ROBOTICS

Product specification

CRB 15000

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Product specification
CRB 15000
OmniCore

Document ID: 3HAC077390-001

Revision: S

Keep for future reference.

Additional copies of this manual may be obtained from ABB.

Original instructions.

Table of contents

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Overview of this specification

About this product specification

This product specification describes the performance of the manipulator or a complete family of manipulators in terms of:

- The structure and dimensional prints
- The fulfilment of standards, safety, and operating equipment
- The load diagrams, mounting or extra equipment, the motion, and the robot reach
- The specification of available variants and options

The specification covers the manipulator using the OmniCore controller.

Usage

Product specifications are used to find data and performance about the product, for example to decide which product to buy. How to handle the product is described in the product manual.

The specification is intended for:

- Product managers and product personnel
- Sales and marketing personnel
- Order and customer service personnel
- Integrators and customers

References

Documentation referred to in the manual, is listed in the table below.

Document name	Document ID
Product manual - CRB 15000	*3HAC077389-001*
Product manual - OmniCore C30 Type A	*3HAC089064-001*
Product specification - OmniCore C line	*3HAC065034-001*

Tip

All documents can be found via myABB Business Portal, *www.abb.com/myABB*.

Revisions

Revision	Description
A	First edition.
B	Published in release 21B. The following updates are made in this revision: • Removed axis resolution data. • Added a note to state Base 54 includes IP54. • Updated temperature for operating conditions. • Added information about robot calibration. • New option 3203-7 All regions cable, 5m added.

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Revision	Description
C	Published in release 21C. The following updates are made in this revision: • Option [438-6] added. • Updated data of Performance according to ISO 9283.
D	Published in release 21D. The following updates are made in this revision: • Add the laser scanner introduction in *Installation* section. • Updated working range for axis 6, see *Working range on page 69*.
E	Published in release 22A. The following updates are made in this revision: • Added screwing depth information to attachment screws for robot foundation. • Added foundation material yield strength data. • Added more information for laser scanners.
F	Published in release 22B. The following updates are made in this revision: • Corrected wire rating for customer cabling. • Updated operating conditions regarding ambient humidity.
G	Published in release 22C. The following updates are made in this revision: • Updated description for Collaborative Safety. • Added pin specification for the customer connectors at the tool flange. • Added protection class for clean room suitability.
H	Published in release 22D. The following updates are made in this revision: • Added support for wrist optimization.
J	Published in release 23A. The following updates are made in this revision: • Added support for the option *Absolute Accuracy*. • Updated image for 1 SafetyIO-based laser scanner (option 3051-2).
K	Published in release 23B. The following updates are made in this revision: • Added new variants CRB 15000-10/1.52 and CRB 15000-12/1.27. • Added new option *Manipulator cable length* - 15 m [3200-3]. • The updated robot stopping distances and times are moved to this document, and removed from the generic document, see *Robot stopping distances and times on page 72*.
L	Published in release 23B. The following updates are made in this revision: • Removed the stop category 0 data.
M	Published in release 23D. The following updates are made in this revision: • Minor corrections. • Updated the figures of stop category 1, axis 1, extension zone 0 for CRB 15000-12/1.27.
N	Published in release 24A. The following updates are made in this revision: • Added information for Clean room certificate. • Minor changes. • Added new option *Manipulator cable length* - 3 m [3200-1]. • Added new option *drag chain cable* - 15 m [3200-6].
P	Published in release 24B. The following updates are made in this revision: • Added support for OmniCore C30 Type A.
Q	Published in release 24C. The following updates are made in this revision: • Updates images of working range and turning radius for CRB 15000-5/0.95. • Updated the flange reach for CRB 15000-10/1.52 and CRB 15000-12/1.27. • Added new Mains cable options [3203-2], [3203-3] and [3203-4].

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Revision	Description
R	Published in release 24D. The following updates are made in this revision: • Added support for the option *Ultra Accuracy*.
S	Published in release 25A. The following updates are made in this revision: • Updated load diagrams for 10 kg and 12 kg variants. • Removed the section *Wrist torque*.

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1 Description

1.1 Structure

1.1.1 Introduction

General

The CRB 15000 robot is a flexible, agile 6-axis articulated robot, available in three variants spanning various options for payload from 5 kg to 12 kg, wrist reach from 0.95 m to 1.52 m (flange reach from 1.05 m to 1.63 m), and designed specifically for manufacturing industries that use flexible robot-based automation. The robot has an open structure that is especially adapted for flexible use, and can communicate extensively with external systems.

Note

The CRB 15000 can only be used together with OmniCore C30.

Intended use

The CRB 15000 robot from ABB is designed for use in industrial applications. For other fields of use, verify whether this robot fulfills the standards required, see *Applicable standards on page 15*.

CAUTION

The integrator of the robot system is required to perform an assessment of the hazards and risks.

Clean room certificate

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Particle emission from the robot fulfill Clean room class 4 standard according to DIN EN ISO 14644-1.

According to IPA test result, the robot CRB 15000 is suitable for use in clean room environments.

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Protection

Manipulator, CRB 15000-5/0.95 standard protection is rated IP54.

Manipulator, CRB 15000-10/1.52 and CRB 15000-12/1.27 standard protection is rated IP67.

Operating system

The robot is equipped with the OmniCore C30 controller and robot control software, RobotWare. RobotWare supports every aspect of the robot system, such as motion control, development and execution of application programs, communication etc. See *Operating manual - OmniCore*.

Note

The CRB 15000 can only be used together with OmniCore C30.

Safety

The listed safety standards are valid for the complete robot, that is, manipulator and controller.

Collaborative Safety

Strong yet safe, designed for handling payloads up to 5 kg, 10 kg and 12 kg, the CRB 15000 has integrated torque sensors in each of its six joints, offering superior power and force limiting performance, as well as a toolbox of safety functions with SafeMove Collaborative and additional robot software functions including motion supervision. Together these prevent the risk of injury by bringing the robot to an immediate stop if it senses any contact with a human worker, whether in free contact or a clamping situation.

Verify the safety functions

Before the robot system is put into operation, verify that the safety functions are working as intended and that any remaining hazards identified in the risk assessment are mitigated to an acceptable level.

Additional functionality

For additional functionality, the robot can be equipped with optional software for application support, for example, network communication features, and advanced functions such as multitasking, sensor control etc. For a complete description on optional software, see the *Product specification - OmniCore C line*.

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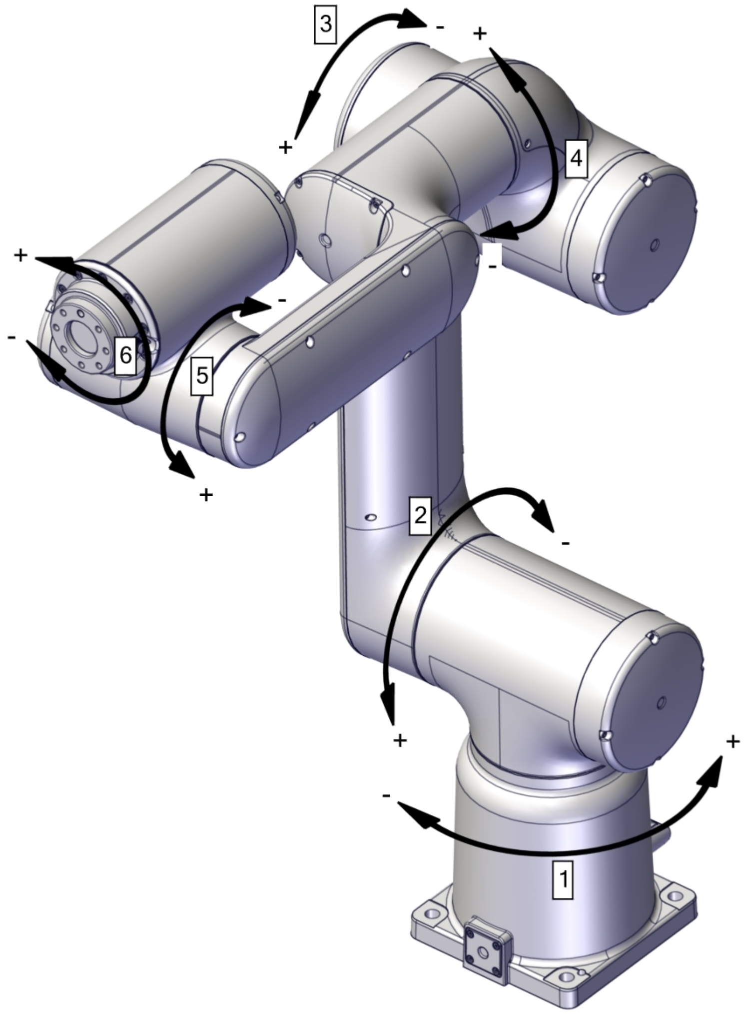
Robot axes



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Pos	Description	Pos	Description
1	Axis 1	2	Axis 2
3	Axis 3	4	Axis 4
5	Axis 5	6	Axis 6

1.1.2 Different robot variants

General

The CRB 15000 is available the following variants.

Robot type	Handling capacity	Wrist reach	Flange reach
CRB 15000-5/0.95	5 kg	0.95 m	1.05 m
CRB 15000-10/1.52	10 kg	1.52 m	1.63 m
CRB 15000-12/1.27	12 kg	1.27 m	1.38 m

1.2 Standards

1.2.1 Applicable standards

General

The product is compliant with ISO 10218-1:2011, *Robots for industrial environments - Safety requirements - Part 1 Robots*, and applicable parts in the normative references, as referred to from ISO 10218-1:2011. In case of deviation from ISO 10218-1:2011, these are listed in the declaration of incorporation. The declaration of incorporation is part of the delivery.

Robot standards

Standard	Description
ISO 9283	Manipulating industrial robots – Performance criteria and related test methods
ISO 9787	Robots and robotic devices – Coordinate systems and motion nomenclatures
ISO 9946	Manipulating industrial robots – Presentation of characteristics

Other standards used in design

Standard	Description
IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements, normative reference from ISO 10218-1
IEC 61000-6-2	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
IEC 61000-6-4	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
ISO 13849-1:2006	Safety of machinery - Safety related parts of control systems - Part 1: General principles for design, normative reference from ISO 10218-1
ISO/TS 15066	Robots and robotic devices - Collaborative robots This Technical Specification specifies safety requirements for collaborative industrial robot systems and the work environment, and supplements the requirements and guidance on collaborative industrial robot operation given in ISO 10218-1 and ISO 10218-2.
UL 1740 (option) CSA Z434 (option)	Standards For Safety - Robots and Robotic Equipment Industrial robots and robot Systems - General safety requirements Valid for USA and Canada.

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Deviations

Deviations from ISO 10218-1:2011 for CRB 15000

The CRB 15000 is intended for collaborative operation. The integrator of the robot system is required to perform an assessment of the hazards and risks.

Requirement	Deviation for CRB 15000	Motivation
§5.3.5 Single point of control.	The arm side interface can be overridden in automatic mode.	The CRB 15000 robot is intended for collaborative applications where contact between robot and the operator is harmless.

1.3 Installation

1.3.1 Introduction to installation

General

The detailed information for installing the CRB 15000 at the working site is found in *Product manual - CRB 15000* and in *Product manual - OmniCore C30*.

The installation must be done by qualified installation personnel in accordance with the safety requirements set forth in the applicable national and regional standards and regulations.

Tip

All documents can be found via myABB Business Portal, www.abb.com/myABB.

Extra loads

See *Fitting equipment on the robot (robot dimensions) on page 28*.

More information for the arm-side interface

The arm-side interface has configurable buttons and a light ring that indicates status, see *Configuring the arm-side interface on page 36*. More details on how to configure this is described in *Product manual - CRB 15000*.

It is also possible to configure an external lamp or similar, using I/O signals. This is described in the product manual for the controller (*Product manual - OmniCore C30*, section *Installation and commissioning*, *I/O system*), and in the manuals describing I/O configuration (also listed in the product manual for the robot controller).

More information for the safety configuration

How to configure SafeMove is described in *Application manual - Functional safety and SafeMove*.

The integrator of the robot is responsible for calculating, designing, and verifying safety measures as defined in ISO 10218-2 and ISO/TS 15066.

Note

When starting the robot, a connected FlexPendant or RobotStudio client, will indicate if there is no validated safety configuration.

1.3.2 Technical data

Weight, robot

The table shows the weight of the robot.

Robot model	Nominal weight
CRB 15000-5/0.95	28 kg
CRB 15000-10/1.52	51 kg
CRB 15000-12/1.27	48 kg

Note

The weight does not include additional options, tools and other equipment fitted on the robot.

Mounting positions

The table shows valid mounting positions and the installation (mounting) angle for the manipulator.

Mounting position	Installation angle
Floor mounted	0°
Wall mounted	Any angle
Suspended	180°

Note

The actual mounting angle must always be configured in the system parameters, otherwise the performance and lifetime is affected. See the product manual for details.

Loads on foundation, robot

The illustration shows the directions of the robots stress forces.

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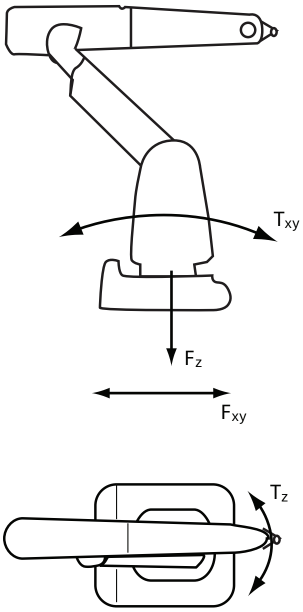
The directions are valid for all floor mounted, table mounted, wall mounted and suspended robots.



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F_{xy}	Force in any direction in the XY plane
F_z	Force in the Z plane
T_{xy}	Bending torque in any direction in the XY plane
T_z	Bending torque in the Z plane

The table shows the various forces and torques working on the robot during different kinds of operation.

Note

These forces and torques are extreme values that are rarely encountered during operation. The values also never reach their maximum at the same time!

WARNING

The robot installation is restricted to the mounting options given in following load table(s).

Floor mounted

Force	Endurance load (in operation)	Maximum load (emergency stop)
Force xy	±303 N [i] / ±470 N [ii] / ±470 N [iii]	±1113 N [i] / ±1460 N [ii] / ±1450 N [iii]
Force z	+280 ±147 N [i] / +500 ±410 N [ii] / +480 ±420 N [iii]	+280 ±857 N [i] / +500 ±650 N [ii] / +480 ±690 N [iii]
Torque xy	±246 Nm [i] / ±570 Nm [ii] / ±580 Nm [iii]	±711 Nm [i] / ±1,280 Nm [ii] / ±1,180 Nm [iii]
Torque z	±145 Nm [i] / ±200 Nm [ii] / ±210 Nm [iii]	±334 Nm [i] / ±720 Nm [ii] / ±690 Nm [iii]

i Valid for CRB 15000-5/0.95.

Continues on next page

ii Valid for CRB 15000-10/1.52.
iii Valid for CRB 15000-12/1.27.

Wall mounted

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	+280 ±130 N[i] / +510 ±490 N[ii] / +480 ±450 N[iii]	+280 ±1000 N[i] / +510 ±1220 N[ii] / +480 ±1260 N[iii]
Force z	±289 N[i] / ±390 N[ii] / ±360 N[iii]	±944 N[i] / ±900 N[ii] / ±1150 N[iii]
Torque xy	±275 Nm[i] / ±700 Nm[ii] / ±677 Nm[iii]	±768 Nm[i] / ±2,000 Nm[ii] / ±1,970 Nm[iii]
Torque z	±162 Nm[i] / ±400 Nm[ii] / ±370 Nm[iii]	±338 Nm[i] / ±780 Nm[ii] / ±790 Nm[iii]

i Valid for CRB 15000-5/0.95.
ii Valid for CRB 15000-10/1.52.
iii Valid for CRB 15000-12/1.27.

Suspended

Force	Endurance load (in operation)	Max. load (emergency stop)
Force xy	±303 N[i] / ±470 N[ii] / ±470 N[iii]	±1113 N[i] / ±1460 N[ii] / ±1450 N[iii]
Force z	-280 ±147 N[i] / +500 ±410 N[ii] / +480 ±420 N[iii]	-280 ±857 N[i] / +500 ±650 N[ii] / +480 ±690 N[iii]
Torque xy	±246 Nm[i] / ±570 Nm[ii] / ±580 Nm[iii]	±711 Nm[i] / ±1,280 Nm[ii] / ±1,180 Nm[iii]
Torque z	±145 Nm[i] / ±200 Nm[ii] / ±210 Nm[iii]	±334 Nm[i] / ±720 Nm[ii] / ±690 Nm[iii]

i Valid for CRB 15000-5/0.95.
ii Valid for CRB 15000-10/1.52.
iii Valid for CRB 15000-12/1.27.

Requirements, foundation

The table shows the requirements for the foundation where the weight of the installed robot is included:

Requirement	Value	Note
Flatness of foundation surface	0.1/500 mm	The value for levelness aims at the circumstance of the anchoring points in the robot base. In order to compensate for an uneven surface, the robot can be recalibrated during installation. If resolver/encoder calibration is changed this will influence the absolute accuracy / ultra accuracy.
Minimum resonance frequency	22Hz **Note** It may affect the manipulator lifetime to have a lower resonance frequency than recommended.	The value is recommended for optimal performance. Due to foundation stiffness, consider robot mass including equipment.[i] For information about compensating for foundation flexibility, see the description of *Motion Process Mode* in the manual that describes the controller software option, see *References on page 7*.

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Requirement	Value	Note
Minimum foundation material yield strength	150 Mpa	

i The minimum resonance frequency given should be interpreted as the frequency of the robot mass/inertia, robot assumed stiff, when a foundation translational/torsional elasticity is added, i.e., the stiffness of the pedestal where the robot is mounted. The minimum resonance frequency should not be interpreted as the resonance frequency of the building, floor etc. For example, if the equivalent mass of the floor is very high, it will not affect robot movement, even if the frequency is well below the stated frequency. The robot should be mounted as rigid as possibly to the floor.

Disturbances from other machinery will affect the robot and the tool accuracy. The robot has resonance frequencies in the region 10 – 20 Hz and disturbances in this region will be amplified, although somewhat damped by the servo control. This might be a problem, depending on the requirements from the applications. If this is a problem, the robot needs to be isolated from the environment.

Storage conditions, robot

The table shows the allowed storage conditions for the robot:

Parameter	Value
Minimum ambient temperature	-40°C
Maximum ambient temperature	70°C
Maximum ambient temperature (less than 24 hrs)	70°C
Maximum ambient humidity	95% at constant temperature (not intended to operate with condensation)
Maximum ambient altitude	0-3,000 m (100-74 kPa)

Operating conditions, robot

The table shows the allowed operating conditions for the robot:

Parameter	Value
Minimum ambient temperature	5°C [i]
Maximum ambient temperature	40°C [ii] / 45°C [iii]
Maximum ambient humidity	<75% relative humidity For limited period of time (<1 month): <95% relative humidity [iv]
Maximum ambient altitude	0-2,000 m (100-84 kPa)

i At low environmental temperature < 10ºC as with any other machine, a warm-up phase recommended to be run with the robot. Otherwise there is a risk that the robot stops or run with lower performance due to temperature dependent oil and grease viscosity.

ii Valid for CRB 15000-5/0.95.

iii Valid for CRB 15000-10/1.52 and CRB 15000-12/1.27.

iv Depending on climate and robot running conditions, condensation may occur on the inside of plastic covers. The condensation will disappear over time by itself, alternatively the user can open the covers and run a program for 12 hours to accelerate the process.

Protection classes, robot

The table shows the available protection types of the robot, with the corresponding protection class.

Protection type	Protection class [i]
Manipulator, protection type Standard (CRB 15000-5/0.95)	IP54 Type 12k [ii] NEMA 12k [iii]

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Protection type	Protection class [i]
Manipulator, protection type Standard (CRB 15000-10/1.52 and CRB 15000-12/1.27)	IP67

i According to IEC 60529.
ii According to UL50/UL50E, CSA C22.2 No 94.2-15.
iii According to NEMA 250.

Clean room suitability, robot

The table shows the suitability for clean room environment for the valid protection types of the robot.

Protection type	Protection class
Manipulator, suitability class (protection type Standard)	ISO Class 4 [i]

i According to ISO 14644-1 / ISO 14644-14.

Harsh environment

The manipulator complies with the following harsh environment.

Parameter	According to
Flowing, mixed gas corrosion test	ISA–71.04-2013 G3 Harsh Group A DIN EN 60068-2-60

Components and concentrations of the mixed corrosive gas:

- Hydrogen sulphide (H_2S): 50 ppb
- Nitrogen dioxide (NO_2): 1,250 ppb
- Chlorine (Cl_2): 10 ppb
- Sulphur dioxide (SO_2): 300 ppb

Environmental information

The product complies with IEC 63000. *Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances*.

Joint torques

The following table shows the maximum torque for each joint. The maximum value can be achieved on one axis at a time.

Axis	Maximum joint torque
1	175.44 Nm [i] / 450 Nm [ii] / 390 Nm [iii]
2	175.44 Nm [i] / 400 Nm [ii] / 400 Nm [iii]
3	90.6 Nm [i] / 160 Nm [ii] / 160 Nm [iii]
4	18.72 Nm [i] / 60 Nm [ii] / 60 Nm [iii]
5	21.44 Nm [i] / 60 Nm [ii] / 60 Nm [iii]
6	9.2 Nm [i] / 60 Nm [ii] / 60 Nm [iii]

i Valid for CRB 15000-5/0.95.
ii Valid for CRB 15000-10/1.52.
iii Valid for CRB 15000-12/1.27.

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Other technical data

Data	Description	Note
Airborne noise level	The sound pressure level outside the working space.	< 50.2 dB(A) Leq (acc. to machinery directive 2006/42/EC) Movement: ISO cube (ISO 9283) TCP velocity: 1500 mm/s

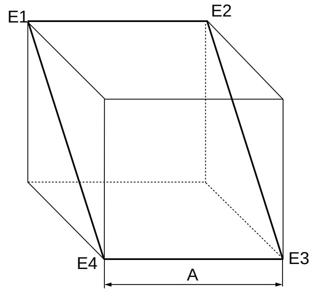
Power consumption at max load

Note

The minimum voltage condition and maximum voltage condition are based on 230V input to the controller.

Type of movement	Power consumption (kW) (all variants)
ISO Cube Max. velocity	0.25

Robot in calibration position	All variants (kW)
Brakes engaged	0.14
Brakes disengaged	0.10



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Pos	Description
A	400 mm

Explosive environments

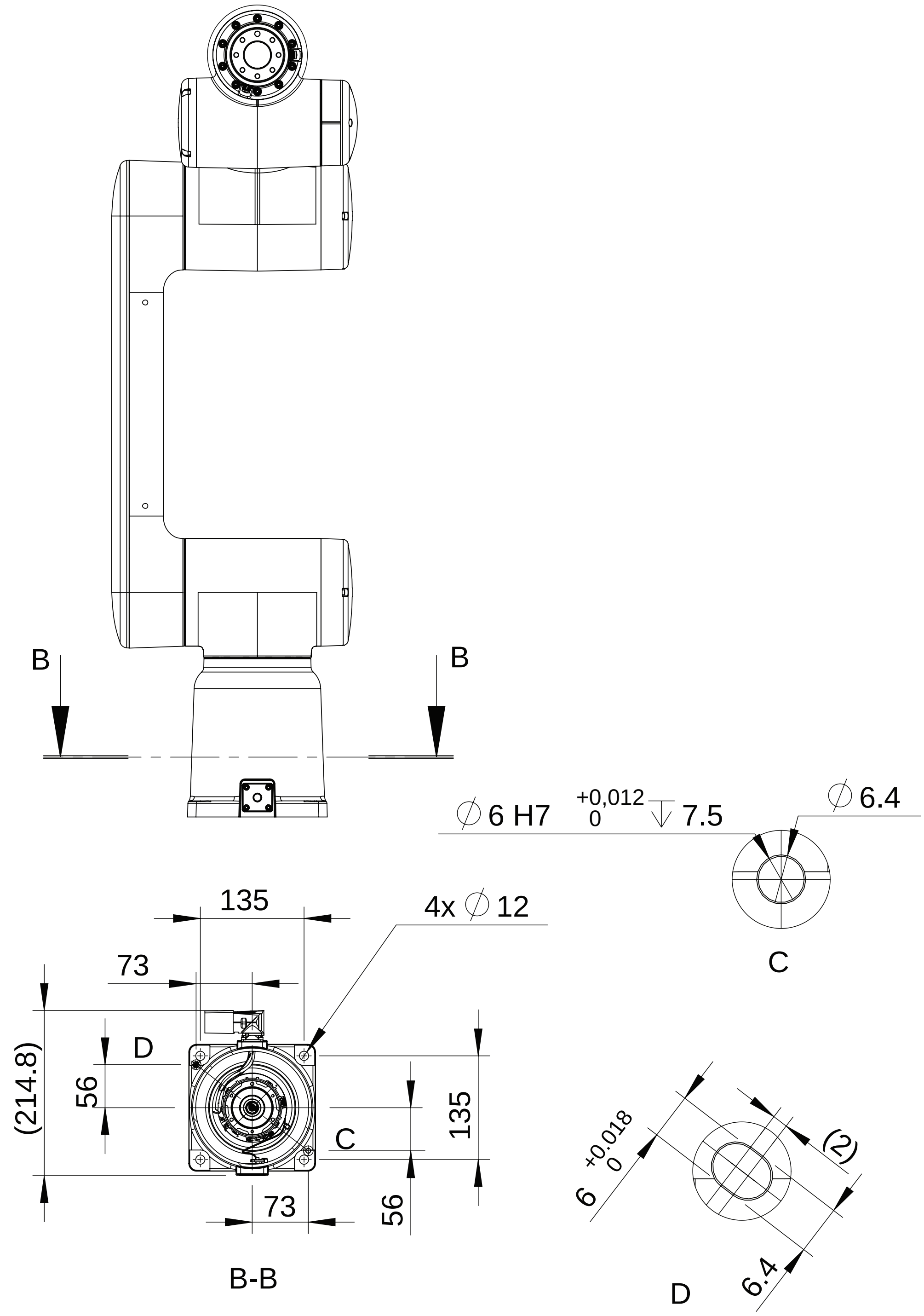
The robot must not be located or operated in an explosive environment.

