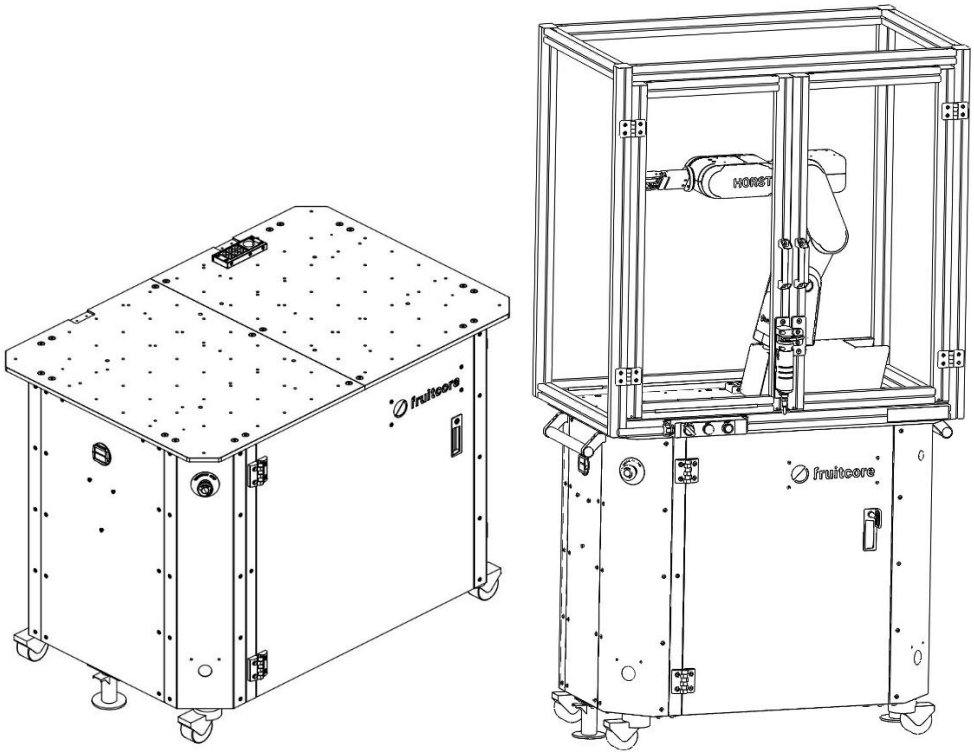
Mobile Robot Base
expandable to Solution Kit



Installation instructions

For installation, operating and maintenance personnel al-
ways keep with the product!

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An up-to-date version always available at www.horstcosmos.com.

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Subject to design and machine alterations

Contents

Abbreviations

AI ..... *Assembly Instructions*
I/O ..... *Input-/Output*
EMC ..... *Electromagnetic Compatibility*
ESPE ..... *Electro-Sensitive Protective Equipment*
HORST ..... *Highly Optimized Robotic Systems Technology*
SK ..... *Solution Kit*
T1/T2 ..... *Teach mode 1/2*
TCP ..... *Tool Center Point*

1. Introduction

1.1 Principle

This manual describes the installation and the safety measures to be taken when using the Mobile Robot Base (MRB) in various product configurations. It contains important information on how to operate the products safely and properly.

The operator is obliged to supplement the instructions with instructions based on existing national or company regulations for accident prevention and environmental protection.

Read the instructions carefully before putting the product into operation. Handle the manual with care and keep it available at the place of use. Any illegible or missing instructions must be replaced immediately.

1.2 General Information

The AI include a detailed description of the MRB and guidelines for transport and installation.

The delivered MRB may include options that deviate from the text and images shown in these AI. This is due to the individual adaptation and further development of the MRB on the basis of the requests and orders of the individual customers. These deviations do not constitute a basis for claims of any kind.

The MRB must be used only for the permissible purposes listed in the AI. The manufacturer assumes no liability for the improper or unauthorized use of the MRB, operating errors, user errors or improper or insufficient maintenance.

1.3 Operating Responsibility and Liability

Operating responsibility lies with the operator of the MRB. The operations manager and all operators are obligated to act according to these AI.

The safety and accident prevention regulations of the following institutions must be observed:

- The country's laws
- The trade associations
- The responsible commercial liability insurance company.

The operations manager, the operating personnel, or – if the former cannot be held responsible due to a lack of training or basic knowledge – their supervisory staff will be charged with accidents resulting from the failure to observe these AI, safety and accident prevention regulations, or a lack of care.

1.4 Legal Disclaimer

We expressly stipulate that the manufacturer shall not be liable for damage caused by incorrect or negligent operation, maintenance, or improper use. This also applies to modifications and additions as well as conversions of the MRB that may impair its safety. The manufacturer's liability shall expire in these cases.

1.5 Warranty

Unless otherwise agreed upon in the purchase contract, we will grant the legally prescribed warranty period for the MRB and spare parts, starting on the day of delivery. The warranty provisions specified in the general terms and conditions of fruitcore robotics GmbH or the individual purchase contract apply in addition.

1.6 Organizational Measures

The responsibilities when operating the MRB must be clearly defined and observed to ensure that no unclear responsibilities arise with regard to the aspect of safety. An operations manager must be appointed by the operator, see 2.4.2. In addition, the operator must observe and provide instruction on generally applicable legal and other binding regulations on accident prevention and environmental protection.

1.7 Standards, Directives and Conformity

1.7.1 Mobile Robot Base

The **Mobile Robot Base** complies with the following directives:

- Machinery Directive 2006/42/EC (and Low Voltage Directive 2014/35/EU)
- EMC Directive 2014/30/EU
- Directive RoHS 2011/65/EU

The following standards were applied in the development of the **Mobile Robot Base**

- DIN EN ISO 12100:2010
  Safety of Machinery – General principles of design – Risk assessment and risk reduction
- DIN EN ISO 13849-1:2015
  Safety of Machinery – Safety-related parts of control systems – Part 1: General principles of design
- DIN EN ISO 13849-2:2012
  Safety of Machinery – Safety-related parts of control systems – Part 2: Validation
- DIN EN ISO 13850:2015
  Safety of Machinery – Emergency stop principles of design
- DIN EN ISO 13855:2010
  Safety of Machinery – Positioning of safeguards with respect to the approach speeds of parts of the human body
- EN 60204-1/A1:2018
  Safety of Machinery – Electrical equipment of machines – Part 1: General requirements

Declaration of Conformity

The Mobile Robot Base is delivered with a declaration of conformity according to Annex IV of the Low Voltage Directive 2014/35/EC.

The conformity expires as soon as changes are made to the system or the system is integrated into other systems or machines.

1.7.2 Solution Kit Pick & Place

The **Solution Kit Pick & Place** complies with the following directives:

- Machinery Directive 2006/42/EC (and Low Voltage Directive 2014/35/EU)
- EMC Directive 2014/30/EU
- Directive RoHS 2011/65/EU

The following standards were applied in the development of the **Solution Kit Pick & Place**:

- DIN EN ISO 12100:2010
  Safety of Machinery – General principles of design – Risk assessment and risk reduction
- DIN EN ISO 10218-2:2012
  Robots and robotic devices – Safety requirements – Part 2: Robot systems and Integration

- DIN EN ISO 13849-1:2015
  Safety of Machinery – Safety-related parts of control systems – Part 1: General principles of design
- DIN EN ISO 13850:2015
  Safety of Machinery – Emergency stop principles of design
- DIN EN ISO 13855:2010
  Safety of Machinery – Positioning of safeguards
- DIN EN ISO 13857:2020
  Safety of Machinery – Safety distances to prevent hazard zones being reached
- DIN EN ISO 14119:2013
  Safety of Machinery – Interlocking devices associated with guards
- DIN EN ISO 14120:2015
  Safety of Machinery – Guards
- DIN EN 60204-1:2019
  Safety of Machinery – Electrical equipment of machines – Part 1: General requirements

Declaration of Conformity

The complete Solution Kit Pick & Place is delivered with a declaration of conformity according to Annex II A of the Machinery Directive 2006/42/EC. **The conformity expires as soon as changes are made to the product or the product is integrated into other systems or machines.**

1.7.3 Solution Kit Machine Tending

The **Solution Kit Machine Tending** complies with the following directives:

- Machinery Directive 2006/42/EC (and Low Voltage Directive 2014/35/EU)
- EMC Directive 2014/30/EU
- Directive RoHS 2011/65/EU

The following standards were applied in the development of the **Solution Kit Machine Tending**:

- DIN EN ISO 12100:2010
  Safety of Machinery – General principles of design – Risk assessment and risk reduction
- DIN EN ISO 10218-2:2012
  Robots and robotic devices – Safety requirements – Part 2: Robot systems and Integration
- DIN EN ISO 13849-1:2015
  Safety of Machinery – Safety-related parts of control systems – Part 1: General principles of design
- DIN EN ISO 13850:2015
  Safety of Machinery – Emergency stop principles of design
- DIN EN ISO 13855:2010
  Safety of Machinery – Positioning of safeguards
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- DIN EN ISO 14120:2015
  Safety of Machinery – Guards
- DIN EN 60204-1:2019
  Safety of Machinery – Electrical equipment of machines – Part 1: General requirements

Declaration of Conformity

The complete Solution Kit Machine Tending is delivered with a declaration of conformity according to Annex II A of the Machinery Directive 2006/42/EC. **The conformity expires as soon as changes are made to the product or the product is integrated into other systems or machines.**

ATTENTION!
To set the SK Machine Tending to the intended operating state, its guards must be adapted so that the robot can transport the workpieces out of and into the machine.

▶ Ensure that personnel are adequately protected in accordance with the applicable standards and directives (e.g. ISO 13855, 13857, 13854, 14120, 14119, etc.).

1.8 Signs, symbols

Lists

– Simple lists are marked with "–".

Instructions for action

All instructions for action for a procedure are listed in chronological order.

▶ Instructions are marked with "▶".

⇒ Intermediate results and end results of the action are marked with "⇒".

Note

This symbol stands for information that allows a more effective and economically efficient use of the MRB.

1.9 Marking of the Safety and Warning Signs

The following safety signs mark all actions that present a danger to the operator or others. Make sure to observe these signs and exercise particular caution in these cases. Also pass on the safety signs to other users.

DANGER!
The sign with the addition DANGER refers to an immediate danger.

The danger will lead to serious injury or death of persons.

▶ The description of the danger is followed by instructions for action that serve to avoid or remove the danger.

WARNING!
The sign with the addition WARNING refers to possible danger.

The danger can lead to serious injury or death of a person.

▶ The description of the danger is followed by instructions for action that serve to avoid or remove the danger.

CAUTION!
The sign with the addition CAUTION refers to a potentially hazardous situation.

The danger can lead to injury of persons.

▶ The description of the danger is followed by instructions for action that serve to avoid or remove the danger.

The safety signs are often used in combination with a pictogram in the text to clarify the source of the danger.

ELECTRICAL VOLTAGE!

This sign is a warning for electricity.

It is posted for all work and operating procedures that are to be observed precisely in order to prevent danger to persons and the system by electricity**.**

ATTENTION! Danger of damage to robot or property.

This sign indicates information that, if disregarded, presents a danger to the MRB, individual modules, or the operating environment. There is no risk of injury.

Wear protective clothing.

Wear your personal protective equipment:

Safety shoes, protective helmet, safety goggles, and work gloves.

Danger of environmental damage.

This sign indicates information that, if disregarded, presents a danger to the environment. There is no risk of injury.

2. Safety

2.1 General Safety Information

The mobile robot base (MRB) and the Solution Kit (SK) Pick & Place are quality products developed and manufactured according to the recognised rules of technology. They have left the manufacturer's works in perfect condition with regard to safety. They are designed and built according to the current state of safety technology. However, a residual risk always remains!

WARNING!

Incorrect operation or handling of the MRB can lead to severe personal injuries.

- ▶ Persons who work with the products must be familiar with the safety instructions in this manual and act accordingly.
- ▶ It is essential to observe the health and safety regulations and safety rules of the legislator, the supervisory authorities and the professional associations.

2.2 Proper Use

2.2.1 Mobile Robot Base

The MRB serves as a mounting surface for the HORST robot system from fruitcore robotics.

The MRB can be moved on swivel castors. The mounting points for the HORST robot system are prepared on the mounting surface. A slide-in compartment for the control cabinet and a holder for the operating panel of the HORST robot system are provided. The MRB has prepared mounting points for up to two safety laser scanners. The MRB can be locked to other machines with machine flanges. In addition, it has fastening possibilities on the two support stands for anchoring to the floor. The MRB may only be operated in dry, level indoor spaces with a solid base.

Please Note:

- The MRB must be used as intended and only in accordance with the AI and the enclosed documents. All information and safety instructions of the AI for the operating personnel must be observed. Any use that differs from or extends beyond this is considered improper and is expressly prohibited.

- In addition, the operator must observe and provide instruction on generally applicable legal and other binding regulations on accident prevention and environmental protection.
- All protection devices must be functional in order for the MRB to be used properly.
- Changes to or conversions of the MRB must not be made without the manufacturer's approval.

DANGER!
The MRB must not be used in rooms with a potentially explosive atmosphere.

2.2.2 Solution Kit Pick & Place

The SK is used for autonomous use of the HORST robot system from fruitcore robotics.

The SK can be moved on swivel castors. The mounting points for the HORST robot system are prepared on the mounting surface. A slide-in compartment for the control cabinet and a holder for the operating panel of the HORST robot system are provided. The SK has prepared mounting points for up to two safety laser scanners. The SK can be locked to other machines with machine flanges. In addition, it has fastening options on the two support feet for anchoring to the floor. The SK may only be operated in dry, level indoor spaces with a solid base. It is intended exclusively for handling non-hazardous objects.

Please Note:

- The SK may only be used as intended in accordance with these instructions and the enclosed documents. All instructions and safety regulations in the manual for the operating personnel must be followed. Any other use or use beyond this is considered improper and is expressly prohibited.
- In addition, the operator must observe and instruct generally applicable legal and other binding regulations for accident prevention and environmental protection.
- For the intended use of the SK, all protective devices must be functional and active.
- No modifications or conversions may be made to the SC without the approval of the manufacturer. Modifications must generally be subjected to a risk assessment. If the changes lead to increased or other hazards, the manufacturer's declaration of conformity becomes invalid.

DANGER!
The product must not be used in rooms with a potentially explosive atmosphere.

2.2.3 Solution Kit Machine Tending

The SK Machine Tending is designed for loading and unloading activities of machines. It may only be operated in dry, level indoor spaces with a solid base. It is intended exclusively for handling non-hazardous objects.

The HORST robot system can be flexibly positioned on the mounting surface thanks to prepared mounting holes. A slide-in compartment for control and a holder for the panel are provided.

The SK has prepared mounting points for one safety laser scanner per side. The mobile SK can be anchored to other machines or to the floor with machine flanges to prevent tipping.

Please note:

- The SK may only be used as intended in accordance with these instructions and the enclosed documents. All instructions and safety regulations in the manual for the operating personnel must be followed. Any other use or use beyond this is considered improper and is expressly prohibited.
- In addition, the operator must observe and instruct generally applicable legal and other binding regulations for accident prevention and environmental protection.
- For the intended use of the SK, all protective devices must be active.

ATTENTION!
To set the SK Machine Tending to the intended operating state, its guards must be adapted so that the robot can transport the workpieces out of and into the machine.

▶ Ensure that personnel are adequately protected in accordance with the applicable standards and directives (e.g. ISO 13855, 13857, 13854, 14120, 14119, etc.).

DANGER!
The product must not be used in rooms with a potentially explosive atmosphere.

2.3 Improper Use

Any use that is not described in subsection 2.2 or goes beyond it is considered improper use.

In the event of foreseeable misuse or improper handling of the MRB, the manufacturer's declaration of incorporation and thus the operating licence automatically expire.

2.3.1 Foreseeable Misuse Mobile Robot Base

Examples of foreseeable misuse include the following:

- Use in potentially explosive atmospheres,
- Use in medical and life-critical applications,
- Use prior to the implementation of a risk assessment of the entire application,
- Use with applications with insufficient response times of the safety functions,
- Use as a climbing aid,
- Operation outside of the permissible operating parameters or specified technical limits,
- Use of the MRB by persons who have not received appropriate instruction, training, or authorization,
- Operation without anchoring to the floor or other fixed object,
- Use of components that have not been approved by the manufacturer,
- Repairs to components performed by unauthorized personnel,
- Manipulation of power settings,
- Attachment of accessories or add-on parts that are not approved for use by the manufacturer,
- Removal or manipulation of protection devices, e.g. covers or speed restrictions,
- Use of unsuitable aids, e.g. tools or lifting gear,
- Operation of the MRB with defects,

These forms of misuse by operating personnel or third parties are strictly prohibited:

- The capacity load of the MRB must not be exceeded.
- Sensors must not be covered, masked off, or otherwise disabled. The configuration of sensors must not be changed under any circumstances.
- The enabling switch and other actuating elements must not be bypassed or otherwise manipulated or disabled.
- Work must be performed only in the operating mode appropriate for the respective situation.

2.3.2 Foreseeable Misuse Solution Kit Pick & Place

Examples of foreseeable misuse are:

- Coating / painting activities when explosion protection is required.
- Handling of components that may pose additional hazards,

- Use in medical and life-critical applications,
- Modification of the assembly without carrying out a risk assessment of the application,
- Use in applications where the reaction times of the safety functions are insufficient,
- Use as a climbing aid,
- Operation outside the permissible operating parameters,
- Operation without anchorage to the ground or other fixed object,
- use of the SC by personnel without appropriate instruction or training,
- Operation of the SC outside the prescribed technical limits,
- use of components, accessories and add-on parts not approved by the manufacturer,
- Repairs to components by unauthorised personnel,
- Manipulation of power settings,
- removal or manipulation of protective devices,
- Use of unsuitable aids, e.g. tools or lifting equipment,
- operation of the SK with defects.

These misuses by operating personnel or third parties are strictly prohibited:

- The carrying capacity of the robot or the base station must not be exceeded.
- Sensors must not be covered, taped over or otherwise rendered inoperative. The configuration of sensors must not be changed under any circumstances.
- The enabling switch and other actuating elements must not be bridged or otherwise manipulated or put out of operation.
- The robot may only be operated in the operating mode appropriate to the situation,
- The robot may only be used within the protective devices.

