FLEXBALL
ITALIANA S.R.L.

Electronic lever 4000 - ELT
Electronic lever 4500 - ELT
for electrical marine engines



Operating manual & mounting instructions

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Version April 2014

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 systems 4000 – ELT and 4500 – ELT are composed with the lever and the necessary cables for the connection to the motor's controller.

2.2. Maximum extension of the system

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

10 meters	Maximum distance between lever and engine room in case of voltage interface towards the motor controller
80 meters	Maximum distance between lever and engine room in case of CANBus interface towards the motor controller

2.3. Specification

Temperature

Operating temperature	From -10 to 85℃
Storage temperature	From -40 to 90℃

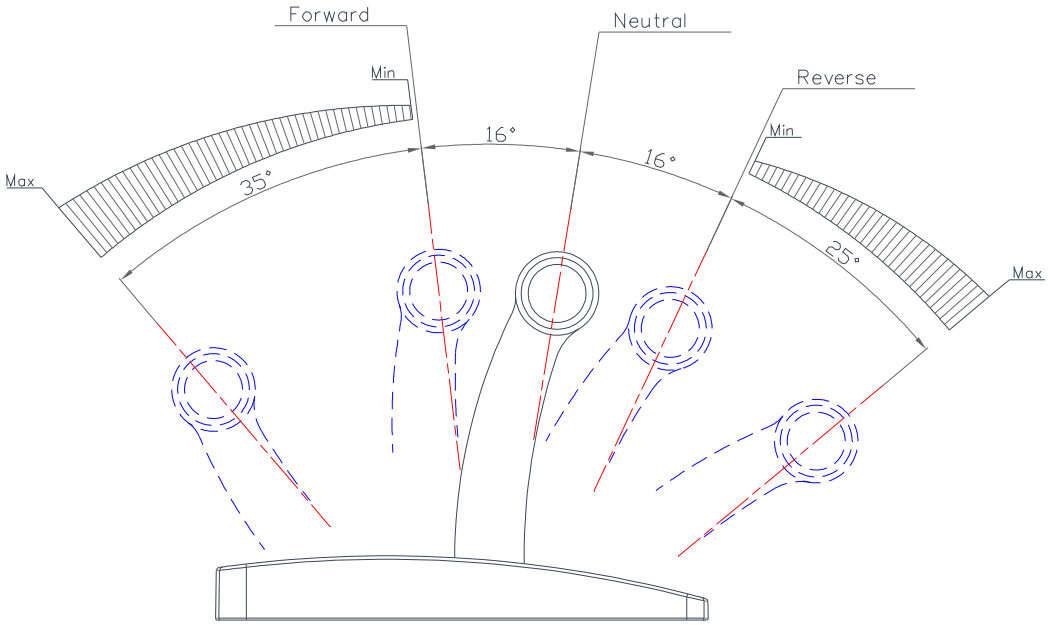
Electrical features

Power supply (*)	From 9,0 to 28,0 V_{dc}
Max. power absorbed from Power Supply (not considering relais contacts)	1W