1.3.3 Hole configuration and attachment screws

Hole configuration, base

CRB 15000-5/0.95

This illustration shows the hole configuration used when securing CRB 15000-5/0.95.



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C	Circular hole for locating pin

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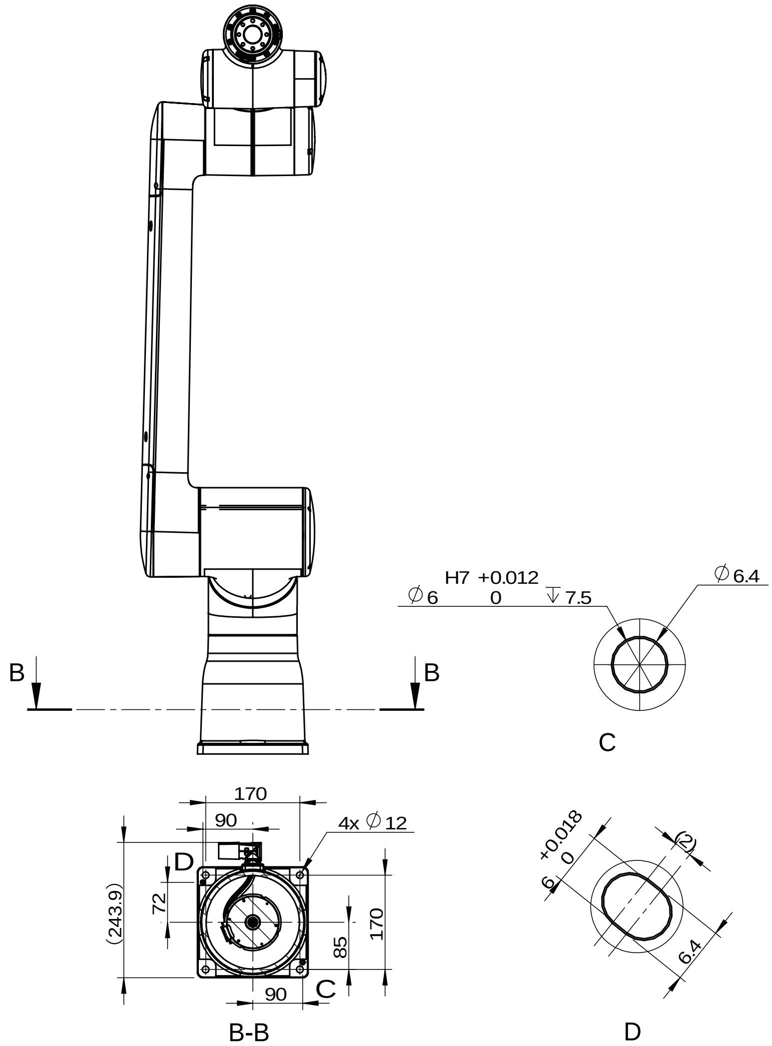
D	Elongated hole for locating pin

CRB 15000-10/1.52

This illustration shows the hole configuration used when securing CRB 15000-10/1.52.



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C	Circular hole for locating pin
D	Elongated hole for locating pin

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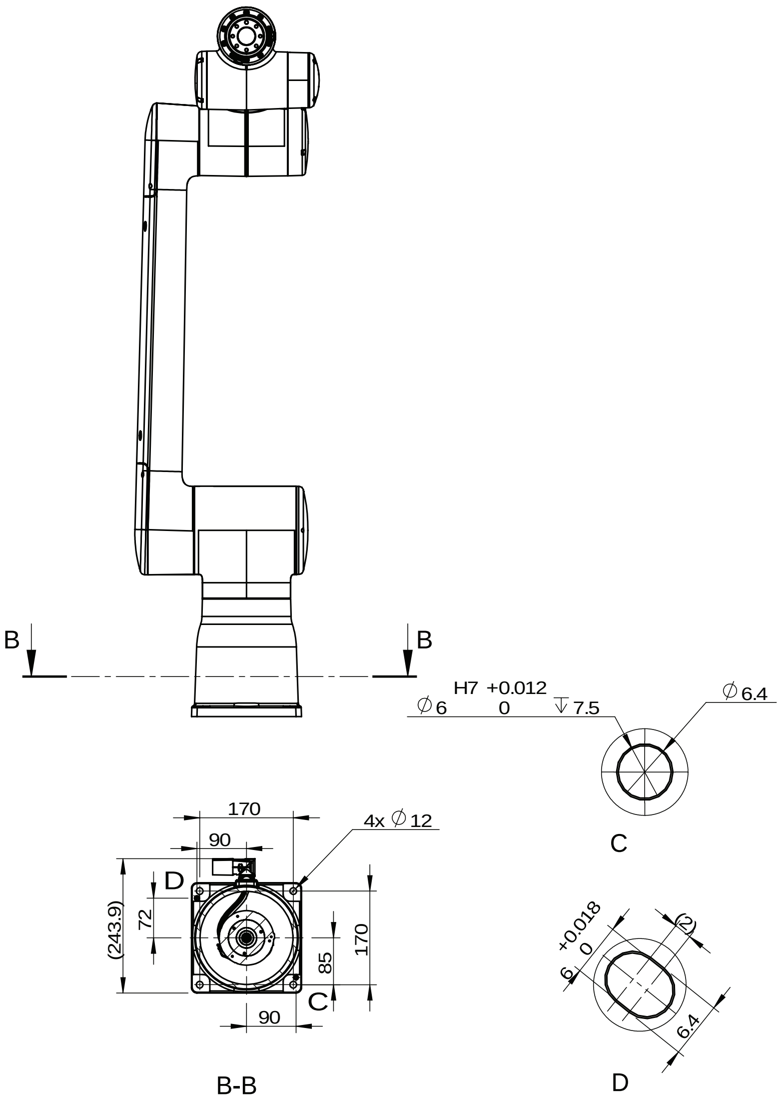
CRB 15000-12/1.27

This illustration shows the hole configuration used when securing CRB 15000-12/1.27.



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C	Circular hole for locating pin
D	Elongated hole for locating pin

Attachment screws

The table below specifies the type of securing screws and washers to be used for securing the robot to the base plate/foundation.

All hardware is enclosed in the robot delivery.

Suitable screws	M10x35
Quantity	4 pcs
Quality	8.8

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Suitable washer	23/10.5/2.5 mm Steel
Guide pins	DIN6325, hardened steel Ø6x24 mm, 2 pcs
Tightening torque	32 Nm ±10%
Length of thread engagement	Minimum 15 mm for ground with material yield strength 150 MPa
Level surface requirements	0.1/500 mm

1.3.4 Fitting equipment on the robot (robot dimensions)

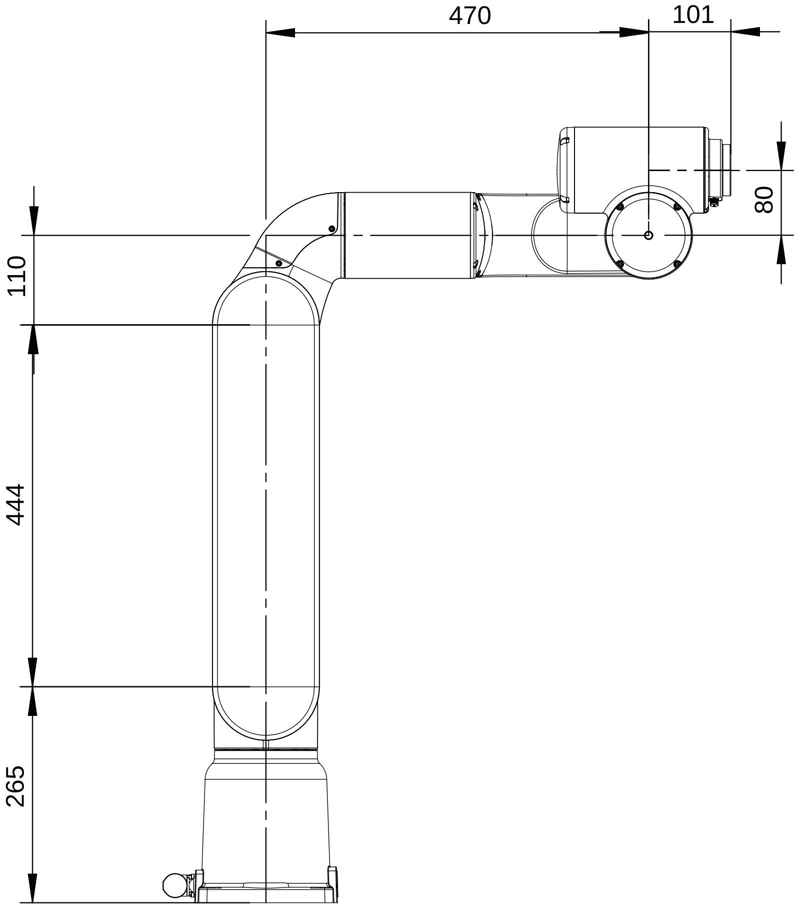
Note

Even after the robot is secured to the foundation, do not lean on it or place loads on it, except what is permitted on the tool flange.

Robot dimensions

The figure shows the dimension of the robot.

CRB 15000-5/0.95



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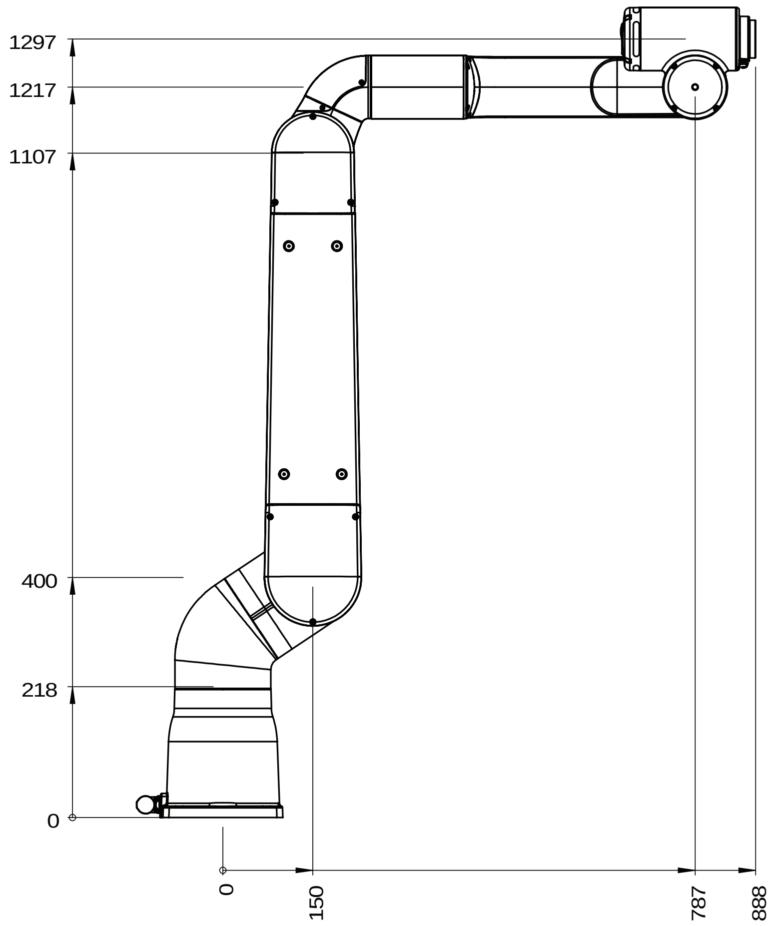
CRB 15000-10/1.52



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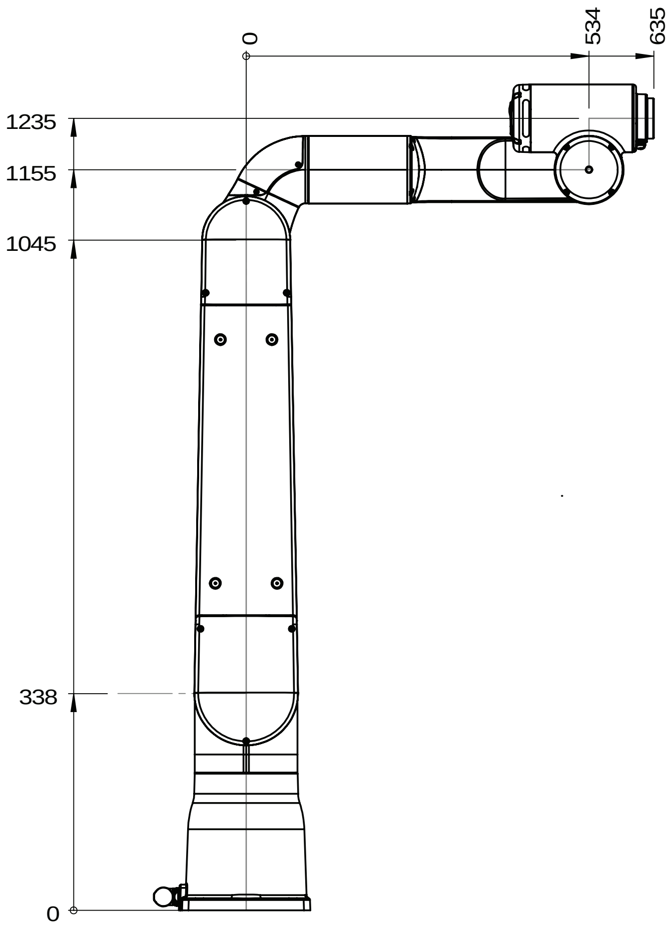

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Fitting equipment on the robot arm

ELECTRICAL SHOCK

External cable routing where voltages deemed to be hazardous live, ground resistance path shall not exceed 0.1 ohms for all metal parts exposed or likely to be touched by a person during normal operation, and likely to become energized through electrical malfunction.

Upper arm

The robot upper arm is not designed with attachment holes for any arm load. However, for light loads such as cables, it is possible to mount them directly on the arm, or to replace the four screws on the upper arm cover with hex spacers, as shown in the following figure (taking CRB 15000-5/0.95 as an example).

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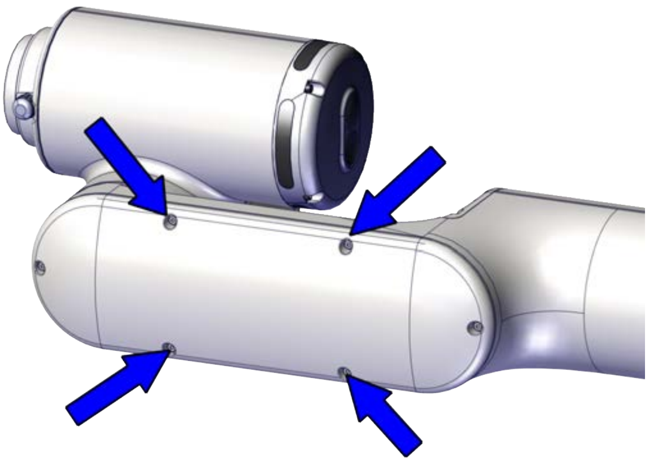

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Definitions of dimensions and masses are shown in *Holes for fitting extra equipment on page 32*. Requirements on hex spacers are shown in *Fastener quality for hex spacers on page 34*.

> **Note**
>
> Sharp edges or other hazards related to the hex spacers or fitted equipment must be taken into consideration.

> **Note**
>
> If the gasket screws on the upper arm cover of CRB 15000-5/0.95 are replaced with hex spacers, then the IP54 is no longer fulfilled.

Before fitting equipment to the robot upper arm, special considerations must be taken:

- Any external cable routing along the robot arm shall be done in a flexible way allowing for robot motion and taking hazards associated with entanglement into account.
- The brake release points on each axis must be accessible in the end application using the external brake release tool.

  > **CAUTION**
  >
  > The external brake release tool works on robots with RobotWare earlier than 7.10. On robots with RobotWare 7.10 or later, the tool does not work.

- The armload interface can handle loads up to 1 kg. This includes the weight of the cabling, tools, and workpiece (if lifted).

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> **Note**
>
> When the arm load is defined, the maximum payload capacity may be reduced in certain poses. A simulation in RobotStudio shall be performed to verify that the combination of arm load and payload works in the intended application.

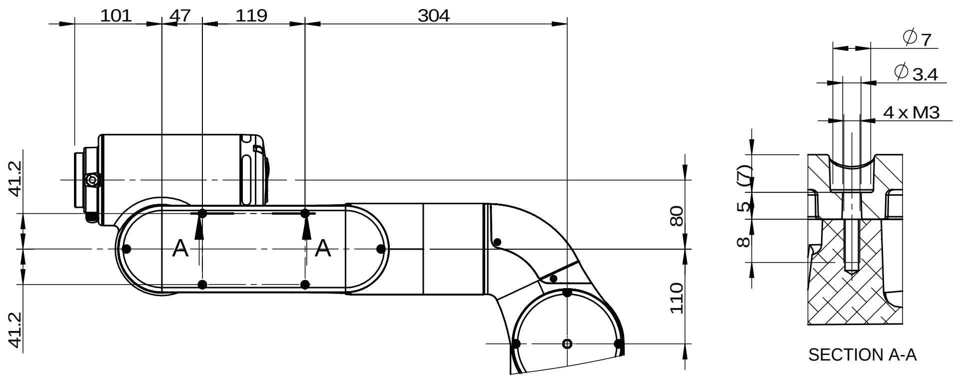
Housing and lower arm

For CRB 15000-10/1.52 and CRB 15000-12/1.27, robot housing and lower arm can also handle extra loads up to 1 kg respectively. Definitions of dimensions and masses are shown in *Holes for fitting extra equipment on page 32*.

Maximum allowed arm load depends on center of gravity of arm load and robot payload. When an armload is attached, the payload on the wrist is reduced.

Holes for fitting extra equipment

Upper arm, CRB 15000-5/0.95



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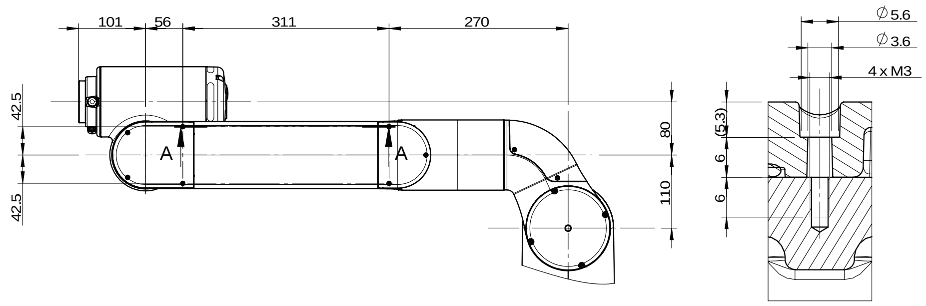
Upper arm, CRB 15000-10/1.52



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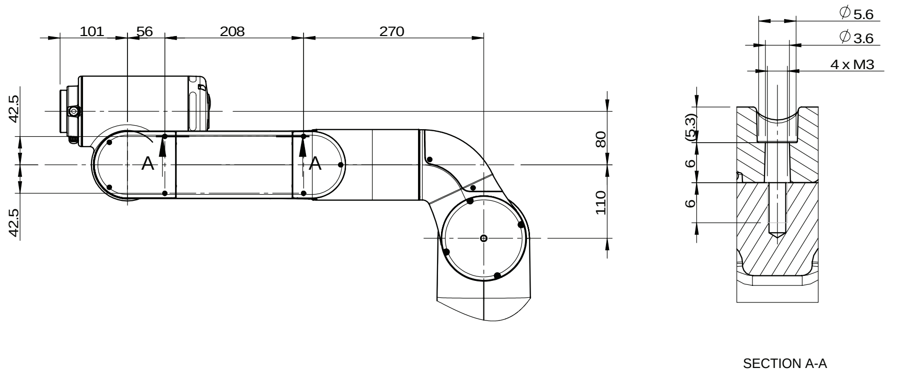
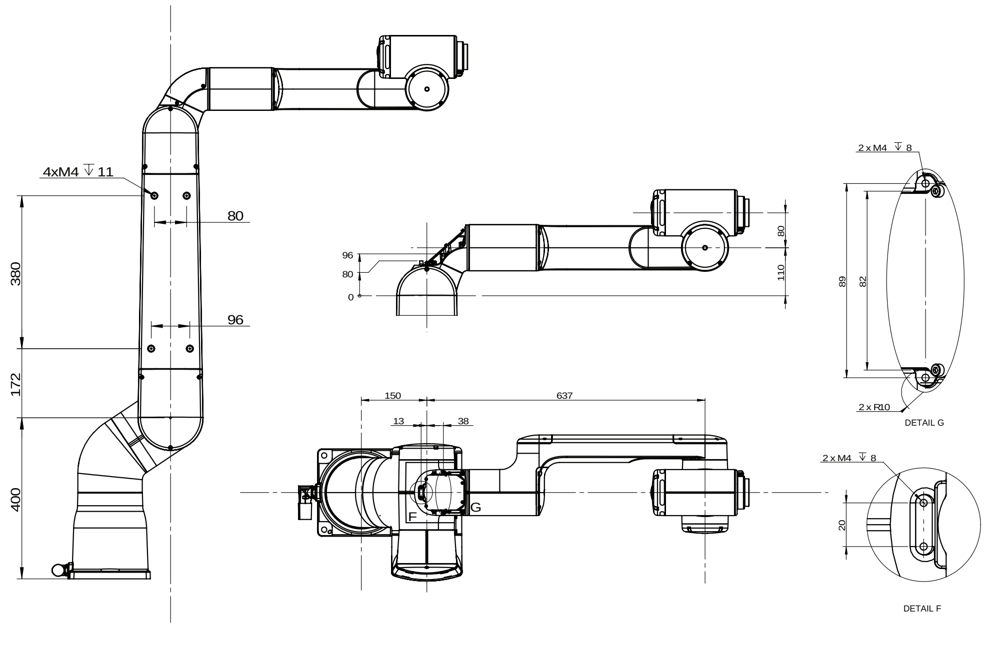
Upper arm, CRB 15000-12/1.27



xx2300000990

Housing and lower arm, CRB 15000-10/1.52



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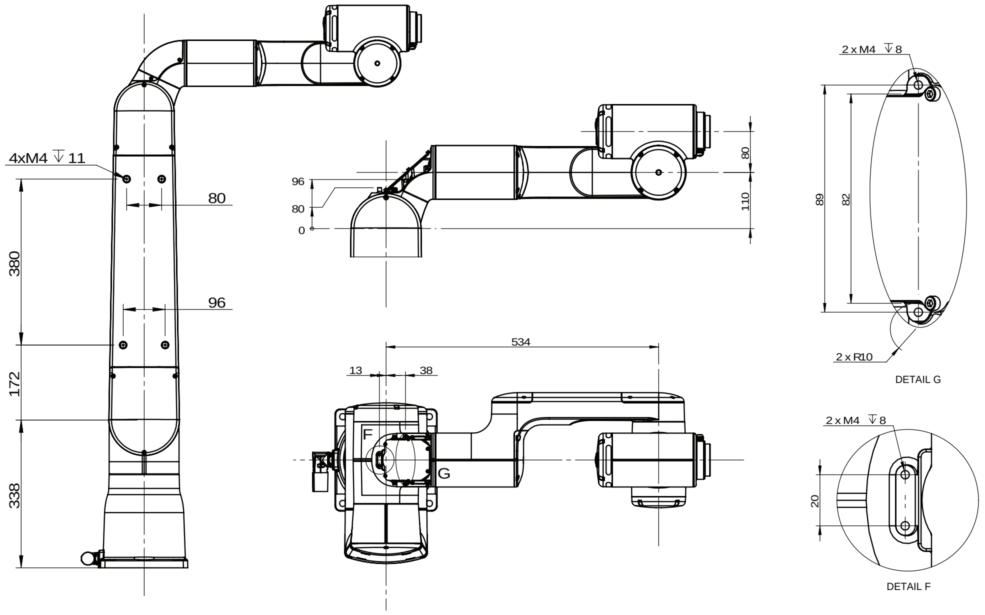
Housing and lower arm, CRB 15000-12/1.27



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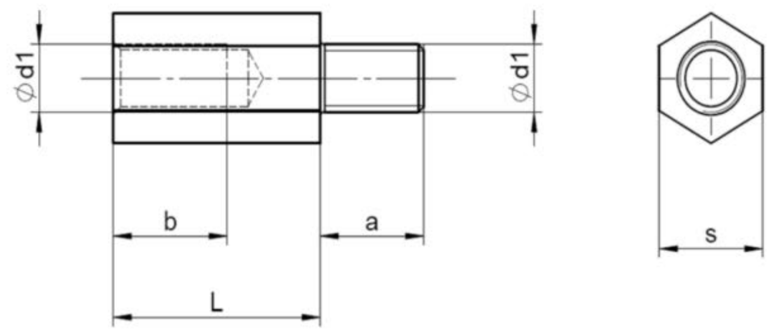
Fastener quality for hex spacers

The following table shows the requirements on hex spacers for fitting equipment on the upper arm covers.



