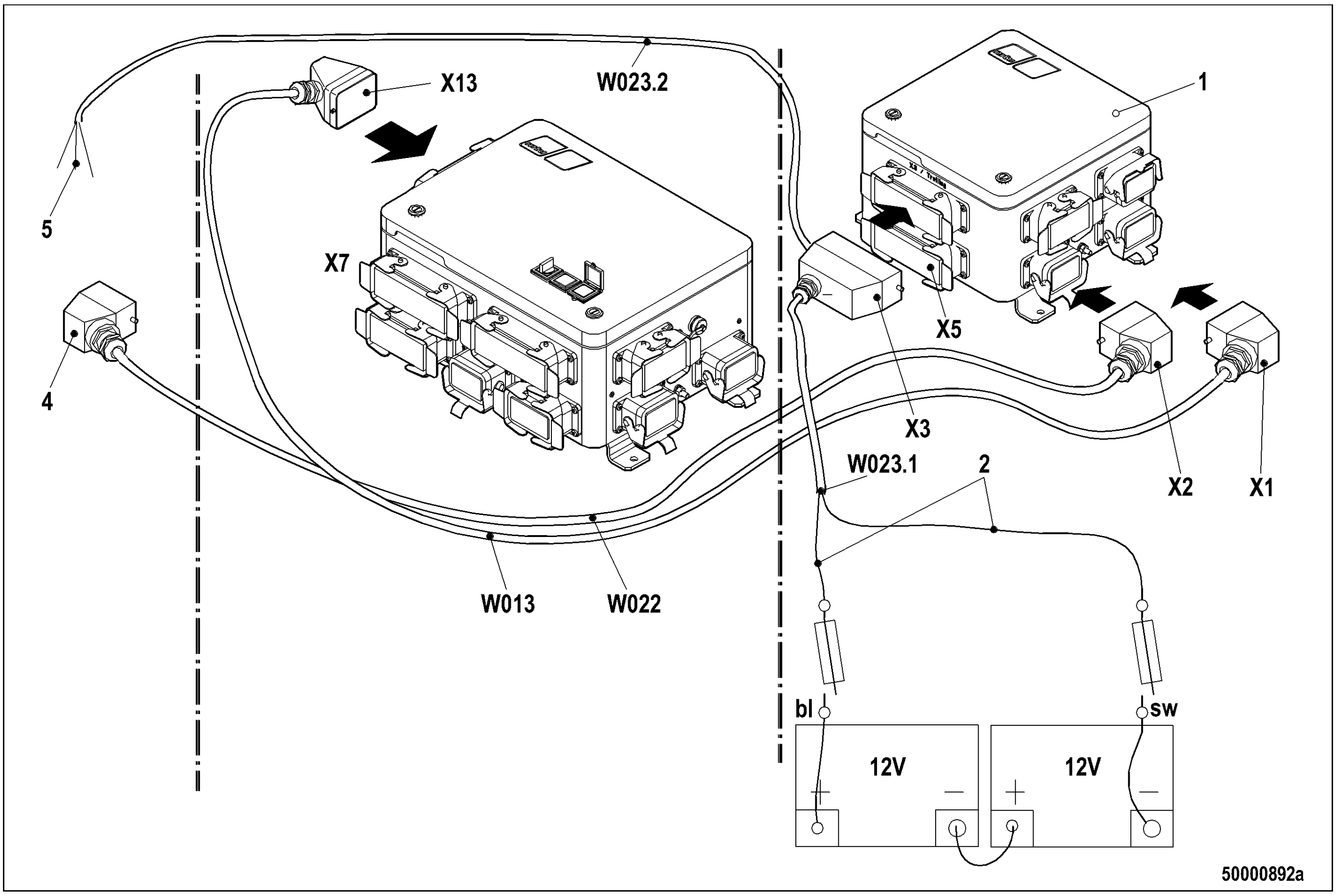


TIM ID: 0000007178 – 001

10.3.4 GCU 3 – Connection

Preconditions

- Cables are routed properly.
- Cables are long enough.



Connectors on GCU

Note: The figure shows connection of GCU 3 to LOP 6 as an example.

1. Remove protective cover from connector socket X1 on GCU.
2. Plug connector X1 of cable W013 into connector socket X1 on the Gear Control Unit (1).
3. Remove protective cover from connector socket X2 on GCU.
4. Plug connector X2 of cable W022 into connector socket X2 on the Gear Control Unit (1).
5. Remove protective cover from connector socket X3 on GCU.
6. Plug connector X3 of cable W023 into connector socket X3 on the Gear Control Unit (1).
7. Engage all connector locking clips.

TIM ID: 0000007193 – 004

Connecting the gearbox trolling device

Note: Only a schematic representation of cable connection at the battery is shown as this varies greatly depending on the specifics of the vessel. Two-pole power circuit-breakers must be provided both in the ground and positive circuits between the connection terminals and the MTU cables.

1. Secure the MTU cable in the vicinity of the battery and cut to a suitable length.
2. Route the two individual wires (2) of cable W023.1 to the power supply connecting points (3) and cut to a suitable length.
   2.1. Blue or brown — positive terminal
   2.2. Black — Negative terminal
3. Fit cable lugs which fit the connecting points to the individual wires.
4. Connect both individual wires to the supply voltage terminals.
5. Route two individual wires (5) of cable W023.2 to the trolling device and cut to a suitable length.
6. Pinpoint the corresponding connections on the trolling device (terminal strip, sensors, actuators).
7. Gain access to the connection points.
8. Connect the individual wires to the connecting points in accordance with the MTU “Wiring diagram”.

Connecting to gearboxes with connector sockets

1. Pinpoint the connector socket on the gearbox.
2. Plug connector X5 (4) of cable W022 into the connector socket on the gearbox.
3. Engage connector lock if applicable.

Connecting to gearboxes with terminal strips

Note: An open-ended cable W022 without any connector (4) is supplied for some gearboxes.

1. Access the terminal strip on the gearbox.
2. Connect the individual wires of cable W022 to the terminal strip (→MTU “Wiring diagram”) (→Gearbox documentation)
3. Fix the wires and secure the terminal strip (depending on design).

Connecting to third-party gearboxes (not MTU scope of delivery)

Note: An open-ended cable is supplied for gearbox types unknown to MTU. In such cases, it is the responsibility of the shipyard to determine how to connect up the gearbox on the basis of the gearbox documentation.

1. Pinpoint and access connections on the gearbox (terminal strip, sensors, actuators).
2. Connect the individual wires to the connection points. Assignment of the wires: (→ Page 355)

Note: A connector to which additional Yard signals must be applied is delivered loose.

3. Connect signal cable/wires to connector X5. Assignment of the pins: (→ Page 355)
4. Assemble connector X5.
5. Secure cabling.
6. Connect connector X5 to socket X5 on the Gear Control Unit (1).

TIM ID: 0000007193 – 004

10.3.5 GCU – Pin assignment for third-party gearbox

Cable W022

The individual wires of cable W022 are assigned as follows:

Core No.	Signal	Meaning
1	Enginewise rotation setting (+24 VDC)	Voltage applied: Valve is activated
2	Enginewise rotation setting (GND)	
3	Gearbox neutral setting (+24 VDC)	Depending on gearbox type: • Not used • Switched by disengagement enable • Always energized by disengagement enable
4	Gearbox neutral setting (GND)	
5	Contrarotation setting (+24 VDC)	Voltage applied: Valve is activated
6	Contrarotation setting (GND)	
7	Output voltage (+24 VDC) for “Gearbox engaged in enginewise rotation” limit switch	On gearboxes with limit switches
8	Input “Gearbox engaged in enginewise rotation”	+24 V DC equivalent to engaged
9	Output voltage (+24 VDC) for “Gearbox disengaged” limit switch	On gearboxes with limit switches
10	Input “Gearbox disengaged”	+24 V DC equivalent to disengaged
11	Output voltage (+24 VDC) for “Gearbox engaged in contrarotation” pressure switch	On gearboxes with limit switches
12	Input “Gearbox engaged in contrarotation”	+24 V DC equivalent to engaged
13	Output voltage (+24 VDC) for “Electrical control” limit switch	On gearboxes with limit switches
14	Input “Electrical control”	+24 V DC equivalent to electrical control
15	Input gearbox control oil pressure (+24 VDC)	4 mA ... 20 mA 0 bar ... 30 bar
16	Input gearbox control oil pressure	
17	Not assigned	
18	Input gearbox lube oil pressure (+24 VDC)	4 mA ... 20 mA 0 bar ... 10 bar
19	Input gearbox lube oil pressure	
20	Not assigned	

Core No.	Signal	Meaning
21	Input gearbox oil temperature	Pt1000 0 °C 120 °C
22	Input gearbox oil temperature	
23	Input (pressure switch) gearbox oil pressure before filter	Switching signal for “gearbox oil filter clogged”
24	Input (pressure switch) gearbox oil pressure before filter	Switching signal for “gearbox oil filter clogged”
25	Not assigned	
26	Not assigned	
27	Not assigned	
28	Not assigned	
—	Shield	

TIM ID: 0000007191 – 003

Connector X5

Connector socket X5 is provided on the Gear Control Unit GCU to connect Yard signals. A separate connector to which these signals may be connected is supplied for this socket. The pins of connector X5 are assigned as follows:

Pin No.	Signal	Comments
1	Output voltage +24 VDC	For “Engagement interlock” signal
2	Engagement interlock input	+24 VDC equivalent to “Interlock” setting
3	Output voltage +24 VDC	For “Disengagement” signal
4	Disengagement input	+24 VDC equivalent to “Disengage” setting
5	Output voltage +24 VDC	For “Trolling active/Alarm interlock” signal
6	GND	Ground
7	Trolling active/Alarm interlock input	+24 VDC equivalent to/means active
8	Trolling active/Alarm interlock input	0 VDC equivalent to/means active
9*	Input voltage +24 VDC_Ext.	Reserved for two-speed gearbox
10*	Input voltage GND_Ext.	Reserved for two-speed gearbox
11*	2-speed manual setting output	Reserved for two-speed gearbox
12*	2-speed manual setting output 2nd gear	Reserved for two-speed gearbox
13*	Output voltage GND_Ext.	Reserved for two-speed gearbox
14*	Output voltage +24 VDC_Ext.	Reserved for two-speed gearbox feedback
15*	Output voltage GND	Reserved for two-speed gearbox feedback
16*	2-speed manual input	+24 VDC equivalent to/means manual
17*	2-speed manual input	0 VDC equivalent to/means manual
18*	2-speed manual setting input 2nd gear	+24 VDC equivalent to/means 2nd gear
19*	2-speed manual setting input 2nd gear	0 VDC equivalent to/means 2nd gear

Pin numbers marked * and the associated signals are currently not used and are intended for future applications.

TIM ID: 0000007191 – 003

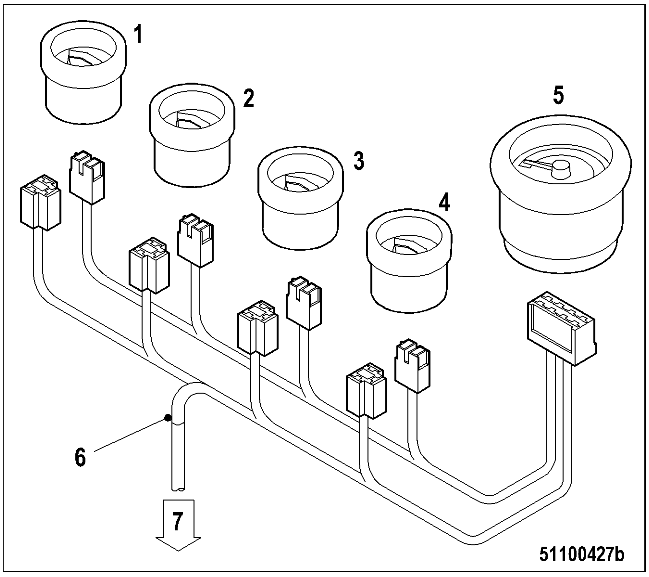
10.3.6 Connecting display instruments on the main control stand

Preconditions

- Cables are routed properly.
- Cable harness is long enough.

Connecting instruments

1. Plug connector (5) into the speed display instrument until the clip engages.
2. Plug the two connectors (4) into the engine oil pressure instrument.
3. Plug the two connectors (3) into the engine coolant temperature instrument.
4. Plug the two connectors (2) into the gear oil control pressure display instrument.
5. Plug the two connectors (1) into the gearbox oil temperature display instrument (two connectors for signal and illumination).



1 Connector P005 (two connectors for signal and lighting), gear-oil temperature display instrument
2 Connector P004 (two connectors for signal and lighting), gear control oil pressure display instrument
3 Connector P003 (two connectors for signal and lighting), engine coolant temperature display instrument
4 Connector P002 (two connectors for signal and lighting), engine oil pressure display instrument
5 Connector P001 (two connectors for signal and lighting), speed display instrument
6 Cable W114 to MCS control unit main control stand
7 Connection to MCS control unit main control stand

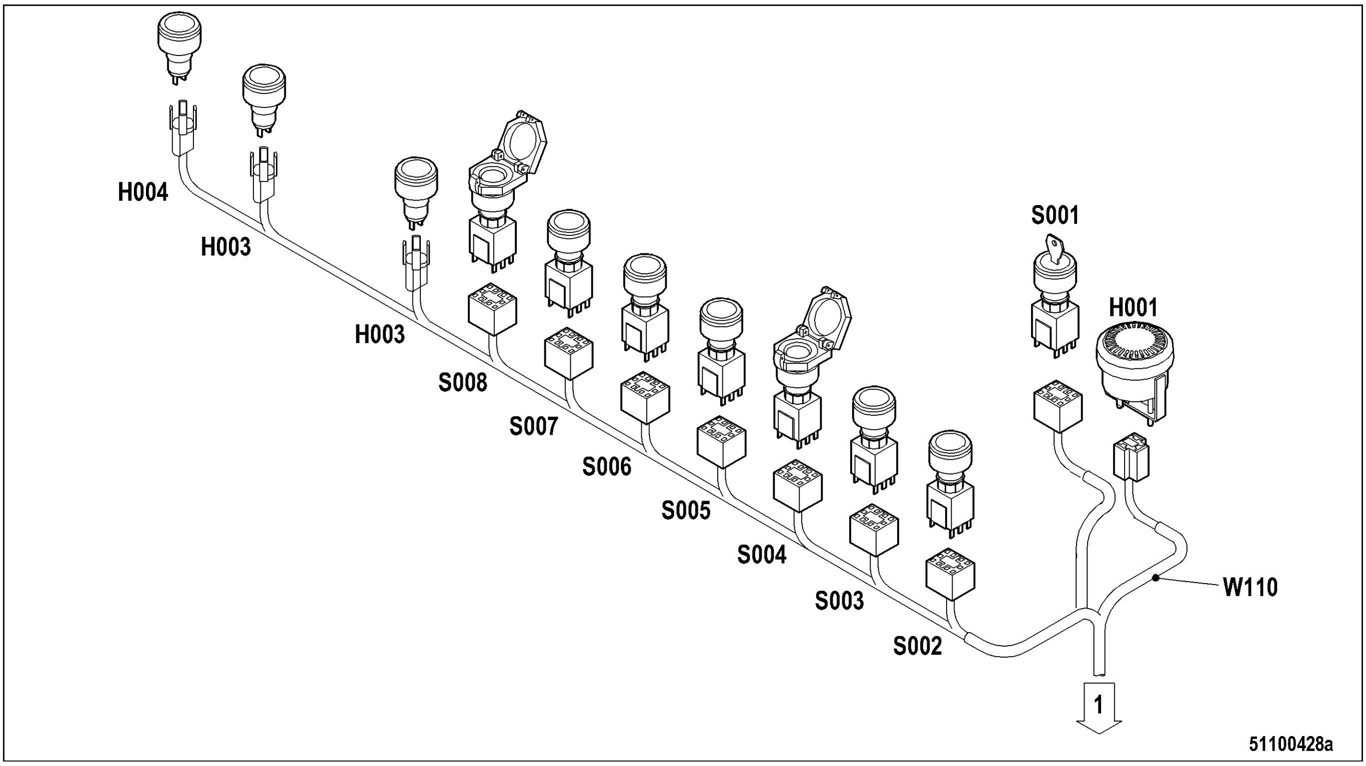
TIM ID: 0000007194 – 003

10.3.7 Main control stands – Connecting controls and status indicator lamps

Preconditions

- Cables are properly routed.
- Cable harness is long enough.

Connecting controls and status indicator lamps



1 Connection to MCS-5 control unit main control stand

W110 Cable to MCS-5 control unit main control stand

1. Plug connector S001 onto the key switch (on main control stand 1 only)
2. Plug H001 onto the horn.
3. Plug connector S002 onto illuminated pushbutton START.
4. Plug connector S003 onto illuminated pushbutton STOP.
5. Plug connector S00$ onto illuminated pushbutton EMERGENCY STOP.
6. Plug connector S005 onto illuminated pushbutton COMBINED ALARM/ACKNOWLEDGE.
7. Plug connector S006 onto illuminated pushbutton DIMM UP.
8. Plug connector S007 onto illuminated pushbutton DIMM DOWN.
9. Plug connector S008 onto illuminated pushbutton OVERRIDE.
10. Plug connector H002 onto indicator lamp READY FOR START/STOP.
11. Plug connector H003 onto indicator lamp ENGINE/GEAR ALARM.
12. Plug connector H004 onto indicator lamp SENSOR/SYSTEM FAULT.

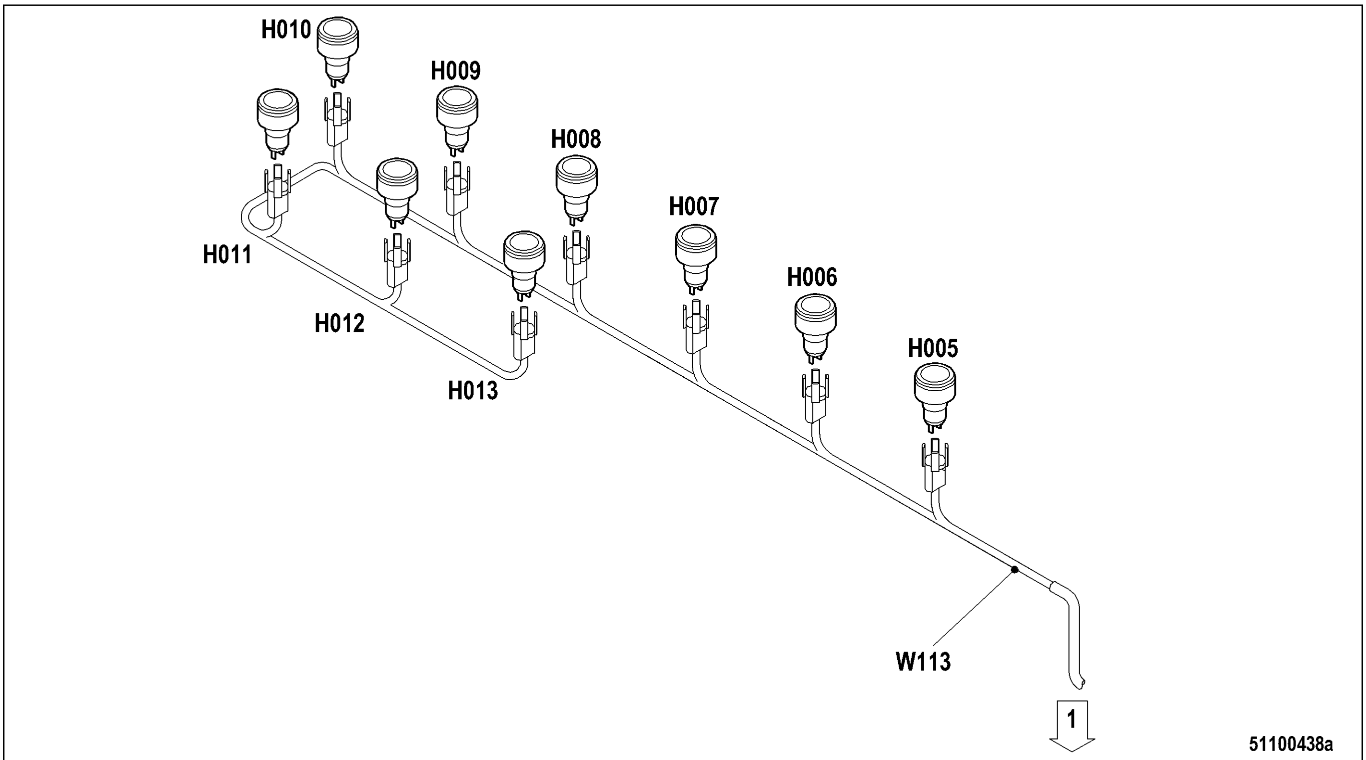
TIM ID: 0000007195 – 001

10.3.8 Indicator lamps for single-point alarms – Connection

Preconditions

- Cables are properly routed.
- Cable harness is long enough.

Indicator lamp connection



1	Connection to MCS-5 control unit main control stand	W...	W113 cable to MCS-5 control unit main control stand

1. Plug connector H005 onto indicator lamp Auto Reduction/Stop.
2. Plug connector H006 onto indicator lamp Overspeed.
3. Plug connector H007 onto indicator lamp Lube Oil Pressure Low.
4. Plug connector H008 onto indicator lamp Coolant Temperature High.
5. Plug connector H009 onto indicator lamp Gear Oil Pressure Low.
6. Plug connector H010 onto indicator lamp Gear Oil Temperature High.
7. Plug connector H011 onto indicator lamp Coolant Level Low.
8. Plug connector H012 onto indicator lamp Leak. Fuel Level High.
9. Plug connector H013 onto indicator lamp Water in Fuel Pre-Filter.

TIM ID: 0000007196 – 003

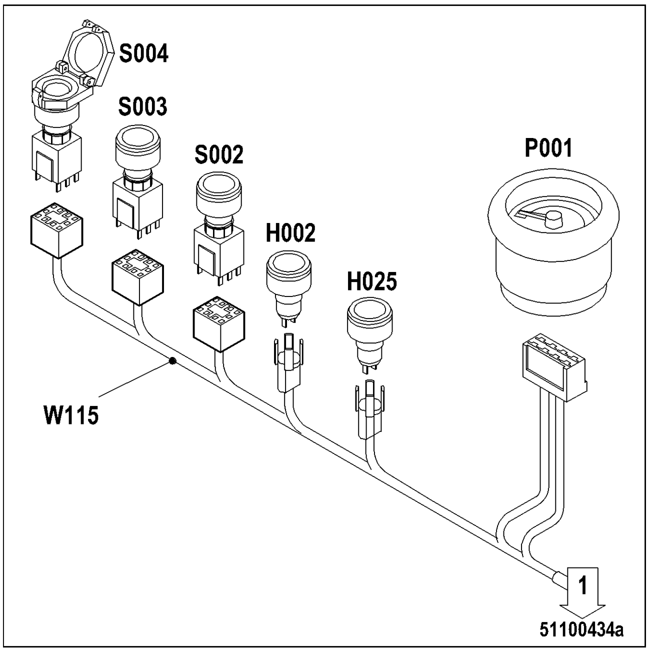
10.3.9 Connecting devices on a slave control stand

Preconditions

- Cables are properly routed.
- Cable harness is long enough.

Connecting indicators and controls

1. Plug connector P001 into the speed display instrument until the clip engages.
2. Plug connector H025 onto indicator lamp COMBINED ALARM.
3. Plug connector H002 onto indicator lamp READY FOR START/STOP.
4. Plug connector S002 onto illuminated pushbutton START.
5. Plug connector S003 onto illuminated pushbutton STOP.
6. Plug connector S004 onto illuminated pushbutton EMERGENCY STOP.



1 Connection to MCS-5 control unit main control stand
W... W115 cable to MCS-5 control unit main control stand

TIM ID: 0000006751 – 002

10.3.10 PIM 4 MCS control unit – Connection

Preconditions

- Cables are routed properly.

CAUTION	Incorrect installation can lead to destruction of the device. **Damage to component!** • Ensure correct connector alignment.

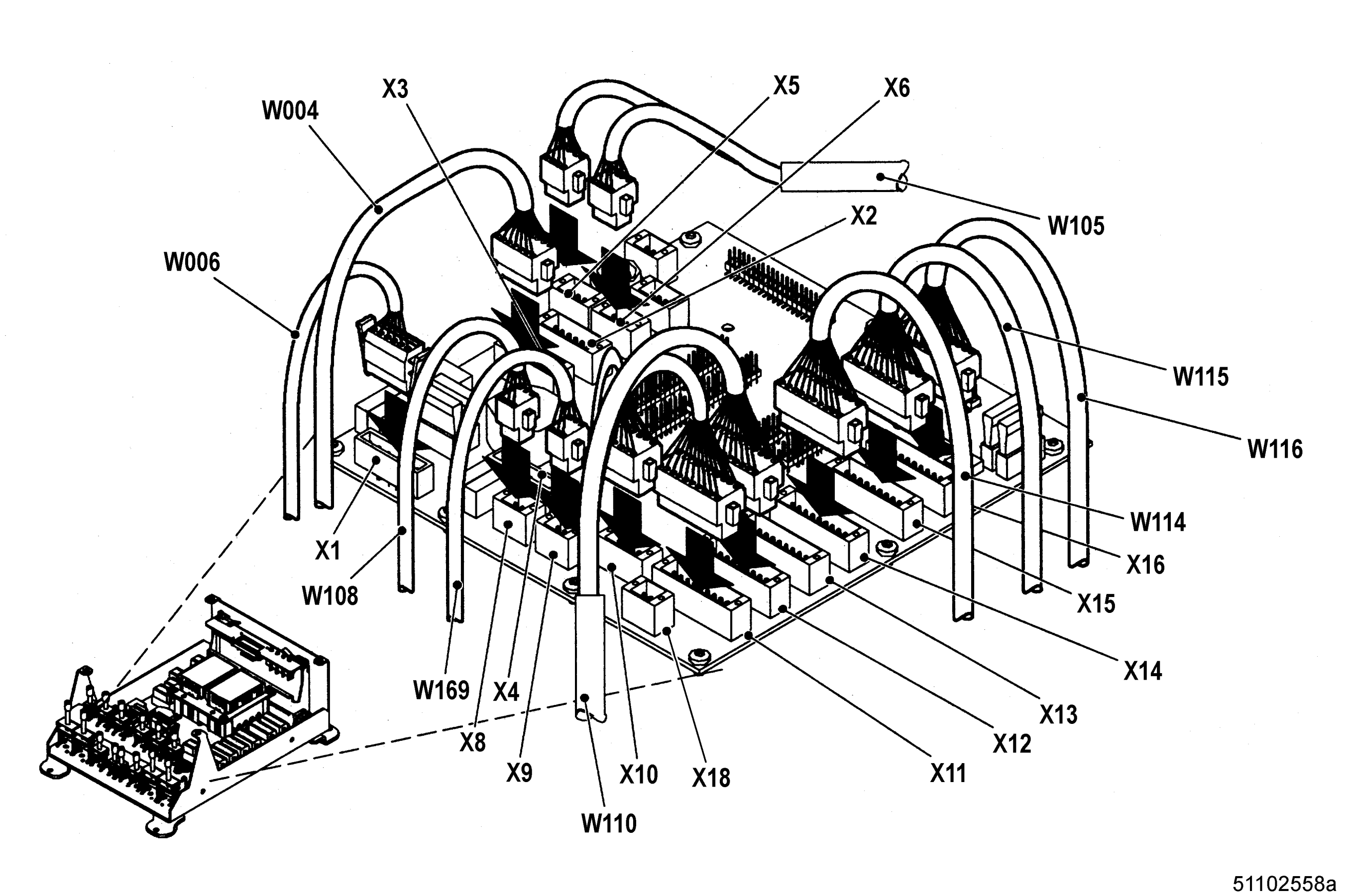
Remove PIM 4 control unit cover (→ Page 352)**.**

Removing strain relief clips

1. Turn the screw on the expanding clips at the cable entries counterclockwise as far as they will go.
   Result: The claws are thus sufficiently expanded to allow the clips to be removed from the four bores.
2. Remove all expanding clips.

