11.607
VertiDrive M7 robot
User manual
Version 2.01

This is the original English manual to be used by technical specialists.

INITIAL ISSUE DATE:	25-09-2017
VERSION:	2.01
ISSUE DATE:	20-03-2019
APPLIES TO:	VertiDrive M7 - 11.607 Carrier

VertiDrive B.V.

Gieterijweg 15
3089JZ, Rotterdam
The Netherlands
Phone: +31(0)10 76 30 200
E-Mail: sales@VertiDrive.nl

Copyright © VertiDrive B.V. All rights reserved. VertiDrive is a trade name of VertiDrive B.V.
No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior written permission of the manufacturer.

vertidrive

1 FOREWORD

This manual is written to inform you, as a user, how to work safely with our product. The manual provides information on the level of technical specialist. The system should not be operated by unauthorized personnel or technical specialist without training.

Read the instructions carefully before installing, start of operation or maintenance. Make sure all security recommendations and precautions have been read and understood. Also read the security recommendations of complementary supplier's documents. The users remain responsible for supervision and compliance with this manual.

This manual only applies to the "M7 Robot" modular carrier for various applications, and does not describe the complete "VertiDrive" set of equipment with applicable tools. Upon request different tools for the M7 robot are available, such as safety winch system and specific designed equipment. Contact the support department of VertiDrive B.V. for more information.

As a Manufacturer we strongly recommend to:
- Contact VertiDrive B.V. for urgent questions.
- Keep the manual on a dry, safe and available place for everyone who's involved.
- Keep all security marks on the system visible, replace them if needed.

Equipment supplied by VertiDrive B.V., to which the machine directive is applicable, complies with the CE declaration of conformity.

1.1 LAYOUT OF MANUAL

This manual contains the following subjects:
- Description and operation.
- Testing and fault isolation.
- Disassembly.
- Cleaning.
- Check.
- Repair.
- Assembly.
- Special tools, fixtures, equipment and materials.

1.2 REVISION SERVICE

The content of this manual will be updated as required by revisions.

1.3 VERIFICATION

All applicable procedures, described in this manual, have been verified by VertiDrive B.V.
The provided images are meant to represent the actual product, but the image content may vary from reality.

2 CONTENTS

1 FOREWORD 2
1.1 Layout of manual 2
1.2 Revision service 2
1.3 Verification 2
2 CONTENTS 3
3 RECORDS OF REVISIONS 5
4 CONTACT INFORMATION 6
4.1 Supplier 6
4.2 Support and service 6
5 TERMS AND DEFINITIONS 7
6 MACHINE SPECIFIC INFORMATION 9
6.1 General specifications 9
6.2 Identification / CE marking 9
6.3 Technical design 10
6.4 Applicable tools 10
6.5 Changeover applications 10
6.6 Applicable documents 10
7 CE MARKING AND LIABILITY 11
7.1 General 11
7.2 Intended and non-intended use of the machine 11
7.3 Responsibilities for owner and user 11
7.4 Warranty 11
7.5 Declaration of Conformity 11
7.6 Liability 12
8 SAFETY 13
8.1 Symbols in this document 13
8.2 Safety signs on the system 14
8.3 General safety instructions 15
8.3.1 Job functions, tasks, certification and team line-up (for UHP tools) 15
8.3.2 Before starting 16
8.3.3 During operation 16
8.3.4 During maintenance/service: 16
8.4 Safety provisions 17
8.4.1 Emergency shut-off 17
8.4.2 Wall contact switch 17
8.5 Environmental measurements 17
8.6 Risk for personal injury 18
8.6.1 Electrocution 18
8.6.2 Electrical safety earth 18
8.6.3 Cuts, injuries on head and feet 18

8.6.4 Injuries on face and eyes 18
8.6.5 Hearing damage 18
8.6.6 Liquid injection by UHP water jet 19
8.6.7 Crushing hand 19
8.6.8 Pinching hand 19
8.6.9 Magnetism 19

9 SYSTEM DESCRIPTION 20
9.1 General 20
9.2 M7 – 11.607 robot 20
9.3 Control box 21
9.4 Remote control panel 22
9.5 Safety winch system (optional) 24

10 INSTALLATION 27
10.1 GENERAL 27
10.2 Handling the Robot 28

11 OPERATION 29
11.1 Operating procedure 29
11.1.1 Starting up 29
11.1.2 Recover from an emergency stop 31
11.1.3 Shutting down 31

12 MAINTENANCE AND CLEANING 32
12.1 Frequency of inspection and maintenance 32
12.2 Maintenance instructions 32
12.3 Cleaning 32
12.4 Trouble shooting 32

13 STORAGE AND TRANSPORT 33

14 DISMANTLING AND ELIMINATION 33

3 RECORDS OF REVISIONS

Rev. No.	Issue date	Description	Drawn up by	Checked by
1.03	25-09-2017	First Issue	D.Doran	G.L.J. Veltman
2.00	10-10-2018	New remote control	G.L.J. Veltman	G.L.J. Veltman
2.01	21-03-2019	SIR Requirements & small (visual) changes	A. Schipper	G.L.J. Veltman

4 CONTACT INFORMATION

4.1 SUPPLIER

VertiDrive B.V.

Gieterijweg 15
3089JZ, Rotterdam
The Netherlands
Telephone: +31(0)10 76 30 200
E-Mail: sales@VertiDrive.nl

4.2 SUPPORT AND SERVICE

Technical support:

VertiDrive B.V.

The Netherlands
Telephone: 31(0)10 76 30 200
E-Mail : sales@VertiDrive.nl

5 TERMS AND DEFINITIONS

To create clarity some of the definitions and abbreviation used in this manual are explained.

Abbreviation	In full	Description
°C	Degrees Celsius	
°F	Degrees Fahrenheit	
ALARP	**A**s **L**ow **a**s **R**easonably **P**racticable	The ALARP principle applies when control measures are put into effect. Risks must be as low as is reasonably achievable in practice. That means that the effectiveness of the control measures is weighed up against the costs. Whether they are feasible and realizable also plays a role in the assessment.
bar		Unit of pressure; 1 bar = 100,000 Pa (pascals) = 100 kPa (kilopascals).
CE	Conformité Européenne	CE marking shows that the product was manufactured in accordance with European standards.
cm	Centimeters	
Confined space		An confined or partially open environment with a narrow entrance or otherwise, not designed for people to be present for long periods and where activities take place that pose a risk to safety, health and wellbeing.
dB(A)	**d**eci**b**els (**a**bsolute)	A measure of the relative loudness of sounds. The decibel is a unit derived from the bel, in the same way as a decimetre is derived from the metre. When working with sound (noise nuisance in particular) the letter 'A' is often appended: dB(A). This means that the measurement method has been corrected for the fact that the human ear is not equally sensitive to all frequencies. A technique known as the 'A filter' has been used.
Emergency shut-off		A stop button which ensures a safe situation when activated.
EN	**E**uropean **N**orm	European standards such as e.g. NEN-EN. This is the European norm that applies in the Netherlands and is managed by the NEN (**N**ederlands instituut voor **E**enheids**N**ormen).
High-pressure system		Collective name for a high-pressure water jetting system or flush water system.
High-pressure water jetting system		A system, which may or may not be mobile, that consists of a drive, pump, safety devices, HP hoses, a cleaning machine or a high-pressure jetting equipment, which can jet water under a high pressure of more than 250 bar.
HP components		Equipment that is required for working with a high-pressure system (e.g. hoses, whip checks, nozzles, etc.)
Jetting area		This is the area where the cleaning is carried out and where people can be hit e.g. by the HP water jet or HP components. If there is no physical shielding, a distance of at least 6 meters should be maintained around the location that the nozzle can operate in.
Kg	Kilogram	
L x W x H	Length x width x height	
Lux		Unit of illuminance (light intensity).
LMRA	Last-Minute Risk Analysis	This is a brief risk assessment carried out in the working area immediately before the start of HP activities by the employees who are going to carry out the HP activities.
m	Meter	Unit of distance
min	Minute	Unit of time
mm	Millimeters	Unit of distance
Nozzle		A head with one or more discharge openings through which the water jet spray emerges and which is directly mounted to the cleaning machine, high pressure jetting equipment or HP hose.
PPE	**P**ersonal **P**rotective **E**quipment	

