FLEXBALL
ITALIANA S.R.L.

Electronic command system for marine engines

Wave 4000

Operating manual & mounting instructions

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Version January 2013

1. Introduction

This manual describes the electronic remote control system in general and its operating, performance and safety aspects. If it is the first time that you install an electronic control system, go to section 22 where you will be guided to the necessary steps.

2. General installation features

2.1. Description of the system and its parts

The electronic engine remote control implements mechanical and electronic solutions with digital communication technology. Only few devices are required to compose a complete electronic engine remote control:

- Command stations
- 1 Actuator
- Data communication cables which connect the command stations to the Actuator

2.2. Maximum extension of the system

The maximum configuration of the system is as shown in the following table:

Actuator	The maximum number of engines that the system can control is 1
Command stations	The maximum number of command stations in the installation is 3
80 meters	Maximum distance between cockpit and engine room

2.3. System performance

Temperature

Operating temperature	From -10 to 85°C
Storage temperature	From -40 to 90°C

Mechanical features

Nominal load when actuator is providing a pushing force	150 N (15 kg) with power consumption 1.5 A
Max load when actuator is providing a pushing force	450 N (45 kg) with power consumption 5 A (with time <1 s)
Stroke of gearbox – forward	Stroke can be set to between 5 and 40 mm
Stroke of gearbox – reverse	
Throttle stroke	Stroke can be set to between 5 and 80 mm

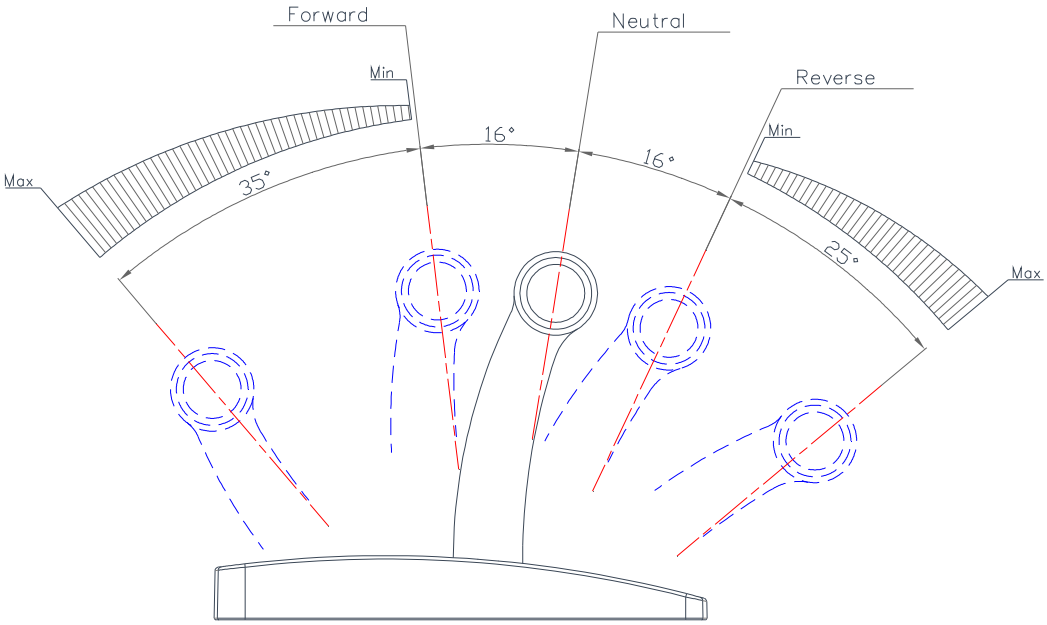
Electrical features

Power supply (*)	from 9,0 to 16 V_{dc} or from 9,0 to 28,0 V_{dc}
Max. current absorbed	5 A
Current absorbed when the system isn't loaded	0,5 A

3. Pilot instructions

Each station can be programmed for the control of one engine. Each lever repeats the functionality of a traditional mechanical lever.
Moving the lever from the neutral position, after 16° forward or reverse automatically the electronic system clutches-in respectively the forward or reverse gear. The accelerator lever has a stroke of 45° both in forward and backward direction.

Command station series 4000



3.1. Control keypad

On the command station it is mounted an electronic keypad with 2 push-buttons and 3 LEDs.

Command station series 4000

Description	LEDs colour
Engine	Green
Warm/Sync	Orange
Command	Red

It follows the table with the definition of LED and push buttons.

Push-button	**LED**	**Description**
(Command)	(Meaning)	
	Engine	If the LED has a fixed light on (green), the gearbox is in neutral position.
	Command	If it is switched off, the Station has not the command. If is switched on, the Station has the command.
	Warm up	If it is blinking, the navigation system is in Warm-up mode; this means that the engines can be warmed up without clutching-in the gear. If the LED is fix lighted, the system is in Synchro mode
Warm up		When the levers of the Station that has the command is in neutral position, if you press for 1,5 seconds the button Warm, it is activated the function Warm-up.
Command		If you press Command for 1,5 seconds the station takes the command, only if one of these two conditions are respected: - after power up lever is in neutral - the lever is synchronized with respect to the lever of the station that at the moment has the command
All LEDs are lighted on		The control system isn't working correctly

3.2. Acquisition of the command

It is possible to acquire the command of the boat from any Station in the following cases:

- **The boat isn't moving**
  1. Position all the levers in neutral and press Command for 1,5 seconds.
  2. LED "Command" is now lighted on while the warm up LED is blinking. You are in Warm up mode: throttle command is enabled but clutch command is disabled.
  3. To take the command you must press for 1,5 seconds the Warm up push-button, afterwards the station acquires the command.

- **In navigation**
  1. Synchronize the lever of the Station which wants to acquire the command with respect to the Station which has the command.
  2. When LED "Engine" of the station which wants to acquire the command is blinking, this lever is synchronised with respect to the lever of the Station which still has the command.
  3. By pressing the push button Command for 1,5 seconds, the new Station takes the command.

► **Important:** before taking the command, proof that all the passengers are safely on board.

3.3. Engine Warm-up

If both levers are in neutral, by pressing for 1,5 seconds the button Warm up of the Station which has the command, you enter in Warm-up mode. If you move the lever it is only affected the accelerator but not the gear. In Warm-up mode the LED Warm up is blinking.

After positioning again the lever in neutral and pressing for 1,5 seconds the Warm up push button, the system comes back to the normal operation mode.

3.4. Synchro mode

Not applicable

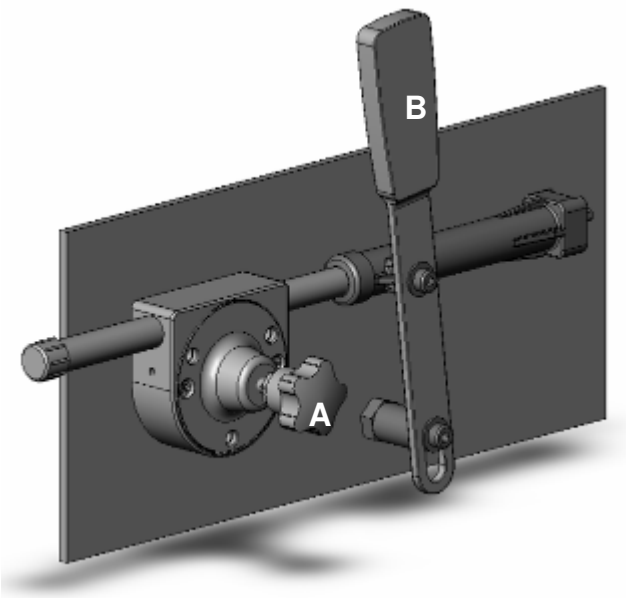
3.5. Fast Start-up Mode

This function is available on the first command station as described in section 8.1 of this manual. When the configuration FSM (Fast Start up Mode) is enabled, the command station with the FSM enabled takes automatically the command at the power on, only if this command station is in neutral position.
If the command station is not in neutral position, the command station will take the command as soon the neutral position will be reached.

3.6. Emergency lever

In case of emergency, the electronic system can be switched off quickly and the engines can be operated directly with the mechanical emergency levers.
Emergency levers are fitted on the control box. It is sufficient to turn completely on (clockwise) knob (A). After this operation, the gearbox can be operated manually using levers (B) and with the throttle set to minimum.

In order to reset the system, turn off completely (counter-clockwise) knob (A). The emergency lever automatically goes back to the position where it was before activating the emergency mode, at the first movement of the command lever.