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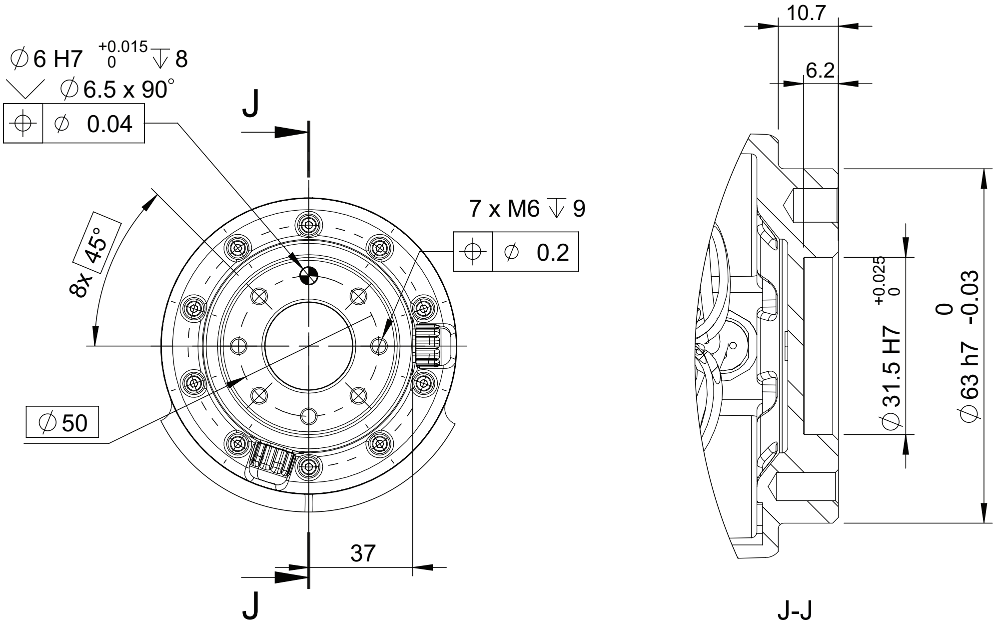
	CRB 15000-5/0.95	CRB 15000-10/1.52 CRB 15000-12/1.27
Material	Stainless steel 4.8, or higher	Stainless steel 4.8, or higher
Tightening torque	0.6 Nm+/-5%	0.6 Nm+/-5%
Minimum thread length (a)	8 mm	10 mm
Thread length (b)	8 mm	10 mm
Screw head width (S)	5 mm	5 mm
Length (L)	18 mm	25 mm

Continues on next page

	CRB 15000-5/0.95	CRB 15000-10/1.52 CRB 15000-12/1.27
Example of suitable hex spacer	Bossard, article number: 304318041152 Keystone, article number: 24289~24294	Bossard, article number: 304325041152 Bossard, article number: 304330041152

Tool flange



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Fastener quality on tool flange

Use screws with suitable length and tightening torque for your application.

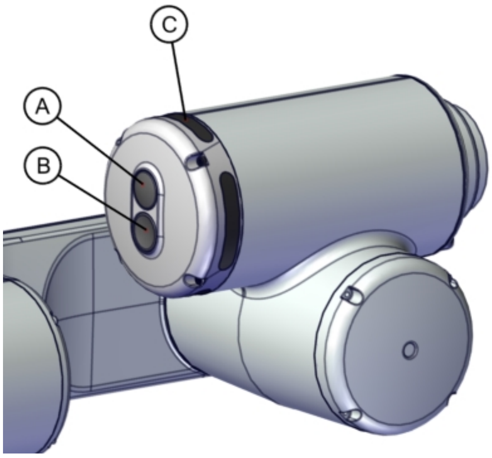
Screws with quality class 12.9 are recommended.

Also note the thread depth on the tool flange. Using too long screws may damage the tool flange and cause the tool to be improperly fastened, which is a safety hazard.

1.3.5 Configuring the arm-side interface

Introduction

The arm-side interface is located on axis 5, opposite to the tool flange. The configuration of the arm-side interface is done using the application **ASI Setting** on the FlexPendant.



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A	Up button (convex button)
B	Down button (concave button)
C	Light ring

Prerequisites

A validated safety configuration must be set up before using the arm-side interface. This must be based on a risk assessment of the application. Particular attention should be paid to the risks of impact, crushing and shearing.

The tool and payload must be configured before configuring the arm-side interface. See *Operating manual - OmniCore*.

1.3.6 Lead-through

What is lead-through?

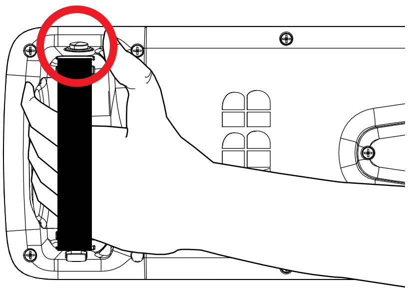
The lead-through functionality is available for robots designed for collaborative applications. If lead-through is available, this is shown on the FlexPendant.

Using lead-through, you can grab the robot arm and move it manually to a desired position, as an alternative to jogging.

Using lead-through

Use the following procedure to jog the robot using the lead-through functionality:

1. Enable lead-through in one of the following ways:
   - Press the thumb button on the FlexPendant.

     xx2100000331

   - On the start screen, tap **Jog** and select the **Lead-through** menu.
   - In the **QuickSet** menu, select the **Lead-through** tab.

   > **Note**
   >
   > If the robot is in motors off state, it will automatically go to the motors on state when the lead-through is enabled.

2. In the **Jog Mode** section select a mode.
3. If required, in the **Lead-through lock** section use the lock button next to a axis to lock it.

   > **Note**
   >
   > The **Lead-through lock** section is disabled for the **Axis 1-6** mode.

4. Gently pull the robot arm to the desired position.

   The robot moves to the selected position. If the **Lead-through lock** option is selected, the robot moves in such a way that the movement is restricted in the locked direction.

Continues on next page

Note

You can feel if an axis reaches its end position. Do not try to force the axis beyond this position.

5. If desired, save the position.

Note

The speed at which the robot moves when using the Lead-through functionality is managed using the horizontal scroll bar available in the **Lead-through Speed** section.

Note

If lead-through is enabled, it will be temporarily disabled during program execution and jogging. This means that it is possible to combine lead-through, jogging, and testing the RAPID program without having to disable the lead-through.

Note

When using lead-through, it is important that the load is correctly defined. If the load is heavier than defined, the effect will be the same as if you are pulling the robot arm downwards. If the load is lighter than the defined load, the effect will be the same as if you are pulling the robot arm upwards.

For the CRB 15000, there is a button for updating/refreshing the load while lead-through is active.

For the CRB 15000, if varying loads from cables and other disturbances are causing the robot to drift during lead-through, this can often be improved by setting the system parameter *Lead through load compensation* to *Always*. See *Technical reference manual - System parameters*, section *Motion*, type *Robot*.

Align to a coordinate system

It is possible to align the robot to a coordinate system either in Auto or Manual mode from the lead-through page for a CRB 15000 robot.

Use the following procedure to align the robot to a coordinate system:

1. In the Lead-through page select the a mode in the **Lead-through Mode** section.
2. In the **Align to coordinate system** section, select the required coordinate system.
3. Enable the motors.

Note

For collaborative robots, the motors are on by default unless extra safety options are selected in the system.

Continues on next page

4 Tap and hold the **Press and Hold Align** button.

The robot is aligned to the selected coordinate system.

Limitations

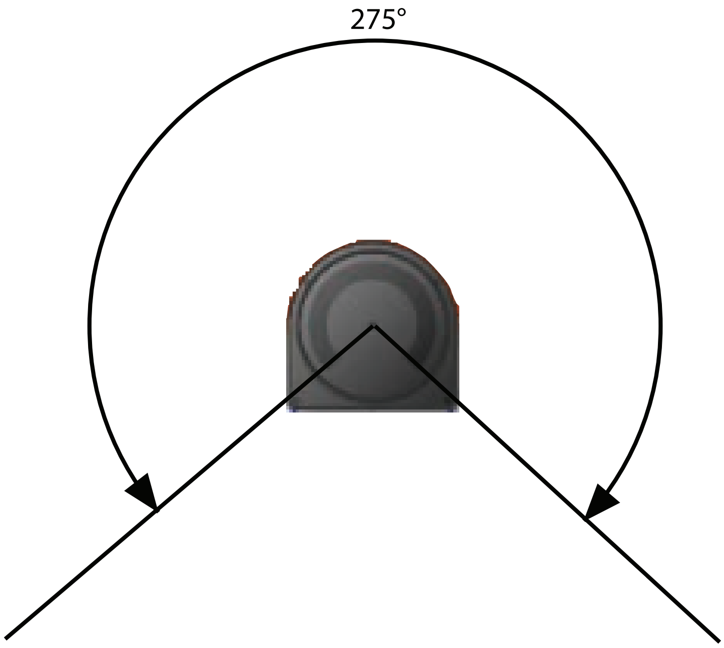
When using lead-through, the path planner is not updated until the program is resumed/restarted or jogging is used. For example, this means that World Zones supervision is not accessible when using lead-through.

1.3.7 Installation of laser scanner

Overview

ABB provides safety separation and speed control functions to CRB 15000 by installing the Collaborative Speed Control add-in in the robot system and connecting the robot with one or two safety laser scanners. The laser scanner(s) provides a timely and continuous monitor on the activities within its scanning area and forms a protective field. One laser scanner can provide a scanning range of approximately 275°. The system integrator shall investigate the site environment and place the laser scanner to a suitable location according to the actual requirements.

> **CAUTION**
>
> Safety in the area that not in the scanning range must always be considered. The system integrator shall assess the potential risks within this area and make sure that proper measures have been applied to reduce risks.



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Laser scanner types

The following laser scanner package options are available:

- 1 PROFIsafe-based laser scanner (option 3051-1 PROFIsafe scanner)
- 2 PROFIsafe-based laser scanners (option 3051-3 Dual PROFIsafe scanner)
- 1 SafetyIO-based laser scanner (option 3051-2 I/O scanner)
- 2 SafetyIO-based laser scanners (option 3051-4 Dual I/O scanner)

Continues on next page

Connection between PROFIsafe-based laser scanners and the OmniCore controller differs according to the PROFINET options selected and installed in the system.

- If only options [3020-2] PROFINET Device and [3023-2] PROFIsafe Device are selected and installed, the laser scanners shall connect to a PLC acting as a master first and then to the OmniCore controller with SafeMove via the PROFINET safe (PROFIsafe) network. Users need to prepare a safety PLC of their own.
- If options [3020-1] PROFINET Controller and [3023-1] PROFIsafe Controller are selected and installed, the laser scanner could communicate with the OmniCore controller directly via the LAN port.

SafetyIO-based laser scanners connects to the OmniCore controller with SafeMove and installed with the scalable I/O device DSQC1042 Safety digital base (option 3037-2). For details about the scalable I/O device, see the product specification of the controller and *Application manual - Scalable I/O*.

The supported PROFINET- and SafetyIO-base laser scanners are *SICK®* microScan 3 Core and *SICK®* microScan 3 Pro, respectively. Detailed scanner model can be obtained on the scanner nameplate. Other scanner types or models might not provide full functionality.

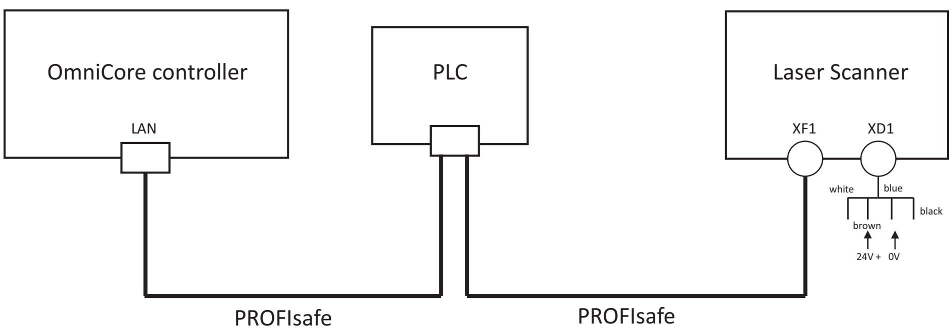
For more details about the safety laser scanners, see *Operating instructions microScan3 - PROFINET* and *Operating instructions microScan3 - Pro I/O* from the vendor, which are available on *SICK®* website.

Connecting the laser scanner(s)

Safety laser scanners shall be connected properly according to the scanner type and system setup.

> **Note**
>
> External 24V power supply shall be prepared for power connection of laser scanners.

1 PROFIsafe-based laser scanner (option 3051-1), with PLC connected



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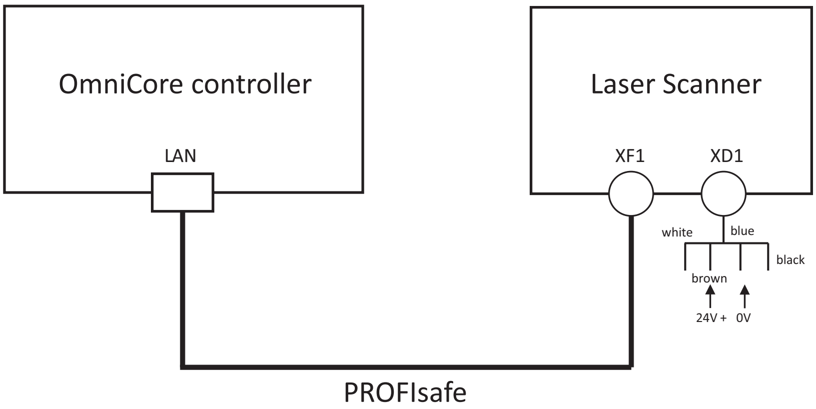
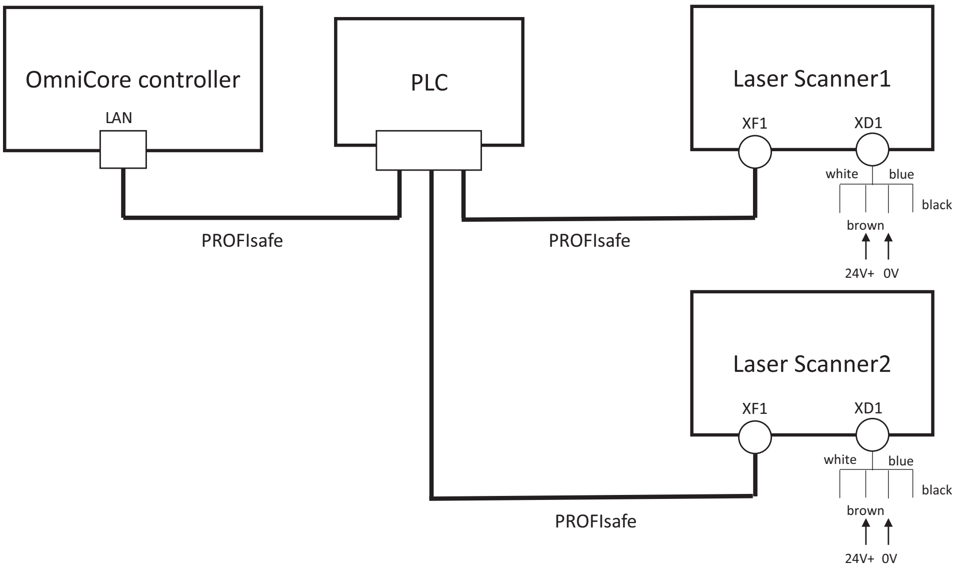
1 PROFIsafe-based laser scanner (option 3051-1), without PLC connected



xx2300000226

2 PROFIsafe-based laser scanners (option 3051-3), with PLC connected



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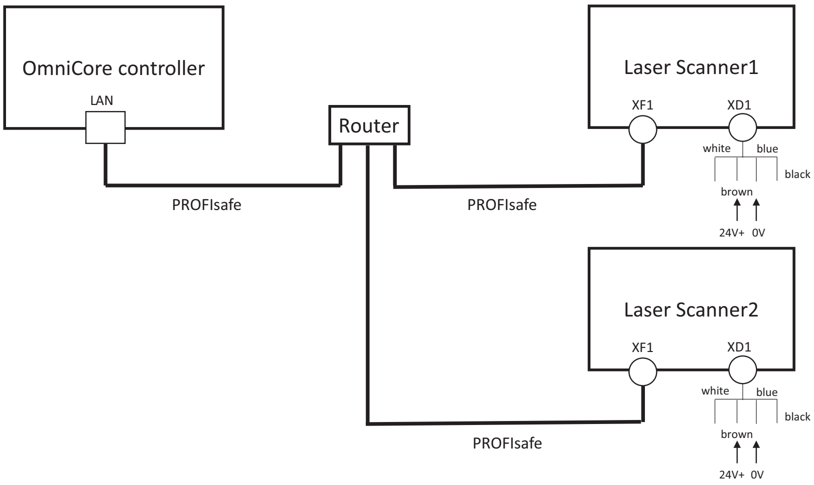
2 PROFIsafe-based laser scanners (option 3051-3), without PLC connected



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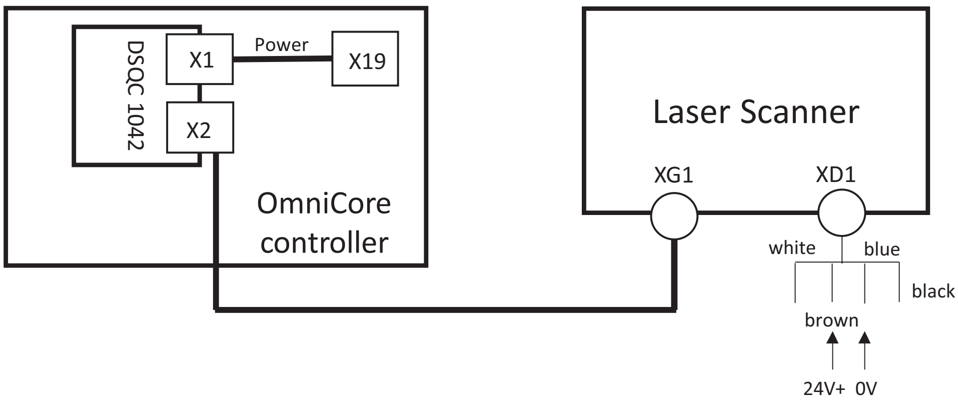
1 SafetyIO-based laser scanner (option 3051-2)



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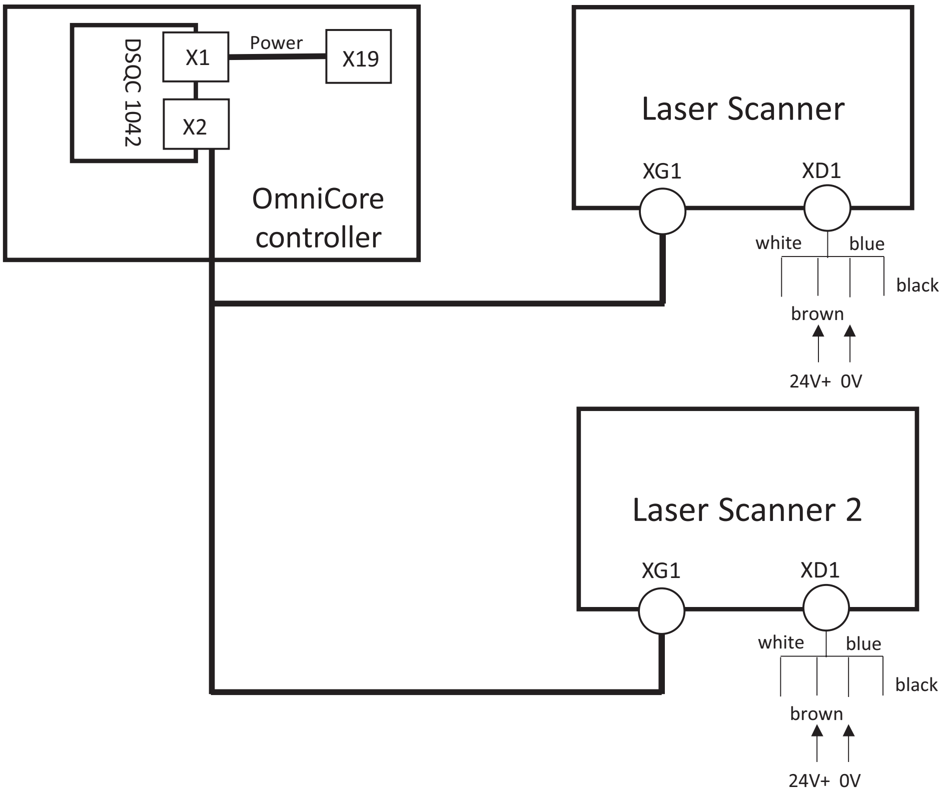
2 SafetyIO-based laser scanners (option 3051-4)



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> **Note**
>
> For PROFIsafe-based laser scanner, if working with the CRB 15000 in a version 1.2.1 or earlier, the scanners should connect to the WAN port on the controller.

> **Note**
>
> If there are additional scalable I/O devices available, install and configure the additional devices by following the detailed procedures in *Application manual - Scalable I/O*.

Connector information

Pin assignment on XG1 of SafetyIO-based laser scanners

XG1 connector on SafetyIO-based laser scanner is a 17-pin, A-coded M12 female connector. Pins 1-4 and pin 17 on XG1 are occupied for connecting the laser scanner and scalable I/O device, while other 12 pins can be used for local inputs and outputs.

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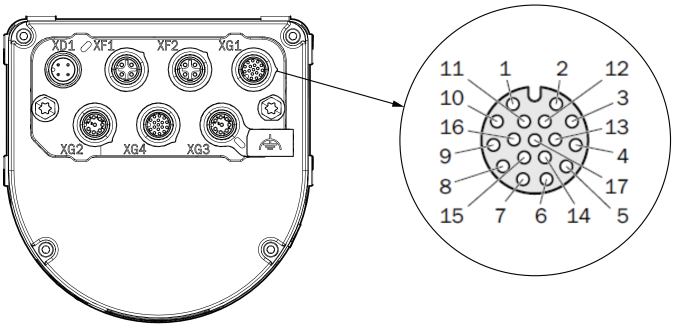

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Pin	Description	Wiring color
1	OSSD pair 1, OSSD A	Brown
2	OSSD pair 1, OSSD B	Blue
3	OSSD pair 2, OSSD A	White
4	OSSD pair 2, OSSD B	Green
5	Universal input 1	Pink
6	Universal input 2	Yellow
7	Universal input 3	Black
8	Universal input 4	Grey
9	Universal input 5	Red
10	Universal input 6	Violet
11	Universal input 7	Grey with pink
12	Universal input 8	Red with blue
13	Universal input 9	White with green
14	Universal input 10	Brown with green
15	Universal output 1	White with yellow
16	Universal output 2	Yellow with brown
17	Voltage 0 V DC	White with grey

Continues on next page

Configuration scenarios

Laser scanner configuration depends on the type and number of scanners connecting to the robot and RobotWare version. Refer to the following table for applicable scenario.

