Installation and Operation Manual

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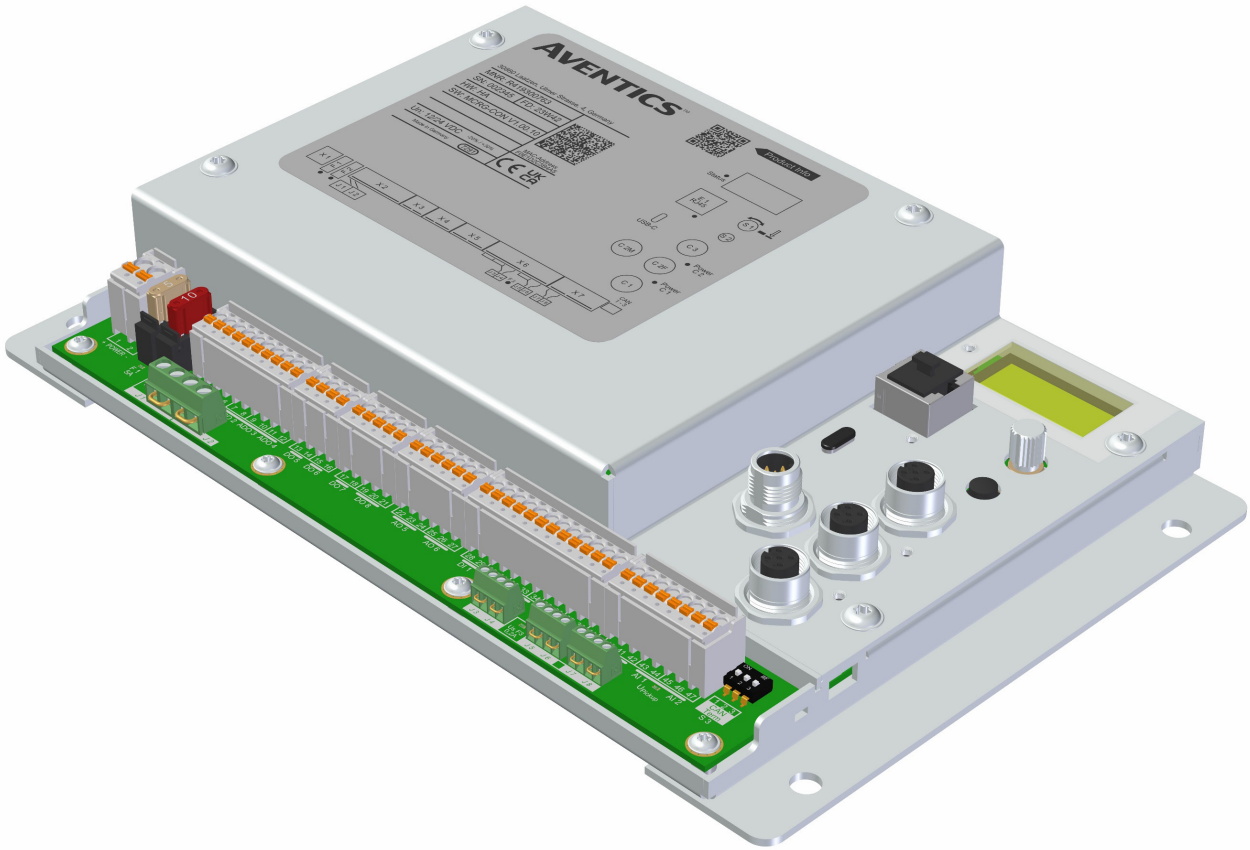
June 2024

Marex Propulsion Controller (MPC)



AVENTICS™

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Document Revisions

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1 About this Manual

1.1 Validity of this Manual

This manual applies to the following components:

- Marex Propulsion Controller, 3rd generation, in the following text also called MPC.
  Material numbers: R419300763
  R419300764 (OEM-version)
  R419300777

- This manual is intended for operators and service technicians. It contains important information on installing, operating, and starting up the Marex Propulsion Controller.

> Read this manual, especially section “2 Safety instructions” page 10, before installing, operating, or starting up the Marex Propulsion Controller.

Important

The Marex Propulsion Controller is a component of Marex Motion Control Systems (Marex MCS). The instructions and settings described in this manual refer to a basic system configuration with twin engines, including Marex Propulsion Controller, Control Heads Type 244, CAN bus cables and standard interfaces to diesel engines and gearboxes.

> Observe system-specific documentation if available.

> Contact Emerson at Emerson.com for information for further information if required.

> Observe the instructions of the engine and gearbox manufacturers.

1.2 Required and Additional Documentation

In addition to this manual, the documents listed in the table below are also relevant for Marex MCS.

> Make sure to read and understand the instructions listed in table 1, Required documentation, before servicing Marex MCS.

> Observe the instructions for Marex MCS components and their predecessors, which were still published under the system name Marex OS.

> Observe the ship ‘s operating instructions.

> Observe project-specific system documentations

Name	Document No.	Document Type
Marex OS II Operating Manual	R419300579	Manual
Marex OS II Devices and Adjustments	R419300593	Manual
EMC Requirements for electrical components in ship systems	3460649703	Specification Sheet
Marex OS Control Head Type 244	R417003610-MON-001-AA	Assembly Instructions

Table 1: Required and additional documentation

1.3 Presentation of Information

For a quick start and safe operation of the product, consistent symbols, terms, and abbreviations are used and safety instructions are given in a consistent manner. For easy understanding, explanations are provided in the following sections.

1.3.1 Safety instructions

This documentation includes safety instructions placed before a sequence of actions during which there is a risk of damage to persons or property. The precautions described must be observed.

Safety instructions are structured as follows:

⚠ DANGER

MAY CAUSE DEATH

Observe all precautionary signs posted on the equipment.

Failure to do so may result in death or serious injury to personnel.

⚠ WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Observe all precautionary signs posted on the equipment.

Failure to do so may result in injury to personnel or cause damage to the equipment.

⚠CAUTION

MAY CAUSE INJURY TO PERSONNEL OR DAMAGE EQUIPMENT

Observe all precautionary signs posted on the equipment.

Failure to do so may result in injury to personnel or cause damage to the equipment.

NOTICE

MAY DAMAGE EQUIPMENT

Observe all precautionary signs posted on the equipment.

Failure to do so may result in property damage.

1.3.2 Further messages and symbols

Important

If this information is not observed, optimum use or operation of the product cannot be ensured.

> Single, independent step

1. Numbered instructions indicating the steps which must be executed in a given order:
2.
3.

1.4 Designations

Table 2: Names and locations of control stations

Bridge	Main control station located at the bridge (helm or wheelhouse) of the ship
Portside	Located at the left side of the ship
Starboard	Located at the right side of the ship
Fly bridge	Located above the bridge of the ship
Afterdeck	Located at the stern deck of the ship
ECR	Located in the engine control room

Table 3: Designations for buttons and parameters

Designation	Meaning
Command (COM)	As LED: the active control station As button: the control station that is to become active
CPP	Controllable Pitch Propeller
Jumper	A short length of conductor used to close, open or bypass part of an electronic circuit.
Heartbeat, Node-Guarding	Methods for monitoring the components on the CAN bus by using the MPC control unit.
Override	To overrule limitations of automatic safety algorithms by manual intervention: e.g., speed reduction, overload control.
Marex MCS	Product name for AVENTICS motion control system
Marex OS	Product name for AVENTICS propulsion control system (predecessor product)
Trolling (TRL)	Operation mode of the control system in which the clutch works with permanent slippage.
Speed	For parameters the term "speed" refers to engine or propulsion shaft RPM.
Slip & Grip (S&G)	Operation mode of the control system with continuous transition from slip mode to engaged mode and vice versa.
Warming up	Adjustment of engine speed while the gear remains in NEUTRAL mode.
Velocity	For parameters the term "velocity" refers to the ship's speed.

The following names apply for the commands transmitted to the engine and gear by setting the control head lever:

Table 4: Control commands to engine and gearbox

Command	Meaning
Full ahead	The lever is in its limit position in AHEAD direction. The value set for the engine speed is 100%.
Ahead	The set direction of the ship is AHEAD. The set position of the gear is AHEAD.
First detent ahead	The first detent after the neutral position in AHEAD direction.
Neutral	Setting the lever to the neutral position means setting the engine to idling speed and the gear to neutral mode.
First detent astern	The first detent after the neutral position in ASTERN direction.
Astern	The set direction of the ship is ASTERN. The set position of the gear is ASTERN.
Full astern	The lever is in its limit position in ASTERN direction. The value set for the engine speed is 100%.

1.4.1 Abbreviations

In this service manual the following abbreviations are used:

Table 5: Abbreviations

Abbreviation	Meaning
AI	Analog Input
AO	Analog Output
ADO	Analog Digital Output
CAN	Controller Area Network, Asynchronous, serial bus system for networking electronic control units.
CO	Changeover (relay)
DI	Digital Input
DIP	Dual Inline Package, a DIP switch element consists of four or eight miniature switches. Each switch can be set separately. The miniature switches are built as slide switches or toggle switches. The two possible switch positions are called either “Open” and “Close” or “ON” and “OFF”.
DO	Digital Output
f	Frequency
FW	Firmware
GND	Ground
M12	Connector for CAN bus cables with a 12-mm locking thread.
MPC	Marine Propulsion Controller, control unit of Marex MCS
NC	Normally closed (relay)
NO	Normally open (relay)
SUB-D	SUB = subminiature, D = D shaped, Connectors (SUB-D socket or SUB-D plug) for data transmission lines
PWM	Pulse-width modulation
R_{IN}	Resistance input
UB	Battery voltage
U_{IN}	(max.) input voltage
U_{OUT}	(max.) output voltage

2 Safety Instructions

2.1 About this Section

The Marex Propulsion Controller has been manufactured in strict compliance with the generally accepted rules of technology. However, this does not exclude the risk of damage to persons or property if the general safety instructions in this section and the safety instructions in this document are not observed.

> Read this manual completely and carefully before starting to operate the Marex Propulsion Controller.

> Keep this manual in a location where it is accessible to all users at any time.

> Always include this manual when passing the Marex Propulsion Controller on to third parties.

2.2 Intended Use

The Marex Propulsion Controller is used to process analog and digital control signals within the Marex motion control system (Marex MCS). It is designed for installation in the engine room on board of boats, yachts, and commercial vessels with fixed pitch propellers, hybrid functions, electric motors, and waterjet applications. The Marex Propulsion Controller may only be used in a splash-proof environment, as e. g. in a cabinet or panel. It must only be operated together with components of the product series Aventics™ Marex MCS under the conditions described in this manual and under observance of the instructions for Marex MCS systems.

A separate emergency stop switch must be provided at every control station.

> Comply with the operating conditions and performance limits stated in section 12, Technical Data, on page 53.

The Marex Propulsion Controller must only be taken into operation after it has been ascertained that the propulsion system into which it shall be integrated corresponds to the applicable national regulations or rules of the corresponding classification society.

Intended use includes having fully read and understood this manual and especially section 2.

2.3 Improper Use

Any use other than as described in "Intended use" is improper and thus inadmissible. If, in applications relevant to safety, inappropriate products are installed or used, unintended operating conditions can be created in the application which may cause damage to persons and/or property. Therefore, only apply a product within applications relevant to safety if this kind of use is clearly specified and permitted in the product's documentation as for example within explosive areas or in parts of a control system which are relevant for functional safety.

Unintended use of the product does also include:

- Connecting the Marex Propulsion Controller to unsuitable supply voltage
- Combining the Marex Propulsion Controller with components which are not released by Emerson for that purpose
- Exposing the Marex Propulsion Controller to ambient conditions which are not admissible

Emerson declines any responsibility for damage resulting from unintended use. The user of the equipment is fully responsible for any risk arising from unintended use of the product.

2.4 Personnel Qualification

The activities described in these assembly instructions require basic knowledge of electronics and the corresponding terminology. To ensure the safe use of the product, those activities may only be performed by authorized personnel or by instructed persons supervised by authorized personnel.

An authorized person is someone who due to his/her expert training, knowledge and experience including his/her knowledge of the relevant regulations can assess the assigned tasks, recognize possible dangers, and take appropriate safety measures. Authorized personnel must comply with the applicable specialist regulations. The Marex Propulsion Controller must only be operated by persons who are familiar with its function and the Marex motion control system (Marex MCS).

2.5 General Safety Instructions

Observe the valid regulations pertaining to accident prevention and environmental protection.

> Observe the safety instructions and guidelines of the country in which the product is used.

> Only use EMERSON products in technically perfect condition.

> Check the product for obvious defects as for example cracks in the housing or missing screws, caps or sealings.

> You must not modify or convert the Marex Propulsion Controller.

> Persons who install, operate, dismantle, or maintain Emerson products must not be under the influence of alcohol, other drugs or medications which affect the responsiveness.

> Make sure that safety devices belonging to the product are available, properly installed and fully operational. Such safety devices must not be relocated, bypassed or rendered ineffective.

> If safety devices are taken out of operation to work on the product you must make sure that no risk arises for persons or property. Observe the additional documentations.

> Warranty applies exclusively for the configuration supplied.

> Incorrect assembly, unintended use or inappropriate handling will invalidate the warranty.

> Under no circumstances the product may be subjected to mechanical load. Never use the product as a handle or step.

> Do not place objects on the product.

2.6 Product and Technology-Related Safety Instructions

> Install, start, and service the Marex MCS and its components in compliance with the documentation and instructions supplied.

> Only connect components to the Marex MCS CAN bus network that have been approved by Emerson.

> Always disconnect the system from the power supply before assembling the Marex Propulsion Controller, connecting or disconnecting plugs. Secure the system against being switched on unintentionally.

> Lay cables in such a way that they cannot be damaged, and nobody can trip over them.

> Before starting the product make sure that all seals and protective caps on connectors are properly fixed and undamaged to prevent that liquids and foreign particles penetrate the product.

> Make sure that all electric ports are used or covered. Only start up products which are fully installed.

> Only allow authorized persons to access the control room.

2.6.1 Use with petrol/gas engines

The Marex MCS has been designed for controlling diesel engines. For use with petrol or gas engines the system components must be installed outside the hazardous area. Strictly observe the regulations for hazardous areas.

2.6.2 Environment

Only operate the Marex Propulsion Controller in a dry environment, e.g., in cabinets or consoles. Observe the protection class IP 20 of the Marex Propulsion Controller:

- Protected from touch by fingers and objects greater than 12 mm.
- Not protected against exposure to liquids.

2.6.3 Engine emergencies stop and control

The operation of the system is only permissible with a separate engine emergency stop system at all control stations. It is recommended to install a supplementary, independent engine emergency control system in addition to the Marex MCS.

2.6.4 Display and acoustic signals

The Marex Propulsion Controller provides a display and two buttons for adjustment and indication of errors. Errors are indicated by a flashing E in the top right corner of the display. Additionally, the MPC provides an LED for signaling the operational status, see also section 14, Product overview, on page 14. Marex MCS control heads provide LEDs and acoustic signals to alert the operator in case of errors in the system.