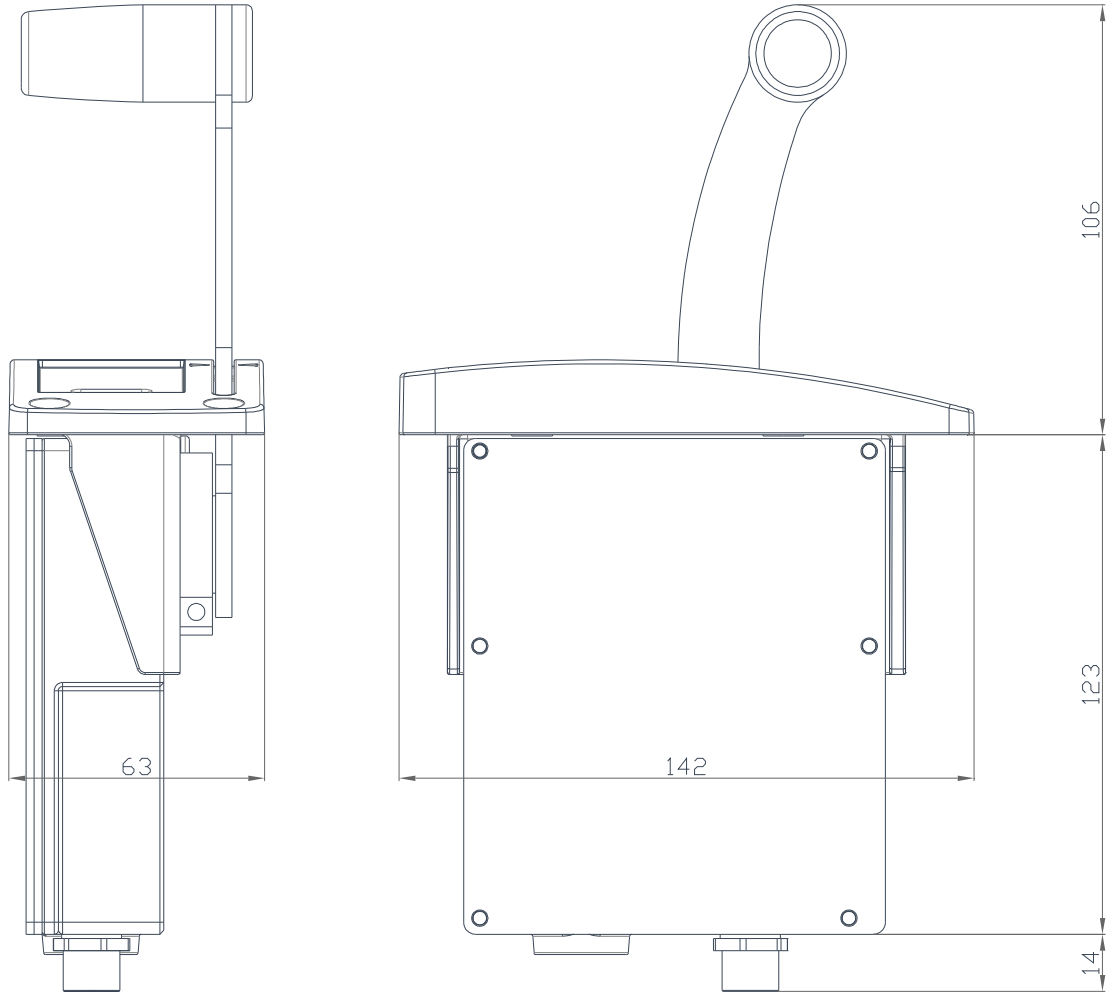


4. Command station

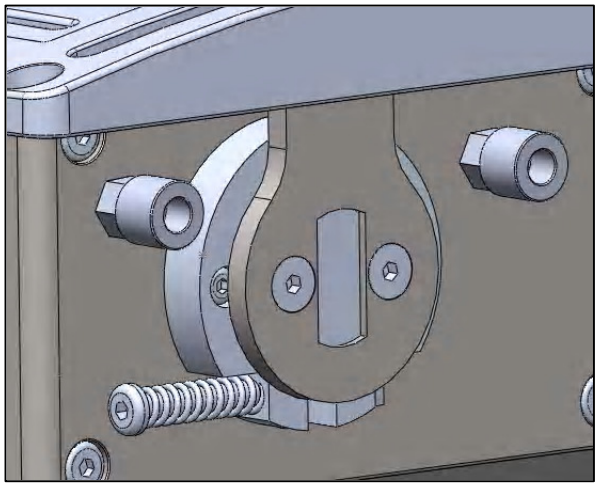
Command stations are classified as devices for the control of the engine. Up to three command stations can be mounted in the same installation. Depending on the application, it is very important to set the dip-switches present on the bottom part of the command station, as described in sections 4.2 and 8.1 of this manual.

4.1. Dimensions

4.1.1. Command station series 4000



4.1.2. Friction adjustment



In order to adjust the friction of the lever, it is enough to tune the screw that you can find just behind the control lever, as shown in the picture on the left. With the help of an hexagon screw driver size 2,5 mm you can loosen or tighten the screw and the friction will become correspondingly softer or harder.

4.2. Command station label

Dip-switch configuration				
	1	2	3	4
1st command station	■	■	■	■
1st comm. station FSM	■	■	■	■
2nd command station	■	■	■	■
3rd command station	■	■	■	■

Code:

S/N:

Under the base of the command station it is present the following label.

This labels indicates the code of the command station, the serial number and the different dip-switches configuration according to the type of the command station.

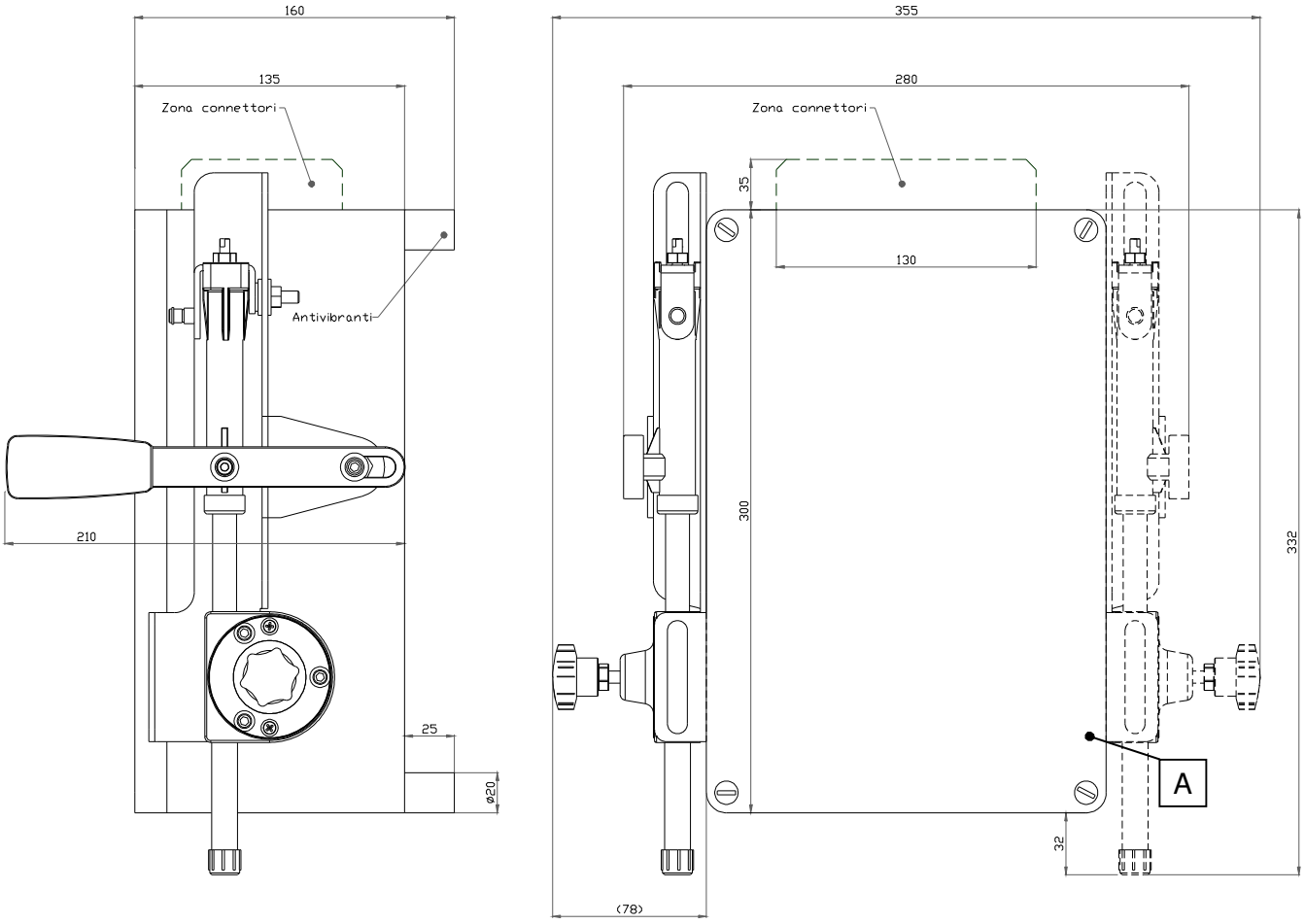
► **Important 1:** these configurations are valid according to schemes from section 7.1 to t.5. in case of different configurations, contact the constructor technical department

► **Important 2:** in the same installation can't coexist a "1st command station FSM" and a "1st command station". "1st command station FSM" replaces "1st command station" and vice versa.