2.3.3 Foreseeable Misuse Solution Kit Machine Tending

Examples of foreseeable misuse are:

- Non-compliant adaptation of the guard,
- Coating / painting activities when explosion protection is required.
- Handling of components that may pose additional hazards,
- Use in medical and life-critical applications,
- Modification of the assembly without carrying out a risk assessment of the application,
- Use in applications where the reaction times of the safety functions are insufficient,
- Use as a climbing aid,
- Operation outside the permissible operating parameters,
- Operation without anchorage to the ground or other fixed object,
- use of the SC by personnel without appropriate instruction or training,
- Operation of the SC outside the prescribed technical limits,
- use of components, accessories and add-on parts not approved by the manufacturer,
- Repairs to components by unauthorised personnel,
- Manipulation of power settings,
- removal or manipulation of protective devices,
- Use of unsuitable aids, e.g. tools or lifting equipment,
- operation of the SK with defects.

These misuses by operating personnel or third parties are strictly prohibited:

- The carrying capacity of the robot or the base station must not be exceeded.
- Sensors must not be covered, taped over or otherwise rendered inoperative. The configuration of sensors must not be changed under any circumstances.
- The enabling switch and other actuating elements must not be bridged or otherwise manipulated or put out of operation.
- The robot may only be operated in the operating mode appropriate to the situation,
- The robot may only be used within the protective devices.

2.4 Operator's Duties

2.4.1 Risk Assessment by the Operator

DANGER!

Add-on parts, workpieces, or combining the MRB with other pieces of machinery can increase dangers or create new dangers.

- ▶ In order to ensure safety, the MRB must be installed in accordance with the guidelines specified in the standards DIN EN ISO 12100 and DIN EN ISO 10218-2.
- ▶ After you have assembled the MRB or integrated it in a system, perform a risk assessment for the entire system.

2.4.2 Operations Manager

DANGER!

Possible personal injuries caused by unsafe condition of the system.

- ▶ The operator is obligated to designate an operations manager at the installation location.
- ▶ The operations manager is obligated to operate the MRB only in perfect and safe condition.

In addition, the operations manager is obligated to:

- only let persons work on the MRB who are familiar with the fundamental regulations on occupational safety and accident prevention and who have read the AI,
- clearly determine the responsibility of the personnel for all phases of the product's lifecycle,
- supervise the safety-conscious behaviour of the personnel,
- encourage the personnel to wear protective clothing,
- provide the personnel with the necessary safety equipment.

The operations manager must conduct checks as to the safety-conscious and danger-conscious behaviour of the operating and maintenance personnel.

2.5 Operating Personnel

2.5.1 Obligation of the Operating Personnel

Before taking up work, all persons commissioned with working on the MRB undertake:

- to observe the fundamental regulations on occupational safety and accident prevention.
- to read the AI and follow its instructions and safety information.
- to check the MRB in terms of safety and proper function before starting work.
- to contact the operations manager or fruitcore robotics in case of questions.

2.5.2 Training of the Operating Personnel

DANGER!
Possible personal injuries caused by untrained operating personnel.

- The operating personnel must be trained on the work with and dangers of the MRB by authorized personnel commissioned by fruitcore robotics.
- Persons who have not received this training are not permitted to operate the MRB.

DANGER!
Possible personal injuries caused by the operation of persons undergoing training.

- Persons to be trained or taught as well as apprentices are only permitted to operate the MRB if supervision by a trained person with technical or electrotechnical training (teaching personnel) is ensured.

The operating personnel must be at least 18 years old and both physically and mentally fit to operate the MRB.

Instructed personnel with technical training may be used for the following activities:

- Operating the MRB in automatic mode
- Adjusting the system parameters (teaching modes T1 and T2)

Instructed personnel with technical and electrotechnical training may also be used for the following activities:

- Assembly and commissioning of the MRB
- Troubleshooting and fault rectification
- Inspection, maintenance, and repair

2.6 Working Area, Danger Zone, and Safe Area

The following definitions apply in combination with the robot system HORST.

The **working area** is a defined 3D space within the range of the robot. When tools, measuring devices, and workpieces are attached, the range of the robot and therefore its working area change.

The **stopping distance** is calculated on the basis of the reaction distance and braking distance of the robot.

The **danger zone** includes the working area and stopping distance of the robot. Persons must not be in the danger zone while the robot is in operation.

DANGER!
Due to the robot's automatic movement, sudden dangers must be expected within the danger zone. Moving modules may cause personal injury or property damage.

- The robot system must be operated only in technically perfect condition and with active safety equipment.
- The robot must be used only within suitable protection devices (e.g. separating protection device, light curtain, or safety laser scanner). The protection devices must stop the robot's movement within the danger zone.

The **safe area** is located outside the danger zone. Persons may be in this area during all operating modes.

2.7 Specific safety instructions

In combination with the HORST robot system, at least the following safety instructions must be observed; in addition, it is essential to observe the AI of the robot model.

WARNING!

Danger due to missing protective devices and defective / damaged assemblies or accessories

- ▶ Make sure that the robot is properly and securely screwed down.
- ▶ Ensure that there is sufficient space for the robot arm to move freely. There must be no obstacles in the working area. Be aware that attachments, tools and pieces change the working area of the robot.
- ▶ Make sure that suitable protective devices have been installed. The guards must stop the robot movements within the danger zone. Check that they are working properly.
- ▶ Do not enter the danger zone during operation.
- ▶ Only operate the products when they are undamaged. Never modify the products. fruitcore robotics excludes any liability if the product has been modified.

2.8 Residual dangers

The products are built according to the state of the art and the recognised safety rules. Nevertheless, hazards for the user or third parties or impairments of the system and other material assets may occur during use.

Observe the residual dangers described in the MA of the HORST robot system in all life phases of the robot system.

RISK OF CRUSHING AND IMPACT!

Possible personal injury due to the product rolling away

- ▶ Make sure that the product is placed on a horizontal, level, solid and non-moving surface.
- ▶ Anchor the product to another fixed object (see chapter 5.2.2).

2.9 Safety Information for Assembly and Commissioning

The following definitions apply in combination with the robot system HORST.

ELECTRICAL VOLTAGE!

Possible personal injuries caused by applied electricity.

- ▶ Make sure that the power supply is switched off while working on the robot and that it cannot be switched on again by accident.
- ▶ Work on the electrical equipment must be performed only by specialist personnel with appropriate training and in accordance with the electrotechnical rules.
- ▶ Use only the included cables to connect to the power grid. Do not use damaged cables.

DANGER!

Danger resulting from incorrect assembly and commissioning.

- ▶ Assembly and commissioning must be performed only by persons with technical and electrotechnical training who were also authorized by fruitcore robotics.

DANGER!

Danger due to missing protection devices and safety equipment as well as defective/damaged modules or accessories.

- ▶ Only commission the robot system with functional protection devices and safety equipment as well as functional modules or accessories.

WARNING!
Danger of impact and crushing due to robot movement.

- ▶ Close off the installation area and protect it against access by unauthorized persons.
- ▶ Secure the panel and Control (switch cabinet) against operation by unauthorized persons.

CAUTION!
Risk of injury due to overloading or the robot falling.

- ▶ The robot must be lifted by at least two persons in order to prevent overloading or the robot from falling.

CAUTION!

Damage due to the formation of condensate.

Never switch the robot on immediately if it has been brought from a cold environment into a warm environment. The condensate that forms in these conditions could damage the electronics. We recommend leaving the system overnight to adjust to the ambient temperature.

3. Technical Data

3.1 Mobile Robot Base

Tab. 1: Technical Data

	MRB S	MRB M	MRB L
Dimensions (LxWxH) [mm]	1085 x 602 x 919	1285 x 802 x 919	1500 x 998 x 922
Empty weight	90 kg	115 kg	157 kg
Maximum load	300 kg	280 kg	240 kg

3.2 Solution Kit Pick & Place

Tab. 2: Technical Data SK P&P

	Solution Kit H600	Solution Kit H1000	Solution Kit H1000 L
Dimensions (LxWxH) [mm]	1040 x 640 x 1940	1285 x 903 x 1940	1532 x 1103 x 2054
Total weight	182 kg	Ca. 252 kg	Ca. 310 kg
Weight of the components			
MRB	90 kg (S)	115 kg (M)	157 kg (L)
Guard	51 kg (S)	61 kg (M)	78 kg (L)
Robot	29 kg	64 kg	64 kg
Control	9 kg	9 kg	9 kg
Panel	2 kg	2 kg	2 kg
Gripper	ca. 0,5 kg	ca. 0,5 kg	ca. 0,5 kg

Ambient conditions	
Ambient temperature	0 – 40 °C
Humidity	10 % – 75 % Control must not be used in dusty or humid environments exceeding protection class IP54. Conductive dust must be particularly avoided.
Height above sea level	Up to 1000 m a.s.l without restrictions

3.3 Solution Kit Machine Tending

Tab. 3: Technical Data SK Machine Tending

	Solution Kit H1000
Dimensions (LxWxH)	1532 x 1101 x 2054 mm
Total weight	Ca. 312 kg
Weight of the components	
MRB	157 kg (L)
Guard	78 kg
Robot	64 kg
Control	9 kg
Panel	2 kg
Gripper	2 kg

Ambient conditions	
Ambient temperature	0 – 40 °C
Humidity	10 % – 75 % Control must not be used in dusty or humid environments exceeding protection class IP54. Conductive dust must be particularly avoided.
Height above sea level	Up to 1000 m a.s.l without restrictions

3.4 Scope of Delivery Mobile Robot Base

The MRB (incl. emergency stop button) is delivered with:

- Assembly instructions,
- 2x mounting set for anchoring the MRB to the floor,
- Control panel holder (optional),
- One or two flange plates with machine flange (optional),
- One or two safety laser scanners (optional),
- Docking station for accurate repetitive positioning (optional).

3.5 Scope of Delivery Solution Kit Pick & Place

The Solution Kit is delivered with:

- Assembly instructions,
- Docking station for accurate repetitive positioning (optional),
- And components according to the following table:

Tab. 2: Scope of Delivery of the available SKs

Solution Kit H600 grip	Solution Kit H600 vac	Solution Kit H1000 grip	Solution Kit H1000 vac
MRB S	MRB S	MRB M	MRB M
Robot system H600	Robot system H600	Robot system H1000	Robot system H1000
Gripper Zimmer GEP2010	Gripper Schmalz Cobot Pump	Gripper Zimmer GEP2010	Gripper Schmalz Cobot Pump
Jaw set	Bellows suction cup	Jaw set	Bellows suction cup
Safety fence S with guard locking and safety sensor	Safety fence S with guard locking and safety sensor	Safety fence M with guard locking and safety sensor	Safety fence M with guard locking and safety sensor

3.6 Scope of Delivery Solution Kit Machine Tending

The Solution Kit is delivered with:

- Assembly instructions,
- Guard L with guard locking and safety sensor,
- Schunk double-gripper JGP-P with user information,
- Docking station for accurate repetitive positioning (optional)

3.7 Type plate

The type plate of the MRB/ SK is located over the compartment for Control.

4. Description of the Mobile Robot Base

4.1 Modules

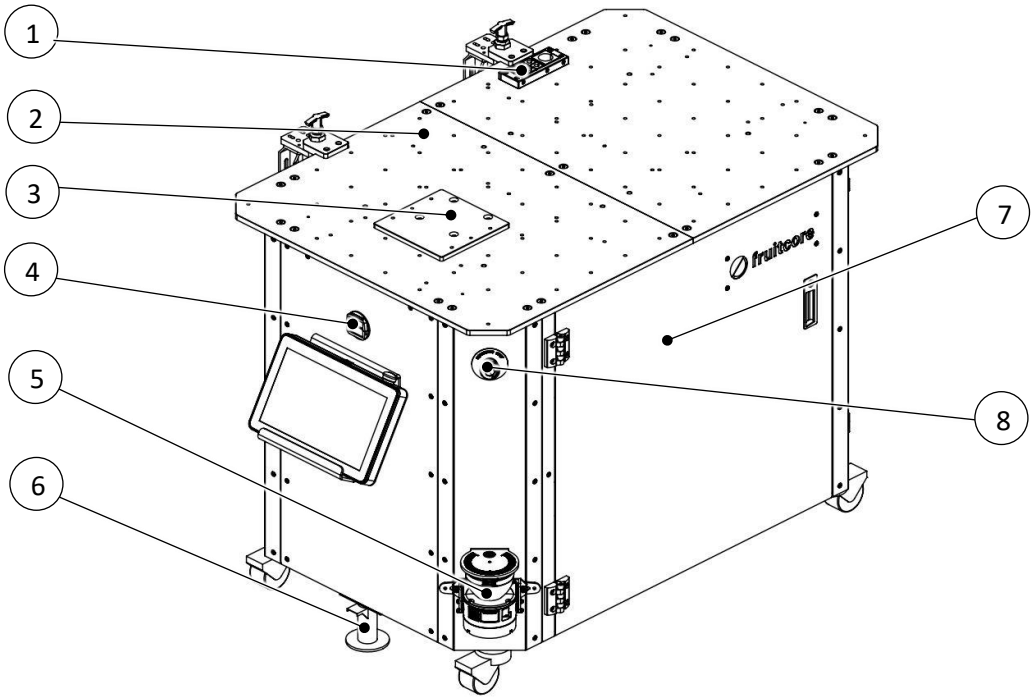


Fig. 4-1: MRB – front

1 Cable duct (for connection cable Control – robot)
2 Mounting surface
3 Adapter plate for mounting of the robot system HORST600
4 Cable duct (for connection cable Control – Panel)
5 Safety laser scanner (optional)
6 Lowerable support stand
7 Swing door
8 Emergency stop button

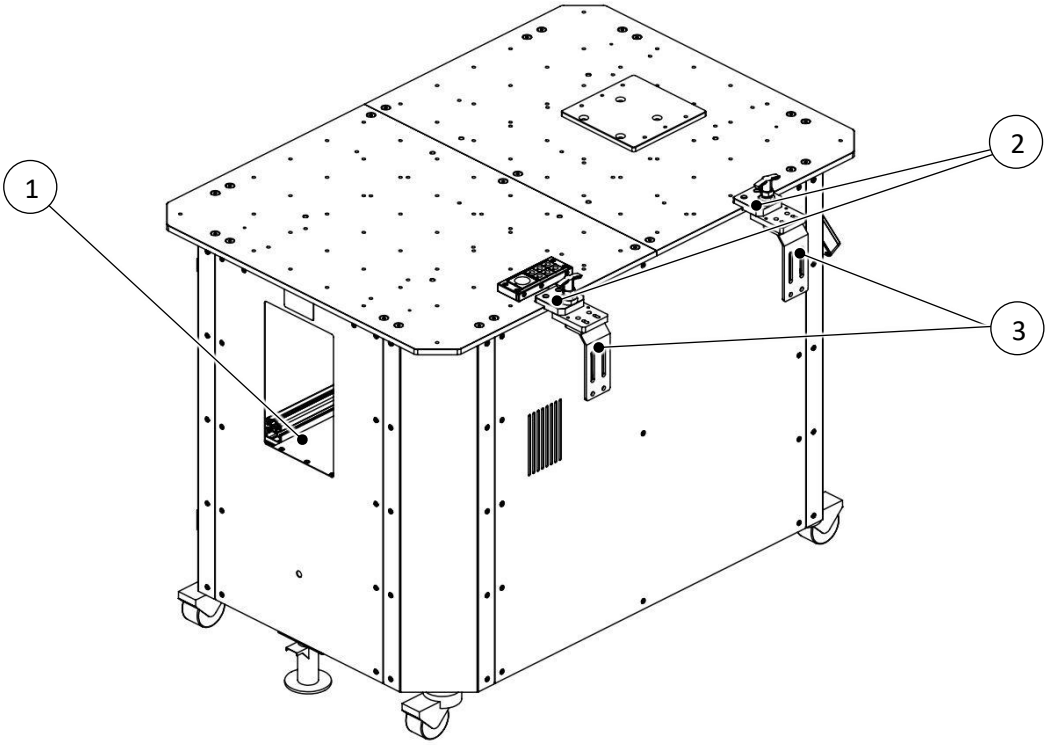


Fig. 4-2: MRB – backside

1 Flange plate
2 Machine flange (optional)
3 Insertion compartment for the control system of the robot system

4.2 Emergency stop button

1 Emergency stop button

The Emergency stop button is located below the mounting surface.

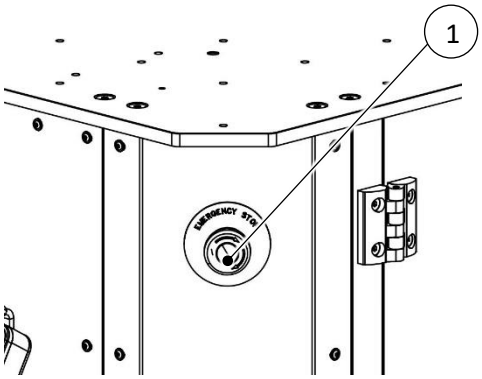


Fig. 4-3: Emergency stop button

For the connection of the emergency stop button to the robot system, follow the installation instructions of the robot system.

4.3 Mounting surface

The 100 mm drilling pattern of the mounting surface allows the robot to be mounted in different positions.

ATTENTION!
Changing the robot position changes the working area, which can cause damage

WARNING!
The robot's movements may cause the product to move unexpectedly

- Secure the product to the floor by bolting it down using the mounting kits, or
- Anchor the MRB to another fixed object (e.g. by the machine flange on an anchored machine).

WARNING!
When operating the HORST1000 or HORST1400 robots on the MRB, it must be bolted to the floor with the supplied mounting sets. This also applies to other machines that can cause comparable tilting moments.

If a HORST600 is operated on the MRB, it is permissible to secure the MRB by lowering the support feet. However, bolting to the floor is always recommended.

Risk of crushing and impact!
Possible personal injury due to tipping of the base

- Make sure that the MRB is set up on a horizontal, level, firm and non-moving surface.
- Anchor the MRB to the ground or to another fixed object (e.g. by the machine flanges on a firmly anchored machine).

Four positions are given as examples for the HORST600 robot. The supplied adapter plate of the HORST600 can be positioned as desired on the drilling pattern of the mounting surface.

