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User's manual

Reference	114300100	Index:	B

robuROC 4

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1 DOCUMENT VERSIONS AND UPDATES

Version	Date	Author	State	Section
A	17/09/2007	NG	Creation of the document	
B	25/09/2007	DS	Minor modifications	

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2 INTRODUCTION

2.1 ABOUT THIS DOCUMENT

This document describes the general conditions of use of the robot. You will find there:

- How to operate the robot correctly (operating conditions),
- Procedures for starting and stopping the robot,
- Main design features,
- Description of the functionalities the user can access.

2.2 ABOUT THE ROBUROC 4

RobuROC4 is a robot that breezes over rugged turf, asphalt, rocks, grass, sand, streams and snow and goes looking for more. Meet Robosoft sturdy, smart and spirited robuROC4, the mobile robot of choice for demanding outdoor applications and research.

Figure 1: General view of the robuROC 4

2.3 GLOSSARY

[M]	
MSRS™	MicroSoft Robotics Studio: Environment and set of libraries for development
[O]	
OS	Operating System
[R]	
RobuBOX ™	Middleware developed by Robosoft to make easier the development of advanced robotics solutions
[U]	
US sensor	Ultra-sonic sensor

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3 OPERATING CONDITIONS

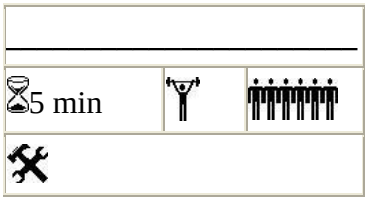
Read this document before using the platform.
⚠Do not approach the platform moving.
⚠The platform must be used under the following climatic conditions:

- Temperature between 0°C and 50°C
- Humidity 0-90% without condensation

⚠Batteries **must NEVER be empty**. **If the battery controller shut off the robot, immediately recharge them** or they could be definitely out of order.

4 HANDLING, PACKING AND UNPACKING THE ROBUROC 4

4.1 HANDLING



With 6 persons, 2 on each side of the robot, catch the handle bar (component 7 figure 2) and transport it.

NOTE: The weight of the robot is about 140 kg.

4.2 UNPACKING

To unpack the robot, follow those steps:

1. Unscrew the six screws at the bottom of the case,
2. Pull up the top of the box,
3. Remove the plastic and the carton box at the back of the robot,
4. Cut all white links,
5. Open the carton box,
6. Plug the power supply key to the control panel,
7. Plug the joystick and go to "Getting started" chapter to turn on the robot and going out of the pallet.

Keep the box for further transport if needed.

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4.3 PACKING

 It is better to use a box than a pallet to transport the robot. If you do not use the original box, the new one should be of type pallet and 4-sides with cover, its dimensions must be at least: 1430 x 900 x 820 mm.

To pack the robot, follow this steps:

1. Drive the robot to put it on the pallet,
2. Turn the robot of,
3. Remove the power supply key,
4. Remove the joystick,
5. Put them in a carton box with remote emergency stop, emergency stop charger and robot charger,
6. Attach the robot and the carton box,
7. Protect the robot,
8. Close the box.

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5 GENERAL OVERVIEW OF THE ROBUROC 4

5.1 TECHNICAL CHARACTERISTICS

Platform	robuROC 4
Dimensions	L x l x h = 1335 x 812 x 745 mm
Ground clearance	170 mm (obstacles 250 mm, steps)
Weight	About 140 kg
Number of wheels	4 independent wheels 2 wheels per side
Direction	Differential type
Turning radius	Turn on the spot
Min speed	0,01 m/s
Max speed	2,80 m/s ; 10,08 km/h (Depending on the battery level)
Payload	100 kg
Slope	41° without load 54° without load (max 60s)
Sideway	45° without load
Using temperature	0°C - 50°C
Storing temperature	0°C - 50°C
Humidity	0 - 90 % without condensing
Protection	IP54 / Protected against water splashes from all direction (NF EN60529)
Batteries	3-Li-ion secondary battery
Autonomy	3-5 h (depending on use)
Recharging time	About 5 h

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Embedded controller	robuBOX™
OS	Windows XPe
Driving mode	Joystick, Xbox360 wireless Gamepad, Graphical user interface, robuBOX commands
Sensors	- Odometry, - proxymeter, - bumper.

5.2 DESCRIPTION OF THE ROBUROC 4

Figure 2: Front view of the robuROC 4

This view shows the front emergency button, the front bumper, the front US sensors and cooling system.