Scanner type	Works with...			Number of connected scanners	RobotWare version	Require...
	PLC	Scalable I/O deviceDSQC1042	OmniCore controller with SafeMove			Collaborative Speed Control add-in
PROFIsafe-based	Y	N	Y	1	RobotWare 7.5 or earlier	N
	Y	N	Y	1	RobotWare 7.6 or later	Y
	Y	N	Y	2	RobotWare 7.6 or later	Y
	N	N	Y	1	RobotWare 7.10 or later	Y
	N	N	Y	2	RobotWare 7.10 or later	Y
SafetyIO-based	N	Y	Y	1	RobotWare 7.6 or later	Y
	N	Y	Y	2	RobotWare 7.6 or later	Y

For details about how to configure the scanners and required actions for scenarios such as RobotWare update or rollback, see *Application manual - Collaborative Speed Control add-in*.

1.4 Calibrating the robot

1.4.1 Calibration methods and when to calibrate

Types of calibration

Type of calibration	Description	Calibration method
Absolute accuracy calibration (optional)	Based on standard calibration, and besides positioning the robot at synchronization position, the Absolute accuracy calibration also compensates for: • Mechanical tolerances in the robot structure • Deflection due to load Absolute accuracy calibration focuses on positioning accuracy in the Cartesian coordinate system for the robot. Absolute accuracy calibration data is found on the serial measurement board (SMB) or other robot memory. A robot calibrated with Absolute accuracy has the option information printed on its name plate (OmniCore). To regain 100% Absolute accuracy performance, the robot must be recalibrated for absolute accuracy after repair or maintenance that affects the mechanical structure.	CalibWare
Ultra accuracy calibration (optional)	Based on standard calibration, and besides positioning the robot at synchronization position, the Ultra accuracy calibration also compensates for: • Mechanical tolerances in the robot structure • Deflection due to load Ultra accuracy option is available to the CRB 15000. The purpose is to improve precision with path accuracy and absolute position accuracy even further. A robot calibrated with Ultra accuracy has the option information printed on its name plate (OmniCore). To regain 100% Ultra accuracy performance, the robot must be recalibrated for ultra accuracy after repair or maintenance that affects the mechanical structure.	CalibWare
Torque sensor calibration	The CRB 15000 torque sensors are calibrated with the service routine *TorqueSensorCal*. No external calibration tools are required. The calibration method for the robot consists of calibrating the motor torque sensors, which are installed to monitor and measure the motor torque.	Torque sensor calibration

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Type of calibration	Description	Calibration method
Optimization	Optimization of TCP reorientation performance. The purpose is to improve reorientation accuracy for continuous processes like welding and gluing. Wrist optimization will update standard calibration data for axes 4 and 5. **Note** For advanced users, it is also possible to use the do the wrist optimization using the RAPID instruction `WristOpt`, see *Technical reference manual - RAPID Instructions, Functions and Data types*. This instruction is only available for OmniCore robots.	Wrist Optimization

Brief description of calibration methods

Torque sensor calibration

The torque sensor in an axis motor must be calibrated if any of the following situations occur:

- A drift in the sensor values has occurred.

  This is shown on the FlexPendant as error code 90549 **Torque sensor check failure** or 34334 **Arm side torque sensor error**.
- A joint unit has been replaced.
- Repair work that involves removal and refitting of the joint units, has been performed.
- After heavy collisions or uncontrolled stops. This does not apply to collisions or stops which may routinely be experienced as part of a power and force limiting application.

No calibration is needed at site at robot installation.

The torque sensor service routine only works on floor mounted robots.

Tip

When designing the robot cell, run the torque sensor service routine in RobotStudio to verify that the path and pose are obtainable in the planned design.

Wrist Optimization method

Wrist Optimization is a method for improving reorientation accuracy for continuous processes like welding and gluing.

The actual instructions of how to perform the wrist optimization procedure is given on the FlexPendant.

CalibWare - Absolute Accuracy calibration / Ultra Accuracy calibration

The CalibWare tool guides through the calibration process and calculates new compensation parameters. This is further detailed in the *Application manual - CalibWare Field*.

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If a service operation is done to a robot with the option Absolute Accuracy or Ultra Accuracy, a new absolute accuracy calibration / ultra accuracy calibration is required in order to establish full performance. For most cases after replacements that do not include taking apart the robot structure, standard calibration is sufficient.

The Absolute Accuracy / Ultra Accuracy option varies according to the robot mounting position. This is printed on the robot name plate for each robot. The robot must be in the correct mounting position when it is recalibrated for absolute accuracy / ultra accuracy.

1.4.2 Absolute accuracy calibration

Purpose

Absolute Accuracy is a calibration concept that improves TCP accuracy. The difference between an ideal robot and a real robot can be several millimeters, resulting from mechanical tolerances and deflection in the robot structure. *Absolute Accuracy* compensates for these differences.

Here are some examples of when this accuracy is important:

- Exchangeability of robots
- Offline programming with no or minimum touch-up
- Online programming with accurate movement and reorientation of tool
- Programming with accurate offset movement in relation to eg. vision system or offset programming
- Re-use of programs between applications

The option *Absolute Accuracy* is integrated in the controller algorithms and does not need external equipment or calculation.

Note

The performance data is applicable to the corresponding RobotWare version of the individual robot.

Note

Singularities might appear in slightly different positions on a real robot compared to RobotStudio, where *Absolute Accuracy* is off compared to the real controller.

What is included

Every *Absolute Accuracy* robot is delivered with:

- compensation parameters saved in the robot memory
- a birth certificate representing the *Absolute Accuracy* measurement protocol for the calibration and verification sequence.

A robot with *Absolute Accuracy* calibration has a label with this information on the manipulator.

Absolute Accuracy supports floor mounted, wall mounted, and ceiling mounted installations. The compensation parameters that are saved in the robot memory differ depending on which Absolute Accuracy option is selected.

When is *Absolute Accuracy* being used

Absolute Accuracy works on a robot target in Cartesian coordinates, not on the individual joints. Therefore, joint based movements (e.g. `MoveAbsJ`) will not be affected.

If the robot is inverted, the Absolute Accuracy calibration must be performed when the robot is inverted.

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Absolute Accuracy active

Absolute Accuracy will be active in the following cases:

- Any motion function based on robtargets (e.g. `MoveL`) and ModPos on robtargets
- Reorientation jogging
- Linear jogging
- Tool definition (4, 5, 6 point tool definition, room fixed TCP, stationary tool)
- Work object definition

Absolute Accuracy not active

The following are examples of when Absolute Accuracy is not active:

- Any motion function based on a jointtarget (`MoveAbsJ`)
- Independent joint
- Joint based jogging

RAPID instructions

There are no RAPID instructions included in this option.

1.4.3 Ultra accuracy calibration

Purpose

Ultra Accuracy is a control concept for GoFa CRB 15000 robots that improves the TCP path accuracy even further.

Here are some examples of when this kind of accuracy is important:

- Gluing extremely small electronics components.
- Laser welding of car body parts in automotive.
- Positioning of composite material layup in aircraft manufacturing.
- High fidelity 3D printing.
- High precision laser cutting of small metal shapes.

The option *Ultra Accuracy* is integrated in the controller algorithms and does not need external equipment.

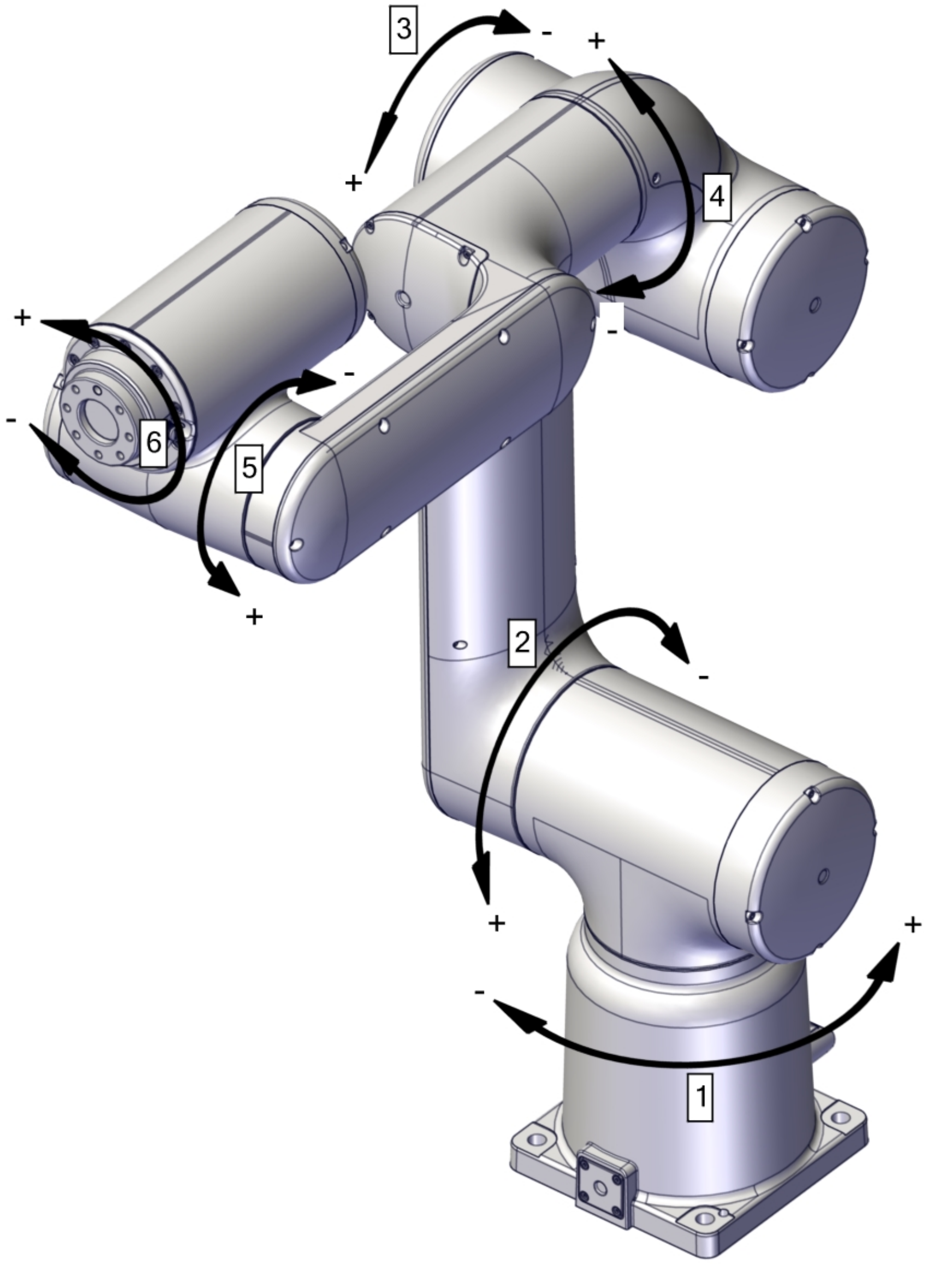
Note

The performance data is applicable to the corresponding RobotWare version of the individual robot.

1.4.4 Jogging directions

Illustration of axis jogging directions

The figure shows the positive and negative directions for each axis when jogging the robot in the base coordinate system.



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1.5 Load diagrams

1.5.1 Introduction

WARNING

It is very important to always define correct actual load data and correct payload of the robot. Incorrect definitions of load data can result in overloading of the robot.

If incorrect load data and/or loads are outside load diagram is used the following parts can be damaged due to overload:

- motors
- gearboxes
- mechanical structure

Note

In the robot system the service routine LoadIdentify is available, which allows the user to make an automatic definition of the tool and load, to determine correct load parameters.

See *Operating manual - OmniCore*, for detailed information.

WARNING

Robots running with incorrect load data and/or with loads outside diagram, will not be covered by robot warranty.

General

The CRB 15000-5/0.95 load diagrams include a nominal payload inertia, J_o of 0.012 kgm^2.

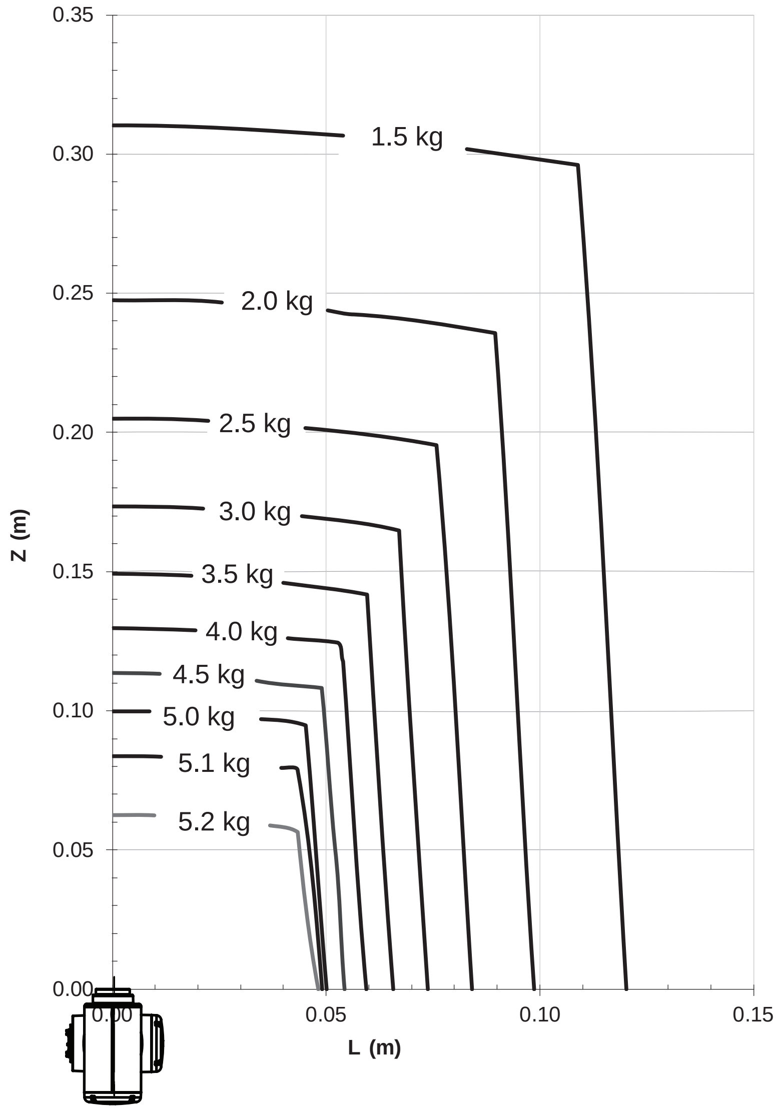
The CRB 15000-10/1.52 and CRB 15000-12/1.27 load diagrams include a nominal payload inertia, J_o of 0.05 kgm^2.

At different moment of inertia the load diagram will be changed. For robots that are allowed tilted, wall or inverted mounted, the load diagrams as given are valid.

The accuracy of the power and force limiting safety functions require that the payload is correctly defined.

1.5.2 Diagrams

CRB 15000-5/0.95



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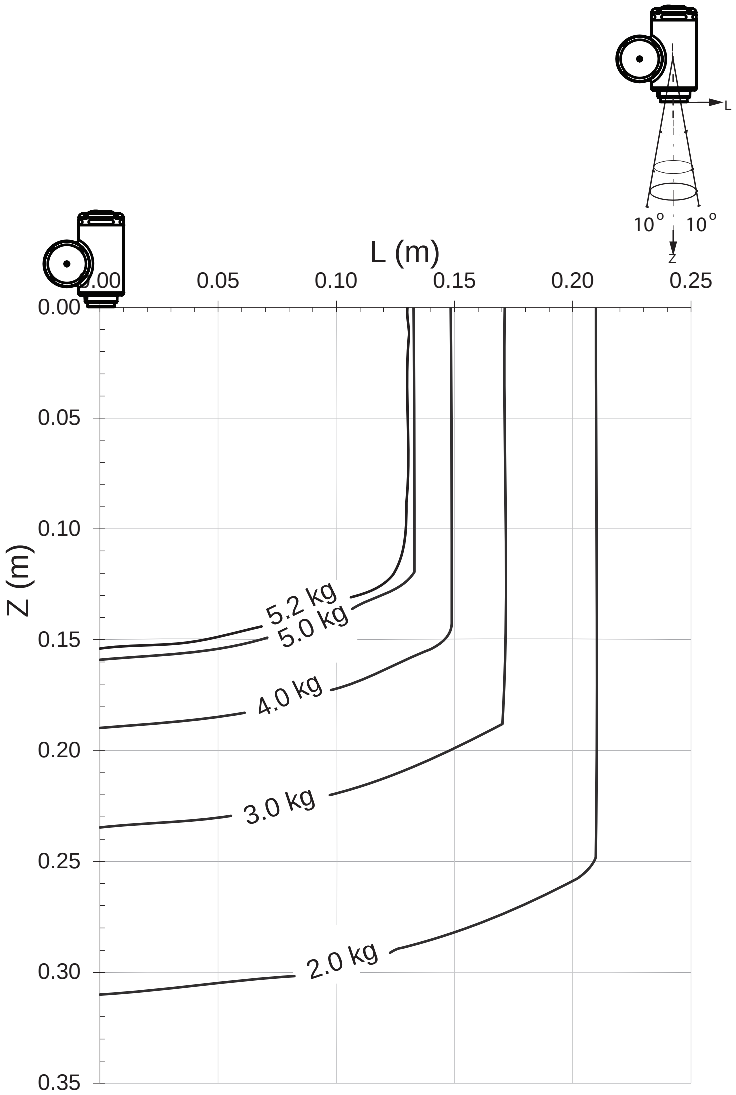
CRB 15000-5/0.95 "Vertical wrist" (± 10°)



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For wrist down (0° deviation from the vertical line).

	Description
Max load	5.2 kg
Z_{max}	0.154 m
L_{max}	0.130 m

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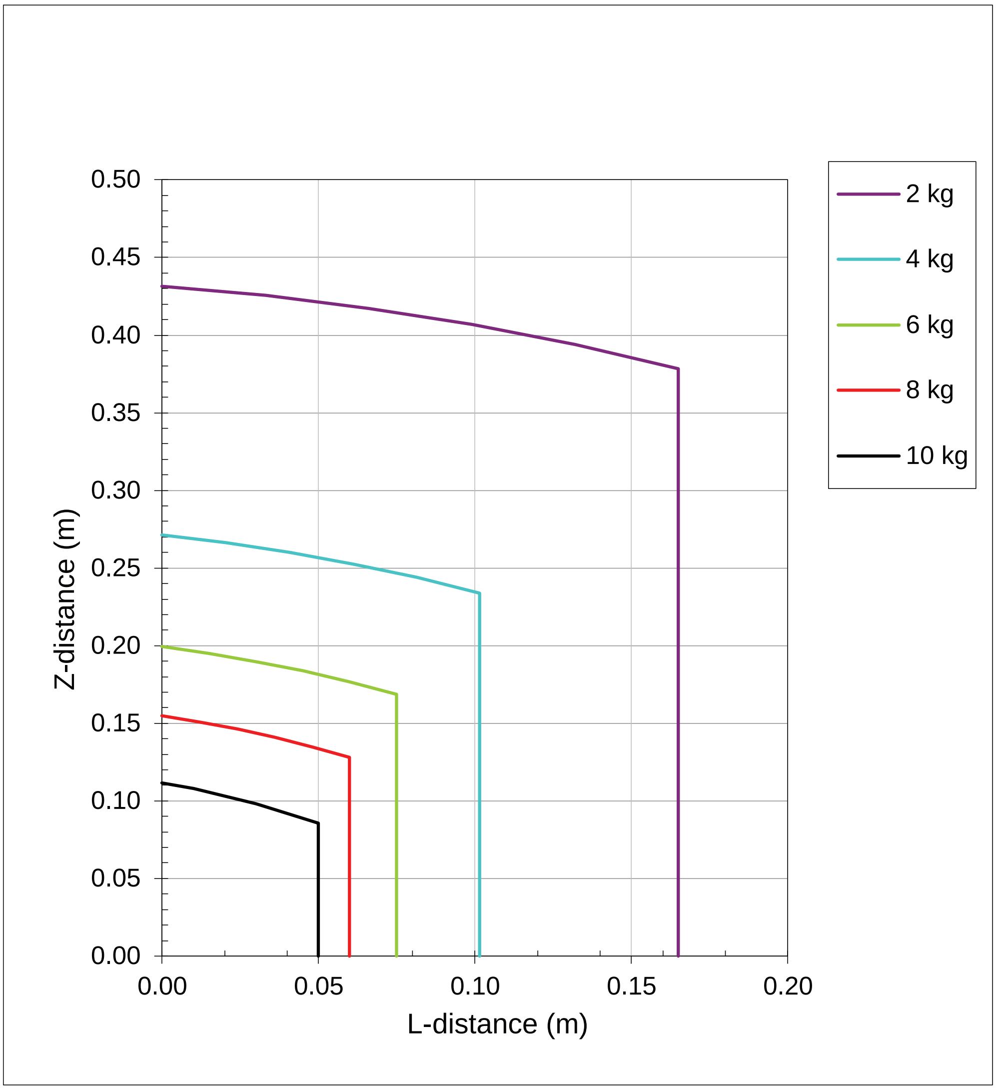
CRB 15000-10/1.52



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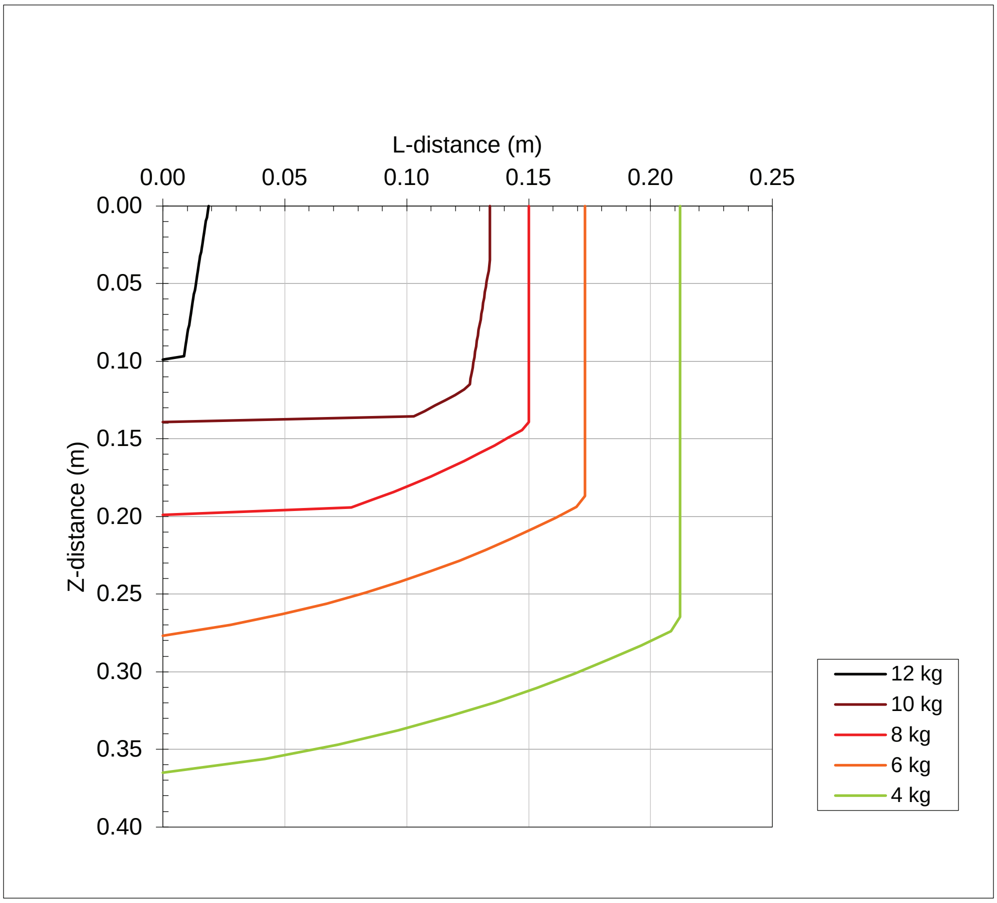
CRB 15000-10/1.52 "Vertical wrist" (±5°)



xx2300000937

For wrist down (0° deviation from the vertical line).