HP	**H**igh **P**ressure	Working pressures from 25 up to 250 bar.
UHP	**U**ltra **H**igh **P**ressure	Working pressures above 250 bar.
Protective hose/sleeve		A protection that is fitted over the HP hose in order to protect it against damage from the outside (e.g. by being dragged along the ground).
Unpressurised		The term 'unpressurised' in this manual means that the residual or control pressure in the system as far as the high-pressure jetting equipment is less than 25 bar.
Whip check		A device consisting of a cable with loops that is installed at the coupling of a HP hose. This ensures that the HP hose cannot whip around randomly if the coupling comes loose.

6 MACHINE SPECIFIC INFORMATION

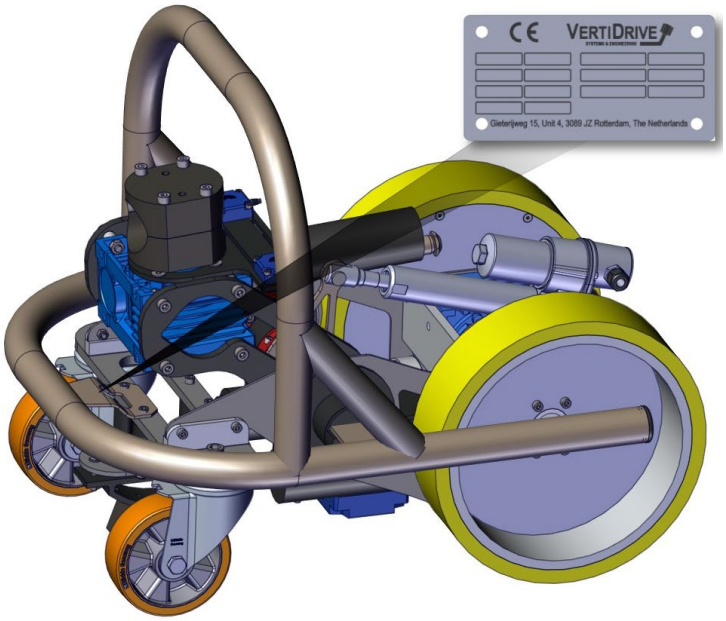
6.1 GENERAL SPECIFICATIONS

Product description : M7 – 11.607 Robot

Location : Rotterdam, The Netherlands

6.2 IDENTIFICATION / CE MARKING

The system/machine/unit has a CE mark, to indicate that the system/machine/unit complies with the fundamental safety and health requirements as written on the Declaration of Conformity. The mark is located at the position as shown in the drawing below.



CE mark M7 Robot

6.3 TECHNICAL DESIGN

Robot

- Robot dimensions : 650 x 550 x 520 mm
- Weight : 55 kg
- Driving speed : max 4,8 m/min

Electrical

- Remote control system : IMET 550 S THOR B2 with MAC receiver
- Range : 100 meters
- Power : 230V, 50Hz, 16 Amp (CEE plug)

6.4 APPLICABLE TOOLS

The robot is designed as a modular carrier for various applications for surface treatment. This to be mounted by the end user with the supplied application manual.

6.5 CHANGEOVER APPLICATIONS

The M7 Robot can be equipped with different types of applications. The procedure for changing application over is described in the application user manuals.

6.6 APPLICABLE DOCUMENTS

M3 – 11.501 User manual	[applied with carrier]
M7 – 11.607 EU Declaration of Conformity	[applied with carrier]
M7 – 11.607 Illustrated parts manual	[applied with carrier]
Checklist startup procedure	[applied with carrier]
Overall maintenance instruction	[applied with carrier]
12.312 - Transport frame user manual (if applicable)	[applied with transport frame]

7 CE MARKING AND LIABILITY

7.1 GENERAL

Vertidrive M7 fulfils all relevant requirements to be used safely. To accomplish this, several instructions are described in this manual and shall be followed prior to and during operation.

The following harmonized standards have been applied:

EN-ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction

Refer to section “Identification / CE Marking” obtain the specific identification and CE-marking of the delivered system.

7.2 INTENDED AND NON-INTENDED USE OF THE MACHINE

The VertiDrive M7 robot is a remote controlled 4-wheel vehicle which by means of magnetism moves on vertical steel flat surfaces. The robot is designed as a modular carrier for various applications for surface treatment. The possibilities and limitations are shown in this document.

By intended use is also meant that the operations on this system must be carried out in accordance with the instructions given in this manual and application manual(s). Tools and materials to be used for this purpose must be applicable for this end product.

Only classified personnel are allowed to carry out operations and maintenance on the system. Prior to the use of the robot, VertiDrive and/or an authorized VertiDrive representative/trainer will demonstrate and give instruction on how to use the robot. Participants receive a signed and dated certificate of participation.

Operators must be instructed by VertiDrive or an authorized VertiDrive representative, minimum operator age is 18. Maintenance engineers must be instructed by VertiDrive or an authorized VertiDrive representative.

7.3 RESPONSIBILITIES FOR OWNER AND USER

Changes to the VertiDrive B.V. M7 robot may lead to severe damage and injury of the user.

The VertiDrive B.V. M7 robot must not be changed in any way without written permission of VertiDrive B.V. The risks and consequences related to adaptations do not come under the responsibility of VertiDrive B.V.

The Manufacturer cannot be held responsible for failures or (sequential) damages caused by improper actions, poor use or overdue maintenance. Personnel will always remain responsible for their actions and the consequential results.