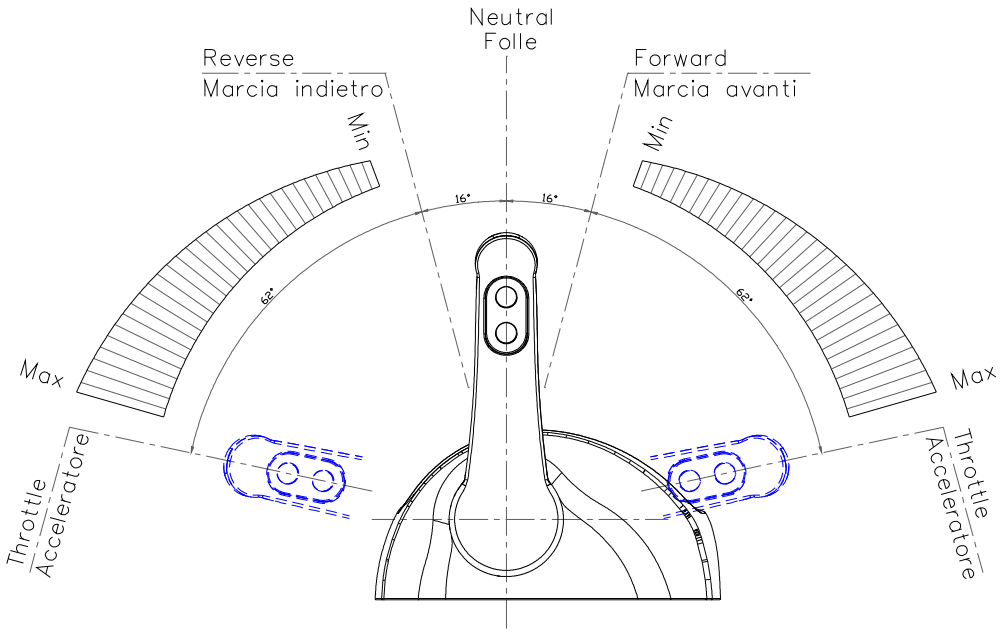
3. Pilot instructions

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 35° in for ward direction and 25° in backward direction.

3.1. Command station series 4000



3.2. Command station series 4500



3.3. Control keypad

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

Command station series 4000



Command station series 4500



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		Not in use for this application
Command		If you press Command for 1,5 seconds the station takes the command, only if one of these two conditions are respected: - lever is on and in neutral position - the lever is synchronized with respect to the lever of the station that at the moment has the command (only on multi-command plant)
	All LEDs are lighted on	The control system isn't working correctly

3.4. Acquisition of the command

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

1. Position the lever in neutral and press Command for 1,5 seconds
2. (only on multi-command plant) - the lever is synchronized with respect to the lever of the station that at the moment has the command

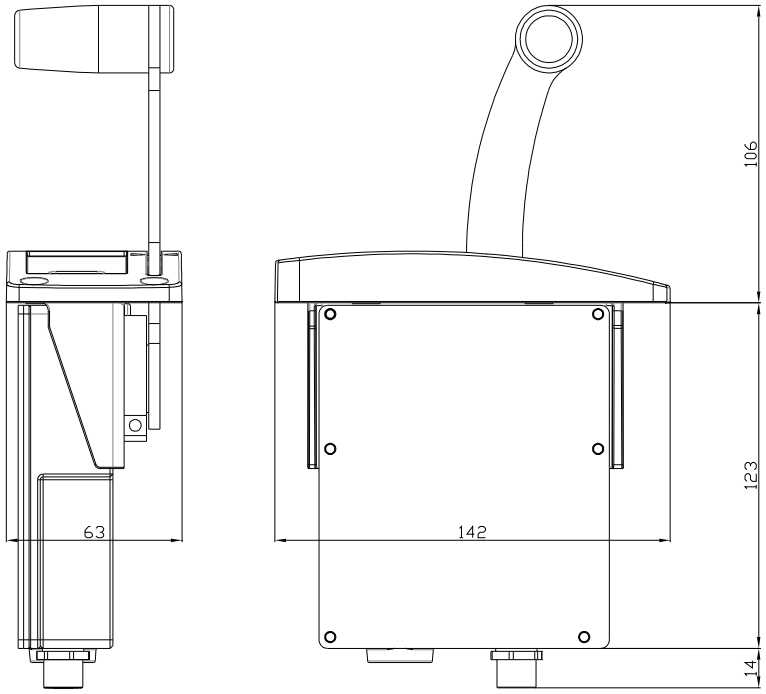
► **Important:** before taking the command, proof that all the passengers are safely on board.