	Description
Max load	12 kg
Z_{max}	0.099 m
L_{max}	0.019 m

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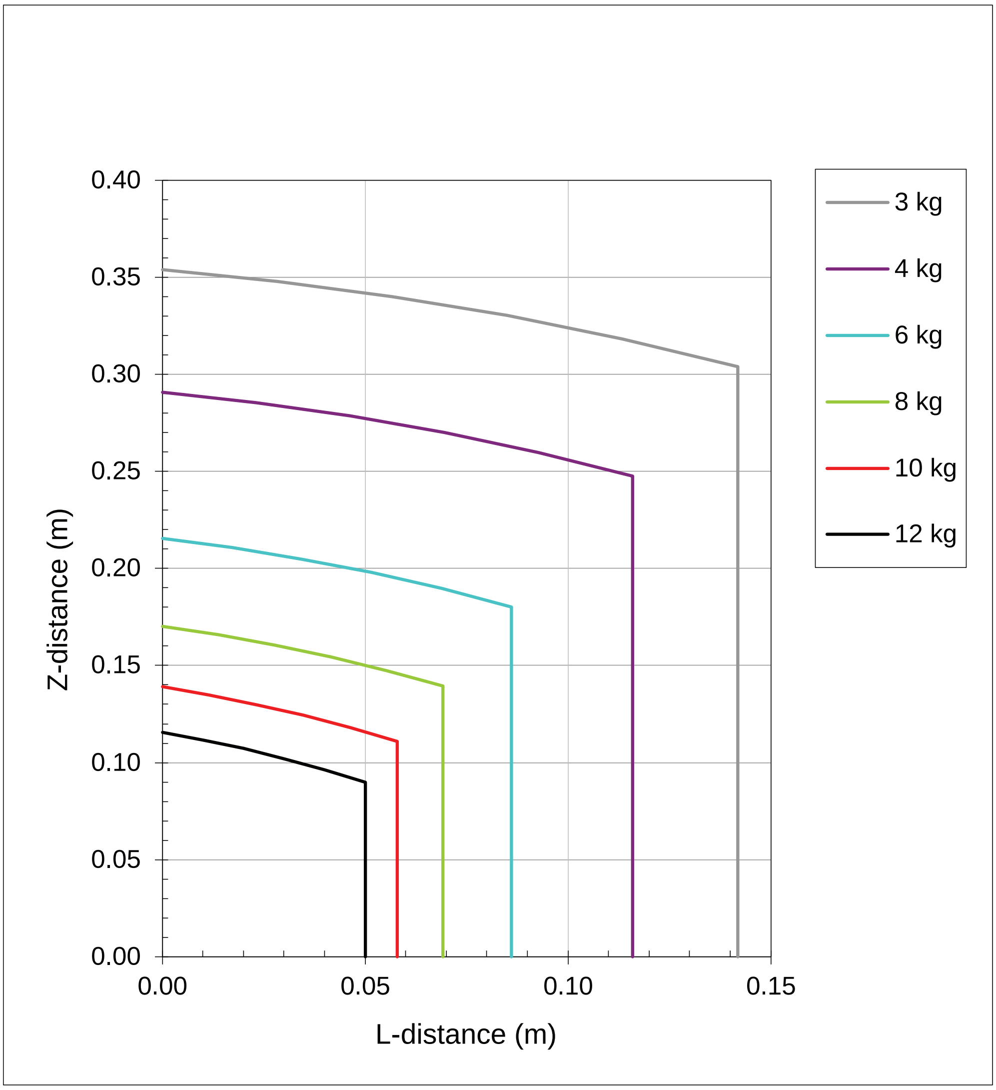
CRB 15000-12/1.27



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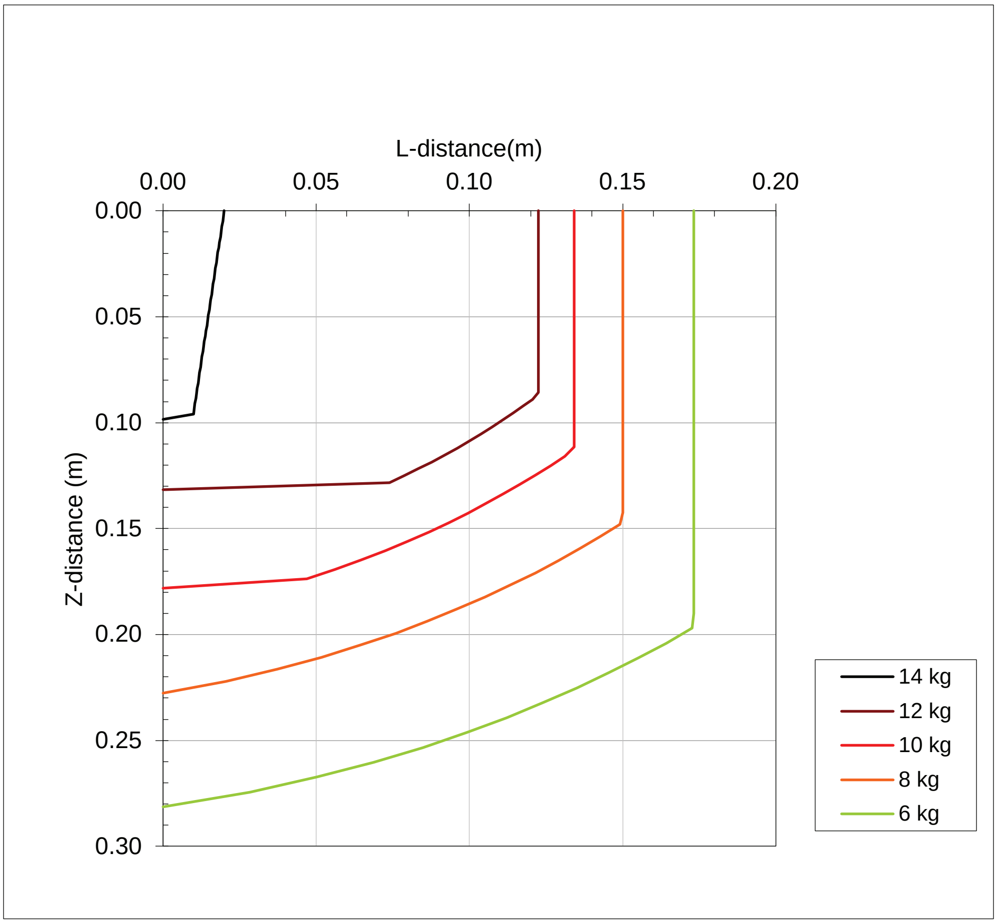
CRB 15000-12/1.27 "Vertical wrist" (± 5°)



xx2300000939

For wrist down (0° deviation from the vertical line).

	Description
Max load	14 kg
Z_{max}	0.097 m
L_{max}	0.019 m

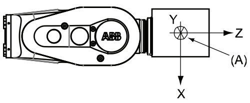
1.5.3 Maximum load and moment of inertia for full and limited axis 5 (center line down) movement

Note

Total load given as: mass in kg, center of gravity (Z and L) in meters and moment of inertia (J_{ox}, J_{oy}, J_{oz}) in kgm^2. L= sqr ($X^2 + Y^2$), see the following figure.

Full movement of axis 5 (-180°/+180°)

Axis	Robot type	Maximum moment of inertia
5	CRB 15000-5/0.95	Ja_5 = Load x ((Z+0.101)^2 + (L+0.08)^2)) + max (J_{ox}, J_{oy}) ≤ 0.35 kgm^2
	CRB 15000-10/1.52 CRB 15000-12/1.27	Ja_5 = Load x ((Z+0.101)^2 + (L+0.08)^2)) + max (J_{ox}, J_{oy}) ≤ 0.58 kgm^2
6	CRB 15000-5/0.95	Ja_6 = Load x L^2 + Joz ≤ 0.1 kgm^2
	CRB 15000-10/1.52 CRB 15000-12/1.27	Ja_6 = Load x L^2 + Joz ≤ 0.2 kgm^2



xx1400002028

Pos	Description
A	Center of gravity

	Description
J_{ox}, J_{oy}, J_{oz}	Max. moment of inertia around the X, Y and Z axes at center of gravity.

Continues on next page

1.5.4 Maximum TCP acceleration

General

Higher values can be reached with lower loads than the nominal because of our dynamical motion control QuickMove2. For specific values in the unique customer cycle, or for robots not listed in the table below, we recommend to use RobotStudio.

Maximum Cartesian design acceleration for nominal loads

Robot type	Emergency stop Max acceleration at nominal load COG [m/s^2] (absolute value)	Controlled motion Max acceleration at nominal load COG [m/s^2] (absolute value)
CRB 15000-5/0.95	62	37
CRB 15000-10/1.52	94	28
CRB 15000-12/1.27	79	27

Note

Acceleration levels for emergency stop and controlled motion includes acceleration due to gravitational forces. Nominal load is defined with nominal mass and cog with max offset in Z and L (see the load diagram).

1.6 Maintenance and troubleshooting

General

The robot requires only minimum maintenance during operation. It has been designed to make it as easy to service as possible:

- Maintenance-free AC motors are used.
- Grease is used for the gearboxes.
- The cabling is routed for longevity, and in the unlikely event of a failure, its modular design makes it easy to change.

Maintenance

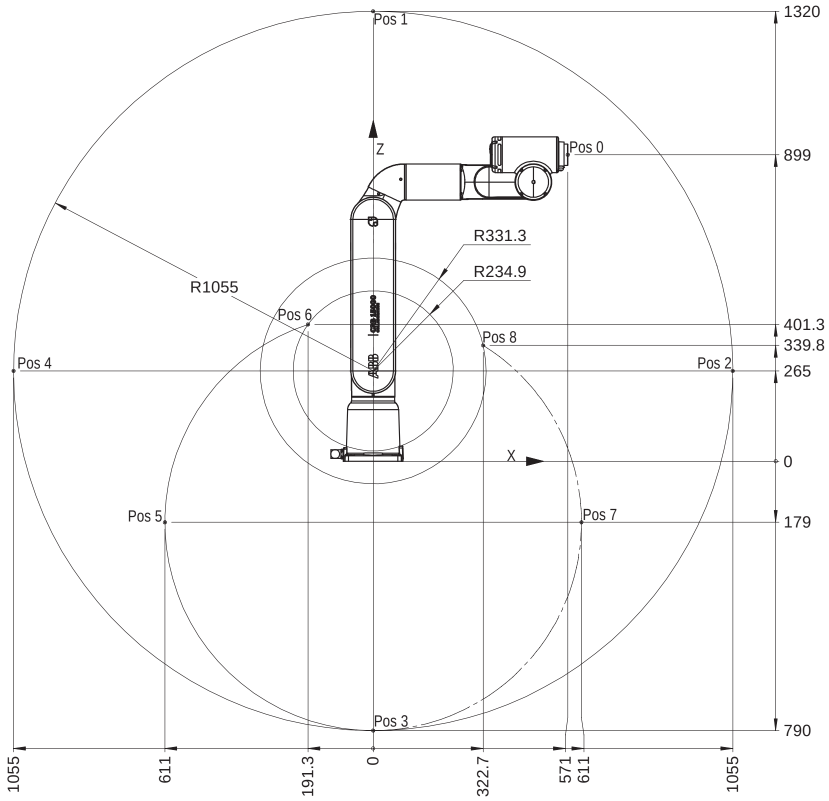
The maintenance intervals depend on the use of the robot. The required maintenance activities also depend on the selected options. For detailed information on maintenance procedures, see the maintenance section in *Product manual - CRB 15000*.

1.7 Robot motion

1.7.1 Working range

Illustration, working range CRB 15000-5/0.95

This illustration shows the unrestricted working range of the robot.



xx2400001418

Positions at intersection point of axes 4-5-6 and angle of axes 2 and 3

Position in the figure	Positions at wrist center (mm)		Angle (degrees)		
	X	Z	axis 2	axis 3	axis 5
pos0	571	899	0°	0°	0°
pos1	0	1320	0°	-76.8°	25.2°
pos2	1055	265	90°	-76.8°	25.2°
pos3	0	-790	180°	-76.8°	25.2°
pos4	-1055	265	-90°	-76.8°	25.2°
pos5	-611	-179	180°	13.2°	25.2°
pos6	-191.3	401.3	180°	85°	25.2°
pos7	611	-179	180°	-166.8°	25.2°
pos8	322.7	339.8	180°	-225°	25.2°

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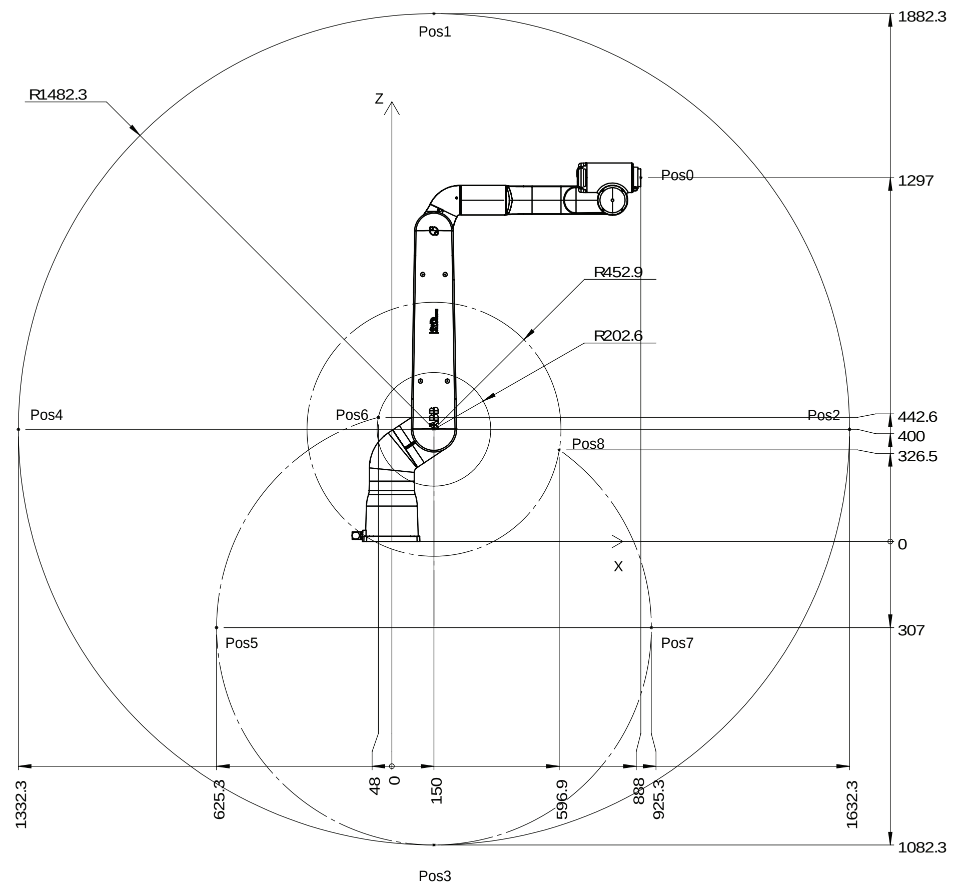
Illustration, working range CRB 15000-10/1.52

This illustration shows the unrestricted working range of the robot.



xx2300000575

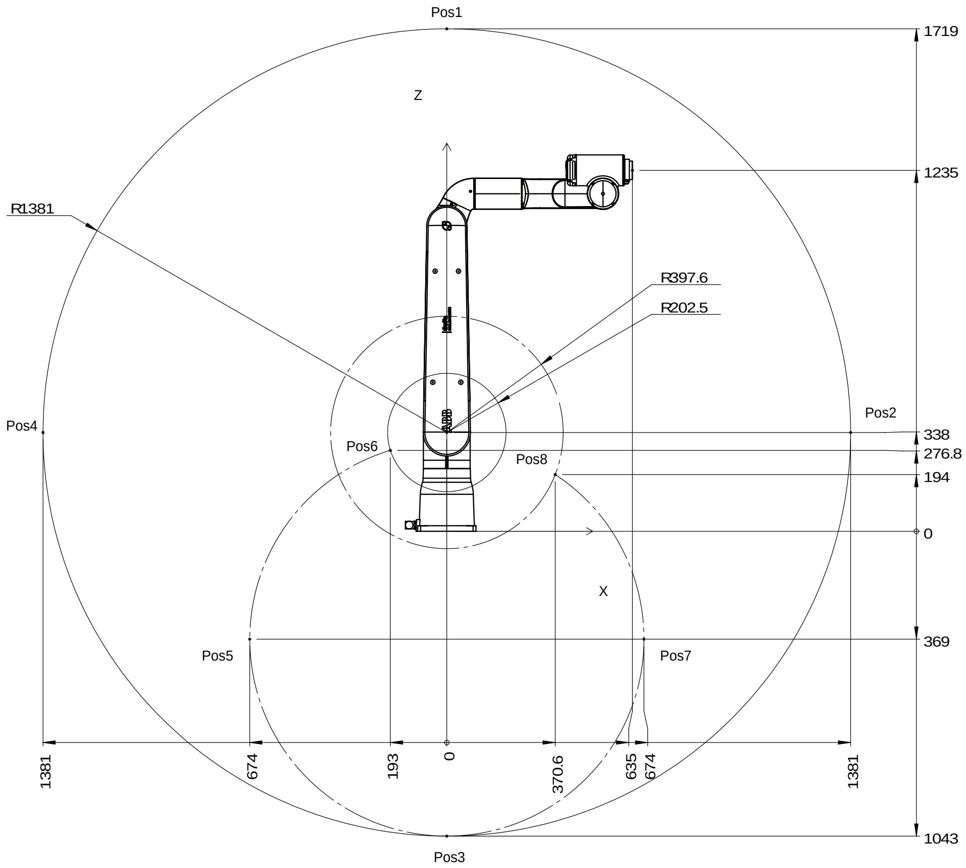
Positions at wrist center and angle of axes 2 and 3

Position in the figure	Positions at wrist center (mm)		Angle (degrees)		
	X	Z	axis 2	axis 3	axis 5
pos0	888	1297	0°	0°	0°
pos1	150	1882.3	0°	-80.2°	28.58°
pos2	1632.3	400	90°	-80.2°	28.58°
pos3	150	-1082.3	180°	-80.2°	28.58°
pos4	-1332.3	400	-90°	-80.2°	28.58°
pos5	-625.3	-307	180°	9.8°	28.58°
pos6	-48	442.6	180°	85°	
pos7	925.3	-307	180°	-170.2°	28.58°
pos8	596.9	326.5	180°	-225°	28.58°

Continues on next page

Illustration, working range CRB 15000-12/1.27

This illustration shows the unrestricted working range of the robot.



xx2300000576

Positions at wrist center and angle of axes 2 and 3

Position in the figure	Positions at wrist center (mm)		Angle (degrees)		
	X	Z	axis 2	axis 3	axis 5
pos0	635	1235	0°	0°	0°
pos1	0	1719	0°	-78.4°	26.7°
pos2	1381	338	90°	-78.4°	26.7°
pos3	0	-1043	180°	-78.4°	26.7°
pos4	-1381	338	-90°	-78.4°	26.7°
pos5	-674	-369	180°	11.6°	26.7°
pos6	-193	276.8	180°	85°	26.7°
pos7	674	-369	180°	-168.4°	26.7°
pos8	370.6	194	180°	-225°	26.7°

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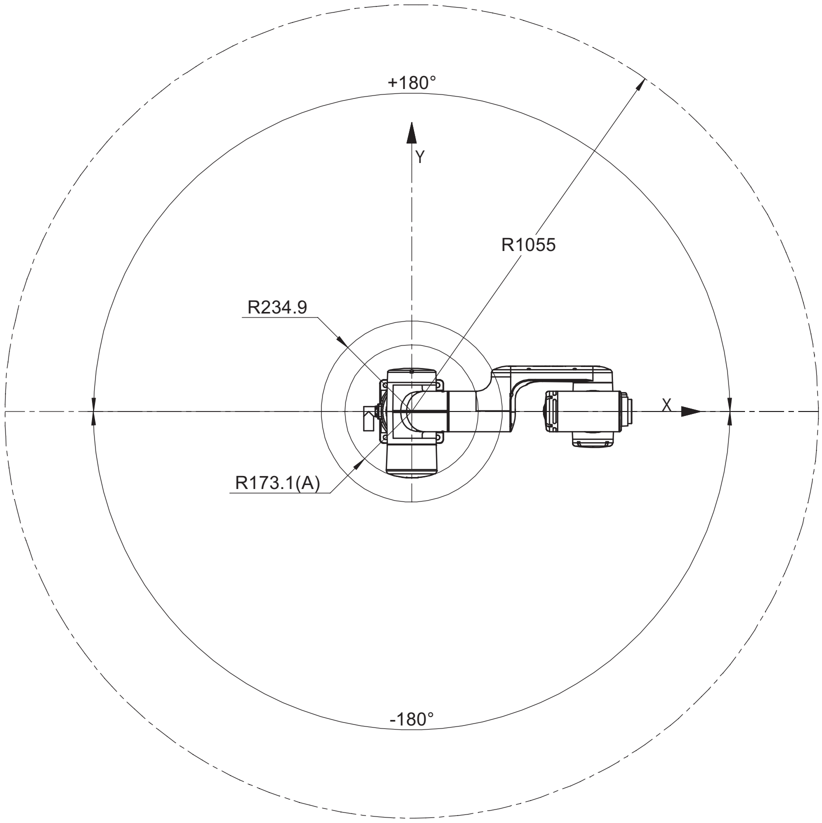
Top view of working range

CRB 15000-5/0.95



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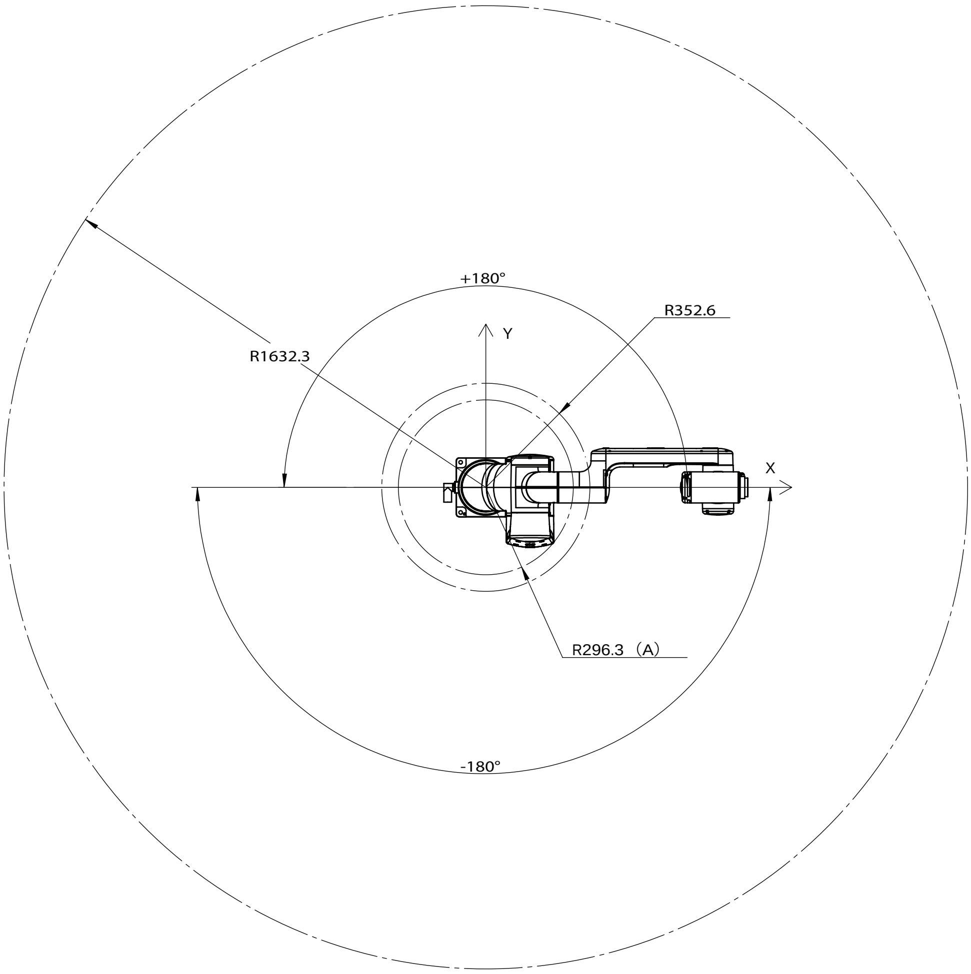
CRB 15000-10/1.52



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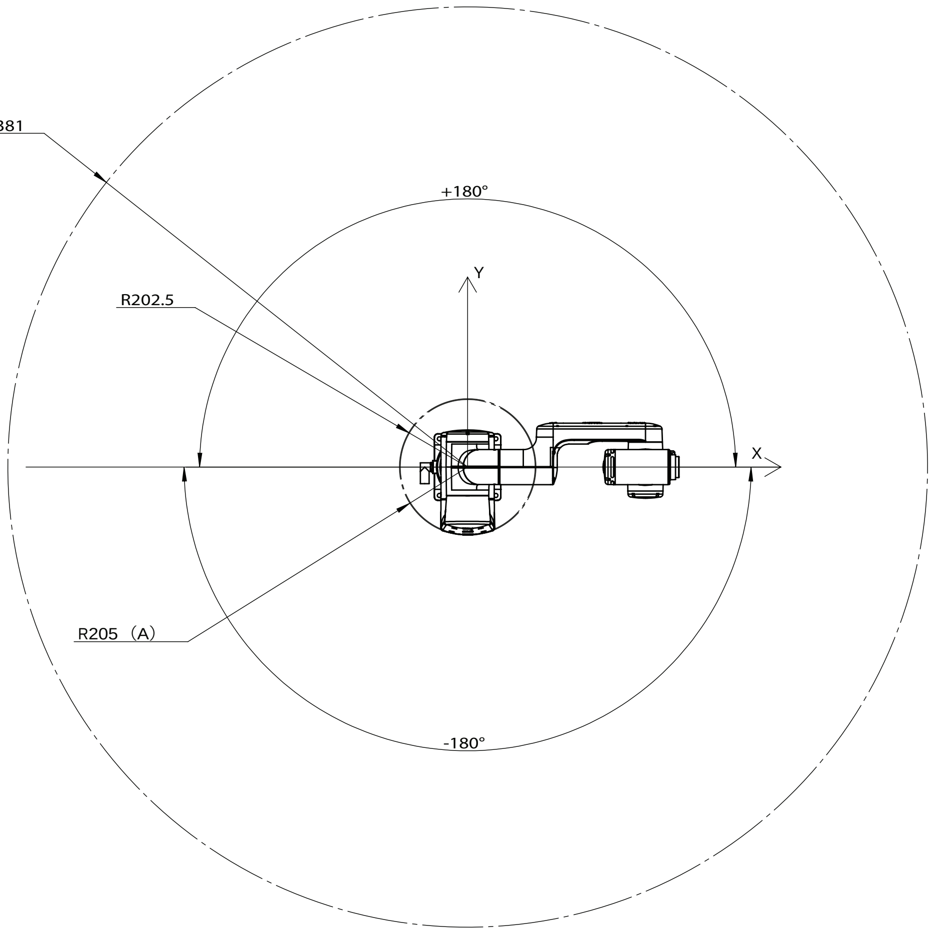
CRB 15000-12/1.27



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Working range

Axis	Working range	Note
Axis 1	±180° [i] / ±270° [ii]	Wall mounted robot has a work area for axis 1 that depends on payload and the positions of other axes. Simulation in RobotStudio is recommended.
Axis 2	±180°	
Axis 3	-225°/+85°	
Axis 4	±180°	
Axis 5	±180°	
Axis 6	±270°	

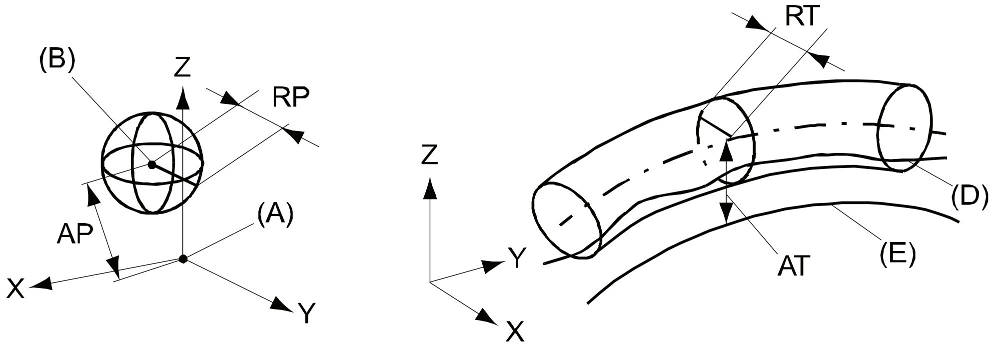
i Valid for CRB 15000-5/0.95.
ii Valid for CRB 15000-10/1.52 and CRB 15000-12/1.27.