7.4 WARRANTY

Delivery takes place according the delivery terms specified in “Metal union conditions”

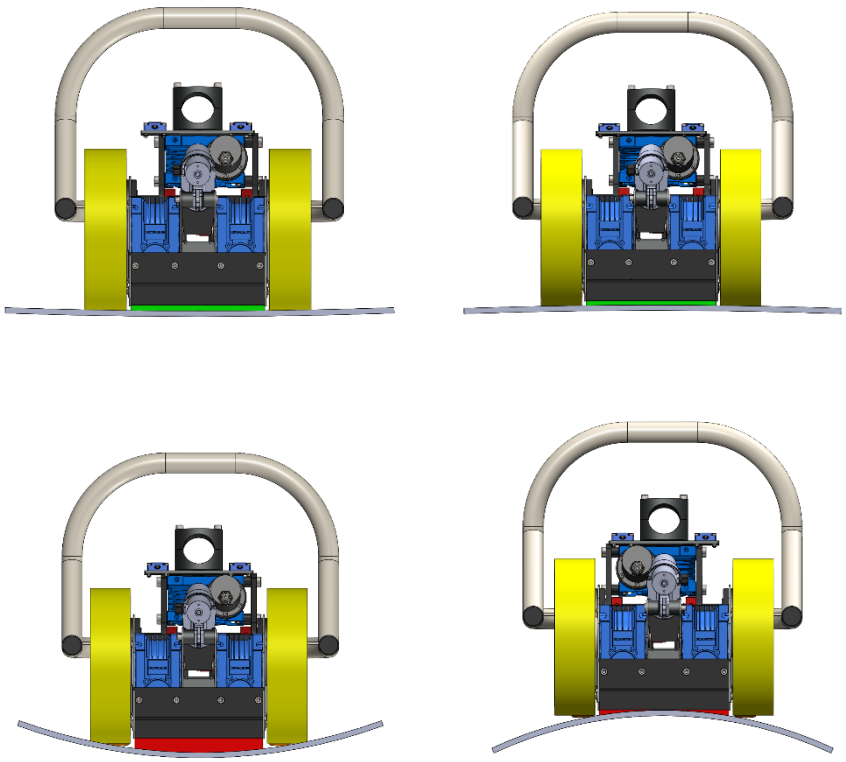
7.5 DECLARATION OF CONFORMITY

The original remains in the possession of the manufacturer, a copy of this statement is included in the documentation.

7.6 LIABILITY

VertiDrive B.V. accepts no liability for unsafe situations, accidents and/or damage resulting from any of the following points:

- Poor maintenance.
- The robot is explicitly NOT suitable for carrying people and or objects.
- It is NOT permitted to modify the robot without prior consultation and prior written permission from VertiDrive.
- Metal thickness of the surface to wash/clean needs to be at least **8 mm**. Lower values will decrease the holding force of the permanent magnets and increase the risk getting detached from the surface.
- For optimal adhesion the distance between wheels and metal should be no more than **3mm.**
- Please note the magnets are temperature sensitive and will lose holding power when exposed to temperatures over 80° Celsius.
- Avoid driving on curved surfaces, the robot is designed for flat and or small radius curved surfaces only. The robot can handle certain curved surfaces as instructed by authorized VertiDrive personnel. Practical instruction how to avoid curved surfaces is explained during training.



Driving on surface with radius

8 SAFETY

Safety instructions in this manual are based on SIR (Stichting Industriële reiniging, the Foundation for Industrial Cleaning) guidelines. These SIR guidelines are based on the Dutch and Belgian legislation and regulations, plus the European regulation (EU) 2016/425 of the European Parliament and the Council dated 9 March 2016 regarding personal protection equipment (superseding European directive 89/656/EEC).

8.1 SYMBOLS IN THIS DOCUMENT

Below is an explanation of the symbols that are used in this document to draw the reader's attention to specific situations.

DANGER OF LIFE!
The life of the user is at risk.

DANGER!
There is a risk that the user gets (seriously) injured and / or the system incurs serious damage. This warning alludes to the risk that occurs if the user does not follow the procedures in this manual carefully.

CAUTION!
The system may be damaged if it is used or operated incorrectly.

ATTENTION!
Remark gives additional information concerning the occurrence of possible problems.

It is important to read this instruction.

8.2 SAFETY SIGNS ON THE SYSTEM

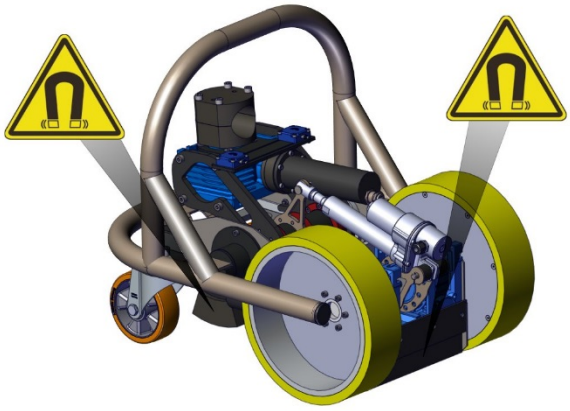
Meaning: High voltage, applies to the control box and electrical connections of components.
Risk: Electrical hazard.
Location: Control box, electrical components.

Meaning: Magnetic field
Risk: Magnets produce a far-reaching, strong magnetic field. They could damage TV's and laptops, computer hard drives, credit and ATM cards, data storage media, mechanical watches, hearing aids and speakers.
Location: In between the front and back wheels, see figure below.

Meaning: Pinch point.
Risk: Pinching hand or fingers.
Location: Near the wheels.

Meaning: Danger for pacemakers and implanted heart defibrillators
Risk: Magnets could affect the functioning of pacemakers and implanted heart defibrillators. A pacemaker could switch into test mode and cause illness. A heart defibrillator may stop working.
Location: Near the magnets.

Meaning: Danger for injection by (U)HP water jet (if applied).
Risk: Force of water is so great that it can penetrate the body. People can be hit not only by the HP water jet from the nozzle, but also e.q. by water jetting from a suddenly leaking HP hose or HP connection.
Location: Near the robot and hoses



Location of the magnetism

8.3 GENERAL SAFETY INSTRUCTIONS

The M7 Robot complies with the fundamental safety and health requirements laid down in the relevant European Community guidelines. However, careless or inexpert use may lead to dangerous situations.

Always follow the safety rules written by local law and/or defined by the company you are working for. Local safety rules must always be followed in the first place. Please inform your supervisor in case these contradict to warnings given in this user manual.

When an application is installed on the robot the operator should be certified and/or trained to use this additional equipment.