4. Command station

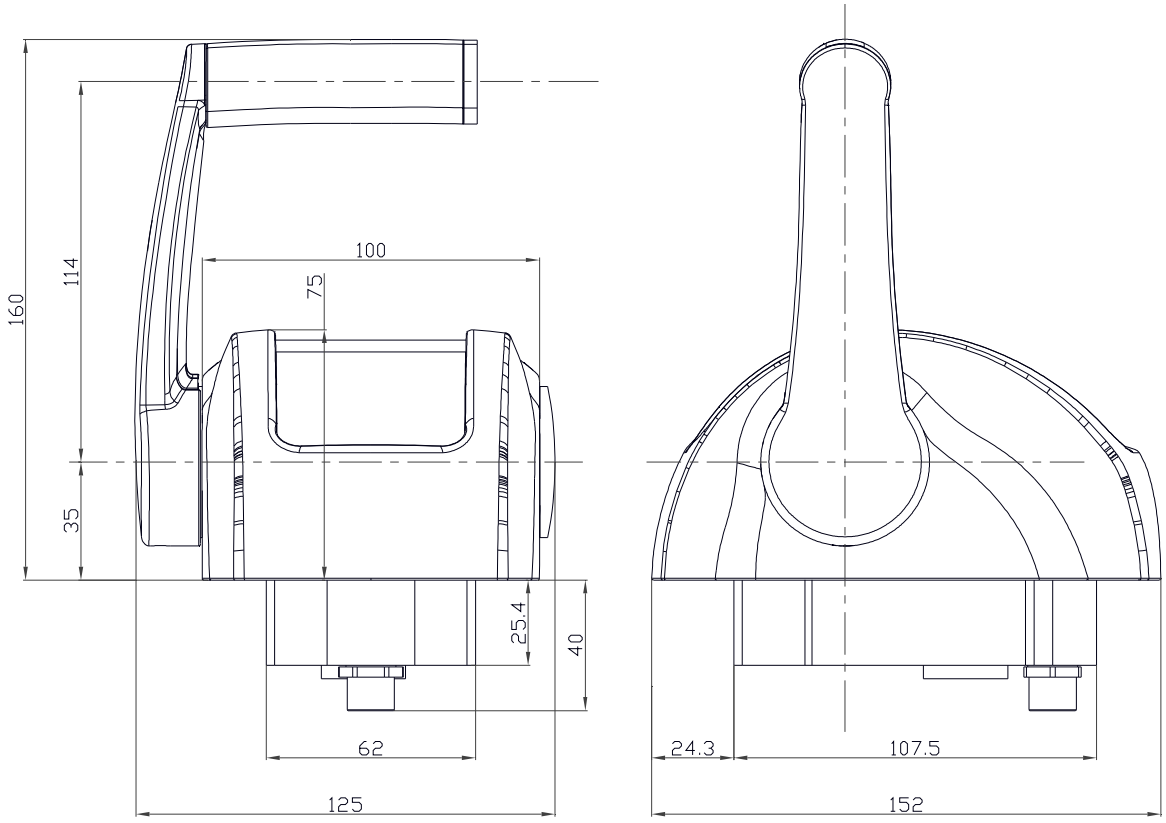
Command stations are classified as devices for the control of the engine. Up to three command stations can be mounted in the same installation.

4.1. Dimensions

4.1.1. Command station series 4000

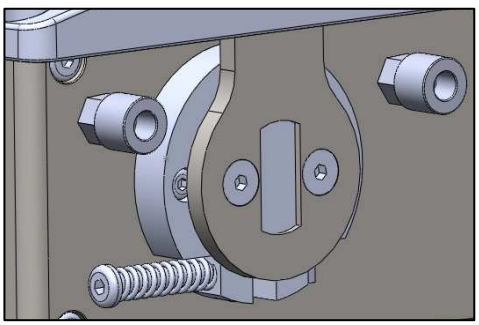


4.1.2. Command station series 4500



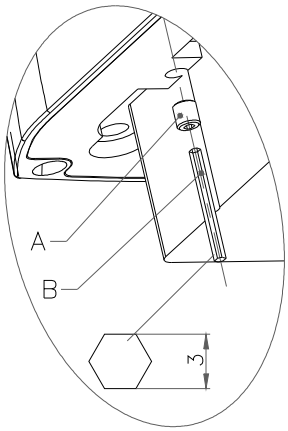
4.2. Friction adjustment

4.2.1. Command station series 4000



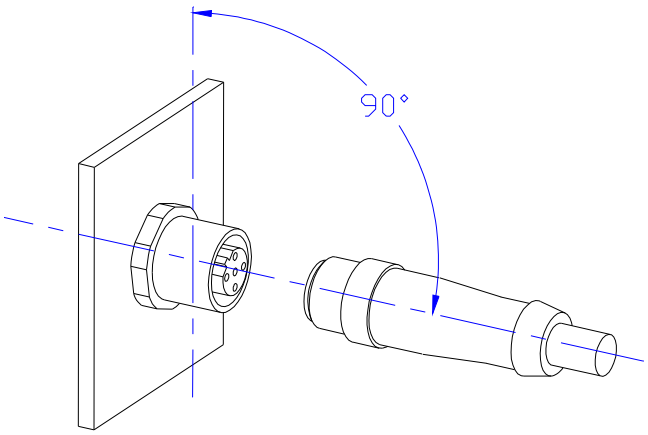
In order to adjust the friction of the lever, it is enough to tune the screw that you can find just behind the control lever, as shown in the picture on the left. With an hexagon screw driver size 2,5 mm you can loosen or tighten the screw and the friction will become correspondingly softer or harder.