5. Actuator

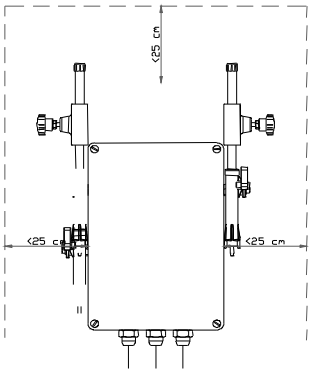
The actuator should be mounted in the engine room in a safety place but as near as possible to the propulsion engine.

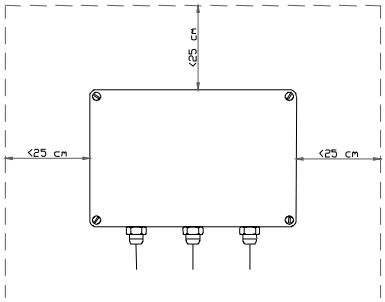
The last page of this manual you find the footprint of the actuator in scale 1:1.



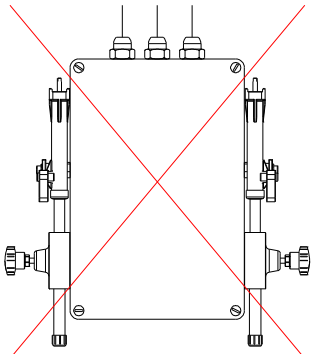
How to mount the actuator

Mount the actuator leaving a space of at least 25 cm on each side



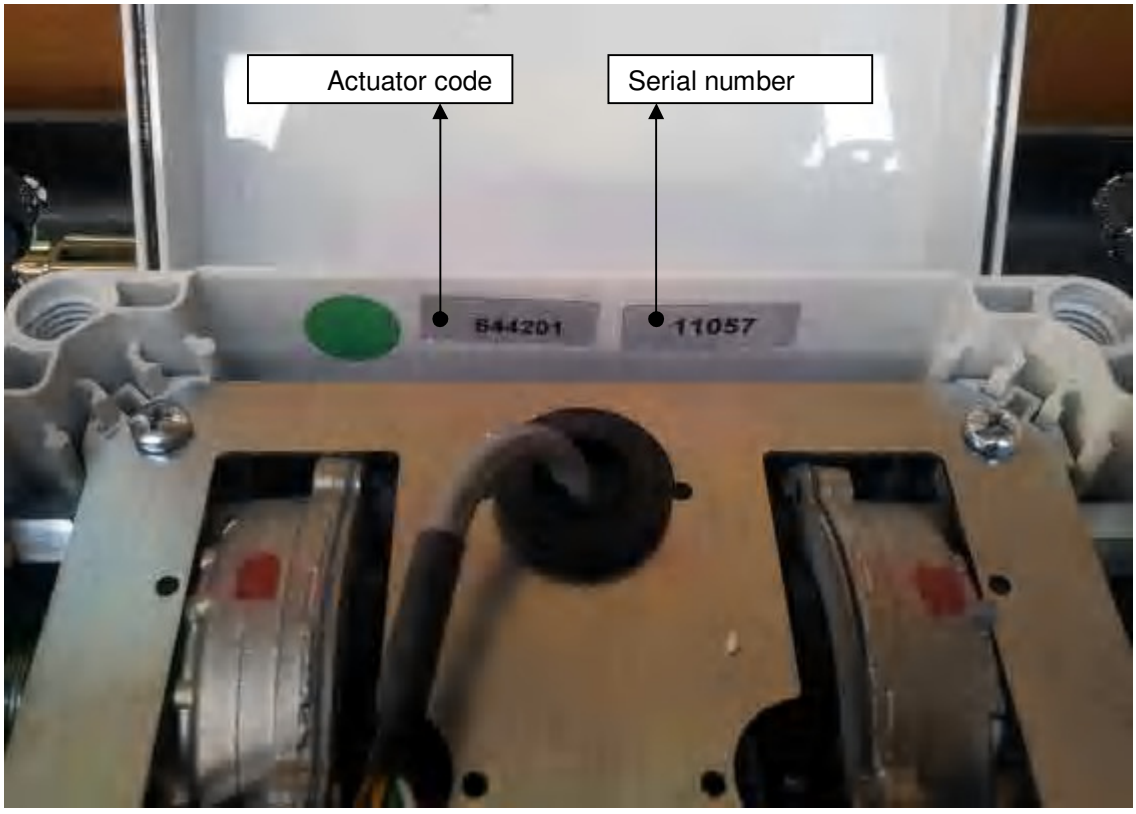


Do not install the actuator with the connectors upwards

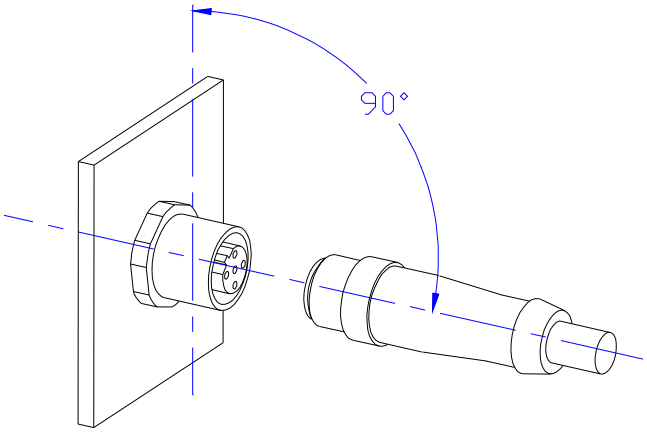


5.3. Actuator labels

Inside the actuator there are two labels indicating code and serial number. Please write them down in case you call for assistance.



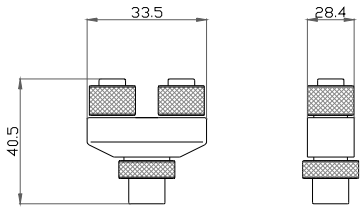
6. Electrical cabling



Cables reported here below are used in standard installations. For specific motors there are anyhow available cables with their proper connectors; in case you need cables for specific motors, please contact the supplier.

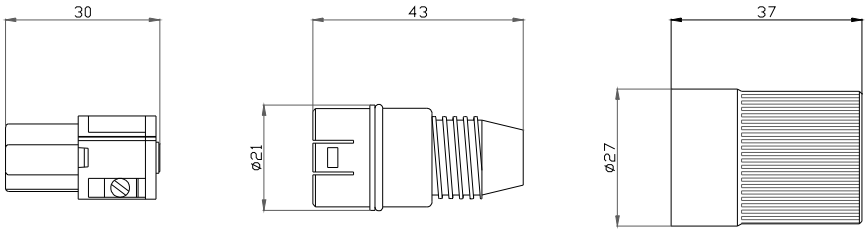
► **Important: for a correct mounting plug in the connector at 90° with respect to wall side of the actuator box. Rotate then the ring until the cable enters into the counterpart M12.**
If the cable has been inserted correctly, it must be possible to screw completely by hand the cable without too much efforts.

6.6. T-Splitter



Code: N-85E010003

6.7. Power supply connector



Code: 3500.38-00000

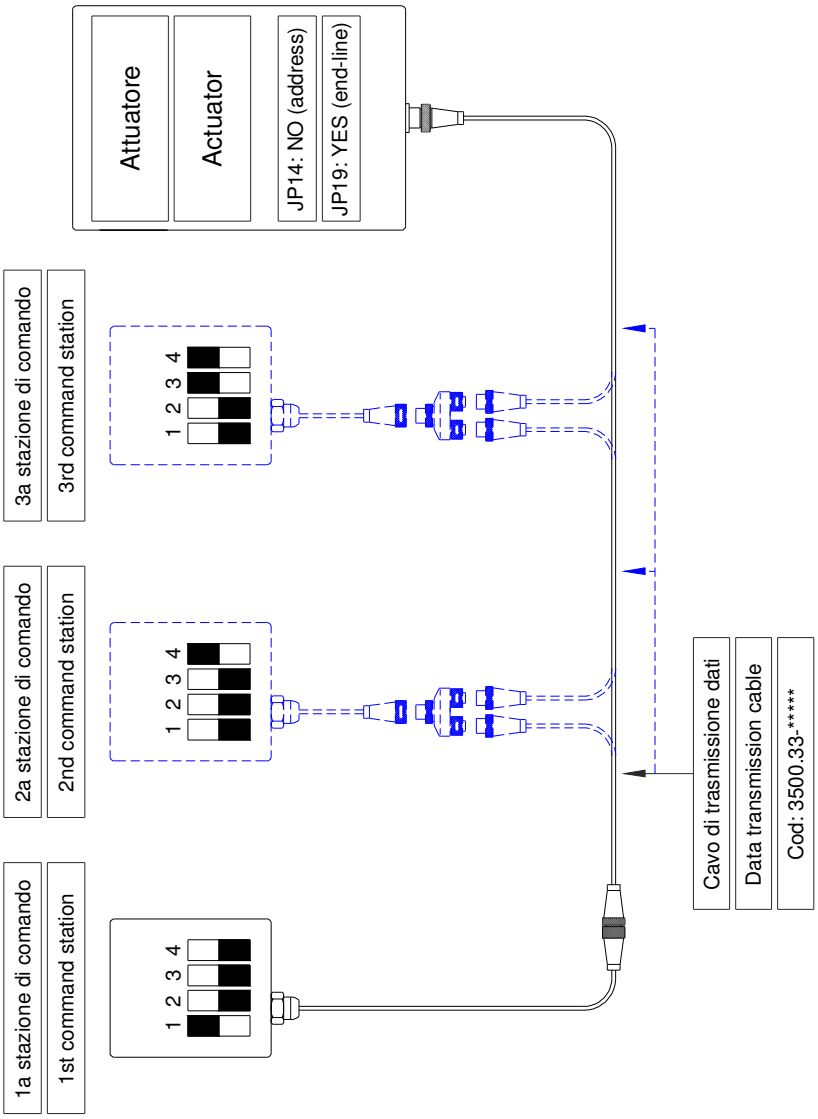
► **Important:** cabling instruction of power supply connector are at section 10.1.1. of this manual.