Observe the following general safety instructions:

8.3.1 Job functions, tasks, certification and team line-up (for UHP tools)

Operator
Trained, educated and certified according to local requirements

- Operates the robot from outside the jetting area
- Operates the emergency shut-off on the robot

Pump engineer
Trained, educated and certified according to local requirements

- Monitors the proper operation of the pumping unit and supply of high-pressure water
- Operates the emergency shut-off on the high-pressure system
- Monitors the jetting area and is in visual and/or audio contact with the operator

8.3.2 Before starting

- Always perform a LMRA in following three steps:
  - **Recognizing potential dangers** that could be present despite all the measures taken. Employees should first ask themselves if they are risking exposure to these dangers. They must not start the work if they believe the risks are unacceptable.
  - **Thinking up solutions or measures** to remove the perceived risks or make them acceptable
  - **Taking measures to let them carry out the work activities safely.** The employee carries out the required control measures to eliminate or control the dangers. If necessary, they should ask for help in achieving this.
    An LMRA never stops. It is a continuous awareness of the steps prior to perform a task or follow a procedure.
- Always secure the robot against falling with appropriate and certified fall arrest equipment.
  When the robot does fall it is possible it will hit other objects, obstacles or humans. Any consequent damage, injuries or cost resulting from inappropriate use and/or falling of the robot is NOT the responsibility of VertiDrive. VertiDrive cannot be held liable for damages, injuries or costs resulting from inappropriate use.
- Prior to usage, mark an area- with yellow/black ribbon to ensure a distance to robot of at least 6 meters. This area should not be entered without the permission of the operator.
- Ensure proper warnings by placing visual signage where necessary.
- Caution should be taken when plugging and unplugging the power supply. Appropriate and approved power cables should be used.
- Prior to use of the VertiDrive M7 Robot, the user/operator must perform a check, see “General Checklist start-up procedure”. Initial training of users/operators is provided by VertiDrive and or VertiDrive certified representatives/trainers, upon delivery of a new robot.
- When additional equipment is installed on the robot the operator should be certified and or trained to use this additional equipment.
- When using UHP equipment extra care should be taken on how to use this equipment and all safety precautions should be taken and respected.
- Attached equipment such as UHP or blasting equipment will make noise. Always use appropriate hearing protection.
  The robot itself produces a low humming sound when only driving.
- To decrease the weight to be carried by the robot, the power cables and vacuum hose can be attached to the winch safety line. Ensure that the safety lines can travel freely to their new position. Ensure cables and hoses are in the correct position in relation to the robot.

8.3.3 During operation

- Always keep visual contact with the robot during usage.
- Never stand underneath the robot!!
  Be aware: If robot falls it may swing towards the operator and or other people in the vicinity.
- Always use protective clothing and use appropriated facial protection.
- Prior to approaching the robot or when in close vicinity make sure the power is turned off by pushing the red emergency stop button on the control box.
- When the robot is NOT in use always unplug the main power supply.
- Do not distract operator while operating.
- Keep at least 6 meters away from the robot during operation.
- Always pay attention for slack of rope/hoses on the floor, the operator might caught by, or stumble over the hoses with risk of injuries.

8.3.4 During maintenance/service:

- Always unplug the main power supply.
- When working on the robot extra caution should be taken to avoid direct contact between steel tools and the magnets. Magnets are very strong and can cause injuries. The magnets will also affect sensitive electronic and mechanic equipment like cell-phones, watches and (bank) cards with magnetic strips.

8.4 SAFETY PROVISIONS

8.4.1 Emergency shut-off

Dangerous or undesirable situations may arise during usage of the robot. To put an end to such a situation immediately, a high pressure system has at least two or more emergency shut-offs.
One emergency shut-off is on the high-pressure system, the other one on the remote control and the last emergency shut-off is controlled from the control box.

Depending on the HP working method, the circumstances and the variant of the cleaning machine or high-pressure jetting equipment, the emergency shut-offs may be operated by the pump engineer, jetter/operator or additional emergency stop operator.

The emergency shut-off on the high-pressure system:

- Shuts off the High pressure jetting equipment.

The emergency shut-off on the remote control panel or/and on the control box:

- Stops all movements of the robot;
- The magnetism of the robot will not be influenced.

8.4.2 Wall contact switch

The robot is equipped with a wall contact switch. In case the robot loosens contact with the (steel) surface, the wall contact switch acts as an emergency shut-off. Refer to chapter “Installation” for how to connect the wall contact switch to the pump.

VertiDrive strongly recommends to integrate the UHP pump equipment (if applicable) in the emergency circuit inside the control box.

For machine operator protection whip-checks are used on all UHP hoses to prevent UHP hoses becoming fully detached from the machine in case the UHP coupling fails.

8.5 ENVIRONMENTAL MEASUREMENTS

Noise:
The process causes a noise level that exceeds 80 dB if an UHP pump is applied. Wear hearing protection.

8.6 RISK FOR PERSONAL INJURY

8.6.1 Electrocution

Where	When	Precaution	Warning sign
Control box.	During maintenance by working on electrical part inside the control box.	Always disconnect the main power cord.	
Electrical cables.	During handling of cables.	Always disconnect the main power cord.	

8.6.2 Electrical safety earth

Where	When	Precaution	Warning sign
Control box.	Always.	Never disassemble the control box and check if the power supply is equipped with a proper earth connection.	

8.6.3 Cuts, injuries on head and feet

Where	When	Precaution	Warning sign
Handling robot.	Always.	Wear safety boots.	
Handling robot.	During operation of the robot.	Wear safety helmet.	
Handling robot	During handling of the robot	Wear protective gloves	

8.6.4 Injuries on face and eyes

Where	When	Precaution	Warning sign
Near robots UHP nozzle.	During cleaning/ stripping with UHP.	Wear face protection.	

8.6.5 Hearing damage

Where	When	Precaution	Warning sign
Near robot and UHP pump, if a UHP pump is applied.	During operation near the robot's nozzles and UHP pump. Noise exceeds 80dBA.	Wear hearing protection.	

8.6.6 Liquid injection by UHP water jet

Where	When	Precaution	Warning sign
Near robot, hoses and UHP pump, if a UHP pump is applied.	During operation with UHP near the nozzles, hoses and pump.	Wear protective clothing.	

8.6.7 Crushing hand

Where	When	Precaution	Warning sign
Near the horizontal rotating axis of the swingarm.	During operation of the swingarm.	Do not touch the swingarm.	

8.6.8 Pinching hand

Where	When	Precaution	Warning sign
Near the rotating wheels.	During maintenance/ adjustment/ cleaning.	Do not touch the rotating wheels when drives are powered.	

8.6.9 Magnetism

Where	When	Precaution	Warning sign
Between the wheels a powerful magnet is present.	During maintenance/ adjustment/ handling.	Use non-ferrous tools.	
Between the wheels a powerful magnet is present.	Always.	Do not approach the robot if you have a pacemaker or implanted heart defibrillator. Keep 60 cm distance.	
Between the wheels a powerful magnet is present.	During maintenance/ adjustment/ handling.	Handle robot by the handle bar during (un)mounting.	