4.2.2. Command station series 4500



In order to adjust the friction of the lever, it is necessary to remove the screw A placed below the plastic base of the command station. With the help of an hexagon screw driver size 3 mm you can loosen or tighten the screw and the friction will become correspondingly softer or harder.
Once the friction has been adjusted, close again the hole with screw A.
Important: In case of a command station for single engine, the friction is present only on the left lever.

5. Accessories and option



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

► **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.

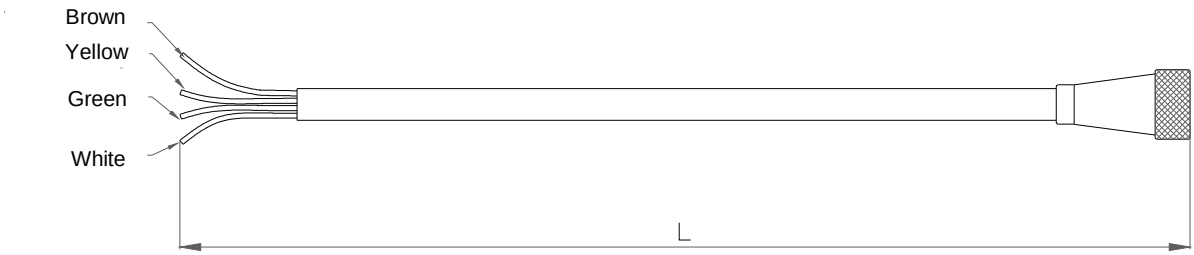
T**o check that the cabling is done properly, connect the supply cable on the actuator and switch-on.** If the display is lighted, the cabling is correct, otherwise it is presumable that you must invert the cable polarities.

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.

5.1. Power supply and speed reference cable (4 poles)

This cable is without connector on motor's controller side.

Wire colour	Function: 1 or 2 Voltage output interface	Function: CANBus interface
Brown	GND	GND
Yellow	Power supply (12/24 Vdc)	Power supply (12/24 Vdc)
Green	CH1	CAN_H
White	CH2	CAN_L

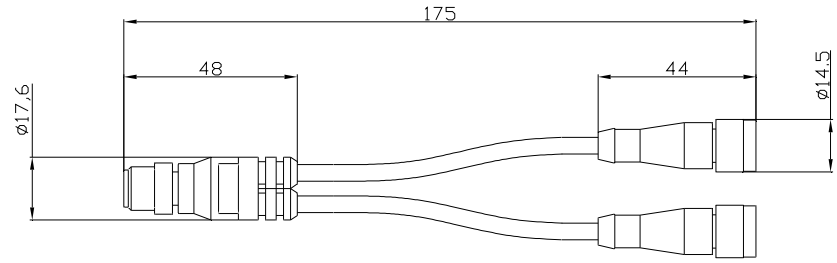


Length	Code
L= 2,5 m	3500.52-02500
L= 5,0 m	3500.52-05000
L= 7,5 m	3500.53-07500

► **Important:** this cable is without connector on motor side

5.2. T-Splitter

The T-splitter has to be used in case you want to split the signals of the *Power supply and speed reference cable* (cable code 3500.34-).