TIM ID: 0000033299 – 002

Connecting PIM 4 MCS on main control stands 1 and 2 (if applicable)



W... Cable
X... Connector or cable entry at connector

Note: The cable numbers Wxxx acc. to the illustration are applicable to main control stand 1. On main control stand 2, cable routing changes as follows:
- Instead of cable W006 (from LOP), connect cable W102 (from main control stand 1).
- Instead of cable W004 (from LOP), connect cable W104 (from main control stand 1).

1. Pinpoint sockets X10, X11 and X12 on the printed circuit board of the MCS-5 control unit in the main control stand. Plug connectors X10, X11 and X12 of cable W110 leading to the illuminated pushbuttons, status indicator lamps and the key switch into sockets X10, X11 and X12. Check polarity!
2. Pinpoint socket X14 on the printed circuit board of the MCS-5 control unit. Plug connector X14 of cable W114 leading to the display instruments into socket X14. Check polarity!
3. Version with single-point alarm indicator lamps only: Pinpoint socket X13 on the printed circuit board of the MCS-5 control unit. Plug connector X13 of cable W113 leading to the alarm indicator lamps into socket X13. Check polarity!
4. Version with display only: Pinpoint socket X9 on the printed circuit board of the MCS-5 control unit. Plug connector X9 of cable W169 leading to the display into socket X9. Check polarity!

TIM ID: 0000033299 – 002

On main control stand 1 only

1. Pinpoint socket X8 on the printed circuit board of the MCS-5 control unit. Plug connector X8 of cable W108 leading to the RCS-5 control unit into socket X8. Check polarity!
2. Pinpoint sockets X5 and X6 on the printed circuit board of the MCS-5 control unit. Remove pluggable jumper from sockets X5 and X6, it is no longer required.
3. Plug connectors X5 and X6 of cable W105 leading to the RCS-5 control unit into sockets X5 and X6. Check polarity!

4. Pinpoint socket X3 on the printed circuit board of the MCS-5 control unit. Plug connector X3 of cable W004 leading to the Local Operating Panel LOP into socket X3. Check polarity!
5. Pinpoint socket X1 on the printed circuit board of the MCS-5 control unit. Plug connector X1 of cable W006 leading to the Local Operating Panel LOP into socket X1. Check polarity! Press in the connectors until the clips engage.
6. Only if main control stand 2 is fitted:
   6.1. Pinpoint socket X2 on the printed circuit board of the MCS-5 control unit in main control stand 1.
   6.2. Plug connector X1 of cable W102 leading to main control stand 2 into socket X2. Check polarity!
   6.3. Press in connector X1 until the lock engages.
   6.4. Pinpoint socket X4 on the printed circuit board of the MCS-5 control unit in main control stand 1. Remove bus terminator from socket X4, it is no longer required.
   6.5. Plug connector X4 of cable W104 leading to the MCS-5 control unit in main control stand 2 into socket X4. Check polarity!
7. Only when main control stand 1 is included:
   7.1. Pinpoint socket X15 on the printed circuit board of the MCS-5 control unit in main control stand 1.
   7.2. Plug connector X15 of the cable W115 leading to the pushbuttons, indicator lamps and the instrument on slave control stand 1 into socket X15. Check polarity!
8. Only when slave control stand 2 is included:
   8.1. Pinpoint socket X16 on the printed circuit board of the MCS-5 control unit in main control stand 1.
   8.2. Plug connector X16 of the cable W116 leading to the pushbuttons, indicator lamps and the instrument on slave control stand 2 into socket X16. Check polarity!

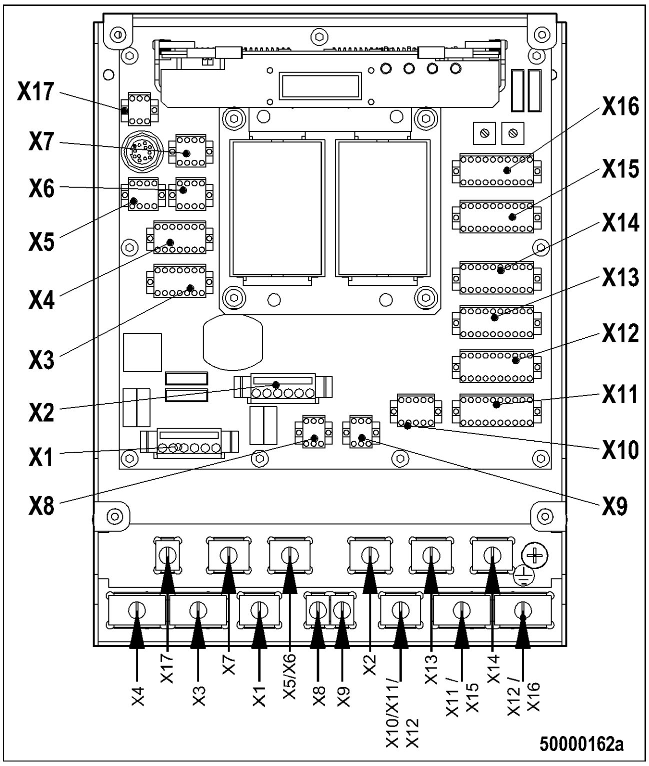
Main control stand 2 only (if applicable)

1. Pinpoint socket X3 on the printed circuit board of the MCS-5 control unit in main control stand 2. Plug connector X3 of cable W104 leading to the MCS-5 control unit in main control stand 1 into socket X3. Check polarity!
2. Pinpoint socket X1 on the printed circuit board of the MCS-5 control unit in main control stand 2. Plug connector X1 of cable W102 leading to the MCS-5 control unit in main control stand 1 into socket X1. Check polarity!
3. Press in connector X1 until the lock engages.
4. Version with display only:
   4.1. Remove pluggable jumper from sockets X5 and X6, it is no longer required.
   4.2. Plug connectors X5 and X6 of cable W169 leading to the display into sockets X5 and X6. Check polarity!

TIM ID: 0000033299 – 002

Final steps

1. Route the cables to the strain reliefs as shown in the illustration (X1 – X1, etc.). Avoid crossing cables unnecessarily.
2. Fit the expanding clips one after the other (insert in the four bores provided).
3. Tighten the screws until the cable concerned is adequately secured against strain.
4. Tighten the plug securing screws on all connectors.



X... Connector or cable entry at connector

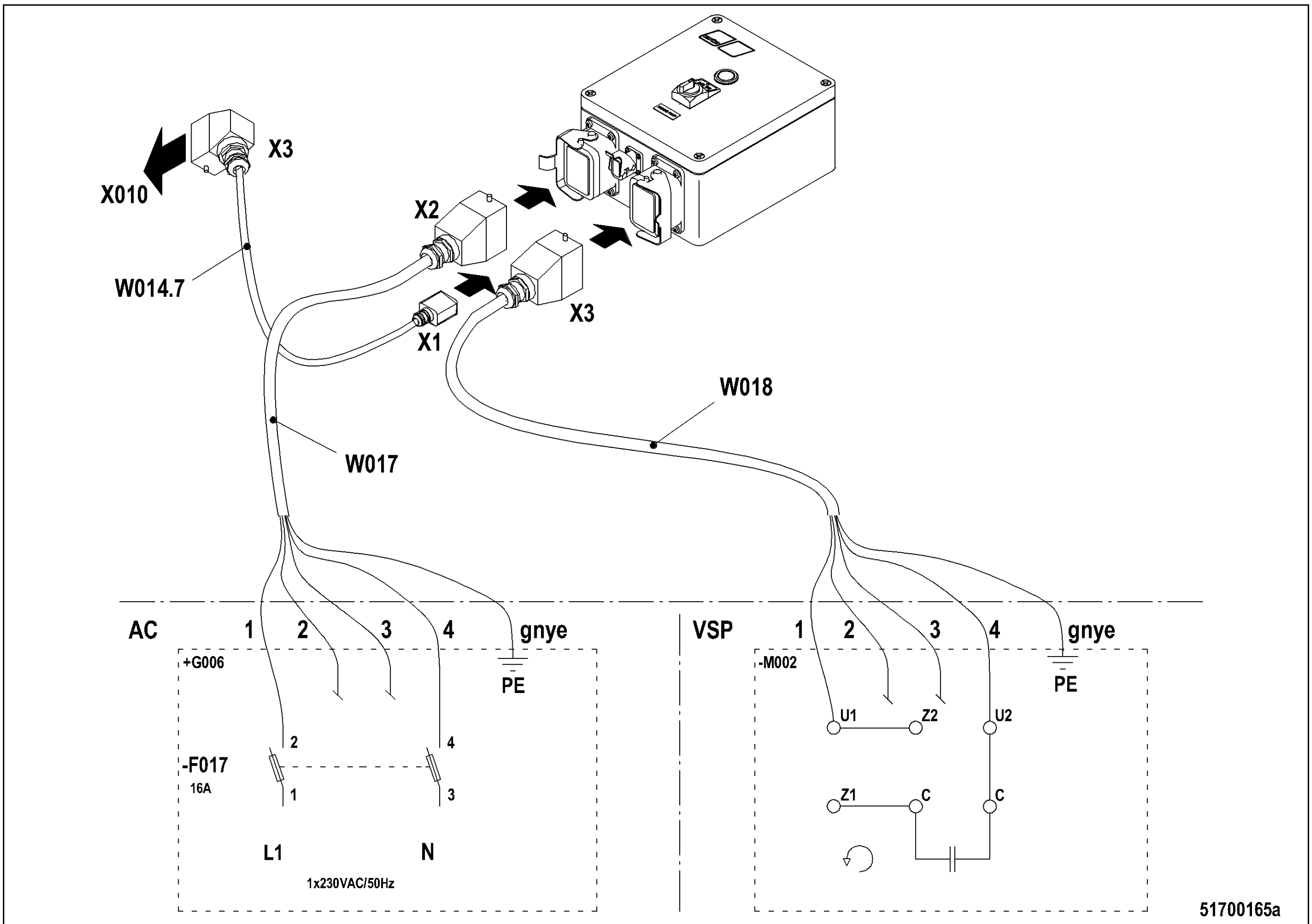
Install PIM 4 control unit cover (→ Page 326).

TIM ID: 0000033299 – 002

10.3.11 Priming Pump Controller PPC – Connection (single phase)

Preconditions

- Cables properly routed
- Cables long enough



Connector on PPC device

Note: The supply connection of cables W017 and W018 is represented schematically in the figure. It depends largely on conditions on-board.

1. Remove cap covering connector socket X1 on PPC.
2. Plug connector X1 of cable W0014.7 into connector socket X1.
3. Remove cap covering connector socket X2 on PPC.
4. Plug connector X2 of cable W017 into connector socket X2.
5. Remove cap covering connector socket X3 on PPC.
6. Plug connector X3 of cable W018 into connector socket X3.

TIM ID: 0000016193 – 001

Connecting the pump and the supply voltage

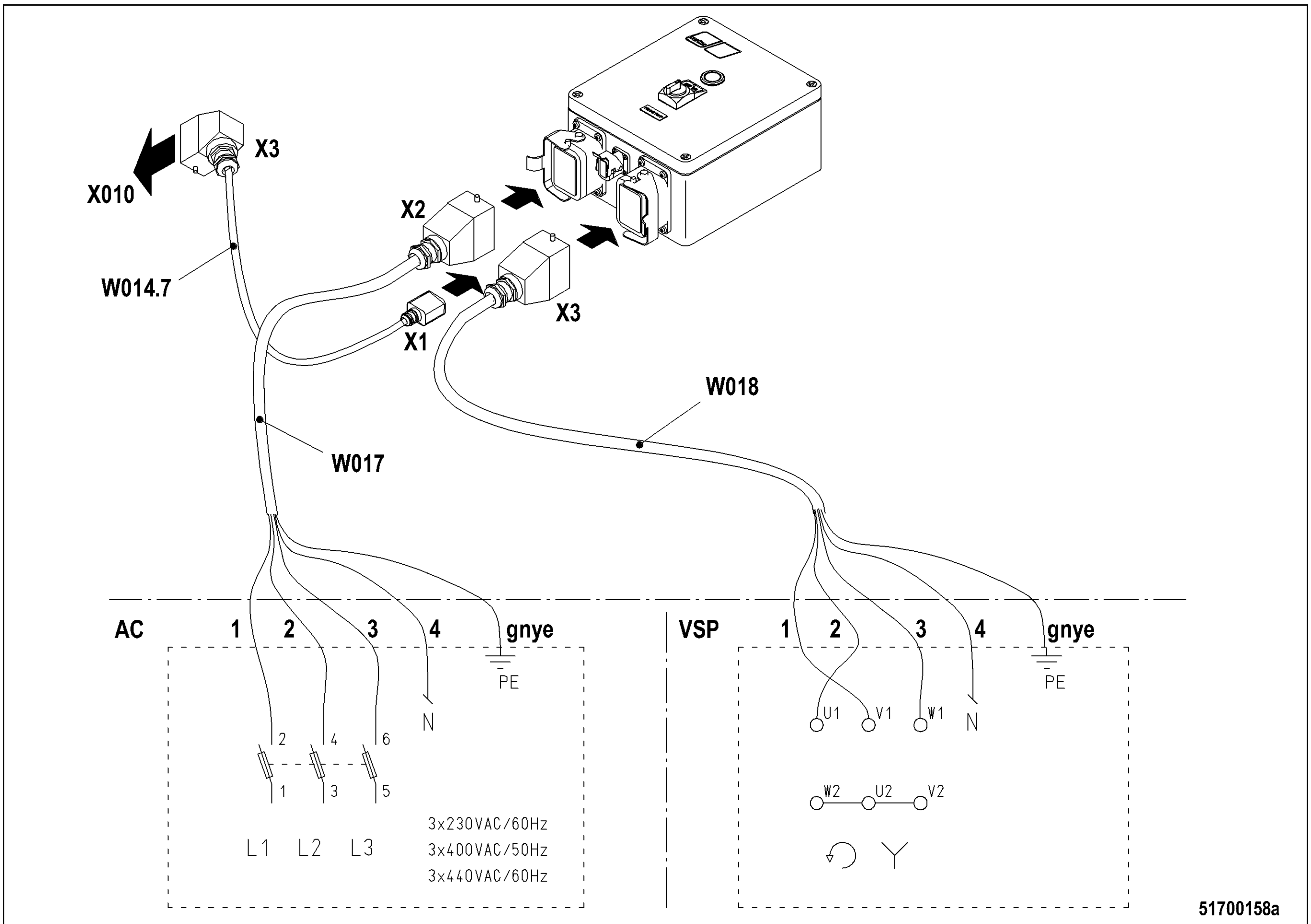
1. Connect individual cores of cable W017 to the supply voltage of the oil priming pump.
    1.1. Install two-pole power circuit breakers in all lines between the connection points and the MTU cable.
    1.2. Prepare the cores:
        - Core 1: L1
        - Core 2: not used, insulate
        - Core 3: not used, insulate
        - Core 4: Neutral conductor
        - Core yellow/green: Housing ground
2. Connect individual cores of cable W018 to the oil priming pump:
    - Core 1: V1/Z2
    - Core 2: not used, insulate
    - Core 3: not used, insulate
    - Core 4: U2
    - Core yellow/green: Housing ground

TIM ID: 0000016193 – 001

10.3.12 Priming Pump Controller PPC – Connection (three phases)

Preconditions

- Cables properly routed
- Cables long enough



Connector on PPC device

Note: The supply connection of cables W017 and W018 is represented schematically in the figure. It depends largely on conditions on-board.

1. Remove cap covering connector socket X1 on PPC.
2. Plug connector X1 of cable W0014.7 into connector socket X1.
3. Remove cap covering connector socket X2 on PPC.
4. Plug connector X2 of cable W017 into connector socket X2.
5. Remove cap covering connector socket X3 on PPC.
6. Plug connector X3 of cable W018 into connector socket X3.

TIM ID: 0000016194 – 001

Connecting the pump and the supply voltage

1. Connect individual cores of cable W017 to the supply voltage of the oil priming pump.
    1.1. Install two-pole power circuit breakers in all lines between the connection points and the MTU cable.
    1.2. Prepare the cores:
    - Core 1: L1
    - Core 2: L2
    - Core 3: L3
    - Core 4: N, not used, insulate
    - Core yellow/green: Housing ground
2. Connect individual cores of cable W018 to the oil priming pump:
    - Core 1: V1
    - Core 2: U1
    - Core 3: W1
    - Core 4: N, not used, insulate
    - Core yellow/green: Housing ground

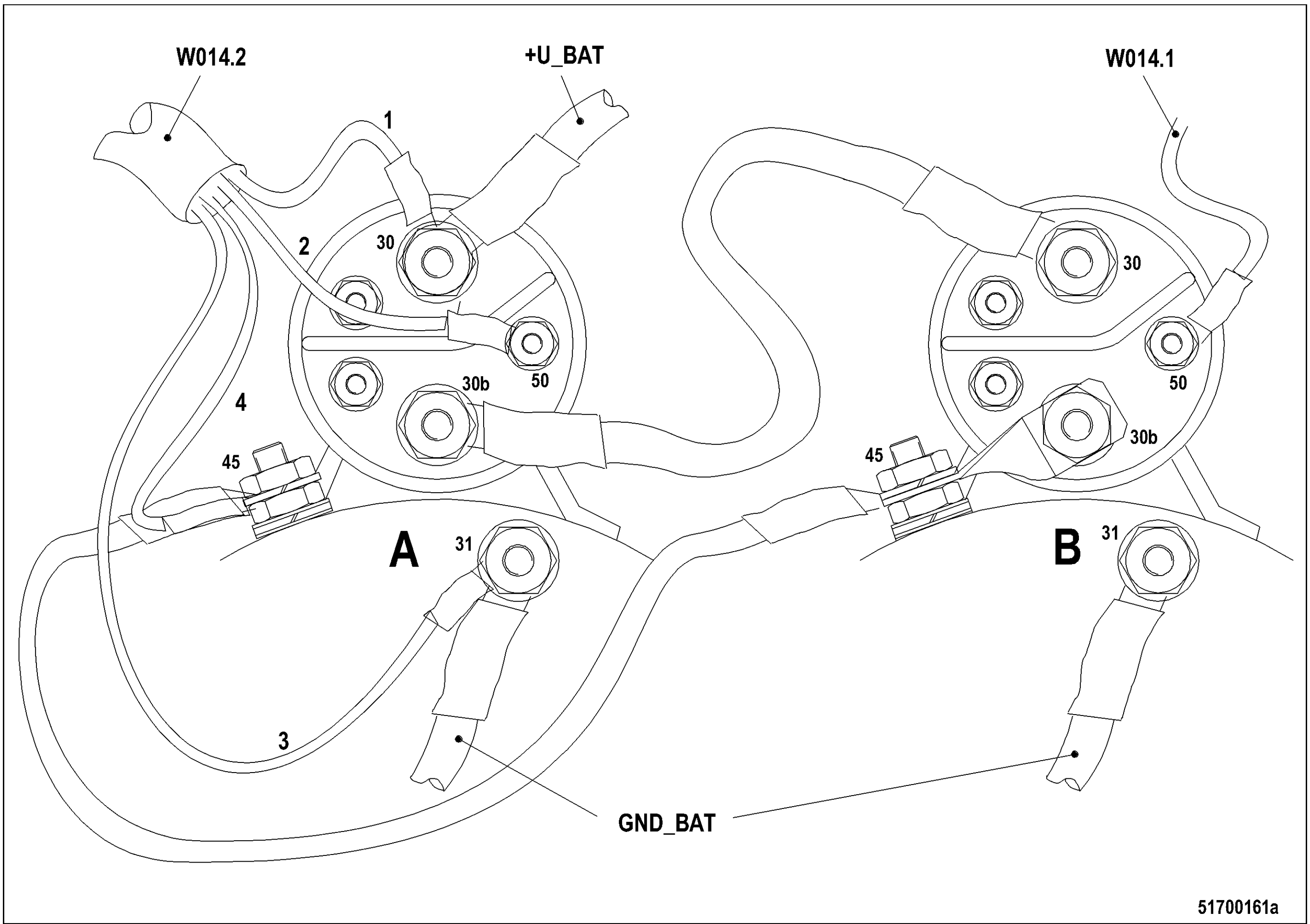
10.3.13 Starter and battery-charging generator – Connection

Preconditions

- Cables properly routed
- Cables long enough
- Required cross-sections have been observed.

CAUTION	Wiring fires due to short-circuits. **Damage to components, major material damage!** • Ensure that connections do not come into contact with each other. • When making connections, make sure that polarity of connections is correct.

Connecting starters A and B — Bosch, Prestolite



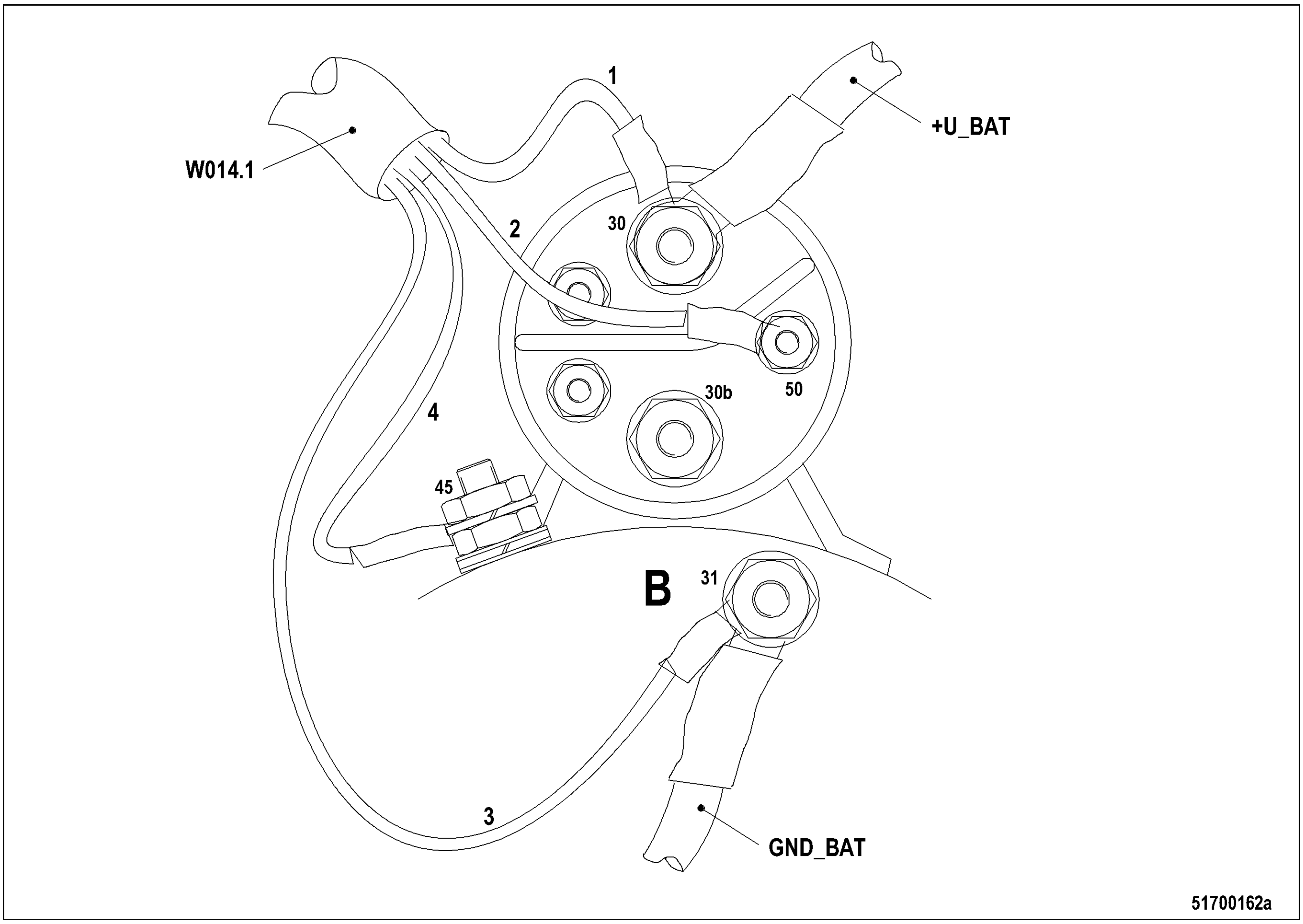
Note: Applicable when two Bosch starters are installed. Starters (A) and (B) and their starter relays are located at the bottom of the engine on the left and right. Starter relays are mounted on top of starters.

1. Route cable (W014.2) with cable lead from terminal box X010 along the engine to the starter.
2. Route two cables (GND_BAT) with an adequate cross-section from battery to starter.
3. Route one cable with an adequate cross-section from starter A to starter B.
4. Fit cable ring for M12 stud to this cable (terminal 30b / terminal 30)
5. Cut cable (W014.2) to size and strip outer insulation back by approx. 100 mm.
6. Conductor 1: Fit cable ring for M12 stud (terminal 30).
7. Conductor 2: Fit cable ring for M6 stud (terminal 50).

TIM ID: 0000007049 – 002

8. Conductor 3: Fit cable ring for M10 stud (terminal 31).
9. Conductor 4: Fit cable ring for M12 stud (terminal 45).
10. Insulate crimp connections with heat-shrinkable hose (red for +, blue or black for --).
11. Fit cable ring for M12 stud (terminal 30) to cable +U_BAT (to battery positive).
12. Fit cable ring for M10 stud (terminal 31) to both GND_BAT cables (to battery negative).
13. Connect cables as shown in figure. Fit all nuts and washers in the right order (see below).
14. Secure cables with cable clamps at suitable points.

Connecting starter B — Bosch, Prestolite



Note: Applicable when only one Bosch starter is installed. Starter (B) is located at the bottom of the engine. Starter relay is mounted on top of starter.

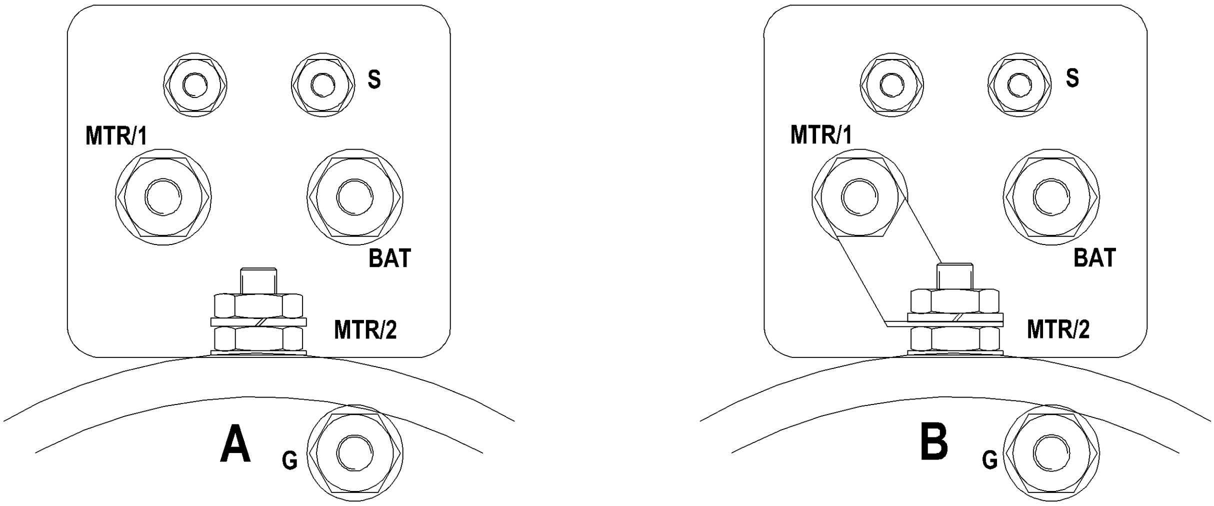
1. Route cable (W014.1) cable lead from terminal box X010 along the engine to the starter.
2. Route one cable (GND_BAT) with an adequate cross-section from battery to starter. Cable cross-sections in accordance with MTU recommendations.
3. Cut the cable (W014.1) to size and strip the outer insulation back by approx. 100 mm.
4. Conductor 1: Fit cable ring for M12 stud (terminal 30).
5. Conductor 2: Fit cable ring for M6 stud (terminal 50).
6. Conductor 3: Fit cable ring for M10 stud (terminal 31).
7. Conductor 4: Fit cable ring for M12 stud (terminal 45).
8. Insulate the crimp connections with heat-shrinkable hose (red for +, blue or black for --).
9. Fit cable ring for M12 stud (terminal 30) to cable +U_BAT (to battery positive).
10. Fit cable ring for M10 stud (terminal 31) to GND_BAT cable (to battery negative).

