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User Manual

VertiDrive M7.2 robot

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



INITIAL ISSUE DATE: REVISION: ISSUE DATE: APPLIES TO: 13-01-2023 1.02 13-01-2023 VertiDrive M7.2 – Robot

VertiDrive B.V.

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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 a technical specialist. The system should not be operated by unauthorized personnel or technical specialist without training.

Read the instructions carefully before installing, start of the 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 "M721 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 M7.2 robot are available, such as a safety winch system and specifically designed equipment. Contact the support department of VertiDrive B.V. for more information.

As a manufacturer, we strongly recommend to:

- V Contact VertiDrive B.V. for urgent questions.
- V Keep the manual in a dry, safe and available place for everyone who's involved.
- V 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.

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> > 3. RECORDS OF REVISIONS

Rev. No.	Issue date	Description	Drawn up by	Checked by
1.00	12-07-2022	First Issue	G.L.J. Veltman	S. van Diessen
1.02	13-05-2023	Updated on M7 configurations / IPM & serial numbers.	R. van den Berg	S. van Diessen
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4. CONTACT INFORMATION

4.1. **Supplier** VertiDrive B.V.

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4.2. Support and service Technical support:

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> > > 5. TERMS AND DEFINITIONS < < <

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

	Abbreviation	In full	Description
< <	°C < <	Degrees Celsius	
-	°E	Degrees Fahrenheit	
	ALARP	As Low as Reasonably	The ALARP principle applies when control measures are put into effect.
< <	< < <	Practicable	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 following European standards.
	cm	Centimeters	
	Confined space		A 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 poses a risk to safety, health, and wellbeing.
	dB(A)	decibels (absolute)	A measure of the relative loudness of sounds. A decibel is a unit derived
			from the bel, in the same way as a decimeter is derived from the meter.
			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 ensures a safe situation when activated.
	EN	European Norm	European standards such as e.g. NEN-EN. This is the European norm that
			applies in the Netherlands and is managed by the NEN (Nederlands
			instituut voor EenheidsNormen).
	High-pressure		Collective name for a high-pressure water jetting system or flush
	system		water system.
	High-pressure		A system, which may or may not be mobile, that consists of a drive,
	water jetting		pump, safety devices, HP hoses, a cleaning machine, or high-pressure
	system		jetting equipment, which can jet water under 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
	Va	Kilogram	
		Longth y width y hoight	
			Unit of illuminance (light intensity)
		Last-Minute Risk Analysis	This is a brief risk assessment carried out in the working area
	LININA		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	Personal Protective	>
		Equipment	
	НР	High Pressure	Working pressures from 25 up to 250 bar.
	UHP	Ultra High Pressure	Working pressures above 250 bar.
	Protective		A protection that is fitted over the HP hose to protect it against damage
	hose/sleeve	1	from the outside (e.g. by being dragged along the ground). \rightarrow

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>	>	\mathbf{i}	Unpressurized	The term 'unpressurized' 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.
>	>	\geq	Whip check	A device consisting of a cable with loops that is installed at the coupling
<	<	<	< < <	of an HP hose. This ensures that the HP hose cannot whip around randomly if the coupling comes loose.
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6. MACHINE SPECIFIC INFORMATION

< < 6.1. General specifications</p>

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Product description:M7.2 - RobotLocation: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 M7.2 Robot

6.3. Technical design

Robot

Robot dimensions I x w x h: Weight: Driving speed:

Electrical

Remote control system: Range: Power: 650 x 550 x 520 mm 55 kg max 4,8 m/min

Hetronic Nova 100 meters 230V, 50Hz, 16 Amp (CEE plug)

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6.4. Applicable tools

The M7.2 Robot can be equipped with different types of applications.



6.5. Changeover applications

The procedure for changing applications over is described in the application user manuals.

6.6. Applicable documents

M7.2 - User manual

[applied with carrier]

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7. CE MARKING AND LIABILITY

7.1. General

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Vertidrive M7.2 fulfills all relevant requirements to be used safely. To accomplish this, several instructions are described in this manual and shall be followed before and during operation.