Code: N-85E010003

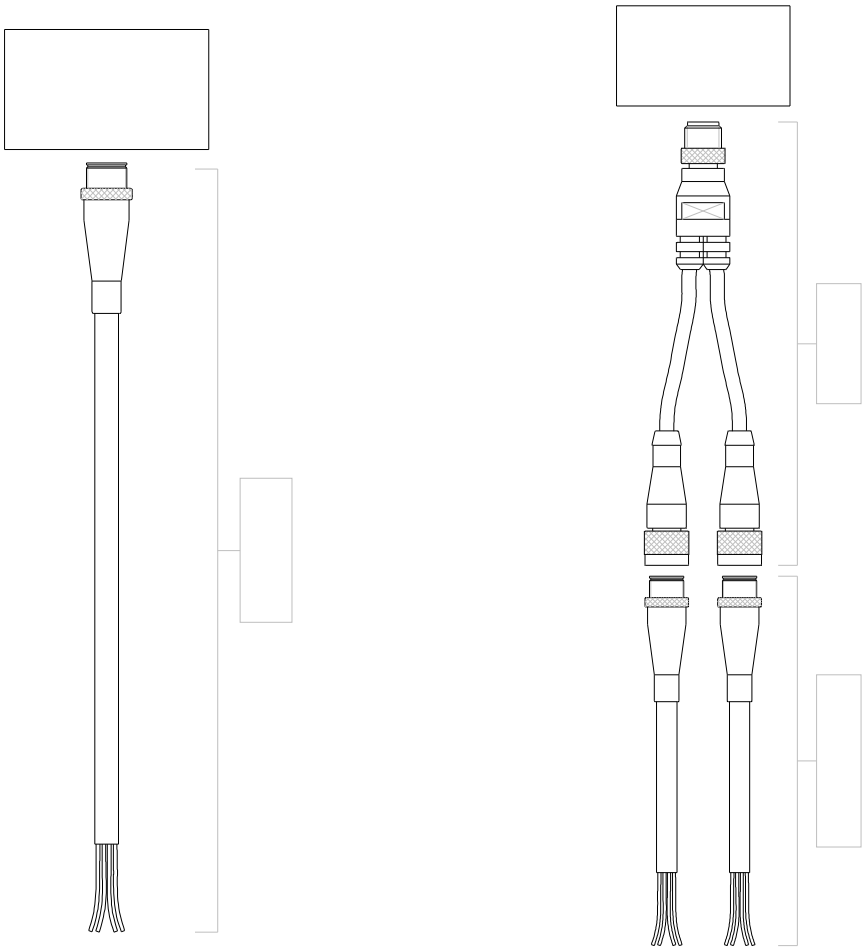
In case you want to:

- Duplicate the signals having the power supply and the signals together
- Separate signals from power supply

the wiring configuration is the following:

Power supply and signals together

Power supply and signals split

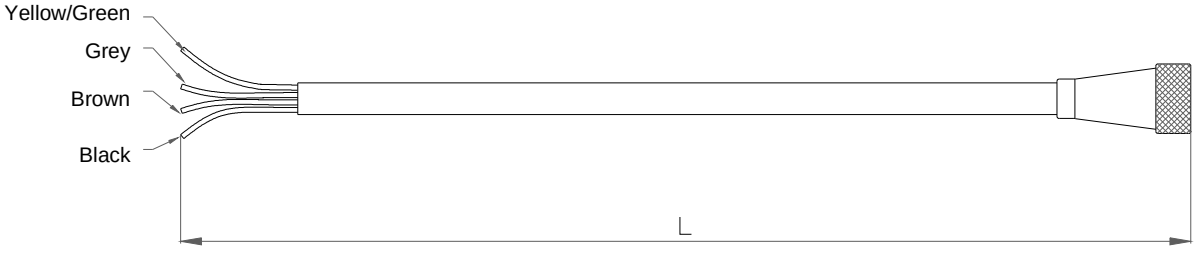


5.3. Command cable (4 poles)

This cable is without connector on motor's controller side. Each wire is a command of a specific function which is given to the motor's controller with active high logic. When the command is active, signal of the corresponding wire is high (equal to Vcc); when the command is deactivated, signal is zero.
Each signal is determined short-circuiting the common wire via an internal relay.

Wire number	Device on command station	Function
Yellow/Green	Common	0 < Vcc < 60 V
Black	Relais 1	Lever is in Neutral position
Brown	Relais 2	Lever is in Forward position
Grey	Relais 3	Lever is in Reverse position

Maximum continuous current is 3 A for each wire.



Length	Code
L= 3,0 m	3500.34-03000
L= 5,0 m	3500.34-05000
L= 7,0 m	3500.34-07000

5.4. Command cable (8 poles)

This cable is without connector on motor's controller side. Each wire is a command of a specific function which is given to the motor's controller with active high logic. When the command is active, signal of the corresponding wire is high (equal to Vcc); when the command is deactivated, signal is zero.
Each signal is determined short-circuiting the common wire via an internal relay.