2.6.5 Battery replacement

Always switch off Marex MCS devices and disconnect them from the power supply before replacing batteries.

2.6.6 Power supply

> Observe the permissible supply voltages of 12 (-20%/+30%) or 24 V DC (-25%/+30%). Do not connect Marex MCS components to other voltages.

> Make sure that the supply voltage of the Marex Propulsion Controller does not fall below the low limit. Lay power cables in such a way that switching on other consumers, e.g., a starter, pump, or fan, does not cause a drop of the supply voltage.

> Always use shielded cables if not otherwise specified. On each side, the shield must relate to low impedance to the vessel ground over the whole circumference.

> Preferably apply the shield within the cable glands of the connected devices. Observe the specifications in sheet 3460649703 “EMC requirements for electrical components in ship systems”.

> Make sure not to damage the electromagnetic shielding of lines when performing installation work as any damage may affect the system and safety.

2.6.7 Adjustment of parameters during service

> Only modify control parameters when the propulsion system is not running. The vessel must be anchored or moored.

> Any fine tuning during a sea trial must be coordinated with the shipmaster. The safety of the crew and other traffic participants must not be endangered. Take the appropriate measures to make sure that erroneous entries during the parameterization process do not result in a loss of control of the vessel.

2.7 Operator's obligations

Installation and maintenance work is subject to the country specific safety regulations and standards of the application. As an operator of a ship which shall be equipped with the Marex Propulsion Controller and further components of a propulsion control system, you are responsible that

- the product is in technically perfect condition,
- the product is used as intended,
- any staff handling the product has read and understood the documentation,
- users of the product are trained and instructed,
- the regulations related to safety, accident prevention and environmental protection are complied.

3 Scope of Supply

1 Marex Propulsion Controller, material No. R419300763, R419300764 or R419300777

1 Manual R417003865

4 About this Product

4.1 Product Description

The Marex Propulsion Controller is the control unit of Marex MCS for fixed pitch propellers. Its task is to process and communicate the drive commands set by the Marex MCS control heads and operating modules, and to display status and feedback on the drives' condition to the operator at the control stations. All Marex MCS components communicate in an internal CAN bus network. The CAN open bus protocol provides a safe control sequence. The commands which are communicated to the Marex Propulsion Controller are converted into electric signals which actuate the main engines and transmissions. In systems with multi engines one Marex Propulsion Controller is provided per propulsion train.

The Marex Propulsion Controller provides an integrated display with two buttons for status indication, reading and adjusting control parameters.

4.2 Classification certificates

The Marex Propulsion Controller is approved by the classification society DNV. Other societies on request.

> Contact Emerson for information about class approvals.

4.3 Applied EMC standards

- EN 60945:2002

Maritime Navigation and Radiocommunication Equipment and Systems
-General Requirements-

Methods of testing and required test results

- IACS El0: 2022-01

Test specification for type approval

- DNV-CG-0339: 2021-08

Environmental Test Specification for Electrical, Electronic and Programmable Equipment and Systems

- Lloyds Register: 2021-12

Performance and Test Specification Number 1

4.4 Product overview

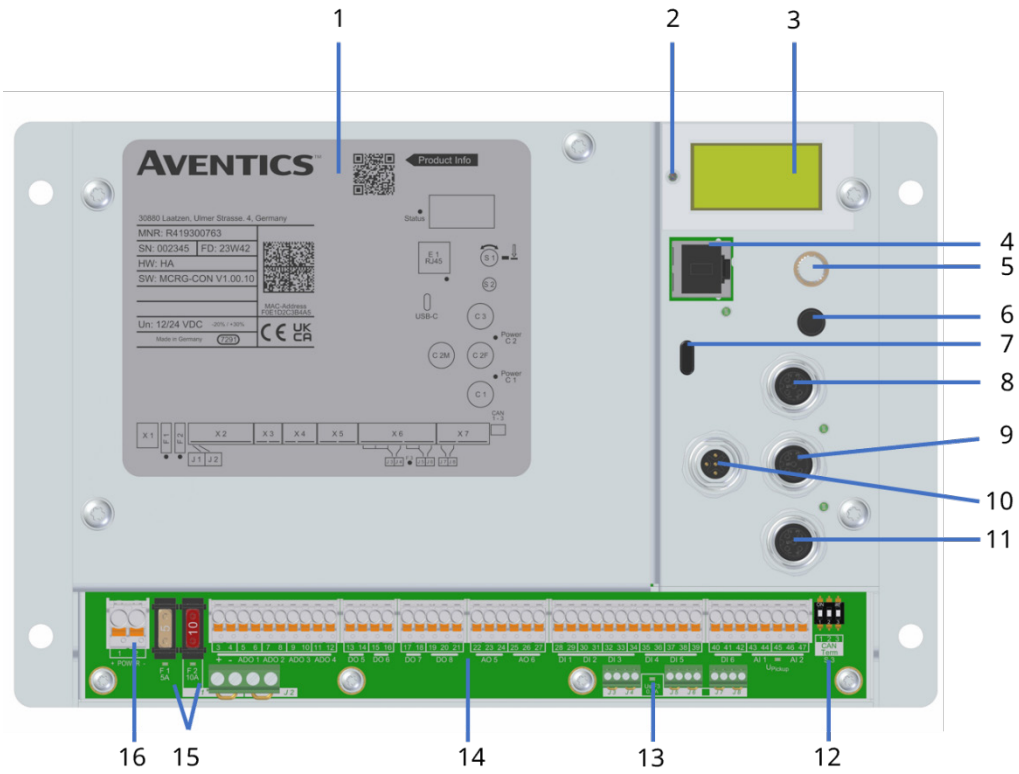


Figure 1: Product overview

1	Product label	9	C2 CAN bus connector, female
2	Status LED	10	C2 CAN bus connector, male
3	Display	11	C1 CAN bus connector, female
4	Ethernet port	12	S3 Terminating resistor switches
5	Rotary push button (select button)	13	Fuse for protection of DI 24V
6	Escape button	14	Terminal strip with in- and outputs
7	USB-C port	15	F1 (5A), F2 (10A) fuses
8	C3 CAN bus connector, female	16	Power supply

4.5 Connectors and Terminals

4.5.1 Connectors

The Marex Propulsion Controller provides the following electric connectors:

Type	Quantity	Specifics
CAN bus	3	M12, female
CAN bus	1	M12, male
Ethernet	1	
USB C	1	

4.5.2 Terminals

The terminal strip of the Marex Propulsion Controller provides 47 connection terminals as well as 3 fuses and 3 CAN bus terminating resistors.

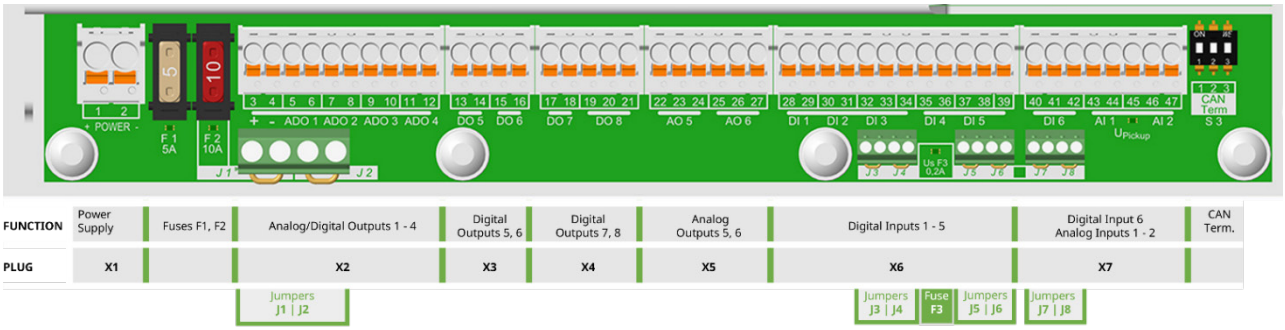


Figure 2: Terminal strip at the Marex Propulsion Controller

4.5.2.1 Terminal assignment

The terminals and their assignment to functions are shown in the following table:

Table 6: Terminal assignment

Terminal No.	Plug	Channel No.	Polarity	Intended Function	Specification
1	X1	UB	+U_B Power Supply		24V DC -25%/+30%
2			-U_B Power Supply		12V DC -20%/+30%
3	X2	ADO 1-4	+U_B ADO 1-4 [1)]		Power supply for ADO 1-4 / 24V DC -25%/+30% or 12V DC -20%/+30%
4			-U_B ADO 1-4 [1)]		
5			ADO 1 signal	Gear ahead	Digital Output 8 - 32V DC, 2A, short circuit proof, wire break detection Analog Output (PWM) 8 - 32V DC, 1A, 10 - 1000 Hz, PWM (12-bit) resolution, short circuit proof, wire break detection, closed loop for current
6			-UB ADO 1 [1)]		
7			ADO 2 signal	Gear astern	
8			-U_B ADO 2 [1)]		
9			ADO 3 signal	Trolling on Trolling off	
10			-U_B ADO 3 [1)]		
11			ADO 4 signal	Trolling proportional valve	
12			-U_B ADO 4 [1)]		
13	X3	Relay DO 5	DO 5 Relay NO	Start interlock	Switching Voltage: 32V DC Max. switching current: 2A DC Min. switching current: 10 mA DC For inductive loads an L/R > 7ms, a freewheeling diode must be connected to the load.
14			DO 5 Relay CO		
15		Relay DO 6	DO 6 Relay NO	Engine start	
16			DO 6 Relay CO		
17	X4	Relay DO 7	DO 7 Relay NO	Engine stop	
18			DO 7 Relay CO		
19		Relay DO 8	DO 8 Relay Alarm NO	Alarm	
20			DO 8 Relay Alarm CO		
21			DO 8 Relay Alarm NC		
22	X5	AO 5	+AO 5 PWM	Throttle (4-20mA)	0-20mA / 4-20mA R_{MAX} 500 Ohm, 12-bit resolution, wire break detection (4-20mA only) 0-10V I_{MAX} 10mA, 12-bit resolution, wire break detection, short circuit proof PWM U_{MAX} 40V, f: 100-1000Hz, 12-bit resolution, short circuit proof
23			+AO 5 U/I		
24			GND AO 5		
25		AO 6	+AO 6 PWM	Trolling signal	
26			+AO 6 U/I		
27			GND AO 6		
28	X6	DI 1-3	+U_B DI 1-3 [2)]	Feedback gear ahead	$U_{IN,LOW}$: 0 - 1,5V DC $U_{IN,HIGH}$: 5 - 32V DC R_{IN}: > 1,5 kOhm P_{IN}: < 150 mW
29			DI 1		
30			+U_B DI 1-3 [2)]	Feedback gear astern	
31			DI 2		
32			+U_B DI 1-3 [2)]	Spare	
33			DI 3		
34			GND DI 1-3 [2)]		
35		DI 4-5	+U_B DI 4-5 [3)]	Spare	
36			DI 4		
37			+U_B DI 4-5 [3)]	Spare	
38			DI 5		
39			GND DI 4-5 [3)]		
40	X7	DI 6	+U_B DI 6 [4)]	Spare	
41			DI 6		
42			GND DI 6 [4)]		
43		AI1/AI2	AI1	Engine RPM	$U_{IN,AI}$: 1 - 50 V f_{in}: 20 - 13000 Hz, resolution: 12 bit U_{OUT}: supply for active pickup 8V DC, 100mA , short circuit proof
44			GND AI 1-2		
45			+U_{out} AI 1-2	Shaft speed sensor	
46			AI 2		
47			GND AI 1-2		

[1)] ... [4)] Not electrically isolated with factory settings. Connected to the supply voltage at X1.

[1)] Open Jumper J1/J2 to use ADO 1-4 electrically isolated.

[2)] Open Jumper J3/J4 to use DI 1-3 electrically isolated.

[3)] Open Jumper J5/J6 to use DI 4-5 electrically isolated.

[4)] Open Jumper J7/J8 to use DI 6 electrically isolated.

[*)] Specification connection terminals.

Power Supply Terminal X1: max. 2,5 mm², 15A

Signal Terminals X2-X7: max. 1,5mm², 10A

[**)] Only one output of ADO 1-4 may be operated in PWM mode at any one time

4.6 Product Identification

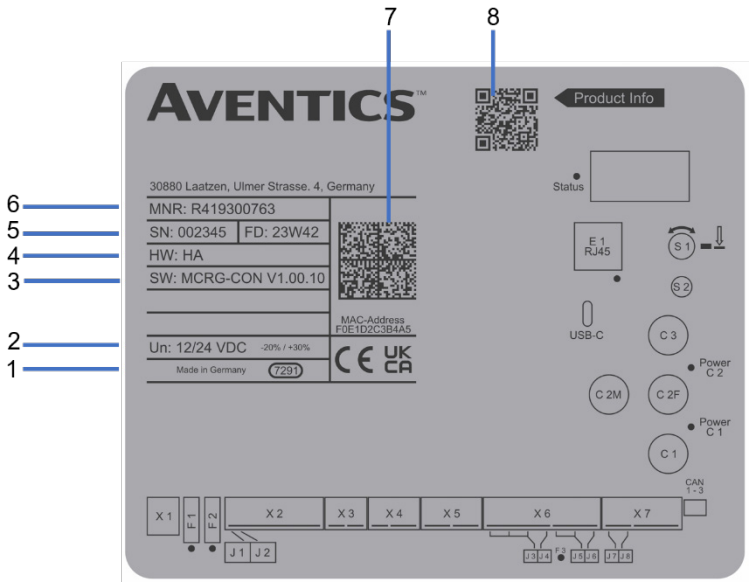


Figure 3: Product label

1 Manufacturing Country | Production site code |CE label
2 Nominal voltage | Tolerance
3 Software code
4 Hardware code
5 Serial number | Manufacturing date (Year, calendar week)
6 Material number
7 Internal production code
8 Product data QR code

5 Transport and Storage

5.1 Product Transport

NOTICE

DAMAGE DUE TO IMPROPER TRANSPORT

Be careful when unloading the packages on delivery and in case of in-plant transport. Observe the symbols and instructions on the package. Only remove the packaging shortly before the assembly.

5.2 Delivery Check

Check the supply immediately on receipt for completeness and transport damage.
Proceed as follows if any visible damage is discovered during receipt of delivery:
– Do not accept the delivery or only under reservation.
– Note the extent of damage on the transportation documents or the delivery note.
– Submit a claim via Emerson.com

5.3 Product Storage

Do not destroy the packaging and only remove it shortly before installation.
Adhere to the following conditions for storage:

> Only store the Marex Propulsion Controller in its original packaging.
> Do not store the Marex Propulsion Controller outside.
> Store the packages in a dry and dust-free place.
> Do not expose the packages to aggressive media.
> Protect the packages against solar radiation.
> Observe the admissible storage temperature of

233 to 358K (-40°C to 85°C), see also section 12 Technical Data on page 53.

- Avoid mechanical impact.
- Make sure all M12 protective caps are applied.