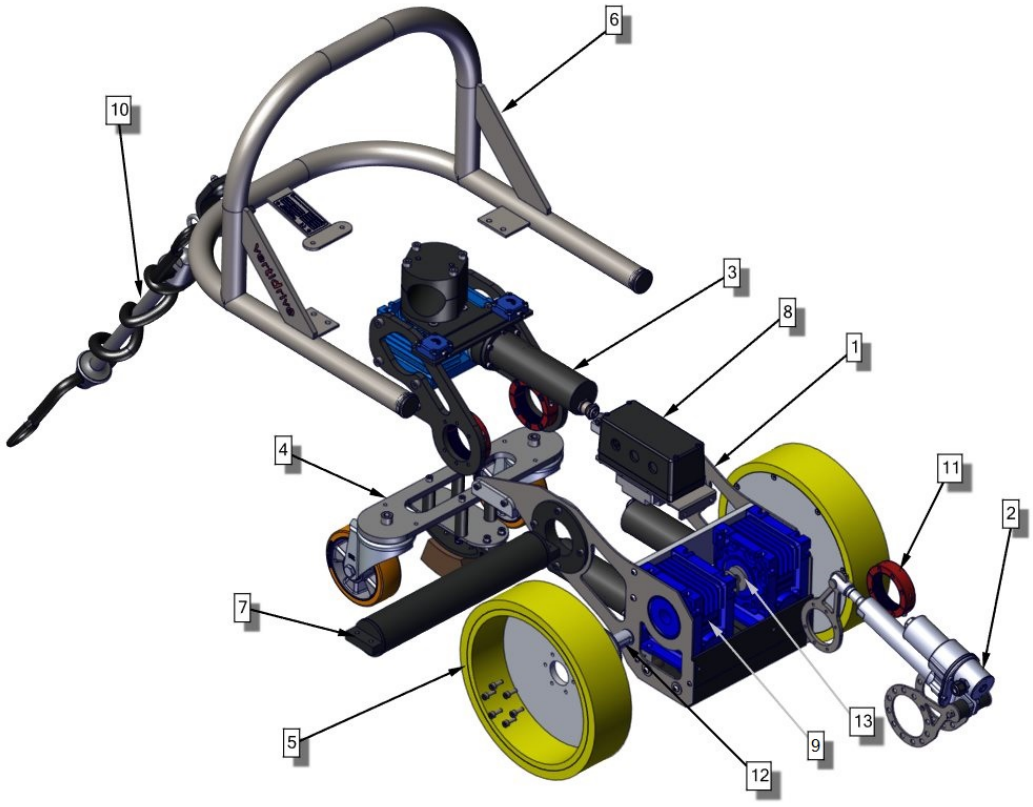
9 SYSTEM DESCRIPTION

9.1 GENERAL

The VertiDrive M7 robot (“the Robot”) is a remote controlled 4-wheel vehicle which by means of magnetism moves on vertical steel and flat surfaces.

The robot is designed as a modular carrier for various technical applications and specifically for the cleaning/stripping of steel surfaces by means of Ultra High Pressure (UHP).

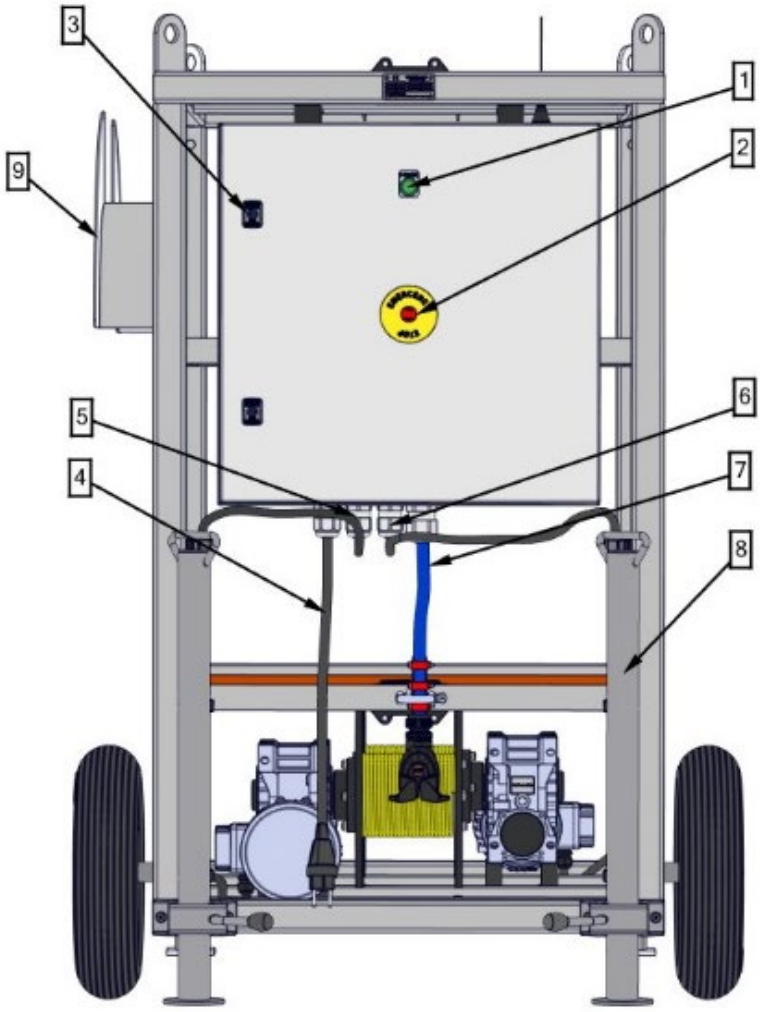
9.2 M7 – 11.607 ROBOT



Exploded view M7 Robot

For full detailed description see the Illustrated parts manual supplied with the robot

9.3 CONTROL BOX



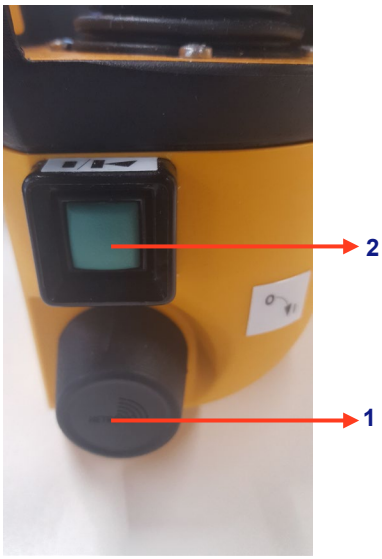
Transport frame with control box

#	Part name	Description
1	Power indicator.	Green light turns on when the system is powered on.
2	Emergency stop.	Switch to shut down the system.
3	Key holes.	For opening and closing control box.
4	Cable power supply “in”.	Main power supply of the system.
5	Cable left winch drum.	Power supply left drum winch (if applicable).
6	Cable right winch drum.	Power supply right drum winch (if applicable).
7	Cable power supply robot.	Power supply of the robot.
8	Support leg.	Supports frame and prevents transport frame from tipping over.
9	Cable winders.	For manually winding up the cable

For detailed information about the transport frame and/or winch system please consult the User manual transport frame / winch system

9.4 REMOTE CONTROL PANEL

The robot is controlled by a wireless remote control system with the following functions and controls.