Wire color	Device on command station	Function
White	GND	0V reference
Orange	+BATT	9 – 28V
Yellow	CH1	Voltage Output CH1 (0-5V)
Green	CH2	Voltage Output CH2 (0-5V)
Red	COMMON	Relais Common Contact
Violet	BACKWARD	Backward Relais Contact
Blue	NEUTRAL	Neutral Relais Contact
Black	FORWARD	Forward Relais Contact

Fore relais: Maximum continuous current is 4 A for each wire

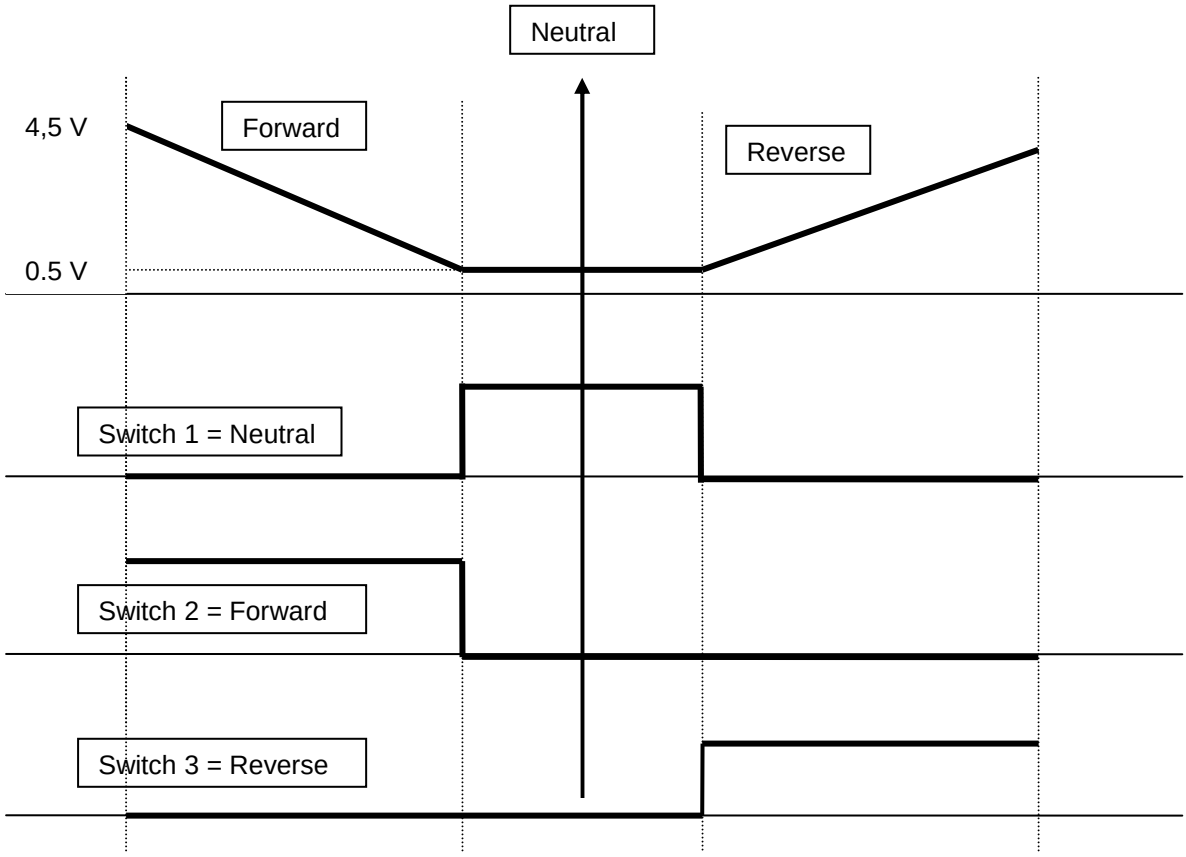
6. Interface towards the motor controller and functioning principle

According to the position of the lever, the following commands are given through electrical signals. Every position is clearly mechanical identified (with end of stroke or detent) and electronic identified also:

- Forward speed (switch 2)
- Neutral (switch 1)
- Backward (switch 3)

The following drawings are be used just as a reference to explain the lever working principle.

Electrical signals



- The analogue signal is ranging from 0 to 5 Volts (programmable via firmware) and increase or decrease proportionally with the movement of the lever. Position measurement is made with hall effect sensor.
- Switch 1 is a normally open switch which is active when the lever is active (supply = ON) and in neutral position.
- Switch 2 is a normally open switch which is active when the lever is in forward position.
- Switch 3 is a normally open switch which is active when the lever is in reverse position.

6.1. Speed signal towards the motor's controller

As standard, the electronic control lever provides 2 channel voltage output signals are reported in the drawing here above. In case you need a different voltage profile, it must be specified when ordering.
As an alternative it is possible to interface to the motor's controller via CANBus, in this case please refer to the next chapter.