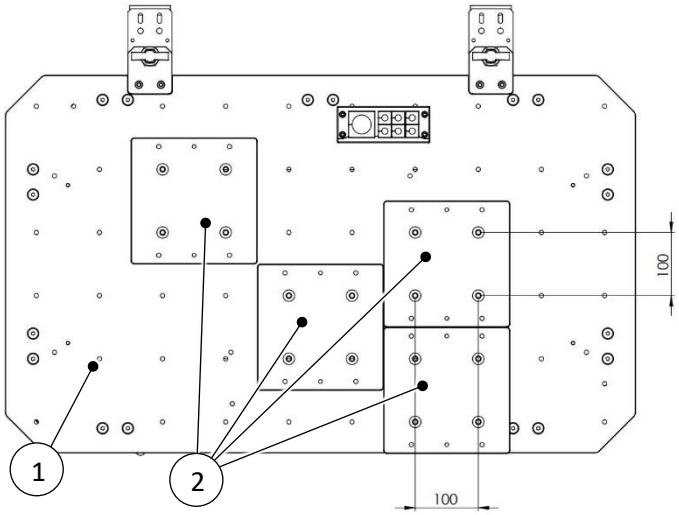


*Fig. 4-7: Positions for **HORST600** on the Mounting surface of the **MRB S***

1 Threaded holes M8 x 12
2 Possible mounting positions for the robot system HORST600

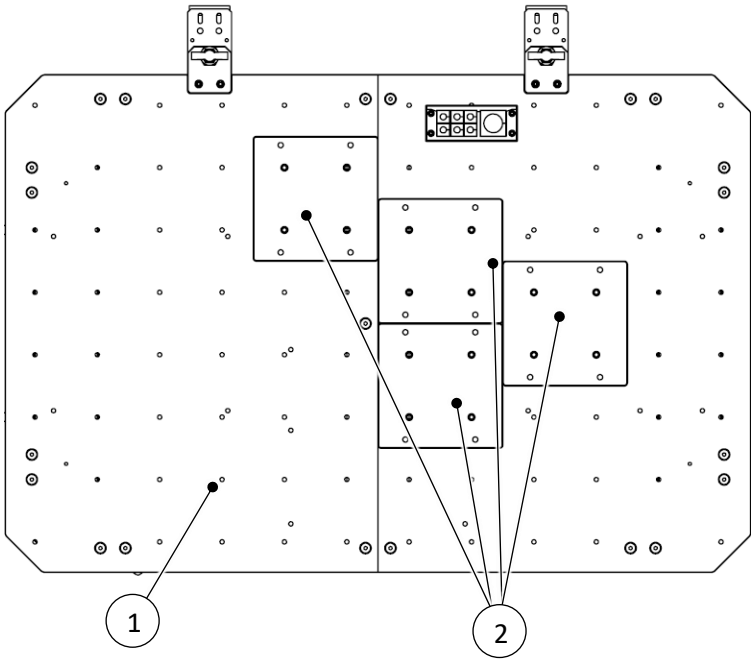


*Fig. 4-9: Positions for **HORST600** on the Mounting surface of the **MRB M***

1 Threaded holes M8 x 12

2 Example mounting positions for the robot system HORST600

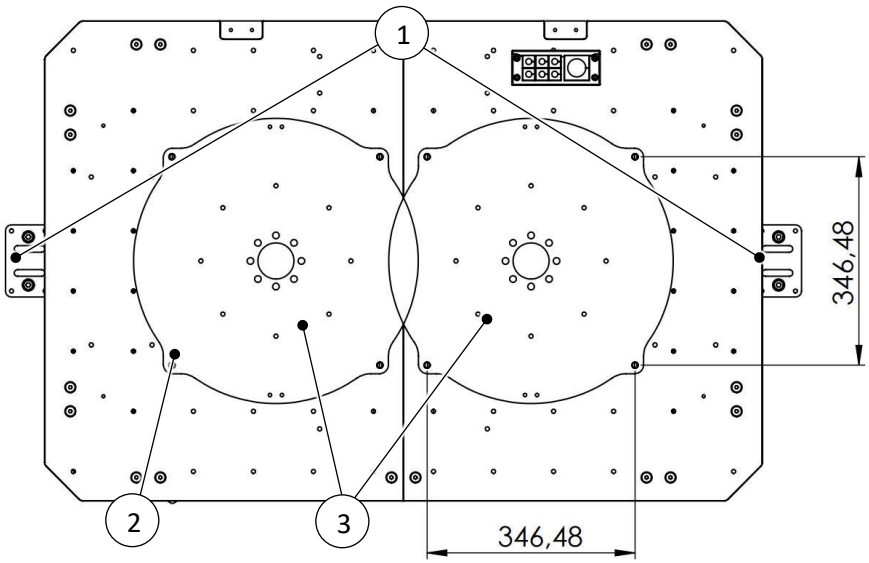


*Fig. 4-10: Positions for **HORST1400** on the Mounting surface of the **MRB M***

1 Mounting device for ground anchorage

2 Threaded holes M10 x 12

3 Example mounting positions for the robot system HORST1400

HORST1000 can be mounted in any position thanks to its base plate with matching hole pattern.

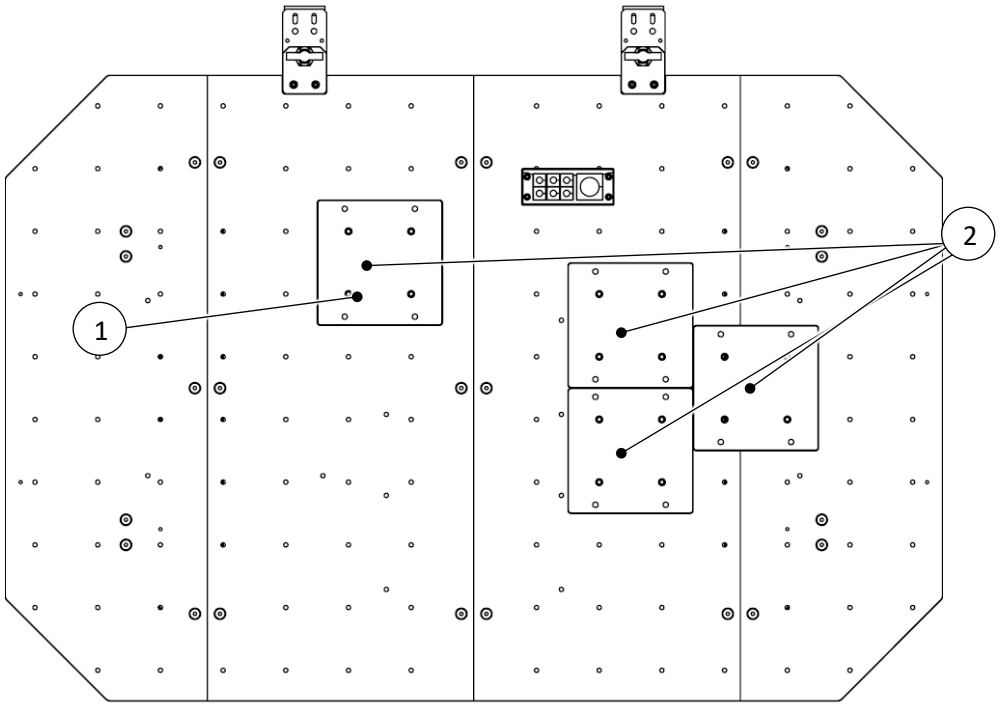


*Fig. 4-12: Positions for **HORST600** on the mounting surface of the **MRB L***

1 Threaded holes M8 x 12

2 Example mounting positions for the robot system HORST600

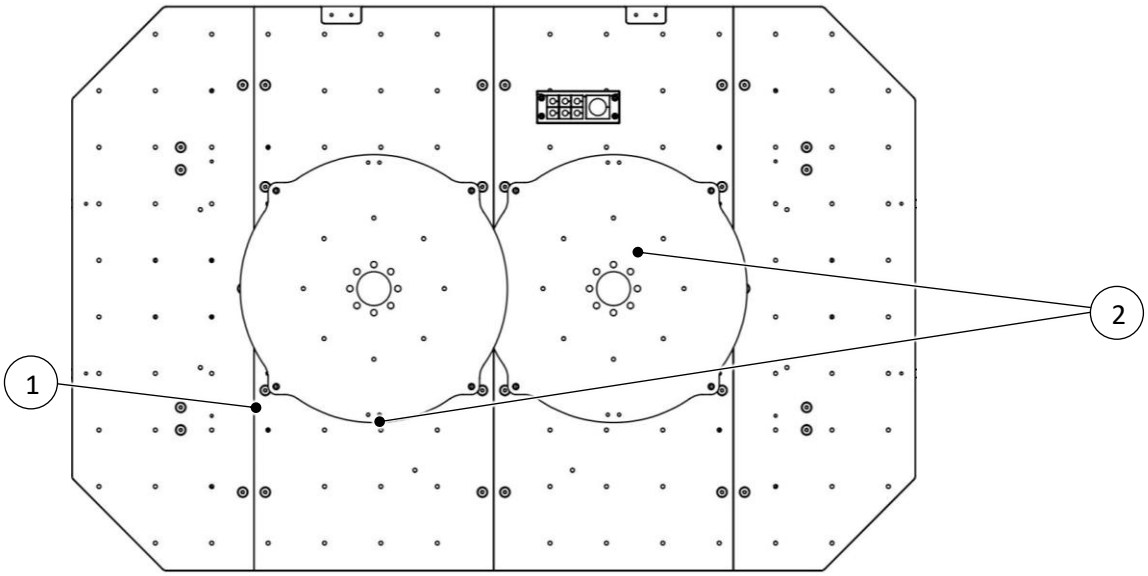


*Fig. 4-13: Positions for **HORST1400** on the Mounting surface of the **MRB L***

1 Threaded holes M10 x 12

2 Example mounting positions for the robot system HORST1400

4.4 Flange plates and machine flanges (optional)

On the Mounting surface of the MRB are notches for the mounting of the flange plates. With these flange plates and with the help of the machine flanges it is possible to attach the MRB on other machines.

The flange plate is attached to the mounting surface of the MRB with 3 supplied screws. The machine flanges are mounted on the machine. The MRB can then be fixed to the machine flanges with the help of the locking pins.

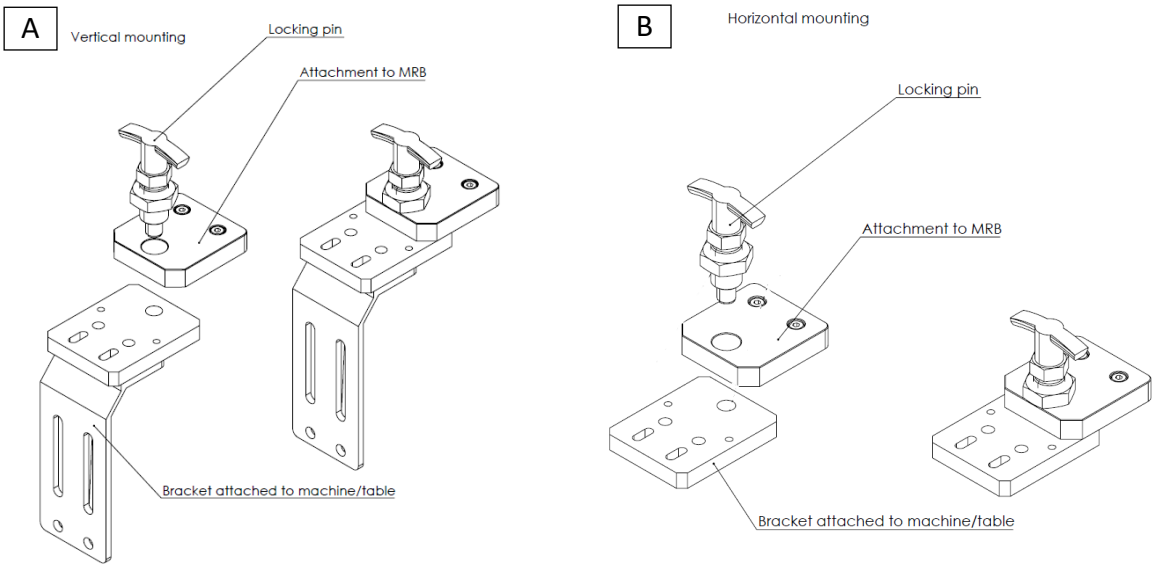


Fig. 4-14: Attachment flange plate to machine flange

A Machine flange mounted vertically with corner brackets

B Machine flange mounted horizontally

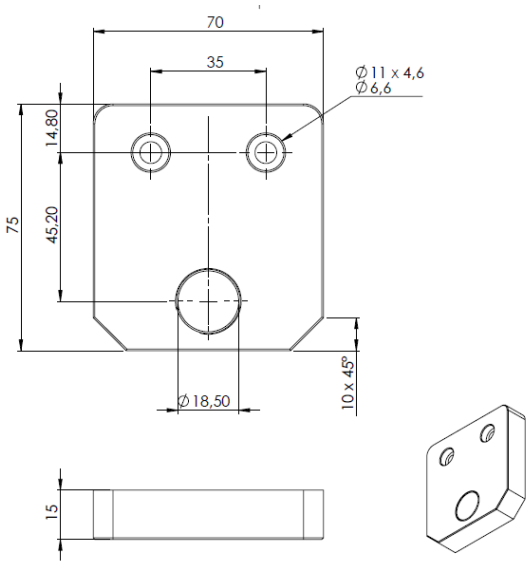


Fig. 4-15: Flange plate – mounting to MRB

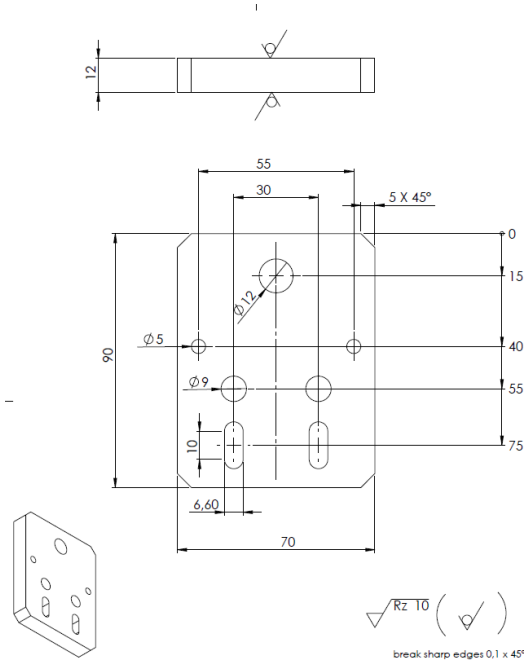


Fig. 4-16: Machine flange – horizontal mounting

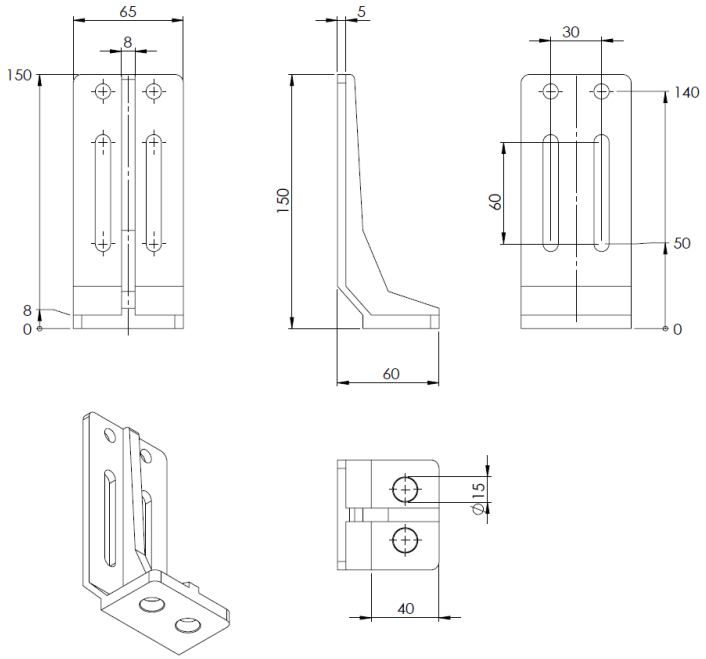


Fig. 4-17: Corner brackets for machine flange – vertical mounting

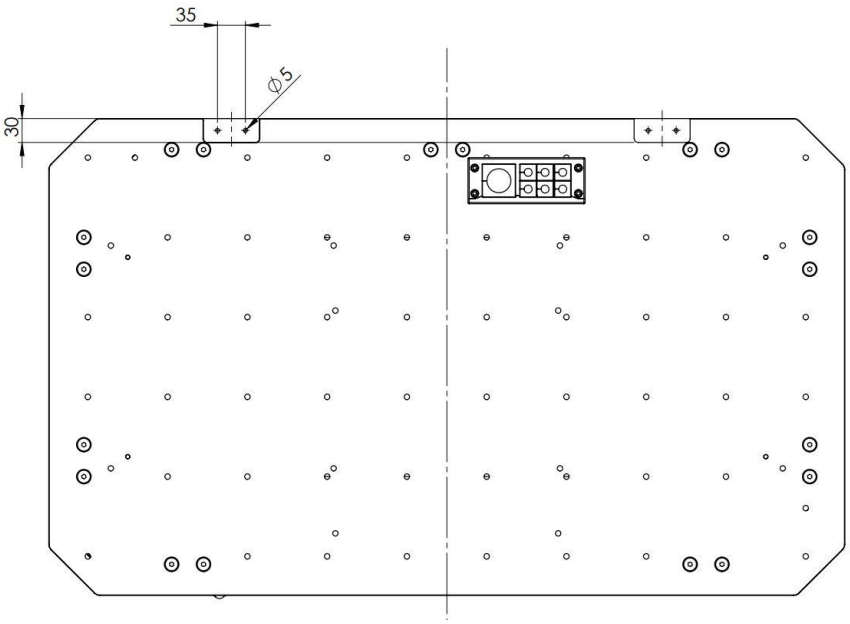


Fig. 4-18: Dimensions of notches for mounting devices (valid for MRB S, M und L)

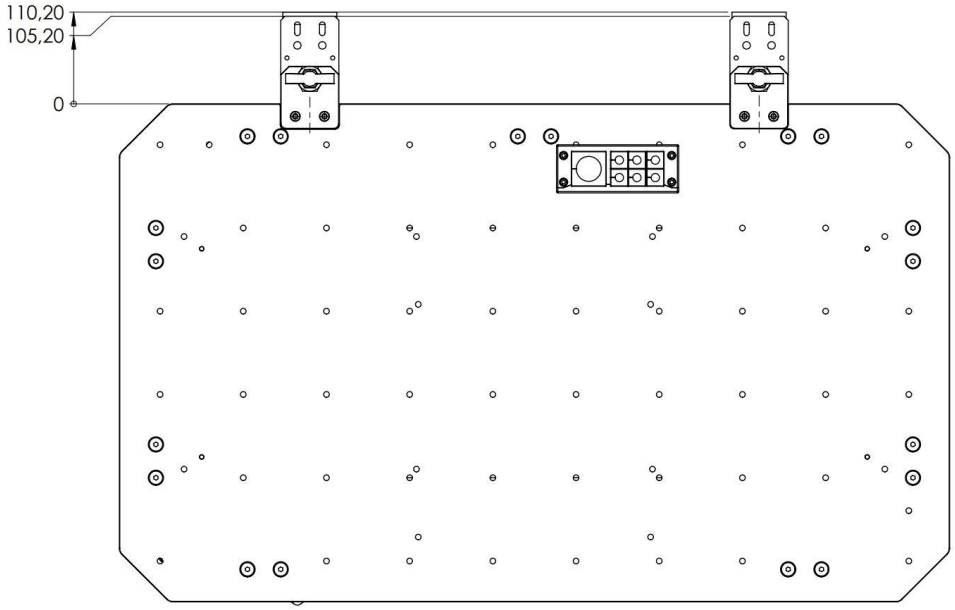


Fig. 4-19: Dimensions flange plates (horizontal mounting) and machine flange (vertical mounting), valid for MRB S, M und L