1.7.2 Performance

General

At rated maximum load, maximum offset and 1.6 m/s velocity on the inclined ISO test plane, with all six axes in motion. Values in the table below are the average result of measurements on a small number of robots. The result may differ depending on where in the working range the robot is positioning, velocity, arm configuration, from which direction the position is approached, the load direction of the arm system. Backlashes in gearboxes also affect the result.

The figures for AP, RP, AT and RT are measured according to figure below.



xx0800000424

A	Programmed position
B	Mean position at program execution
AP	Mean distance from programmed position
RP	Tolerance of position B at repeated positioning
D	Actual path at program execution
E	Programmed path
AT	Max deviation from E to average path
RT	Tolerance of the path at repeated program execution

CRB 15000	5/0.95	10/1.52	12/1.27
Pose accuracy, AP[i] (mm)	0.02	0.02	0.02
Pose repeatability, RP (mm)	0.02	0.02	0.02
Pose stabilization time, PSt (s) within 0.1 mm of the position	0.229	0.398	0.887
Path accuracy, AT (mm)	1.205	4.392	2.377
Path repeatability, RT (mm)	0.057	0.056	0.058

i AP according to the ISO test above, is the difference between the teached position (position manually modified in the cell) and the average position obtained during program execution.

1.7.3 Velocity

Maximum axis speed

Robot type	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
CRB 15000-5/0.95	125 °/s	125 °/s	140 °/s	200 °/s	200 °/s	200 °/s
CRB 15000-10/1.52	120 °/s	120 °/s	125 °/s	200 °/s	200 °/s	200 °/s
CRB 15000-12/1.27	120 °/s	120 °/s	125 °/s	200 °/s	200 °/s	200 °/s

There is a supervision function to prevent overheating in applications with intensive and frequent movements (high duty cycle).

1.8 Robot stopping distances and times

1.8.1 Robot stopping distances according to ISO 10218-1

About the data for robot stopping distances and times

All measurements and calculations of stopping distances and times are done according to ISO 10218-1, with single axis motion on axes 1, 2, and 3. If more than one axis is used for the movement, then the stopping distance and time can be longer or shorter. The movement of the axes does not necessarily represent the actual application. Therefore, the braking distance must be validated for each application.

Normal delays of the hardware and software are taken into account. See more about the delays and their impact on the results, *Reading the data on page 74*.

The stopping distances and times are presented using the tool data and extension zones presented for the respected robot variant. These variables are 100%, 66%, and 33% of the maximum values for the robot.

The stop categories 0 and 1 are according to IEC 60204-1.

Note

The category 0 stop is not necessarily the worst case (depending on load, speed, application, wear, etc.).

Note

The stop category 1 is a controlled stop and will therefore have less deviation from the programmed path compared with a stop category 0.

Loads

The tool data that is used is presented for the respective robot variant.

The used loads represent the rated load. No arm load is used. See the *Load diagrams on page 54*.

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Extension zones

The extension zone for the stop category 1 is based on the tool mounting interface (tool flange) with the axis angles according to the following illustrations. The zone data is presented for the respective robot variant.

The extension zone outer limits are defined by the TCP0 position for the stated angles.

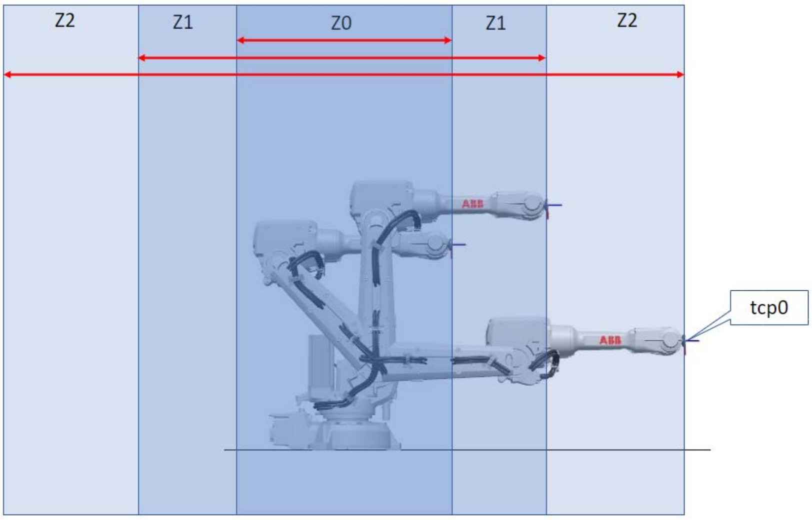
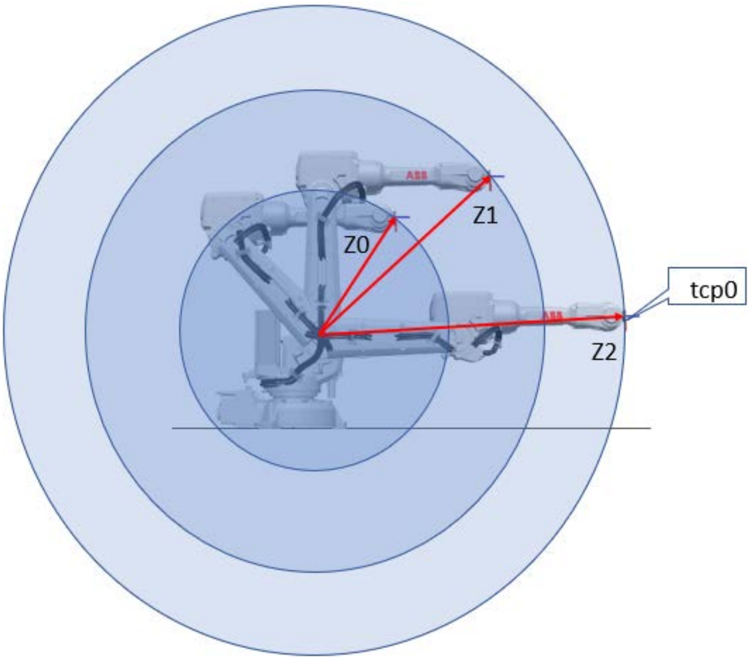
	Illustration
Axis 1	 xx2300000860
Axis 2	 xx2300000861

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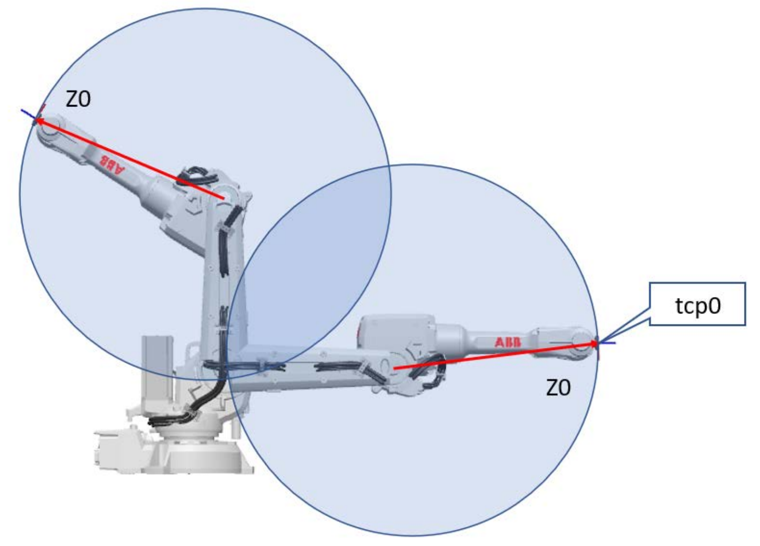
	Illustration
Axis 3	 xx2300000862

Speed

The speed in the simulations is based on TCP0.

The TCP0 speed is measured in meters per second when the stop is triggered.

Stopping distances

The stopping distance is measured in degrees.

Stopping times

The stopping time is measured in seconds.

Limitations

The stopping distance can vary depending on additional loads on the robot.

The stopping distance for category 0 stops can vary depending on the individual brakes and the joint friction.

Reading the data

The data for stop category 0 is presented in tables, with distance and time for each axis.

The data for stop category 1 is presented as graphs with curves representing the different loads.

There is a short delay in the stop, which means that if the axis is accelerating when the stop is initiated (C), it will continue to accelerate during this delay time. This can result in graphs where a higher load (A) gives shorter stopping distance than a smaller load (B).

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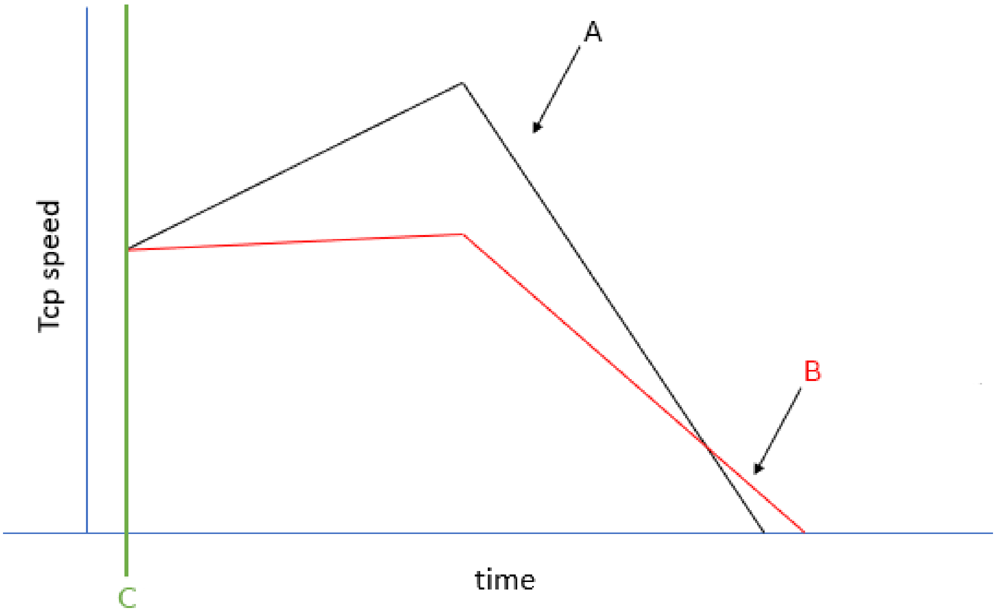

xx2300001041

The tcp speed is the actual speed when the stop is initiated, which is not necessarily the programmed speed.

1.8.2 Measuring stopping distance and time

Preparations before measuring

For measurement and calculation of overall system stopping performance, see ISO 13855:2010.

The measurement shall be done for the selected stop category. The emergency stop button on the robot controller is configured for stop category 1 on delivery. A risk assessment can conclude the need for another stop category. The stop category can be changed through the system parameter *Function* (topic *Controller*, type *Safety Run Chain*).

CAUTION

The measurement and calculation of overall stopping performance for a robot must be tested with its correct load, speed, and tools, in its actual environment, before the robot is taken into production.

All load and tool data must be correctly defined (weight, CoG, moment of inertia). The load identification service routine can be used to identify the data.

CAUTION

Follow the safety instructions in the respective product manual for the robot.

Measuring with TuneMaster

The software TuneMaster can be used to measure stopping distances and times for ABB robots. The TuneMaster software contains documentation on how to use it.

1. Download TuneMaster from *www.abb.com/robotics*, section **RobotStudio - Downloads - RobotWare Tools and Utilities**.
2. Install TuneMaster on a computer. Start the TuneMaster app and select **Log Signals**.
3. Connect to the robot controller.
4. Define the I/O stop signal to use for measurement, for example, ES1 for emergency stop.
5. Define the signal number to use for measurement, 1298 for axis position. The value is given in radians.
6. Start the logging in TuneMaster.
7. Start the test program on the controller.

   Tip

   Use the tool and zone definitions for the respective variant in this document to get results that are comparable with this document.

8. When the axis has reached maximum speed, press the emergency stop button.

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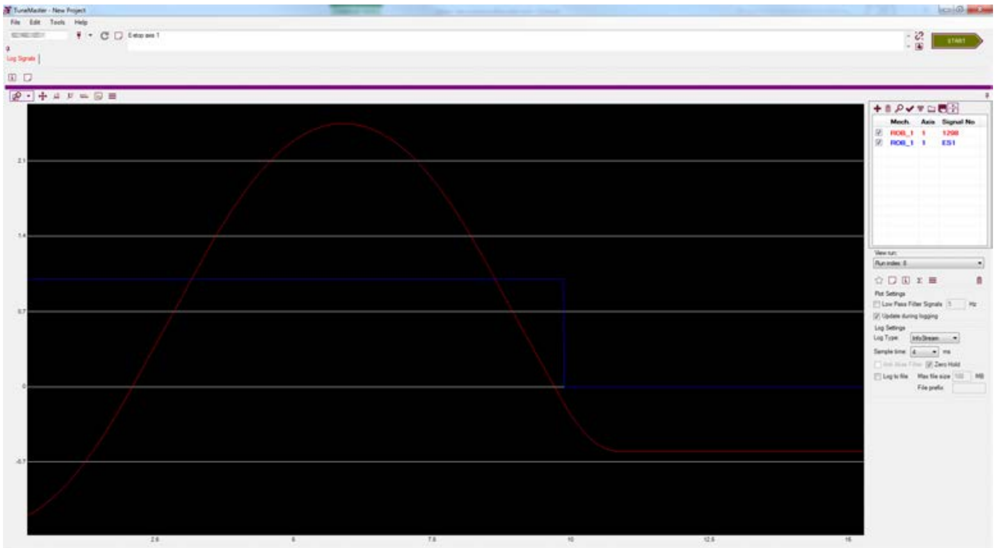
9 In TuneMaster, measure the stopping distance and time.
10 Repeat for all installed emergency stop buttons until the identified hazards due to stopping distance and time for axes have been verified.

Example from TuneMaster



xx1600000386

1.8.3 CRB 15000-5/0.95

Used tooldata

```
PERS tooldata P100:= [ TRUE, [[0, 0, 0], [1, 0, 0 ,0]], [5, [0, 0,
     100], [1, 0, 0, 0], 0.0083, 0.0083, 0.0083]];
PERS tooldata P66:= [ TRUE, [[0, 0, 0], [1, 0, 0 ,0]], [3.3, [0,
     0, 67], [1, 0, 0, 0], 0.0037, 0.0037, 0.0037]];
PERS tooldata P33:= [ TRUE, [[0, 0, 0], [1, 0, 0 ,0]], [1.7, [0,
     0, 33], [1, 0, 0, 0], 0.00093, 0.00093, 0.00093]];
```

Category 1, extension zones

For definitions of the zones, see *Extension zones on page 73*.

The zone border is the mounting interface location for axis 2 and axis 3.

Axis 1

Zone border	Axis 2	Axis 3
z0-z1	-42°	42°
z1-z2	6°	-6°

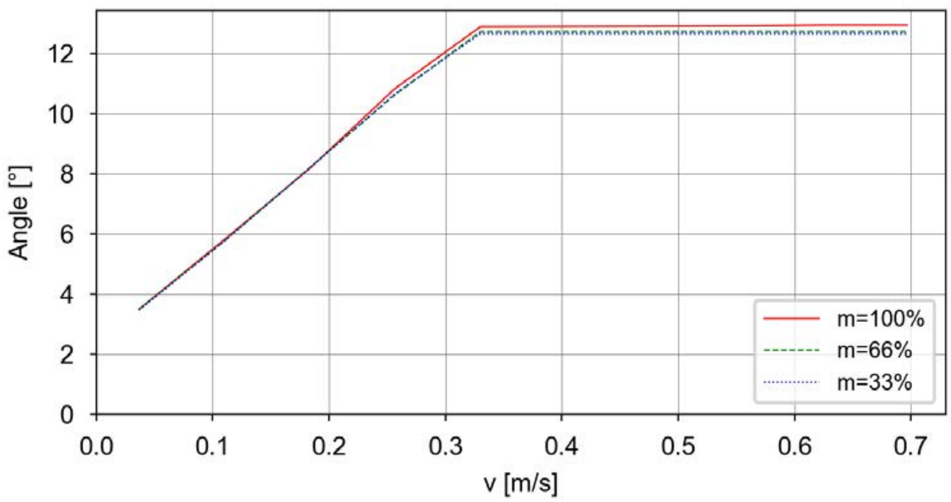
Axis 2

Zone border	Axis 2	Axis 3
z0-z1	48°	30°
z1-z2	90°	-30°

Axis 3

Only one zone exists.

Category 1, Axis 1, Extension zone 0, stopping distance and stopping time



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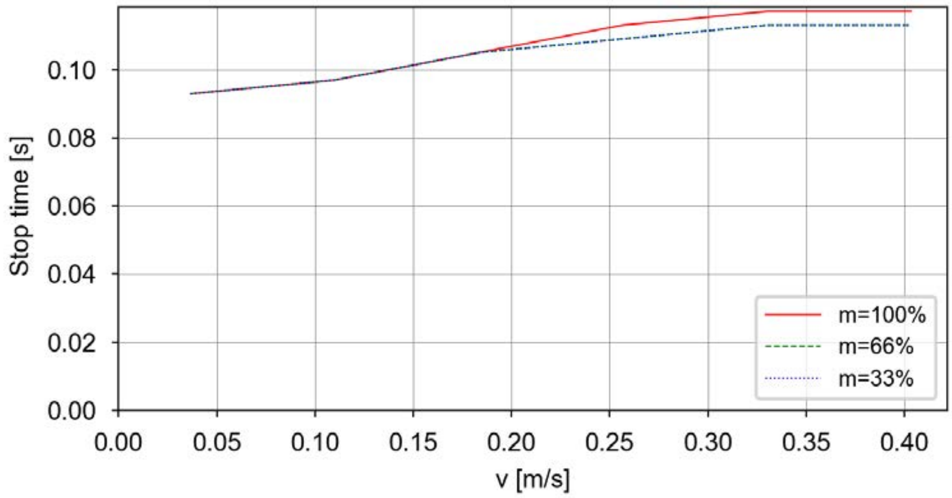
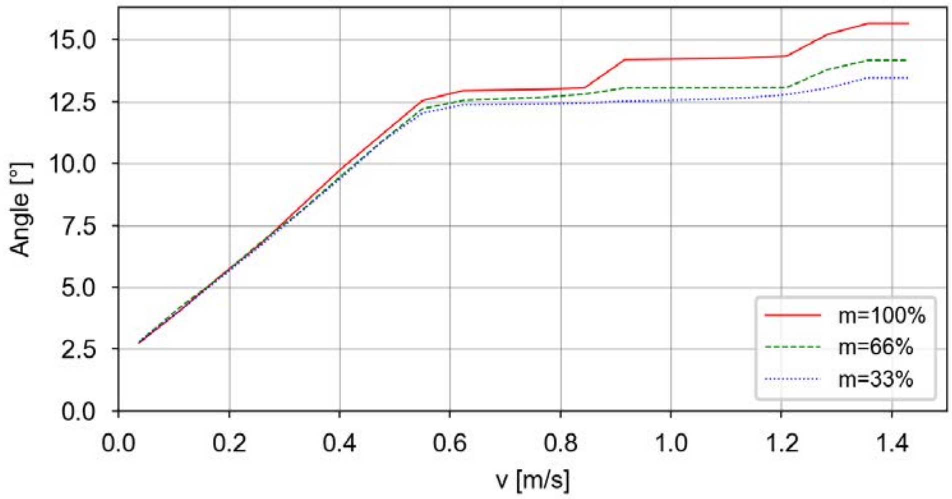
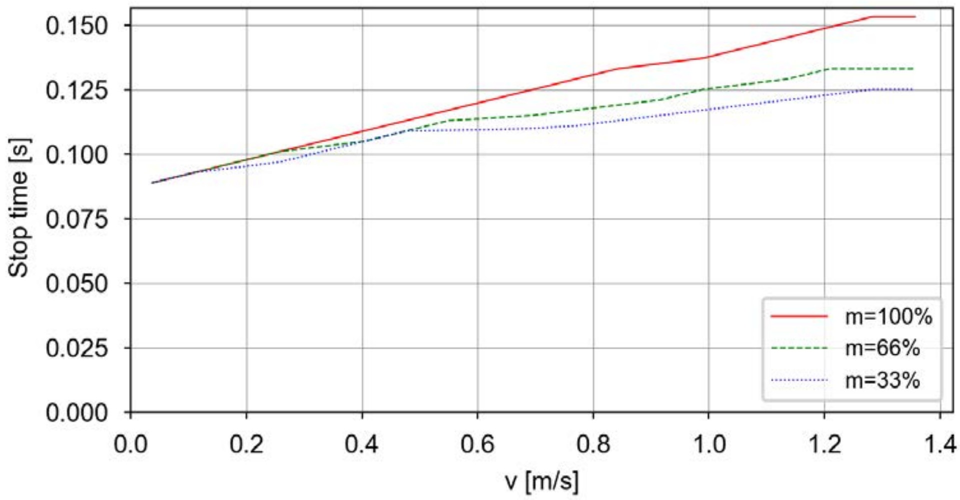