TIM ID: 0000007049 – 002

11. Connect cables as shown in figure. Fit all nuts and washers in the right order (see below).
12. Secure cables with cable clamps at suitable points.

TIM ID: 0000007049 – 002

Connecting starters A and B — Delco Remy



51700160a

Note: Delco Remy starters are connected similarly to Bosch, Prestolite starters.

1. FIRST REMOVE THE METAL JUMPER BETWEEN CONNECTIONS MTR/1 AND MTR/2 ON STARTER A.
2. Connect the starter as described under“Connecting starters A and B — Bosch; Prestolite”.

Pin assignment Bosch, Prestolite — Delco Remy

Standard designation	Function	Terminal designation Bosch, Prestolite	Delco Remy terminal designation
30	Input directly from battery positive	30	BAT
50	Starter control	50	S
30b	Input battery positive 2nd starter	30b	MTR/2
45	Output at separate starter relay, input at starter (main current)	45	MTR/1
31	Battery ground	31	G

TIM ID: 0000007049 – 002

Connecting starter B — Delco Remy

Note: Delco Remy starter is connected similarly to Bosch, Prestolite starter.

1. See table for pin assignments.
2. Connect the starter as described under “Connecting starter B — Bosch, Prestolite”.

Connecting the battery-charging generator

1. Route cable (W014) with cable lead from terminal box X010 along the engine to the battery-charging generator.
2. Secure cable W014 to battery-charging generator stress reliever.
3. Cut cable W014 to size and strip back approx. 10 cm.
4. Insulate conductor 2, it is not connected.
5. Connect conductor 1 to terminal 61 on the battery-charging generator (spade lug, cable ring etc. depending on the circumstances).
6. For “separate battery banks for starter and electronics” only: Open terminal box X010.
7. Remove jumper wire between terminals X010 -- 2 and X010 -- 9.
8. Route cable W014.3 through cable entry on left side of terminal box (preparing cable entry HSK (→ Page 350)).
9. Connect the cable W014.3 to terminal X010 -- 9 (preparing the terminal strip (→ Page 351)).
10. Route the cable W014.3 to the battery-charging generator and connect it to the + terminal there (means of connection depend on type).
11. Secure cables with cable clamps at suitable points.

Connecting the batteries

1. Fit a suitable connection to the cable applied to the positive terminal on the batteries.
2. Fit a suitable connection to the cable applied to the negative terminal on the batteries.
3. Connect both cables to the battery terminals.

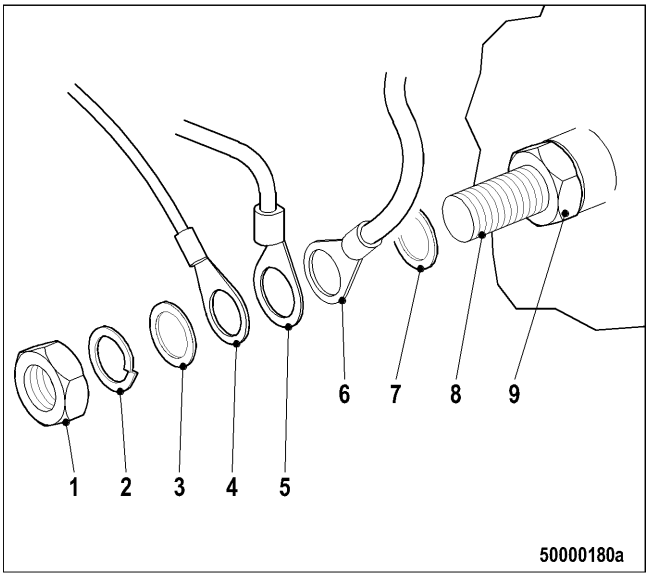
Barring gear limit switch

1. Route cable W037 from terminal box X010 to connector X037 on the engine. Connector X037 is located at the bottom on the ECU mounting plate.
2. Connect the cable in connector X037 and engage the bayonet lock.

TIM ID: 0000007049 – 002

Arrangement of parts on a threaded pin

1. Fit thick cable over stud.
2. Fit thin cable over stud.
3. Fit both washers over stud.
4. Secure the cable with a nut, countering the locknut in so doing.



1 Nut
2 Spring washer
3 Plain washer
4 Ring terminal with thin cable
5 Ring terminal with thick cable
6 Ring terminal with other thick cable
7 Plain washer
8 Stud
9 Locknut

TIM ID: 0000007049 – 002

10.3.14 Connecting engine governor ECU

Preconditions

- Cables are properly routed.
- Cables are long enough.

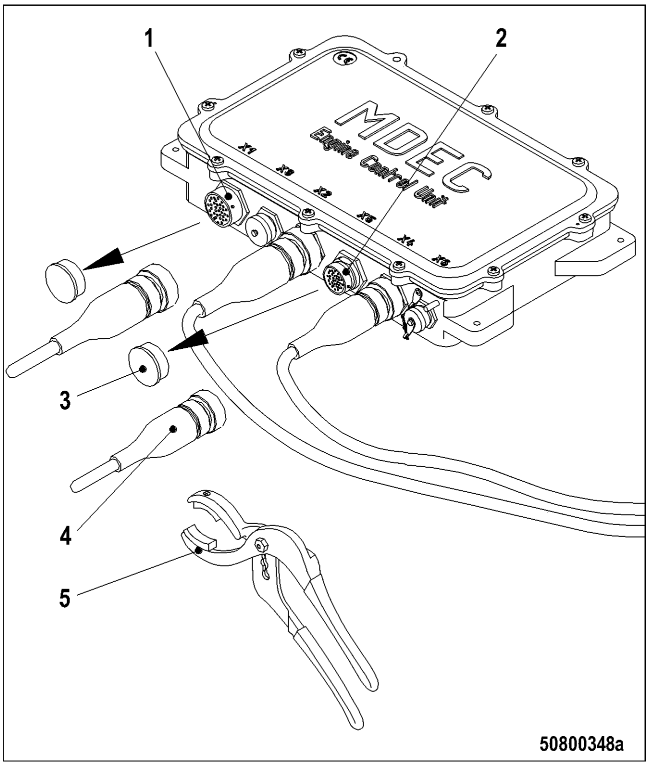
Special tools

Designation / Use	Part No.	Qty.
Connector pliers	0135315483	1

CAUTION	Loose contact at plug connections. **Risk of malfunctions in engine operation!** • Ensure that bayonet union nuts engage completely.

ECU – Connection

1. Remove covers (3) from sockets (1, 2).
2. Plug connector X1 into socket X1.
3. Plug connector X5 into socket X5.
4. Route cables up and away from the engine.
5. Turn the bayonet union nuts on the connectors (4) clockwise using connector pliers (5) until they engage firmly (do not tighten by hand!).



TIM ID: 0000007045 – 002

10.3.15 Barring tool limit switch – Connection

Preconditions

- Cables are routed properly.
- Cables are long enough.

Note: The barring gear limit switches are wired up together with the engine cabling on Series 4000.

Connecting the limit switch

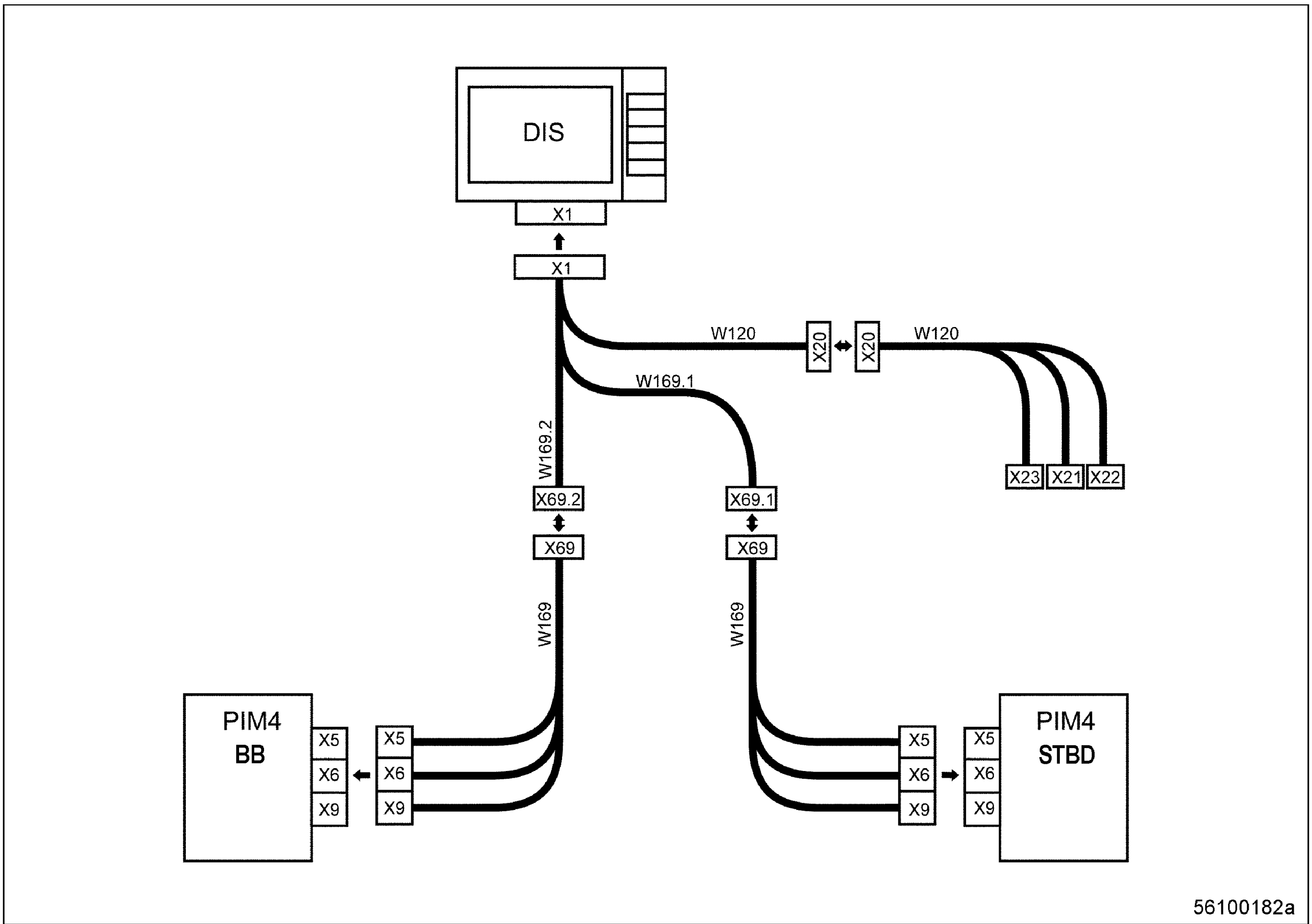
1. Route cable W037 from terminal box X010 to the barring gear limit switches.
2. Remove adapter plug (DIN 72585) from the top left corner of the governor mount and plug it onto the connector of cable W037.
3. Connect cable W037 to the barring gear limit switches with the adapter plug.

TIM ID: 0000007199 – 002

10.3.16 Display MFD – Connection

Note: Connectors X21, X22 and X23 of cable W120 are reserved for future extensions.

Connection diagram variant 1: 1 display for 2 power trains

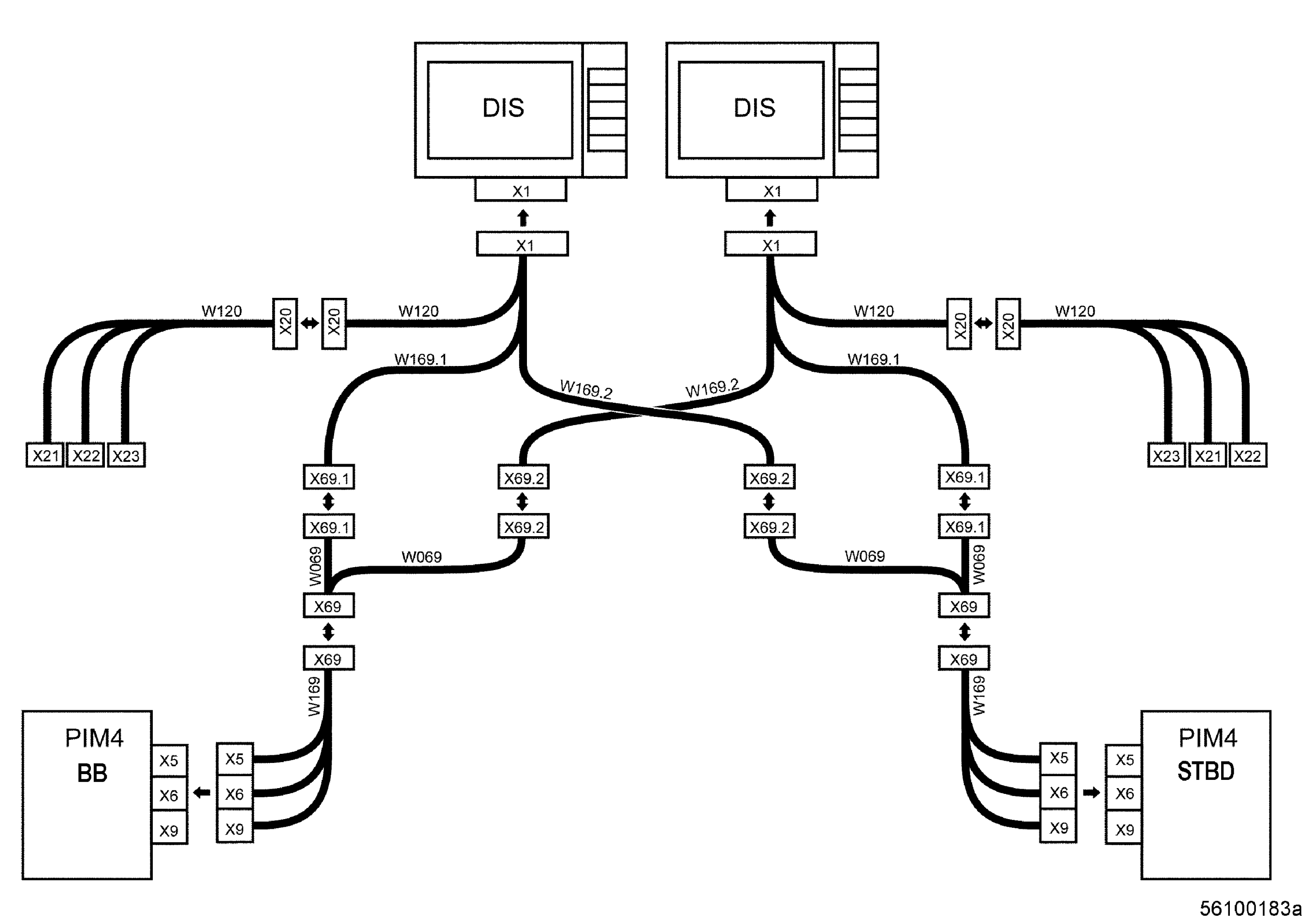


BB Port STBD Starboard

1. Connect the precut cables as shown in the figure.
2. Check that plug connections are firmly seated.

TIM ID: 0000030411 – 002

Connection diagram variant 2: 2 displays for 2 power trains



BB Port STBD Starboard

1. Connect the precut cables as shown in the figure.
2. Check that plug connections are firmly seated.

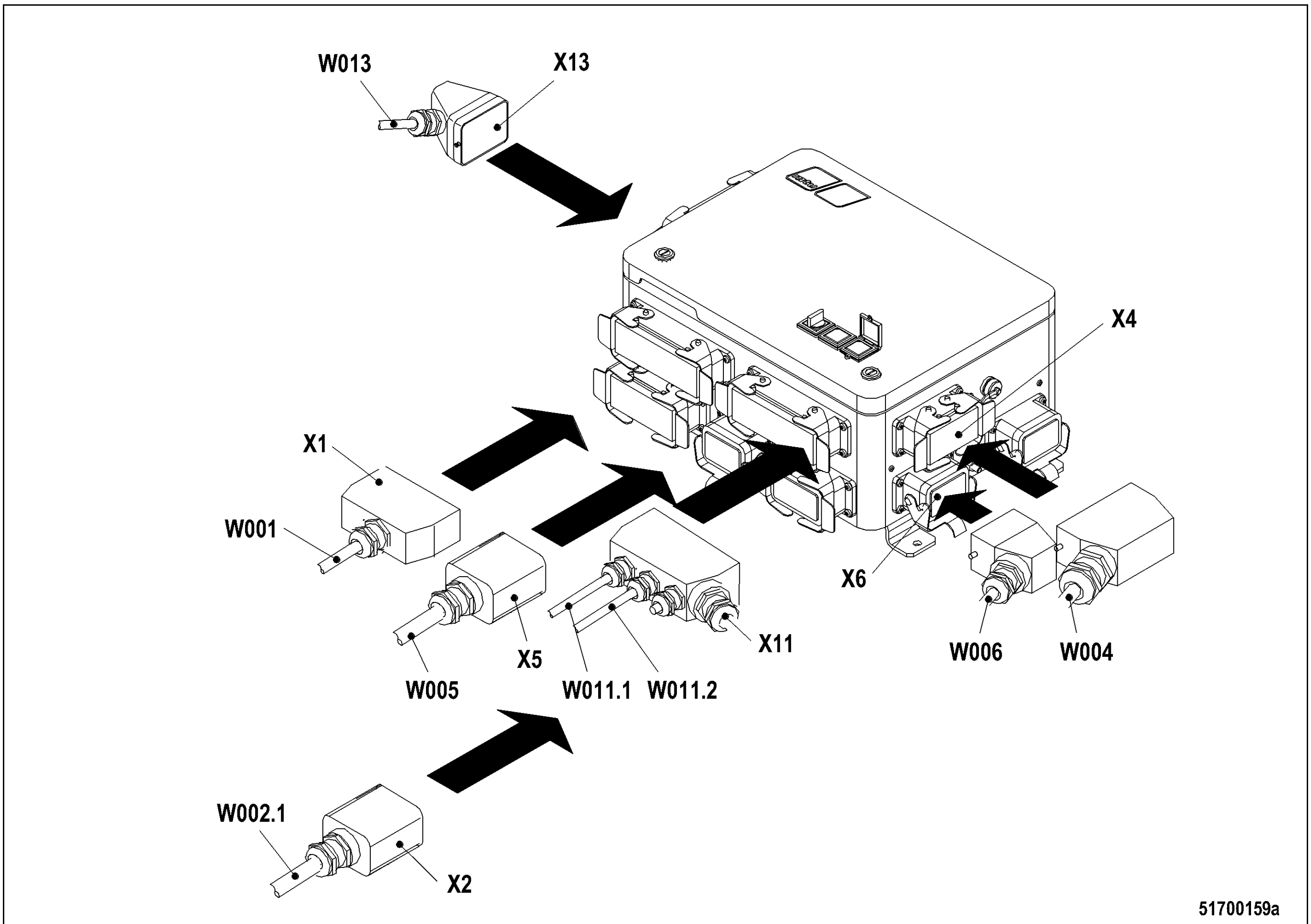
TIM ID: 0000030411 – 002

10.3.17 LOP – Connection

Preconditions

- Cables are routed properly.
- Cables are long enough.

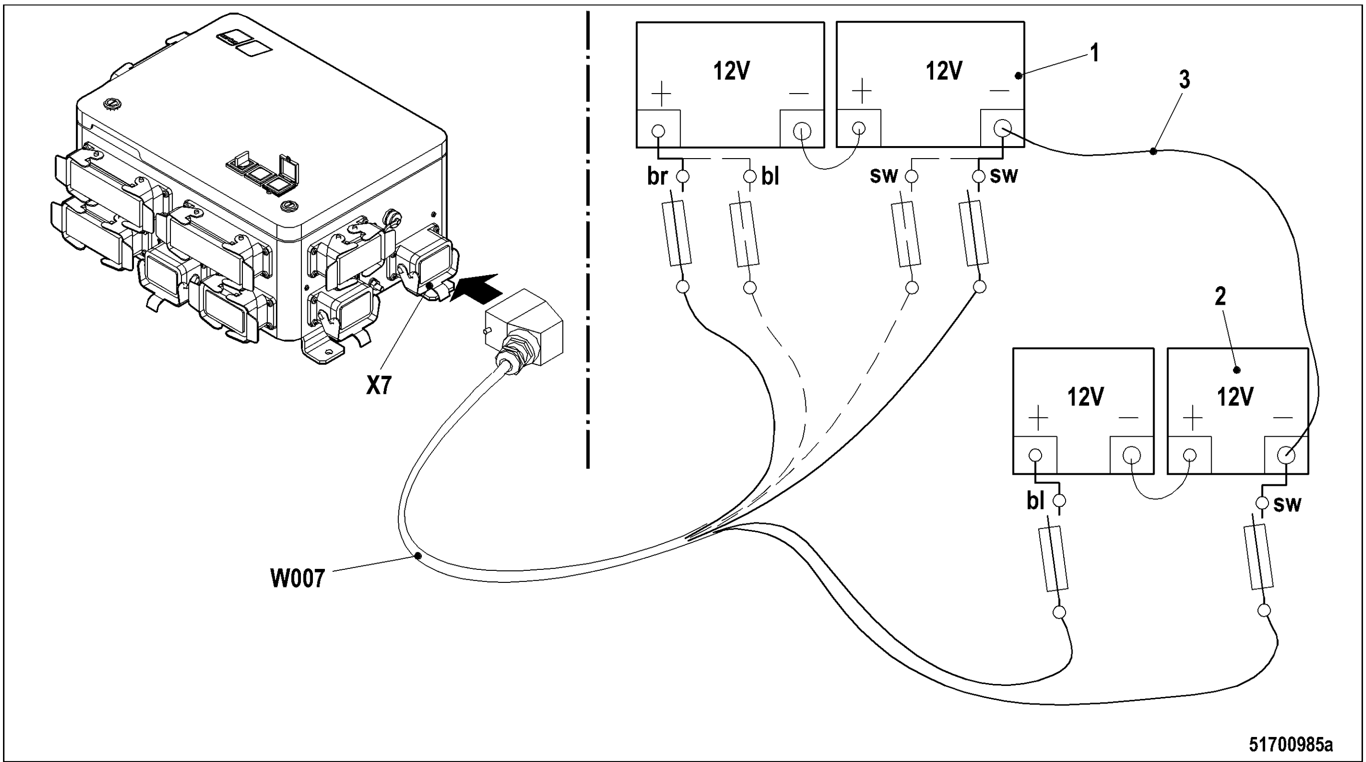
Connectors on the LOP



1. Pinpoint sockets X1 and X5 on LOP in the engine room. Remove the protective covers.
2. Plug connector X1 of the cable W001 (leading to Engine Control Unit ECU) into socket X1.
3. Plug connector X5 of the cable W005 (leading to Engine Control Unit ECU) into socket X5.
4. Pinpoint socket X11 on LOP in the engine room. Remove the protective cover.
5. Plug connector X11 of the cable W011 into socket X11. Check polarity! The connector has two cables (W011.1 and W011.2) for the two “water in fuel prefilter” sensors.
6. Pinpoint socket X13 on LOP in the engine room. Remove the protective cover.
7. Plug connector X13 of the cable W013 (leading to GCU) into socket X13.
8. Pinpoint socket X2 on LOP in the engine room. Remove the protective cover.
9. Plug connector X2 of cable W002.1 leading to terminal box X010 into socket X2.
10. Pinpoint socket X6 on LOP in the engine room. Remove the protective cover.
11. Pinpoint socket X4 on LOP in the engine room. Remove the protective cover.

TIM ID: 0000007051 – 002

Power supply



Note: MTU recommends equipping the vessel with two battery banks for each power train (see fig.). In this case, the auxiliary battery bank may have a lower capacity (approx. 45 Ah) as it is only used to supply the electronic system in emergencies when the starter batteries have become discharged. This increases operational reliability of the electronic system.

1. Connect the negative terminals of the two battery banks to the same ground potential, i.e. interconnect the two battery banks with a suitably thick cable (3).
2. Pinpoint socket X7 on LOP in the engine room. Do not remove the protective cover.
3. Route connector X7 of the cable leading to the battery banks to socket X7, but do not plug it in.
4. Ensure that fuses are provided between the connection terminals and the MTU cables (two-pole power circuit-breakers both in the ground and positive circuits). Only a schematic representation of cable connection at the battery is shown as this varies greatly depending on the specifics of the vessel. Power is generally distributed via a main switchboard.
5. Secure the MTU cable in the vicinity of the connection point and cut it to length.
6. Strip approx. 500 mm of outer sheath off the cable.
7. Route the four individual wires to the connection point and cut to size accordingly:
   7.1. Brown — Main supply positive terminal +24V DC (1)
   7.2. Black — Main supply ground negative terminal (1)
   7.3. Blue — Emergency supply positive terminal (second battery bank if applicable) (2)
   7.4. Black — Emergency supply negative terminal (second battery bank if applicable, ground) (2)
8. Fit suitable terminal lugs on the four individual wires (they must fit on the battery terminals).
9. Connect the four individual wires to the battery terminals.

TIM ID: 0000007051 – 002

Yachts equipped with only one main battery bank for each power train

1. Connect the two cables for + 24 V (brown and blue) together to the supply of this one battery bank (note A in figure).
2. Connect the two cables for ground (both black) together to the ground of this one battery bank (note A in figure).

Connect up the “water in fuel prefilter” level sensors

Note: The system features two sensors (systems with double prefilter). Two cables run from Local Operating Panel LOP (W011.1 and W011.2) from connector X11. Sensor connection is identical.

1. Route the cable W011.1 from Local Operating Panel LOP to the connector of sensor F070. Route the other cable W011.2 from Local Operating Panel LOP to the connector of sensor F070.2.
2. Remove the connector on the filter.
3. Route the cable through the connector housing.
4. Strip off approx. 3 cm of outer sheath from the cable.
5. Strip the three wires and connect them to the connector as follows:
   - 5.1. Wire No.1 +24 V DC supply at connector pin A
   - 5.2. Wire No.2 Supply ground at connector pin B
   - 5.3. Wire No.3 Signal at connector pin C
6. Assemble the connector.
7. Plug in the connector at the fuel prefilter and tighten the union nut.