5.3.1 Maximum storage period

The Marex Propulsion Controller may be stored for two years at maximum. The storage period will be prolonged by 2 more years if the Marex Propulsion Controller is connected to the power supply for at least one minute before expiry.

6 Assembly

CAUTION

RISK OF INJURY AND PROPERTY DAMAGE DUE TO IMPROPER INSTALLATION OR MOUNTING WORK

Improper installation can cause damage to property. The Marex Propulsion Controller may only be installed by Emerson or qualified personnel as specified in section 2.4.

> Install or uninstall Marex Propulsion Controller only if the component and the system are powered off.
> Prepare mounting work carefully.
> Make sure there is enough space to mount the product professionally.

6.1 Unpacking

> Observe the symbols and instructions on the package.
> Only remove the packaging shortly before the assembly.

6.2 Installation Conditions

> Make sure the display is not covered and remains legible at all times.
> Provide sufficient space for neat cable routing.
> We recommend installation in a control cabinet or underneath the control panel.

6.3 Mounting Orientation

The Marex Propulsion Controller can be installed in any position. We recommend horizonal installation shown below:

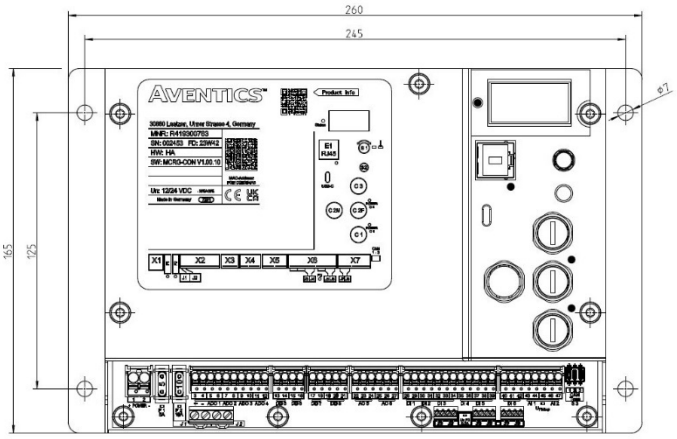


Figure 4: Installation position

6.4 Mounting

The Marex Propulsion Controller provides four bore holes for installation to a wall or into a control cabinet.

> Mount the Marex Propulsion Controller firmly, preferably in the position shown in Figure 4.

6.5 Establishing the Electric Connections

Important

Relay outputs:

For the wiring of one of the DO1 to DO6 relay outputs with inductive loads, a sufficiently rated flywheel diode must be provided near the load to protect the relay contact.

Shielded cables:

Only shielded cables must be used for the CAN connections. The shield must relate to low impedance to the vessel ground over the entire circumference. This is preferably done within the screwed cable glands of the connected devices or by means of cable clamps that are supplied together with the Marex Propulsion Controller.

NOTICE

COVER UNUSED CAN BUS CONNECTIONS

If you do not cover unused CAN bus connections, the signal performance of the CAN bus may be affected as the required shielding is interrupted at these points.

Always close all unused CAN bus connections with blanking plugs. Use the supplied blanking plugs for this purpose.

6.5.1 Grounding

The Marex Propulsion Controller must be grounded by ensuring proper contact between the fastening lugs and the vessel ground at the mounting points. If this is not possible, grounding must be ensured by ground bolts. Strictly observe the grounding and shielding instructions as per information sheet 3460649700 “EMC requirements of electrical components in ship systems”. See also section 1.2, Required and Additional Documentation, on page 5.

6.5.2 Connecting the CAN bus lines

Important

Observe the maximum cable length of **300 m** for each CAN bus line.

Apply a **blanking plug** to unused CAN bus connectors at the Marex Propulsion Controller.

Apply a **terminating resistor** at unused CAN bus connectors at the last CAN bus participant.

Always **observe project-specific wiring diagrams** and documentation if available.

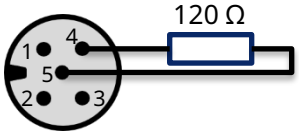
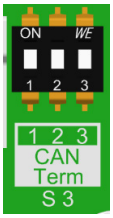
6.5.2.1 Terminating resistors

Every CAN bus line must be terminated at each end with a resistance of 120 ohms between the CAN+ and CAN- signal lines. For this purpose, Emerson offers ready-made connector sockets and plugs with integrated terminating resistors. The Marex Propulsion Controller provides adjustable terminating resistors for each CAN bus line at the terminal board. These are set to “ON” on delivery.

> Attach a terminating resistor to the last component at a CAN bus line.

> Make sure to switch off the corresponding terminating resistor in the Marex Propulsion Controller if the MPC is <u>not</u> the last participant in the CAN bus line.

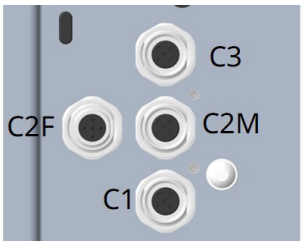
Table 7: Terminating Resistors

Terminating resistor	Pin assignment	Symbol	Resistors at MPC
			

The Marex Propulsion Controller provides four CAN bus connectors type M12 for the connection to the Marex network. The connectors are named C1, C2F, C2M and C3. CAN bus C1 and C2 provide integrated power supply of 38 V for operating connected components such as the Marex MCS Control Heads Type 244, and Operating Modules Type 242. The integrated power supply can be activated or deactivated via a parameter setting.

Overview:

Table 8: CAN bus connectors at the MPC

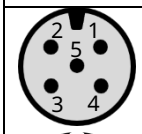


C1: CAN bus for the connection of Marex MCS control heads, switchable +38V

C2F, C2M: CAN bus plug and socket for the cross-communication line between Marex Propulsion Controllers in multi engine systems, switchable + 38V

C3: Auxiliary CAN bus for the connection to further networks

M12 pin and socket contacts

Pin arrangement	CAN bus C1, C2	CAN bus C3
 M12 plug	1 GND 2 Vcc 3 CAN GND 4 CAN+ 5 CAN-	1 not assigned 2 not assigned 3 CAN GND 4 CAN+ 5 CAN-
M12 socket		

6.5.2.2 Establishing the connection to the control heads

Marex MCS Control Heads Type 244 provide four connectors. These are assigned as follows:

Table 9: CAN bus assignment at Control Head Type 244

		Number of engines		
Connector	**Type**	**Single engine**	**Twin engines**	**Function of M12 Connector**
X11	Male	Engine 1	Starboard	Input
X12	Female	Engine 1	Starboard	Output
X21	Male	Not applicable	Portside	Input
X22	Female	Not applicable	Portside	Output

Figure 5: Control Heads Type 244

Figure 6: CAN bus connectors at Control Head Type 244

> For further information on the Control Head Type 244 refer to the assembly instructions of the component. See also 1.2, Required and Additional Documentation, on page 5.

> Proceed as explained below. Refer to Table 8 and Table 9 on page 21 for the assignment of plugs and sockets.
With a single engine system, use the connectors assigned to starboard. With twin engines, start with the starboard CAN bus, then proceed accordingly to connect the portside CAN bus, using the connectors named in brackets ().

> Apply a torque of 0.4 Nm to fasten the M12 connectors**.**

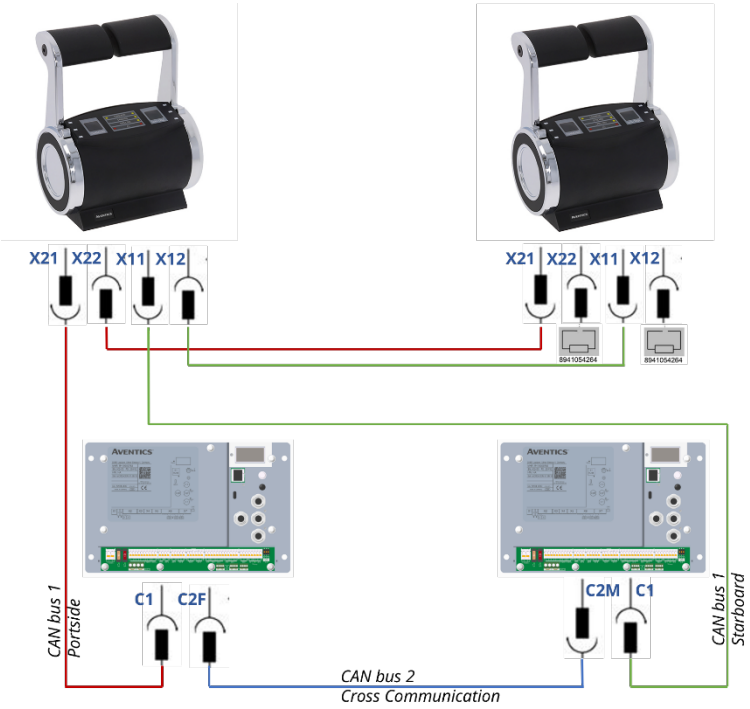


Figure 7: CAN bus connection example with twin engines

Make sure that all components are dead before establishing the CAN bus connections.

1. At the connector C1 of the Marex Propulsion Controller for the starboard (port) engine connect a CAN bus cable M12.
2. Route the other end of the cable to the first Control Head Type 244 in the CAN bus line and attach it to connector X11 (X21) at the control head.
   a. If the control head is the last participant in the CAN bus line, apply a terminating resistor to the remaining open CAN bus connector.
   b. To connect a second Control Head Type 244, apply a CAN bus cable to the connector X12 (X22) at the first control head and route the cable to the second Control Head Type 244. Connect it to X11 (X21) at the second control head.
      > If applicable, proceed accordingly to connect further Control Heads Type 244.
      > Terminate the CAN bus line by applying a terminating resistor to open CAN bus connectors at the last component.
      > With multi-engine systems continue at section 6.5.2.3.

6.5.2.3 Establishing the cross-communication

Multi engine propulsions provide one Marex Propulsion Controller per engine. CAN bus C2 is used to ensure reliable communication between the Marex Propulsion Controllers. The MPC provides one plug (C2M) and one socket (C2F) type M12 for connecting the bus cable from plug to socket or vice versa.

Proceed as follows:

> At one Marex Propulsion Controller, connect a CAN bus cable M12 to socket C2F or plug C2M.

> Route the other end of the cable to the other Marex Propulsion Controller and connect it correspondingly, i. e. to C2M if connector C2F is used at the first MPC, or to C2F if C2M is used.

> Proceed accordingly to connect a third or more controllers if applicable.

> Switch off the terminating resistor 2 if the Marex Propulsion Controller is not the last participant in the CAN bus line.

> Apply a blanking plug on empty CAN bus plugs or sockets.

6.5.2.4 Establishing the CAN bus to exterior systems

CAN bus C3 enables the communication with bus systems other than Marex MCS.

> Use connector C3 to establish a CAN bus connection between Marex MCS and an additional CAN bus system.

> Make sure to apply a terminating resistor at the last participant.

> Observe project-specific documentation.

6.5.3 Connecting the power supply

Important:

The power supply and the supply lines of the device must be rated such as to ensure that with short-term current peaks of up to 15 A the voltage at the device remains within the specified limits.

In addition, the routing of the supply line must be selected in such a way that other consumers, such as starter motors, pumps, fans, etc., do not cause the supply voltage at the supply voltage at the control unit does not briefly fall below the specified limits. limits.

> Connect the power supply to Terminals 1 (+) and 2 (-) (plug X1) at the terminal strip. The specified voltage is 24 V DC -25%/+30% or 12 V DC -20%/+30%. See also Table 6: Terminal assignment on page 16.

6.5.4 Connecting the in- and outputs

> Connect the in- and outputs following the wiring diagram in the project documentation or terminal assignment in Table 6: Terminal assignment on page 16.

Important:

When connecting inductive loads to the relay outputs DO 5 ... 8, an adequately dimensioned freewheeling diode must be provided close to the load to protect the relay contact.

When connecting inductive load to the digital outputs ADO 1. . .4 in ON/OFF operating mode, we recommended providing a sufficiently dimensioned freewheeling diode close to the load in order not to disturb other sensitive signals.

7 Starting up the Marex MCS system

Important:

The Marex Propulsion Controller may only be put into operation once it has been established that the propulson system in which the MPC is to be installed complies with the applicable national regulations or the classification regulations for ships.

7.1 Checking the wiring

Check the wiring in the following order before the Marex MCS motion control is powered up:

1. Power supply 12 or 24 V DC at the MPCs
2. Power supply 12 or 24 V DC at the gearbox
3. Wiring of the interfaces (rpm, trolling, gears, enable stations)
4. Connection of the CAN bus cables
5. Activation of the terminating resistors at the MPCs
6. CAN bus: Terminating resistor in place at the last control head on the internal CAN-bus. Refer to the service manual for instructions how to check the CAN-bus cable, see also section 1.2, Required and Additional Documentation, on page 5.

7.2 Sequence of proceeding

The following steps must be distinguished:

1. Commissioning
During the commissioning, the control is started up until its correct function is guaranteed. The diesel engine and hydraulics of the gearbox are not started.

⚠ CAUTION

RISK OF INJURY TO PERSONNEL OR DAMAGE OF EQUIPMENT

Under no circumstances, the gears may be engaged in ahead or astern with a running engine during the commissioning. The following instructions must be strictly observed:

> Remove the plugs at the solenoid valve of the gearbox for the actuation of ahead and astern before the commissioning.
> Make sure they cannot be reconnected by mistake.

The diesel engine must remain off and it is not allowed to activate the hydraulics in the gearbox.

2. Mooring trial
During the mooring trial, the correct function of the control and the connected drive elements (diesel engine, gearbox) is tested.

3. Sea trial
During the sea trial the ship-specific parameters are determined and parameterized after performing special cruising maneuvers.

7.3 Starting up the Marine Propulsion Controller

In multi engine systems the Marex Propulsion Controllers are started up one by one while the other MPCs in the Marex MCS motion control system must remain switched off. Proceed as follows:

1. Power up the (portside) MPC.
2. Set the parameters in the MPC as explained in the following sections.
3. Power the portside MPC off after completion and storage of all adjustments.
4. Repeat the steps with the next (starboard) MPC.
5. If applicable, proceed accordingly with further MPCs in the propulsion control system.

Important

Only when all Marex Propulsion Controllers have been put into operation one after the other can all MPCs be switched on and the system functions of Marex MCS be tested.

7.3.1 Operating the Marex Propulsion Controller

The Marex Propulsion Controller provides a display with 6 lines for clear text information. The display includes several menus for the operation, adjustment and error analysis of the Marex Propulsion Controller. Every menu provides a heading which is underlined. A slider bar on the right-hand side of the display indicates the position of an item within the menu. The currently selected menu item is highlighted in yellow.

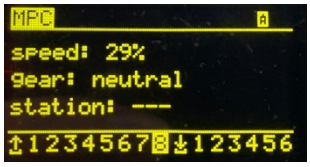


Figure 8: Home screen

In the submenus, text or values between brackets are parameters. A blank within the brackets indicates that another submenu is available. Flashing brackets indicate a parameter can be modified by turning the select button. The last item of every menu is "ESC" = Escape. That line is used to return to the superior menu.