Category 1, Axis 1, Extension zone 1, stopping distance and stopping time





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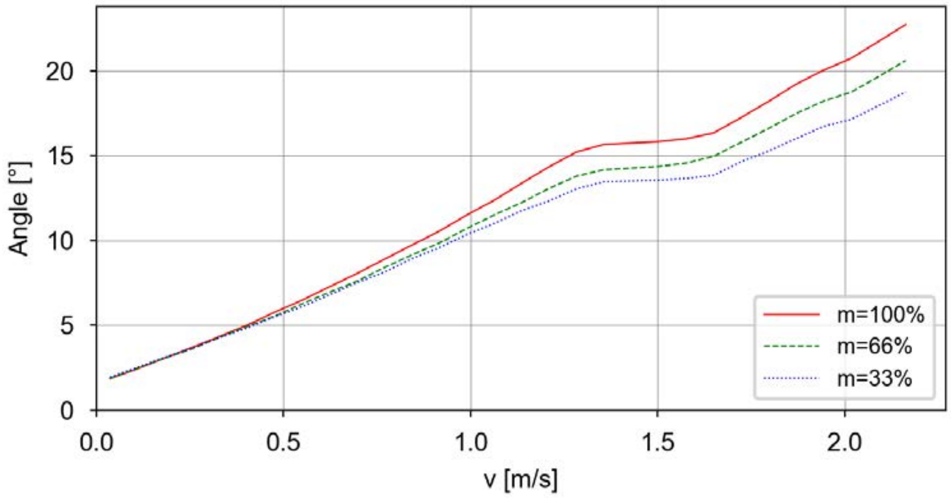
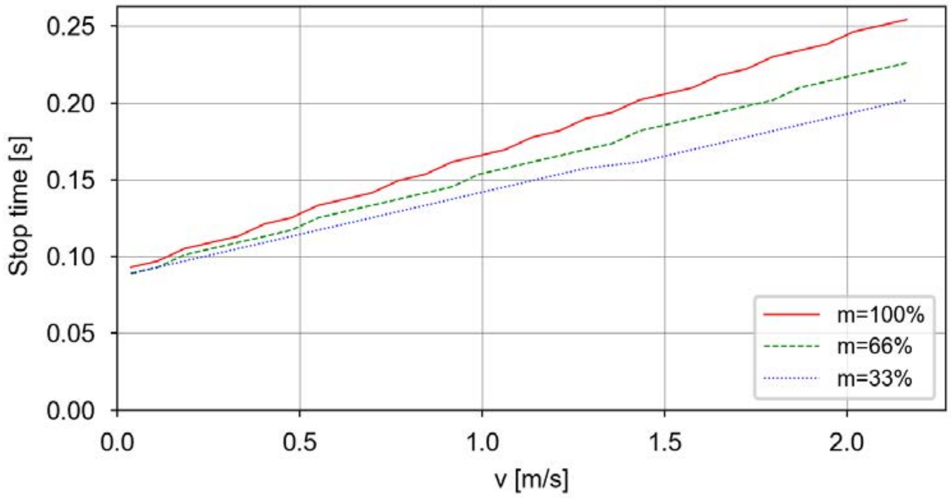
Category 1, Axis 1, Extension zone 2, stopping distance and stopping time





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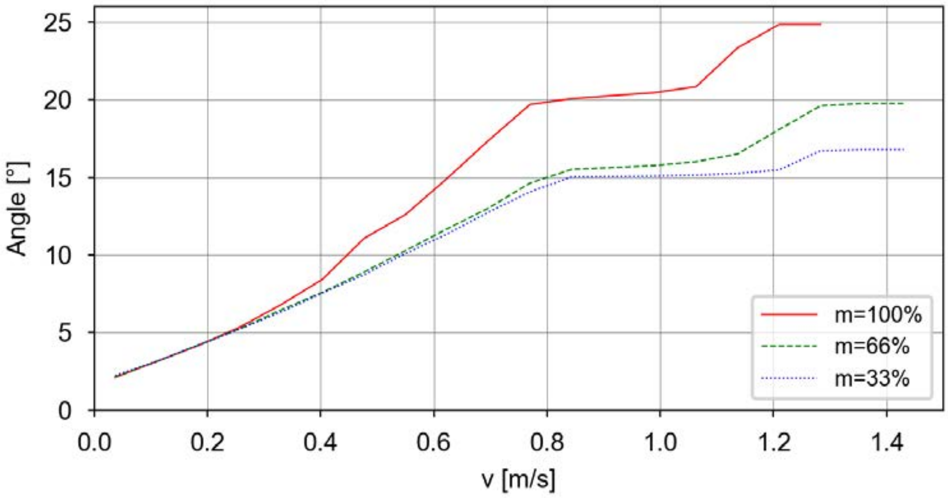
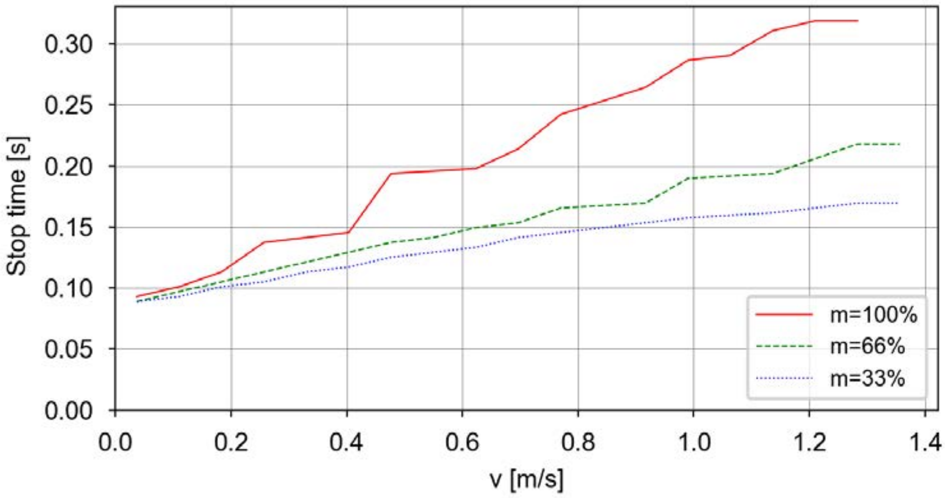
Category 1, Axis 2, Extension zone 0, stopping distance and stopping time





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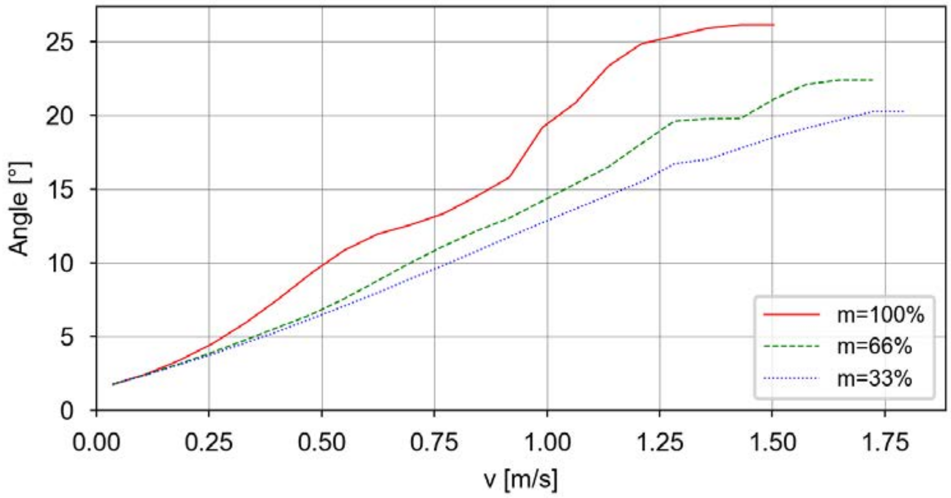
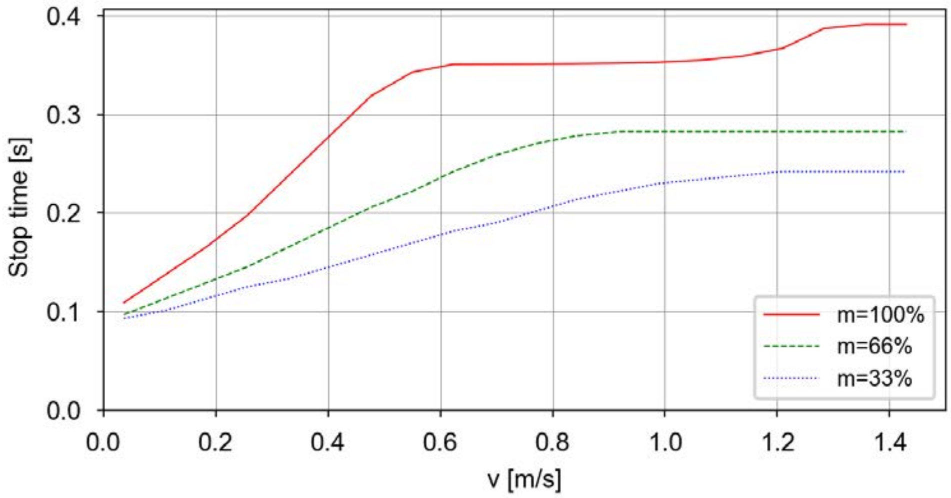
Category 1, Axis 2, Extension zone 1, stopping distance and stopping time





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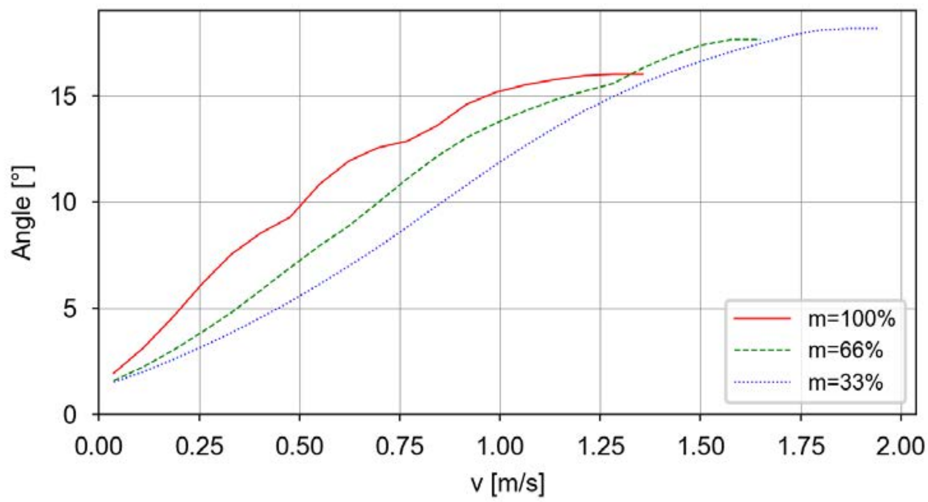
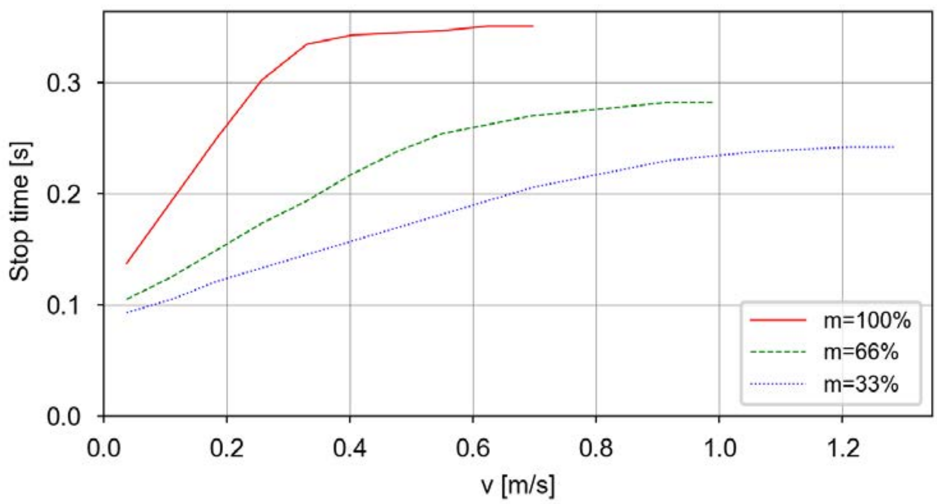
Category 1, Axis 2, Extension zone 2, stopping distance and stopping time





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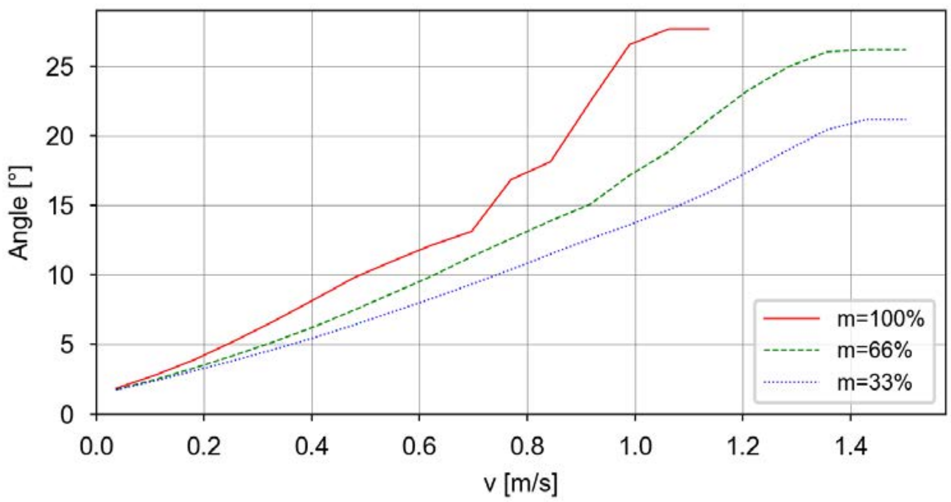
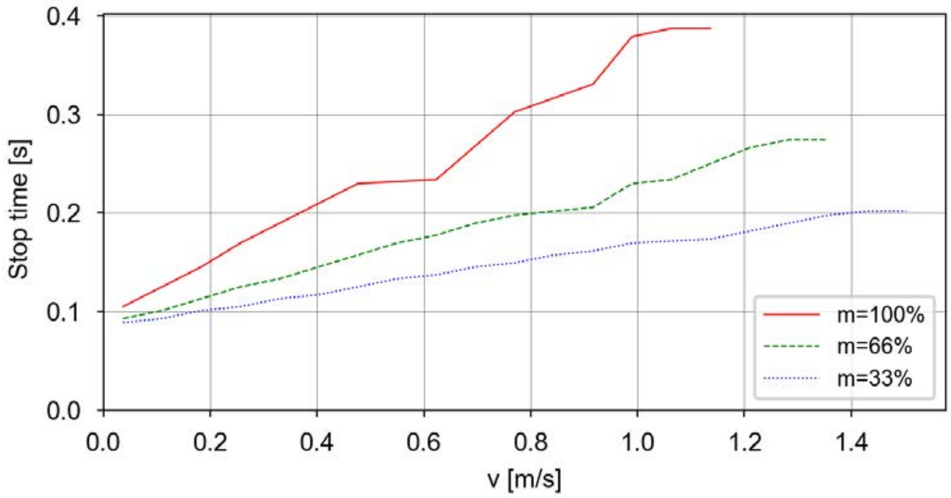
Category 1, Axis 3, Extension zone 0, stopping distance and stopping time





1.8.4 CRB 15000-10/1.52

Used tooldata

```
PERS tooldata P100:= [ TRUE, [[0, 0, 0], [1, 0, 0 ,0]], [10, [0,
     0, 85], [1, 0, 0, 0], 0.012, 0.012, 0.012]];
PERS tooldata P66:= [ TRUE, [[0, 0, 0], [1, 0, 0 ,0]], [6.7, [0,
     0, 57], [1, 0, 0, 0], 0.0054, 0.0054, 0.0054]];
PERS tooldata P33:= [ TRUE, [[0, 0, 0], [1, 0, 0 ,0]], [3.3, [0,
     0, 28], [1, 0, 0, 0], 0.0013, 0.0013, 0.0013]];
```

Category 1, extension zones

For definitions of the zones, see *Extension zones on page 73*.

The zone border is the mounting interface location for axis 2 and axis 3.

Axis 1

Zone border	Axis 2	Axis 3
z0-z1	-42°	42°
z1-z2	6°	-6°

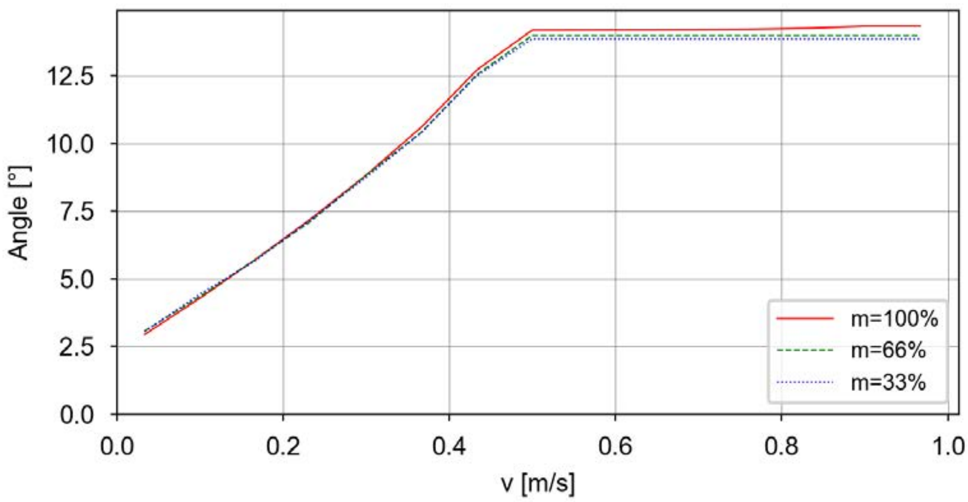
Axis 2

Zone border	Axis 2	Axis 3
z0-z1	48°	30°
z1-z2	90°	-30°

Axis 3

Only one zone exists.

Category 1, Axis 1, Extension zone 0, stopping distance and stopping time



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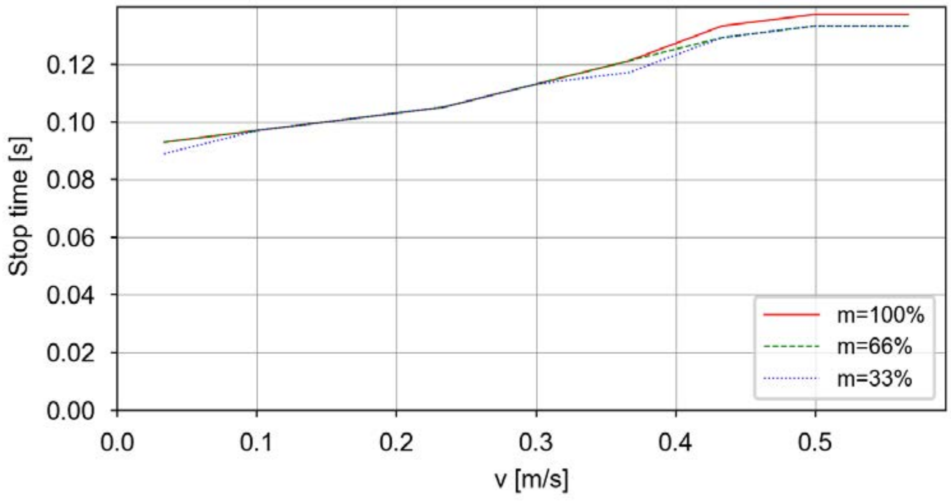
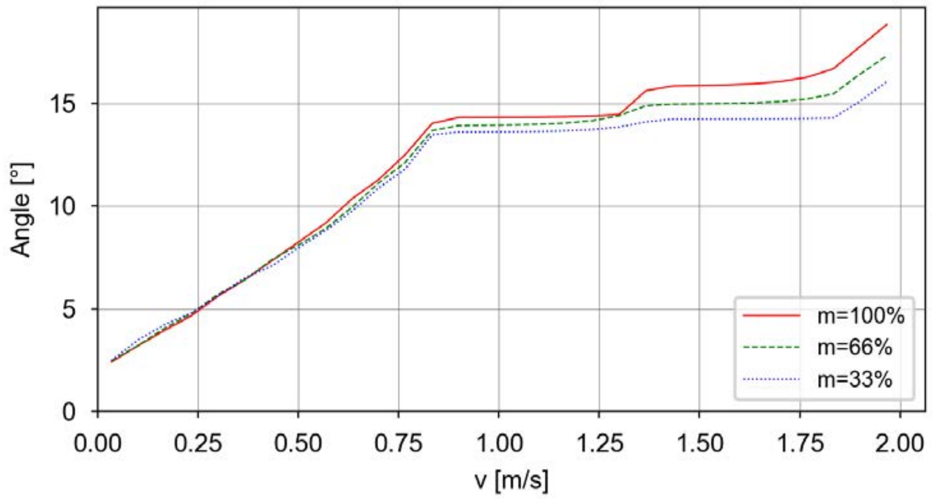
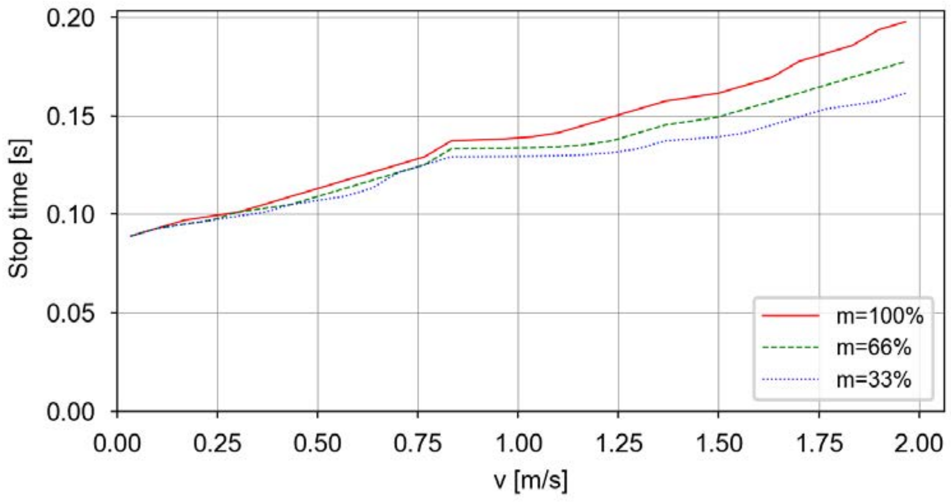


Category 1, Axis 1, Extension zone 1, stopping distance and stopping time





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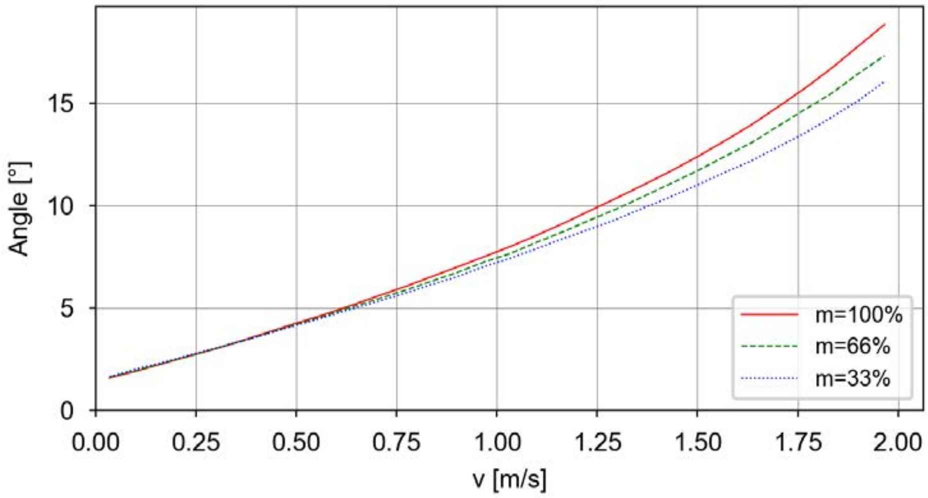
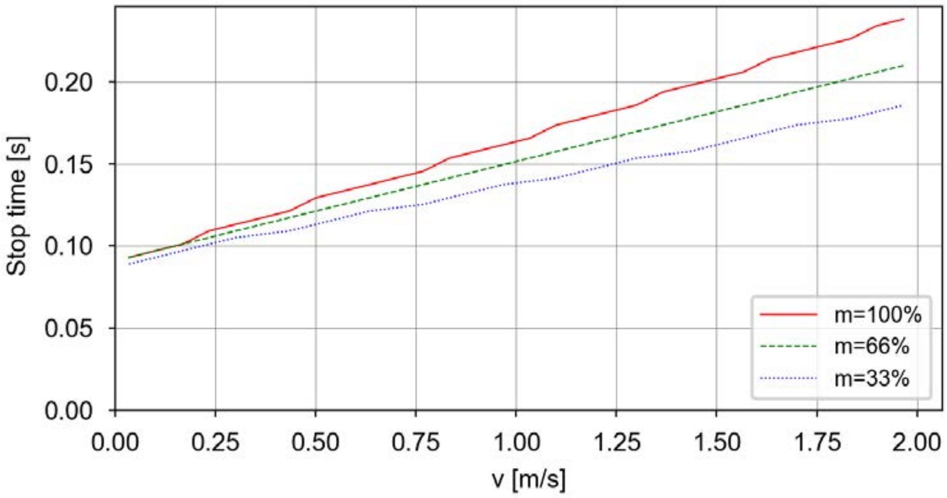
Category 1, Axis 1, Extension zone 2, stopping distance and stopping time