TIM ID: 0000007051 – 002

10.3.18 Connecting additional Yard signals (optional)

Connector X10

The signals described here are not included in the standard MTU BlueLine product range. A connector to which these signals may be applied is delivered loose for socket X10. The pins of connector X10 are assigned as follows:

Pin No.	Signal	Comments
1	Output voltage +24 VDC	For “Coolant level” sensor
2	Output GND	For “Coolant level” sensor
3	“Coolant level” input	
4	Output voltage +24 VDC	For “Starting-air pressure” sensor
5	“Starting-air pressure” input	NC
6	Not used	
7	Output voltage +24 VDC	For “Exhaust back pressure” sensor
8	“Exhaust back pressure” input	NC
9	Not used	
10	Output voltage +24 VDC	For “External start interlock” switch
11	“External start interlock” switch	+24 VDC means “interlocked” (NO)
12	Not used	
13	Not used	
14	Output voltage +24 VDC	For “Engine running” signal, intended for jumper at pin no. 15
15	Relay output COM	“Engine running”
16	Relay output NO	“Engine running”
17	Relay output NC	“Engine running”
18	Output GND	For “Engine running” signal
19	Output voltage +24 VDC	For “Cylinder cutout off” signal infeed
20	“Cylinder cutout off” input	
21	“Engine speed fixed” input	
22	Not used	
23	Not used	
24	Not used	

TIM ID: 0000007204 – 002

Connector X11

The signals described here are not included in the standard MTU BlueLine product range. The signals on connector X11 must be applied in addition. The pre-wired lines for connecting the “Water in fuel prefilter” sensor(s) are connected here. Appropriate cable entries are provided on the connector. The pins of connector X11 are assigned as follows:

Pin No.	Signal	Comments
1	Output voltage (+24 V DC) for sensor 1 “Water in fuel prefilter”	Pre-wired by MTU
2	GND for sensor 1	Ground, pre-wired by MTU
3	Signal input from sensor 1 “Water in fuel prefilter”	Pre-wired by MTU
4	Output voltage (+24 V DC) for sensor 2 “Water in fuel prefilter”	Pre-wired by MTU
5	GND for sensor 2	Ground, pre-wired by MTU
6	Signal input from sensor 2 “Water in fuel prefilter”	Pre-wired by MTU
7	Horn/flashing light (+24 VDC)	
8	Horn/flashing light (GND)	
9	+24 VDC supply	Jumper at pin no. 10
10	Combined alarm COM	
11	Combined alarm NO	
12	Combined alarm NC	
13	GND	
14	+24 VDC	Switched on with key switch
15	GND	
16	Not used	
17	Not used	
18	Not used	
19	Not used	
20	Not used	
21	Not used	
22	Not used	
23	Not used	
24	Not used	

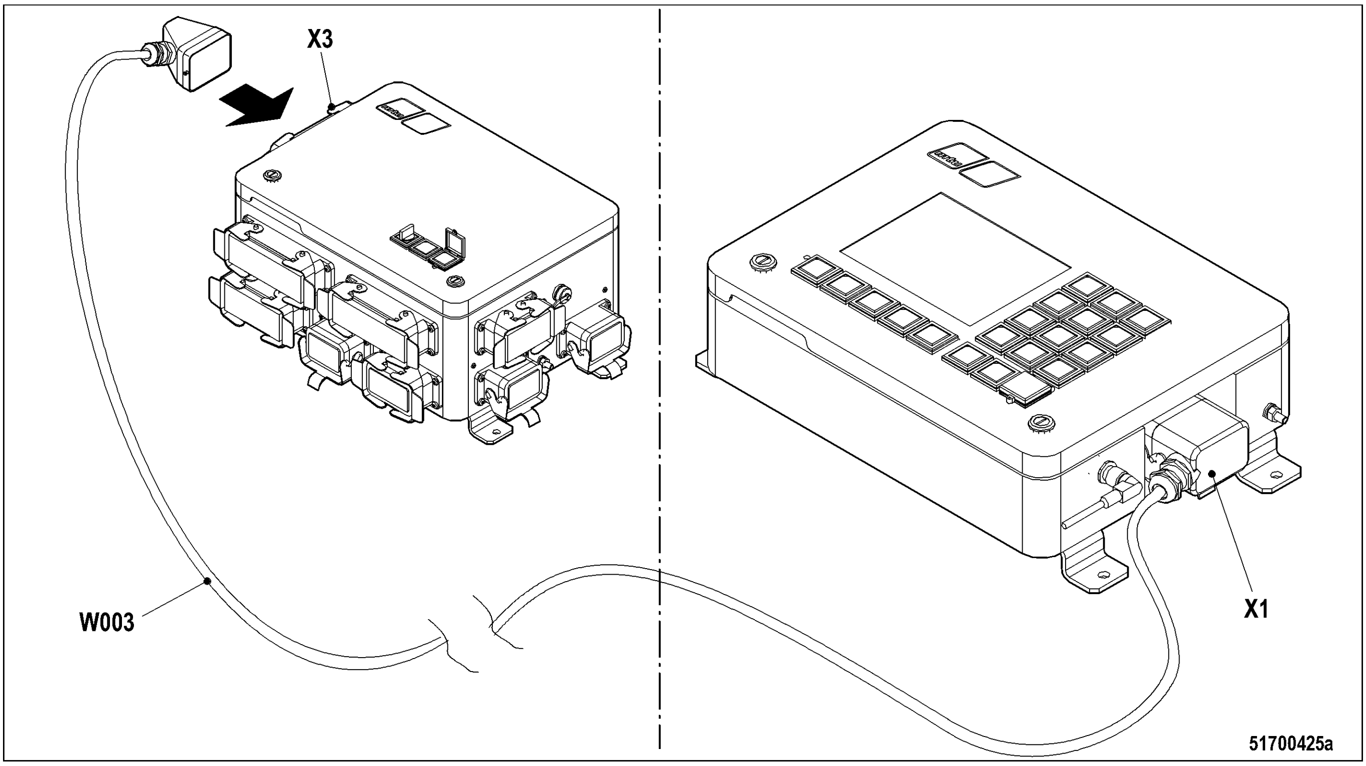
TIM ID: 0000007204 – 002

10.3.19 LOS – Connecting

Preconditions

- Cables are properly routed.
- Cables are long enough.

Connection to LOP



Note: Local Operating Station LOS can only be used with a Local Operating Panel (without display DIS!).

1. Pinpoint socket X3 on Local Operating Panel LOP in the engine room.
2. Remove the protective cover.
3. Plug connector X3 of the cable leading to the Local Operating Station LOS into socket X3.
4. Engage the locking clip.

Connecting LOS

1. Plug the other connector into socket X1 on the Local Operating Station LOS.
2. Engage the locking clip.

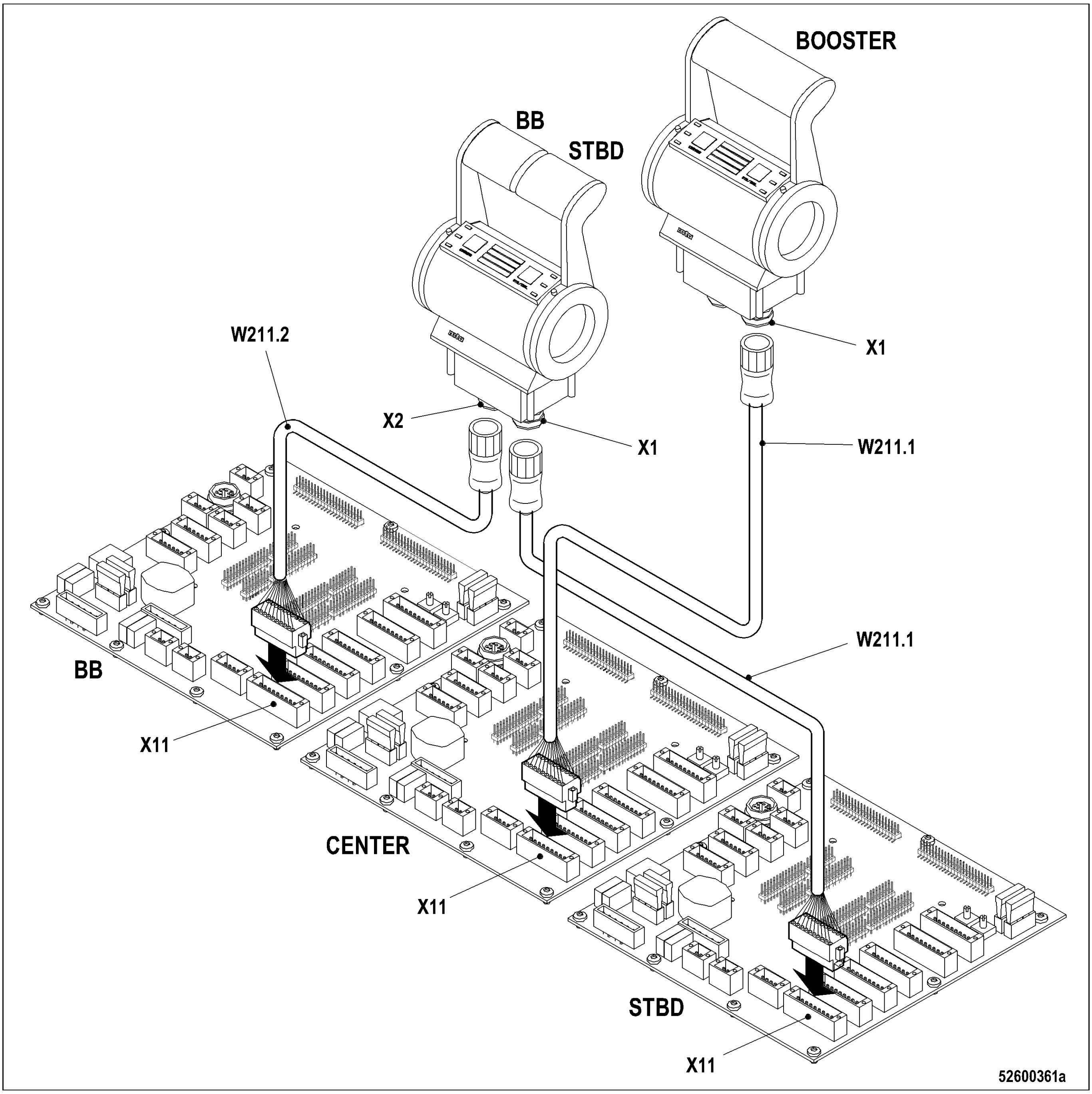
TIM ID: 0000007207 – 001

10.3.20 Command units on triple-shaft propulsion systems – Connection

Preconditions

- Cables are routed properly.
- Cables are long enough.

Three shafts with ROS 7 and ROS 9



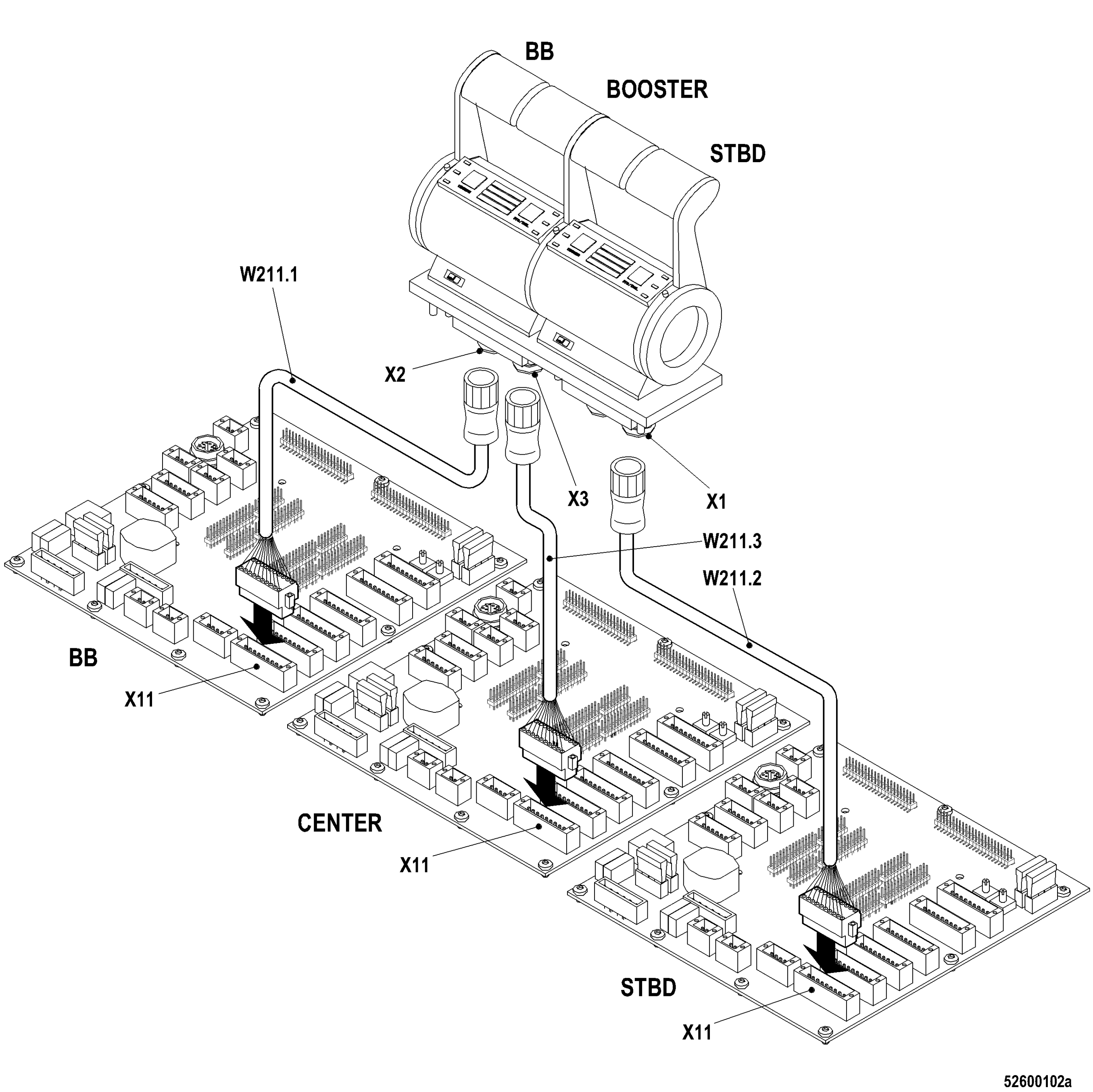
BB	Port	BOOSTER	Middle shaft	W211	Connecting cable for command unit
STBD	Starboard	X11	Connector PIM 4 RCS for command unit on main control stand 1		
CENTER	Middle				

TIM ID: 0000007209 – 002

1. Connect cable W211.1 to port PIM 4 RCS, connector X11.
2. Connect cable W211.1 to the port propulsion control lever (socket X2) on command unit RCS-DUO (ROS 7).
3. Connect the second cable designated W211.1 to the middle PIM 4 RCS, connector X11.

4. Connect the second cable designated W211.1 to the command unit RCS-UNO (ROS 9), socket X1.
5. Connect cable W211.2 to starboard PIM 4 RCS, connector X11.
6. Connect cable W211.2 to the starboard propulsion control lever (socket X1) on command unit RCS-DUO (ROS 7).
7. Tighten the three union nuts on the command unit connectors by hand.

Three shafts with ROS 11



BB	Port	BOOSTER	Middle shaft	W211	Connecting cable for command unit
STBD	Starboard	X11	Connector PIM 4 RCS for command unit on main control stand 1		
CENTER	Middle				

TIM ID: 0000007209 – 002

1. Connect cable W211.1 to port PIM 4 RCS, connector X11.
2. Connect cable W211.1 to the port propulsion control lever (socket X2) on command unit RCS-TRIO (ROS 11).
3. Connect cable W211.3 to middle PIM 4 RCS, connector X11.

4. Connect cable W211.3 to the middle propulsion control lever (socket X3) on command unit RCS-TRIO (ROS 11).
5. Connect cable W211.2 to starboard PIM 4 RCS, connector X11.
6. Connect cable W211.2 to the starboard propulsion control lever (socket X1) on command unit RCS-TRIO (ROS 11).
7. Tighten the three union nuts on the command unit connectors by hand.
8. Tighten the two securing screws on all X11 connectors.
9. Connect the command units in the same way on any other additional control stands. Use the following connectors on the appropriate PIM 4 RCS:
   - Main control stand 1: X11 (as described above)
   - Slave control stand 2: X14
   - Slave control stand 1: X13
   - Main control stand 2: X12

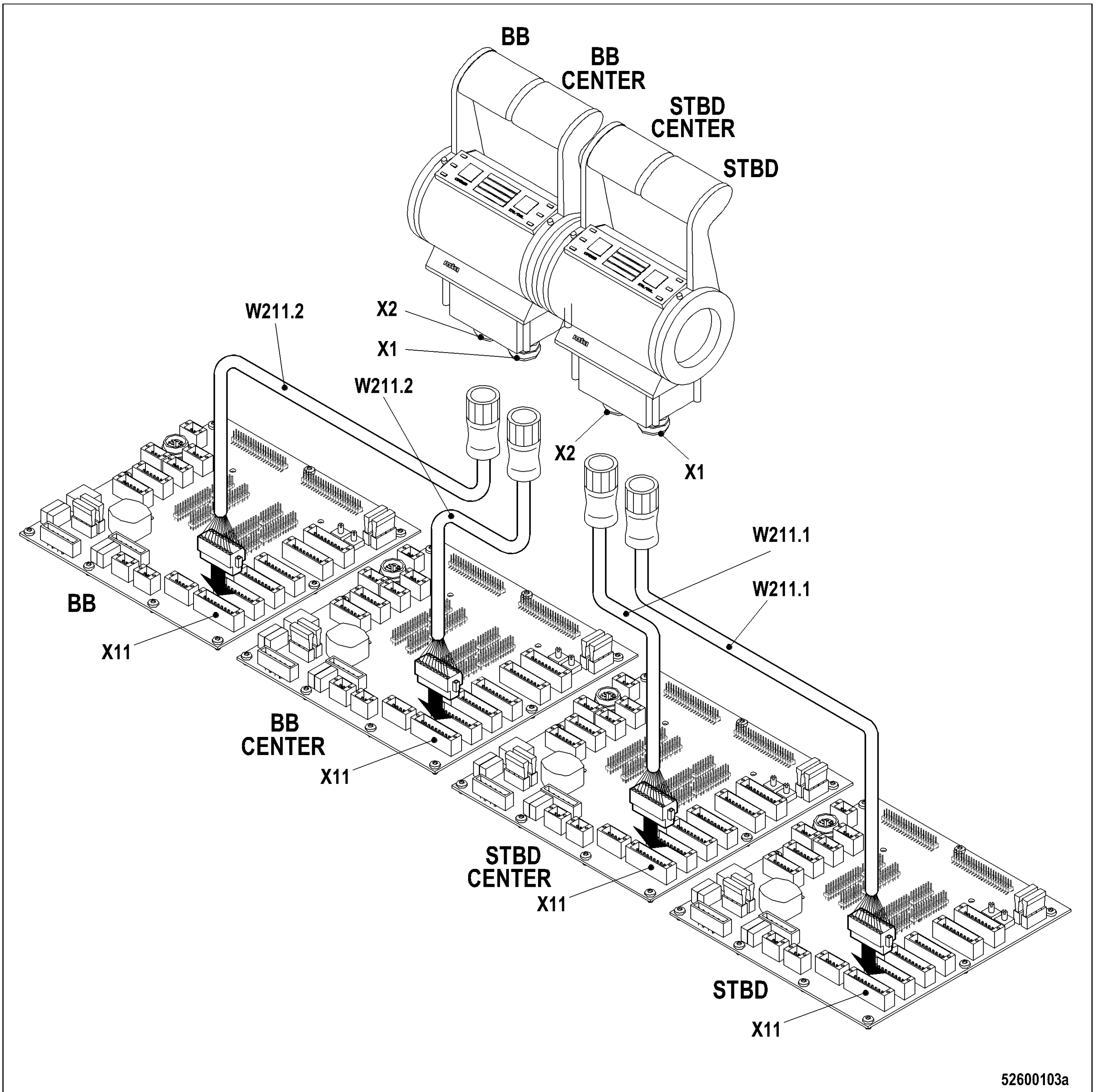
TIM ID: 0000007209 – 002

10.3.21 Command units – Connecting on propulsion systems with four shafts

Preconditions

- Cables are properly routed.
- Cables are long enough.

Four shafts with two ROS 7



BB	Port
CENTER	Port middle
STBD CENTER	Starboard middle
STBD	Starboard
X11	Connector PIM 4 RCS for command unit on main control stand 1
W211	Connecting cable for command unit

TIM ID: 0000007210 – 001

Note: Two RCS-DUO (ROS 7) command units are "cross-connected" on four-shaft systems:
- The two cables W211.1 are connected to the right-hand command unit for the two starboard power trains (outer power train to connector X1, inner power train to connector X2).
- The two cables W211.2 are connected to the left-hand command unit for the two port power trains (outer power train to connector X2, inner power train to connector X1).

1. Connect cable W211.2 to the port PIM 4 RCS, connector X11.
2. Connect cable W211.2 to the outer propulsion control lever (socket X2) on command unit RCS-DUO port (ROS 7).
3. Connect the second cable designated W211.2 to the PIM 4 RCS (middle port), connector X11.
4. Connect the second cable designated W211.2 to the inner propulsion control lever (socket X1) on command unit RCS-DUO port (ROS 7).
5. Connect cable W211.1 to the starboard PIM 4 RCS, connector X11.
6. Connect cable W211.1 to the outer propulsion control lever (socket X1) on command unit RCS-DUO starboard (ROS 7).
7. Connect the second cable designated W211.1 to the PIM 4 RCS (middle starboard), connector X11.
8. Connect the second cable designated W211.1 to the inner propulsion control lever (socket X2) on command unit RCS-DUO starboard (ROS 7).
9. Tighten the four union nuts on the command unit connectors by hand.
10. Tighten the two securing screws on all X11 connectors.
11. Connect the command units in the same way on any other additional control stands. Use the following connectors on the appropriate PIM 4 RCS:
    - Main control stand 1: X11 (as described above)
    - Main control stand 2: X12
    - Slave control stand 1: X13
    - Slave control stand 2: X14

TIM ID: 0000007210 – 001

10.3.22 Connecting command unit ROS 7 / ROS 9

Preconditions

- Cables are properly routed.
- Cables are long enough.

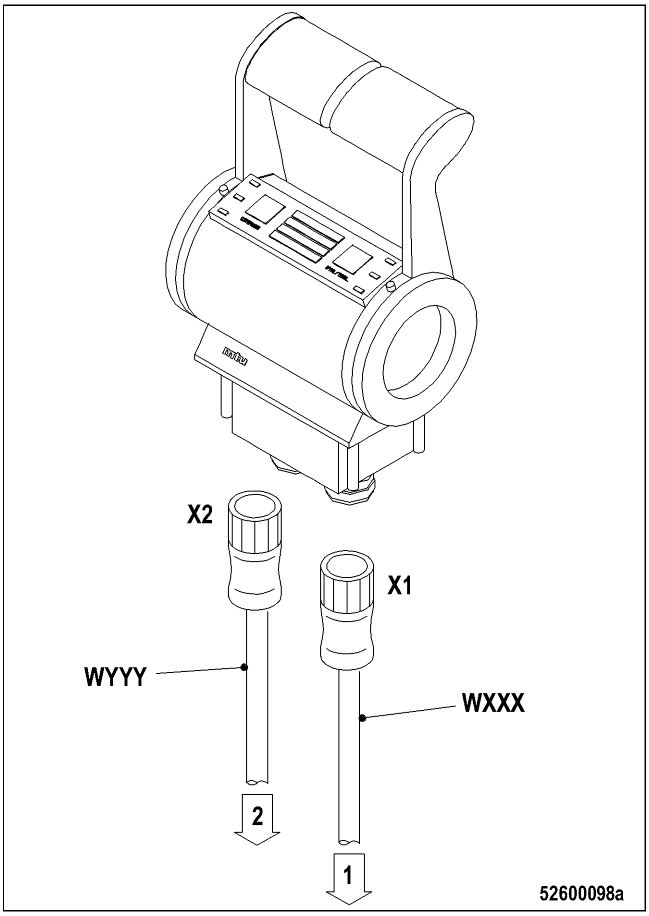
Connecting command unit

Note: Wxxx cable designations depend on the installation location of the command unit and port/starboard side.

1. Connect connector X1 to socket X1 on the command unit.
2. Tighten union nut X1 by hand.

Note: ROS 7 only, a cap closes off connector X2 on ROS 9

3. Connect connector X2 to socket X2 on the command unit.
4. Tighten union nut X2 by hand.



1 Connection to RCS-5 control unit main control stand 1 starboard
2 Connection to RCS-5 control unit main control stand 1 port

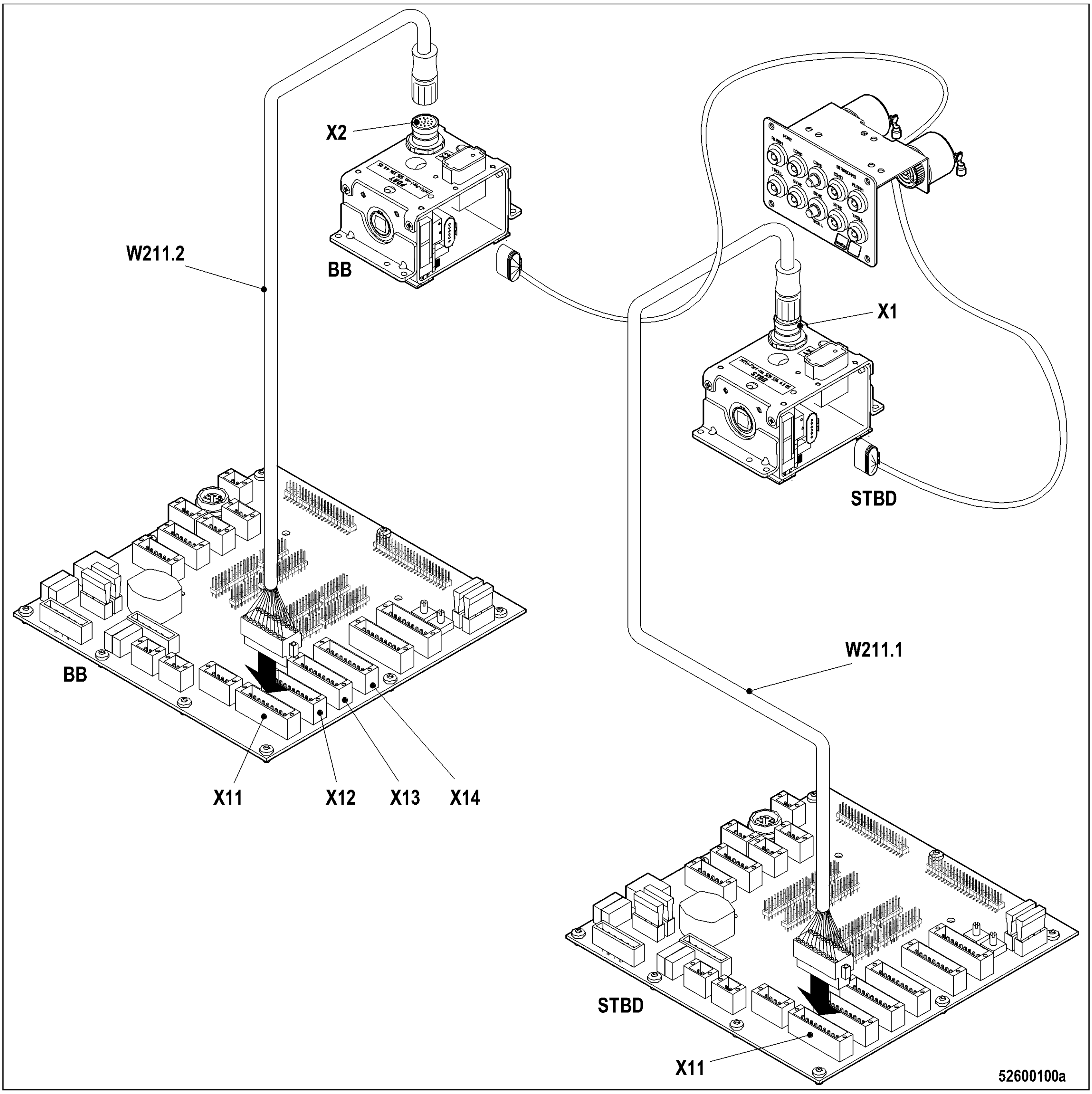
TIM ID: 0000007212 – 002

10.3.23 Rotary encoder module and remote operating station – Connecting

Preconditions

- Cables are properly routed.
- Cables are long enough.