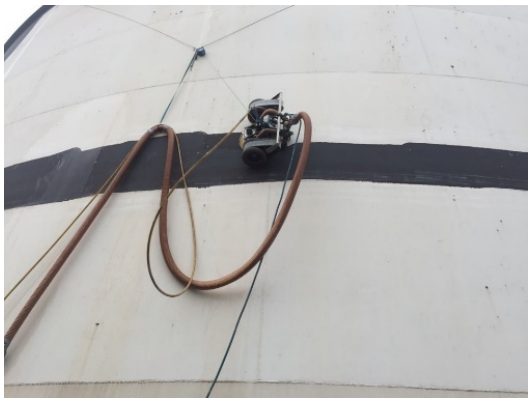


NOVA XL Remote control

#	Part name	Explanation
1	On/Off switch / Safety key.	For turning on the remote control, turn clockwise. Remove key to prevent unexpected starting of system.
2	Connection switch.	To Connect remote control with the control box.
3	Swing arm speed control	To adjust swing arm speed
4	Indicator light	To check system on
5	Swing arm control	To turn swingarm on/off
6	Swing arm up down control	N/A for M3 robot
7	Step control	To select usage and setting of step control
8	Emergency button	Precondition: • System is powered. Operation: Press the button in case of emergency. To unlock the button, pull it out while turning clockwise. Result: • All movements from the robot and winches are stopped immediately; • All the adjacent equipment, connected to the robot system will be turned off as well; • The magnetism will not be influenced.
9	Drives speed control	To adjust driving speed
10	Joystick robot control	To adjust driving direction of the robot
11	Swingarm overrule	To use spot blasting (return swingarm immediately)
12	Pump control	To turn pump on/off
13	Winch selector	To select left/right/both winch(es)
14	Joystick winches control	To position winches for optimum fall protection

Check if the key of the remote control nr. 1 (see NOVA XL Remote control) is removed during inspection/maintenance.
With key removed there's no risk of unexpected operation of the system.

9.5 SAFETY WINCH SYSTEM (OPTIONAL)



Winch system

A winch system, integrated in a transport frame, can optionally be provided.

It is very important to install the fall arrestor before placing the robot on the surface. The users are hereby protected from the robot from losing contact with the wall.

This winch system has a dual purpose:

1. Carry the fall arrest equipment which is attached to the robot and make sure this equipment is in the correct position in relation to the robot. The fall arrestor always needs to be in the proximity of the robot (max. 4 meters between robot & fall arrestor).
2. Carry the weight of all the hoses and cable connected to the robot.

Carrying the weight of the hoses is very important to make sure the robot can maneuver easily and will not be restricted.

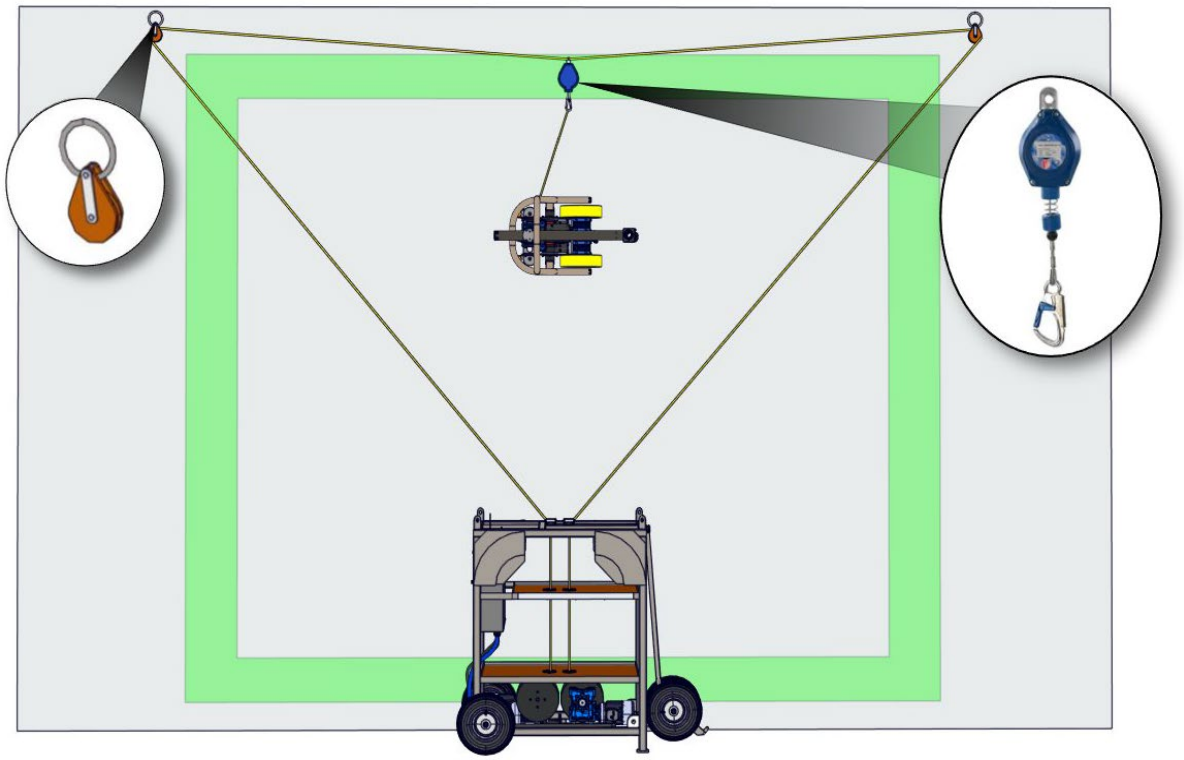
Two winches with drums can be controlled simultaneously or independently with the special joystick on the remote-control unit.

On each winch drum 100-meter line is available (breaking strength 3000 kg). With these lines the position of the fall arrestor and attached hoses can be controlled.

- Always replace ropes with the subscribed type.
- Inspect ropes according to Maintenance Inspection Schedule

For detailed information about the transport frame and/or winch system please consult the user manual transport frame / winch system.

Each line should be positioned as shown in the sketch below.



Winch setup

The two snatch blocks on either end do need to guide the line in order to heave in and out smoothly. To avoid sway in case the robot loose contact with the steel surface, the working area should be kept within the two snatch blocks (within the green marked area) and the fall arrestor should be positioned as close as possible above the robot.

The pulling strength of the 2 winches is approximately 120 Kg each winch.

The UHP hose and umbilical should be tied together and lifted simultaneously using the winch system.

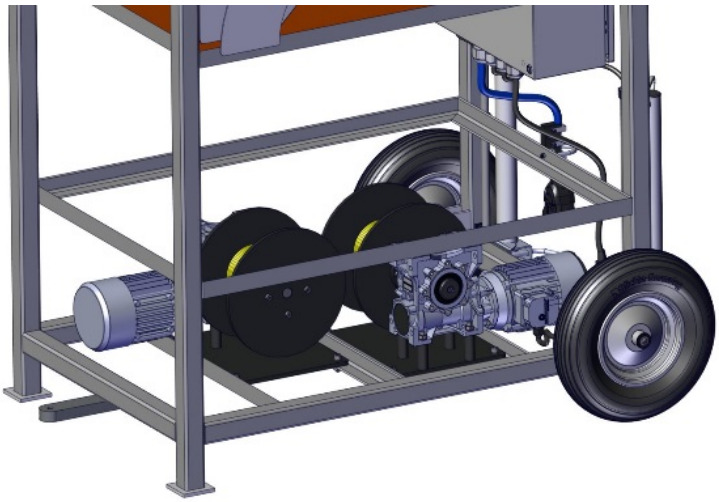
All connections:

- *To and from snatch blocks;*
- *From UHP hose to winch system;*
- *From fall arrestor to winch system;*
- *Etc.*

Should be made with certified slings/ strops!!!

Fall arrestor

Pulley



Winch system

Do not place hands or object close to the winches when they are in operation.

Always secure transport frame to a solid object or structure in order to counteract sudden forces on the winch lines (e.g. if the robot detaches from the surface).