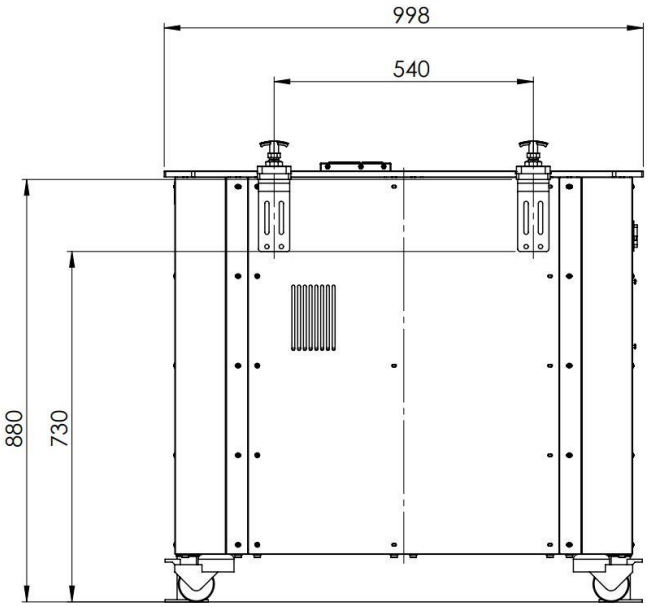


*Fig. 4-20: Dimensions mounting device for flange plates and machine flanges **MRB S***

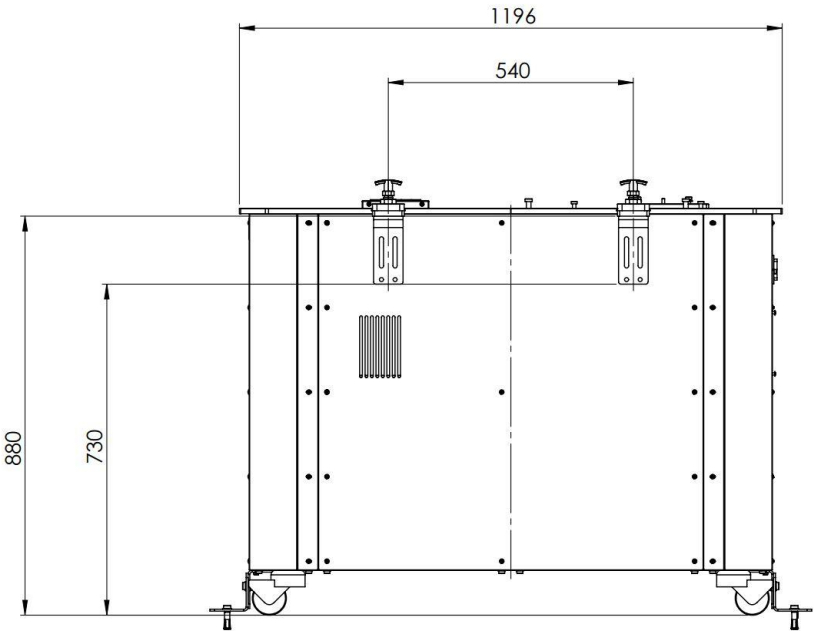


*Fig. 4-21: Dimensions mounting device for flange plates and machine flanges **MRB M***

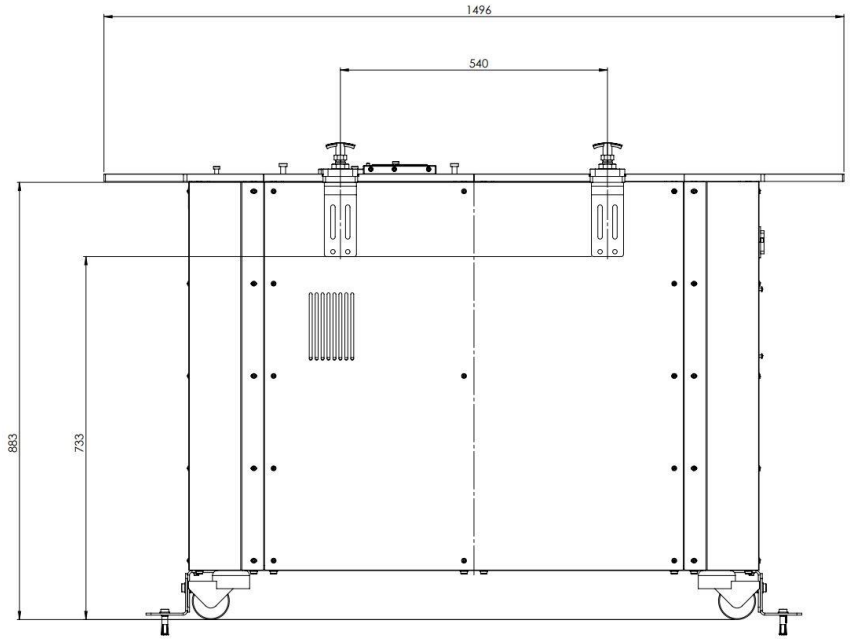


*Fig. 4-22: Dimensions mounting device for flange plates and machine flanges **MRB L***

4.5 Docking station (optional)

The MRB can additionally be equipped with a docking station, which allows accurate repetitive positioning of +/- 0.3 mm of the MRB at its place of use.

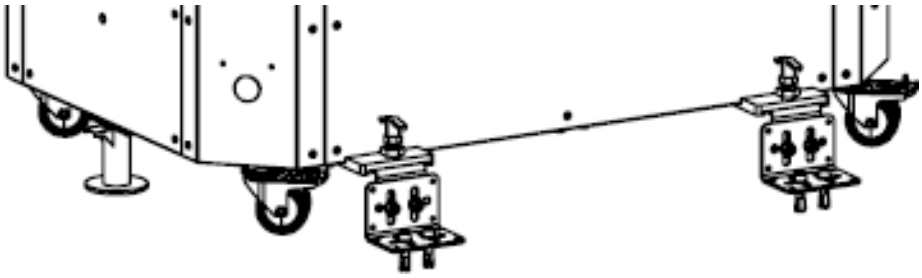


Fig 4-1: MRB with docking station

The two-part docking station consists of an angle for floor anchorage (1) and a tapered angle (2), which is positioned on the MRB by the matching guide in the centring plate (3). The whole thing is fixed by a centring pin (4).

For correct use, the entire docking station should first be mounted on the MRB and then fixed to the floor. After that, the application can be docked.

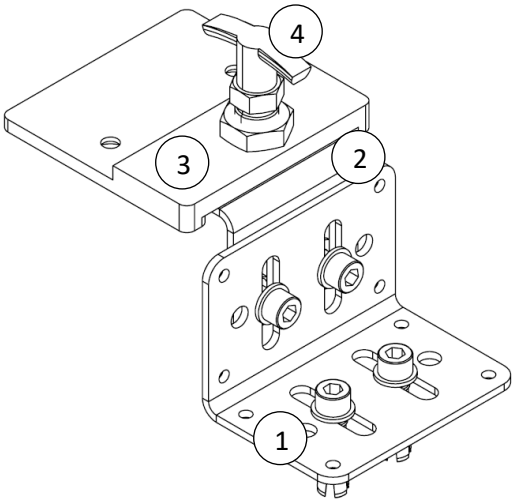


Fig 4-2: Docking station

5. Transport, Installation and Assembly

5.1 Transport

The MRB is transported by an authorised shipping company.

5.2 Installation

The product must be placed on a horizontal, level, solid, dry, vibration-free, non-moving surface.

▶ Move the product to the intended installation location.

WARNING!

The movements of the robot may cause the MRB to move unexpectedly:

- ▶ Secure the MRB to the ground by lowering the support stands or by bolting it to the ground using the mounting kits or
- ▶ Attach the MRB to another stationary object (e.g with machine flanges to another machine).

WARNING!
If the robot HORST1400 is operated on the MRB, it must be bolted to the floor with the supplied mounting sets.

- If a HORST600 or a HORST900 is operated on the base station, it is permissible to secure the MRB by lowering the support stands.
- Depending on the application, it may also be advisable to screw the MRB to the floor when operating a HORST600 or a HORST900.

5.2.1 Securing with drop-down support stands (optional)

- Secure the MRB by lowering the support stands (for the operation of H600)

1 Support stands
2 Castors with brakes

- Lower the support stands to the floor.
- Activate the breaks of the castors.

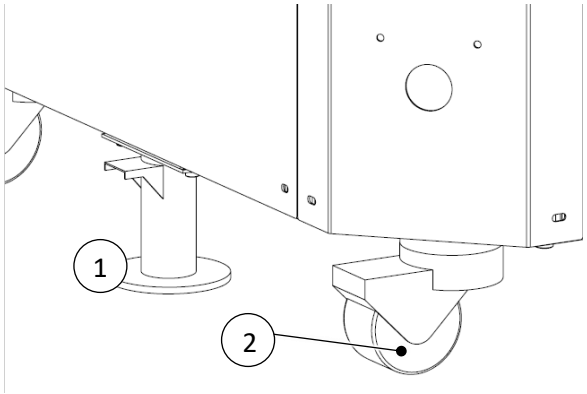


Fig. 5-1: Installation

5.2.2 Anchoring the MRB to the floor with mounting sets

- Before the mounting sets can be attached, the support stands must first be removed.

1 Mounting sets

- Drill two holes in the floor on both sides of the MRB (see Fig. 5.4). The length of the MRB can be found in *chapter 3*.
- Follow the manufacturer's instructions when drilling the holes and installing the anchors.
- Anchor the MRB on both sides with the supplied corner brackets and screws (see Fig. 5.3).

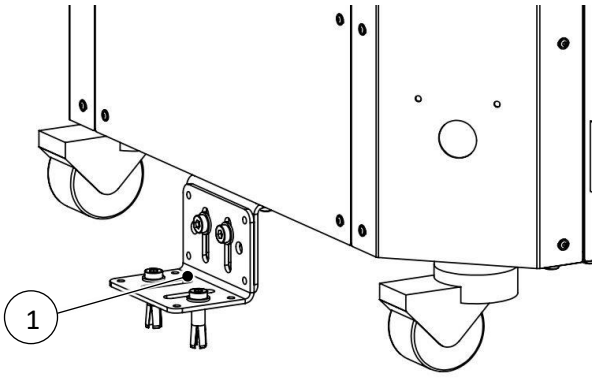


Fig. 5-2: Installation

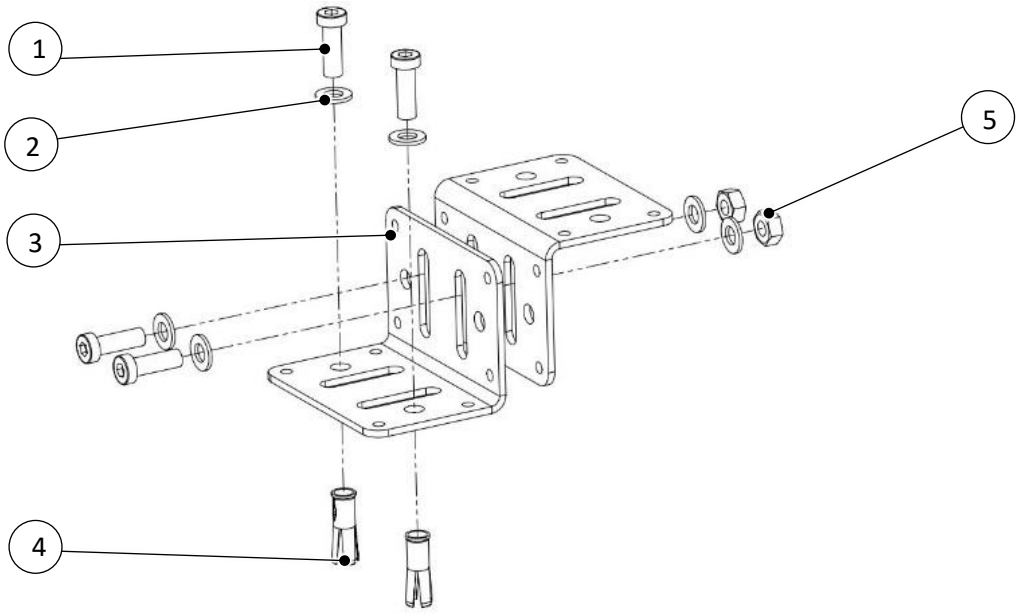


Fig. 5-3: Mounting set for anchoring the MRB to the floor:

1 4 x DIN 7984 M10x30
2 6 x DIN 125 M10
3 2 x Corner brackets for anchoring
4 2 x Hammerset anchors Fischer EAII M10x30
5 2 x DIN 4032 M10

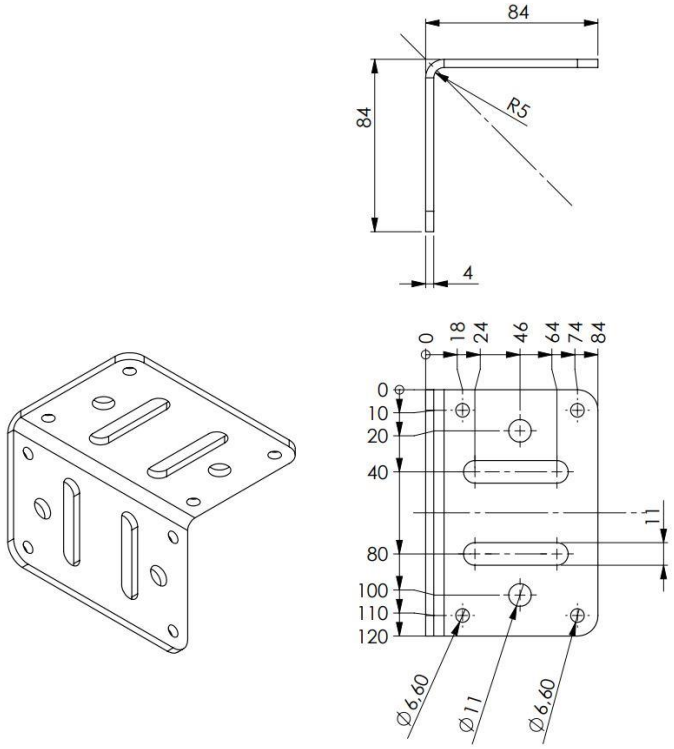


Fig. 5-4: Technical drawing of the corner brackets

5.3 Installation of the robot system

For information on transporting the HORST robot system, please refer to its AI.

ELECTRIC VOLTAGE!

Possible personal injuries caused by electricity

- ▶ Work on the electrical equipment must be performed only by specialist personnel with appropriate training and in accordance with the electrotechnical rules.
- ▶ Make sure that the power supply is switched off while working on the robot and that it cannot be switched on again by accident.
- ▶ Use only the included cables to connect to the power grid. Do not use damaged cables.

WARNING!

EMC problems may occur due to incorrect grounding.

- ▶ When grounding the robot system, ensure corresponding protective and functional measures as per DIN VDE 0100 and EMC Directive 2014/30/EU.
- ▶ Ensure that the robot system is properly grounded. I.e. there must be a shared electrical connection between all elements belonging to the system and ground.

WARNING!

Trip hazard

- ▶ Ensure that the cables and hoses for media and power supply are properly laid and secured

WARNING!

Unexpected movements of the robot

- ▶ Connect the power supply only after making sure that assembly has been correctly completed.

CAUTION!

Risk of injury due to the robot falling down.

- ▶ Secure the robot against tipping over until it has been fixed to the mounting surface.

ATTENTION!

Risk of damage to the robot.

Do not lift the robot by the swivel or support arm.

- ▶ Do not move the robot's axes by force.

The mounting points for the robot are prepared on the mounting surface. (see section 4.3).

- ▶ Position the robot on the mounting surface.
- ▶ Dismount the carrying aid from the base. (Keep it for further transports of the robot).
- ▶ Secure the robot against tipping until it has been fixed to the mounting surface.
- ▶ Secure the robot with the 4 supplied mounting screws (DIN 7984, M8x20) with a torque of 20 Nm.

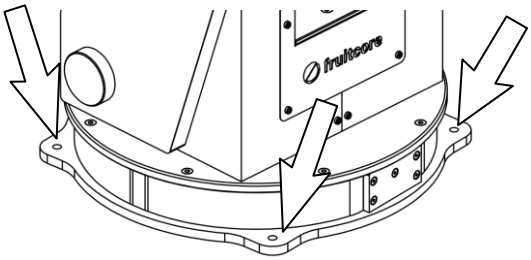


Fig. 5-2: Mounting screws secure points

1 Cable duct cover for I/Os

2 Interface for robot connection

The Interfaces for the I/Os are behind the cover (1).

▶ Remove the cable duct cover.

⇒ The I/Os are now accessible.

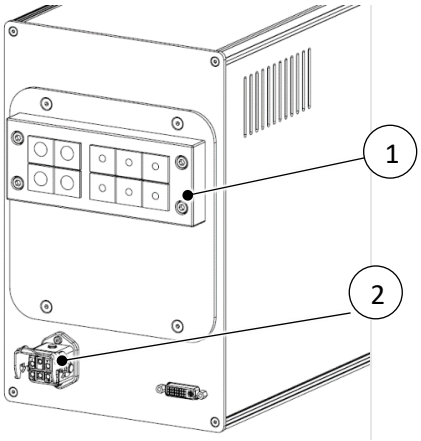


Fig. 5-3: Control – interfaces

▶ Reattach the cover to Control.

▶ Plug the cable for the robot connection into the control system and secure it.

DANGER!

Danger due to incorrectly connected emergency stop and safety stop devices

▶ Only use the interface for emergency stop I/O to connect external emergency stop devices. Do not connect any emergency stop devices to normal I/O or to the safety stop I/O.