Connecting control panel



BB Port rotary encoder module STBD Starboard rotary encoder module

TIM ID: 0000007216 – 001

1. Plug the connector marked BB into the connector on the side of the port rotary encoder module ensuring that the clip engages.
2. Plug the connector marked STBD into the connector on the side of the starboard rotary encoder module ensuring that the clip engages.

3. Plug connector X2 into socket X2 on the command unit (only on ROS 7, a cap covers off connector X2 on ROS 9).
4. Tighten union nut X2 by hand.

Connecting rotary encoder modules to PIM 4 RCS

1. Connect cable W211.2 to the port PIM 4 RCS, connector X11.
2. Connect cable W211.2 to the port rotary encoder module, connector X2.
3. Connect cable W211.1 to the starboard PIM 4 RCS, connector X11.
4. Connect cable W211.1 to the starboard rotary encoder module, connector X1.
5. Tighten the four union nuts on the command unit connectors by hand.
6. Tighten the two securing screws on all X11 connectors.
7. Connect the command units in the same way on any other additional control stands. Use the following connectors on the appropriate PIM 4 RCS:
   - Main control stand 1: X11 (as described above)
   - Main control stand 2: X12
   - Slave control stand 1: X13
   - Slave control stand 2: X14

TIM ID: 0000007216 – 001

10.3.24 PIM 4 RCS control unit – Connection

Preconditions

- Cables are routed properly.

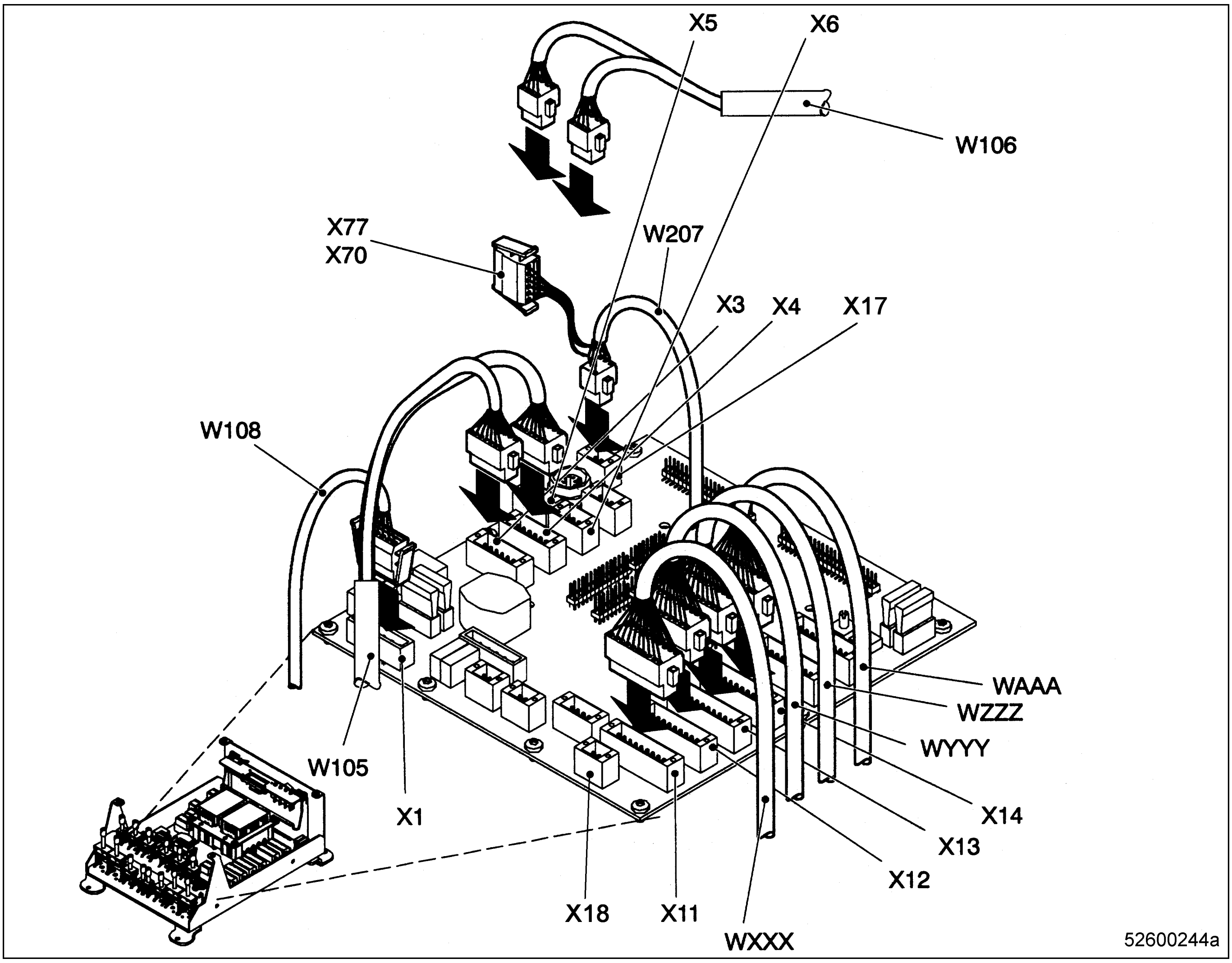
CAUTION	Incorrect installation can lead to destruction of the device. **Damage to component!** • Ensure correct connector alignment.

Remove PIM 4 control unit cover (→ Page 352)**.**

Removing strain relief clips

1. Turn the screw on the expanding clips at the cable entries counterclockwise as far as they will go.
   Result: The claws are thus sufficiently expanded to allow the clips to be removed from the four bores.
2. Remove all expanding clips.

PIM 4 RCS (main control stand 1) connection, on each shaft separately



W... Cables (numbers depend on commanding control stand and port/starboard arrangement)
X... Connector or cable entry at connector

1. Pinpoint socket X11 on the printed circuit board of the RCS-5 control unit. Plug connector X11 of cable W211.x leading to the command unit on main control stand 1 into socket X11. Check polarity!
2. If the plant incorporates further commanding control stands, connect their command units to the following sockets:
   - Command unit main control stand 2: X12 to W212.x
   - Command unit slave control stand 1: X13 to W213.x
   - Command unit slave control stand 2: X14 to W214.x
3. Pinpoint socket X1 on the printed circuit board of the RCS-5 control unit. Plug connector X1 of cable W108 leading to the MCS-5 control unit in main control stand 1 into socket X1. Check polarity! Press in connector X1 until the lock engages.
4. Pinpoint sockets X3 and X4 on the printed circuit board of the RCS-5 control unit.
5. Remove bus terminator from socket X4, it is no longer required.
6. Plug connectors X3 and X4 of cable W105 leading to the MCS-5 control unit in main control stand 1 into sockets X3 and X4. Check polarity!
7. Version with display only:
   7.1. Pinpoint sockets X5 and X6 on the printed circuit board of the MCS-5 control unit. Remove pluggable jumper from sockets X5 and X6, it is no longer required.
   7.2. Plug connectors X5 and X6 of cable W169 leading to the display into sockets X5 and X6. Check polarity!

Connecting PIM 4 RCS (main control stand 1), twin-shaft plants

1. Route the cable W207 such that the X17/X70 connector combination is located at the RCS-5 control unit for the port side.
   Result: The X17/X77 connector combination is located at the RCS-5 control unit for the starboard side.
2. On the RCS-5 control unit for the port side:
   2.1. Pinpoint socket X17.
   2.2. Plug connector X17 of the cable W207 into socket X17. Check polarity!
   2.3. Cable connector X70 unconnected for twin-shaft propulsion systems.
3. On the RCS-5 control unit for the starboard side:
   3.1. Pinpoint socket X17.
   3.2. Plug connector X17 of the cable W207 into socket X17. Check polarity!
4. Only if RCS-HSG extension system is fitted: Connect another cable W207 (connector X77) to the RCS-HSG on the starboard side on connector X77 of cable W207 routed here from port side.

Note: For propulsion systems with more that two shafts, another cable W207 leading to the RCS-5 control unit for the next shaft is connected to cable connector X70.

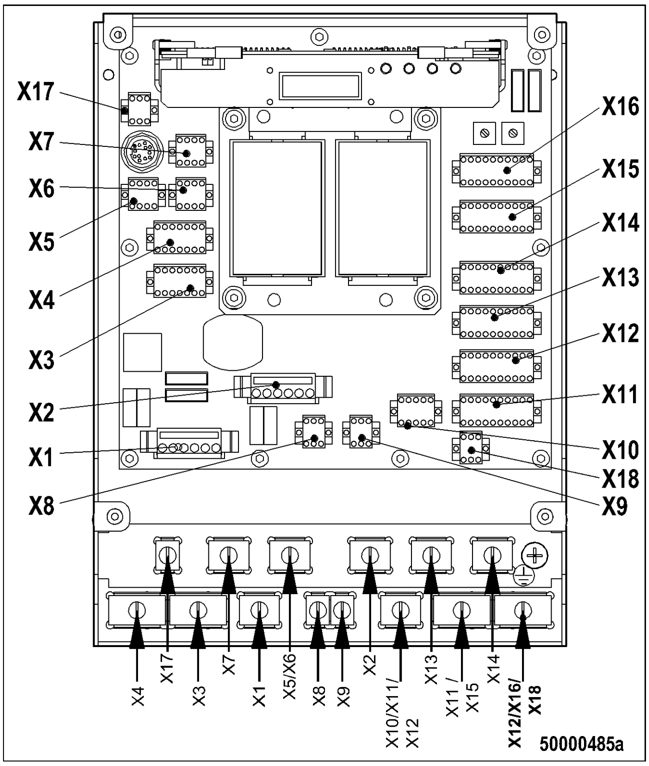
Plants with three shafts (→ Page 386)

Plants with four shafts (→ Page 389)

Connecting rotary encoder modules (→ Page 392)

Final steps

1. Route the cables to the strain reliefs as shown in the illustration (X1 – X1, etc.). Avoid crossing cables unnecessarily.
2. Fit the expanding clips one after the other (insert in the four bores provided).
3. Tighten the screws until the cable concerned is adequately secured against strain.
4. Tighten the plug securing screws on all connectors.



X... Connector or cable entry at connector

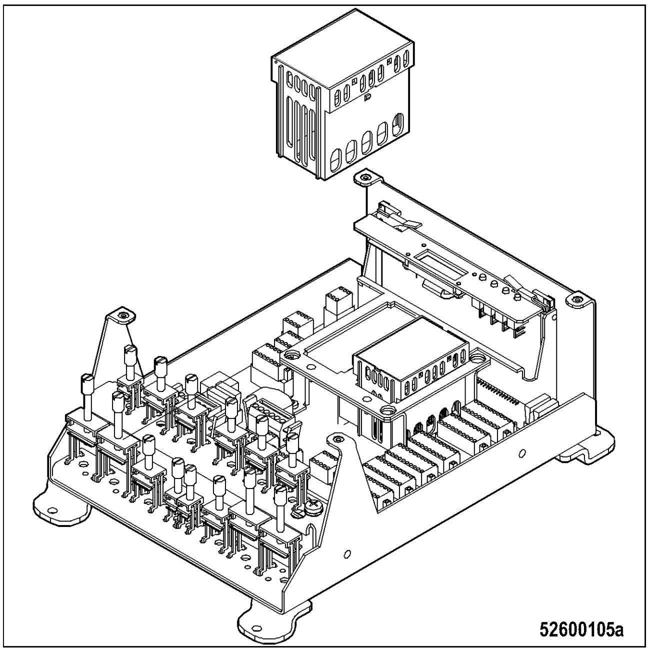
Install PIM 4 control unit cover (→ Page 326).

10.3.25 RCS extension module – Installation in PIM 4 RCS

Remove PIM 4 cover (→ Page 352)**.**

Inserting cassette

1. Check that two type MFB printed circuit boards are loaded in the cassette (extension module).
2. Insert the RCS extension module into the empty slot on the PIM 4 RCS control unit.



Install PIM 4 cover (→ Page 326)**.**

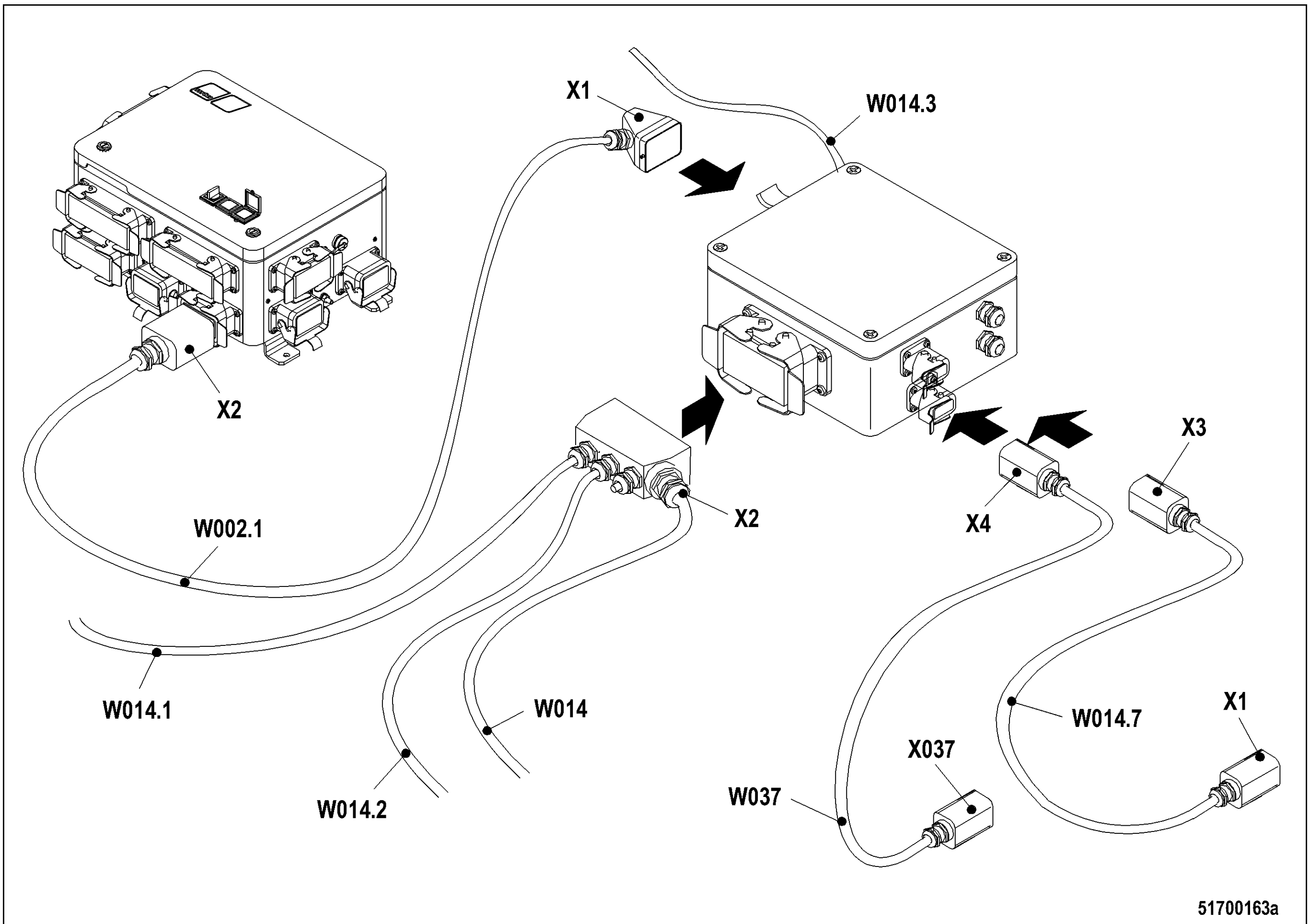
TIM ID: 0000007219 – 001

10.3.26 Terminal box X010 – Connection (battery-charging generator charges starter battery)

Preconditions

- Cables are routed properly.
- Cables are long enough.

Cable W002.1 (LOP to terminal box X010)



Note: Connection for the most common application is described at this point (consult the wiring diagram for other applications, e.g. compressed-air starting):
- Electric starting
- No emergency air-shutoff flaps (SDAF) included
- Generator charges starter battery

1. Route cable W002.1 between Local Operating Panel LOP and terminal box X010. Connector X1 at terminal box X010, connector X2 at Local Operating Panel LOP.
2. Plug in connectors X1 and X2.
3. Route the cable from connector X2 to the engine:
   - W014: To battery-charging generator
   - W014.1: To starter B
   - W014.2: To starter A (if applicable)
4. Route cable W037 between the barring gear limit switch and terminal box X010. X4 to terminal box X010, X037 to the limit switch.
5. Plug in connectors X4 and X037.

TIM ID: 0000007056 – 002

6. Only when Priming Pump Controller PPC is installed:
   6.1. Route the cable W014.7 between X010 and PPC. X3 to terminal box X010, X1 to the Priming Pump Controller PPC.
   6.2. Plug connector X1 into socket X1.
7. Only when second battery bank (service battery) is installed (battery-charging generator charges service battery):
   7.1. Open terminal box X010.
   7.2. Remove the jumper between terminal 2 and terminal 9 (preparing the terminal strip (→ Page 351)).
   7.3. Route the cable W014.3 between the battery-charging generator and terminal box X010.
   7.4. Route the cable W014.3 to the terminal box from the right and cut to size (approx. 30 cm of cabling are required inside the terminal box).
   7.5. Install cable W014.3 on terminal box X010 with an appropriate cable gland (preparing the HSK cable gland (→ Page 350)).
   7.6. Strip 8 mm of insulation off the core of the cable W014.3.
   7.7. Connect the core of the cable W014.3 to terminal 9.

Terminal strip X010 in terminal box X010 is assigned as follows:			
Wire no.	**Signal**	**Connector at X010**	
X010–1	+U BAT terminal 30 (battery supply)	X1–1	X2–a1
X010–2		X1–2	X2–e6
X010–3	Starter A terminal 50 (starter A control)	X1–3	X2–a2
X010–4		X1–4	X2–d3
X010–5	GND_BAT, terminal 31 (battery ground)	X1–5	X2–e3
X010–6	Starter A terminal 45 (starter A engaged)	X1–6	X2–e1
X010–7	Barring gear switch +24V	X1–7	X4–1
X010–8	Barring gear switch switching signal (barring tool installed = +24V)	X1–8	X4–2
X010–9	Common battery bank for starter and electronics: +U_BAT, terminal 30 (battery supply) For separate battery banks for starter and electronics: +U_BAT_SERVICE, terminal 30 of the battery for electronics supply	X1–9	—
X010–10	Charging check, battery-charging generator terminal 61 (D+)	X1–10	X2–e4
X010–11	Spare (cable to battery-charging generator, not assigned)	-	X2–e5
X010–12	Starter terminal 45 (starter B engaged)	X1–12	X2–d4
X010–13	Starter B terminal 50 (starter A control)	X1–13	X2–b1
X010–14		X1–14	
X010–15	+24 V supply for PPC control section	X1–15	X3–1
X010–16	GND (ground for PPC control section)	X1–16	X3–2
X010–17			

Terminal strip X010 in terminal box X010 is assigned as follows:			
Wire no.	**Signal**	**Connector at X010**	
X010–18	Priming on control signal	X1–17	X3–3
X010–19			
X010–20	Engine running (engine speed > 300 rpm = +24V)	X1–18	—
X010–21	Feedback oil priming pump running	X1–19	X3–4
X010–22	Feedback oil priming pump fault (pump protection switch tripped)	X1–20	X3–5
X010–23	Emergency air-shutoff flap solenoid +24 VDC*	X1–21	—
X010–24	Emergency air-shutoff flap solenoid GND*	X1–22	—
X010–25	Emergency air-shutoff flap limit switch COM*	X1–23	—
X010–26	Emergency air-shutoff flap limit switch NC*	X1–24	—
X010–27	Emergency air-shutoff flap limit switch NO*	X1–11	—
X010–28	—	–	—
X010–29	—	–	—
X010–30	-	–	—
NOTE: PIN numbers marked * and the associated signals are currently not used and are intended for future applications.			

TIM ID: 0000007056 – 002

10.4 Data Transmission

10.4.1 RS422 – Transmission values

Transmission values of block 1

General data:
- Block number: 1
- Block type: Binary
- Direction: Receive

Index No.	PV No.		Process variable	Ref. 1		Ref. 2		Ref. 3		Ref. 4	
	Sys.	No.		Bl.	No.	Bl.	No.	Bl.	No.	Bl.	No.
1	610	901	Start Command RS422								
2	610	902	Stop Command RS422								
3	610	903	Acknowledge RS422								
4	610	904	Override RS422								

Transmission values of block 2

General data:
- Block number: 2
- Block type: Alarm
- Direction: Send

Index No.	PV No.		Process variable	Ref. 1		Ref. 2		Ref. 3		Ref. 4	
	Sys.	No.		Bl.	No.	Bl.	No.	Bl.	No.	Bl.	No.
1	114	492	SS Overspeed (ECU)	4	1	4	2				
2	110	058	HI ETC 1 Speed	4	5	4	6				
3	110	070	SS ETC1 Overspeed	4	5	4	7				
4	110	029	LO P-Lube Oil (ECU)	4	14	4	15				
5	110	030	SS P-Lube Oil (ECU)	4	14	4	16				
6	110	047	LO P-Fuel	4	17	4	18				
7	110	048	SS P-Fuel	4	17	4	19				
8	610	910	Spare RS422								
9	110	050	LO P-Charge Air	4	22	4	23				
10	114	421	LO P-Start Air	4	24	4	25				
11	110	143	HI T-Lube Oil	4	30	4	31				
12	110	144	SS T-Lube Oil	4	30	4	32				
13	110	299	HI T-Fuel	4	33	4	34				

TIM ID: 0000016425 - 001

Index No.	PV No.		Process variable	Ref. 1		Ref. 2		Ref. 3		Ref. 4	
	Sys.	No.		Bl.	No.	Bl.	No.	Bl.	No.	Bl.	No.
14	610	911	Spare RS422								
15	610	912	Spare RS422								
16	610	913	Spare RS422								
17	610	914	Spare RS422								
18	110	129	HI T-Coolant (ECU)	4	35	4	36				
19	101	130	SS T-Coolant (ECU)	4	35	4	37				
20	110	133	HI T-Charge Air	4	38	4	39				
21	110	168	SS T-Charge Air	4	38	4	40				
22	610	915	Spare RS422								
23	110	055	LO Coolant Level	3	7						
24	110	056	HI Fuel Leakage	3	8						
25	610	916	Spare RS422								
26	114	494	AL Shut Down Air Flaps Closed								
27	114	489	SS Security Shutdown								
28	110	009	SS Autom. Power Reduct. active								
29	114	490	SS Emergency Stop								
30	114	491	SS Emergency Stop External								
31	114	470	AL Override Activated	3	2						
32	610	917	Spare RS422								
33	114	360	AL Barring Gear Engaged								
34	114	411	AL Water in Fuel Prefilter								
35	114	416	AL Battery Charger Failure								
36	610	918	Spare RS422								
37	110	177	SS Engine Speed too low								
38	110	170	HI T-ECU	4	48	4	49				
39	110	122	LO ECU Power Supply Voltage	4	43	4	44				

TIM ID: 0000016425 – 001

Index No.	PV No.		Process variable	Ref. 1		Ref. 2		Ref. 3		Ref. 4	
	Sys.	No.		Bl.	No.	Bl.	No.	Bl.	No.	Bl.	No.
40	110	270	LOLO ECU Power Supply Voltage	4	43	4	45				
41	110	123	HI ECU Power Supply Voltage	4	43	4	46				
42	110	271	HIHI ECU Power Supply Voltage	4	43	4	47				
43	110	116	AL ECU Defect								
44	110	178	AL ECU Error/ Check Error code								
45	610	919	Spare RS422								
46	114	601	AL Power Amplifier 1 Failure								
47	114	602	AL Power Amplifier 2 Failure								
48	114	603	AL Status Transistor Outputs								
49	610	920	Spare RS422								
50	114	435	AL Main Power Supply Fail								
51	114	440	AL Emerg.Power Supply Fail								
52	114	355	MG Not Ready for Operation								
53	114	351	MG Gear not Neutral								
54	114	352	MG Barring Gear Engaged								
55	114	353	MG SDAF closed								
56	114	354	MG External Start Interlock								
57	210	004	LO P-Gear Control Oil	4	53	4	54				
58	210	005	SS P-Gear Control Oil	4	53	4	55				
59	210	013	HI T-Gear Oil	4	56	4	57				
60	210	015	AL Gear Oil Filter Clogged								
61	210	147	AL Clutch interlock								
62	610	921	Spare RS422								
63	210	150	MG Eng.Speed High/Low (Clutch)								

TIM ID: 0000016425 – 001

Index No.	PV No.		Process variable	Ref. 1		Ref. 2		Ref. 3		Ref. 4	
	Sys.	No.		Bl.	No.	Bl.	No.	Bl.	No.	Bl.	No.
64	210	151	AL Emergency Disengage								
65	210	152	MG Engage Error								
66	210	153	MG Disengage Error								
67	210	180	AL Trolling On Failure								
68	210	181	AL Trolling Sys. Fault								
69	810	057	AL RCS Combined Alarm								
70	110	118	AL RCS Speed Demand Defect								
71	610	922	Spare RS422								
72	610	923	Spare RS422								
73	610	924	Spare RS422								
74	610	925	Spare RS422								
75	610	926	Spare RS422								
76	610	927	Spare RS422								
77	610	928	Spare RS422								
78	610	929	Spare RS422								
79	610	930	Spare RS422								
80	610	931	Spare RS422								
81	610	932	Spare RS422								

Transmission values of block 3

General data:
- Block number: 3
- Block type: Binary

TIM ID: 0000016425 – 001

- Direction: Send

Index No.	PV No.		Process variable	Ref. 1		Ref. 2		Ref. 3		Ref. 4	
	Sys.	No.		Bl.	No.	Bl.	No.	Bl.	No.	Bl.	No.
1	114	006	Combined Alarm (All)								
2	110	066	Feedback Override (ECU)	2	31						
3	110	068	Engine Running								
4	610	940	Spare RS422								
5	110	069	ETC 2 Cut In								
6	110	074	Cylinder Cutout								
7	110	290	Coolant Level Switch	2	23						
8	110	291	Fuel Leakage Level Switch	2	24						
9	110	008	Injection Limitation								
10	114	250	ML LOP Ready For Operation								
11	114	255	ML LOP Local								
12	114	265	ML LOP Start								
13	114	270	ML LOP Stop								
14	210	113	Neutral/Out								
15	210	114	Ahead/In								
16	210	115	Astern								
17	210	129	External Engage Interlock								
18	210	131	Trolling Active								
19	610	941	Spare RS422								
20	610	942	Spare RS422								
21	610	943	Spare RS422								
22	610	944	Spare RS422								
23	610	945	Spare RS422								
24	610	946	Spare RS422								
25	610	947	Spare RS422								