The following harmonized standards have been applied:

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

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

7.2. Intended and non-intended use of the machine

The VertiDrive M7.2 robot is a remote-controlled 4-wheel vehicle that through 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 following 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. Before the use of the robot, VertiDrive and/or an authorized VertiDrive representative/trainer will demonstrate and instruct 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, the 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. M7.2 robot may lead to severe damage and injury to the user.

The VertiDrive B.V. M7.2 robot must not be changed in any way without the 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 to 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 this manual.

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7.6. Liability

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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.
- V 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 <u>8 mm</u>. Lower values will decrease the holding force of the permanent magnets and increase the risk of getting detached from the surface.
- Y For optimal adhesion, the distance between wheels and metal should be no more than <u>3mm.</u>
- 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 large radius curved surfaces only. The robot can handle certain curved surfaces as instructed by authorized VertiDrive personnel. Practical instruction on how to avoid curved surfaces is explained during training.





Driving on a surface with a radius

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> 8. SAFETY

Safety instructions in this manual are based on <u>SIR</u> (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.

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8.2. Safety signs on the system

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	Meaning: Risk: Location:	High voltage, applies to the control box and electrical connections of components. Electrical hazard. Control box, electrical components.
	Meaning: Risk: Location:	Magnetic field Magnets produce a far-reaching, strong magnetic field. They could damage TVs and laptops, computer hard drives, credit and ATM cards, data storage media, mechanical watches, hearing aids, and speakers. In between the front and back wheels, see figure below.
	Meaning: Risk: Location:	Pinch point. Pinching hands or fingers. Near the wheels.
	Meaning: Risk: Location:	Danger for pacemakers and implanted heart defibrillators 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. Near the magnets.
Keep 6 meters distance while machine is in operation	Meaning: Risk: Location:	Danger for injection by (U)HP water jet (if applied). 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.g. by water jetting from a suddenly leaking HP hose or HP connection. Near the robot and hoses



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8.3. General safety instructions

The M7.2 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 an LMRA in the 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.

- V Thinking up solutions or measures to remove the perceived risks or make them acceptable
- **Y** 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 before performing a task or following a procedure. Always secure the robot against falling with appropriate and certified fall arrest equipment.

When the robot does fall it may 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.

Before usage, mark an area- with yellow/black ribbon to ensure a distance to the 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. Before the use of the VertiDrive M7.2 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.*

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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 with the robot.

8.3.3. During operation

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Always keep visual contact with the robot during usage.

Never stand underneath the robot!!

Be aware: If the robot falls it may swing towards the operator and or other people in the vicinity.

Always use protective clothing and use appropriate facial protection.

Before 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 the operator while operating.

Keep at least 6 meters away from the robot during operation.

Always pay attention to the slack of rope/hoses on the floor, the operator might be 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 mechanical 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 the 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 is 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:

V Shuts off the High-pressure jetting equipment.

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

- V Stops all movements of the robot;
- Y 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 loses 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 integrating 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 from becoming fully detached from the machine in case the UHP coupling fails.

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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 / Action sign
Control box.	During maintenance by work on the 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 / Action 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 / Action sign
Handling robot.	Always.	Wear safety boots.	
Handling robot.	During the operation of the robot.	Wear a safety helmet.	0
Handling robot	During handling of the robot	Wear protective gloves.	

8.6.4. Injuries on face and eyes

Where	When	Precaution	Warning sign / Action sign	
Near robot UHP nozzles.	During operation with UHP.	Keep at least 6 meters distance. Wear face protection.		N

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8.6.5. Hearing damage

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-			Where	When	Precaution	Warning sign / Action sign
\geq	>	\geq	Near robot and UHP pump,	During operation near the	Wear hearing protection.	
<	<	<	if a UHP pump is applied.	robot's nozzles and UHP pump. Noise exceeds 80dB.		
>	>	>	> > >			
<	<	<	< < <			J