▶ Only use the interface for safety stop I/O to connect external safety stop devices (e.g. safety laser scanners). Do not connect any safety stop devices to normal I/O or to the emergency stop I/O.

The description of the I/O interfaces can be found in the AI of the HORST robot system in the chapter "Technical data".

Information on the connection of emergency stop devices and safety stop devices can also be found in the documentation of the respective manufacturers.

The procedure for configuring the safety devices (e.g. safety laser scanners, light curtains) can be found in the documentation of the respective manufacturer.

▶ Connect the inputs/outputs to the control system. The cables must be routed through the cable duct cover.

▶ Connect the emergency stop button of the MRB and, if necessary, other external emergency stop devices to the interface for emergency stop I/Os on the control system.

▶ Connect the safety laser scanners of the MRB (optional) and, if necessary, other external safety stop devices (e.g. light curtains) to the interface for safety stop I/Os on the control system

▶ If necessary, connect further I/Os to the control system.

1 Interface to Control
2 Cable duct

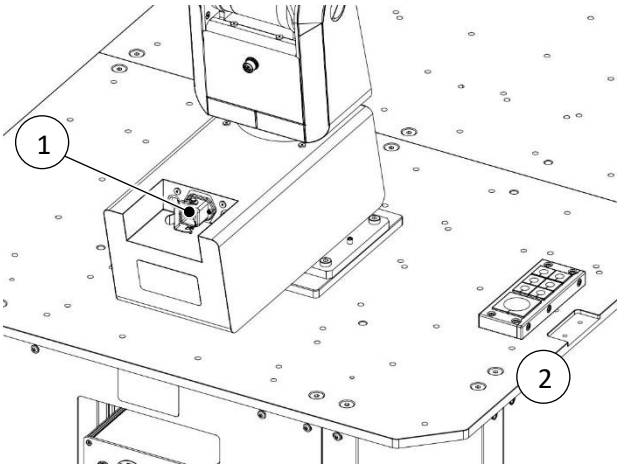


Fig. 5-4: Robot connection

- ▶ Guide the robot connection cable from below through the cable bushing of the mounting surface to the robot.
- ▶ Plug the cable into the interface on the robot and secure it.

1 Interface for robot connection cable

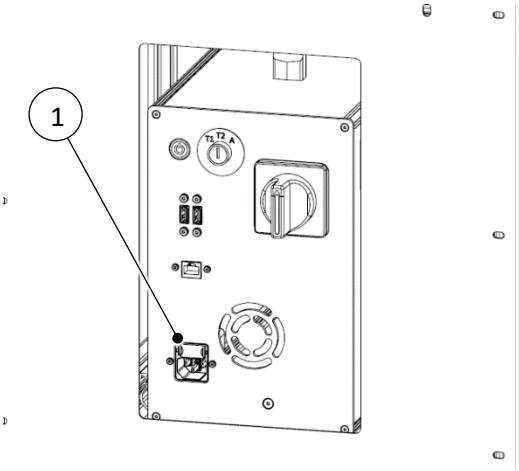


Fig. 5-5: Compartment for Control

- ▶ Insert the control cabinet into the compartment on the MRB.
- ▶ Arrange the power supply cable in a way that does not cause any hazards for the operating personnel due to the risk of tripping or slipping and that it is not within the range of movement of the robot system.

1 Cable duct (for Panel – Control)
2 Control panel holder

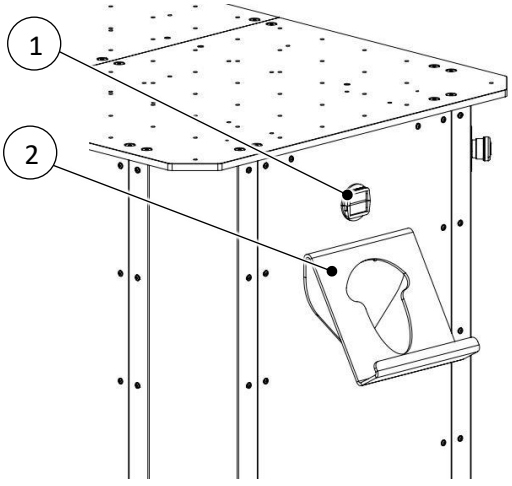


Fig. 5-6: Cable duct and panel holder

- The three through-holes (see arrows) have the same drilling pattern as the control panel holder.
- To fix the control panel holder to the MRB, 3 pieces DIN 912 M4x12 (cylinder head screw), 6 pieces DIN 125 M4 (washer) for inside and outside and 3 pieces DIN 934 M4 (hexagon nut) are required.

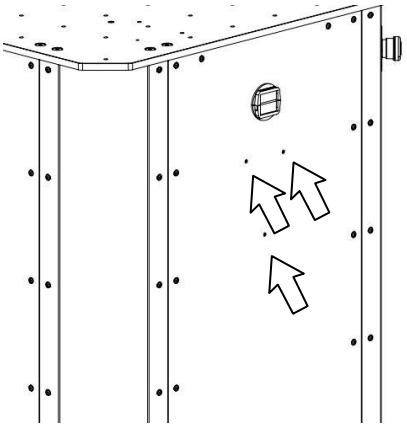


Fig. 5-7: Mounting of the control panel holder

6. Mobile Robot Base Product Configurations

Possible combinations of the MRB with other products and their installation situations are presented below. Deviating set-up situations must be subjected to a risk assessment. Please make sure that the final configuration and installation comply with the provisions of the applicable standards and directives. fruitcore robotics accepts no liability for configurations other than those as delivered.

6.1 Mobile Robot Base with Robot system HORST600

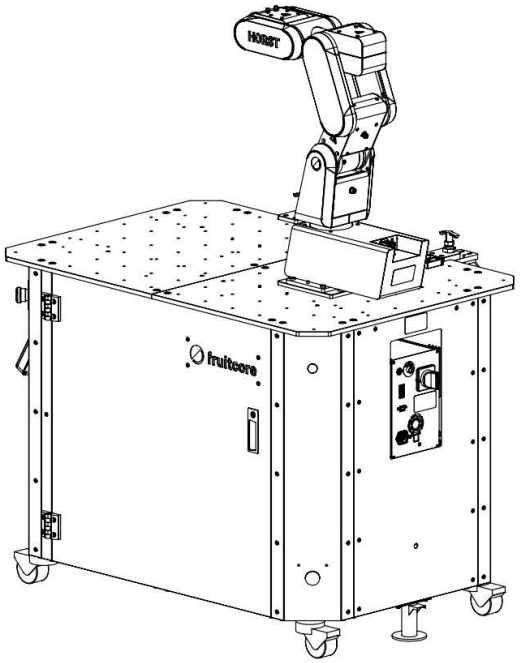


Fig. 6-1: MRB with mounted robot system Horst600

1 Robot system HORST600
2 Control of the robot system HORST

DANGER!

Due to the robot's automatic movement, sudden dangers must be expected within the danger zone. Moving modules may cause personal injury or property damage.

- The robot system must be operated only in technically perfect condition and with active safety equipment.
- Note that attachments and workpieces change the range of the robot and thus the danger zone.

RISK OF CRUSHING AND IMPACT!

Possible personal injury due to the MRB rolling away.

- Make sure that the MRB is set up on a horizontal, level, firm and non-movable surface.
- Secure the MRB by anchoring it to the ground or use the support stands or anchor the MRB to another fixed object.

If the HORST robot system is mounted on the MRB, it must be set up in such a way that the danger zone is protected by suitable safety devices.

6.2 Solution Kit Machine Tending

The SK Machine Tending mainly consists of the MRB L with safety fence L, the robot system HORST1000 and the Schunk double gripper JGP-P.

ATTENTION!

In order to transfer the SK Machine Tending to the intended operating state, its protective device must be adapted so that the robot can transport the workpieces out of and into the machine.

- In doing so, ensure that personnel are adequately protected in compliance with the relevant standards and guidelines (e.g.: ISO 13855, 13857, 13854,14120, 14119, etc.).
- It is important to avoid sharp edges and to maintain the correct distance from the danger zone.

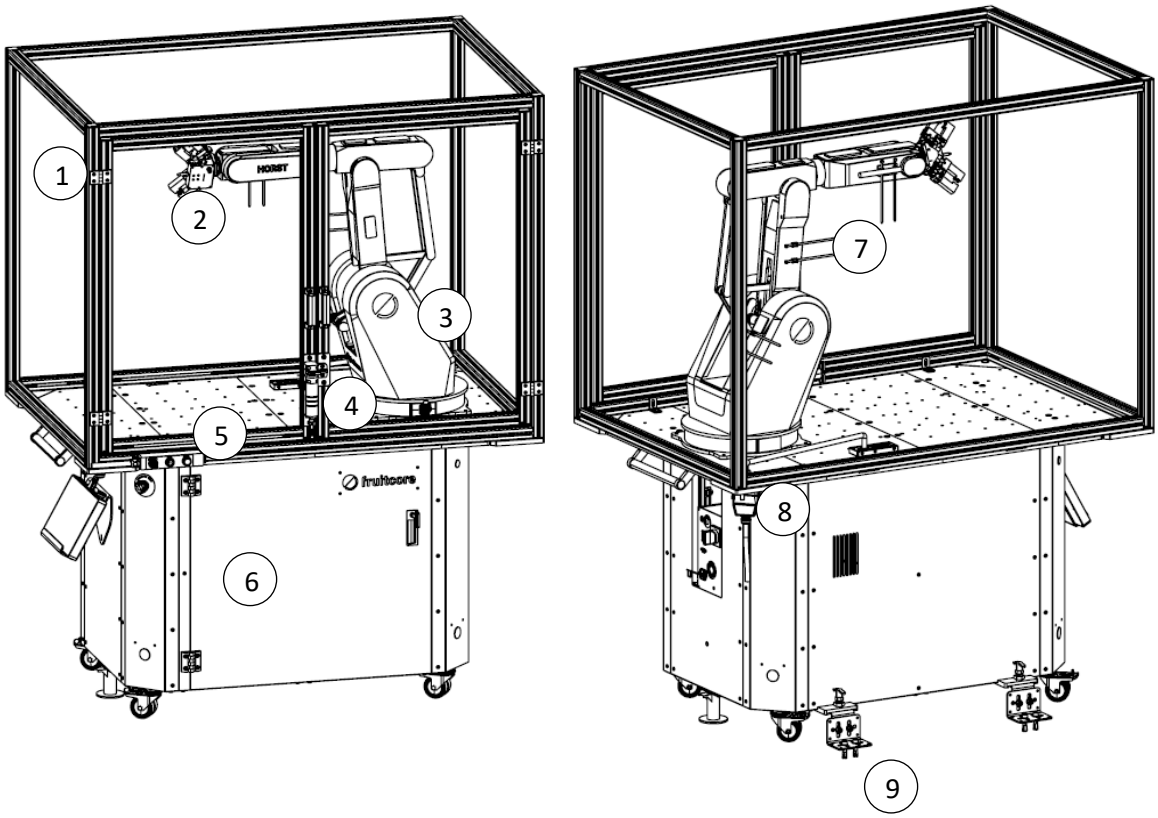


Fig. 6-2: SK Machine Tending - front and rear side

1 Guard L
2 Schunk double gripper JGP-P
3 Robot HORST1000
4 Mechanical bolt with safety sensor (SICK)
5 Operating console
6 MRB S
7 Mounting for compressed-air supply and signal cable
8 ½-inch quick-release compressed-air coupling for the gripper's compressed-air supply and machine interface (Harting plug) see the following detailed illustration (*Fig 6-1)*
9 Docking station for ground anchoring

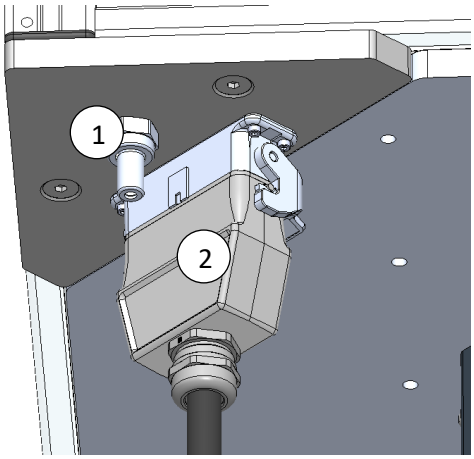


Fig 6-1: Quick release compressed-air coupling (1) and machine interface (Harting plug, 2)

6.2.1 Electronic Interfaces

Open cable end (Harting plug) for assembling the machine interface with the following signals:

Cord number open cable	Clamp Control	I/O HORST	Cord number open cable	Clamp Control	I/O HORST
1	X1.6	DI06	21	X5.3	SI5A
2	X1.7	DI07	22	X5.4	SI5B
3	X1.8	DI08	23	X5.5	SI6A
4	X2.1	DI09	24	X5.6	SI6B
5	X2.2	DI10	25	X7.3	SO2A
6	X2.3	DI11	26	X7.4	SO2B
7	X2.4	DI12	27	X7.5	SO3A
8	X2.5	DI13	28	X7.6	SO3B
9	X2.6	DI14	29	X8.1	SR5A1
10	X2.7	DI15	30	X8.2	SR5A2
11	X9.1	DO01	31	X8.3	SR5B1

12	X9.2	DO02	32	X8.4	SR5B2
13	X9.3	DO03	33	X4.1	TA
14	X9.4	DO04	34	X4.2	TA
15	X9.5	DO05	35	X4.5	TB
16	X9.6	DO06	36	X4.6	TB
17	X9.7	DO07	37	X13.1	24V
18	X9.8	DO08	38	X15.1	GND
19	X10.1	DO09	39	Reserve	Reserve
20	X10.2	DO10	PE	-	-

6.2.2 Operating console and guard locking

See 0.

6.2.3 Programming Schunk double gripper

The gripper requires taught-in values for the correct positioning of the gripper jaws in the closed state. Teach sequence for teaching the gripper jaw sensor (workpiece gripped / not gripped) is provided as a global function (see user information horstFX). Functions for opening and closing the gripper are also available as global functions.

For more information see user information Schunk MTB JGP-P.

6.2.4 Compressed air interfaces

The compressed air supply for the Schunk gripper is provided via the ½-inch compressed-air quick coupling. A compressed-air supply line with 6 bar nominal pressure (min. 2.5 bar, max. 7 bar) and a volume flow of at least 3000 cm³/s must be connected to it (cf. User Information Schunk MTB JGP-P paragraph 5.3.1).

6.2.5 Docking station

The SK Machine Tending is delivered with a docking station for accurate repetetive positioning, see 4.5.

6.3 Solution Kit Pick & Place

The SK is available in various configurations.

The MRB S configuration with HORST600 is shown below.

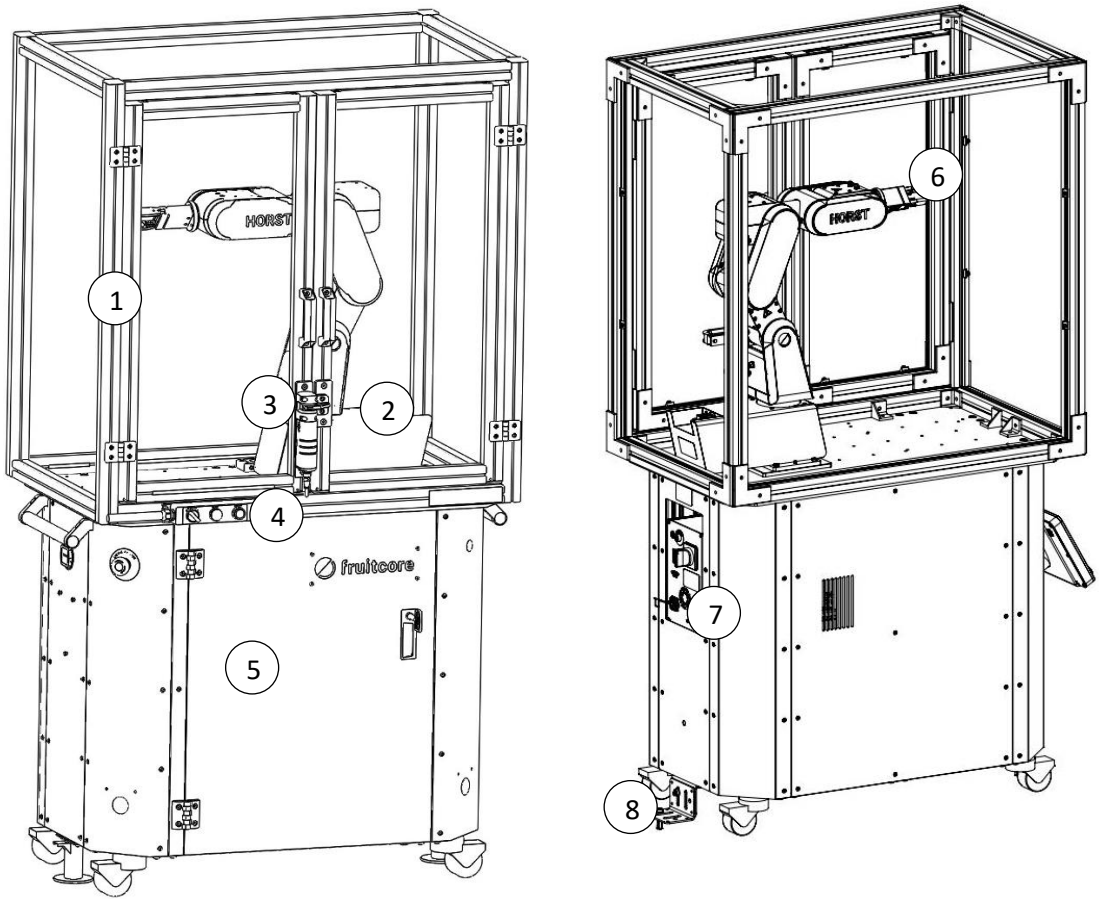


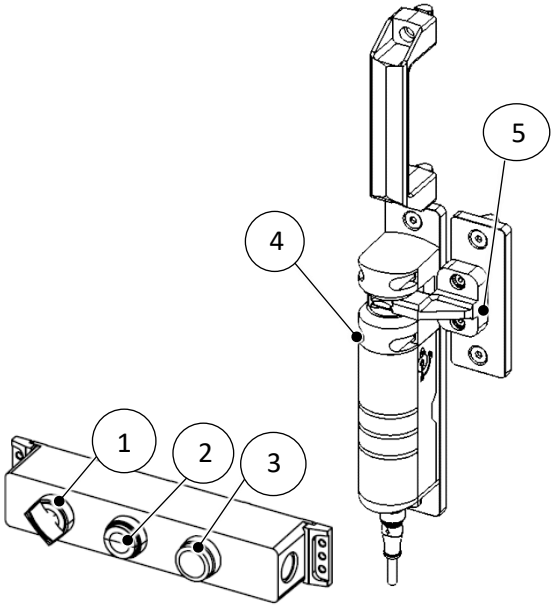
Fig. 6-3: SK HORST600 – front and rear side

1 Guard S
2 Robot HORST600
3 Mechanical bolt with SICK safety sensor
4 Operating Console
5 MRB S
6 Parallel jaw gripper Zimmer GEP2010 incl. jaws (grip) or
Vacuum gripper Schmalz Cobot Pump incl. bellows gripper (vac)
7 Control
8 Floor anchoring

6.3.1 Operating console and locking system

The locking system of the SK consists of a solenoid interlock which can be controlled via an operating console.