7. System types and installation schemes

How to configure the installation depends from the quantity, type of motors and gearboxes and number of command stations. Actuators and command stations, which communicate together through the CANBus network, must be configured in relation to how they are connected to the CANBus network. In the following installation schemes you find:

- Components necessary to build an installation
- Configuration of actuators and command stations in relation of their position on the CANBus network

The actuator is placed at one end of the CANBus network.



This installation scheme is valid for systems with up to 3 command stations and 1 engine with mechanical throttle, mechanical gearbox

8. Configuration of the CANBus network: end of line termination resistor and address setting of command stations and actuators

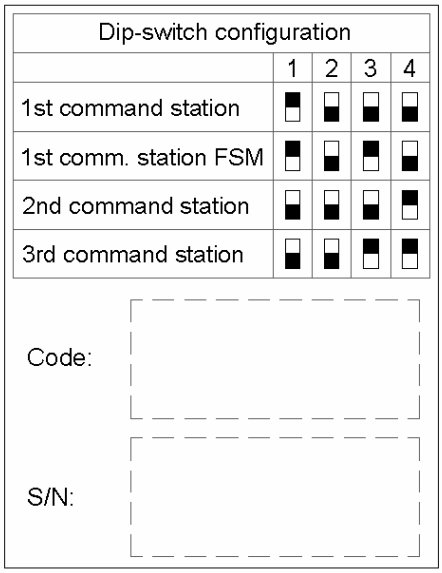
According to the number and to the position on the CANBus communication net, command stations and actuators must be properly configured to guarantee the correct functioning of the system. End of line termination resistor must be enabled, in case the device is placed at the end of the CANBus network.

8.1. Configuration of the command station

This operation allows to setup the command station in relation to its position on the CANBus net. Each command station must have a different address number and if the command station is connected at the end of the CANBus net, the end line dip-switch must be enable (ON).

Under the base of the command station there is a plastic cap. Unscrewing it, you can access to the dip-switches.
Operation:

- unscrew the plastic cap;
- set the dip-switch position according to the following table;
- screw again the cap.



Dip-switch 1: OFF end-line resistance disabled
ON end-line resistance enabled

Dip-switch 2: available for future developments

Dip-switch 3 and 4: identify the command station

	Dip- switch 3	**Dip- switch 4**
Command station position A	OFF	OFF
Command station Fast Start-up Mode (this is alternative to command station position A)	ON	OFF
Command station position B	OFF	ON
Command station position C	ON	ON

► **Important 1:** if there are more command stations connected to the same CANBus network, each command station must have a unique address/position. This unique position of the command station is defined by the configuration of the dip-switches.

► **Important 2:** “command station A” and “command station Fast Start-up Mode” cannot co-exist in the same system: either you have a “Fast Start-up Mode” or “Command station in position A”.

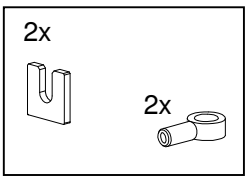
► **Important 3:** To configure the dip-switches of each command station, please refer to the installation schemes reported from section 7.1. to section 7.5.

9. Push-pull cables installation

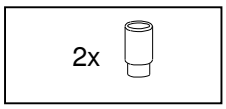
For the connection of the push-pull cable to the actuator, it is necessary to use its proper connection kit. The available kits are for Volvo® cable (E2, E3, C0, C3, C33…), Johnson® cable and Mercruiser® stern drive cable.

9.1. Connection kit

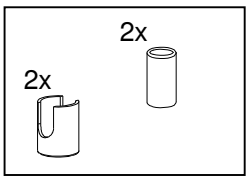
Connection kit for Volvo® cable, or cable type E2, E3, C0, C3, C33…



Connection kit for Johnson® cable

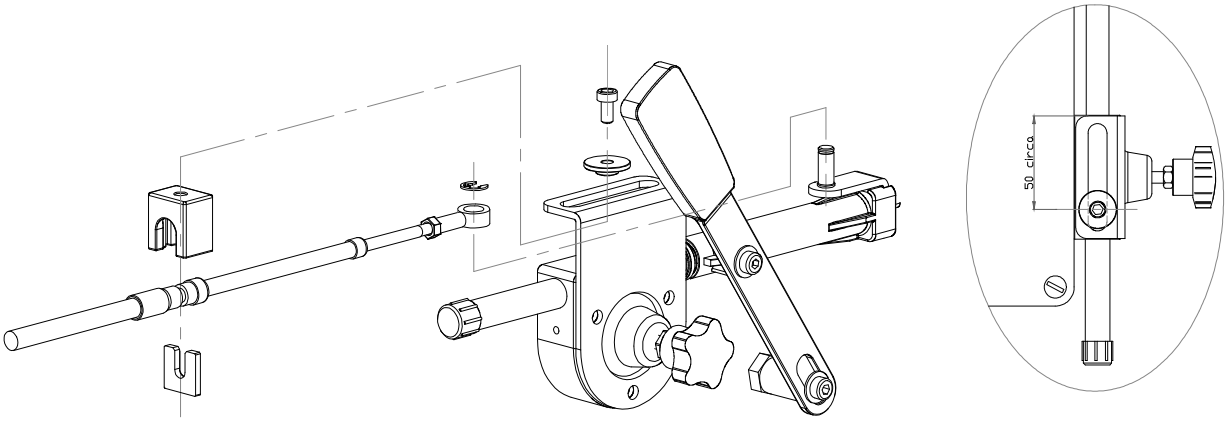


Connection kit for Mercruiser® cable



Each kit is sufficient to connect two push-pull cables.

9.2. Standard push-pull cable (E2, E3, Volvo®, C0, C3, C33…)



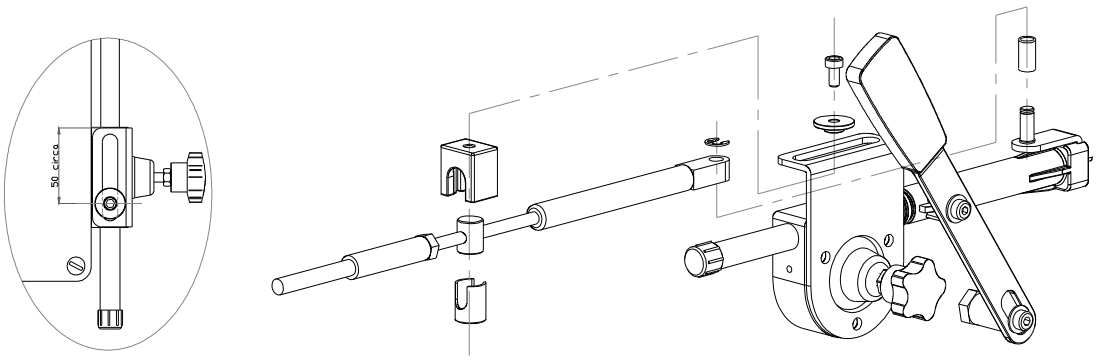
► **How to mount:**

1. tighten the eyelet on the thread of the cable;
2. screw the emergency knob placed on the actuator until the emergency lever is free to move;
3. insert the push-pull cable between the stainless steel fork plate and the aluminium locking device as shown in the picture;
4. insert the push-pull cable into the bracket on the actuator and connect the eyelet to the pin and lock it using the Seeger. Use the emergency lever to help during this operation;
5. lock the aluminium device with the screw, the brass spacer and the washer, at the distance indicated into the picture;
6. loose the emergency knob and move the emergency lever until the device will reach the correct position (it will be automatically locked)

► **Important:** before the assembly, the throttle must be in minimum position and the gearbox must be in neutral position.

9.3. Push-pull cable outgoing from the Mercruiser® stern driver

In case it is used the push-pull cable outgoing directly from the Mercruiser® stern driver, the plastic Mercruiser® bracket is not necessary.