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Figure 3: Rear view

On this view, you can see the joystick, customer's lamp, switches, connectors and antenna. The standard bottom part contains the emergency antenna, the rear bumper, the rear US sensor, the cooling system and the control panel (see 5.4 Control Panel for more information).

5.3 DRIVING MODES

The robuROC 4 could be operated by 3 ways:

- Manually (default mode), using the USB joystick or the Xbox360 wireless Gamepad (option).
- Remotely, using a Graphical User Interface.
- Autonomously, using robuBOX provided Reference Control Architectures or developing customized software using robuBOX and MSRS™.

See **"Quick start" chapter and "Introduction to robuBOX" for more details**.

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5.4 CONTROL PANEL

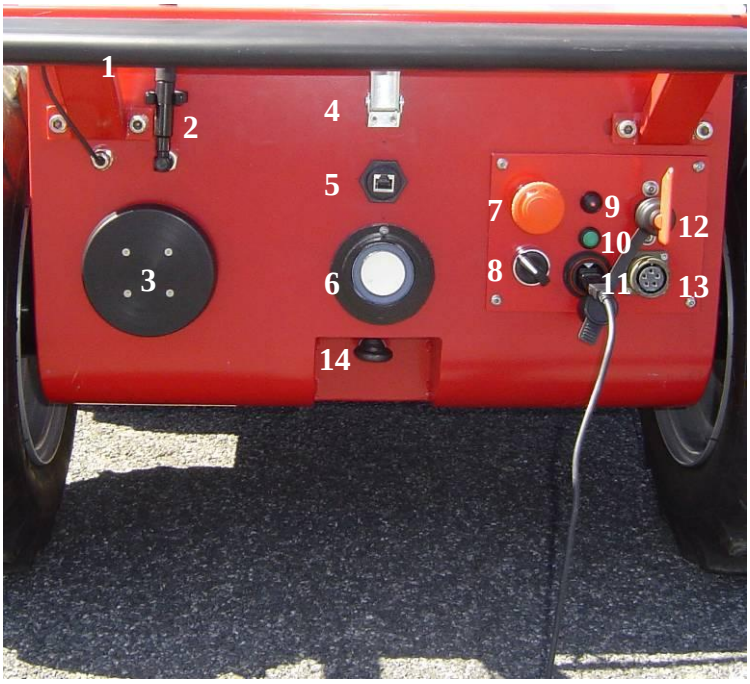

Figure 4: Robot interfaces

Composed of:

Label	Description	Function
1	Rear bumper	This bumper stops backward movements.
2	Emergency antenna	Receive emergency communication.
3	Cooling system	Allows air to go to the vehicle and stop water.
4	Rear latch	Release this latch (and the others) to remove the roof.
5	RJ45	Allows user to be connected to the wired Ethernet network of the robot.
6	US rear sensor	Ultrasonic sensor at the rear of the robot.
7	Emergency button	Push that button to turn of secured power
8	Brakes	Switch from automatic brakes to manual brakes
9	Power validation	Push that button to start secured power
10	BMC validation	Push that button to turn ON the BMC
11	USB	Allows user to connect USB devices such as USB joystick
12	Main power switch	This switch is used for powering ON and OFF the robot.

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13	Batteries charger plug	Used for recharging the robot batteries. The robot includes a set of lead batteries: these batteries accept to be recharged whenever it is possible.