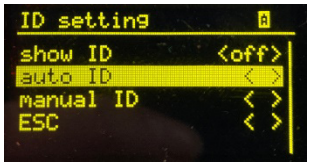


Figure 9: Parameter menu items with available submenu

7.3.2 Special characters

Special characters may flash in the top right corner of the display. Their meaning is explained in the following table:

A	Admin	Indicates the user is logged in as an admin with permission to change parameters.
E	Error	As long as the "E" is flashing, at least one error exists in the MPC. (For details refer to the service manual, see also section 1.2, Required and Additional Documentation, on page 5).
S	Store	As long as the "S" is flashing, parameters are stored. In that condition the MPC must not be powered off or parameter changes will be lost. The storing procedure takes about 30 sec after the last parameter modification.

7.3.3 Operating elements

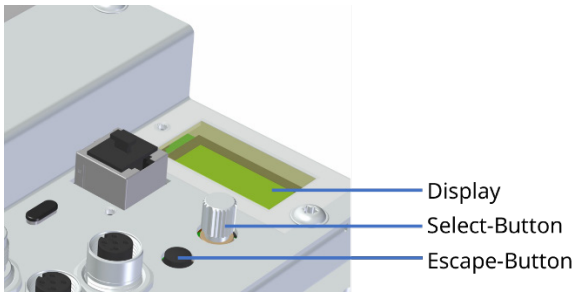
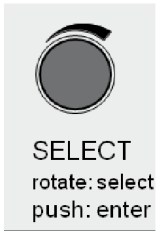
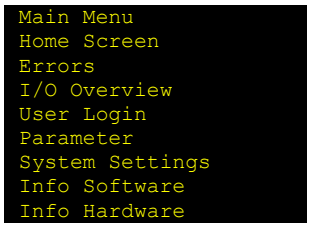


Figure 10: Operating elements and display

Button	Symbol for instructions	Button operation
SELECT		TURN By turning the SELECT button to the left or right you can scroll the menu up or down or increase or decrease a parameter value.
		PRESS Briefly press the SELECT button to provide the following navigation or setting options, depending on the line selected in the Display of the MPC control unit: **Display** — **Meaning** < > — Access the next submenu level. <xxx> — Select the change mode in which xxx can be changed. yyy — Save the changed parameter value yyy. <ESC> — Select the next higher menu level.
ESCAPE 	ESC 	**PRESS** Briefly press the ESCAPE button to access the next higher menu level or abort the already started change of a parameter. The parameter remains unchanged.

7.3.4 Main menu

The main menu consists of the following items:



Home Screen:
Calls up the home screen (Figure 8).

Errors:
Displays errors in the system and provides submenus for diagnosis and elimination.

I/O Overview:
Provides information on the connections via discrete signals.

User Login:
Enables a higher user level of operation for changing and saving parameters.

Parameter:
List of system parameters including submenus available for adjustment

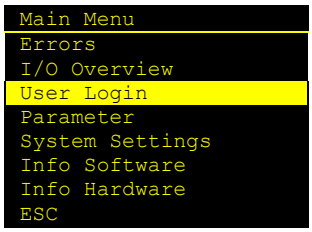
System Settings:
Enables general settings of the device such as language, time, brightness.

Info software:
Gives information on the software version stored in the MPC.

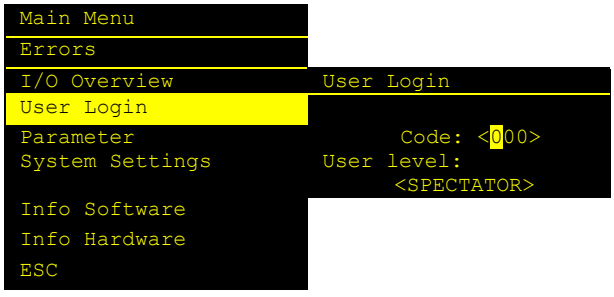
Info hardware:
Gives information on the Marex Propulsion Controller such as material number and manufacturing date.

7.3.5 User login for changing and storing settings

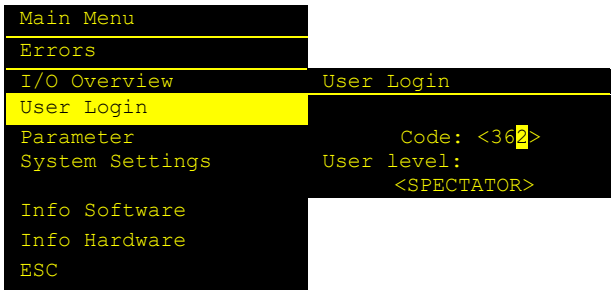
All menu items in the MPC can be viewed without restriction. However, the changing and storing of parameters or system settings requires a user login. To log in the MPC proceed as follows:



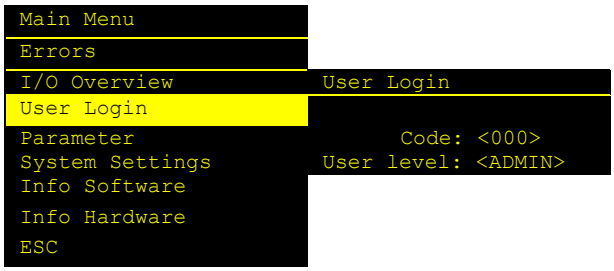
> Push the select button for 3 s to open the main menu of the Marex Propulsion Controller.
> Turn the select button to the menu item "User Login".
> Push the select button to open the submenu.



In the line "Code", "000" is displayed between the brackets. The cursor flashes on the first digit. In the line "User level" "Spectator" is displayed.



> Push the select button.
> Turn the select button until the first digit is set to "3".
> Push the select button. The cursor now flashes on the second digit.
> Set the second digit to "6" and push the select button.
> Finally, set the third digit to "2". Now the number "362" is displayed between the brackets.



> Push the select button.

In the "Code" line, the display changes to "000". The user level changes to "Admin". The admin role is indicated by **A** in the top right corner of the home screen.

> Push the escape button to return to the main menu.

You can now make adjustments and store the changes.

7.4 Registration and configuration of control heads

To proceed with the commissioning, every control head in the Marex MCS network must be assigned an ID number and a mounting location. This ensures a correct system communication and control station administration. e.g., during command transfer or when displaying error messages.

The ID assignment is an automated procedure which is enabled via parameter entry in the Marex Propulsion Controller and confirmed by pushing the command button at the control head. For multi-engine systems, the ID assignment must be carried out separately for each Marine Propulsion Controller and, correspondingly, each lever of a twin or triple control head.

Marex MCS can operate control heads at 6 locations on board at maximum. These locations are named in the Marex Propulsion Controller as follows:

Bridge	Main control station at the helm, wheelhouse or command bridge
Portside	Control station at the left (portside or port) wing station
Starboard	Control station at the right (starboard) wing station
Fly bridge	Control station located above the bridge station
Afterdeck	Control station at the stern deck
ECR	Control station at the engine control room

7.4.1 Entering the portside control heads

Important

Proceed separately with every Marine Propulsion Controller and control head. This will prevent errors and help identify wiring mistakes.

> Power off the starboard MPC.
> Power up the portside MPC.

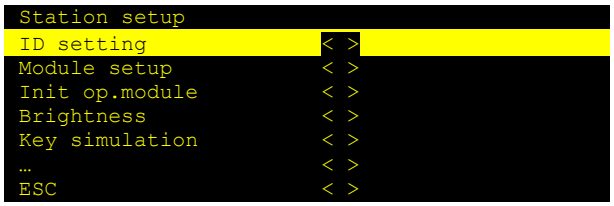
> Log in the portside MPC and select the parameter menu as explained in section 7.3.5, User login for changing and storing settings, on page 27.

Important

The storage of data in the parameter memory is indicated by a flashing S. During this time the MPC must not be switched off, as otherwise the changes have not yet been completely stored.

7.4.1.1 Activate automated ID setting

The setting of the control head IDs is automated if the parameter "setting ID" is set to "on" for a control station. Proceed as follows:



> In the parameter menu, navigate to the item "station setup" and open the submenu by pushing the select button.
> In the submenu select "setting ID".
> Push the select button to open the submenu.

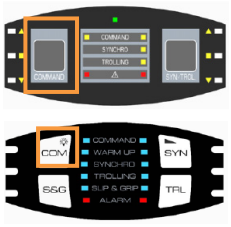
> Select the item "auto ID" and open the submenu.

> Select the item "Setting ID". The factory setting is "off".
> Push the select button. The brackets start flashing.
> Turn the select button until "on" appears between the brackets.
> Store the setting by pushing the select button.

> Now select the item "Station" and open the submenu.
> Push the select button. The brackets start flashing.
> Turn the select button until the requested station (bridge in the example) appears between the brackets.
> Store the station by pushing the select button. The command LEDs are now flashing at all control heads and the control heads emit a buzzer signal.

Important

The setting of the "station" parameter defines the location of a control head.



> Go to the control station (bridge in the example).
> Push the "Command" button once at the control head. The buzzer and lamp signals stop.

Note:

Predefined IDs are set for each control head during the automatic ID setting:

Location	ID Portside	ID Starboard
Bridge	51	71
Starboard	52	72
Portside	53	73
Fly	54	74
Afterdeck	55	75
ECR	56	76

For acknowledgment, specific LEDs at the assigned control head light up to indicate the ones column of the ID, i.e., 1, 2, 3, 4, 5, or 6.

ID acknowledgment at a control head type 244 with two buttons:

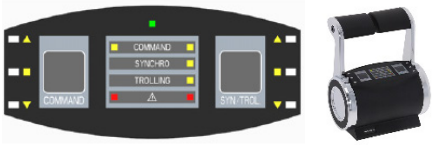


Figure 11: Keypad Control Head Type 244, 2 buttons

Bridge (ID 51/71)	Starboard (ID 52/72)	Portside (ID 53/73)	Fly (ID 54/74)	Afterdeck (ID 55/75)	ECR (ID 56/76)
COMMAND	COMMAND	COMMAND	COMMAND	COMMAND	COMMAND
SYNCHRO	SYNCHRO	SYNCHRO	SYNCHRO	SYNCHRO	SYNCHRO
TROLLING	TROLLING	TROLLING	TROLLING	TROLLING	TROLLING
⚠	⚠	⚠	⚠	⚠	⚠

ID-acknowledgment at control head type 244 with four buttons:

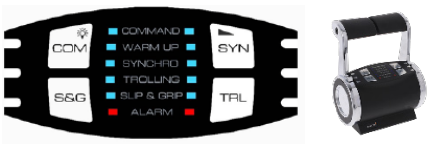


Figure 12: Keypad Control Head Type 244, 4 buttons

Bridge (ID 51/71)	Starboard (ID 52/72)	Portside (ID 53/73)	Fly (ID 54/74)	Afterdeck (ID 55/75)	ECR (ID 56/76)
COMMAND	COMMAND	COMMAND	COMMAND	COMMAND	COMMAND
WARMING UP	WARMING UP	WARMING UP	WARMING UP	WARMING UP	WARMING UP
SYNCHRO	SYNCHRO	SYNCHRO	SYNCHRO	SYNCHRO	SYNCHRO
TROLLING	TROLLING	TROLLING	TROLLING	TROLLING	TROLLING
SLIP&GRIP	SLIP&GRIP	SLIP&GRIP	SLIP&GRIP	SLIP&GRIP	SLIP&GRIP
ALARM	ALARM	ALARM	ALARM	ALARM	ALARM

After pushing the command button, ID 51 is saved as the control head for the port propulsion at the bridge.

> Return to the Marex Propulsion Controller and continue with assigning the IDs of the control heads at all remaining control stations.

> Proceed as explained in section 7.4.1.1 Activate automated ID setting on page 29 and select the next control station in the "Station" parameters.

> Always confirm your setting by pushing the select button, then push the command key at the corresponding control head.

7.4.1.2 Completing and storing the auto-ID-setting

The auto-ID-setting is completed by resetting the parameter "setting ID" to "<off>" and confirming by pushing the select button. At the same time, the control head IDs which have been set will be stored, indicated by the inverse S which flashes in the display.

NOTICE

RISK OF LOSING PARAMETERS

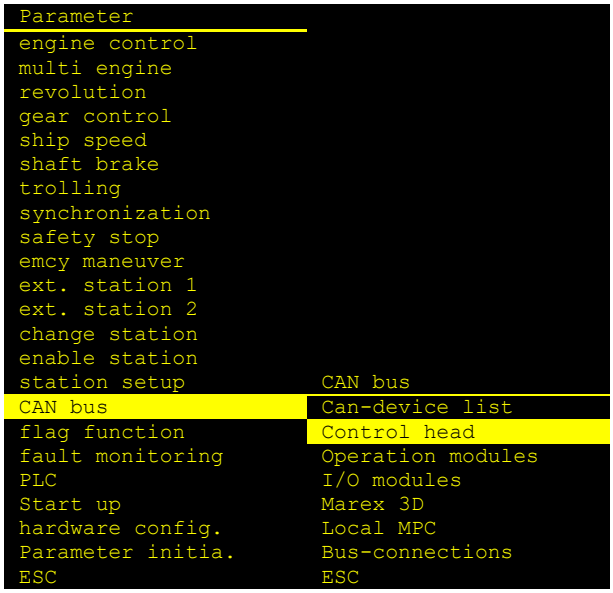
Do not power down the Marex Propulsion Controller while the S is flashing in the display.

Be aware that the control heads are supplied via the CAN bus and need 10 s to store IDs.

Auto ID Setting ID <off> Station <to select > ESC < >	> Select the item "Setting ID". > Push the select button. The brackets start flashing. > Turn the select button until "off" appears between the brackets. > Store the setting by pushing the select button. > Push the escape button three times to return to the main menu.

7.4.1.3 Checking the IDs set

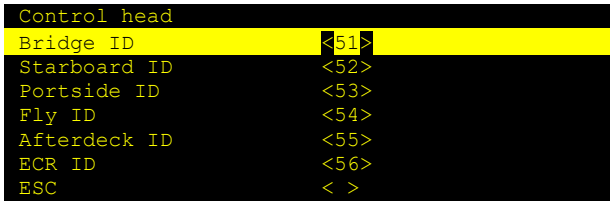
The assigned IDs need to be checked in the parameter menu. Proceed as follows:



> In the parameter menu, choose the line “CAN bus” and open the submenu.

> Select “Control head” in the submenu.

In the submenu "control head" IDs 51, 52, 53, 54, 55 or 56 may be displayed in the portside MPC:



7.4.2 Entering the starboard control heads

NOTICE

RISK OF MALFUNCTION DURING COMMISSIONING

Absolutely make sure that the name (location) for control stations, which you set via the “station” parameter, matches the entries for the portside.

Do not confuse control heads when acknowledging the ID by pushing the command key.

> Power down the portside MPC.

> Power up the starboard MPC.

> Open the main menu in the display of the starboard Marex Propulsion Controller by pushing the select button for 3 s.

> Log in the starboard Marex Propulsion Controller as explained in section 7.3.5 User login for changing and storing settings on page 27.