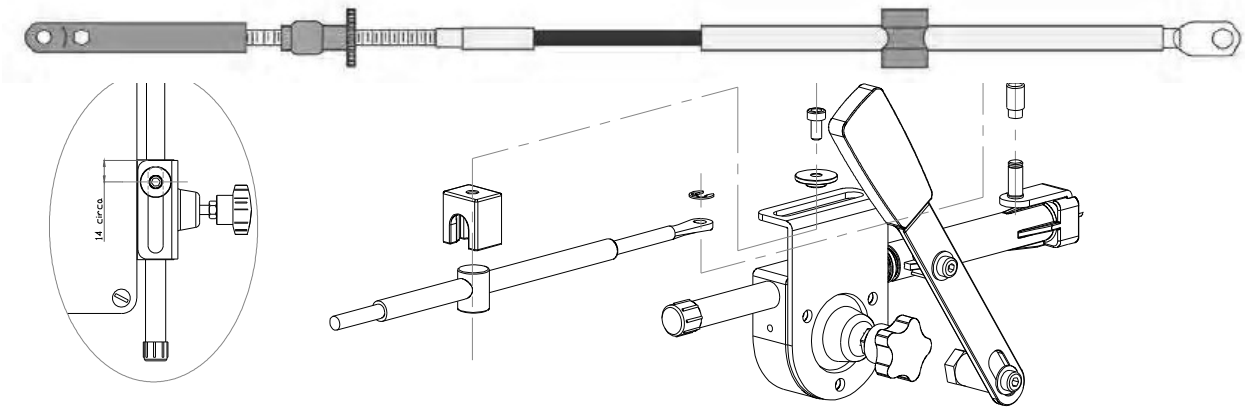


► **Important:** before the assembly, the throttle must be in minimum position and the gearbox must be in neutral position.

► **How to mount:**

1. tighten the eyelet on the thread of the cable;
2. screw the emergency knob placed on the actuator until the emergency lever is free to move;
3. insert the push-pull cable between the plastic cup and the aluminium locking device as shown in the picture;
4. insert the push-pull cable into the bracket on the actuator;
5. put the brass spacer on the pin and fix the plastic eyelet of the cable on it. Lock the eyelet with the Seeger. Use the emergency lever to help during this operation;
6. lock the aluminium device with the screw, the brass spacer and the washer at the distance indicated into the picture;
7. loose the emergency knob and move the emergency lever until the device reaches the correct position (it will be automatically locked)

9.4. Johnson® push-pull cable



► **Important:** before the assembly, the throttle must be in minimum position and the gearbox must be in neutral position.

► **How to mount:**

1. tighten the eyelet on the thread of the cable;
2. screw the emergency knob placed on the actuator until the emergency lever is free to move;
3. put to the aluminium device on the cable and insert them into the bracket on the actuator;
4. put the brass spacer on the pin and fix the eyelet on the cable on it. Lock the eyelet with the Seeger. Use the emergency lever to help during the operations;
5. lock the aluminium device with the screw, the brass spacer and the washer at the distance indicated into the picture;
6. loose the emergency knob and move the emergency lever until the device reaches the correct position (it will be automatically locked)

10. Electrical installation

Extreme care must be paid during electrical installation of supply and motor cables.

Supply cable

For a correct wiring of the supply cable see section 10.1.1. T**o check that the cabling is done properly, connect the supply cable on the actuator and switch-on.** If the display is lighted, the cabling is correct, otherwise it is presumable that you must invert the cable polarities.
In case of installations with 2 actuators repeat the same procedure separated on each actuator (check that both displays light on) before connecting all the other cables onto the actuators.

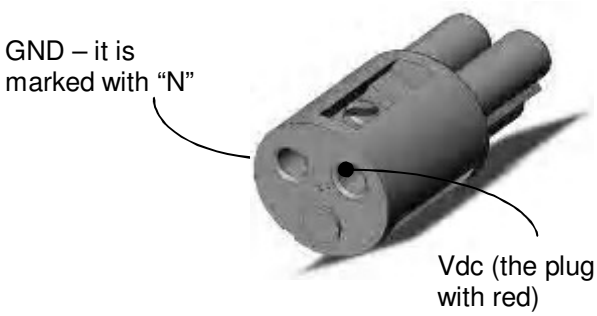
Motor cables

Almost all the cables are provided with connector and it is very easy to identify the cable type, its function and define where to mount it: connectors have different polarization, therefore it is almost impossible to mount a cable in the wrong position.
When mounting the electronic motor cable on the actuator take care to insert the M12 connector on the actuator panel mounting counterpart. Rotate then the ring until the cable enters into the counterpart M12. If the cable has been inserted correctly, it must be possible to screw completely by hand the cable without too much efforts. For further explanation look at section 6.

10.1. Wiring of actuator output cables

10.1.1. Cabling of the supply connector

Supply voltage	**12 V**	**24 V**	**12/24 V**
Internal fuse (on the PCB)	3,15 A		
Wall fuse	6,15 A	-	6,15 A
Current absorbed in no loaded condition	0,5 A	0,25 A	0,5 A (max)

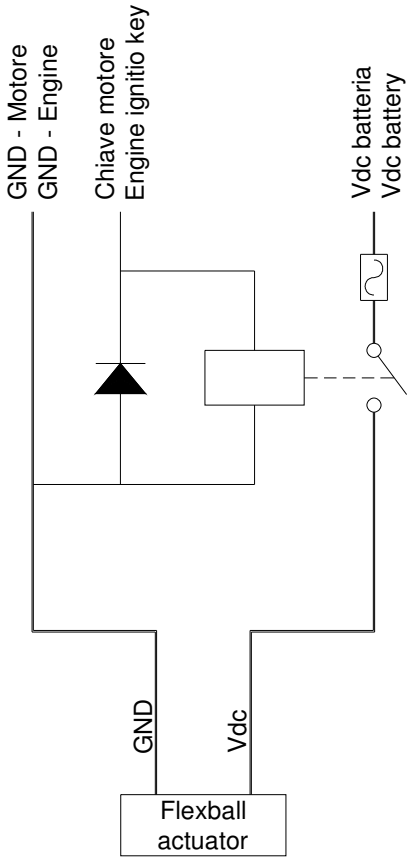


Each actuator is delivered with an external supply plug that must be cabled during the installation of the system on the boat.
Important: take care to connect properly the polarity of the cables (supply is marked with a red sign).

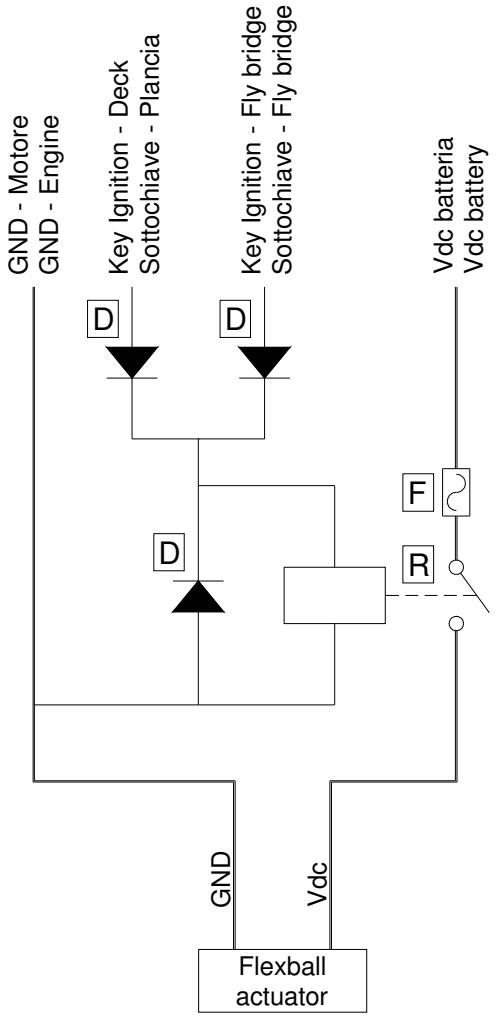
10.1.2. Electrical installation of systems with 1 motor, 1 actuator and 1 dashboard

It follows the electrical schemes to be used to make the connection to power supply, including dimensional value of the electrical components.

Ref.	Description	12 V power supply	24 V power supply
D	Diode	10 A, 20 V	5 A, 24 V
R	Relè	10 A, 12 V	5 A, 24 V
F	Fuse	10 A	
	Supply cable cross section	2,5 mm^2	1,5 mm^2



10.1.3. Electrical installation of systems with 1 motor, 1 actuator and 2 dashboards

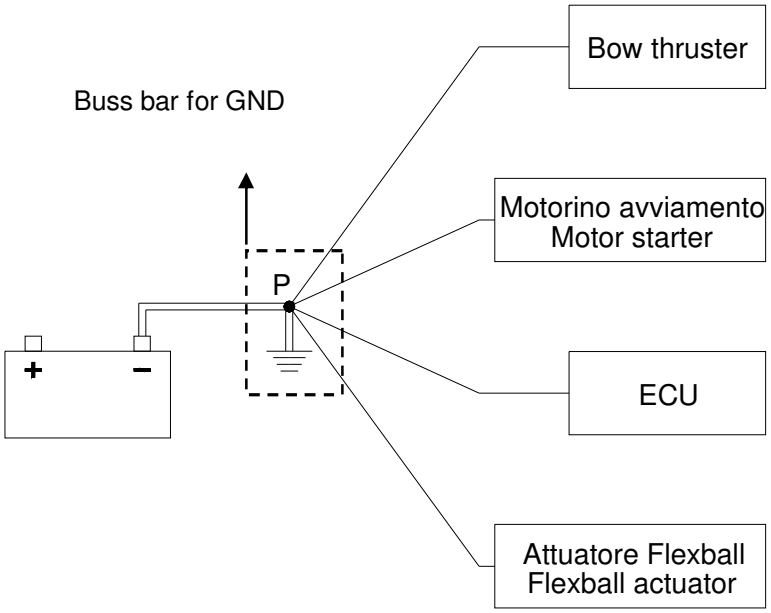


For the detailed list of components, please refer to the table at section 10.1.2.