TIM ID: 0000016425 – 001

Transmission values of block 4

General data:
- Block number: 4
- Block type: Analog

- Direction: Send

Index No.	PV No.		Process variable	Ref. 1		Ref. 2		Ref. 3		Ref. 4		MIN	MAX	Unit	Scale
	Sys.	No.		Bl.	No.	Bl.	No.	Bl.	No.	Bl.	No.				
1	110	002	Engine Speed (ECU)	4	2	2	1					0	3000	rpm	10
2	110	162	UL Engine Speed (ECU)	2	1	4	1					0	3000	rpm	10
3	110	117	Engine Speed Camshaft									0	3000	rpm	10
4	110	186	Engine Speed Crankshaft									0	3000	rpm	10
5	110	057	ETC 1 Speed	4	6	2	2	4	7	2	3	0	100	krpm	10000
6	110	160	U1L ETC 1 Speed	2	2	4	5					0	100	krpm	10000
7	110	172	U2L ETC 1 Speed	2	3	4	5					0	100	krpm	10000
10	110	216	Injection in Relation to DBR									0	100	%	1000
11	110	007	Engine Load Reserve									0	100	%	1000
14	110	026	P-Lube Oil (ECU)	4	15	2	4	4	16	2	5	0	10	bar	100000
15	110	027	L1L P-Lube Oil (ECU)	2	4	4	14					0	10	bar	100000
16	110	028	L2L P-Lube Oil (ECU)	2	5	4	15					0	10	bar	100000
17	110	046	P-Fuel	4	18	2	6	4	19	2	7	0	10	bar	100000
18	110	158	L1L P-Fuel	2	6	4	17					0	10	bar	100000
19	110	159	L2L P-Fuel	2	7	4	17					0	10	bar	100000
22	110	049	P-Charge Air	4	4	2	9					0	5	bar	100000
23	110	163	L1L P-Charge Air	2	9	4	22					0	5	bar	100000
24	114	420	P-Start Air	4	25	2	10					0	50	bar	100000
25	114	422	LL P-Start Air	2	10	4	24					0	50	bar	100000
30	110	140	T-Lube Oil	4	31	2	11	4	32	2	12	-20	120	°C	100
31	110	141	L1H T-Lube Oil	2	11	4	30					-20	120	°C	100
32	110	142	L2H T-Lube Oil	2	12	4	30					-20	120	°C	100

TIM ID: 0000016425 – 001

Index No.	PV No.		Process variable	Ref. 1		Ref. 2		Ref. 3		Ref. 4		MIN	MAX	Unit	Scale
	Sys.	No.		Bl.	No.	Bl.	No.	Bl.	No.	Bl.	No.				
33	110	152	T-Fuel	4	32	2	13					-20	120	°C	100
34	110	298	UL T-Fuel	2	13	4	33					-20	120	°C	100
35	110	126	T-Coolant (ECU)	4	36	2	18	4	37	2	19	-20	120	°C	100
36	110	127	U1L T-Coolant (ECU)	2	18	4	35					-20	120	°C	100
37	110	128	U2L T-Coolant (ECU)	2	19	4	35					0	120	°C	100
38	110	131	T-Charge Air	4	39	2	20	4	40	2	21	0	120	°C	100
39	110	132	U1L T-Charge Air	2	20	4	38					0	120	°C	100
40	110	167	U2L T-Charge Air	2	21	4	38					-20	120	°C	100
41	110	151	T-Intake Air	4	42	2	22					-20	120	°C	100
43	110	104	ECU Power Supply Voltage	4	44	2	39					0	35	V	1000
44	110	266	L1L ECU Power supply voltage	2	39	4	43					0	35	V	1000
45	110	267	L2L ECU Power supply voltage	2	40	4	43					0	35	V	1000
46	110	268	L1H ECU Power supply voltage	2	41	4	43					0	35	V	1000
47	110	269	L2H ECU Power supply voltage	2	42	4	43					0	35	V	1000
48	110	169	T-ECU	4	49	2	38					0	100	°C	100
49	110	300	UL T-ECU	2	38	4	4					0	100	°C	100
50	110	115	ECU Operat.Hours									0	100000	h	1
51	110	075	ECU Codes:									0	400	digit	1
53	210	001	P-Gear Control Oil	4	54	2	57	4	55	2	58	0	30	bar	100000
54	210	002	L1L P-Gear Control Oil	2	57	4	53					0	30	bar	100000
55	210	003	L2L P-Gear Control Oil	2	58	4	53					0	30	bar	100000
56	210	011	T-Gear Oil	4	57	2	59					0	120	°C	100
57	210	012	UL T-Gear Oil	2	59	4	56					0	120	°C	100

10.5 Technical Data

10.5.1 LOP 8 – Technical data

Item	Unit	Rating
Dimensions (width x height x depth, wall-mounting)	mm	Approx. 480 x approx. 330 x approx. 190 (incl. connector sockets and mounting brackets)
Draw-out clearance (left and right)	mm	Approx. 150
Weight	kg	Approx. 11.5
Installation position		Wall-mounting (flap hinge at top)
Operating voltage	VDC	24; +30% / –25%
Power consumption	A	42 (max.)
EMC protection		IEC 60533: 1999 EN 61000-6-2: 2002 EN 61000-6-4: 2002
Dielectric strength		IEC 60092-504: 2001
High-tension voltage		IEC 60092-504: 2001
Operational ambient temperature	°C	0 … +55
Storage temperature	°C	–10 … +70
Relative air humidity	%	5 … 95, non-condensing
Degree of protection		IP 54 (DIN 40050)
Shock resistance		15 g (duration 11 ms) (EN 60068-2-27: 1995)
Vibrostability		2 …13.2 Hz: x_{pp} = ± 1.0 mm 13.2 …100 Hz: a = ± 0.7 g

TIM ID: 0000024380 – 001

10.5.2 Display MFD – Technical data

General information

Item	Unit	Rating
Width (mounting frame)	mm	247
Height (mounting frame)	mm	151
Depth (inserted)	mm	159
Installation depth (inserted) behind front panel	mm	145
Required space behind front panel	mm	Approx. 190
Installation opening	mm	223 x 127
Weight (without cables)	kg	3.3
Installation position	°	0 to 90
Material (housing)		PC-30GF, PET
Compass safety distance	m	5

Operating conditions

Item	Unit	Rating
Operating voltage min.	V	19.2
Operating voltage max.	V	32
Ambient temperature min.	°C	-25
Ambient temperature max.	°C	+70
Housing temperature max.	°C	+70
Storage temperature min.	°C	-30
Storage temperature max.	°C	+70
Power consumption max. at 19.2 VDC	A	1
Switching outputs	kΩ/Ω	$20k\Omega<R_{load}<32\Omega$
Shock resistance (IEC 68–2–27)	g	15 duration 11 ms
Vibrostability IEC 60068-2-6		

TIM ID: 0000030806 – 002

Item	Unit	Rating
Heat loss	W	Max. 18, typ. 12
Relative air humidity, condensing	%	5 to 98

Safety

Item	Unit	Rating
Degree of protection (inserted) DIN 40050 front		IP66
Degree of protection (inserted) DIN 40050 back		IP65
Dielectric strength; IEC 60092–504	MΩ	>10 (50VDC)
ESD EN 61000-4-2: 2002 (IEC 61000-4-2)		
EMC protection • EN 61000-6-2: 2002 (CE) • EN 61000-6-4: 2004 (CE) • EN 50121-3-2: 2001 (Rail) • EN 50155: 2004 (Rail) • IEC 60533: 1999 (Marine)		
Grounding necessary by means of grounding strip		
Mean time between failure (MTBF), at 25 °C ambient temperature	h	20000

Electromagnetic compatibility (EMC)

The EMC limit values stated above apply when the following requirements are fulfilled:

- Shielded cables must be used without exception. The inner shield must be applied to Pin 3 of the bus connector, the outer shield must be connected to ship's ground.
- The grounding cable must not exceed 30 cm in length. It must have a cross-section of at least 2.5 mm^2.

TIM ID: 0000030806 – 002

10.5.3 ECU 4 – Technical data

Item	Unit	Rating
Housing material		G-AlSi10Mg wa
Dimensions (length x width x height)	mm	455 x 277 x 91
Draw-out clearance (transverse direction)	mm	Approx. 250
Weight (without cable connection)	kg	7.0
Installation position		Horizontal alignment (cover at top) or vertical alignment (tilted by max. 90° over a random cover edge)
Operating voltage	VDC	16.5 … 32 (continuous operation) 11 … 36 (temporarily restricted operation)
Power consumption	A	0.3 … 17
Heat loss	W	35 (max.)
Grounding		Necessary
EMC protection		DIN EN 50081-2 DIN EN 50082-2
Operational ambient temperature	°C	–25 … +65
Storage temperature	°C	–25 … +75
Housing temperature	°C	75 (max.)
Relative air humidity	%	0 … 95, condensing
Degree of protection		IP 65 (DIN 40050)
Shock resistance		15 g (semi-sinusoidal shock, duration 11 ms)
Vibrostability		2 …25 Hz: Travel amplitude (peak) = ±1.6 mm 25 …100 Hz: Acceleration (peak) = 4 g 20 …2000 Hz: Electrical noise = 1.3 g (rms)
MTBF	h	20000 (at an ambient temperature of 50 °C)

TIM ID: 0000024374 – 001

10.5.4 GCU 3 – Technical data

Item	Unit	Rating
Dimensions (width x height x depth, wall-mounting)	mm	Approx. 350 x approx. 330 x approx. 190 (incl. connector sockets and mounting brackets)
Draw-out clearance (height)	mm	Approx. 140 (right) Approx. 225 (bottom)
Weight (without cable connection)	kg	Approx. 6.5
Installation position		Wall-mounting (flap hinge at top)
Operating voltage	VDC	24; +30% / –25%
Power consumption	A	4 (max.)
EMC protection		IEC 60533: 1999 EN 61000-6-2: 2002 EN 61000-6-4: 2002
Dielectric strength		IEC 60092-504: 2001
High-tension voltage		IEC 60092-504: 2001
Operational ambient temperature	°C	0 … +55
Storage temperature	°C	–10 … +70
Relative air humidity	%	5 … 95, non-condensing
Degree of protection		IP 65
Shock resistance		15 g (duration 11 ms) (EN 60068-2-27: 1995)
Vibrostability		2 …13.2 Hz: x_{pp} = ± 1.0 mm 13.2 …100 Hz: a = ± 0.7 g

TIM ID: 0000024378 – 001

10.5.5 GCU 6 – Technical data

Item	Unit	Rating
Dimensions (width x height x depth, wall-mounting)	mm	Approx. 350 x approx. 330 x approx. 190 (incl. connector sockets and mounting brackets)
Draw-out clearance	mm	Approx. 140 (right) Approx. 225 (bottom)
Weight (without cable connection)	kg	Approx. 6.5
Installation position		Wall-mounting (flap hinge at top)
Operating voltage	VDC	24; +30% / –25%
Power consumption	A	4 (max.)
EMC protection		IEC 60533: 1999 EN 61000-6-2: 2002 EN 61000-6-4: 2002
Dielectric strength		IEC 60092-504: 2001
High-tension voltage		IEC 60092-504: 2001
Operational ambient temperature	°C	0 … +55
Storage temperature	°C	–10 … +70
Relative air humidity	%	5 … 95, non-condensing
Degree of protection		IP 54
Shock resistance		15 g (duration 11 ms) (EN 60068-2-27: 1995)
Vibrostability		2 …13.2 Hz: x_{pp} = ± 1.0 mm 13.2 …100 Hz: a = ± 0.7 g

10.5.6 PPC – Technical data

Item	Unit	Rating
Dimensions (length x width x height)	mm	Approx. 280 x 200 x 136
Draw-out clearance (longitudinal direction)	mm	Approx. 125
Weight (without cable connection)	kg	Approx. 10
Installation position		As desired
Operating voltage (PPC)	VDC	24; +30% / –25%
Operating voltage/power (controlled oil priming pump)		PPC 5: 3-phase, 400 VAC, 50 Hz, 750 W PPC 6: 1-phase, 230 VAC, 50 Hz, 1100 W PPC 7: 3-phase, 230 VAC, 60 Hz, 900 W PPC 8: 3-phase, 440 VAC, 60 Hz, 900 W
Rated current (controlled oil priming pump)	A	PPC 5: 2.0 PPC 6: 7.5 PPC 7: 4.0 PPC 8: 2.0
EMC protection		IEC 801
Operational ambient temperature	°C	–25 … +70
Storage temperature	°C	–35 … +70
Relative air humidity	%	0 … 95, condensing
Degree of protection		IP 65 (DIN 40050)
Shock resistance		10 g (semi-sinusoidal shock, duration 11 ms)
Vibrostability		2 …12.8 Hz: x_{pp} = 3 mm 12.8 …100 Hz: a = ± 1 g

TIM ID: 0000024382 – 001

10.5.7 Technical data X010

Item	Unit	Rating
Dimensions (length x width x height)	mm	Approx. 310 x approx. 270 x 111
Draw-out clearance (3 sides)	mm	Approx. 130
Weight (without cable connection)	kg	Approx. 4.0
Installation position		As desired
Operational ambient temperature	°C	–25 … +70
Storage temperature range	°C	–35 … +70
Relative air humidity	%	0 … 95, condensing
Degree of protection		IP 65 (DIN 40050)
Shock resistance		10 g (duration 11 ms)
Vibrostability		2 …12.8 Hz: x_{pp} = 3 mm 12.5 …100 Hz: a = ± 1 g
EMC protection		IEC 801

TIM ID: 0000024383 – 001

10.5.8 PIM 4 control unit – Technical data

Item	Unit	Value
Dimensions (L x B x H)	mm	321 x 228 x 138
Weight	kg	2.5
Color		RAL 5002 (blue)
Installation position		Vertical, display up
Connection		Premanufactured cables with Phönix plug connectors, secured with locking screws.
Operating voltage	VDC	24; (+30 %, –25 %), residual ripple less than 5%.
Power consumption	mA	Max. 300
Current consumption, nominal	A	28 (average continuous consumption during operation).
Current consumption, maximum	A	43 (short-time peaks during operation).
Storage temperature	°C	-10 to +70
Ambient temperature during operation	°C	0 to +55
Relative air humidity		5 % to 55 % at 55 °C, non-condensing.
Degree of protection		IP 23 DIN 40 050
Shock		Half-sine shock pulse 15 g, duration 11 ms
Vibrostability Frequency f =2 Hz to 12.8 Hz: Frequency f =12.8 Hz to 100 Hz:	 mm g	 x_{ss} = 1.5 a = ±1
EMI/EMC protection		IEC 801/EN 50081-2/EN 50082-2
Insulation resistance		IEC 92-504 (>10 MΩ/50 VDC) Assemblies comprising electronic components must be removed during the test.

TIM ID: 0000014626 – 001

11 Initial Operation

11.1 Preparatory Work

11.1.1 Checks prior to startup

Checking system installation

Note: Carry out the tasks listed below in the given order prior to switching on the operating voltage for the first time (first for one power train, then for the second, third power train etc.). Carry out tasks on devices installed at several control stands consecutively on each control stand.

1. Check that all plug connectors are correctly connected at the Local Operating Panel and that the locking clips are engaged.
2. Check that the plug connector is correctly connected at the Local Operating Station LOS (if applicable).
3. Check that all cables are correctly connected at the starter; make sure that none of the cables/lugs are touching.
4. Check that the plug connectors are correctly connected at the Engine Control Unit ECU and that the union nuts are properly tightened or that the locking clips are engaged.
5. Check that all battery cables are properly connected and cannot cause short circuiting.
6. Check that the plug connectors are correctly connected at the Gear Control Unit GCU and that the locking clips are engaged.
7. Check that the connector or the cables is/are properly connected at the gearbox.
8. Check that the individual wires are correctly connected in terminal box X010.
9. Check that the engine and the various devices in the engine room are properly connected to ground.
10. Check that the command units and control units in the control stands are properly connected to ground.
11. Check that all plug connectors on printed circuit board LMB 02 of the MCS-5 control unit are correctly connected (check connector designations and firm seating, connector housings must be fully inserted and screwed down).
12. Check that all plug connectors on printed circuit board LMB 02 of the RCS-5 control unit are correctly connected (check connector designations and firm seating, connector housings must be fully inserted and screwed down).
13. Check that all connectors on operating devices are properly connected (check connector designations and firm seating). Make absolutely sure that port and starboard devices have not been misconnected.
14. Check that all cables connected to control units are secured by a clip to the cable clamps at the control units (strain relief).
15. Check that an extension module (2nd cassette) is inserted in the RCS control unit if at least one slave control stand is included.
16. Ensure that all bus terminator and jumper plugs are inserted in the control units.
17. Check that all cables are suitably secured at appropriate points on the vessel.
18. Check that all cables are suitably secured on the engine. These cables (to the starter and to the ECU on the engine) must not be allowed to hang loose, they must be secured to the engine.
19. Check that all cables are neatly routed in the consoles. Connector and cable designations should still be legible when installed if at all possible.
20. Ensure that cables are never routed over sharp edges unless suitably protected against chafing.
21. Ensure that none of the cables can be sheared through when doors or flaps etc. are closed.

Check LOP supply voltage (→ Page 244)

TIM ID: 0000007189 – 005

Check supply voltage distribution (→ Page 420)

1. Set up the multimeter for voltage measuring (connect leads to the appropriate jacks, set voltage measuring range to min. 30 V).
2. Check at the fuses and connectors on the individual devices to ensure that the supply voltage is applied and is within the tolerated range.

11.1.2 Operating voltage – Initial application

Check power supply of LOP (→ Page 244)

Preparation

Note: The operating voltage is applied to the individual units step by step:

1. Remove F16 (1) and F19 (2) fuses from all control units (RCS and MCS).
2. Disconnect X9 connector from W169 cable at PIM4 (port and starboard sides).
3. Disconnect X5 connector at Engine Control Unit ECU.
4. Disconnect Local Operating Station LOS connector (if present).
5. Open front flap of Local Operating Panel.
6. Disconnect X1 connector at transmission control.
7. Plug connector into X7 socket at Local Operating Panel.
8. Engage clip on connector.

Applying operating voltage

1. Insert and turn key for power train to be turned on.
   Result: Operating voltage is on but is only on at the Local Operating Panel LOP.
2. Watch Local Operating Panel LOP carefully!
   - If the Local Operating Panel shows no imadmissible operating states, then the following:
     - Transmission control
     - Engine Control Unit ECU
     - Control units

     can be places into operation one by one.
3. Switch off operating voltage at key switch.
4. Plug X1 connector to the transmission control. Open transmission control flap.
5. Switch on operating voltage at key switch.
   Result: Operating voltage is applied to Local Operating Panel LOP and to transmission control GCU.
6. Watch transmission control very carefully!
   - Watch for any components that may become hot or any unusual actions (display is blank, or something similar).
   - The LEDs show the operating states.
7. Switch off operating voltage at key switch.
8. Plug and lock X5 connector to Engine Control Unit ECU. Open Local Operating Panel flap.
9. Switch on operating voltage at key switch.
   Result: Operating voltage is applied to Local Operating Panel LOP, transmission control GCU and to ECU.
10. Now watch the Local Operating Panel LOP carefully!
    - Now is the only time to check if the current flow is too high due to the ECU. The fuse F67 (20A) should not trip.
11. Switch off operating voltage at key switch.
12. Plug connector to the Local Operating Station LOS (if present).
13. Switch on operating voltage at key switch.
    Result:
    1. Operating voltage is applied to the entire ECS-5.
    2. Display on the Local Operating Station LOS will boot.
14. Switch off operating voltage at key switch.
15. Insert F16 (1) and F19 (2) fuses into the MCS-5 control unit of the main control stand 1 (F16 = 15 A violet, F19 = 10 A red).
16. Switch on operating voltage at key switch.
    Result: The operating voltage is applied to the ECS-5 and to MCS-5 control unit in the main control stand 1.
17. Watch the MCS-5 control unit in the main control stand 1 carefully!
    - Watch for any components that may become hot or any unusual actions (display is blank, or something similar).

TIM ID: 0000033133 – 003

18. Repeat the above mentioned steps for all control units.
19. Switch off operating voltage at key switch.

The following steps are only to be performed on versions with displays:

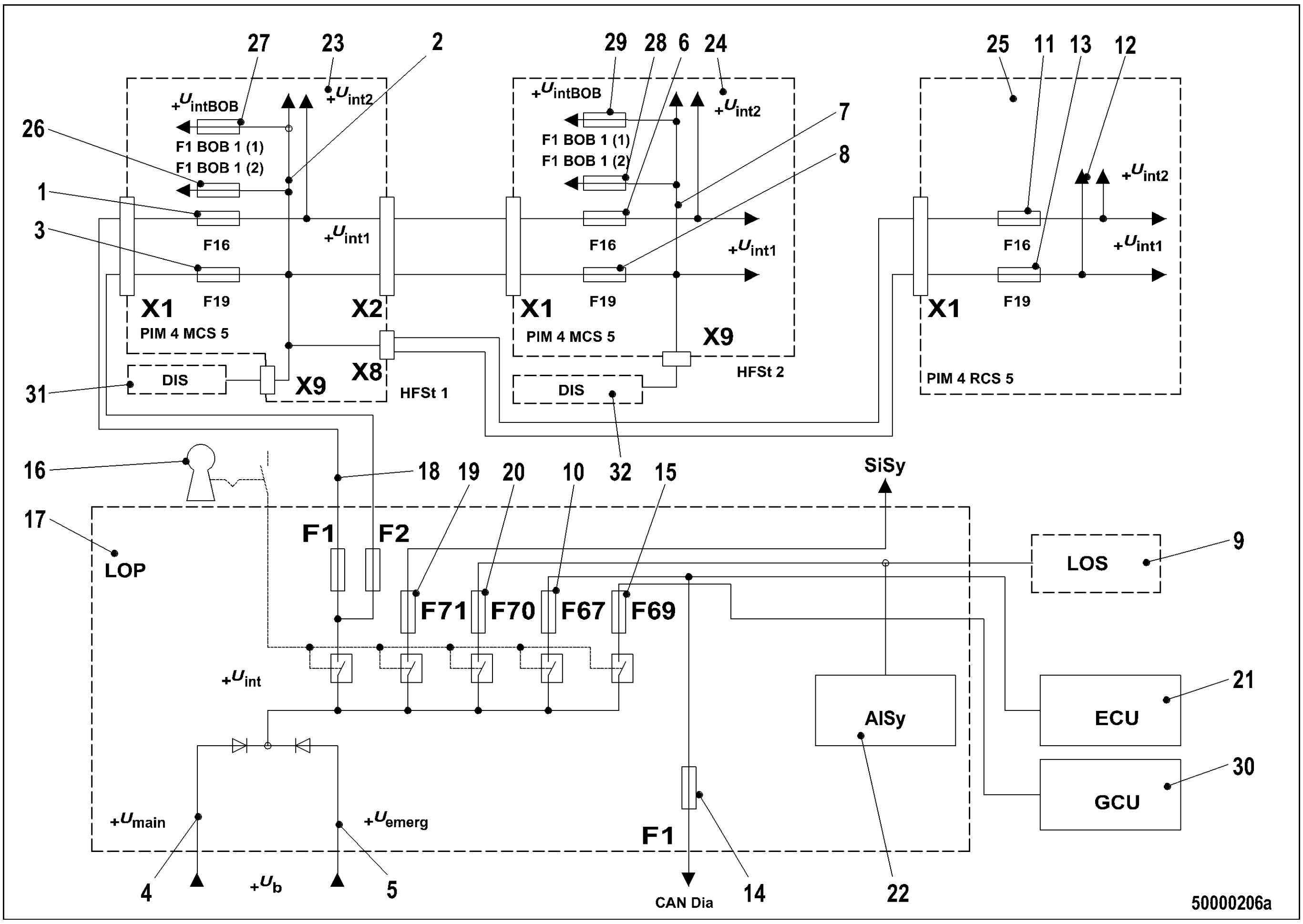
1. Plug X9 connector of W169 cable at PIM4.
2. Switch on operating voltage at key switch.
   Result:
   1. Operating voltage is applied to Local Operating Panel LOP, control units and to this display.
   2. Display will boot.
3. Watch the display carefully during this initial operating phase.
   - Watch for any components that may become hot or any unusual actions (display is blank, or something similar).
4. Repeat the above mentioned steps for all PIMs.
5. Switch off operating voltage at key switch.

Only perform the following steps if the system has an oil priming pump:

1. Switch on the pump's supply voltage (AC voltage).
2. Turn the rotary switch of the oil priming pump controller PPC to “Manual”.
3. Make sure that the pump is operating and that the motor protection switch is not triggered.
4. Turn the rotary switch of the oil priming pump controller PPC to “Automatic”.

TIM ID: 0000033133 – 003

11.1.3 Supply voltage distribution – Check



Pos.	Function name	Meaning
1	F16 -- 15 A	Input for internal supply voltage and (optional) main control stand 2
2	$+U_{bint}$	Internal supply voltage
3	F19 -- 10 A	Input for internal supply voltage and (optional) main control stand 2
4	F1 -- 15 A	Output circuit control stand supply (located on printed circuit board PSB, on side in LOP)
5	F2 -- 15 A	Output circuit control stand supply (located on printed circuit board PSB, on side in LOP)
6	F16 -- 15 A	Input for internal supply voltage
7	$+U_{bint}$	Internal supply voltage
8	F19 -- 10 A	Input for internal supply voltage
9	LOS	Local Operating Station (optional)

TIM ID: 0000007186 – 005

Pos.	Function name	Meaning
10	F67 -- 20 A	Supply for Engine Control Unit ECU and externally connected dialog units
11	F16 -- 15 A	Input for internal supply voltage
12	$+U_{bint}$	Internal supply voltage
13	F19 -- 10 A	Input for internal supply voltage
14	F1 -- 4 A	Supply for dialog unit CAN
15	F69 -- 4 A	Supply for Gear Control Unit GCU
16	S001	Key switch
17	LOP	Local Operating Panel
18	$+U_{MCS/RCS}$	Supply voltage control stands
19	F71 -- 3 A	Supply voltage safety system
20	F70 -- 15 A	Supply voltage alarm system ALSY
21	ECU	Engine Control Unit ECU (installed on engine)
22	ALSY	Alarm system (integrated in LOP of Engine Control System ECS-5)
23	PIM 4 MCS-5	MCS-5 control unit in main control stand 1
24	PIM 4 MCS-5	MCS-5 control unit in main control stand 2 (optional)
25	PIM 4 RCS-5	Control unit RCS-5
26	F1 on BOB 1 (1) -- 3.15 A	Supply for indicator lamps in pushbuttons on main control stand 1 and slave control stands
27	F1 on BOB 1 (2) -- 3.15 A	Supply for alarm indicator lamps on main control stand 1 and slave control stands
28	F1 on BOB 1 (1) -- 3.15 A	Supply for indicator lamps in pushbuttons on main control stand 2 (optional)
29	F1 on BOB 1 (2) -- 3.15 A	Supply for alarm indicator lamps on main control stand 2 (optional)
30	GCU	Gear Control Unit GCU
31	DIS	Display in main control stand 1
32	DIS	Display in main control stand 2

TIM ID: 0000007186 – 005

The $+U_b$ power supply for all devices, i.e. for the entire electronic system (comprising the subsystems ECS-5, MCS-5 and RCS-5) is supplied to the Local Operating Panel LOP of the Engine Control System ECS-5 (with the exception of the supply voltage for the Trolling device on the gearbox which is supplied directly to the GCU).

The $+U_b$ power supply comprises a main supply $+U_{main}$and an emergency supply $+U_{emerg}$. Both voltages are connected to the Local Operating Panel and interconnected there to form the $+U_{int}$ supply voltage. The overall system can thus be immediately supplied with a second voltage should one of the voltages fail.

The frame potentials of the two supply voltages ($+U_{main}$ and $+U_{emerg}$) are interconnected.

The starter is connected directly to the starter battery which supplies it.

The individual supply voltages for all devices requiring a power supply are derived from the internal $+U_{int}$ voltage. They are protected by separate fuses in Local Operating Panel LOP and are then distributed to the devices.

In the PIM 4 control units of the RCS-5 remote control system and the MCS-5 monitoring system, the voltages are distributed to the system devices and additionally fused.

TIM ID: 0000007186 – 005

11.1.4 Data module MEM on MPU 29 – Installation

Preconditions

- Engine is stopped.
- Operating voltage is not present.