6.2. CanBUS protocol

Every CANBus interface card has one output. Communication starts automatically at power-up.
This document refers to SAE J1939 CANBus protocol. The electronic system can handle also other communication protocols.

Bit rate	Repetition rate	Identifier	
		29 bit in according to CAN 2.0B	
default value	default value	description	n°byte
250 Kbit/s	10 ms	Priority	1
		PGN	2
		Address	1

Identifier:

Identifier	Priority	PGN	Address
Hexadecimal values (_)	0x_ _	0x_ _ _ _	0x_ _

Data field:

The 8 bytes of the Can Data Link are completely programmable according to the profile used by the motor producer. In the data field you must write the motor speed reference. Necessary information for majority of the motors are **minimum speed** and **maximum speed without load**.

6.3. Technical data of the CANBus interface card

Maximum speed which each channel can generate is 100 mA. Each channel output is protected against short circuit towards ground and towards voltage supply. Termination resistor is already mounted on the CANBus interface card but it can be removed when ordering at factory.

7. Behaviour of the electronic system in case of failures

7.1. Troubleshooting

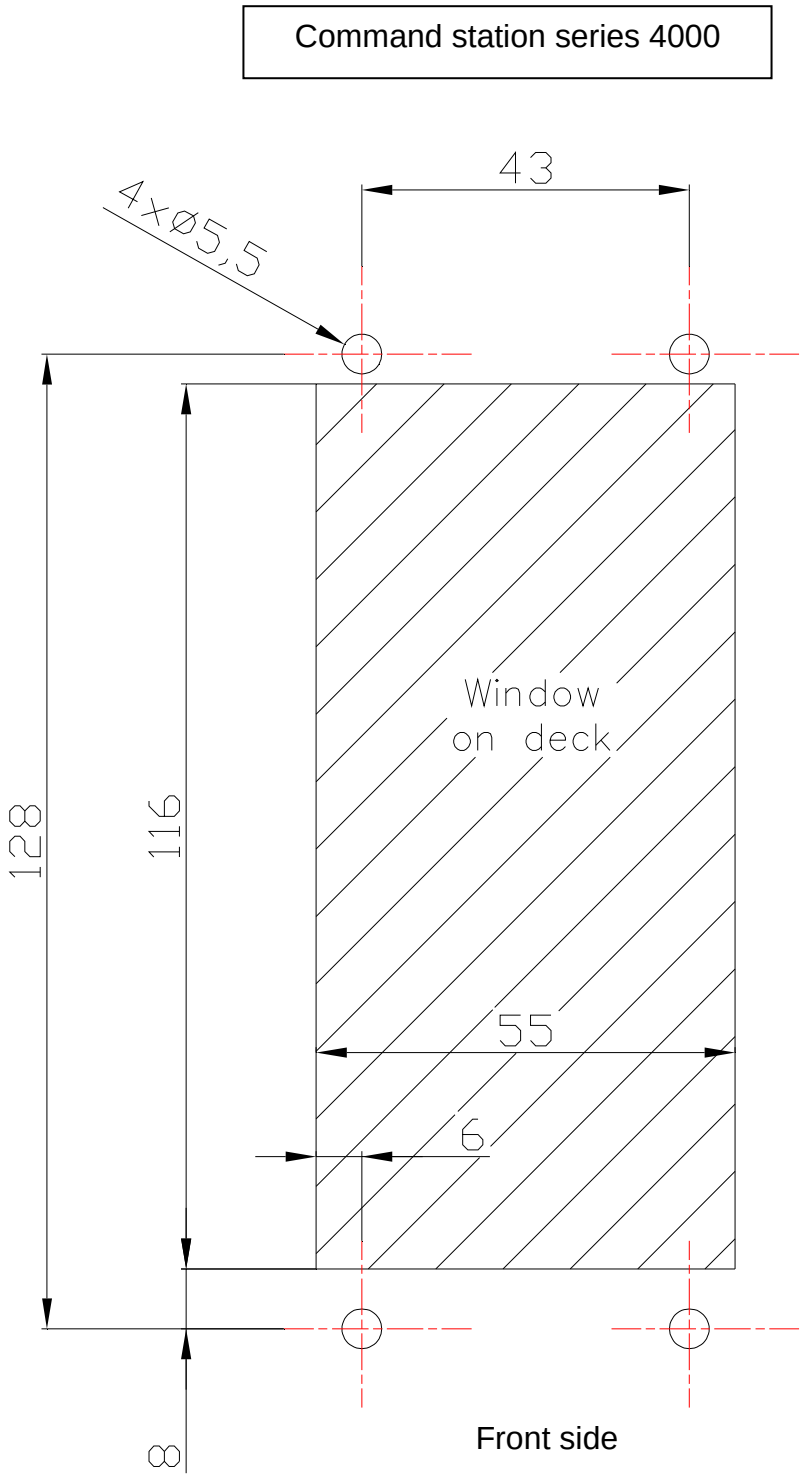
Irregularity	What to check	Section to refer
The lever doesn't take the command	Check wiring and in case of CANBus signalling, check that the end of line resistance termination on the motor controller has been activated	Section 4.3.