10.1.4. Dimensional criteria of the power cables for the overall installation

For supply cabling respect the following conditions:

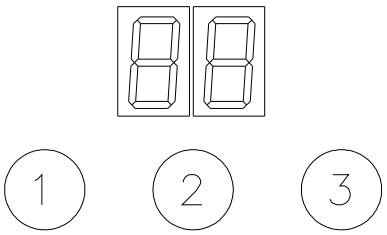
- Cables from the battery to motor starter (both positive and negative poles) must have a minimum cross section of 50 mm^2, if not specified a higher cross section by the motor supplier.
- The GND of the actuator must be connected directly to the negative pole of the battery. Minimum cross section is 2,5 mm^2
- In case of systems with electronic throttle, it is very important to connect to a common GND point (GND buss bar) all the negative poles (GND) of every electronic equipment.



11. Programming of the actuator, general guidelines

11.1. Programming keypad

The keyboard has a display with two figures and three programming pushbuttons/keys.



Colour of key	Reference
Red	1 (-)
Yellow	2 (+)
Grey	3 (↵)

► **Important 1:** command stations must be set to neutral in order to be able to access the programming of the actuators including the setting of parameters.

► **Important 2:** command stations are already programmed in the factory and it should not be necessary to make any changes. In case it is required to modify their configuration, refer to chapter 6.1.

11.2. Display and Parameters

After power up, the display shows a sequence of 2 codes: 'FI' and 'XX':
- 'FI' means Firmware;
- 'XX' is the firmware version.

After some time the display shows "_ _". To enter the Parameters, press at the same time keys "1" and "2". It is now possible to move from one parameter to the other using the keys "1" and "2".
For the setting of the specific parameters follow this procedure:

1. with the actuator turned on (the display shows _ _) press both keys "1" and "2" and the first parameter will appear on the display;
2. pressing either "1" or "2" it is now possible to scroll in one or the other direction, all the parameter lists
3. pressing the key "3" the value of the parameter will be shown on the display. The display is now blinking and it is possible to modify the parameter value, using the keys "1" and "2";
4. when the parameter has been modified, use the key "3" (↵) to store the value of the parameter; the display stops blinking.
5. to set the other parameters, scroll the menu using the keys "1" and "2" and when the parameter that you would like to change is reached, follow this procedure starting from the point 3.

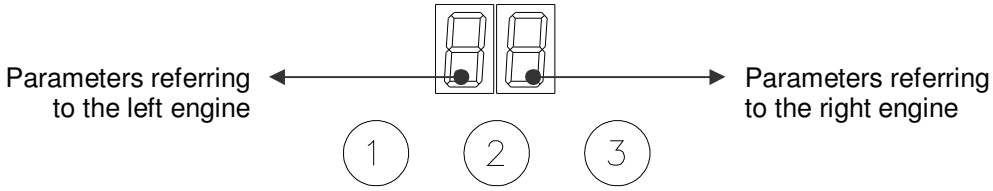
11.3. Actuator parameters

Parameters are different in relation of the kind of actuator and application. The detailed parameter list is described in section for the specific application. Here bewol are listed the parameters present in any type of actuator.

Code display	Description	Values	Factory value	Value shown on display (factory value)	Note
A0	Push-pull cable movement direction	1 .. 4	4	4	
dI	Delay before disengaging the gearbox	0 .. 9,9 s	0,0 s	0	
dA	Delay on the throttle	0 .. 9,9 s	0,0 s	0	
CC	To be used for the check-up of the internal CANBus communication				

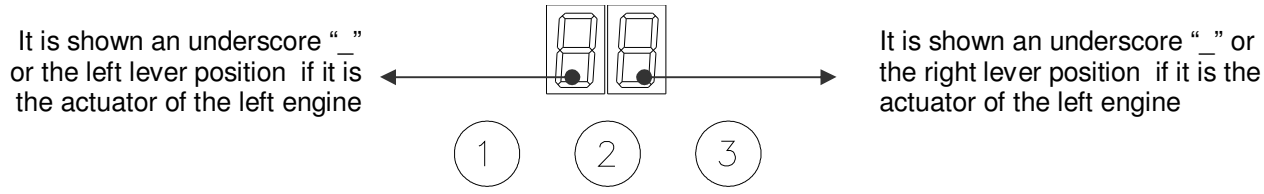
11.3.1. Parameter "CC"

With this parameter you can check if the communication between the command station and the actuator is correct. The value of the parameter corresponds to a precise physical position of the lever and it is described in the following table:



Value shown on display	Description
N	indicates that the command station is in neutral position
F	indicates that the command station is in forward position
R	indicates that the command station is in rear position
1-2-3-4-…..-9-A	indicates that the command station is in throttle condition: "1" is the position of minimum gas and "A" is the position of maximum gas

► **Important:** for systems where the actuator commands only one engine, the values displayed are according to the following picture:



12. Setting of the strokes of push-pull cables

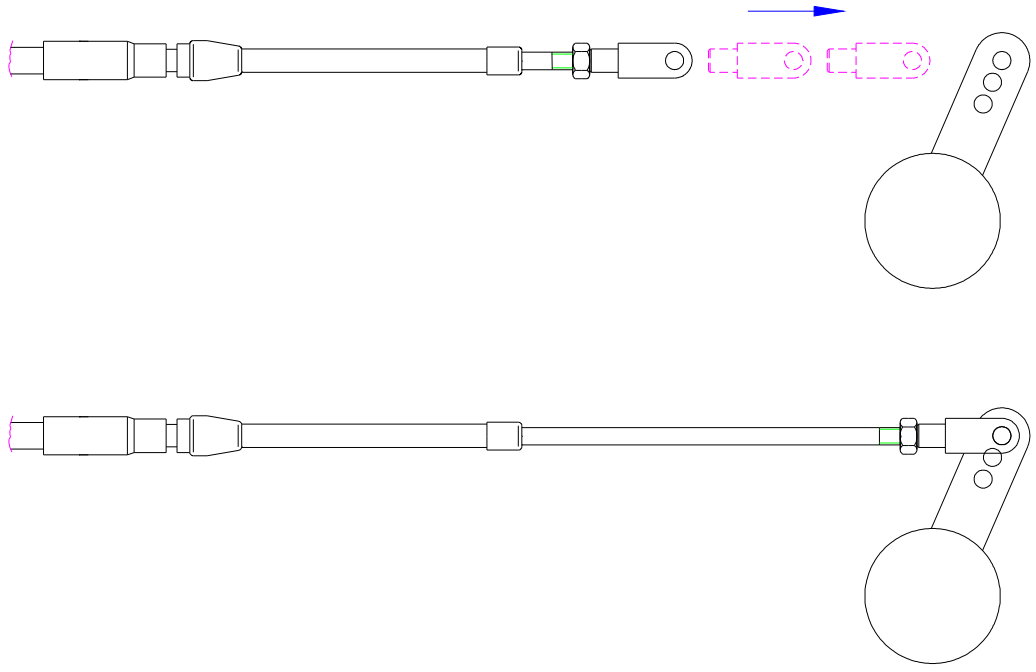
In case of systems with mechanical interface, first of all you have to set the strokes of the push-pull cables. The procedure is the following:

1. first press at the same time key “1” and “2” and, **keeping pressed both keys “1” and “2”,** then turn on the actuator;
2. on the display it will appear the first parameter to be set. Each parameter identifies a specific position of the push-pull cable; depending on the application, there are many different positions/strokes to be set.
3. pressing the key “3” the parameter on the display starts to flash and with the keys “1” and “2” it is now possible to move the push-pull cable; move up and down with keys “1” and “2” to reach the optimal position of the cable;
4. when you have defined the right position or cable stroke, press key “3” to store this parameter; now the display has stopped flashing
5. to set the other parameters, scroll the menu using the keys “1” and “2” and when you have found the parameter that you want to change, follow the positioning procedure as described at point 3.
   when you have set all parameters, switch off the actuator. At next power up, all the modifications will be automatically validated.

12.1. Setting of the stroke of the accelerator cable

For throttle position setting, proceed in the following way:

a. select the parameter (either UL or UH) as described in the procedure above;
b. disconnect the pin of the fork (or the ball joint) from the throttle lever on the engine side;
c. move manually the throttle lever (potentiometer) on the engine in the minimum or maximum position, according to the parameter that you are setting. Hold the throttle lever (potentiometer)in that position manually;
d. move the push-pull cable pressing keys “1” and “2” as described in point 3 until the centre of the fork will be aligned with the hole on the throttle lever (potentiometer);



e. When the hole on the fork (or the ball joint) is aligned with the hole on the throttle lever (potentiometer), store the position with key “3”.