> Select the item "Parameter" in the main menu and open the submenu.

> Perform all steps explained in section 7.4, Registration and configuration of control heads, on page 28 in the same way as for the portside system. Complete by checking the set IDs as explained in section 7.4.1.3 on page 32. The IDs for the starboard side are as follows:

```
Control head
Bridge ID        <71>
Starboard ID     <72>
Portside ID      <73>
Fly ID           <74>
Afterdeck ID     <75>
ECR ID           <76>
ESC              < >
```

> If applicable, proceed in the same way with further Marine Propulsion Controllers.

7.4.3 Testing the command transfer between stations

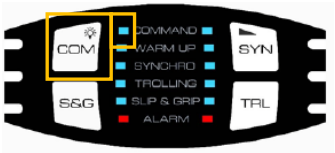
> Power down both Marex Propulsion Controllers.

> Then power up the ***portside*** Marine Propulsion Controller only. The control heads signal their readiness for operation by emitting a buzzer tone.

> Go to one of the control stations.

> At the station move the control head levers to the neutral position.

> Push the command key twice.



The command transfer was successful if the portside Command LED lights up and the buzzer signal stops.

> Check if only the portside LED is lit at the control head which is now active.

> Take over the command at every control station one after the other. If the *starboard* Command LED lights up, the CAN bus connectors at the control head have been confused.

> After testing successfully, power down the portside MPC.

> Then power up the ***starboard*** Marine Propulsion Controller only and test the command transfer function in the same way as with the portside MPC.

> Proceed accordingly with further Marine Propulsion Controllers if applicable.

> Power off the MPCs after completion of the test.

7.4.4 Starting up the cross communication

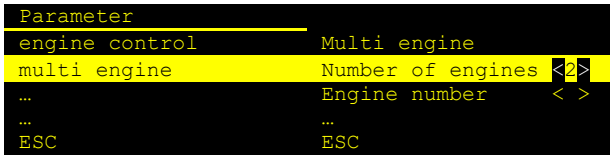
For multi engine systems the number of engines must be entered into the Marine Propulsion Controllers and a number assigned to identify each engine.

7.4.4.1 Portside parameterization

Proceed as follows:

> Power up the portside MPC.

> Open the parameter menu (see section 7.3.5, User login for changing and storing settings, on page 27).

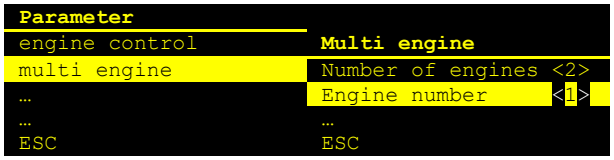


> Select the menu item "Multi engine" and push the select button to open the submenu.

> Push the select button. The brackets start flashing.

> Turn the select button to enter the number of engines which are provided in the system.

> Push the select button.



> In the Multi engine submenu, select the item "Engine number" and push the select button. The brackets start flashing.

> Turn the select button to assign number "1" to the portside engine.

> Push the select button.

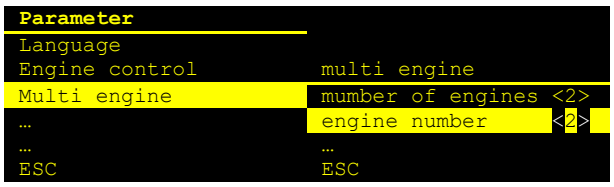
> Power off the portside MPC.

7.4.4.2 Starboard parameterization

Proceed as follows:

> Power up the starboard MPC.

> Proceed as explained in section 7.4.4.1 Portside parameterization on page 34, but assign engine number "2" to the starboard engine.



> Power off the starboard MPC and proceed accordingly to assign further engines if applicable.

7.4.4.3 Testing the cross communication

With multi engines, taking over the command at a control station is possible only for all propulsions at the same time. By default, all control head levers at a control station must be set in the neutral position before.

> Power down all Marex Propulsion Controllers.

> Power up all MPCs. The command-LEDs at the control heads flash slowly accompanied by a buzzer signal.

> Set one control head lever to a position other than neutral. Set all other control head levers in the neutral position.

> Push the command-key at the control head twice.

If the cross communication works correctly, the command LED of the control head lever, which is not in neutral, flashes slowly. The command LEDs of the other control head levers flash quickly, and it is not possible to take over the command.

Cross communication faulty:

The command-LED of the control head lever, which is not in neutral, flashes slowly. The command LEDs at the other control head levers are permanently lit indicating the command was taken over, although one control head lever is not set in the appropriate position.

7.5 Parameterizing the interfaces

NOTICE

RISK OF DAMAGE TO EQUIPMENT

The gear manufacturers stipulate a maximum permissible engine speed for engaging the clutch. Overload may destroy the gear system.

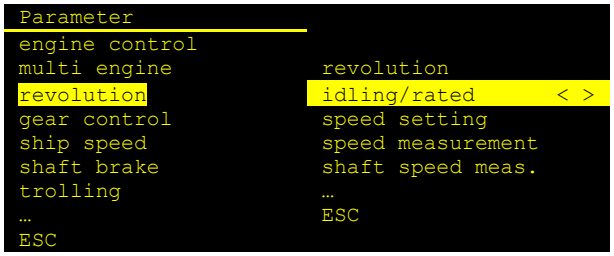
Adhere strictly to the operation parameters stated by the manufacturer in the gearbox manual (gear oil pressure, valve current, engine speed).

7.5.1 Engine control

The following settings must be made in all Marex Propulsion Controllers in the Marex MCS system:

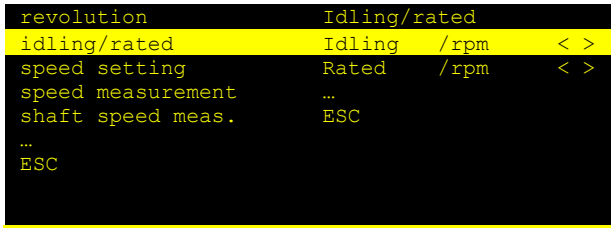
1. Parameterize the idling speed in rpm.
2. Parameterize the rated speed in rpm.
3. Activate analog output AO5.

Proceed as follows:



> In the parameter menu, select the line “revolution” and open the submenu.

> Select the menu item "idling/rated" and push the select button. In the submenu, the first line "idling/rpm" is highlighted.

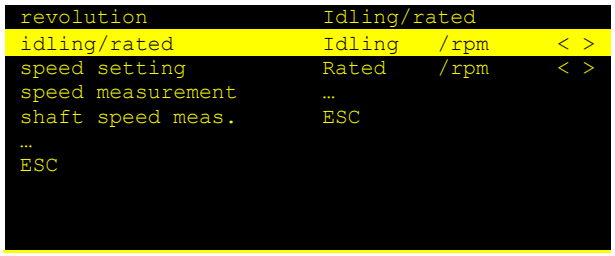


In the submenu, the first line "idling/rpm" is highlighted.

> Push the select button. The brackets start flashing.

> Turn the select button until the requested value for the idling engine speed is displayed between the brackets.

> Push the select button.

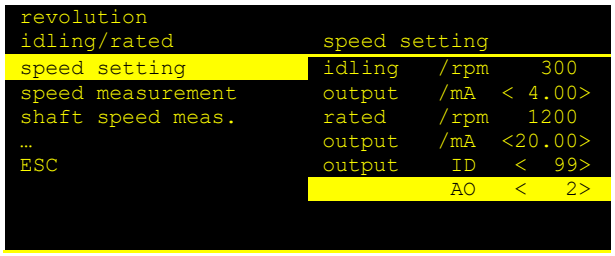


> Now go to the second line in the idling/rated submenu: "rated/rpm".

> Push the select button and turn it until the requested rated engine rpm value is reached.

> Push the select button.

> Push the escape button and return to the "revolution" menu.



> In the menu "revolution", select the menu item "speed setting" and push the select button.

The menu displays the settings for idling and rated speed including the corresponding values in mA. By default, the output is assigned to the MPC with ID 99.

> Select the item AO in the line below the ID and push the select button. Now turn the select button until the number "5" is displayed.

> Push the select button.

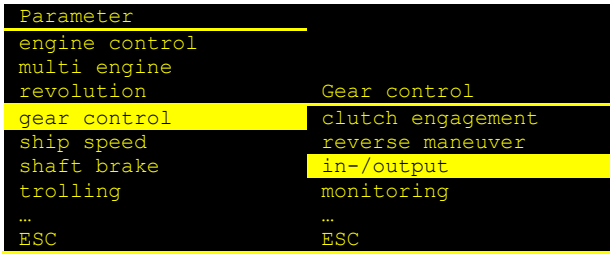
> Push the escape button twice to return to the parameter menu.

7.5.2 Gear control

The following settings must be made in all Marex Propulsion Controllers of the Marex MCS system:

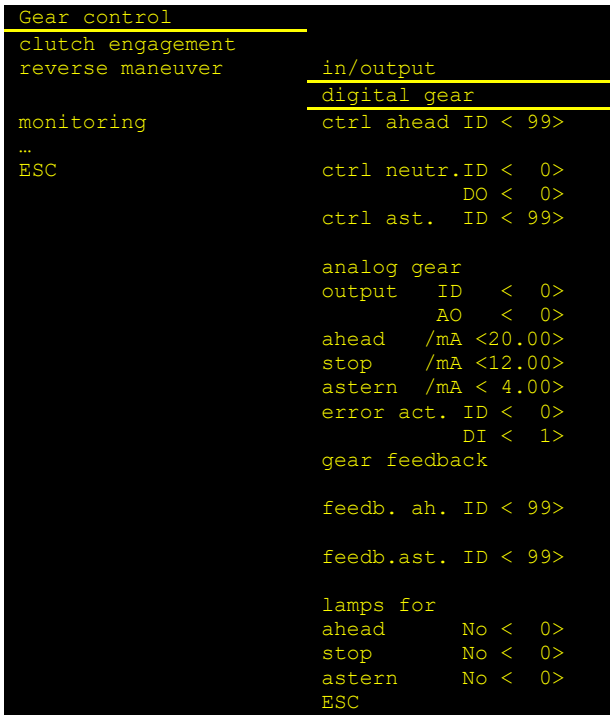
1. Activate the digital outputs for ahead (ADO1) and astern (ADO2).
2. Set the digital inputs for the gear feedback for ahead (DI1) and astern (DI2).
3. Set the minimum and maximum engine speed in rpm admissible for engaging the clutch.

Proceed as follows:



> In the parameter menu, select the line “gear control” and open the submenu.

> Go to the menu item "in-/output" and push the select button.



> In the submenu "in/output", select the line “ctrl ahead". By default, the output is assigned to the MPC with ID 99.

> Go to the line below "DO" and push the select button. Turn the select button to "1" and push it.

> Now go to the line "ctrl ast." By default, the output is assigned to the MPC with ID 99.

> Go to the line below "DO" and push the select button. Turn the select button to "2" and push it.

> To activate the gear feedback, select the line "feedback enabl". Push the select button and set the parameter to "on".

> Go to the line below "feedb. ah. By default, the input is assigned to the MPC with ID 99.

> Select the line "DI" and set the value to "1".

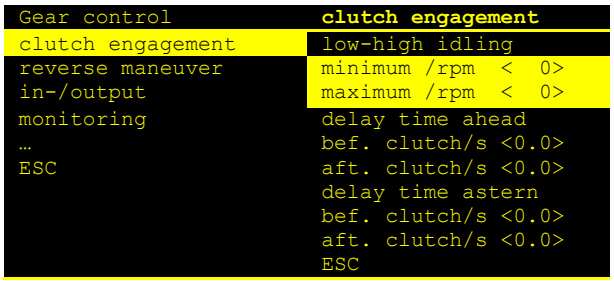
> Push the select button.

> Select the line "feedb.ast." By default, the input is assigned to the MPC with ID 99.

> Select the DI and set the value to "2".

> Push the select button to store your setting.

> Push the escape button. The superior menu "gear control" is called up.



> In the gear control menu, select the line “clutch engagement” and open the submenu.

> Go to the menu item "minimum / rpm" and push the select button.

> If not otherwise specified, set the value to the idling engine rpm.

> Push the select button.

> Now go to the line "maximum / rpm". Push the select button. Turn the button until the maximum rpm admissible for the clutch engagement is reached.

> Push the select button.

> Push the escape button twice to return to the parameter menu.

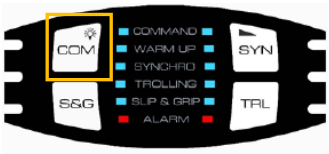
7.5.3 Warming up

The Warming up function allows for accelerating the engine without engaging the clutch.

At the Control Heads Type 244, the function is switched on by pushing and holding the command key and, at the same time, moving the control head lever for the corresponding engine from stop to the first detent ahead. The command key can be released as soon as the lever is in the first detent ahead. The Command LED flashes at long intervals to signal that the warming up mode is active. The control head lever can then be moved further ahead to accelerate the engine without thrust.

The mode switches off when the lever is set back to the neutral position.

In the parameter menu, key number "6" must be set.



Proceed as follows:

Parameter	Engine control
engine control	start release
multi engine	start engine
revolution	stop engine
gear control	start fault
ship speed	warming up
shaft brake	engine protection
trolling	mesure fuel rack
…	…
ESC	ESC

> In the parameter menu, select the line “engine control” and open the submenu.

> Go to the menu item "warming up" and push the select button.

Engine control	Warming up	
start release	activate	
start engine	input	ID < 0>
stop engine		DI < 0>
start fault	key	No < 0>
warming up	lever/key	No < 6>
engine protection	message	
mesure fuel rack	output	ID < 0>
…		DO < 0>
	lamp	No < 0>
	start release	< on>
ESC	ESC	

> In the warming up menu, select the line “lever/key” and open the submenu.

> Set the entry to "6" and push the select button.

> Push the escape button twice to return to the parameter menu.

7.5.4 Trolling

Note: This section is relevant only for ships with twin engines and gearboxes with trolling feature.

NOTICE

RISK OF DAMAGE TO EQUIPMENT

The gear manufacturers stipulate a maximum permissible engine speed for the trolling mode. Overload may destroy the gear system.

Adhere strictly to the operation parameters stated by the manufacturer in the gearbox manual (gear oil pressure, valve current, engine speed).

Trolling allows the pressure of the clutch to be regulated between 0 % and 100 %. If the trolling mode is activated, there is an adjustable slip between engine and propeller. This improves considerably the maneuverability of the ship at slow speed. The engine rpm is reduced before being transferred to the propeller.

The Marex MCS control heads type 244 provide buttons for switching trolling on and off and LEDs to indicate trolling is active. For switching on the trolling function, the control head must be in command (active) with both levers in the neutral position.