Spare parts

Designation / Use	Part No.	Qty.
Programmed data module MEM for power train 1/3		
Programmed data module MEM for power train 2/4		

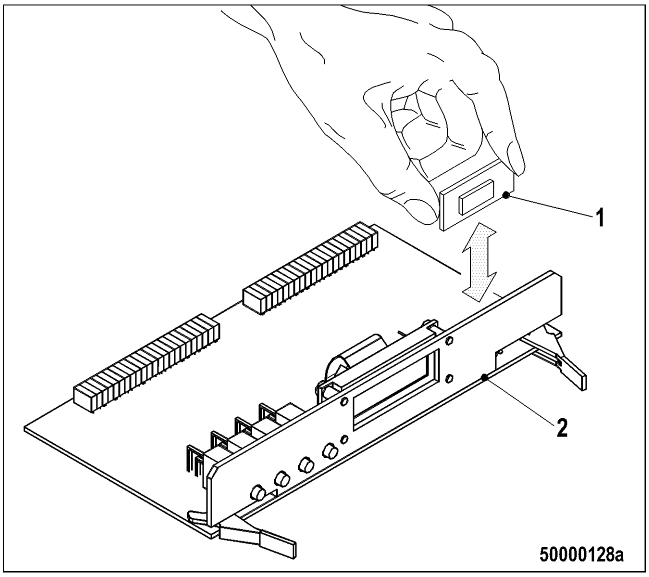
CAUTION	Electrostatic discharge. **destruction of electronic parts or assemblies!** • Before touching electronic components: Electrostatically discharge and ground personnel, tools and working surfaces. • Avoid nonconductive materials from coming into contact with electronic components. • Do not replace electrical/electronic components while voltage is present.

Remove printed circuit board MPU 29 (→ Page 278)**.**

Note: The MEM data modules of the power trains are not identical, it is therefore essential to assign the MEM data modules to the appropriate power train!

Installing data module MEM

1. Place the data module MEM on printed circuit board MPU 29 in the LOP. Check polarity!
2. Press the data module firmly in until the data module connector makes full contact with the printed circuit board.
3. Switch on the system to start downloading data.



Install printed circuit board MPU 29 (→ Page 279)**.**

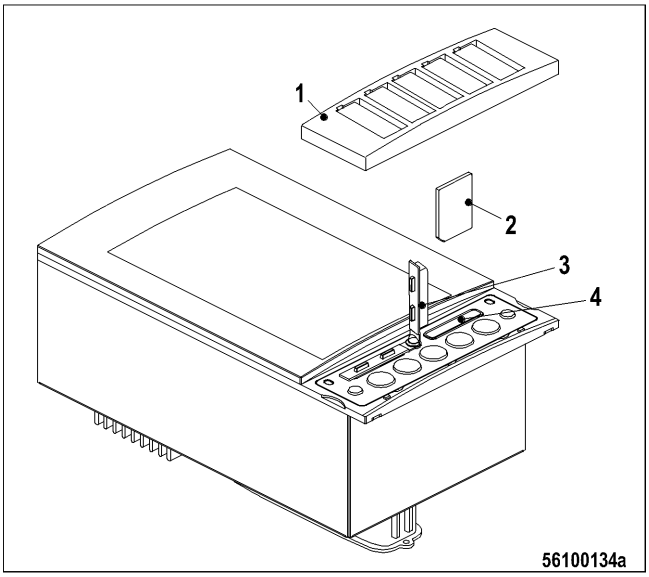
TIM ID: 0000031741 – 001

11.1.5 SD memory card in display MFD – Installation

Note: The card incorporates the plant software for the MFD display. The display loads the appropriate plant software components depending on the node configuration. Power train allocation is set depending on the process bus node setting.

Installing an SD memory card in the MFD display

1. Remove the key unit (1) from the MFD display.
2. Open up the rubber cover (3).
3. Insert the SD memory card (2) in the slot.
4. Gently press in the SD memory card.
   Result: The memory card lock engages (press/press lock/unlock).
5. Press down the rubber cover (3).
6. Fit the key unit (1).
7. Switch on the system.
   Result: Downloading to the MFD display starts.



For other displays on the control stands

1. Switch off the system.
2. Remove the key unit (1) from the MFD display.
3. Open up the rubber cover (3).
4. Gently press in the SD memory card.
   Result: The memory card lock disengages (press/press lock/unlock).
5. Remove the SD memory card (2) from the slot (4).
6. Install the SD memory card in the next MFD display.
   - The procedure is described under “Installing the SD memory card in the MFD display”.
7. After downloading on the last display, install the SD memory card in the starboard display of the main control stand.

TIM ID: 0000031742 – 001

11.2 Settings

11.2.1 Configuration

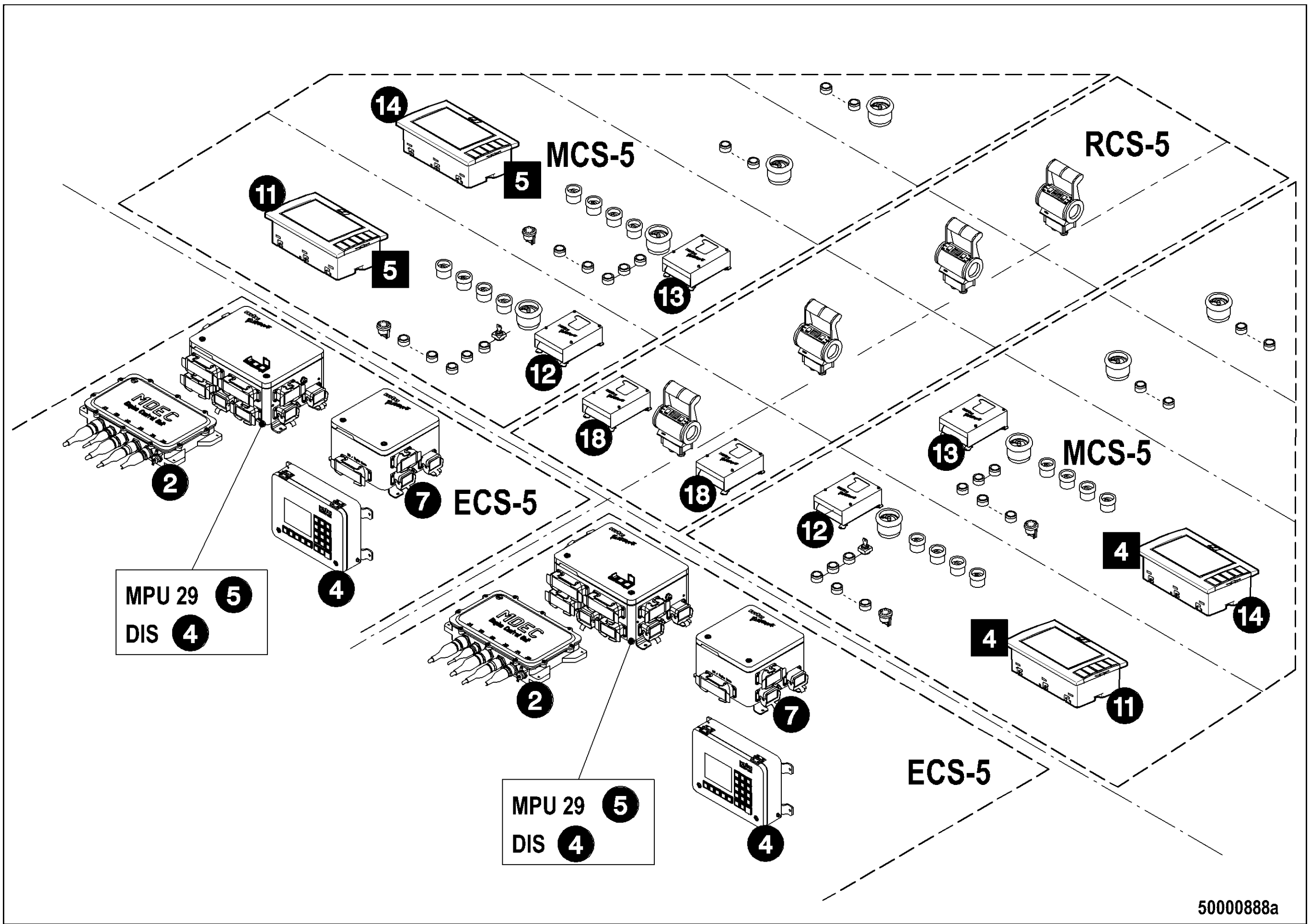
Devices with CAN connection

The following devices of every power train are equipped with a CAN interface and therefore have a CAN node:
- Local Operating Panel LOP: MPU29 and display (if present)
- ECU 4 engine governor
- Transmission control GCU
- Local Operating Station LOS (can only be used if the Local Operating Panel has no display)
- PIM 4 MCS control unit
- PIM 4 RCS control unit
- MFD display main control stand 1
- MFD display main control stand 2

The following illustrations contain the node numbers for each device.

Two nodes must be set at the MFD display whereby a differentiation must be made between process bus nodes and field bus nodes.
- Process bus node for the assignment to power train:
  Node no. 4: Starboard side
  Node no. 5: Port side
- Field bus nodes for the assignment to control console:
  Node no. 11: Main control stand
  Node no. 14: Slave control stand

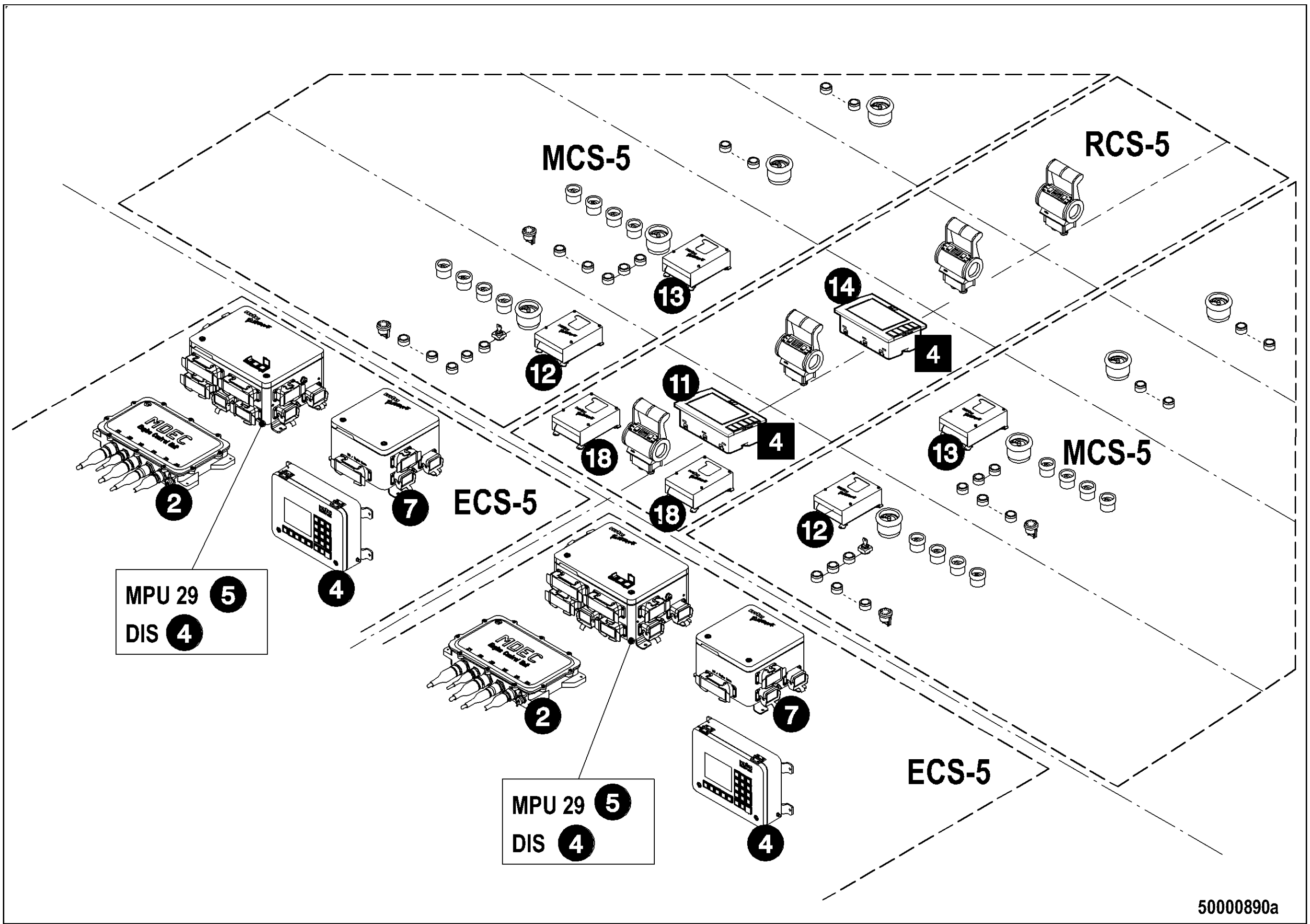
Version 1: One display per power train



■ Process bus node ● Field bus node

TIM ID: 0000032260 – 002

Version 2: One display for two power trains



■ Process bus node ● Field bus node

Node numbers

Each node number can be assigned to each power train only once. If a Local Operating Panel LOP with a DIS display is used, not Local Operating Station LOS can be connected. In this case the DIS display in the Local Operating Panel has the node number 4.

Settings for power limit values of the oil priming pump controller PPC

Power limits of the oil priming pump control unit must be set as follows:

- PPC 5: 3 x 400 VAC 50 Hz, 0.75 kW: 2 A
- PPC 6: 1 x 230 VAC 50 Hz, 1.1 kW: 7.5 A
- PPC 7: 3 x 230 VAC 60 Hz, 0.90 kW: 4 A
- PPC 8: 3 x 440 VAC 60 Hz, 0.90 kW: 2 A

TIM ID: 0000032260 – 002

11.2.2 Mini Dialog – Settings

Preconditions

- Operating voltage available
- Engine switched off

Entering hexadecimal numbers in printed circuit board MPU 29

Note: If the display shows a page that requires entering of a hexadecimal number, the cursor is positioned at the digit with the highest value. The following entry can be canceled at any time with the ESC key.

1. Change the value of that digit using the ↑ or↓ key.
2. Press the ENTER key.
   Result: Value is confirmed. The cursor moves to the next digit with the lower value.
3. Repeat the previous steps for all digits of the number.
   Result: Following confirmation of the digit with the lowest value, the entire hexadecimal number is taken over.

Note: The “Download completed” message only appears when the system is switched on once the plant has been properly configured. Under no circumstances must the initial engine start be carried out prior to this!

Setting MPU 29 node address (→ Page 240)

Setting the engine model

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.
   Result: The engine model is shown in the second line.
3. Press the ENTER key.
   Result: The value currently set is shown in the second line.

4. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the desired engine model is displayed. Possible values:
   - 16 V 2000 M93
   - 16 V 2000 M92
   - 16 V 2000 M91
   - 16 V 2000 M90
   - 16 V 2000 M80
   - 16 V 2000 M72
   - 16 V 2000 M70
   - 16 V 2000 M60
   - 12 V 2000 M93
   - 12 V 2000 M92
   - 12 V 2000 M91
   - 12 V 2000 M90
   - 12 V 2000 M80
   - 12 V 2000 M72
   - 12 V 2000 M70
   - 12 V 2000 M60
   - 10 V 2000 M93
   - 10 V 2000 M92
   - 10 V 2000 M72
   - 8 V 2000 M93
   - 8 V 2000 M92
   - 8 V 2000 M90
   - 8 V 2000 M80
   - 8 V 2000 M72
   - 8 V 2000 M70
   - 8 V 2000 M60
   - 20 V 4000 M93
   - 20 V 4000 M92
   - 16 V 4000 M 93
   - 16 V 4000 M 92
   - 16 V 4000 M 90
   - 16 V 4000 M 73
   - 16 V 4000 M 72
   - 16 V 4000 M 71
   - 16 V 4000 M 70
   - 16 V 4000 M 61
   - 16 V 4000 M 60
   - 12 V 4000 M 93
   - 12 V 4000 M 92
   - 12 V 4000 M 90
   - 12 V 4000 M 73
   - 12 V 4000 M 72
   - 12 V 4000 M 71
   - 12 V 4000 M 70
   - 12 V 4000 M 60
   - 8 V 4000 M 70
   - 8 V 4000 M 60
5. Press the ENTER key.

   Result: Selection is confirmed.
6. Press ENTER key until “Save Changes? Exit-Yes” is displayed and confirm with Yes (Enter).

Specifying the shaft number

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.

   Result: The engine model is shown in the second line.
3. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 until the display shows “Shaft/Eng. No.”.

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4. Press the ENTER key.

   Result: The currently set shaft number is displayed in the second line.
5. Press the ↑ or ↓ key on printed circuit board MPU 29 to set the shaft number as follows:
   - On single-shaft plants: 1
   - On twin-shaft plants:
     - Starboard power train: 1
     - Port power train: 2
   - On triple-shaft plants:
     - Starboard power train: 1
     - Port power train: 2
     - Center power train (“Booster shaft”): 3
   - On four-shaft plants:
     - Outer starboard power train: 1
     - Outer port power train: 2
     - Inner starboard power train: 3
     - Inner port power train: 4
6. Press the ENTER key.

   Result: Selection is confirmed.

Setting optional LOS or LOP with display DIS

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.

   Result: The engine model is shown in the second line.
3. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “LOS/LOP Displ.”.
4. Press the ENTER key.

   Result: The value currently set is shown in the second line.
5. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the appropriate parameter is set. Possible values:
   - Not defined
   - LOS/LOP display not fitted: None
   - LOS/LOP display fitted: Yes
6. Press the ENTER key.

   Result: Selection is confirmed.

Setting priming pump control PPC

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.

   Result: The engine model is shown in the second line.
3. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 until “Priming Pump Not Defined” is displayed.
4. Press the ENTER key.

   Result: The value currently set is shown in the second line.
5. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the appropriate parameter is set. Possible values:
   - Oil priming pump with PPC installed: Yes
   - Oil priming pump with PPC not installed: No
6. Press the ENTER key.

   Result: Selection is confirmed.
7. Press ENTER key until “Save Changes? Exit-Yes” is displayed and confirm with Yes (Enter).

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Setting generator (24 V)

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.
   Result: The engine model is shown in the second line.
3. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “Generator (24 V)”.
4. Press the ENTER key.
   Result: The value currently set is shown in the second line.
5. Set generator using ↑ or↓ key on printed circuit board MPU 29. Possible values:
   - Yes
   - No

Setting compressed-air starter

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.
   Result: The engine model is shown in the second line.
3. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “Start Air”.
4. Press the ENTER key.
   Result: The value currently set is shown in the second line.
5. Set compressed-air starter using ↑ or↓ key on printed circuit board MPU 29. Possible values:
   - Yes/Set Limit: Start-air limit can be entered.
   - No

Setting the number of main control stands

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.
   Result: The engine model is shown in the second line.
3. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “MCS Config.”.
4. Press the ENTER key.
   Result: The value currently set is shown in the second line.
5. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the desired number and type of control stands are set. Possible values:
   - Not defined
   - MCC1: MCC without display
   - MCC1/DIS: MCC with display for each power train
   - MCC1/DualDIS: MCC with one display for both power trains
   - MCC1 +MCC2: MCC 1 and MCC 2 without display
   - MCC1/DIS+MCC2: MCC 1 with display for each power train + MCC 2 without display
   - MCC1/DualDIS+MCC2: MCC 1 with one display for both power trains + MCC 2 without display
   - MCC1+MCC2/DIS: MCC 1 without display + MCC 2 with display for each power train
   - MCC1+MCC2/DualDIS: MCC 1 without display + MCC 2 with one display for both power trains
   - MCC1/DIS+MCC2/DIS: MCC 1 with display for each power train + MCC 2 with display for each power train
   - MCC1/DIS+MCC2/DualDIS: MCC 1 with display for each power train + MCC 2 with one display for both power trains
   - MCC1/DualDIS+MCC2/DIS: MCC 1 with one display for both power trains + MCC 2 with display for each power train
   - MCC1/DualDIS+MCC2/DualDIS: MCC 1 with one display for both power trains + MCC 2 with one display for both power trains
6. Press the ENTER key.
   Result: Selected value is displayed.
7. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “Ackn. Config.”.

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8. Specify how alarm acknowledgment is to take effect at the other control stand:
   - MCC1 --> MCC2: MCC1 also acknowledges MCC2
   - MCC1 <--> MCC2: MCCs acknowledge each other
   - MCC1 <-- MCC2: MCC2 also acknowledges MCC1
   - MCC1 I MCC2: MCC1 and MCC2 acknowledgment separate
9. Press the ENTER key.

   Result: Selection is confirmed.

Setting the number of slave control stands

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.

   Result: The engine model is shown in the second line.
3. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “Slave Controls”.
4. Press the ENTER key.

   Result: The value currently set is shown in the second line.
5. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the desired number of slave control stands is set. Possible values:
   - Slave control stand not defined: Not Defined
   - No slave control stand: NONE
   - One slave control stand: 1
   - Two slave control stands: 2
6. Press the ENTER key.

   Result: Selection is confirmed.

Setting remote control system

Note: The following settings apply to propulsion control levers and similarly to speed setting modules.

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.

   Result: The engine model is shown in the second line.
3. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “RCS Lever Type”.
4. Press the ENTER key.

   Result: The value currently set is shown in the second line.
5. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the type of propulsion control lever is displayed. Set the following values:
   - On single-shaft plants (no non-MTU RCS possible): UNO
   - On twin-shaft plants: DUO for both power trains
   - On triple-shaft plants with two different command units (single command unit for the center shaft):
     - Starboard power train: DUO
     - Port power train: DUO
     - Center power train: UNO
     - On triple-shaft plants with command unit ROS 11-01 for all three shafts: TRIO for all power trains
   - On four-shaft plants: DUO for all power trains
   - Only third-party RCS-WJ possible: Foreign RCS-WJ.
6. Press the ENTER key.

   Result: The text for the other propulsion control levers is shown in the second line.

Setting SCL

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.

   Result: The engine model is shown in the second line.

3. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “SCL Off Conf.”.
4. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the desired SCL operation is displayed. Set the following values:
   - Panic (Classic); moving the propulsion control lever out of the neutral position is sufficient to cancel SCL operation.
     - Indication on MPU 29 display: 0
   - Panic (Standard), SCL cancellation additionally by neutral position or reducing the SCL master propulsion control lever setting.
     - Indication on MPU 29 display: 64
   - Button+Panic+d, SCL cancellation by adapting the SCL slave propulsion control lever position to that of the SCL main propulsion control lever or by moving the SCL slave propulsion control lever out of neutral position.
     - Indication on MPU 29 display: 65
   - Button+delta, SCL cancellation only by pressing button and adapting SCL slave propulsion control lever to SCL master propulsion control lever or SCL master propulsion control lever in neutral position.
     - Indication on MPU 29 display: 66

Setting the portable control unit option

Note: The portable control unit can only control two shafts. On triple-shaft plants the two outer shafts are therefore controlled. Shaft numbers:
- Outer starboard shaft: 1
- Outer port shaft: 2

The center shaft (on triple-shaft plants) is assigned number 3. The only influence the portable control unit exerts on it is that the shaft is automatically set to neutral if the portable control unit is put in command. Set Yes for the portable control unit on the third shaft as well.

1. If required, repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.

   Result: The engine model is shown in the second line.
3. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “Portable Ctrl”.
4. Press the ENTER key.

   Result: The value currently set is shown in the second line.
5. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until
   - For portable control unit: Yes
   - No portable control unit RCS-HSG: No
6. Press the ENTER key.

   Result: Selection is confirmed.
7. Set the shaft / engine number to 1 (starboard) on the starboard side so that the starboard thumbwheel controls the starboard power train.
8. Set the shaft / engine number to 2 (port) on the port side so that the port thumbwheel controls the port power train.
9. Press the ENTER key.

   Result: Selection is confirmed.

Setting RCS Quiet Mode

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.

   Result: The engine model is shown in the second line.
3. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “RCS Quiet Mode”.
4. Press the ENTER key.

   Result: The value currently set is shown in the second line.
5. Set values using ↑ or↓ key on printed circuit board MPU 29. Possible values:
   - On (default setting)
   - Off

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Setting gearbox parameters (standard gearbox)

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.
   Result: The engine model is shown in the second line.
3. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “Gear Type”.
4. Press the ENTER key.
   Result: The value currently set is shown in the second line.
5. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the desired gearbox is displayed. Consult the gearbox manufacturer for details of the correct gearbox option or refer to the gearbox documentation.
6. Press the ENTER key.
   Result: Selection is confirmed.

Setting gearbox parameters (special gearbox)

1. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “Special Type”.
2. Press the ENTER key.
3. Set 8-digit hexadecimal code.
4. Determine exact gearbox data as per below table.

Pos.	Letter	Meaning	Values
1	W	Type of gearbox	0 = Reversing gearbox 1 = Reduction gearbox
2	kkk	Available channels	001 = Gearbox oil pressure 010 = Gearbox oil temperature 100 = Filter clogged
3	bb	Actuation	00 = Not defined 01 = Ahead/astern 10 = Ahead/astern/24V 11 = Ahead/astern/neutral
4	rrr	Feedback	000 = None 001 = Neutral 010 = Ahead and astern 011 = Ahead and astern and neutral 101 = Mech. act. and neutral 111 = Mech. act. and ahead/astern/neutral
5	vv	Pressure interlock	00 = No neutral interlock 01 = Neutral interlock 11 = Interlock via parameter
6	00000	—	Must always be 00000.

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Pos.	Letter	Meaning	Values
7	ggggg	1st limit value for gearbox lube oil pressure	00000 = Suppress alarm. 00001 = 7 bar 00010 = 7.5 bar 00011 = 8 bar ... 11111 = 22 bar
8	0	—	Must always be 0.
9	GGGGG	2nd limit value for gearbox lube oil pressure	See above; limit value p_{Lim} = 6.5 bar + Gg x 0.5 bar
10	ttt	1st limit value for gearbox oil temperature	000 = Suppress alarm. 001 = 85 °C 010 = 90 °C 011 = 93 °C 100 = 95 °C 101 = 98 °C 110 = 100 °C 111 = 103 °C
11	P	Limit values via parameter	0 = Values above are set. 1 = Values above are ignored, they must be set using the dialog unit.
12	0	—	Must always be 0.

5. Compile the binary number. Example: The following gearbox specifications have been established:
   - Reversing gearbox
   - Gearbox oil pressure sensor, gearbox oil temperature sensor and “Filter clogged ” sensor are provided
   - One limit switch for ahead, astern and gearbox neutral feedback respectively are provided
   - Actuation valves for ahead and astern, with 24 V
   - No neutral interlock
   - Gearbox oil temperature alarm upwards of 85°C
   - The limit value for low gearbox control oil pressure is 22 bar

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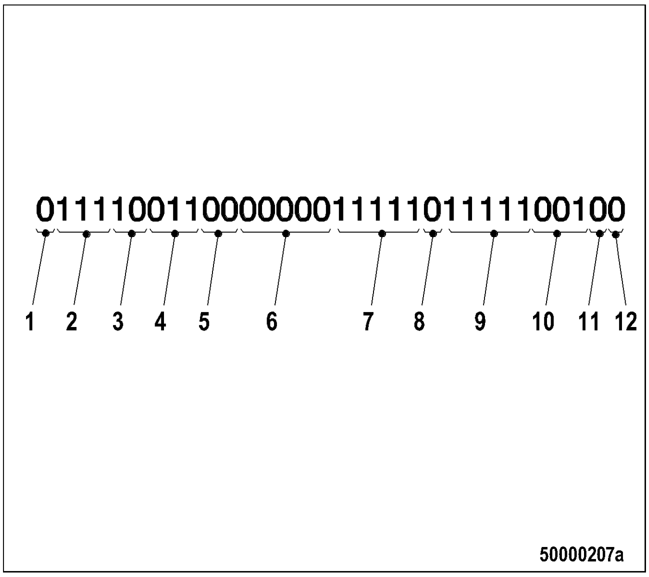
6. This information can be represented by the following binary number: 01111001100000001111100100
7. Convert the binary string into a hexadecimal value. The result in the example is: F980FBE4.
8. Enter the hexadecimal value under “Special Type” in the Mini Dialog.
9. Press the ENTER key.