12.2. Setting of the stroke of the gearbox cable

For gearbox positions proceed in the following way:

a. select the parameter (e.g.: 0L, 0F, 0H, 1L,1F,1H) as described in the procedure above;
b. disconnect the pin of the fork (or the ball joint) from the lever on the gearbox side;
c. move manually the lever on the gearbox in one of the three positions (reverse, neutral, forward) according to the parameter that you have set;
d. move the push-pull cable pressing keys “1” and “2” has described in point 3 until the centre of the fork is aligned with the hole on the gearbox lever;
e. when the hole on the fork (or the ball joint) is aligned with the hole on the gearbox lever, store the position with key “3”.

► **Important 1:** when the display is flashing your are in “jog mode” and you can move back and forward the cable simply pressing “1” or “2”. When the display has a fixed light, you can scroll parameters UL,UH, 0lL, 0F, 0H…

► **Important 2:** test the correct functioning of the gearbox and the throttle by moving the command lever. If the control lever is in forward position and the gearbox is actuated reverse, modify the parameter A0 as described at section 13.2 of this manual.

► **Important 3:** actuators are delivered from factory with Forward, Reverse and Neutral positions coincident in the Neutral position. There is therefore no stroke between Neutral and Reverse or Neutral and Forward and the installer has to make the correct setting the stroke in order to start-up correctly the system.

► **Important 4:** a not precise setting of the strokes may generate malfunctioning of the gearbox (delays in clutch-in, clutch-out) or an excessive current absorption on the Actuator.

► **Important 5:** this procedure must be carried out while the motor is running and the vessel is sailing. It is important to pay the greatest attention to the settings for forward and reverse, in order to prevent sudden or uncontrolled movements of the vessel. If necessary, ask for help to a second person who can help you to switch the engine on and off, if required.

► **Important 6:** in case of stern drive and outboard engines, if the motor isn’t running, it isn’t possible to set the strokes, because the clutch-in operation becomes very hard. In this is the case, actuate the rotation of the propeller manually, this will make easier the clutch-in of the gearbox.

13. Programming of the actuator in installations with mechanical motor and gearbox

13.1. Mounting of the push-pull cable

Please refer to section 9.

13.2. Programming of the push-pull cable strokes

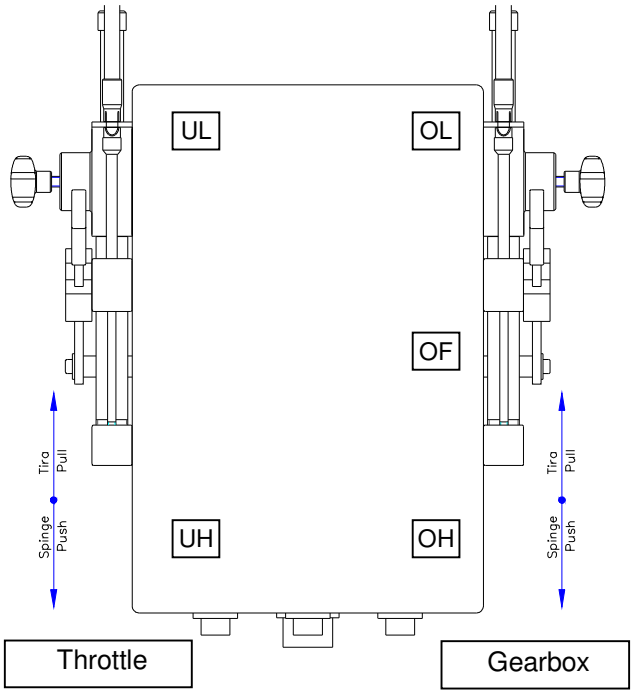
For the general programming instructions please refer to section 12. With this kind of actuator you must program 5 positions (2 for the throttle and 3 for the gearbox).

Parameters to set	Value on display
Throttle	UL
	UH
Gearbox	0L
	0F
	0H

Gearbox and throttle positions have to be set according to the parameters of the above table.
Parameter A0 associates the direction movements of throttle and gearbox to the command of the lever. Scheme and table here below define the directions of throttle and gearbox in relation to the 4 possible values of parameter A0, **with the assumption to move the command station lever in forward direction** (gearbox forward and motor accelerated).

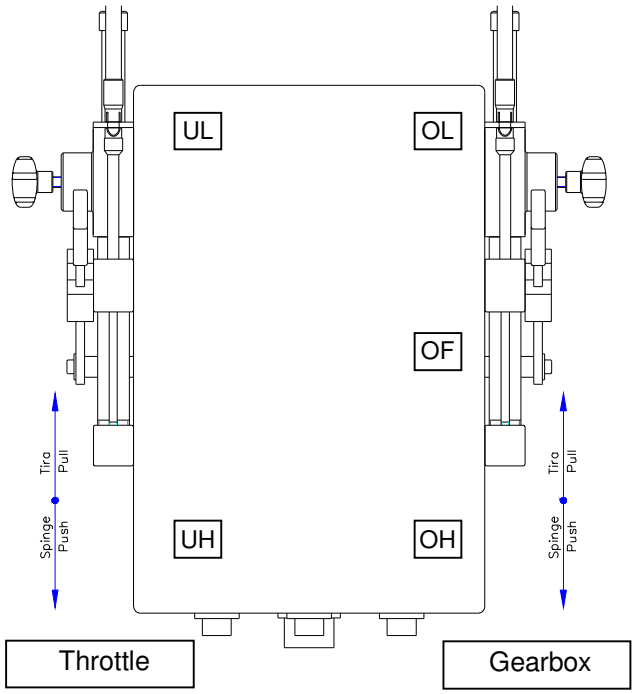
Value A0	Throttle	Gearbox
1	Push (direction UL)	Pull (direction OH)
2	Push (direction UL)	Push (direction OL)
3	Pull (direction UH)	Push (direction OL)
4	Pull (direction UH)	Pull (direction OH)

Le impostazioni di fabbrica prevedono A0 = 4



After having set the stroke positions, it might happen that there is not the right correspondence between the direction of the lever and the movement executed by the actuator (e.g.: you move the lever forward and the gearbox cable pushing instead of pulling). Changing the value of parameter A0 you can modify the correlation between the direction on the lever and the direction on the actuator. The following examples show how to operate in case there is not the exact correspondence between the command lever and the actuator.

System with mechanical throttle and mechanical gearbox



Problem	Solution
The gearbox push-pull cable positions are inverted while the throttle push-pull cable works correctly (forward and backward positions are inverted)	Set A0=3
The gearbox is working correctly while the throttle push-pull cable positions are inverted (min and max throttle positions are inverted)	Set A0=1
Both gear or throttle push-pull cables positions are inverted	Set A0=2

13.3. Specific parameters

Display code	Description	Values	Factory value	Value shown on display (factory value)	Note
A0	Push-pull cable movement direction	1 .. 4	4	4	
dI	Delay before disengaging the gearbox	0 .. 9,9 s	0,0 s	0	
dA	Delay on the throttle	0 .. 9,9 s	0,0 s	0	
PP	Proportional coefficient	0 .. 99	40	40	These parameters must not be changed
PI	Integral coefficient	0 .. 99	0	00	
CC	To be used for the check-up of the internal CANBus communication				

21. Behaviour of the electronic system in case of failures

21.1. Unforeseen motor switching off

In any case where the motor switches off during navigation, the normal procedure requires to turn off the ignition key and then to turn it on again. During the turn-on operation, independently on the position of the command station, the actuator behaves as follows:

- Gearbox is moved to a the safety position (neutral)
- Motor accelerator is moved to minimum

The command station that had the control of the vessel, has now lost the command. In order to acquire the command again, you must start again the procedure:

- put the lever in neutral
- press “Command” and then “Warm-up”.

This procedure is described in section 3

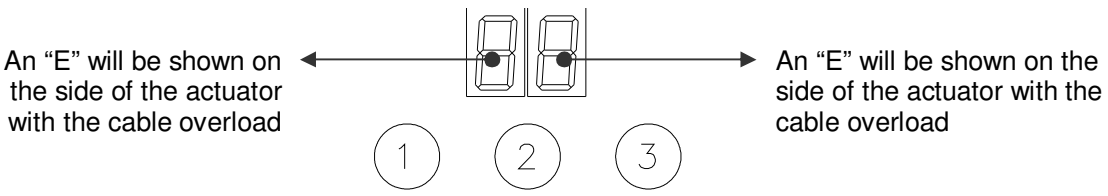
21.2. Faults in the electrical network

In case of system fault (missing power supply, data transmission cables broken, etc) if the vessel is equipped with mechanical actuators, it can be controlled via emergency levers. See the procedure ‘Emergency levers’ in section 3.6. of this manual.

21.3. Protection in case of overload or break of the push-pull cables

The actuator has a built-in control that generates a failure alarm, in case the push-pull cables becomes “too hard” or in case the cable stroke is not set correctly (beyond the maximum stroke allowed by the actuator).
If one of the above mentioned cases occurs:

- the systems stops (no movements on the push-pull cables)
- on the display of the actuator appears an “E” on the side of the overloaded cable
- all the LEDs of the command stations start to blink.