Use appropriate straps to secure the frame to a solid or secure object. As an alternative the frame can be weighted with 4 sand filled bags to be secured to the lugs at the vertices.
Empty bags will be delivered with the transport frame.

10 INSTALLATION

10.1 GENERAL

Before using the robot, it is mandatory to secure the robot with certified and appropriate fall arrestors. This equipment is to be supplied by the end user and should be placed by an authorized person to do so.

The commissioning work must only be carried out by authorized personnel. Prior to use of the VertiDrive M7 Robot, the user/operator must follow operating and safety instructions. Initial training of users/operators is provided by VertiDrive and or VertiDrive certified representatives/trainers, upon delivery of a new robot.

Customer is responsible for transport of the complete system and therefore he bears all risks of loss, damage or wear caused during transport.

Environment must meet following requirements

Ambient temperature operating : > +3°C (avoid frost) to +40°C

Commissioning the robot

1. Prior to usage, mark an area with yellow/black ribbon of approx. to ensure a distance from the robot of 6 meters in all cases. This area should not be entered without the permission of the operator. Always take in account the possible swing of the robot when the robot falls down.
2. Perform the robot inspection procedure prior connecting it to power (and, if applicable UHP pump). For full detailed description see M7 – Checklist startup procedure supplied with the robot
3. Connect Robot to the power supply.

   It is important to organize the power cable in a way it can't be tangled or caught between objects. Also caution should be taken to ensure the power cable is out of reach of the magnetic wheels. It is recommended when using UHP connections to tie power cable and UHP hose together using proper cable binders.

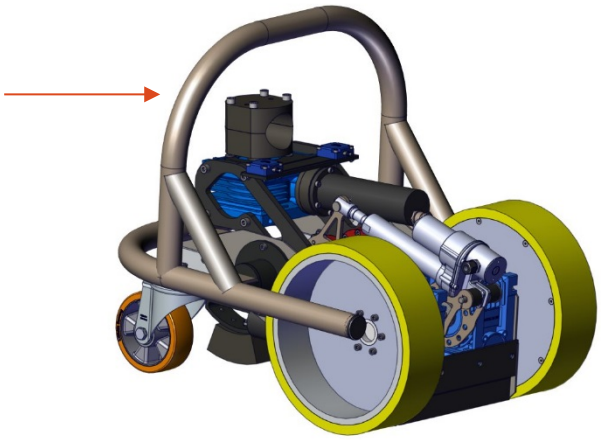
   Unroll the power cable entirely. Connect the cable to the robot and the electric control box. Always use the securing latch to secure the connectors. Secure the cable on the robot by pushing the attached securing block over the two guiding pins.

   Connect the control box to the main power supply.

4. Keep a minimum of 6 meters from the robot during operation.
5. Test all functions briefly prior to using the robot.
6. Always keep a safe distance from adjacent equipment.
7. Always turn off the power supply when it is necessary to be in close proximity of the robot.

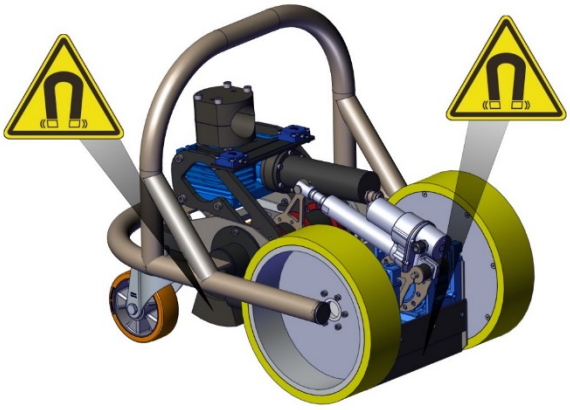
10.2 HANDLING THE ROBOT

1. Only the Stainless-steel bar on the robot and the main frame should be used to carry or move the robot. Other parts are not suitable for handling/carrying the machine.
2. When carrying the robot, 55 KG of weight should be taken into account. Always follow health and safety rules when handling the robot.



Handle bar

The magnetism is very strong, avoid getting caught between metal objects and the magnets!



Location of the magnetism

11 OPERATION

11.1 OPERATING PROCEDURE

First read the safety instructions in chapter 8 before starting the system. It is important to read all safety measures and to use the personnel protective equipment accordingly.

11.1.1 Starting up

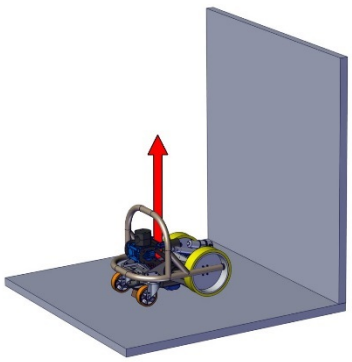
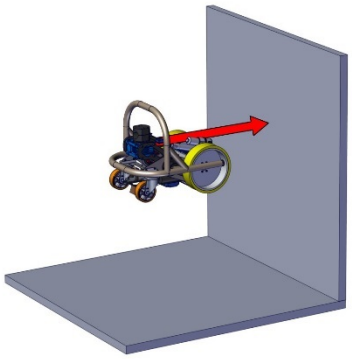
NOTE: Before using the robot it is mandatory to secure the robot with certified and appropriate fall arrestors.

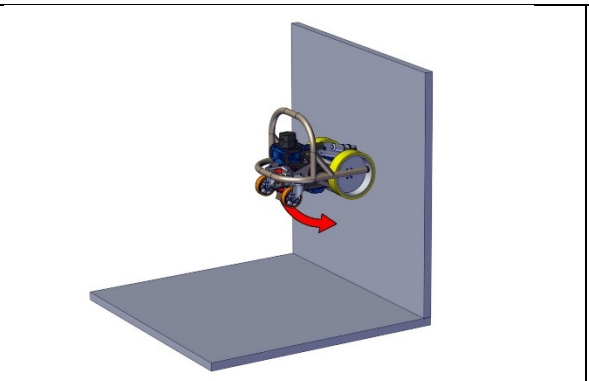
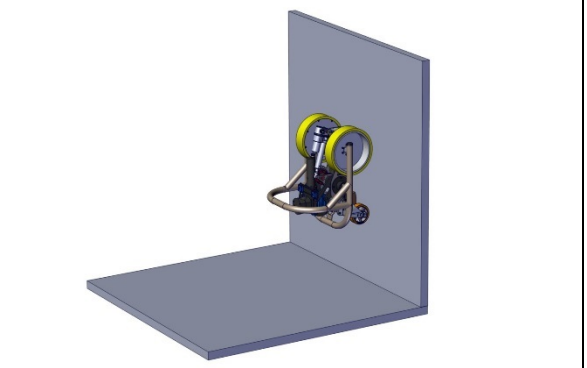
1. Always take into account the possible swing of the robot if it falls.
2. Take a minimum distance of 2 meters from the robot when turning on the power and or the remote control.
3. Test all functions briefly prior to using the robot.
4. Always keep a safe distance from adjacent equipment.
5. Always turn off the power supply when it is necessary to be in close proximity of the robot.