7.2. 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
LED red is on	Power up	Command station is powered, it has taken the command and it is configured correctly	-
LED green with fixed light	After power up	Lever is in neutral, the installation works correctly	-
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

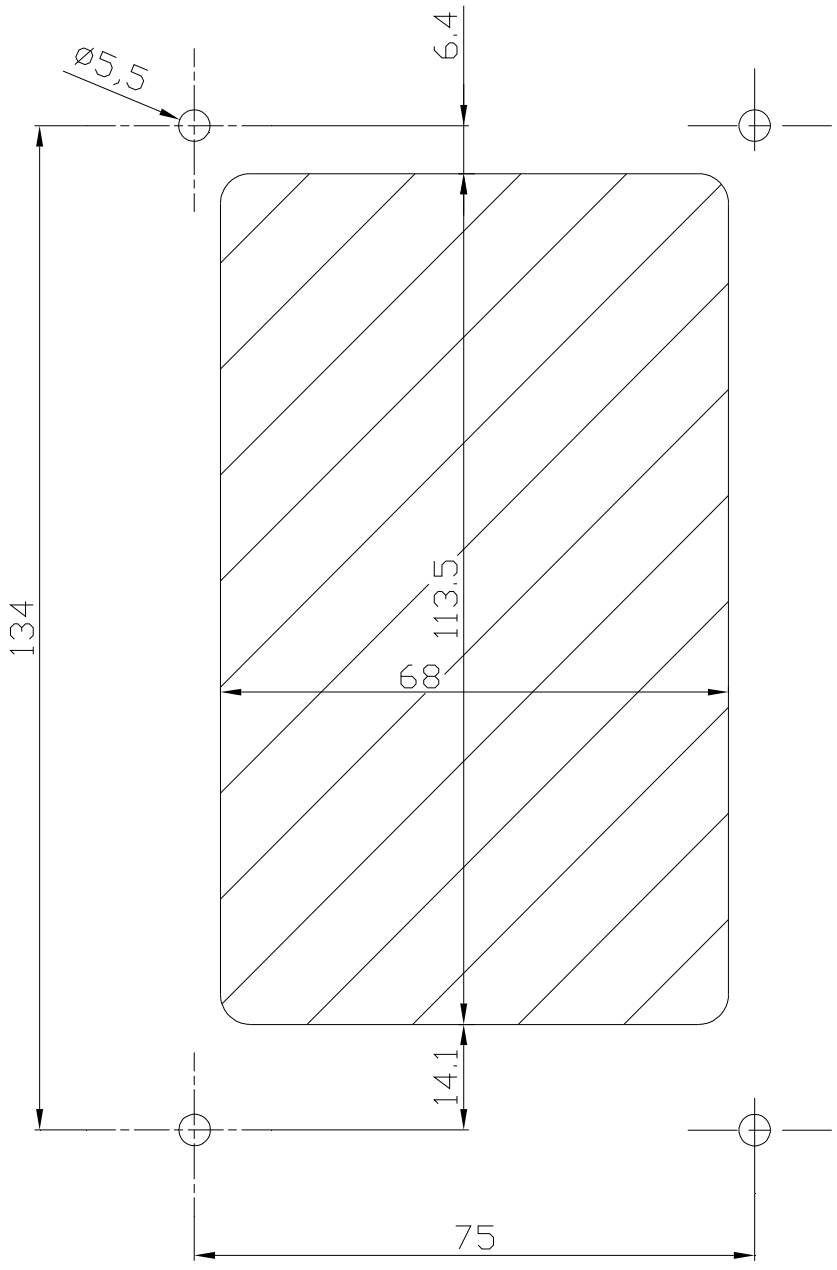
8. Drilling mask for command station



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

Command station series 4500

Front side



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