In case this alarm is activated, turn off the system, verify the causes that have generated the alarm before turning on again the system.

21.4. Troubleshooting

Irregularity	What to check	Section to refer
Command station is activated and without moving the lever, the actuator generates movements, changes speed of activates the gear	▪ 2 command stations have the same CANBus address ▪ It is missing the end of line bus termination	Section 4.4. e chapters 7., 8.
Station doesn't take the command	Check that end of line resistance terminations have been activated	Section 4.4. and chapters 7., 8.
On installations with mechanical actuators when you move forward the command lever, the actuator generates a reverse movement	Modify parameter A0	Section 13.2
Minimum speed position on the command stations corresponds to maximum speed on the actuator	• Check that throttle positions are according to the scheme • Check settings of parameter A0	• Scheme at section 13.2

21.5. LED diagnosis on command station

Command station produces signals to show either the operating conditions or possible causes of irregularities.

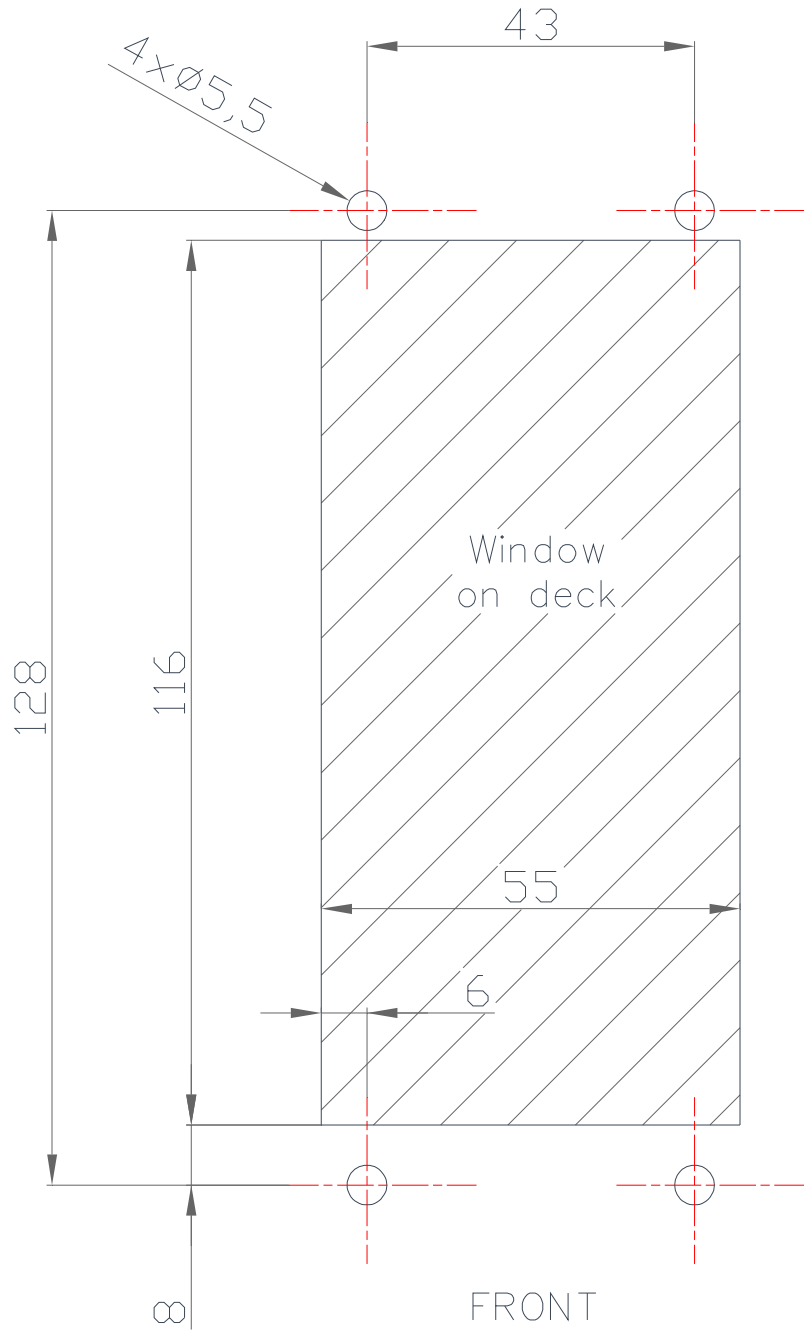
LED indications	When it happens	Meaning/problem	What to do
1° flash long and 2° flash long	Power up	Command station is configured correctly	-
LED green with fixed light	After power up	Gearbox command is in neutral, the installation works correctly	-
On the command station don't light on either 1 or 2 green LED		• Power supply is missing • In installation with push-pull cables, the gearbox hasn't come to neutral position	• Check on the actuator that the display is enlightened • Check and remove the obstacle which don't let the actuator go to neutral position (see sections 3.6. and 21.3.)
Green LED on command stations is blinking (90% ON, 10% OFF)		Command station is not configured correctly.	Contact Flexball
Green LED on command station is blinking (50% ON, 50% OFF)		Might be a problem on the positioning measuring device of the command station	Contact Flexball
All 4 LEDs are blinking		There is a failure on mechanical actuators, probably due to an extra load on push-pull cables	To remove the failure refer to section 21.3.

22. How to start

Once you have received the system package, follow these steps:

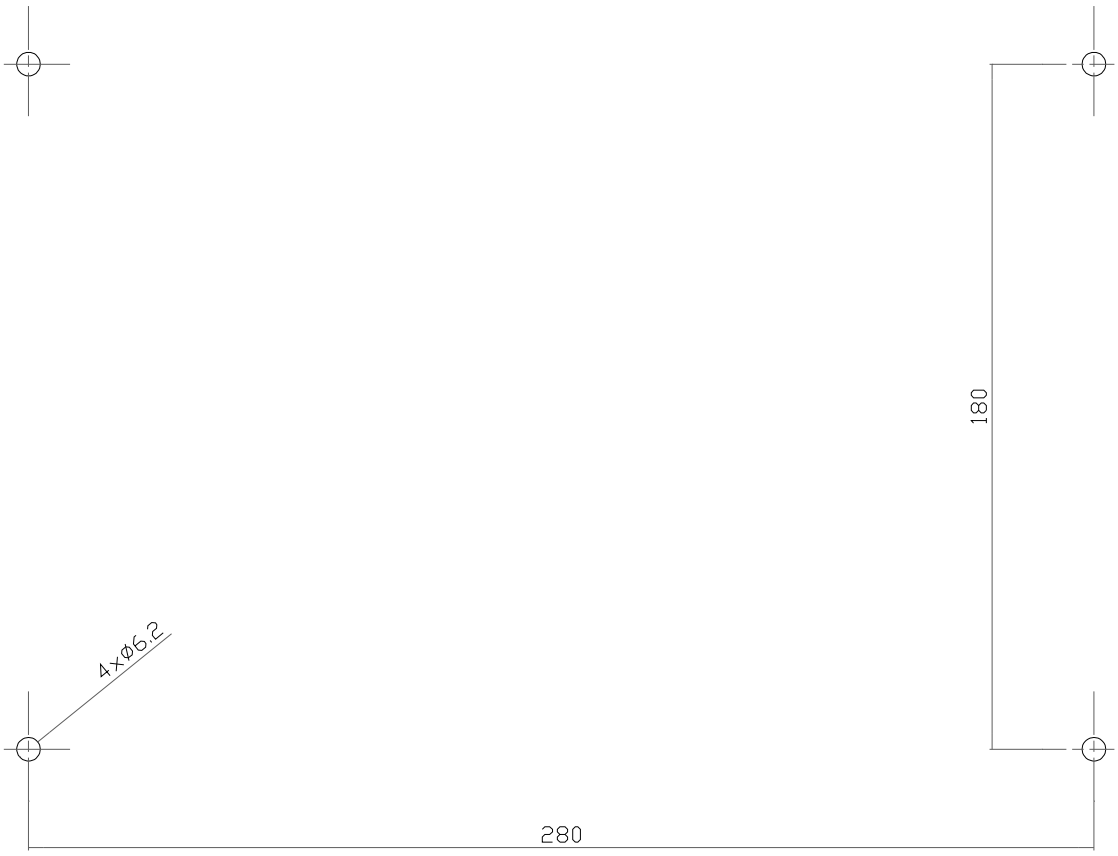
1) identify all the components necessary to build up your system with the help of instructions at sections 4,5,6
2) identify your installation type with the help of section 7.
3) configure the CANBus network, set dip-switches and end of line termination of actuators and command stations, as described at section 8
4) mount command stations and actuators with the help of drilling mask (section 23)
5) make electrical wiring (section 10)
6) install push-pull cables, if your application requires it (section 9)
7) make setting of mechanical strokes, if your application requires it (section 12)
8) program the actuator specific installation parameters at section 13
9) once you have set-up the electronic system, read the pilot instruction (section 3) and, good navigation!

23. Drilling masks for command stations



► **Important:** drilling mask is represented in scale 1:1

24. Drilling masks for actuator



► **Important:** drilling mask is represented in scale 1:2