The following description refers to the operation in the delivery state. Other configurations are adjustable.



1 Rotary switch for opening request
2 Programme pause button (yellow)
3 Button to start or continue programme (green)
4 SICK mechanical bolt with safety sensor
5 Actuator
6 Bolt

Fig. 6-4: Operating console and safety interlock

The door opening must be requested via the selector switch (1). To do this, turn the switch from "O" to "I". If a programme is being played, it is automatically paused. As soon as the robot is at a safe stop, the guard locking (4) will unlock, and a safety stop is triggered at the robot (in automatic mode). The safety door can now be opened. If it is closed again and the actuator (5) is pushed into the guard locking, the safety stop will automatically be released, and the programme is continued.

The guard locking works according to the open-circuit current principle - if the system is de-energised, the guard locking can be opened.

A loaded programme can be started by pressing the green button (3). The green button lights up while the programme is being played. The programme can be paused at any time by pressing the yellow button (2) and continued by pressing the green button again.

For further information on the mechanical latch and the safety sensor, please refer to the respective operating instructions.

DANGER!

Danger due to missing or bypassed protective devices and defective / damaged assemblies or accessories.

- ▶ Never bridge or bypass the protective device.
- ▶ After completing maintenance work, carry out a test run of the entire system and check for correct functioning.

6.3.2 Assembly of the gripper system

The following section is intended to support the assembly and application of the gripper systems to the fruitcore robotics robot models. The following description does not correspond to an AI in the actual sense, but is intended as support for the commissioning of the SK. For further information on connecting the gripper systems, please refer to the documentation of the respective manufacturers.

ELECTRICAL VOLTAGE!

Possible personal injury due to applied electrical voltage

- Work on the electrical equipment may only be carried out by appropriately trained personnel in accordance with the electrotechnical regulations.
- Only use the cables supplied to connect the gripper to the robot. Do not use damaged cables.
- When connecting the gripper, make sure that the robot is in a de-energised state. Once all steps have been carried out, the electrical power supply can be switched on again.

WARNING!

Possible injury and personal damage due to changes in the danger zone.

- Please note that connecting a gripper system changes the robot's danger zone.
- Therefore, always observe the currently applicable safety regulations and instructions.

6.3.2.1 Assembly aid Zimmer GEP2010

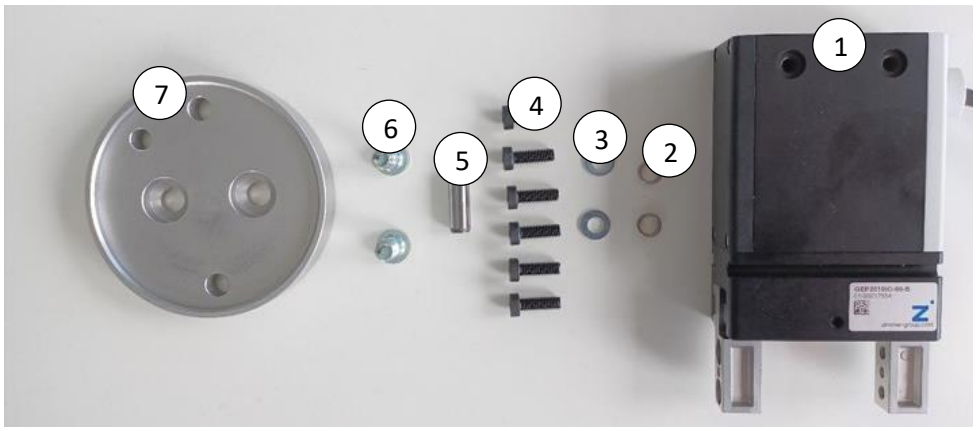


Fig. 6-5: Assembly set Zimmer GEP2010

1 Electric gripper Zimmer GEP2010IO-00-B
2 2 x Centring sleeve gripper to adapter 7x3 mm
3 2 x Washers DIN 9021 4,3x12x1,00
4 6 x cheese head screw DIN 7984 M4x12 (low head)
5 Centring pin 6H7
6 2 x cheese head screw DIN 6912 M6x12
7 Adapter plate Schunk EGP 40 NNB

For mounting the gripper Zimmer GEP2010IO-00-B Allen keys in the sizes 2.5 mm and 5 mm are required.

1 Centring sleeve gripper to adapter 7x3 mm

2 Gripper Zimmer GEP2010IO-00-B

▶ Insert the two centring sleeves into the holes provided on the gripper housing.

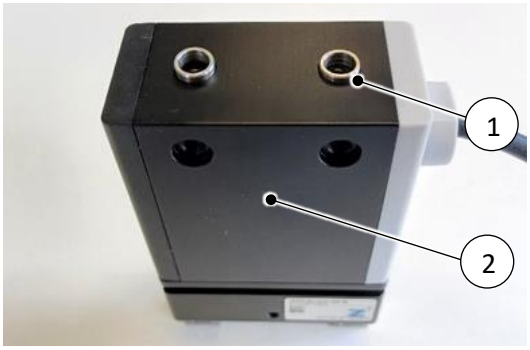


Fig. 6-7: Centring sleeves on the housing of the gripper

1 Adapter plate Schunk EGP 40 NNB

2 Cheese head screw DIN 7984 M4x12 (low head)

3 Washers DIN 9021 4,3x12x1,00

▶ Remove any dirt from the surfaces on the hook and the adapter plate.

▶ First press the adapter plate onto the centring sleeves by hand.

▶ Due to the anodising, it cannot be pressed completely onto the housing of the hook.

▶ Then fasten the adapter plate to the gripper with the washers and screws supplied.

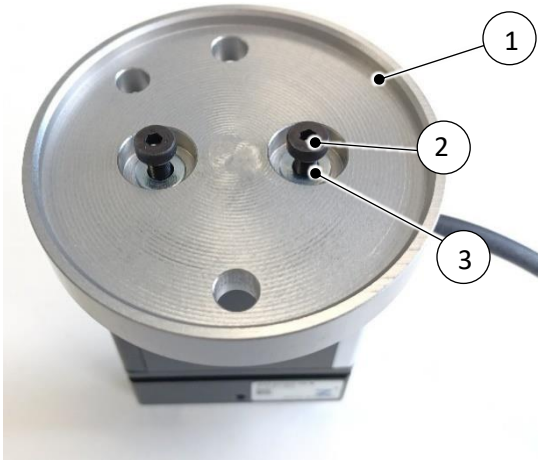


Fig. 6-8: Adapter plate on centring sleeves

▶ Note that the adapter plate must rest completely on the body of the grab after the screws have been tightened.

▶ It must be ensured that the screw heads do not protrude from the milling.

Fig. 6-9: Adapter plate screwed on

1 Adapter plate Schunk EGP 40 NNB
2 Gripper Zimmer GEP2010IO-00-B
3 Cheese head screws DIN 7984 M4x12
4 Gripper finger
5 Gripper jaws (exemplary)

- ▶ Position the two supplied gripper jaws on the outside of each of the two gripper fingers.
- ▶ Fasten both gripper jaws with two cylinder-head screws DIN 7984 M4x12 each.

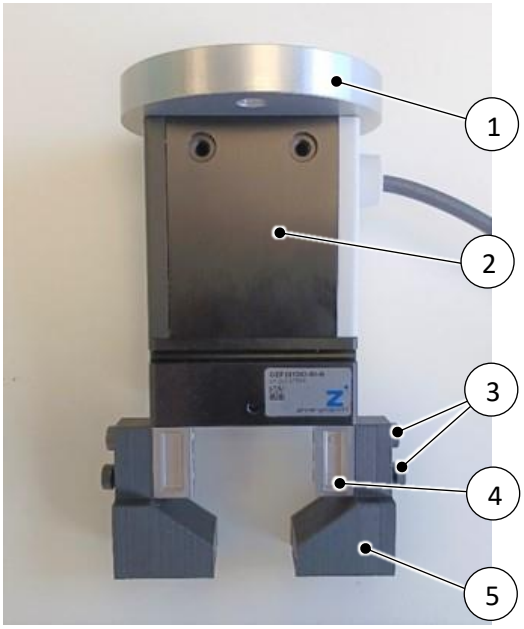


Fig. 6-10: Mounting the gripper jaws

1 Centring pin 6H7
2 Robot flange

- ▶ Insert the centring pin 6H7 into the hole provided on the robot flange.

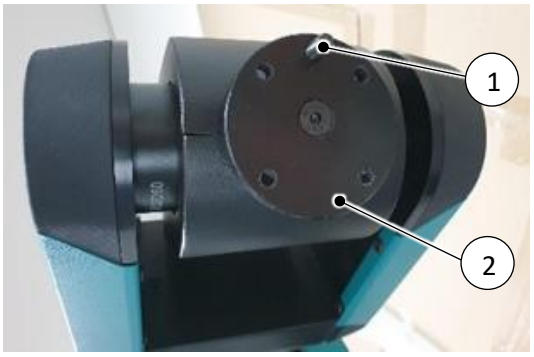


Fig. 6-11: Centring pin on the robot flange

1 re-assembled gripper
2 Cheese head screws DIN 6912 M6x12

- ▶ Remove any dirt from the surfaces on the flange and the adapter plate.
- ▶ Align the pre-assembled gripper with the robot flange using the centring pin and press the gripper onto the robot flange in this orientation.
- ▶ Fasten the gripper using two DIN 6912 M6x12 cylinder screws.

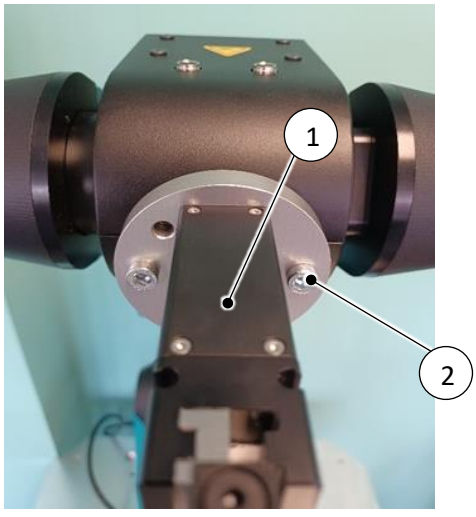


Fig. 6-12: Gripper on the robot flange

1 Signal cable to the gripper

2 Right socket on the support arm 3

- ▶ Connect the transmission cable of the gripper to the right socket on the support arm 3 of the robot.
- ▶ The gripper can now be controlled directly with the horstFX robot controller via TOOL-OUTPUT-1 and TOOL-OUTPUT-2.

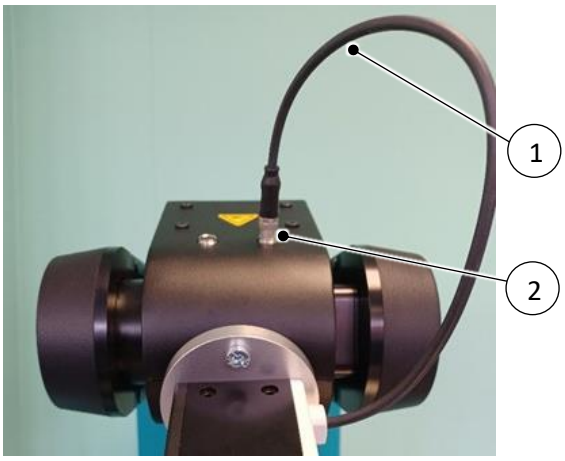


Fig. 6-13: Electrical final assembly

6.3.2.2 Assembly aid Schmalz Cobot Pump Mini ECBPM

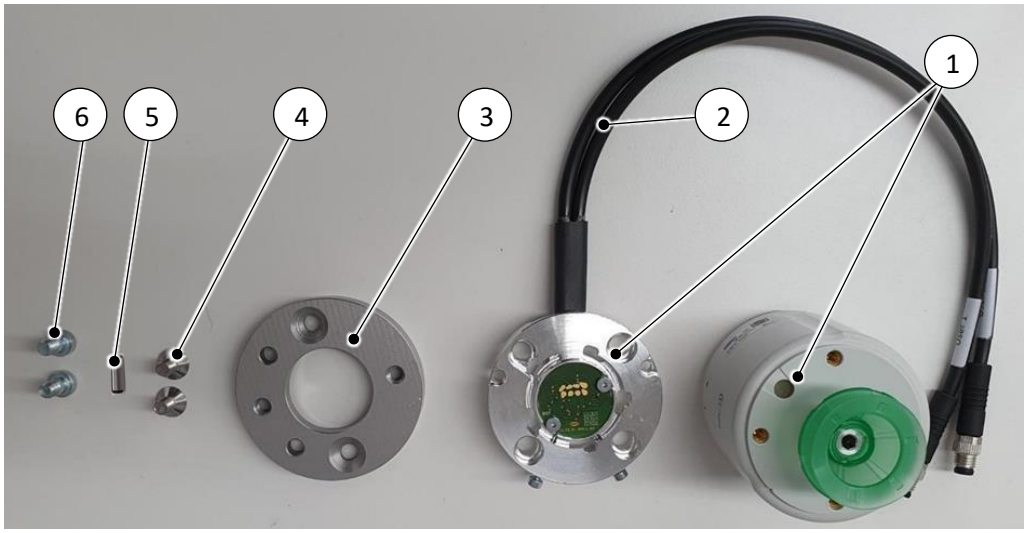


Fig. 6-13: Assembly set Schmalz Cobot Pump Mini ECBPM

1 Schmalz Cobot Pump Mini ECBPM 24V-DC M12-8

2 Cable 4-pole pre-assembled with stranded wires

3 Adapter plate for ISO9409 flange TK50

4 2 x countersunk screw DIN 7991 M6x10 (robot side)

5 Centring pin 6H7

6 2 x cheese head screw DIN 912 M6x10 (gripper side)

Allen spanners in sizes 3mm and 4mm are required for mounting the gripper Zimmer GEP2010IO-00-B.

1 Robot flange

2 Centering pin 6H7

▶ Place the centring pin 6H7 in the hole provided in the robot flange..

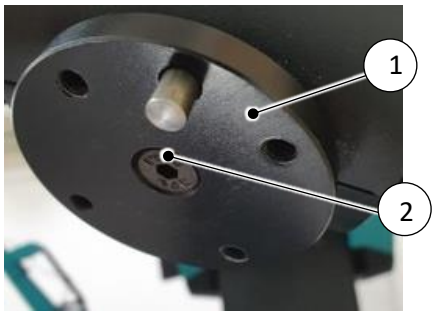


Fig. 6-14: Centering pin on the robot flange

1 Adapter plate

2 Screws DIN 7991 M6x10

▶ Remove any dirt from the surfaces on the flange and the adapter plate.

▶ Align the adapter plate with the robot flange using the centring pin.

▶ Press the adapter plate onto the robot flange and fasten it using the screws supplied (2 x DIN 7991 M6x10).

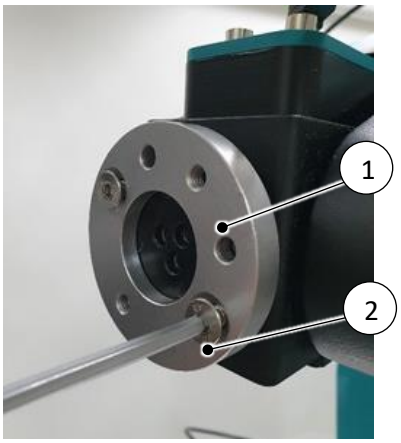


Fig. 6-15: Mounting of the adapter plate

1 electrical basic element of the vacuum gripper

2 Cheese head screws DIN 912 M6x10

▶ Place the basic electrical element on the adapter plate so that the circuit board is visible when mounted.

▶ Fix the basic element using the two cylinder head screws (2 x DIN 912 M6x10)).

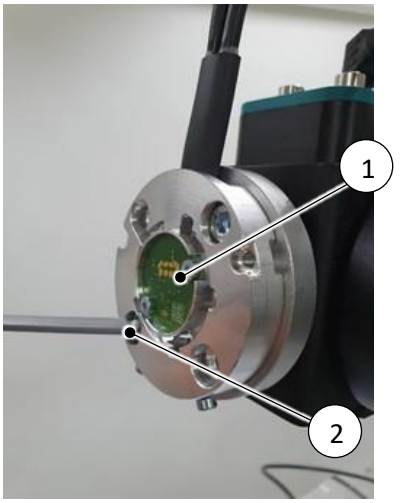


Fig. 6-16: Mounting the basic electrical element

ATTENTION!

Incorrect orientation of the basic electrical element when mounting the gripper can result in damage. The electrical base element of the vacuum gripper can be mounted in two different orientations.

▶ Make sure that the orientation is adapted to the application in terms of cable routing.

1 Basic electrical element of the vacuum gripper
2 Basic unit of the vacuum gripper

Fig. 6-17: Fastening the basic unit in the base

- ▶ Place the basic unit of the vacuum gripper on the electrical base element so that the end faces are on top of each other.
- ▶ When orienting the basic unit, make sure that the bolts on the back can be inserted into the base.
- ▶ Turn the basic unit clockwise by approx. 90°. This will tighten it in the base.

1 Basic electrical element of the vacuum gripper
2 Cheese head screws DIN 912 M6x10

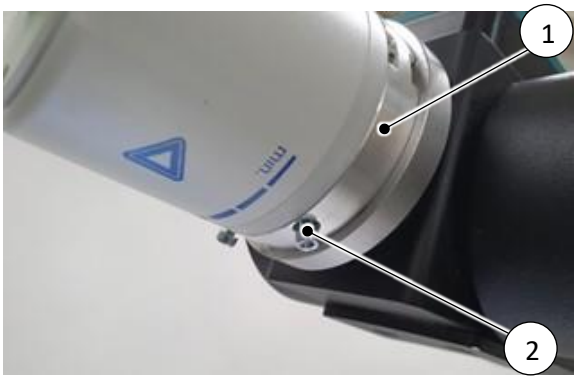


Fig. 6-18: Fixing the vacuum gripper

- ▶ Secure the basic unit with the cylinder head screws (2 x DIN 913 M6x10).