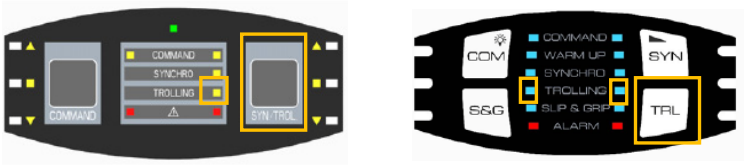


Figure 13: Keys and lamps for trolling at control heads type 244

The amount of slip is related to the lever position of the control head. In the first detent the slip is approx. 99 %, the propeller rotating very slowly. In the lever positions full ahead or full astern the gear engagement is nearly positive:

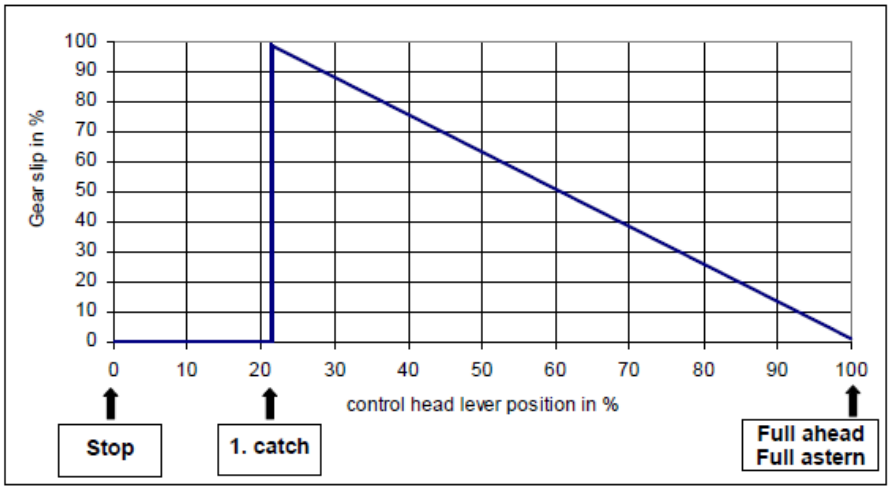


Figure 14: Gear slip in relation to lever position with trolling

The engine speed is changed according to the lever position. It is recommended to set idle speed in the neutral position and the first detent ahead or astern. In the lever positions full ahead or full astern the maximum admissible speed in the trolling mode is set.

7.5.4.1 Activating trolling

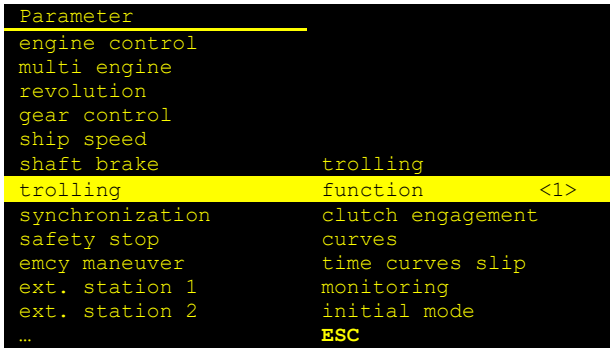
To use the trolling function, the following settings must be made at the Marex Propulsion Controller:

1. Activate the trolling function.
2. Activate the SYN/TROL (TRL) key (No. 9 in the Marine Propulsion Controller) to enable switching trolling on and off at the control heads.
3. Activate the "Trolling" lamp (No. 9 in the Marine Propulsion Controller) to enable the indication that trolling is active at the control heads.
4. Activate the outputs ADO3 or AO6 in the Marex Propulsion Controller to enable the slip control.
5. Define the type of signal and range of adjustment from 0 % slip to 100 % slip, e. g. 0 % = 4 mA, 100 % = 20 mA.
6. Define the maximum engine rpm at which the clutch may be engaged in the trolling mode.

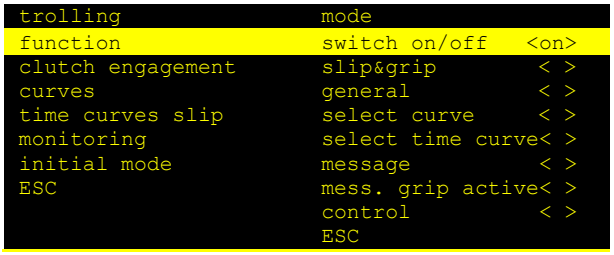
7. Define a speed curve in the trolling mode, i. e., assign an rpm value to every position of the control head lever on a scale from 0-10 in ahead and astern direction.

Proceed as follows:

Activating trolling in the MPC

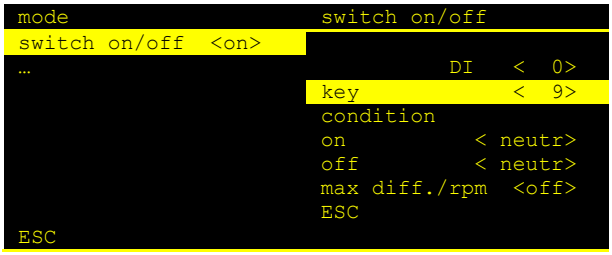


> In the parameter menu, choose the line “Trolling” and open the submenu.
> Select “function” and push the select button.
> Turn the select button until "1" is displayed between the brackets.
> Push the select button. The submenu "mode" is opened.



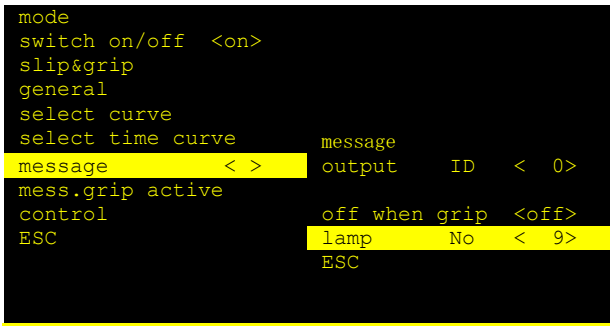
> In the submenu "mode", select the item "switch on/off" and push the select button.
> Turn the select button until "on" appears between the buttons.
> Push the select button. The submenu "switch on/off" is called up.

Activating the SYN/TROL (TRL) key at the control head



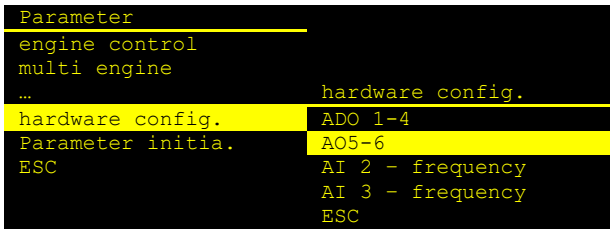
> In the submenu "switch on/off", select the item "key" and push the select button.
> Turn the select button until "9" appears between the buttons.
> Push the select button. The TROL/SYN (TRL) key is now set for switching trolling on and off.
> Push the escape button and go back to the "mode" submenu.

Activating the trolling LEDs.

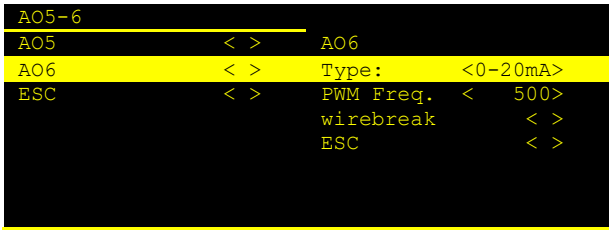


> In the submenu "mode", go to the item "message" and push the select button.
> In the message submenu, navigate to the line "lamp".
> Push the select button.
> Turn the select button and adjust the value to "9".
> Push the select button. The trolling LED at the control heads is activated.
> Push the escape button 3 times to return to the parameter menu.

Setting the output – 4-20mA / 0-10 V

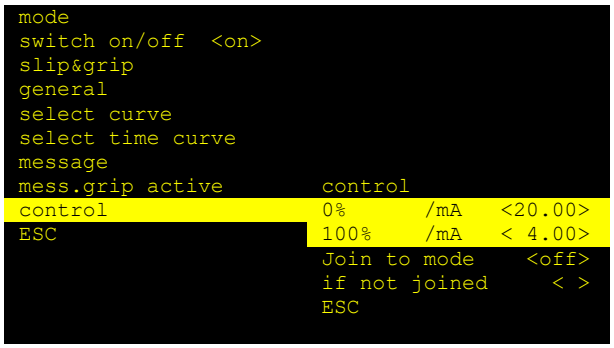


> In the parameter menu, navigate to the item "hardware config." and push the select button.
> In the submenu, go to the item AO5-6 and push the select button.
> In the submenu, select A05-6.



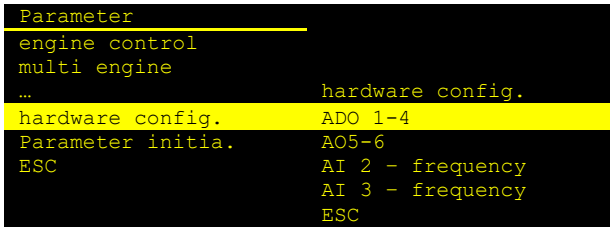
> Select AO6 in the next submenu.
> In the AO6 submenu, go to "type:" and push the select button.
> If trolling is controlled via a current-signal, set the value to
0-20 mA and push the select button.
> If the trolling signal is in voltage, set the value to 0-10 V and push the select button.
> Push escape 3 times to return to the parameter menu.

Defining the control range 4-20mA / 0-10 V

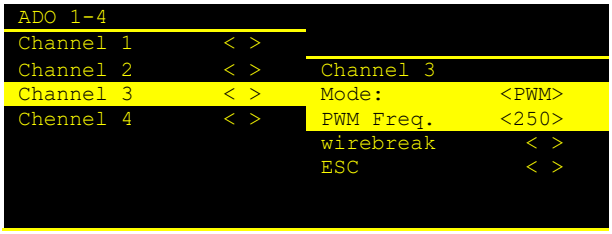


> In the submenu "mode" go to the item "control" and push the select button.
> In the submenu, define the signal range for the trolling control from 0% to 100% slip: Go to the line "0%" and push the select button.
> Set the value to 20.00 and push the select button.
> Now navigate to the line "100%" and push the select button.
> Adjust the value to 4.00 mA.
> Push the select button. The signal range for trolling is now set.

Setting the output – Proportional valve



> In the parameter menu, navigate to the item "hardware config." and push the select button.
> In the submenu, go to the item ADO1-4 and push the select button.

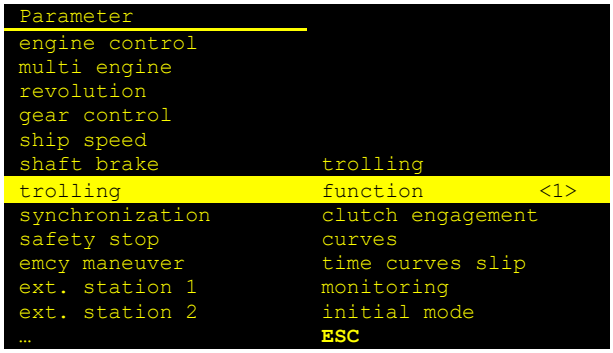


> Select "Channel 3" in the ADO 1-4 submenu and push the select button.
> Go to the menu item "Mode:" and push the select button.
> Set the parameter to PWM and push the select button.
> Navigate to the item "PWM Freq." and push the select button.
> Set the PWM frequency to 250.

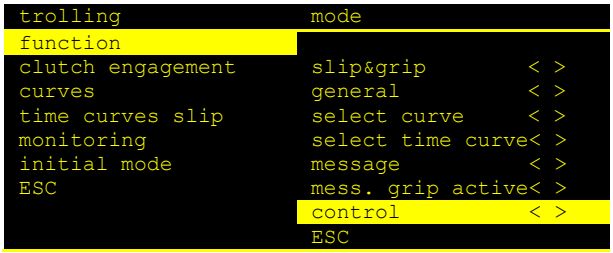
Note:
Observe instructions from the gear manufacturer.

> Push the select button.
> Push the escape button and return to the parameter menu.

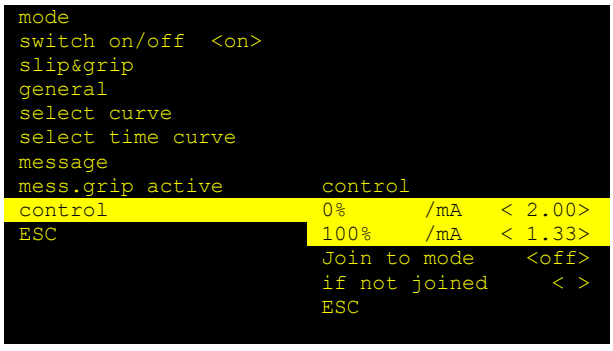
Defining the control range with proportional valve



> In the parameter menu, choose the line “Trolling” and open the submenu.
> Select “function” and push the select button.
> Turn the select button until "1" is displayed between the brackets.
> Push the select button. The submenu "mode" is opened.



> In the submenu "mode", select the item "control" and push the select button.

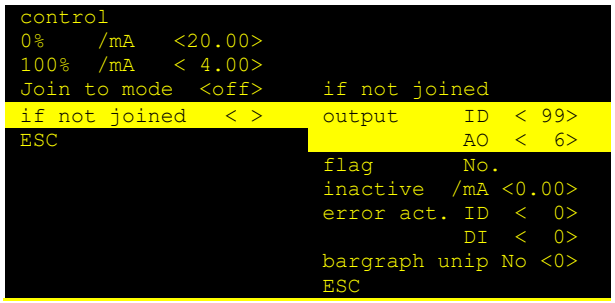


> For PWM control of a proportional valve, the values for the output current in the control submenu need to be adapted as follows:

Parameter	Output current	Value entry
0%/mA	300 mA	2.00
100%/mA	200 mA	1.33
Inactive/mA	0 mA	0.00

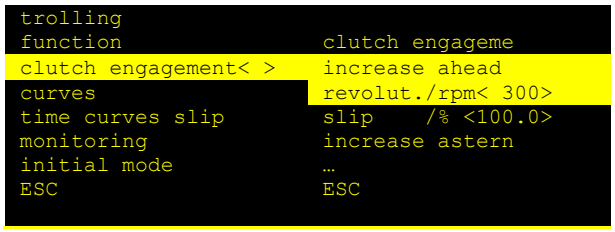
> Enter the values displayed in "value entry" as parameters for the trolling control. Push the select button.

Assigning the output.



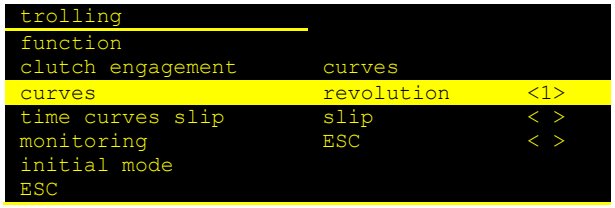
> In the submenu "control" navigate to the item "if not joined" and push the select button.
> Set the ID to "99", for the MPC. Push the select button.
> Go to the next line and set the analog output to "6" (4-20mA or 0-10V) or "3" (proportional valve control).
> AO 6 at the MPC is now set for analog trolling control.
> Push the select button.
> Push the escape button twice to return to the trolling submenu.

Defining the maximum speed for clutch engagement.