8.6.6. Liquid injection by UHP water jet

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

8.6.9. Magnetism

Where	When	Precaution	Warning sign / Action sign
The wheels contain powerful magnets.	During maintenance/ adjustment/ handling.	Use non-ferrous tools.	
The wheels contain powerful magnets.	Always.	Do not approach the robot if you have a pacemaker or implanted heart defibrillator. Keep 60 cm distance.	
The wheels contain powerful magnets.	During maintenance/ adjustment/ handling.	Handle robot by the handlebar during (un)mounting.	
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9. SYSTEM DESCRIPTION

9.1. General

The VertiDrive M7.2 robot ("the Robot") is a remote-controlled 4-wheel vehicle which through 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 through Ultra High Pressure (UHP).

9.2. M7.2 - robot



Exploded view M7.1 Robot



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

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Control box in transport frame and lever

#	Part name	Explanation
01	Power indicator.	The green light turns on when the system is powered on.
02	Emergency stop.	Switch to shut down the system.
03	Winch connector left.	For connecting left winch.
04	Winch connector right.	For connecting right winch.
05	Support legs.	Supports frame and prevents transport frame from tipping over.
06	Lever.	For moving transport frame.
07	Cable power supply.	The main power supply of the system.
08	Cable gland pump switch.	To take cable for pump switch into the control box.
09	Connector umbilical robot.	For connecting the umbilical robot.
10	Cable winders.	For manually winding up the umbilical robot.
11	Keyholes control box.	For opening and closing control box.

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

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9.4. Remote control panel

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







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Remote control

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#	Part name	Explanation
1	Indicator light	To check system on
2	Swingarm speed control	Not applicable for M4 robot
> >3	Swingarm control (on/off)	Not applicable for M4 robot
4	Swingarm control (up/down)	Not applicable for M4 robot
5	Step control (off/slow/fast)	For M4 robot use "Off"
> >6	Emergency button	Precondition:
11	1	V 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 (e.g. UHP pump); Magnetism will not be influenced.
7	Drives speed control	To adjust the driving speed
8	Joystick robot control	To adjust the driving direction of the robot
9	Counterbalance drives control	To counterbalance drive speed left/right
10	Pump control	To turn the pump on/off
11	Winch selector	To select left/right/both winch(es) – For details check manual transport frame (if used)
12	Joystick winches control	To position winches for optimum fall protection (if used) – For details check manual transport frame.
13	Swingarm overrule	
14	Light control (on/off)	To turn light on/off (optional)
15	Connection switch.	To Connect remote control with the control box.
16	On/Off switch / Safety key.	For turning on the remote control, turn clockwise. Remove the key to prevent unexpected starting of the system.



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Check if the key of the remote control nr. 16 is removed during inspection/maintenance. With the key removed, there's no risk of unexpected operation of the system.

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9.5. Safety winch system (optional)



Winch system

A winch system, integrated into 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 with 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 cables 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, a 100-meter line is available (breaking strength 3000 kg). With these lines, the position of the fall arrestor and attached hoses can be controlled.

- V 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.

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



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The two pulleys on either end do need to guide the line to heave in and out smoothly. To avoid sway in case the robot loses 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, vacuum hose, and air hoses should be tied together and lifted simultaneously using the winch system.

All connections:

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- To and from the pulleys.
- From UHP hose to winch system.
- From fall arrestor to winch system.
- Etc.

Should be made with certified slings/ strops !!!





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



Always secure transport frame to a solid object or structure 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.

The lifting eyes are also suitable for lifting the transport frame.

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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. Before the use of the VertiDrive M7.2 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.

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

: > +3°C (avoid frost) to +40°C

The environment must meet the following requirements

Ambient temperature operating

Commissioning the robot

- 1. Before 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 into account the possible swing of the robot when the robot falls.
- 2. Perform the robot inspection procedure before connecting it to power (and, if applicable UHP pump). For a full detailed description see M7.2 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 the 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 before 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 close to the robot.