5.5 THE SAFETY REMOTE EMERGENCY STOP

This safety remote control is used to stop the vehicle in case of problem

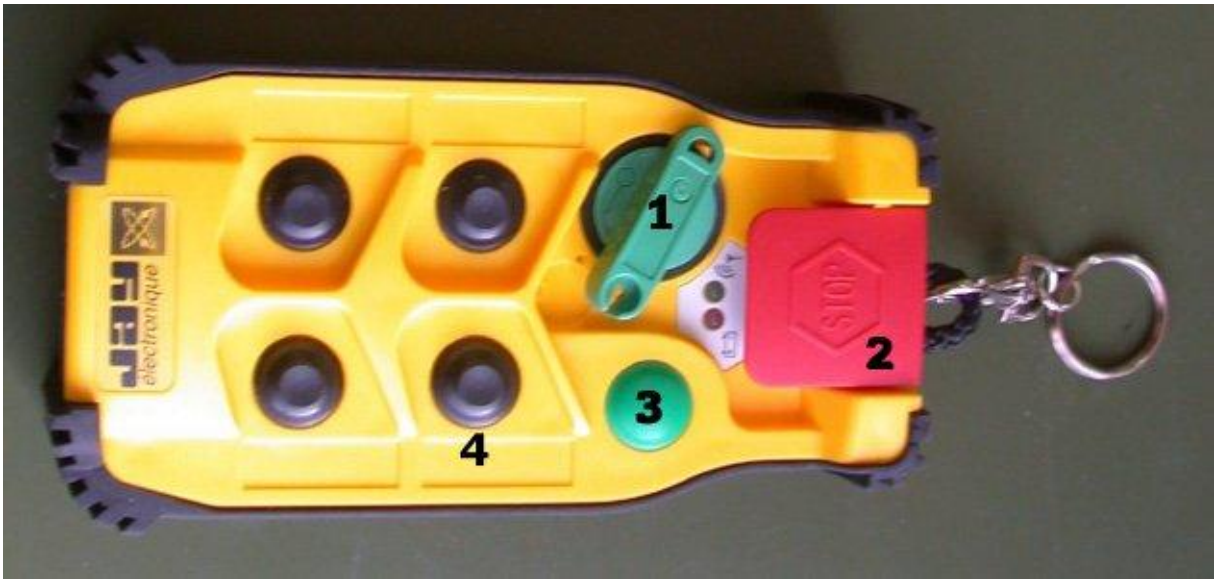

Figure 5: The safety remote emergency stop.

Label	Description	Function
1	Validation key *(1)*	This key is used for manufacturer adjustment. **It must be UP as in the picture below for customer use.**
2	Emergency button	This button is used as a wired emergency button
3	Rearm button	This button rearm the safety relay when it is down
4	Start button	This button validate the communication

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Figure 6: The safety remote emergency stop charger.

6 QUICK START

This guide should be considered as the strict minimum to be able to run the robot.

Many software applications can be developed and deployed on the robot, using robuBOX to define control architectures, use provided services etc...

For more information on how to make best advantage of robuBOX and how to unleash your robot, please refer to the "**Introduction To robuBOX"** documentation.

6.1 POWERING THE ROBUROC 4 & MANUAL TELEOPERATION

Turn the main power switch

Press the BMC validation button

On the safety remote control, press the ream button

On the safety remote control, press the start button

Then on the robuROC 4, press the power validation button to power it ON.

By default, the robuROC 4 launches the software for Joystick control at system startup, so once the emPC has booted, you can drive the robot.

The boot time is about 45 seconds, plus 45 seconds for hardware initialization. So control of the robot is available 1,5 minutes after powering it up.

Note: When a bumper is activated, the corresponding movement is forbidden meanwhile reverse movement is allowed to avoid obstacle.

6.2 DRIVING USING USB JOYSTICK

Plug the USB Joystick on the rear connector.

The upper button is used as "dead man" function. That is means that order is validated only when button is down.

Press and maintain the button, if the button is released, the robuROC 4 automatically stops.

Give direction and speed using the joystick

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6.3 DRIVING USING XBOX 360 GAMEPAD (OPTION)

To drive the robuROC 4, press and maintain the A green button. If A green button is released, the robuROC 4 is stopped.

The following table gives actions and buttons:

Action	Button
Go forward	RT
Go background	LT
Turn right	Right on Left thumb stick
Turn left	Left on Left thumb stick

6.4 DRIVING USING GRAPHICAL USER INTERFACE

Depending on the sensors available on the robot, the graphical interface gives information about odometry position, ultrasounds measurements, IP camera image, scan laser information and driving mode such as joystick connected to the PC, mousestick, buttons on the GUI or elementary motions such as “move front x meters or turn left y degrees”.

For more information about this interface, please refer to the “Introduction To robuBOX” documentation or the “RobosoftGenericDifferentialControlGUI” specific robuBOX documentation.

6.5 REMOTE CONNECTION TO THE ROBOT THROUGH REMOTE DESKTOP

To connect from a remote PC to the robot emPC, one must use the “Remote Desktop” functionality provided by Windows.

It is available on the remote user PC at:

Start, click **All Programs**, click **Accessories**, click **Communications**, and then click **Remote Desktop Connection.**