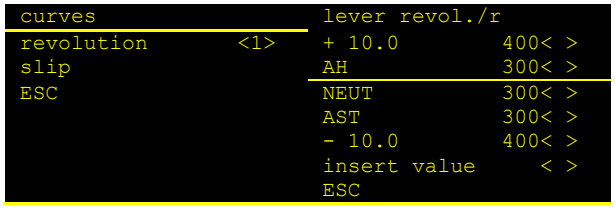


> In the submenu "trolling" select the item "clutch engagement and push the select button.
> In the submenu, navigate to the item "revolut./rpm" under the headline "increase ahead" and push the select button.
> Adjust the value between the brackets to the requirements of your system and push the select button.
> Push the escape button to return to the trolling submenu.

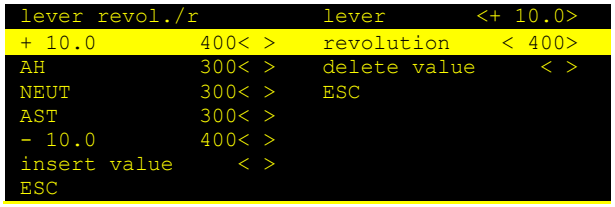
Setting the rpm curve



> In the submenu trolling, select the item "curves" and push the select button.
> Select the item "revolution" and push the select button.
> Adjust the entry to "1" and push the select button.



> In the submenu "lever revol./r", the rpm values for trolling in the lever positions
+ 10.0 (max. ahead)
AH (1st detent ahead)
NEUT (neutral)
AST (1st detent astern)
-10.0 (max. astern),
which are set by default, are displayed.



> For changing a value, navigate to the corresponding menu line and push the select button.

Marex MCS automatically interpolates the rpm values for the remaining lever positions.

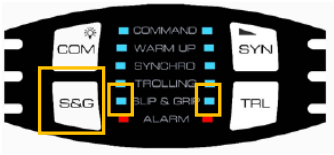
> After adjusting the last value, push the select button, then 3 times the escape button, to return to the parameter menu.

7.5.5 Slip & Grip

Note: This section is relevant only for ships with twin engines and gearboxes with Slip & Grip feature.

Like trolling, Slip & Grip is a cruising mode which allows controlled clutch slippage while maintaining the minimum engine speed. Transmissions with Slip & Grip provide an electronic closed-loop control for delivering a constantly slow propeller speed.

The Control Head Type 244 with ***four*** key provides one key for switching Slip & Grip on and off. The function can only be activated at the active control head if the control head lever is in the neutral position. Active Slip & Grip is indicated at the control head via two LEDs labeled "Slip & Grip.



To use the Slip & Grip function, the following settings must be made at the Marex Propulsion Controller:

1. Activate the Slip & Grip function.
2. Activate the S&G key (No. 10 in the Marine Propulsion Controller) to enable switching Slip & Grip on and off at the control heads.
3. Activate the "Slip & Grip" lamp (No. 10 in the Marine Propulsion Controller) to enable the indication that Slip & Grip is active at the control heads.
4. Activate the output DO6 in the Marex Propulsion Controller to enable the slip control.

Proceed as follows:

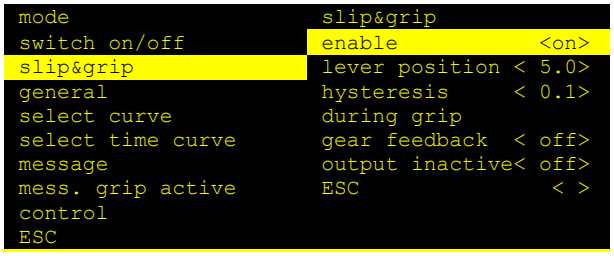
Activating the Slip&Grip function.

Parameter	
engine control	
multi engine	
revolution	
gear control	
ship speed	
shaft brake	trolling
trolling	function <2>
synchronization	clutch engagement
safety stop	curves
emcy maneuver	time curves slip
ext. station 1	monitoring
ext. station 2	initial mode
…	**ESC**

> In the parameter menu, choose the line “Trolling” and open the submenu.
> Select “function” and push the select button.
> Turn the select button until "2" is displayed between the brackets.
> Push the select button. The submenu "function" is called up.

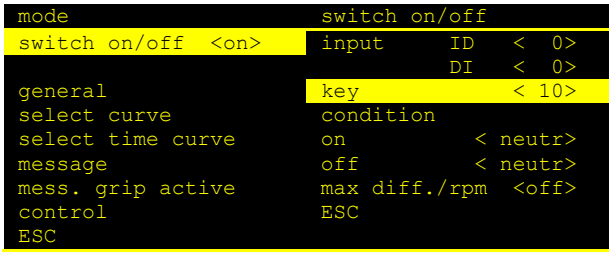
trolling	mode
function	switch on/off <on>
clutch engagement	slip&grip < >
curves	general < >
time curves slip	select curve < >
monitoring	select time curve< >
initial mode	message < >
ESC	mess. grip active< >
	control < >
	ESC

> In the submenu "mode", select the item "slip&grip" and push the select button to open the submenu.



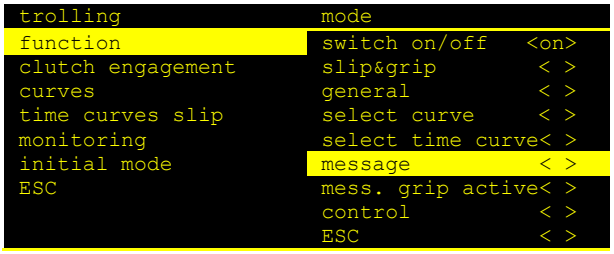
> In the submenu "slip&grip", select the item "enable" and push the select button.
> Adjust the entry to "on" and push the select button.
> Push the escape button to return to the "mode" menu.

Activating the S&G key.

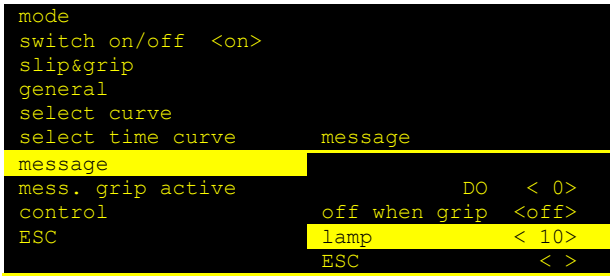


> In the submenu mode, navigate to the item "switch on/off" and push the select button.
> Set the entry to "on" and the select button.
> In the submenu, navigate to the item "key" and push the select button.
> Turn the select button until "10" appears between the brackets.
> Push the select button. The S&G key is now set for switching Slip&Grip on and off.
> Push the escape button and go back to the "mode" submenu.

Activating the S&G LEDs.

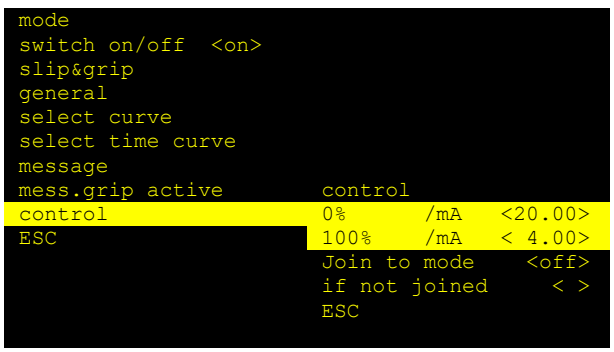


> In the submenu "mode", select the item "message" and push the select button to open the submenu.



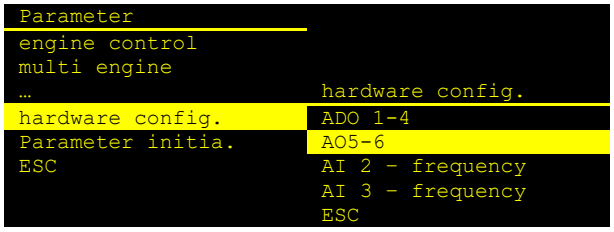
> In the message submenu, navigate to the line "lamp".
> Push the select button.
> Turn the select button and adjust the value to "10".
> Push the select button. The Slip&Grip LEDs at the control heads are activated.
> Push the escape button and return to the "mode" submenu.

Defining the control range 4-20mA / 0-10 V

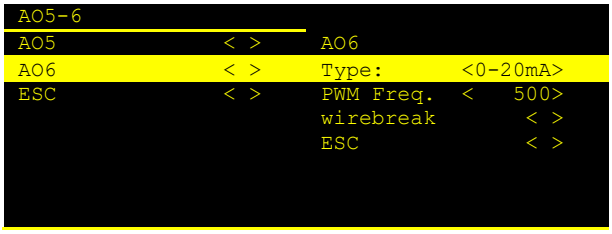


> In the submenu "mode" go to the item "control" and push the select button.
> In the submenu, define the signal range for the Slip&Grip control from 0% to 100% slip: Go to the line "0%" and push the select button.
> Set the value to 20.00 and push the select button.
> Now navigate to the line "100%" and push the select button.
> Adjust the value to 4.00 mA.
> Push the select button. The signal range for Slip&Grip is now set.

Setting the output – 4-20mA / 0-10 V

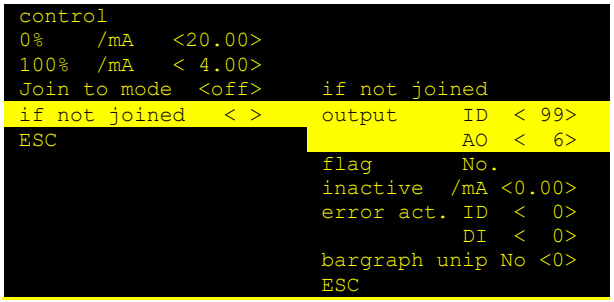


> In the parameter menu, navigate to the item "hardware config." and push the select button.
> In the submenu, go to the item AO5-6 and push the select button.
> In the submenu, select A05-6.



> Select AO6 in the next submenu.
> In the AO6 submenu, go to "type:" and push the select button.
> If Slip&Grip is controlled via a current signal, set the value to 0-20 mA and push the select button.
> If the signal is in voltage, set the value to 0-10 V and push the select button.

Assigning the output.



> In the submenu "control" navigate to the item "if not joined" and push the select button.
> Set the ID to "99", for the MPC. Push the select button.
> Go to the next line and set the analog output to "6" (4-20mA or 0-10V) or "3" (proportional valve control).
> AO 6 at the MPC is now set for Slip&Grip control.
> Push the select button.
> Push the escape button 3 times to return to the parameter menu.

7.5.6 Synchronizing

The synchronization mode allows the operator to control both diesel engines at the same speed with one control head lever.

With Control Head Type 244 with ***two*** buttons, synchronizing is activated and deactivated by the same key as trolling (SYN/TROL). Both control head levers must be in the ***ahead*** range when the SYN/TROL key is pushed, the lever positions deviating by 10 % (default setting) at maximum. If trolling is on and both control head levers are placed in ahead, synchronizing cannot be used. Control head type 244 with two buttons provides one LED labeled "Synchro" to indicate that synchronizing is active.

At the Control Head Type 244 with ***four*** keys one button each is provided for synchronizing and trolling. Synchronizing can be used while trolling is active. Two "Synchro" LEDs light up when synchronizing is active. To switch on the synchronizing function both control head levers must be in the ***ahead*** range when the SYN key is pushed, the lever positions deviating by 10 % at maximum.

At both control head versions, one ***command*** LED will switch off when synchronizing is active, thus indicating that the corresponding control head lever does not longer preset the engine speed.

Flashing "Synchro" LEDs indicate that synchronizing is switched on, but not operating because of deviating lever positions. By default, "flashing" is set to "on" in the parameters.

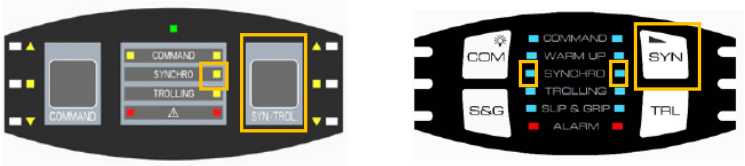


Figure 15: Keys and lamps for Synchronizing at control heads type 244

7.5.6.1 Activating the synchronizing function

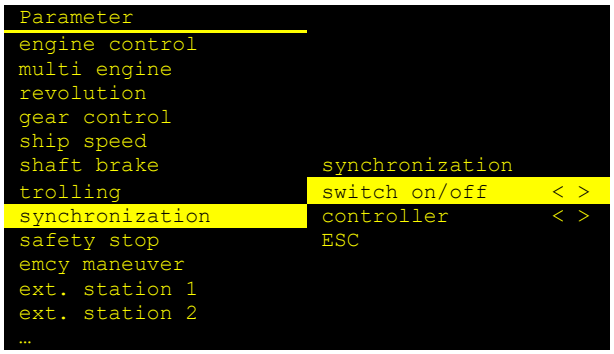
The following settings must be made to activate the synchronization function at the Marex Propulsion Controller:

1. Activate the Synchronizing feature.
2. Activate the SYN/TROL (SYN) key (No. 8 in the Marex Propulsion Controller) to enable switching synchronizing on and off at the control heads. The MPC at which the key is parameterized becomes the master controller in the Marex MCS system for presetting the engine rpm in the synchronizing mode.
3. Activate the "Synchro" lamp (No. 8 in the Marex Propulsion Controller) to enable the indication that synchronizing is active at the control heads.

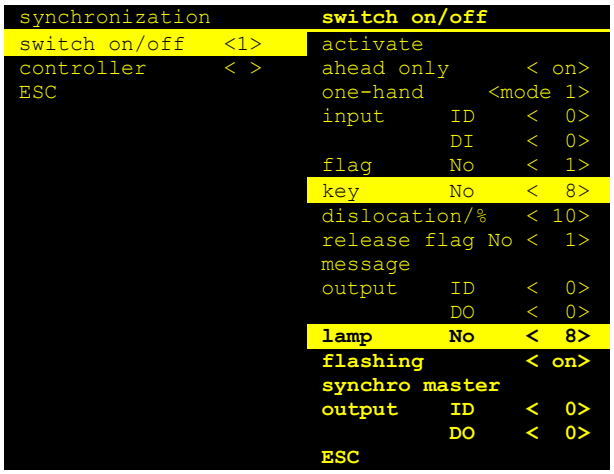
Important

The key SYN/TROL (TRL) - No. 8 in the Marine Propulsion Controller – must only be activated at the MPC which shall be the master of speed setting later (e. g. starboard MPC). All other parameters must be set at both Marine Propulsion Controllers.

Proceed as follows:



> In the parameter menu, choose the line “synchronization” and open the submenu.
Select “switch on/off” and push the select button.



> In the switch on/off submenu, navigate to the line "key" and push the select button.

Note:
The SYN/TROL (SYN) key must only be set at the master MPC (starboard).

> Turn the select button until "8" is displayed between the brackets.
> Push the select button.
> Go to the item "lamp" and push the select button.
> Turn the select button until "8" is displayed between the brackets.
> Push the select button.
> Push the escape button twice to return to the parameter menu.