   Only use handle bar for handling the robot.

1. Take the carrier/robot out of the transport frame and place it either on a flat clean surface or on a vertical steel surface.

When placing the robot on a vertical surface follow instruction below.

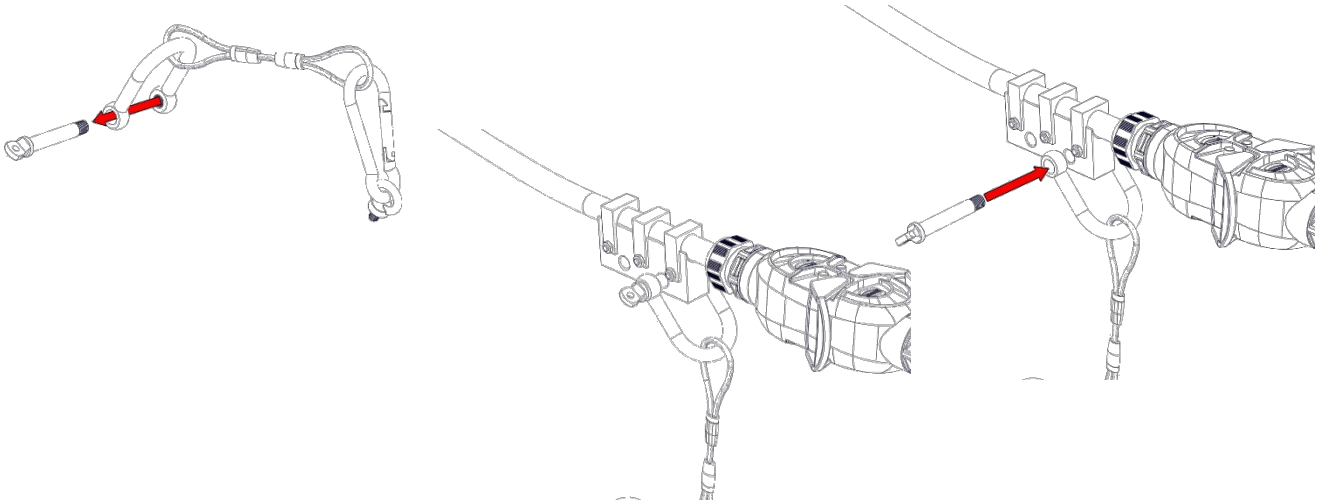
	1. Lift robot in horizontal position. **Avoid entrapment of hands and/or fingers!!!**
	2. Place the two front wheels on the steel surface. **Avoid entrapment of hands and/or fingers!!!**

	3. Lower the castor wheels. Avoid entrapment of hands and/or fingers. **Avoid entrapment of hands and/or fingers!!!**
	4. The magnetism will directly hold the robot on its place. **Avoid entrapment of hands and/or fingers!!!**

Make sure the swing arm is removed from robot before detaching, otherwise robot will not be able to detach from the wall!!!

2. Unroll the entire umbilical cable to prevent heat buildup and failure of signals.
3. Connect the male and female connectors on both robot and control box.

4. Connect the strain relieve on the robot and secure this with two locking pins as shown on the picture below.



5. Connect 230 V 50 Hz (16 Amp) to the control box.
   Make sure the power light on the control box is ON and the emergency stop button is pulled out.

6. Make sure the key K1 is fully inserted (K1 = black key at the right bottom corner).
   All the switches on the transmitter need to be in the OFF position.

   Unlock the emergency stop button. Turn on the transmitter by flipping the green switch to aux. The green light should stay on. If the light flickers, check the above procedure and repeat it.

11.1.2 Recover from an emergency stop

After an emergency stop, the system has to return to its initial state.

In case the robot has fallen and the fall arrestor is activated it is necessary to lower the robot and release the tension of the fall arrestor.

1. Turn all switches in the off position.
2. Unlock the emergency stop: pull out while turning it clockwise.
3. Connect to the control box by flipping the green switch (No. 2) up. (See figure “remote control panel”)

11.1.3 Shutting down

Reverse order of Starting up described in “starting up”

12 MAINTENANCE AND CLEANING

First read the safety instructions in chapter 0. It is important to read all safety measures and to use the personnel protective equipment accordingly.

The maintenance of all mechanical and electrical parts must be done according to the maintenance instructions of supplier/sub vendor.

Do not approach the robot if you have a pacemaker or implanted heart defibrillator. Keep 60 cm distance!

The wheels contain powerful magnets. When working on the robot extra caution should be taken to avoid direct contact between steel tools and the magnets. Use non-ferrous tools! Magnets are very strong and can cause injuries. The magnets will also affect sensitive electronic and mechanic equipment like cell-phones, watches and (bank) cards with magnetic strips.

Maintenance must only be performed by authorized and qualified personnel!

Customer is held liable for consequential damage or loss such as damaged products, production downtime, etc. by failure of the system due to inadequate maintenance or lack of maintenance.

12.1 FREQUENCY OF INSPECTION AND MAINTENANCE

In principle the robot only needs very little maintenance beside regular cleaning and replacement of worn tracks. All other parts only need to be replaced after inspection and judged to see if replacement is needed. It is recommended to inspect the robot on regular basis. Best inspection can be done by removing the tracks and inspect all parts.

Maintenance is to be performed on regular base according to Maintenance Inspection Schedule

12.2 MAINTENANCE INSTRUCTIONS

VertiDrive keeps a stock of the mechanical parts. See the M7 – 11.607 Parts manual supplied with the robot
When ordering parts specify the part number and describe shortly why a part needs to be replaced.

12.3 CLEANING

To insure maximum performance, it is important to keep the robot clean. The inside of the drive assembly should be kept clean as well (check regularly!). Dirt inside the driving assembly can be removed with (low, max 1 bar) pressurized air or water. When there is excessive build-up of dirt it will influence the flexible mounting of the magnets. In this case it is recommended to disassemble the drive unit and clean thoroughly. When reassembling the individual parts, it is important to ensure all are clean. Nuts and bolts should all be applied with (mounting) grease.

12.4 TROUBLE SHOOTING

When faults occur, it is recommended to contact VertiDrive.

13 STORAGE AND TRANSPORT

Do not approach the robot if you have a pacemaker or implanted heart defibrillator. Keep 60 cm distance!

When handling and transporting the robot extra caution should be taken to stay away from the magnets. The magnets are very strong and entrapment between the magnet or wheels and metal objects can cause serious injuries. The magnet will also affect sensitive electronic and mechanic equipment like cell-phones, watches and (bank) cards with magnetic strips. Keep those at least 50 cm away from the magnet!

When carrying the robot, 55 KG of weight should be taken into account. Always follow health and safety rules.

Storage:

- If the system is stored for a longer time, cover the equipment and be sure the place is dry and clean.
- Make sure all water is drained from the system before storage. It will prevent frost damage and legionella bacteria in the system.

14 DISMANTLING AND ELIMINATION

After lifetime, the system must be set secure according to the safety and environmental rules.
Only classified personnel, allowed to carry out maintenance may dismantle the system.

All contaminated or harmful parts must be disposed in accordance to the local statutory requirements.