1 Connection User 1
2 Connection User 2

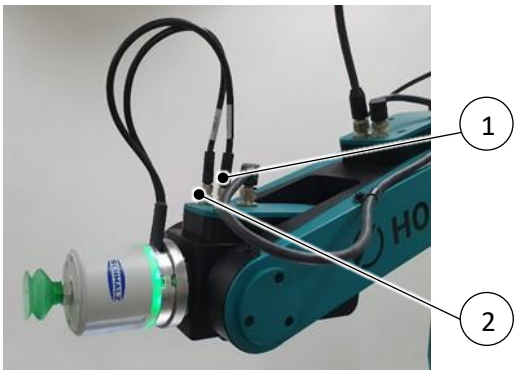


Fig. 6-19: Final electrical assembly

- ▶ Connect the gripper to the electrical interface on the robot using the connection cable supplied.
- ▶ Make sure to plug the cable labelled User 1 into the socket on the right when viewed from the front and the cable labelled User 2 into the left socket accordingly.
- ▶ If the connection is correct, the vacuum gripper lights up green and is ready for operation.
- ▶ The gripper can now be controlled directly via the horstFX robot controller.
- ▶

6.4 Assembly with Electro-Sensitive Protective Equipment

WARNING!
Danger due to incorrect selection, arrangement and setting of electro-sensitive protective equipment (safety laser scanners, safety light grids).

- ▶ Only use electro-sensitive protective equipment (ESPE) that meets the requirements of the applying standards (e.g. DIN EN ISO 61496-1 and 13855).
- ▶ To connect additional safety monitoring devices, use only the interfaces for safety monitoring I/O in the control cabinet of the HORST robot system.

Formulas for calculating the safety distance when using ESPE (safety laser scanners, safety light grids) can be found in section 7.1.

6.4.1 Assembly of the safety laser scanners on the Mobile Robot Base

To attach the laser scanner to the MRB, 2x 5.5 mm through holes (for M5 screws) with a distance of 73 mm are provided.

This hole pattern is present in two places on the MRB (opposite each other).

1. Through holes

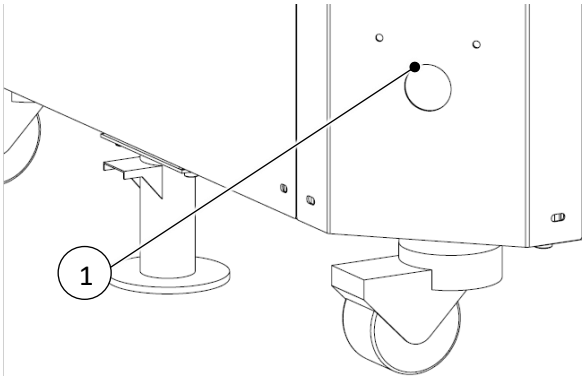


Fig. 6-20: Through holes for laser scanner attachment

6.4.2 Set-up with safety laser scanners

The safety concept of the robot system provides for the following safety functions when using safety laser scanners:

- When a person/object approaches into the danger zone, the safety stop of the robot system is to be triggered.
- Two warning zones are also provided. In the warning zones, the speed of the robot movements is to be gradually reduced when a person/object approaches.

Please note that the mounting point of the safety laser scanners does not coincide with the centre of the robot's danger zone.

Program the safety laser scanners in a way that the scanner protective field protects at least the danger zone (working area of the robot + safety distance).

There must be no objects within the danger zone (working area + safety distance) that restrict the view of the safety laser scanner

6.4.2.1 Set-up with two safety laser scanners

All four sides of the MRB are protected by a safety laser scanner.

The protective field of the safety laser scanner must cover the danger zone (working area + safety distance).

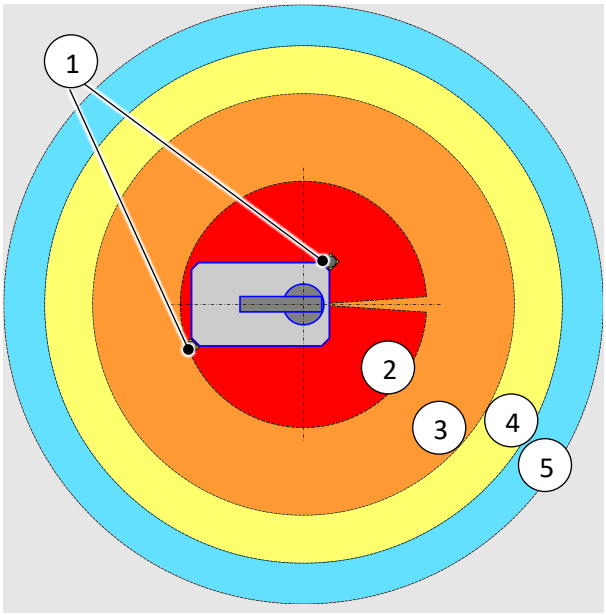


Fig. 6-21:Set-up with two safety laser scanners

1 Position of safety laser scanner 1 & 2

2 Working area of the robot

3 Danger zone (working area + safety distance)
Monitoring by the safety laser scanners (safety zone). Detection of persons or objects leads to a safety stop of the robot. (For calculation of the safety distance, see section 7.1.2)

4 Warning zone 1 - Monitoring by the safety laser scanners.
Detection of persons or objects leads to a further reduction of the robot's working speed.

5 Warning zone 2 - Monitoring by the safety laser scanner.
Detection of persons or objects leads to a reduction of the working speed of the robot.

6.4.2.2 Set-up with a safety laser scanner in the corner of a room

Two sides of the MRB are protected by a safety laser scanner. The other two sides are protected by fixed guards (e.g. walls).

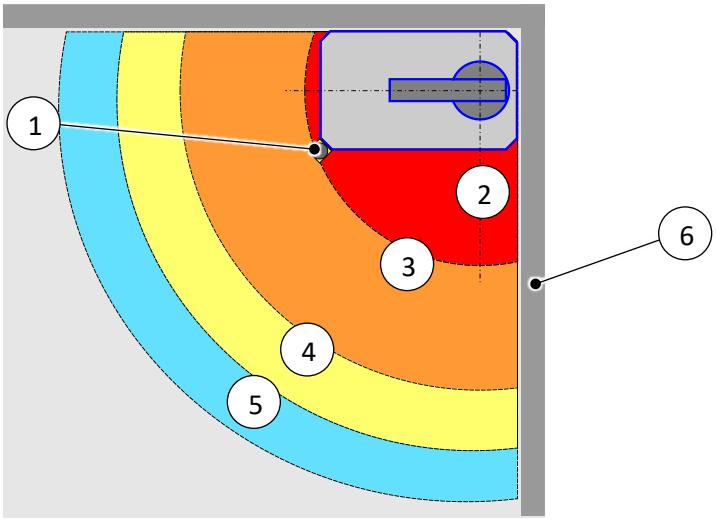


Fig. 6-22: Set-up with a safety laser scanner in the corner of a room (example)

1 Position of the safety laser scanner
2 Working area of the robot
3 Monitoring by the safety laser scanners (safety zone). Detection of persons or objects leads to a safety stop of the robot. (For calculation of safety distance, see section 7.1.2)
4 Warning zone 1 - Monitoring by the safety laser scanners.
Detection of persons or objects leads to a further reduction of the robot's working speed.
5 Warning zone 2 - Monitoring by the safety laser scanner.
Detection of persons or objects leads to a reduction of the working speed of the robot.
6 Walls

WARNING!
Danger from subsequently changing the position of the robot

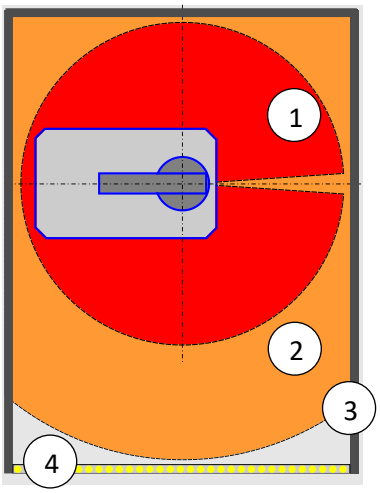
▶ Do not change the position of the robot under any circumstances. This would change the position of the danger zone. Protection may then no longer be provided.

6.4.3 Installation with Safety Light Grid in an Assembly Cell

An assembly cell secures the robot against intervention from all four sides and from above. Access to the robot's danger zone is monitored by a safety light grid.

WARNING!
Danger from subsequently changing the position of the robot within the assembly cell.

▶ Never change the position of the robot within the assembly cell. This would change the position of the danger zone. Protection may then no longer be provided.



1 Working area
2 Danger zone (working area + safety distance).
Monitoring by a safety light grid (safety zone).
Detection of persons or objects leads to a safety stop.
(For calculation of the safety distance, see section 7.1.2)
3 Assembly cell
5 Safety light curtain

Fig. 6-23: Set-up with safety light grid in an assembly cell (example)

The side walls must be installed outside the working area. If there is no protection against interference from above, the height of the side walls and their safety distance from the working area is determined according to chapter 7.2.

6.5 Installation with fixed, separating Guards

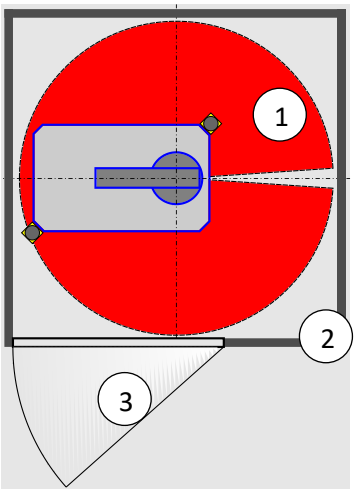
6.5.1 Installation in an Assembly Cell

An assembly cell secures the MRB against intervention from the sides and above. Access to the robot is possible via secured, interlocked safety doors. The interlock may only be released after the robot movement has come to a standstill.

WARNING!

Danger due to subsequent change of the robot's position within the assembly cell

- ▶ Never change the position of the robot within the assembly cell. This would change the position of the danger zone. Protection may then no longer be provided.



1 Working area

2 Assembly Cell

3 Interlocked safety door

Fig. 6-24: Installation in an assembly cell with locked safety door (example)

The side walls must be installed outside the working area. If there is no protection against interference from above, the height of the side walls and their safety distance to the working area is determined according to chapter 7.2.

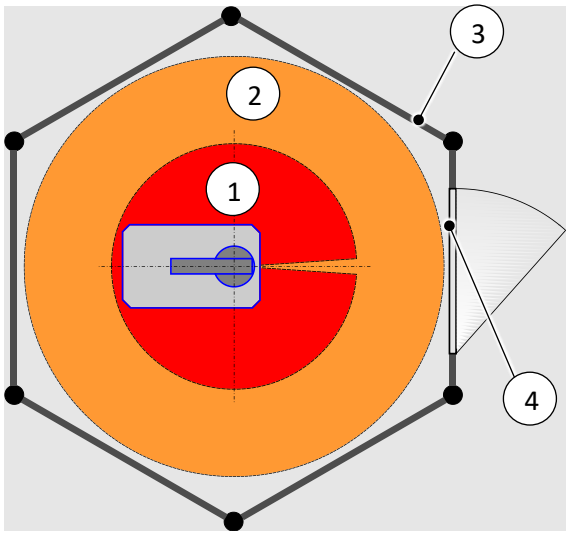
6.5.2 Assembly with a Guard

All four sides of the MRB are secured by a perimeter safety fence. Access to the robot system is possible via secured, locked safety doors. The lock may only be released after the robot movement has come to a standstill. The safety fence must protect the danger area (working area + safety distance). The safety distance of the safety fence to the working area depends on the height of the working area and the height of the safety fence and is defined according to DIN EN ISO 13857.

WARNING!

Danger due to subsequent change of the position of the robot within the protective fence

- ▶ Never change the position of the robot inside the safety fence. This would change the position of the danger zone. Protection may then no longer be given.



1 Working area

2 Danger zone (working area + safety distance)
(Determination of the safety distance for a fence with the height 2 m / 2.2 m and the mesh size 40 x 40 mm, see section 7.3)

3 Protective guard

4 Interlocked safety door

Fig. 6-25: Installation with protective barrier (example)

1 Working area

2 Danger zone (working area + safety distance)
(Determination of the safety distance for a fence with the height 2 m / 2.2 m and the mesh size 40 x 40 mm, see section 7.3)

3 Protective guard

4 Interlocked safety door

7. Determination of the Safety Distance to the Working Area

7.1 Use of Electro-Sensitive Protective Equipment

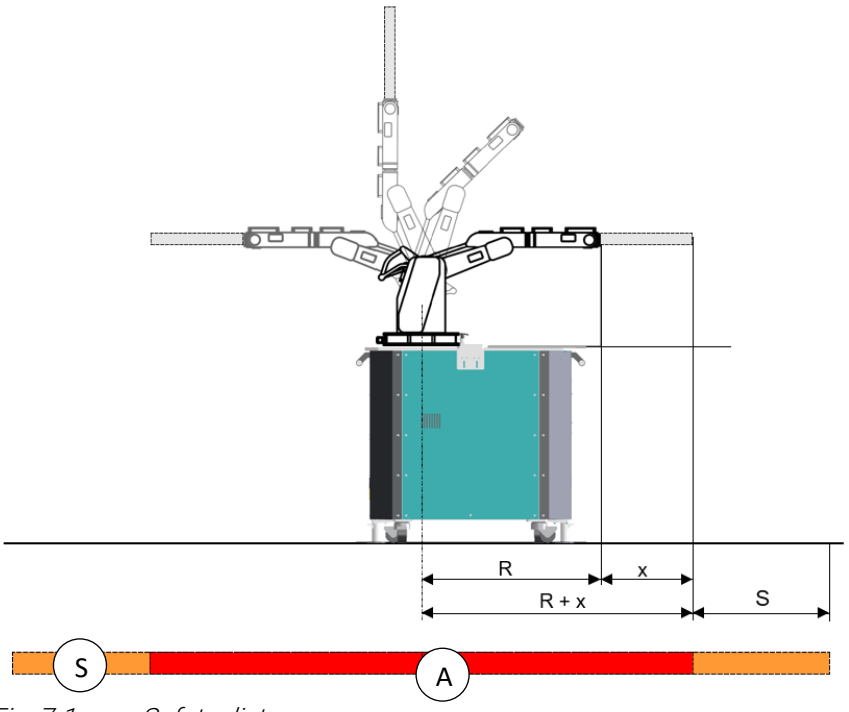


Fig. 7-1: Safety distance

A Working area

R Range of the robot (see *Tab. 4*)

S Safety distance of the protective equipment to the working area

x Maximum length of gripper + workpiece

Tab. 4: Values for Range R

Robot model	HORST600	HORST900	HORST1000	HORST1400
Range	584 mm	905 mm	1018 mm	1425 mm

The protective field of an ESPE must cover the danger zone (working area A + safety distance S).

For the calculation of the safety distance S, the standard DIN EN ISO 13855 applies.

If no other specifications are given by the manufacturer of the ESPE, use the calculation bases on the following pages (see sections 7.1.1 and 7.1.2).

7.1.1 Stopping time T

The stopping time T of the entire system is an essential characteristic value for the calculation of the safety distance. It is composed of:

t_1 – response time (reaction time) of the protective device in seconds [s] (see documentation of the protective device manufacturer) and

t_2 – stopping time of the robot system in seconds [s] (see HORST robot system AI).

$$T = t_1 + t_2$$

7.1.2 Safety distance S

The minimum safety distance S to the working area of the robot is generally calculated by the following equation:

$$S = (K \times T) + C$$

S – Minimum safety distance in mm

K – Approach speed of persons in mm/s

T – Stopping time of the entire system in s (see section 7.1.1)

C – Penetration distance (safety allowance)

Depending on the orientation of the protective field, the values for the approach speed K and the penetration distance C vary. This is explained in the following.

7.1.2.1 Protective field perpendicular to the approach direction

If the protective field is aligned at right angles to the approach direction (e.g. a vertically aligned light grid), the following calculations apply:

When using active optoelectronic protective devices with sensor detection capability ≤ 40 mm the following applies:

K = 2000 mm/s (see DIN EN ISO 13855)

C = 8 × (d – 14) (see DIN EN ISO 13855)

but not less than 0

d - Sensor detection capability of the protective device in mm (minimum object resolution)

Thus, the following results for the minimum safety distance S:

$$S = (2000\ mm/s \times T) + C$$

This applies to a minimum safety distance S up to and including 500 mm. **The minimum value of S must be 100 mm.**

If the value calculated for S exceeds 500 mm, the following equation can be used. **In this case, the minimum value of S must be 500 mm.**

$$S = (1600\ mm/s \times T) + C$$

For sensor detection capability of the protective device > 40 and ≤ 70 mm, the following applies

K = 1600 mm/s (see DIN EN ISO 13855)

C = 850 mm (see DIN EN ISO 13855)

Thus, the following results for the minimum safety distance S:

$$S = (1600\ mm/s \times T) + 850\ mm$$

Example calculation for a protective field perpendicular to the approach direction

When using a safety light grid with the output values:

t_1 = 0.2 s - response time (reaction time) of the protective device

t_2 = 0.53 s - stopping time of the robot system

d = 60 mm - sensor detection capacity

results in the stopping time T:

$$T = 0{,}2\ s + 0{,}53\ s$$

$$T = 0{,}73\ s$$

and thus, the minimum safety distance S to the working area:

$$S = (1600\ mm/s \times T) + 850\ mm$$

$$S = (1600\ mm/s \times 0{,}73\ s) + 850\ mm$$

$$S = 1168\ mm + 850mm$$

$$\underline{S = 2018\ mm}$$

The protective field of the safety light grid must be configured so that the entire danger zone (i.e. working area + safety distance S) is protected.

7.1.2.2 Protective field parallel to the approach direction

If the protective field is aligned parallel to the approach direction (e.g. a horizontally aligned safety laser scanner), the following calculations apply:

K = 1600 mm/s (DIN EN ISO 13855)

C = 1200 mm – 0,4 × H (DIN EN ISO 13855)

but not less than 850 mm, where H is the height of the protective field (in mm) above the floor.