   Result: Selection is confirmed.



1 Reversing gearbox
2 All channels
3 Actuation ahead/astern/24V
4 All limit switches
5 No interlock
6 Always 00000
7 22 bar
8 Always 0
9 22 bar
10 85ºC
11 No dialog
12 Always 0

Setting the clutch control mode

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.

   Result: The engine model is shown in the second line.
3. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “Swap Clut.Ctrl”.
4. Press the ENTER key.

   Result: The value currently set is shown in the second line.
5. Press the ↑ or ↓ key on printed circuit board MPU 29 until “Yes” is displayed in the second line.

   Result: The gearbox engages ahead if the corresponding propulsion control lever is moved forwards
6. Press the ENTER key.

   Result: Selected value is displayed.
7. Adapt the clutch position feedback as per previous settings.
8. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “Swap Clut. Fdbk”.
9. Press the ENTER key.

   Result: The value currently set is shown in the second line.
10. Press the ↑ or ↓ key on printed circuit board MPU 29 until “Yes” is displayed in the second line.

    Result: The clutch control gives feedback regarding the clutch position.
11. Press the ENTER key.

    Result: Selection is confirmed.

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Setting the crash stop response

Note: The “Crash Stop” response refers to a sudden reversal of thrust direction in order to stop the vessel as quickly as possible. First of all, define whether these settings are to be made at the display of the LOP (via Mini Dialog) or whether a dialog unit is available and the settings are to be made using this dialog unit (via Dialog Unit). Setting via the Mini Dialog is described below.

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.
   Result: “Motor Type” is displayed.
3. Repeatedly press ↑ or↓ key on printed circuit board MPU 29 until “Crash Stop Conf.” and in the second line “via Mini Dialog” is displayed. Set the following if required:
   3.1. Max.alt.eng.Spd.: The clutch is engaged in the opposite direction delayed by the time entered under Del.alt.engage: when the engine speed exceeds the sum of idling speed and the offset entered here (value in second line) (example: If the idling speed is 800 rpm and an offset of 600 rpm is set, reversal of thrust is delayed by 5 seconds from speeds of 1400 rpm onwards. The following values can be set:
   - offs: 600 rpm (def)
   - offs: 700 rpm
   - offs: 800 rpm
   - offs: 400 rpm
   - offs: 500 rpm

   3.2. Max.alt.dis.Spd.: The clutch is disengaged on reversing direction when the engine speed falls below the sum total of idling speed and the offset entered here. The following values can be set:
   - offs: 200 rpm (def)
   - offs: 250 rpm
   - offs: 300 rpm
   - offs: 100 rpm
   - offs: 150 rpm

   3.3. Del.alt.engage.: Enter the time delay for the previous Max.alt.eng.Spd setting. The following values can be set:
   - 5 sec (def)
   - 6 sec
   - 8 sec
   - 10 sec
   - 12 sec
   - 14 sec
   - 1 sec
   - 2 sec
   - 3 sec
   - 4 sec
4. Press the ENTER key.

Activating the Trolling option

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.
   Result: The engine model is shown in the second line.
3. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “Trolling Unit”.
4. Press the ENTER key.
   Result: The second line of the display reads “No Trolling”

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5. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the appropriate control for the desired gearbox appears on the display (see gearbox and Trolling Control Unit documentation):
   - ZF
   - ZF MTCU(EST-59)
   - ZF PWM 2 Valve
   - ZF PWM 1 Valve
   - ZF CANOPEN
   - Reintjes G-ADS
   - TD E-Troll
   - TD E-Tr. EC 050
6. Press the ENTER key.
7. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the desired method of control "Trolling Conf." appears (see gearbox documentation).
8. Note that there is a link between the Trolling Control Unit setting under menu option "Trolling Unit:" and the trolling configuration setting at this menu option ("Trolling Conf:") ..
9. The following settings are possible for ZF, ZF MTCU (EST-59) and Reintjes G-ADS:
   - Voltage demand for voltage setting 1.2 to 3.8 V
   - 4 to 20 mA demand for 4 to 20 mA current setting
10. The following settings are possible for ZF PWM:
    - PWM 450/160mA
    - PWM 150/300mA
    - PWM 200/300mA
    - PWM man. Config. for setting via PWM signal (for the setting "PWM man. Config." the settings for PWM must be 0% mA and PWM 100% mA)
11. Press the ENTER key to enter an 8-figure hexadecimal value. The fault message MG TROLLING CONF. FAULT appears if inappropriate settings are made.
12. Press the ENTER key.

    Result: The selected value is displayed
13. Press the ENTER key.
14. Max Troll Spd: Set max. trolling speed.
    - No Trolling
    - ZF Standard
    - ZF Surface
    - ZF CANOPEN
    - ZF CO Surface
    - GADS Standard
    - E-Troll Standard
    - Manual setting
15. Select operating mode (Mode Select):

    15.1. Trolling: Trolling is activated manually via buttons

    Note: Docking with suitable auto-trolling unit only. PWM trolling not suitable.

    15.2. Docking Mode: Trolling mode engages automatically at low propulsion control lever settings

    15.3. Max Dock. Spd. Possible values:
    - Use Max. Troll.
    - ZF (default)
    - Manual Setting

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16. Changeover Pos: At what propulsion control lever position does the trolling mode switch on/off automatically? Possible values:
    - ZF(default30%)
    - TD(default30%)
    - 25%
    - 30%
    - 35%
    - 40%
    - 45%
    - 50%
    - 55%
    - 10%
    - 15%
    - 20%
    - Manual Setting
17. Set minimum trolling value.
    17.1. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “Min Dock Troll:”
    17.2. Press the ENTER key.
    17.3. Set value. The following values can be set:
    - ZF default
    - TD default
    - 0% to 50% (in steps of five)
    - Manual Setting

    17.4. Press the ENTER key.
    Result: The selected value is displayed.

Setting T-Riser

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.
   Result: The engine model is shown in the second line.
3. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “T-Riser”.
4. Press the ENTER key.
   Result: The value currently set is shown in the second line.
5. Set values using ↑ or↓ key on printed circuit board MPU 29. Possible values:
   - Switch_NO (NormalOpen)
   - Switch_NC (NormalClosed)

Setting Test mode

1. Repeatedly press the ↑ or↓ key on printed circuit board MPU 29 in the LOP until the display shows “Select parameter page”.
2. Press the ENTER key.
   Result: The engine model is shown in the second line.
3. Repeatedly press the ↑ or ↓ key on printed circuit board MPU 29 until the display shows “Testmode”.
4. Press the ENTER key.
   Result: The value currently set is shown in the second line.
5. Set values using ↑ or↓ key on printed circuit board MPU 29. Possible values:
   - On
   - Off

TIM ID: 0000007050 – 006

11.3 Tests

11.3.1 Initial engine startup at service interface on LOP

Preconditions

- All mechanical connection and installation work on the engine must have been properly completed prior to initial engine startup. This particularly applies to the entire coolant circuit and the entire oil supply system.
- All installation work on the gearbox must have been completed in accordance with the gearbox documentation (refer to the appropriate gearbox manual).
- Operators must familiarize themselves with all emergency operating procedures for the engine and gearbox. They must be able to stop the engine immediately in case of unforeseen irregularities. Refer to the operating instructions for information concerning emergency operating procedures.
- Ensure that the gearbox is not permanently engaged by means of its emergency mechanism (there are various ways of permanently engaging the gearbox depending on its design, refer to the gearbox documentation for details).
- Engine and gearbox must be filled or supplied with lube oil, coolant and fuel. Refer to the operating instructions and gearbox documentation.
- If the vessel is in dry-dock during initial startup, the coolant circuit must be supplied externally via a water line. Furthermore, always make sure that all personnel is clear of the propeller and shaft. Remove the propeller if necessary (shaft still moves).
- If the vessel is in the water during initial startup, be aware that the vessel will start moving when the propulsion control lever is set to engage. The propulsion shaft flanges must be disconnected if this is to be prevented.
- The green indicator lamp is lit on the Local Operating Panel LOP associated with power train concerned.

⚠ **DANGER**	Unguarded rotating and moving engine components. **Risk of serious injury – danger to life!** • Take special care when working on a running engine.

⚠ **WARNING**	Engine noise above 85 dB (A). **Risk of damage to hearing!** • Wear ear protectors.

⚠ **CAUTION**	Engine damage due to wrong actions. **Major material damage!** • Ensure engine is ready for operation before starting. See engine documentation.

Preparatory steps

1. Switch on the overall system for the power train of the engine which is to be started.
2. Both propulsion control levers of the command unit on the commanding control stand set to NEUTRAL.

Starting the engine

Note: The automatic starting sequence can be cancelled at any time by turning the rotary switch to the STOP position.

1. Turn the rotary switch on Local Operating Panel LOP clockwise to the START position.
2. Release the rotary switch.

   Result:
   - The rotary switch automatically returns to the ON position.
   - The starting sequence is represented on the control stand (or control stands if several are included) in the same way as a normal engine start.
   - The engine runs at idling speed after a certain time.
   - The power train concerned is ready for engagement.
   - The gearbox of the power train concerned is disengaged.

TIM ID: 0000007203 – 002

11.3.2 Initial engine startup at display on Local Operating Panel LOP or Local Operating station LOS

Preconditions

- All mechanical connection and installation work on the engine must have been properly completed prior to initial engine startup. This particularly applies to the entire coolant circuit and the entire oil supply system.
- All installation work on the gearbox must have been completed in accordance with the gearbox documentation (refer to the appropriate gearbox manual).
- Operators must familiarize themselves with all emergency operating procedures for the engine and gearbox. They must be able to stop the engine immediately in case of unforeseen irregularities. Refer to the operating instructions for information concerning emergency operating procedures.
- Ensure that the gearbox is not permanently engaged by means of its emergency mechanism (there are various ways of permanently engaging the gearbox depending on its design, refer to the gearbox documentation for details).
- Engine and gearbox must be filled or supplied with lube oil, coolant and fuel. Refer to the operating instructions and gearbox documentation.
- If the vessel is in dry-dock during initial startup, the coolant circuit must be supplied externally via a water line. Furthermore, always make sure that all personnel is clear of the propeller and shaft. Remove the propeller if necessary (shaft still moves).
- If the vessel is in the water during initial startup, be aware that the vessel will start moving when the propulsion control lever is set to engage. The propulsion shaft flanges must be disconnected if this is to be prevented.
- Local mode must be activated, i.e. the indicator lamp LOCAL OPERATION is lit (green).

⚠ **DANGER**	Unguarded rotating and moving engine components. **Risk of serious injury – danger to life!** • Take special care when working on a running engine.

⚠ **WARNING**	Engine noise above 85 dB (A). **Risk of damage to hearing!** • Wear ear protectors.

⚠ **CAUTION**	Engine damage due to wrong actions. **Major material damage!** • Ensure engine is ready for operation before starting. See engine documentation.

Preparation

1. Switch on the overall system for the power train of the engine which is to be started.
2. Both propulsion control levers of the command unit on the commanding control stand set to NEUTRAL.

Starting the engine

Note: The automatic starting sequence can be cancelled at any time by pressing illuminated pushbutton STOP.

1. Retrieve the ECU graphic page on the display of the LOP (or on the LOS). The engine speed etc. is displayed here.
2. Press the illuminated pushbutton START.

   Result:
   - Increasing engine speed is indicated by the bargraph on the display.
   - The starting sequence is represented on the control stand (or control stands if several are included) in the same way as a normal engine start.
   - The engine runs at idling speed after a certain time.
   - The power train concerned is ready for engagement.
   - The gearbox of the power train concerned is disengaged.

TIM ID: 0000007202 – 001

11.3.3 Initial engine startup at MCS

Preconditions

- All mechanical connection and installation work on the engine must have been properly completed prior to initial engine startup. This particularly applies to the entire coolant circuit and the entire oil supply system.
- All installation work on the gearbox must have been completed in accordance with the gearbox documentation (refer to the appropriate gearbox manual).
- Operators must familiarize themselves with all emergency operating procedures for the engine and gearbox. They must be able to stop the engine immediately in case of unforeseen irregularities. Refer to the operating instructions for information concerning emergency operating procedures.
- Ensure that the gearbox is not permanently engaged by means of its emergency mechanism (there are various ways of permanently engaging the gearbox depending on its design, refer to the gearbox documentation for details).
- Engine and gearbox must be filled or supplied with lube oil, coolant and fuel. Refer to the engine and gearbox documentation.
- If the vessel is in dry-dock during initial startup, the coolant circuit must be supplied externally via a water line. Furthermore, always make sure that all personnel is clear of the propeller and shaft. Remove the propeller if necessary (shaft still moves).
- If the vessel is in the water during initial startup, note that the vessel starts moving when the propulsion control lever is set to engage. The propulsion shaft flanges have to be disconnected to prevent this.
- Local mode must be deactivated, i.e. the indicator lamp LOCAL OPERATION is dark.
- The indicator lamp READY FOR START/STOP is lit on the control stands.

DANGER	Unguarded rotating and moving engine components. **Risk of serious injury – danger to life!** • Take special care when working on a running engine.

WARNING	Engine noise above 85 dB (A). **Risk of damage to hearing!** • Wear ear protectors.

CAUTION	Engine damage due to wrong actions. **Major material damage!** • Ensure engine is ready for operation before starting. See engine documentation.

Preparation

1. Switch on the overall system for the power train of the engine which is to be started.
2. Both propulsion control levers of the command unit on the commanding control stand set to NEUTRAL.

Engine start

Note: The automatic starting sequence can be canceled at any time by pressing illuminated pushbutton STOP. The engine then runs down again.

1. Retrieve the ECU graphic page on the display. The engine speed etc. is displayed here.
2. Press the illuminated pushbutton START.

   Result:
   - Increasing speed is indicated on the display.
   - The starting sequence is represented on the control stand (or control stands if several are included) in the same way as a normal engine start.
   - The speed display instrument indicates increasing speed.
   - The power train concerned is ready for engagement.
   - The engine runs at idling speed after a certain time.
   - The gearbox of the power train concerned is disengaged.

11.3.4 Testing speed control and clutch setting

Preconditions

- The engine concerned is running at idling speed.
- On systems with a Local Operating Panel LOP with DIS or when a Local Operating Station LOS is included: Local mode must be deactivated, the indicator lamp LOCAL OPERATION is dark.
- On systems with a Local Operating Panel with service interface: The rotary switch must be set to ON.

⚠ **WARNING**	Uncontrolled vessel movements due to sudden control lever movement. **Danger of injury, major material damage!** • Actuate control lever with caution.

Engaging and disengaging the clutch

1. Move the propulsion control lever of the power train concerned forwards on the command unit of the commanding control stand.
   Result:
   - The gearbox is engaged ahead.
   - The engine speed increases.
   - Thrust is exerted in the ahead direction.
2. Set the propulsion control lever to the NEUTRAL position on the command unit of the commanding control stand.
   Result:
   - The engine speed decreases.
   - The gearbox is disengaged.
   - Thrust in no longer exerted.
3. Move the propulsion control lever backwards on the command unit of the commanding control stand.
   Result:
   - The gearbox is engaged astern.
   - The engine speed increases.
   - Thrust is exerted in the astern direction.

Course of action in case of malfunction

Position	Result	Action
Propulsion control lever	Power train sides misconnected on one or more propulsion control levers.	• Check and correct connection of connectors X1 and X2 (X3 as well in the case of RCS-TRIO) at the command units (→ Page 391) and (→ Page 386) • Check and correct connection of connectors X11, X12, X13 and X14 at the port/starboard PIM 4 RCS control units (→ Page 394)
Propulsion control lever	Wrong direction of thrust	Check the “Swap Clutch Control” setting in MINIDIAG at the Local Operating Panel and correct as necessary (→ Page 427).

TIM ID: 0000007214 – 001

11.3.5 Testing command transfer (only when several control stands are included)

Preconditions

- The systems for both power trains are switched on.
- Both propulsion control levers are set to NEUTRAL on the command unit of the control stand which is to assume command.

Assuming command

Note: The description is formulated for a two-shaft plant. Proceed accordingly for plants with fewer or more power trains.

1. Press the COMMAND key on the command unit of the control stand which is to assume command.
2. Set both propulsion control levers to the same position as the propulsion control levers on the previously commanding control stand within two seconds.
   Result:
   - The two COMMAND light emitting diodes on the command unit of the previously commanding control stand go out.
   - The buzzer on the previously commanding control stand sounds for 2 seconds.
   - The two COMMAND light emitting diodes on the command unit of the newly selected control stand light up.
   - The newly selected control stand is in command.
   - The gearbox remains engaged in the same direction.
   - The engine speed is adjusted to the setting made at the newly selected control stand.

Course of action in case of malfunction

Position	Result	Action
COMMAND key	Command is not transferred as described.	Reset the system (→ Page 444)

TIM ID: 0000007213 – 004

11.3.6 System reset

Preconditions

- All overall systems for all power trains are switched off.

System reset

1. Press and hold down all COMMAND and SYN./TROL. keys on main control stand 1.
2. Put all overall systems for all power trains into operation consecutively; hold down the COMMAND and SYN./TROL. keys on all command units on the main control stand in so doing.
3. Release the COMMAND and SYN./TROL. keys on all command units.

   Result:
   - The systems are reinitialized.
   - The systems are ready for operation after a few seconds.

TIM ID: 0000007190 – 003

Annex

12 Annex

12.1 Conversion tables

Length

Unit A	multiplied by factor	= Unit B
in	25.4	= mm
ft	0.3048	= m
yd	0.9144	= m
stat. mile	1.609	= km
nm	1.852	= km
yd	3	= ft
yd	36	= in

Unit B	multiplied by factor	= Unit A
mm	0.03937	= in
m	3.281	= ft
km	0.6215	= stat. mile

Area

Unit A	multiplied by factor	= Unit B
in^2	645.16	= mm^2
ft^2	0.0929	= m^2
yd^2	0.8361	= m^2
stat. $mile^2$	2.5889	= km^2

Unit B	multiplied by factor	Unit A
mm^2	0.00155	= in^2
m^2	10.7643	= ft^2
m^2	1.1960	= yd^2
km^2	0.3863	stat. $mile^2$

TIM ID: 0000000413 – 005

Volume

Unit A	multiplied by factor	= Unit B
in^3	16387	= mm^3
ft^3	0.02832	= m^3
yd^3	0.7646	= m^3
gallon (US)	3.787	= dm^3
gallon (Brit.)	4.546	= dm^3

Unit B	multiplied by factor	= Unit A
cm^3	0.06102	= in^3
m^3	35.31	= ft^3
dm^3	0.2642	= gallon (US)
dm^3	0.22	= gallon (Brit.)

Speed

Unit A	multiplied by factor	= Unit B
ft/s	0.3048	= m/s
stat. mile/h (mph)	1.609	= km/h
knot (Brit.)	1.852	= km/h

Unit B	multiplied by factor	= Unit B
m/s	3.281	= ft/s
km/h	0.6215	= stat. mile/h (mph)
km/h	0.54	= knot (Brit.)

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Mass

Unit A	multiplied by factor	= Unit B
lb	0.4536	= kg
oz	28.35	= g
ton	1.016	= t

Unit B	multiplied by factor	= Unit A
g	0.03527	= oz
kg	2.205	= lb
t	0.9843	= ton

Force

Unit A	multiplied by factor	= Unit B
lb	0.4536	= kp
lb	4.4483	= N

Unit B	multiplied by factor	= Unit A
kp	2.205	= lb
N	0.101972	= kp
kp	9.80665	= N

Density

Unit A	multiplied by factor	= Unit B
lb s^2/ft^4	515.4	= kg/m^3

Unit B	multiplied by factor	= Unit A
kg/m^3	0.00194	= lb s^2/ft^4

Torque

Unit A	multiplied by factor	= Unit B
ft lb	1.3563	= Nm

Unit B	multiplied by factor	= Unit A
Nm	0.7373	= ft lb

Pressure

Unit A	multiplied by factor	= Unit B
lb/sq in (psi)	703.1	= kp/m^2 (mm WS)
lb/sq in (psi)	0.06895	= bar
lb/sq ft	47.883	= Pa
in QS	0.03386	= bar
in QS	345.3	= kp/m^2

Unit B	multiplied by factor	= Unit A
atm	760	= mm QS
atm	1.0133	= bar
atm	10332	= kp/m^2 (mm WS)
atm	1.0332	= kp/cm^2 (at)
atm	14.696	= lb/sq in
bar	14.503	= lb/sq in

Mass moment, 2nd grade

Unit A	multiplied by factor	= Unit B
ft lb s^2	1.3563	= kg m^2

Unit B	multiplied by factor	= Unit A
kg m^2	0.7373	= ft lb s^2

TIM ID: 0000000413 – 005

Energy

Unit A	multiplied by factor	= Unit B
ft lb	1.356	= J
kcal	4186.8	= J
BTU	1055	= J
CHU	1899	= J

Unit B	multiplied by factor	= Unit A
J	0.7376	= ft lb
J	0.0002389	= kcal
J	0.0009479	= BTU
J	0.00052656	= CHU

Power

Unit A	multiplied by factor	= Unit B
HP (horse power)	0.7355	= kW
HP	0.7457	= kW
BTU/s	1.055	= kW
kcal/h	1.163	= W
HP	550	= ft lb/s

Unit B	multiplied by factor	= Unit A
kW	1.36	= PS
kW	1.341	= HP
kW	0.9479	= BTU/s
W	0.8598	= kcal/h
ft lb/s	0.0018	= HP

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Temperature

	Celsius	Kelvin	Fahrenheit	Réaumur
x °C		= x + 273.15 K	= 9/5x + 32 °F	= (4/5x) °R
x K	= x − 273. 15 °C		= 9/5(x − 273.15) + 32 °F	= 4/5(x − 273.15) °R
x°F	= 5/9(x − 32) °C	= 5/9(x − 32) + 273.15 K		= 4/9(x − 32) °R
x°R	= 5/4x °C	= (5/4x) + 273.15 K	= (9/4x) + 32 °F	

Fuel consumption

Unit A	multiplied by factor	= Unit B
mile/gal (US)	0.4251	= km/l
gal/mile (US)	2.3527	= l/km

Unit B	multiplied by factor	= Unit A
km/l	2.3527	= mile/gal (US)
l/km	0.4251	= gal/mile (US)

TIM ID: 0000000413 – 005

12.2 Abbreviations

Abbreviation	Meaning	Explanation
ADEC	Advanced Diesel Engine Control	Engine governor
AL	Alarm	
ANSI	American National Standards Institute	Umbrella organization administering and coordinating U.S. standards
ATL	Abgasturbolader	Exhaust turbocharger
BR	Baureihe	Series
CAN	Controller Area Network	Data bus system, bus standard
CPP	Controllable Pitch Propeller	
°C	Degrees Celsius	
DIN	Deutsches Institut für Normung e. V.	German Standardization Organization, at the same time identifier of German standards ("Deutsche Industrie-Norm")
DIS	Display Unit	
DL	Default Lost	Alarm: Default CAN bus failure
DTS	Depot Test System	Test system
ECS	Engine Control System	Engine management system
ECU	Engine Control Unit	Engine governor
EDM	Engine Data Module	Memory module for engine data
EEPROM	Electrically Erasable and Programmable Read Only Memory	Memory module
EPROM	Electrically Programmable Read Only Memory	Memory module
EMU	Engine Monitoring Unit	
ESD	Electrostatic Device	Component susceptible to electrostatic discharge
ETC	Electronic Transmission Controller	J1939 message
FDH	Field Data Handling	
FL	MTU Fluids and Lubricants Specifications	Publication No. A001016/..
FPP	Fixed Pitch Propeller	
GCU	Gear Control Unit	
GMU	Gear Monitoring Unit	
h	Hour	
HI	High	Alarm: Measured value exceeds 1st maximum limit value

TIM ID: 0000006649 – 007

Abbreviation	Meaning	Explanation
HIHI	High High	Alarm: Measured value exceeds 2nd maximum limit value
HT	High Temperature	
Hz	Hertz	
ICFN	ISO - Continuous rating - Fuel stop power - Net	Power specification in accordance with DIN-ISO 3046-7
IDM	Interface Data Module	Memory module for interface data
IMO	International Maritime Organization	
IP	Degree of protection against contact, dust and moisture as per DIN 40050	
ISO	International Organization for Standardization	
kg	Kilogram	
kΩ	Kiloohm	
KGS	Kraftgegenseite	Engine free end in accordance with DIN ISO 1204
KS	Kraftseite	Engine driving end in accordance with DIN ISO 1204
LCD	Liquid Crystal Display, Liquid Crystal Device	Liquid crystal display
LCU	Local Control Unit	LOP subassembly
LED	Light Emitting Diode	
LMU	Local Monitoring Unit	LOP subassembly
LO	Low	Alarm: Measured value lower than 1st minimum limit value
LOLO	Low Low	Alarm: Measured value lower than 2nd minimum limit value
LOP	Local Operating Panel	
LOS	Local Operating Station	
MCD	Marine Control Drive	Remotely-controllable and regulated fluid coupling
MCS	Monitoring and Control System	
MD	Missing Data	No data available
MFD	Multifunction Display	
MG	Message	
MPU	Microprocessor Unit, Microprocessing Unit	
mm	Millimeter	
MTU	Motoren- und Turbinen-Union	

TIM ID: 0000006649 – 007

Abbrevia-tion	Meaning	Explanation
MΩ	Megaohm	
ms	Millisecond	
OT	Oberer Totpunkt	Top dead center
P-xyz	Pressure-xyz	Pressure measuring point xyz
PAN	Panel	Control panel
PCU	Propeller Control Unit	
PGN	Parameter Group Number	J1939 message
PIM	Peripheral Interface Module	
PVC	Polyvinylchloride	
RCS	Remote Control System	
RL	Redundancy Lost	Alarm: Redundant CAN bus failure
SAE	Society of Automotive Engineers	U.S. standardization organization
SAM	Service and Automation Module	
SD	Sensor Defect	Alarm: Sensor failure
SDAF	Shut Down Air Flaps	Emergency air-shutoff flap(s)
SE	System Error	Operating system error
SPC	Spare Parts Catalog	
SPN	Suspect Parameter Number	J1939 message
SS	Safety System	Indicated alarm is initiated by the safety system
SSK	Emergency air-shutoff flap(s)	
T-xyz	Temperature-xyz	Temperature measuring point xyz
TC	Tool Catalog	
TD	Transmitter Deviation	Alarm: Sensor comparison fault
UT	Unterer Totpunkt	Bottom dead center
VS	Voith Schneider	Voith Schneider drive
WJ	Water Jet	Waterjet drive
ZKP	Relationship category parameter	Numbering scheme for ADEC engine governor signals

TIM ID: 0000006649 – 007

12.3 MTU-contact person/service partner

Service

We provide immediate attention through fast and direct access to our worldwide sales and service network.

On-site service

Skilled product experts will assist you with knowledge and experience and thus contribute to your business success.

For further information on our on-site service, visit: http://www.mtu-online.com/mtu/worl/

24h hotline

With our 24h hotline and the flexibility of our service staff, we are always ready to assist you - either during operation, for preventive maintenance, corrective work in case of malfunction or changed operating conditions, or for spare parts supply.

Your contact in our headquarters: Service-support@mtu-online.com

Spare parts service

Fast, straightforward and accurate identification of spare parts for your drive plant or vehicle fleet. The right spare part at the right time, at the right place.

With this aim in mind, we can call on a globally networked spares logistics system,

- a central warehouse at headquarters and on-site stores at our subsidiary companies, agencies and service workshops.

Your contact in our headquarters:

E-Mail: spare.parts@mtu.online.com

Phone: +49 7541 908779

Fax: +49 7541 908102

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