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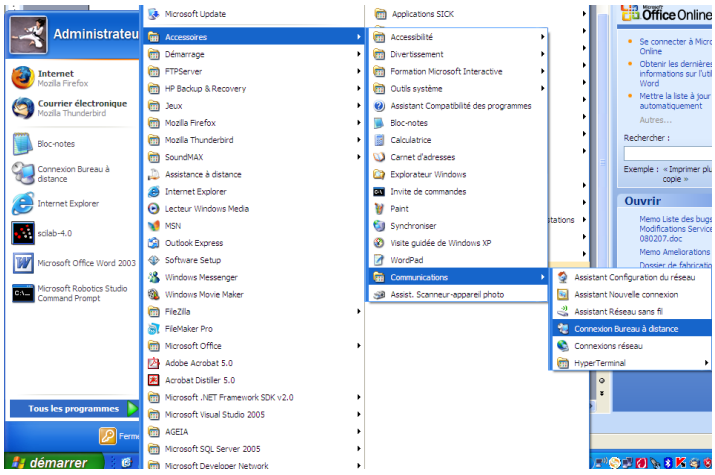
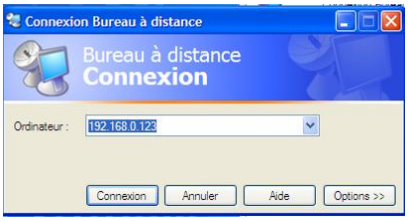


If this link is not available in the Windows graphical interface, one must Execute **mstsc.exe** located at: Windows-> System32.

If it is not, this software package can also be found on the Windows XP Professional and Windows XP Home Edition product CDs and can be installed on any supported Windows platform. To install from the CD, insert the disc into the target machine's CD-ROM drive, select **Perform Additional Tasks**, and then click **Install Remote Desktop Connection**.

The Remote Desktop function asks the computer Id to connect to. Enter the IP address of the robuROC 4 (located in a dedicated **"Robot ID-Card"**, provided with the robot):



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A new window requesting user name and password appears:

User : Administrator
Password: Administrator
Click connect, the robot PC desktop appears.

You can now control the PC in the robot as if you had a screen, keyboard and mouse connected to it.

6.1 USING THE ROBUROC 4 XP EMBEDDED OPERATING SYSTEM

6.1.1 ACCESSING USER INTERFACES

The robuROC 4 emPC runs an XP Embedded image. In order to provide faster boot sequence, this image is configured to boot with a command shell, so the usual Windows TaskBar is not available.

However, most of the user interfaces available under a classical Windows XP can be used.
The table below lists the command lines to use to launch them.

Interface	Command line	Purpose
Explorer	Prompt:>explorer	Launches the classical Windows Explorer, application, useful to access files and folders.
Control Panel	Prompt:>control	Launches the control panel, useful to change network parameters, language or keyboard options, firewall, …
Task manager	Prompt:>taskmgr	Launches the windows task manager. It can be used to start and stop processes, or monitor CPU and memory usage.

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6.1.2 USING EWF AND HORM

The XP Embedded image is used with EWF (Enhanced Write Filter). EWF is used to write protect the CompactFlash disk. This means that all disk writes are cached in RAM. When the system reboot, the changes are lost.

To transfer cached data to disk, you must use the following command line:

```
PROMPT> ewfmgr -all -commit
```

It is possible to use HORM (Hibernate Once Resume Many) with the installed image.

This means that each time the system is powered, it is always loaded with the same hibernation file. This reduces the boot time.

If you want to activate HORM, create an empty text file called “resmany.dat” in C:\.

You must then generate the hibernation file, with the following command:

```
PROMPT> xpepm -hibernate
```

At next startup, the emPC will resume from the hibernation file.

6.1.3 TRANSFERRING FILES

The original image is configured with a MSRS directory that is shared over network. This is useful to deploy services or any other files.

On the emPC, this folder is C:\MSRS.

From another machine connected on the same network as the robot, one can access it using the Windows Explorer, and by typing in the address bar:

```
\\robot_ip\msrs
```

6.1.4 STARTING APPLICATIONS AT SYSTEM BOOT

The XP Embedded image includes a Task Scheduler. You can use it to start an application at sytem startup. You can access it in control panel -> Scheduled tasks.

Note that it doesn’t work when using HORM.

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7 TROOBLESHOOTING

Problem	Possible causes	Solutions
RobuROC 4 is not powered	1 Main power switch if OFF 2 Batteries are empty 3 An emergency button is engaged 4 Safety remote control is engaged 5 Safety remote control is discharged 6 Validation button is OFF	1 Press the main power switch ON 2 Recharge batteries, if batteries cannot be recharged, contact Robosoft. 3 Release all emergency button 4 Rearm safety remote control 5 Recharge safety remote control 6 Press validation button
On board does not start	1 Main power switch is ON 2 Safety remote control is engaged 3 Safety remote control is discharged	1 Wait some seconds to connect to the wired network and try to ping the PC. If the problem persists, contact Robosoft. 2 Rearm safety remote control 3 Recharge safety remote control
RobuROC 4 can not go forward	1 An obstacle is in front of the robot 2 Bumper is damaged	1 Drive back the robuROC 4 to avoid obstacle. 2 Contact Robosoft to know how to change the bumper.

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