Thus, the following results for the minimum safety distance S:

$$S = (1600\ mm/s \times T) + (1200\ mm - 0{,}4\ H)$$

The height H of the protective field must not exceed 1000 mm. According to EN ISO 13855, for a protective field height of more than 300 mm, the possibility that the protective field can be crawled under must be taken into account.

The lowest permissible height H of the protective field is calculated in the following equation:

$$H = 15 \times (d - 50)$$

d – Sensor detection capability of the protective device in mm (minimum object resolution).

If d is less than 50 mm, H must never be less than 0.

Thus, for a defined height H of the protective field, the equation for the sensor detection capability d of the protective device is obtained:

$$d = (H/15) + 50$$

Then the sensor detection capability d (minimum object resolution) of the protective device must be configured.

When using safety laser scanners, it must be taken into account that measurement errors of the scanner and errors due to reflective background can occur. To take these errors into account, an additional safety value Z is added to the minimum safety distance S.

$$S = (K \times T) + C + Z$$

This safety value Z can vary between 60 and 200 mm. Please refer to the scanner manufacturer's documentation for the corresponding information.

Example calculation for a protective field parallel to direction of approach

When using a safety laser scanner on the MRB with the output values:

t_1 = 0,2 s – Response time (reaction time) of the protective device

t_2 = 0,53 s – Stopping time of the robot system

H = 300 mm (with d = 70 mm)

results in the stopping time T:

$$T = 0{,}2\ s + 0{,}53\ s$$

$$T = 0{,}73\ s$$

and thus, the minimum safety distance S to the working area:

$$S = (1600\ mm/s \times T) + (1200\ mm - 0{,}4\ H)$$

$$S = (1600\ mm/s \times 0{,}73\ s) + (1200\ mm - 120\ mm)$$

$$S = 1168\ mm + 1080\ mm$$

$$\underline{S = 2248\ mm}$$

The protective field of the safety laser scanner must be configured so that the entire danger zone (i.e. working area + safety distance S) is protected.

7.2 Using an assembly cell

In the following, the height of the assembly cell is determined if there is no protection against reaching from above. **The assembly cell must not have any openings on the sides through which people can reach into the range of the robot.**

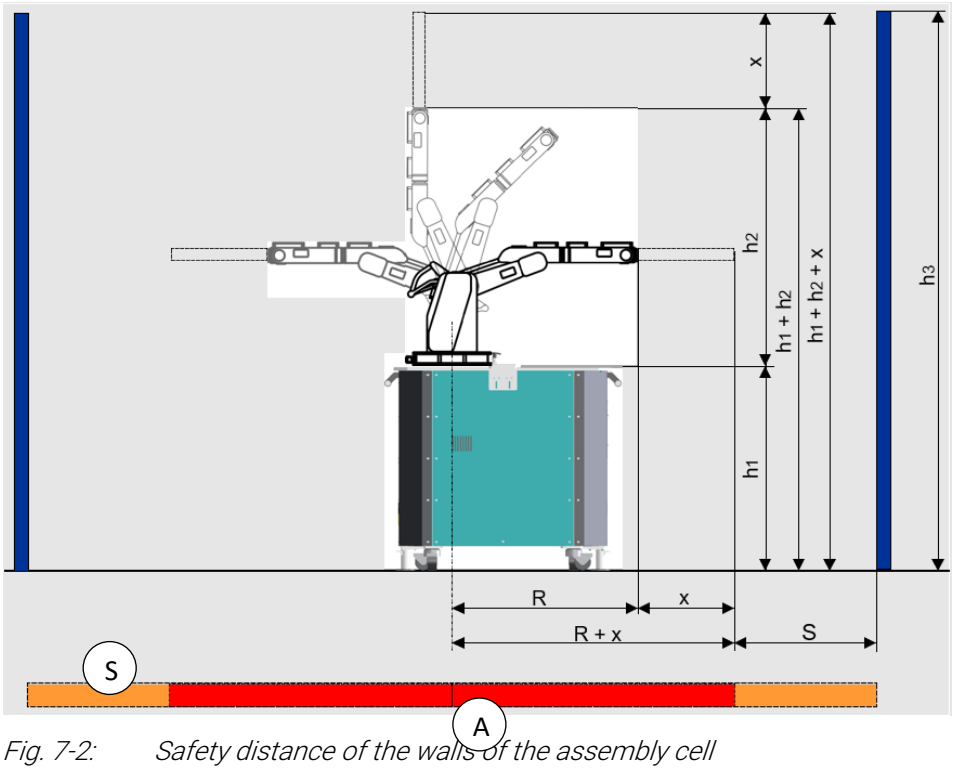


Fig. 7-2: Safety distance of the walls of the assembly cell

A Working area
S Safety distance of the walls to the working area
R Range of the robot system (see *Tab. 4*)
x Maximum Length von gripper + workpiece
h1 Height of the MRB (see *Tab. 5*)
h2 Maximum height of the robot system (see *Tab. 6*)
h3 Height of the walls

Tab. 5: Heights of the MRB-models

Model	MRB S	MRB M	MRB L
h1	900,5mm	900,5mm	1031,9mm

Tab. 6:Maximum heights of the robot system h2

Robot model	HORST600	HORST900	HORST1000	HORST1400
h2	955 mm	1265 mm	1269 mm	1940 mm

If no other specifications are given by the manufacturer of the assembly cell, use the following information to determine the safety distance S.

Avoid the danger of reaching over the walls of the assembly cell by using the following safety distances to the working area (extract from DIN EN ISO 13857):

Tab. 7: Safety distances when using guards

Height working area [mm]	Safety distance S [mm]						
	1600	1800	2000	2200	2400	2500	2700
2700	0	0	0	0	0	0	0
2600	600	600	500	400	300	100	0
2400	800	700	600	400	300	100	0
2200	900	800	600	400	300	0	0
2000	900	800	600	400	0	0	0
1800	900	800	600	0	0	0	0
1600	900	800	500	0	0	0	0
1400	900	800	0	0	0	0	0
1200	900	700	0	0	0	0	0
1000	800	0	0	0	0	0	0
800	600	0	0	0	0	0	0
600	0	0	0	0	0	0	0

7.3 Usage of Guards (Safety Fences)

The Safety distance of guards to the working area depends on the height of the working area and on the height of the guard and is defined in DIN EN ISO 13857.

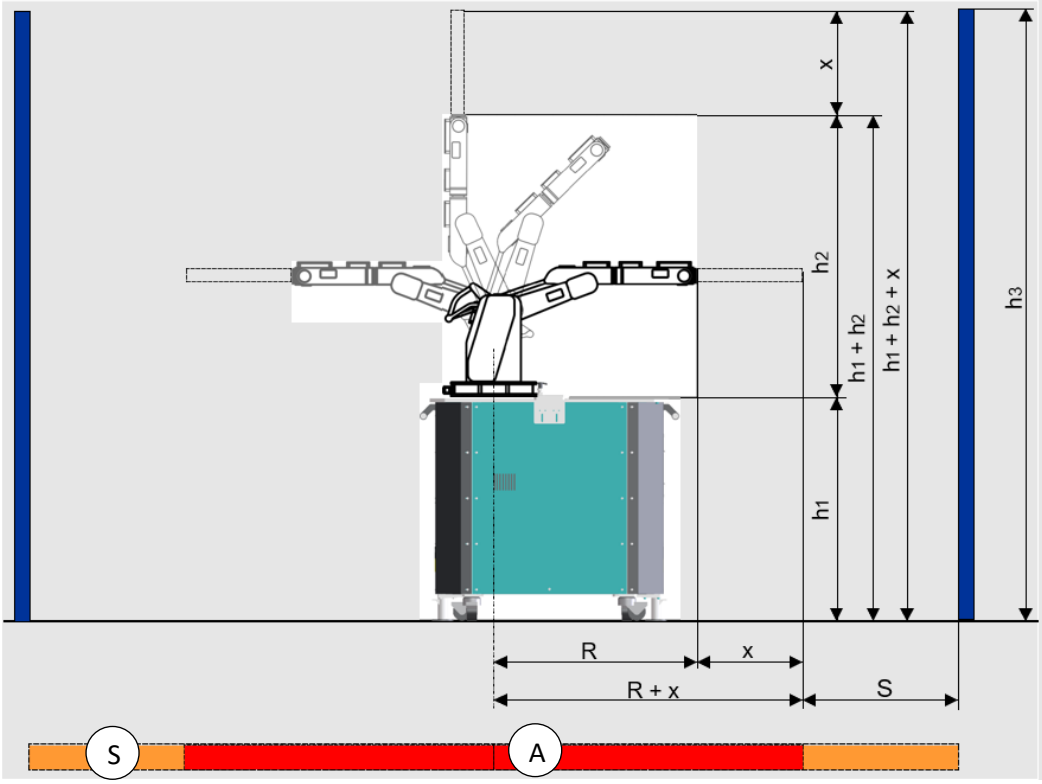


Fig. 7-3: Safety distance of the guard

A Working area
S Safety distance of the guard to the working area
R Range of the robot system (see *Tab.1*)
x Maximum Length of gripper + workpiece
h1 Height of the MRB (see *Tab.2*)
h2 Maximum height of the robot system (see *Tab.3*)
h3 Height of the guard

If no other specifications are given by the manufacturer of the guard, use the following information to determine the safety distance S.

For a guard with a height of 2 m or 2.2 m and a mesh size of 40 x 40 mm, the following safety distances to the working area apply in order to avoid the risk of stray objects (extract from DIN EN ISO 13857):

Tab. 8: Safety distances when using guards

Height of the working area	Safety distance S when Guard height = 2 m	Safety distance S when Guard height = 2.2 m
2700 mm	200 mm	200 mm
2600 mm	500 mm	400 mm
2400 mm	600 mm	400 mm
2200 mm	600 mm	400 mm
2000 mm	600 mm	400 mm
1800 mm	600 mm	200 mm
1600 mm	500 mm	200 mm
1400 mm and less	200 mm	200 mm

8. Commissioning

The following contents refer primarily to the SK, as many dangers arise mainly with the use of the robot system.

DANGER!
Danger due to incorrect commissioning

- ▶ Commissioning may only be carried out by persons with technical and electrical training who have also been authorised by fruitcore robotics

Before commissioning:

- ▶ Make sure that any transport equipment or transport locks have been removed.
- ▶ Make sure that the robot and any attachments are properly and securely screwed down.
- ▶ Make sure that the product is properly and safely set up.
- ▶ Make sure that there is enough space for the robot arm to move freely. There must be no obstacles or people in the working area.
- ▶ Be aware that attachments and workpieces change the reach of the robot and thus the danger zone.
- ▶ If the robot is combined with other machines, make sure that they cannot damage each other.

- ▶ Make sure that the safety measures are set up and configured according to the risk assessment, so that commissioning personnel, operators and bystanders are protected.
- ▶ Check that the protective devices are working properly.
- ▶ In case of damage to the robot, Control, the mechanical interface, as well as any parts of the protective equipment, the product must not be used.
- ▶ Check the emergency stop and safety stop functions.
- ▶ Make sure that the robot is earthed (connection of the mains plug to PE protective conductor). A suitable RCD (residual current device) must be installed.
- ▶ Before switching on the power supply, make sure that the connection cable between the control cabinet and the robot and the mains cable are connected to the power supply.

9. Operation

This section only describes specific information related to the SK. To ensure safe operation of the HORST robot system within the SK, it is essential to follow the user information for the robot system itself and its HorstFX software.

CAUTION!

Operation of the product remains prohibited until all set-up and commissioning requirements have been met.

WARNING!
Serious injury may result from operation without functioning protective devices.

- ▶ Check daily that the EMERGENCY STOP and the door interlock function.

CAUTION!

The working area of the robot is not limited to the protected area.

- ▶ During operation, avoid collisions with the guard.

9.1 Behaviour in Emergencies

WARNING!
Risk of impact and crushing due to robot movements.

The safety stop function is deactivated during teach mode.

- ▶ In teach mode, block off the area around the robot and secure it against access by unauthorised persons. No persons may be in the robot's danger zone.
- ▶ In teach mode, secure the horstPANEL and the horstCONTROL against operation by unauthorised persons.

WARNING!
The robot arm may only be moved by external force in emergencies.

If the robot arm was moved manually in an emergency, assemblies of the robot system may have been damaged. Uncontrolled start-up may be the result.

- ▶ Have the robot system checked by fruitcore robotics customer service before putting it back into operation

- ▶ In an emergency, press the emergency stop button (1).
  - ⇒ All movements of the robot are slowed down to a standstill. The programme is paused.

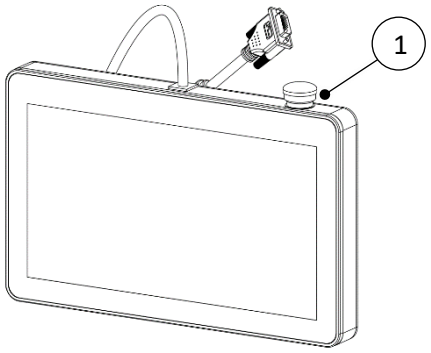


Fig. 9-1: Panel

  - ⇒ The pop-up window appears in the display with the warning message that the EMERGENCY STOP has been triggered.

- ▶ Eliminate the hazardous situation.

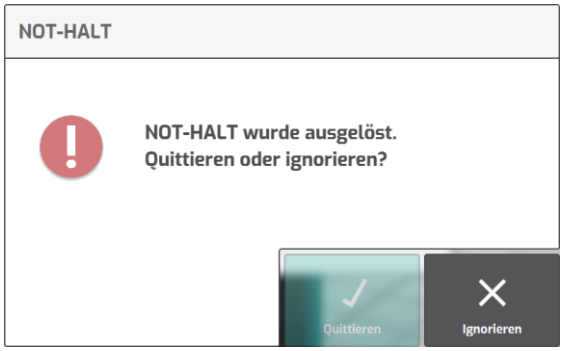


Fig. 9-2: Emergency stop warning message

Resetting the Emergency stop

- ▶ Before resetting the EMERGENCY STOP, check whether the danger has been eliminated.
- ▶ Unlock the EMERGENCY STOP button by pulling it out.
  - ⇒ The Acknowledge button is activated.
- ▶ Acknowledge the warning message on the display.
  - ⇒ If the EMERGENCY STOP has been reset, the programme will not continue until it is resumed manually.
- ▶ If necessary, bring the robot into a safe position by manual movement via the Free Movement menu (see horstFX User Manual, chapter *Free Movement*).

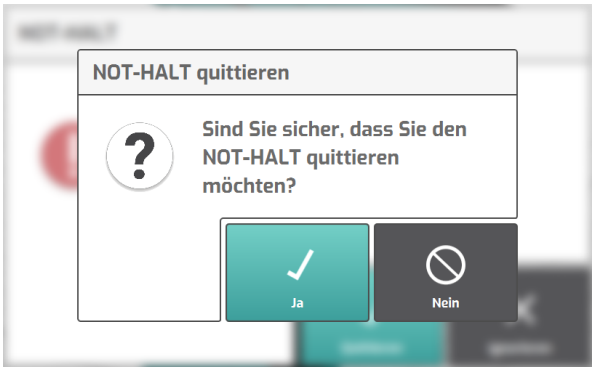


Fig. 9-3: Emergency stop – Confirm acknowledgement

9.2 Troubleshooting

If faults occur in the robot system, corresponding error messages (system errors) are displayed on the operating panel.

- ▶ Follow the instructions on the control panel to eliminate the cause of the error.
- ▶ Acknowledge the error message on the display when all error causes have been eliminated.
- ▶ Call fruitcore robotics service if you are unable to eliminate the cause of the error yourself.

The troubleshooting procedure is described in the manual for the robot model..

10. Cleaning and Maintenance

DANGER!
Danger of electric shock.

- The connection and any work on the electrical equipment must be performed by electrotechnical specialist personnel only.

DANGER!
Danger resulting from incorrect maintenance.

- Maintenance must be performed only by persons with technical and electrotechnical training who were also authorized by fruitcore robotics GmbH.

Spare parts must correspond to the technical requirements specified by fruitcore robotics. This is always guaranteed with original spare parts.

10.1 Cleaning

Depending on the environmental conditions of the products, the components get dirty. Clean them as required. The frequency depends on the degree of soiling. fruitcore robotics recommends monthly cleaning.

Wear protective clothing!

- Wear safety goggles, protective gloves, and a dust mask while cleaning.

ATTENTION!
Danger of machine damage

- Do not clean electrical components with compressed air.
- Do not use aggressive, flammable or abrasive liquids / cleaning agents to clean the products.
- Avoid penetration of liquids into electrical assemblies.
- Clean the outside of the products with a clean and dry cleaning cloth.
- Remove chips and other particles from the products with a hoover.
- Clean electrical assemblies with a clean and dry cleaning cloth

Environmental protection!

- Dispose of the waste and used cleaning cloths in an environmentally responsible way.

10.2 Maintenance and Repair

When maintaining the SK, it is essential to also follow the instructions in the robot model manuals.

DANGER!

Danger due to missing or defective protective devices

- ▶ Reassemble all protective devices after completing maintenance work. Check all assemblies and accessories.
- ▶ After completing maintenance work, carry out a test run of the entire system and check for correct functioning.

The operating personnel must check the products daily for external damage.

Repairs to the products may only be carried out by fruitcore robotics.

If there is no service contract, all maintenance work must be ordered independently from fruitcore robotics. If deadlines are missed, safe and fault-free operation cannot be guaranteed and liability for any events arising in this connection will lapse.

The emergency stop function must be functionally tested weekly.

In combination with a robot system, the fastening screws must be checked monthly for tightness.

Maintenance of peripheral equipment must be carried out in accordance with the manufacturer's documentation.

Direct links:

https://www.sick.com/de/de/sicherheitslaserscanner/sicherheitslaserscanner/microscan3/mics3-aaaz40az1p01/p/p368945

https://www.zimmer-group.com/de/technologien-komponenten/komponenten/handhabungstechnik/greifer/elektrisch/2-backen-parallelgreifer/serie-gep2000/produkte/gep2010io-00-b

https://www.schmalz.com/de/vakuumtechnik-fuer-die-robotik/vakuum-erzeuger/vakuum-erzeuger-ecbpmi-312576/10.03.01.00556/

11. Storage

If the product is stored for later use or taken out of service, it must be protected with suitable packaging.

The product must be stored dry, frost-free and without the influence of precipitation and strong temperature fluctuations.

12. Disposal

Danger of environmental damage.

All parts of the MRB must be disposed of in such a way that any damage to health or the environment can be ruled out.

- ▶ Dispose of all parts of the MRB in such a way that any damage to health or the environment can be ruled out. Note the materials used.