7.6 Parameters for calculation of the ship speed

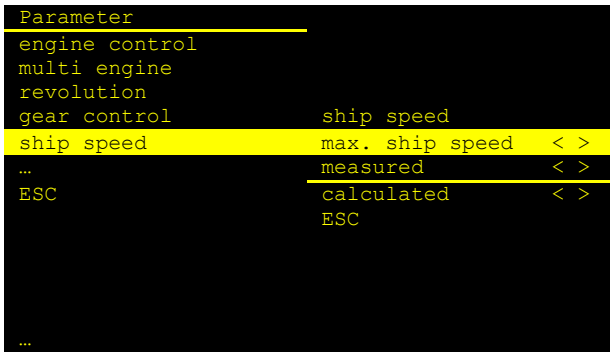
Marex MCS automatically calculates the current ship speed from three parameters that are measured during a sea trial using the current position of the control head lever. These parameters are necessary for the control to react properly, for example in case of a reversing maneuver. They enable to calculate the velocities for clutch disengagement and clutch engagement which is important to prevent engine stalling during reversing maneuvers.

The following values are recorded:

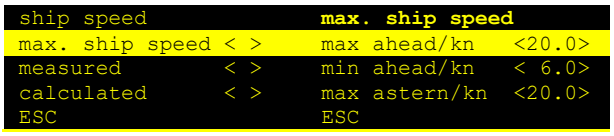
No.	Parameter name	Description of the measured values	Measured value
1	neutral → max ahead	Time the vessel requires after the clutch engagement to reach the maximum speed (Lever is moved from neutral to full ahead.)	seconds
2	max ahead	Maximum speed the vessel can achieve when cruising ahead	knots
3	max ahead → min ahead	Time the vessel requires to slow down from full ahead to almost stop (Lever is moved from full ahead to 1st detent ahead)	seconds

7.6.1 Entering the maximum ship speed

Proceed as follows:

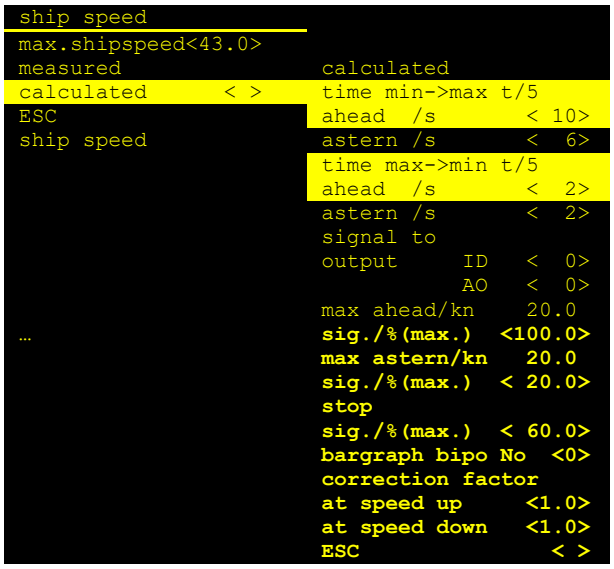


> In the parameter menu, choose the line “ship speed” and open the submenu.
> Select the item "max.ship speed” and push the select button. The submenu "max ship speed" opens.



> Navigate to the item "max ahead/kn". Enter the maximum speed measured during the sea trial when moving the control head lever to full ahead. In the example, with a measured speed of 20 knots, the parameter entry is 20.0.
> Push the select button.

7.6.2 Entering the measured time constants



> In the submenu ship speed, select the line “calculated” and open the submenu.
> Select the item "ahead /s” under the headline "time min->max" and push the select button.
> Enter the time measured during the sea trial from clutching in to reaching the full ship speed, divided by 5. For example, with a measured time of 50 s, the parameter entry is 10.
> Push the select button.
> Navigate to the item "ahead /s" under the headline "time max->min and push the select button.
> Enter the time measured during the sea trial required to slow down from full speed to nearly stop, divided by 5.
> Push the select button.
> Push the escape button twice to return to the parameter menu.

8 Error display and diagnosis

Marex MCS distinguishes between three error states, which have a different influence on the control function of the system depending on the type of error. Information about the cause of an error is displayed at the Marine Propulsion Controller.

> For information about remedial actions, refer to the Marex MCS service manual. See also section 1.2, Required and Additional Documentation, on page 5.

8.1 Warning

A warning is signaled by the red alarm LEDs at the control head

. There will be no buzzer signal. At this control station the propulsion system can be operated without restrictions. Warnings will not be forwarded to external alarm systems if connected. A typical error of the category "warning" is an error at a passive control station.

Error in the system Control from this station is possible.

8.2 Light alarm

A light alarm signals that the control function of the system is restricted. The alarm LEDs at the control station light up and an integrated or connected external buzzer emits an acoustic alarm. The buzzer at the control head can be muted by pushing the Command key.

A light alarm will be triggered if the propulsion can still be partly controlled, e. g. if gear control is defective, but the engine speed can still be altered.

Error in the system Control from this station is possible with restrictions.

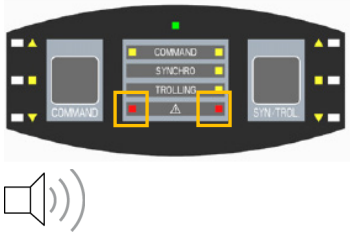
8.3 Alarm

An alarm is signaled in case of a serious control failure. The current control status of the propulsion can no longer be changed. The Marex MCS retains the last command. The alarm LED switches on. The buzzer or a connected alarm system emits an acoustic signal. The buzzer at the control head can be muted by pushing the Command key. The Command LED of the affected propulsion side switches off. A typical alarm is an error at the active control station.

Error in the system Propulsion cannot be controlled from this station anymore.

8.4 Indication of alarms and errors

Control Heads Type 244 provide LEDs and a buzzer for signaling warnings and alarms:



At the Marex Propulsion Controller, the presence of an error is indicated by a flashing **E** in the top right corner of the home screen and the status LED (2, Figure 1) lighting up red.

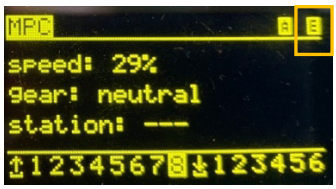
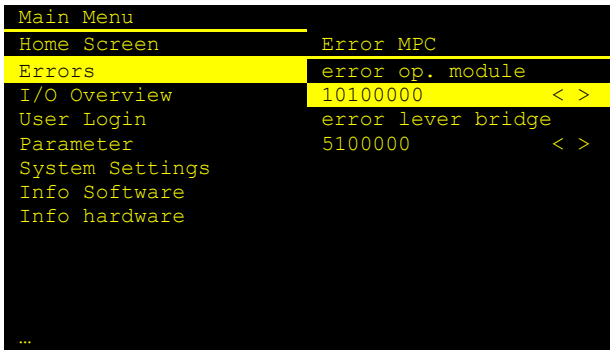


Figure 16: Home screen with pending error

8.5 Calling up errors in the display

Proceed as follows to view and acknowledge errors in the display:



> Starting from the home screen, push the select button for 3 s.

> Navigate to the menu item "errors" by turning the select button.

> Push the select button and open the submenu.

After selecting the error submenu, the last occurred error is indicated on top of the list of errors. Errors flash as long as they are not acknowledged.

> Navigate to the error number and push the select button. The error is acknowledged and stops flashing. The status LED of the MPC will remain red until the error is solved.

> Push the escape button to return to the main menu.

> Refer to the service manual for information about the error codes and remedial actions. See also section 1.2, Required and Additional Documentation, on page 5.

> To return to the main menu, push the escape key.

9 Maintenance and Repair

9.1 Cleaning and Care

Cleaning agents may damage the Marex Propulsion Controller.

> Clean the MPC only by using a lint-free cloth.

> Never use water or cleaning agents on the Marine Propulsion Controller.

9.2 Inspection

Check the Marex Propulsion Controller at regular intervals:

> Make sure all cables and connection terminals are still firmly connected.

> Verify that the display is legible and works as intended.

> Test the select and escape buttons (5, 6 in Figure 1: Product overview on page 14) for proper function.

> Check the condition of the fuses F1 and F2 (15 in Figure 1: Product overview, on page 14).

9.3 Maintenance

The Marex Propulsion Controller does not require maintenance.

9.4 Spare parts

- Battery for real-time clock type CR2032, lifetime 10 years approximately
- Fuse 5 A, automotive mini (material No. R419802071)
- Fuse 10 A, automotive mini (material No. R419802105)

9.5 Repair

The Marex Propulsion Controller needs replacing if defective.

> Do not attempt to repair the device yourself.

> Contact Emerson at Emerson.com in case of defective components.

10 Disassembly

⚠ DANGER

RISK OF INJURY AND PROPERTY DAMAGE WHEN REMOVING THE MAREX PROPULSION CONTROLLER WHILE THE PROPULSION IS WORKING

Control over the propulsion will be lost if the MPC is removed with running engines.

Shut off the engines. The ship must be anchored or moored.

The safety of the crew and other traffic participants must not be endangered.

Only disassemble Marex MCS components if all plugs are removed and the system is powered off.

Proceed as follows to dismantle the Marex Propulsion Controller:

1. Switch off the power supply of the Marex Propulsion Controllers.
2. Disconnect the power supply and terminal and CAN bus connections.
3. Loosen the mounting nuts. You may now remove the Marex Propulsion Controller.

11 Disposal

NOTICE

ENVIRONMENTAL DAMAGE DUE TO IMPROPER DISPOSAL.

Electronic components require special waste treatment and must only be disposed of by approved specialist companies.

Dispose of electronic scrap in an environmentally sound way.

Consult the responsible local authorities regarding the environmentally sound disposal.

Dispose of the packaging in an environmentally compatible way.

12 Technical Data

Dimensions	165 mm (H) x 260 mm (W) x 42 mm (D)
Weight	1.6 kg
Supply voltage	24 V DC – 25%/+30%
	12 V DC – 20%/+30 %
Nominal current consumption	24 V: 3A
	12 V: 6 A
Fuse	F1: 5A (T) Electronic
	F2: 10 A (T) ADO1 ...ADO4
Operating temperature	-25...+70°C / 248...343 K
Storage temperature	-40...+85°C / 233...358 K
Relative humidity	0.95 %
Vibration solidity	4G (2...100 Hz), IEC 60068-2-6, Test FC
Isolation strength	500 V AC
Protection category	IP20, IEC 60529
Max. conductor cross-section of terminals	1.5 mm^2
	2.5 mm^2 (only for terminals 1 and 2)
Max. current load of terminals	10 A
	15 A (only for terminals 1 and 2)
Housing	Stainless steel

13 Accessories

Material No.	Description	
R417003900	Control cabinet 300 x 300 x 120 mm	
8941054264	Terminating resistor	male
8941054274	Terminating resistor	female
8946054792	Bus cable	0.5 m
8946054802	Bus cable	2 m
8946054812	Bus cable	5 m
8946054822	Bus cable	10 m
8946054832	Bus cable	15 m
8946054842	Bus cable	20 m
8946054852	Bus cable	30 m
8946054862	Bus cable	50 m
8946054872	Bus cable	80 m
8946054882	Bus cable	100 m

14 Appendix

14.1 Dimensions

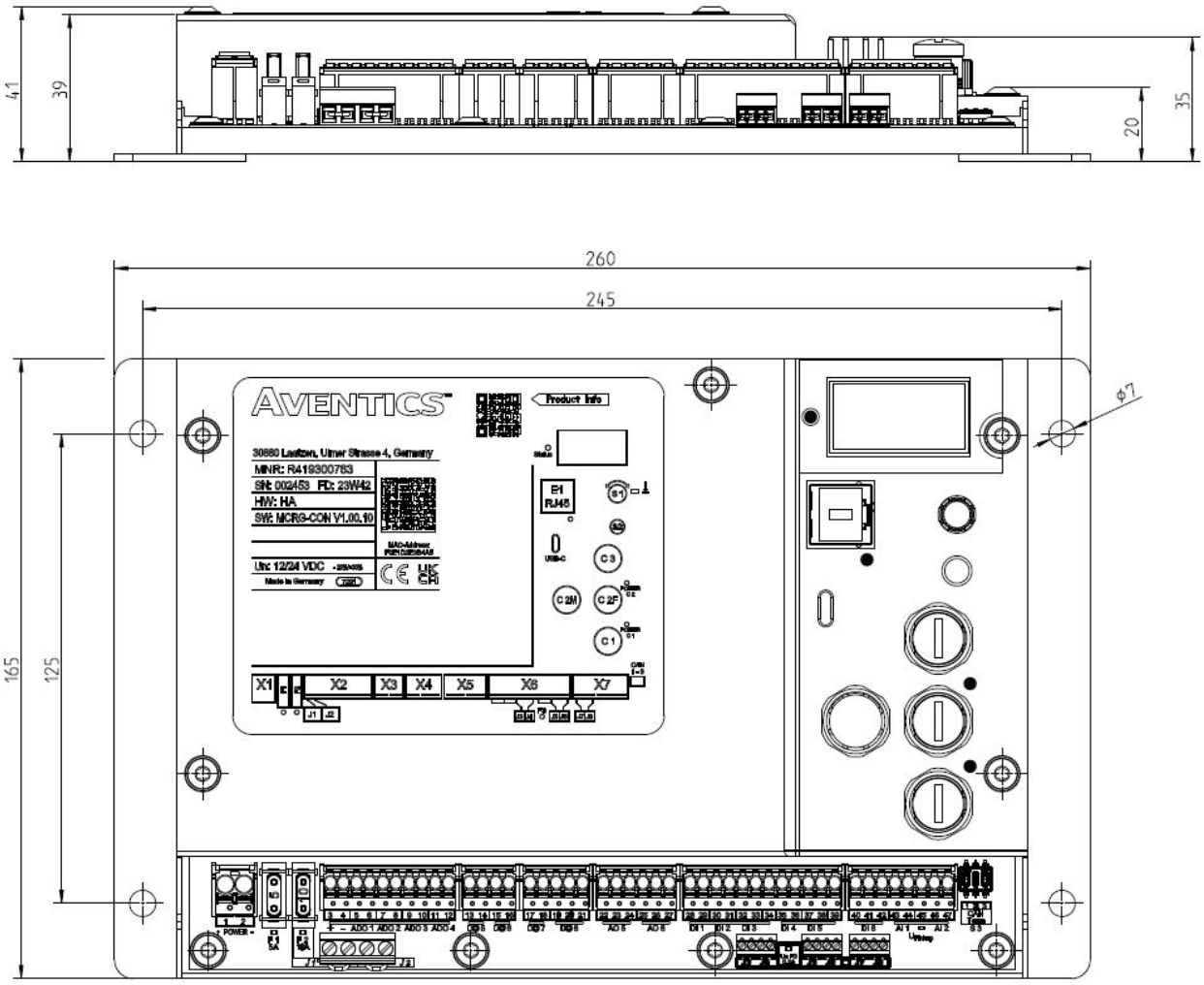


Figure 17: Dimensional drawing (mm)

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