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> > 10.2. Handling the Robot

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1. Only the Stainless-steel bar on the robot and the mainframe should be used to carry or move the robot. Other parts are not suitable for handling/carrying the machine.

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



Handlebar



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



Location of the magnetism

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11.OPERATION

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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

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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.** <u>Test</u> all functions briefly before 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 close to the robot.

Only use the 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 the instruction below.



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Make sure the swing arm is removed from the robot before detaching, otherwise the 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 the robot and control box.



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



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.



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.

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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. The fall arrestor needs to be replaced immediately after each fall incident, the activated fall arrestor needs to be inspected before re-use is allowed. Refer to the fall arrestor user manual for detailed instructions.

- 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"

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12.MAINTENANCE AND CLEANING

12.1. General

First, read the safety instructions in chapter "Safety". 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 the 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 mechanical equipment like cell phones, watches, and (bank) cards with magnetic strips.



Maintenance must only be performed by authorized and qualified personnel!



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

12.2. Frequency of inspection and maintenance

In principle, the robot only needs very little maintenance besides 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 regularly according to Maintenance Inspection Schedule



12.3. Maintenance instructions

VertiDrive keeps a stock of the mechanical parts. See the M7.2 – Parts manual supplied with the robot When ordering parts specify the part number and describe shortly why a part needs to be replaced.

12.4. Cleaning

To ensure maximum performance, it is important to keep the robot clean. The inside of the drive assembly should be kept clean as well (check regularly!). The dirt inside the driving assembly can be removed with (low, max 1 bar) pressurized air or water. When there is an 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 it thoroughly. When reassembling the individual parts, it is important to ensure all are clean. Nuts and bolts should all be applied with (mounting) grease.

12.5. Troubleshooting

When faults occur, it is recommended to contact VertiDrive.



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13. STORAGE AND TRANSPORT

13.1. General

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

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 mechanical 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 <u>dry and clean</u>. 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

14.1. General

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

After a 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 following the local statutory requirements.



After a lifetime, the system must be set secure according to the safety and environmental rules. Only classified personnel are allowed to carry out maintenance may dismantle the system. All contaminated or harmful parts must be disposed following the local statutory requirements. All magnets need to be demagnetized before disposal.

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 |
 THE NETHERLANDS

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 SALES@VERTIDRIVE.COM
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 CHAMBER OF COMMERCE 24448205
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 VAT NL 8201.77.064.B01

In all cases where we act as provider or supplier, our offers, orders placed with us, and agreements concluded with us are subject to the conditions and requirements laid down by the Netherlands Metal Association (the 'Metaalunievoorwaarden') These conditions and requirements are filed with the registrar of the District Court of Rotterdam.

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Attachment A - EU declaration of conformity

	vertidriv	'e	EU Declaration of conformity	CE
>> < < >>	> > > < < < > > >			
<	EU	Declaration of	conformity	
< <	We,			
	Company name: Postal address: Postcode: City: Country: Telephone number:	VertiDrive B.V. Gieterijweg 15 3089 JZ Rotterdam The Netherlands +31 (0) 10 76 20 300		
	Email:	sales@vertidrive.nl		
	declare that the declaration the following product:	of conformity is issued unde	er our sole responsibility and be	elongs to
	Object of the declaration:	VertiDrive Robot for steel	surface cleaning	
	Туре:	M7.2 Robot		
	The object of the declaratio harmonization legislation: Machine directive 2006/42/ EMC directive 2014/30/EU	n described above is in confo EC	ormity with the relevant Union	
	The following harmonized s	tandards and technical speci	fications have been applied:	
	NEN-EN-ISO 12100 Safety of	machinery - Risk assessment	and risk reduction	
	A complete Technical File is 600-23-001 M7.2 Robot	held at Vertidrive B.V. in Ro	tterdam under reference:	> 3
	Signed for and on behalf of:		Marros	
	Rotterdam	13-01-2023	Contraction of the second seco	222 2
	Place of issue	Date of issue	S.L.M. van Diessen,	
			Managing director	>>> <
			5 5	

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