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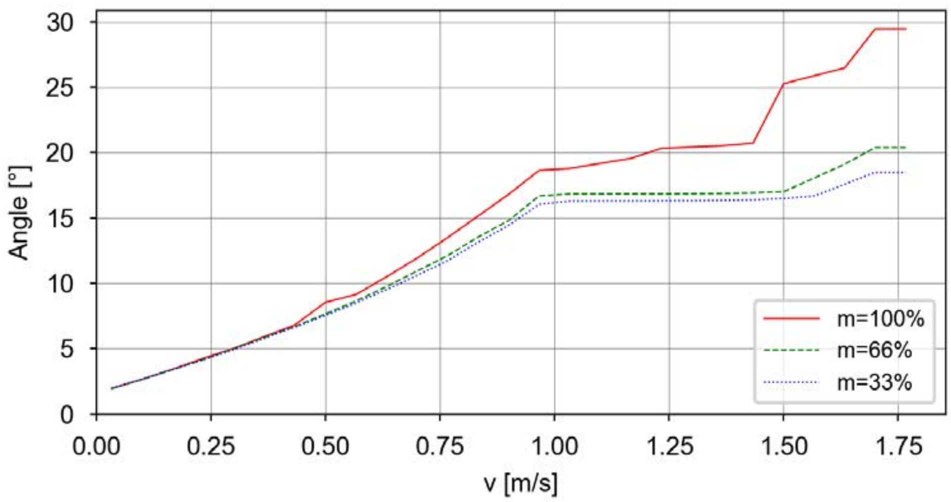
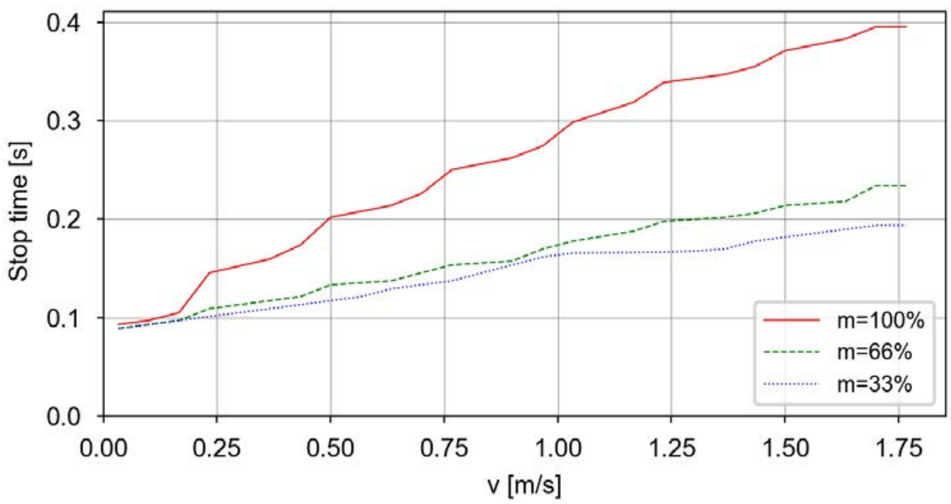
Category 1, Axis 2, Extension zone 0, stopping distance and stopping time





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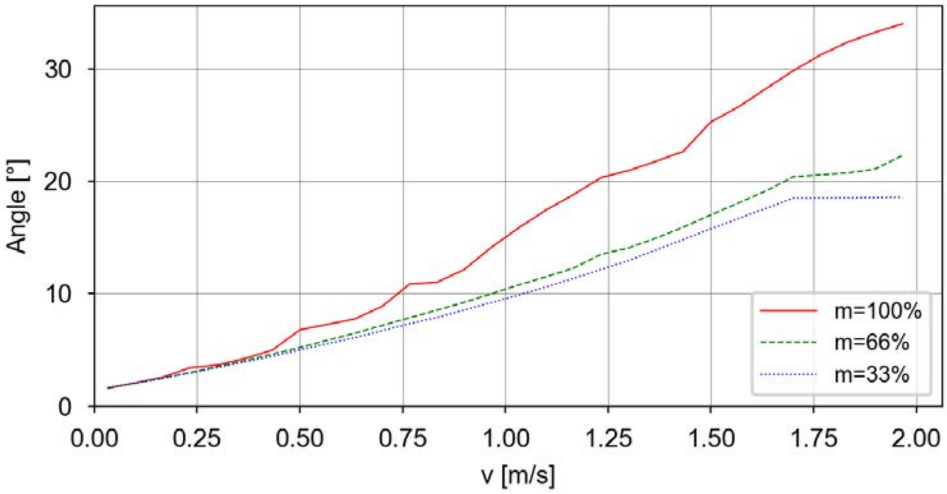
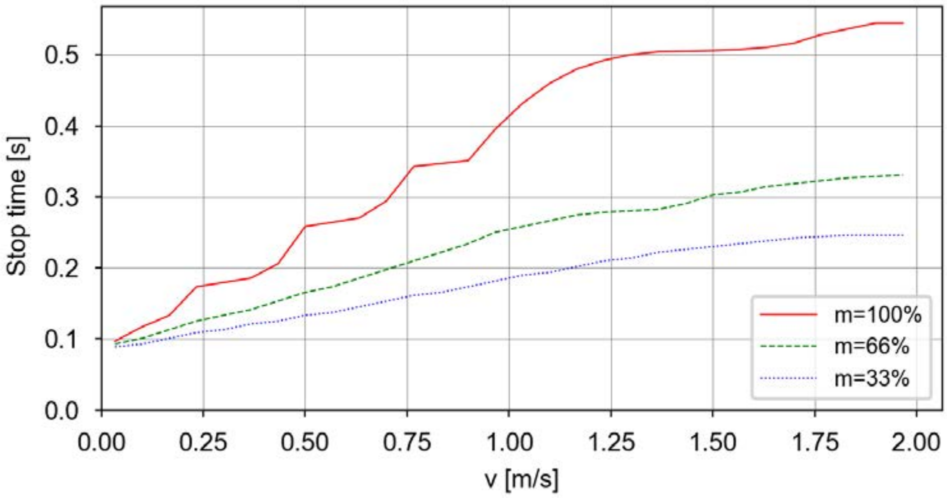
Category 1, Axis 2, Extension zone 1, stopping distance and stopping time





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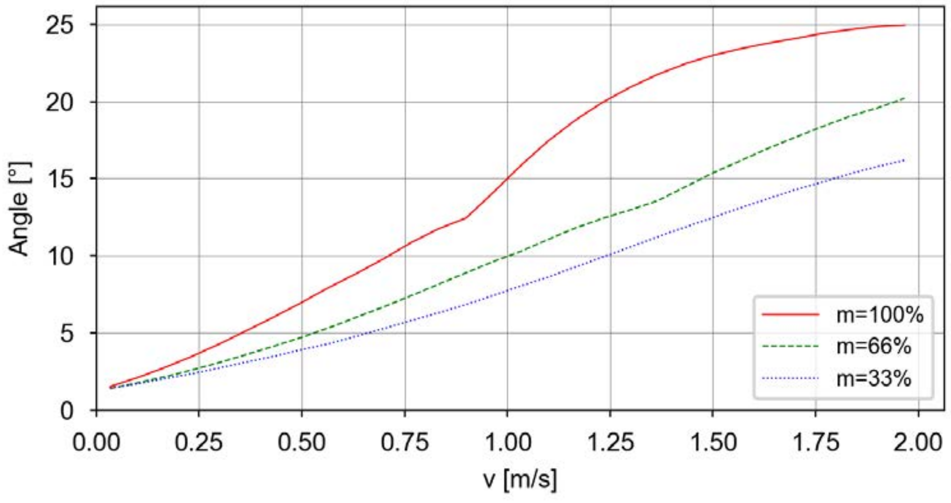
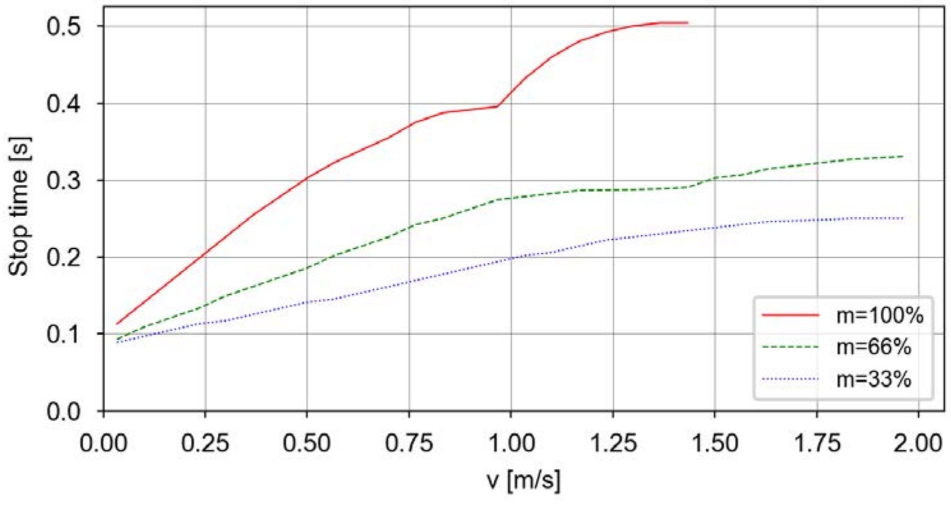
Category 1, Axis 2, Extension zone 2, stopping distance and stopping time





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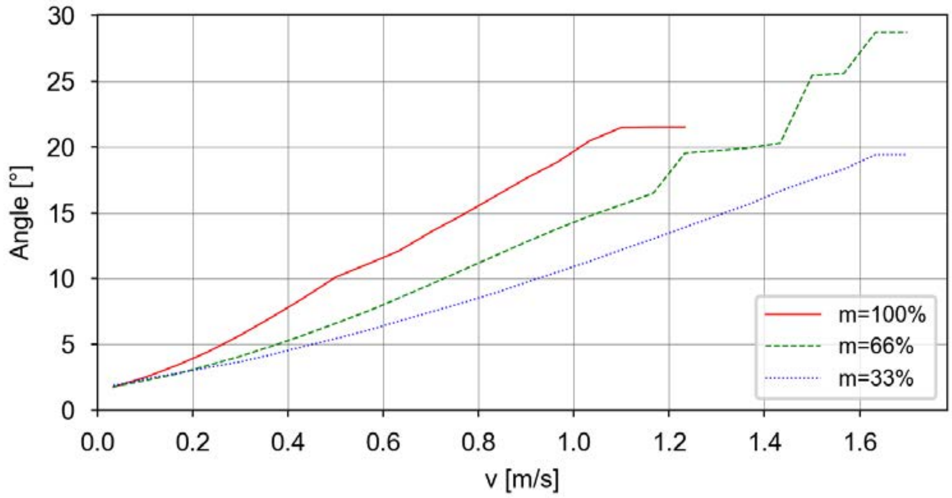
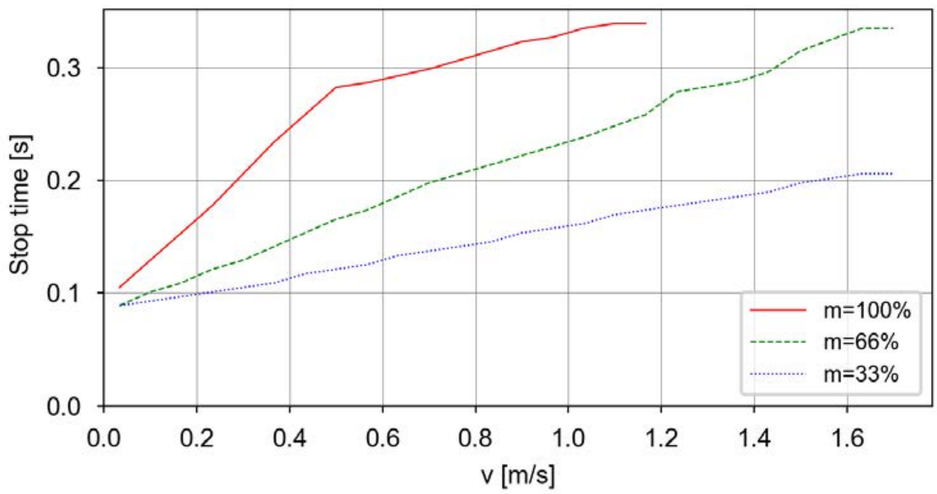
Category 1, Axis 3, Extension zone 0, stopping distance and stopping time





1.8.5 CRB 15000-12/1.27

Used tooldata

```
PERS tooldata P100:= [ TRUE, [[0, 0, 0], [1, 0, 0 ,0]], [12, [0,
     0, 90], [1, 0, 0, 0], 0.016, 0.016, 0.016]];
PERS tooldata P66:= [ TRUE, [[0, 0, 0], [1, 0, 0 ,0]], [8, [0, 0,
     60], [1, 0, 0, 0], 0.0072, 0.0072, 0.0072]];
PERS tooldata P33:= [ TRUE, [[0, 0, 0], [1, 0, 0 ,0]], [4, [0, 0,
     30], [1, 0, 0, 0], 0.0018, 0.0018, 0.0018]];
```

Category 1, extension zones

For definitions of the zones, see *Extension zones on page 73*.

The zone border is the mounting interface location for axis 2 and axis 3.

Axis 1

Zone border	Axis 2	Axis 3
z0-z1	-42°	42°
z1-z2	6°	-6°

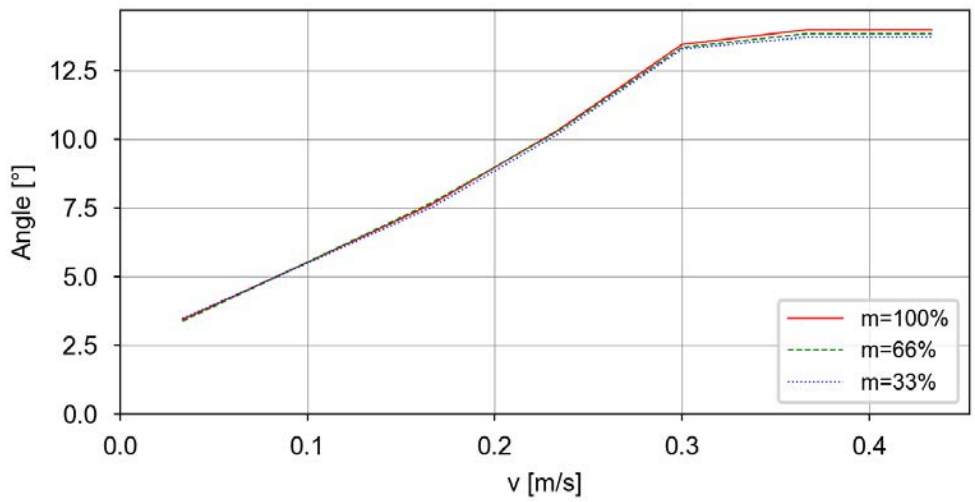
Axis 2

Zone border	Axis 2	Axis 3
z0-z1	48°	30°
z1-z2	90°	-30°

Axis 3

Only one zone exists.

Category 1, Axis 1, Extension zone 0, stopping distance and stopping time



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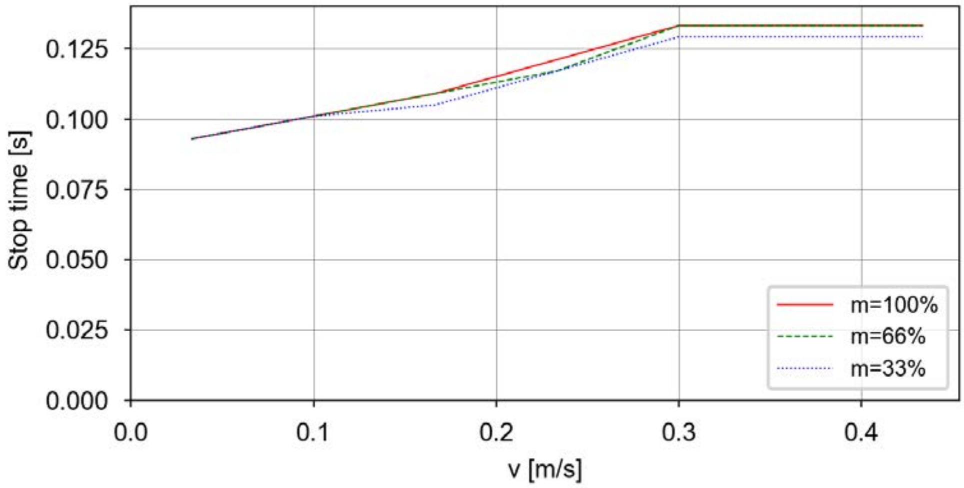
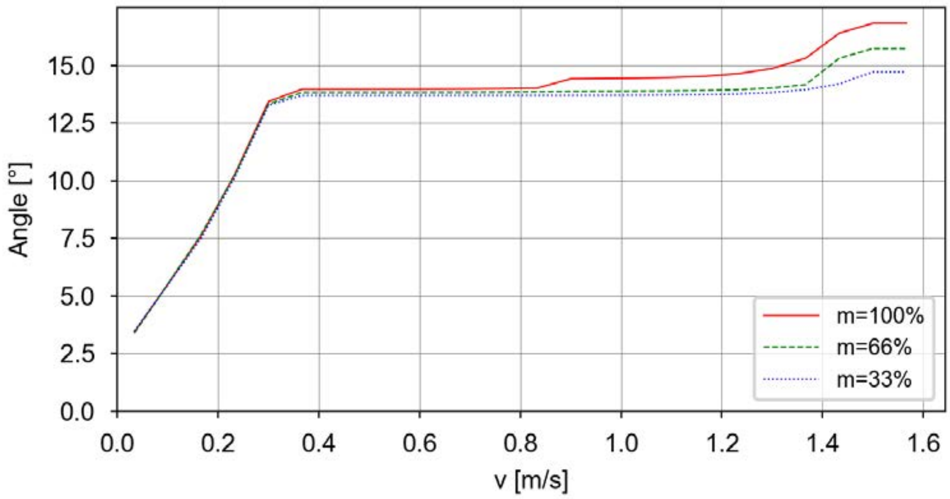
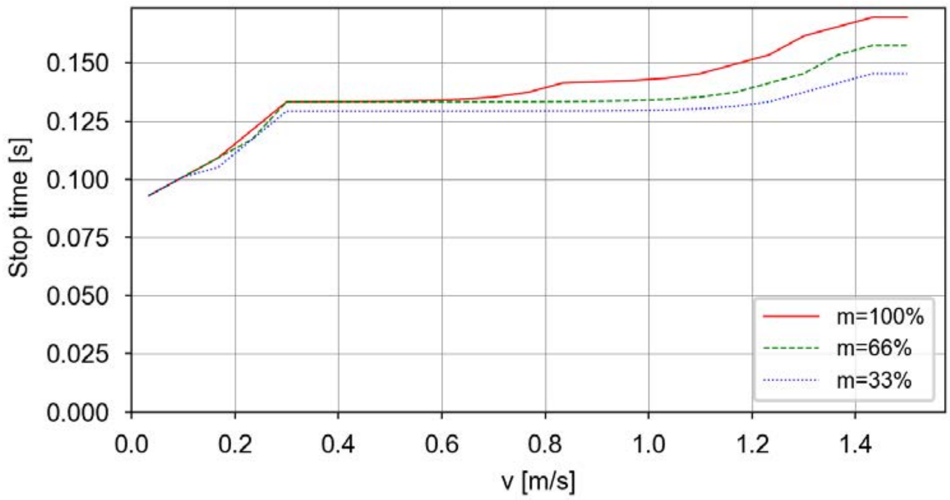


Category 1, Axis 1, Extension zone 1, stopping distance and stopping time





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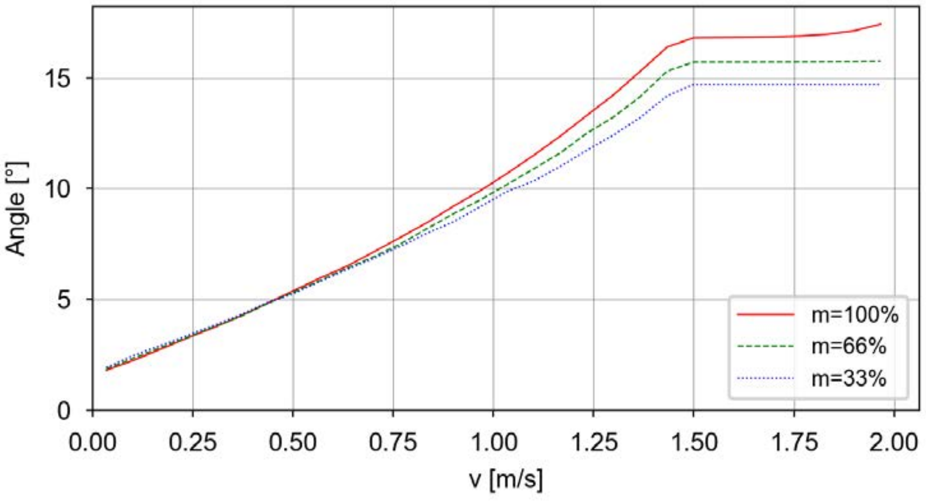
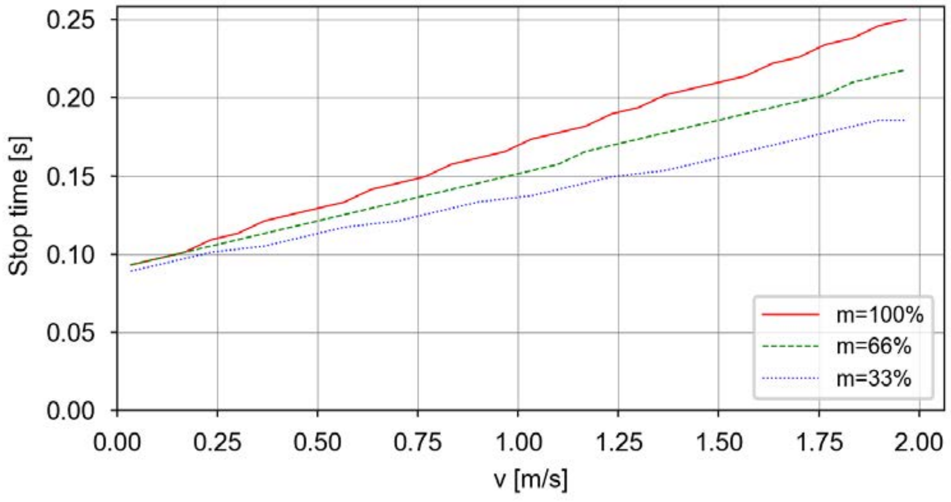
Category 1, Axis 1, Extension zone 2, stopping distance and stopping time





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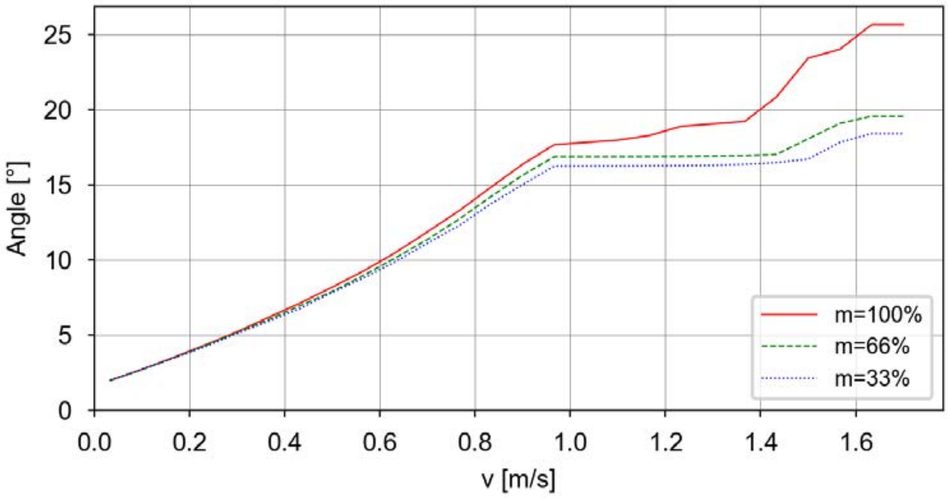
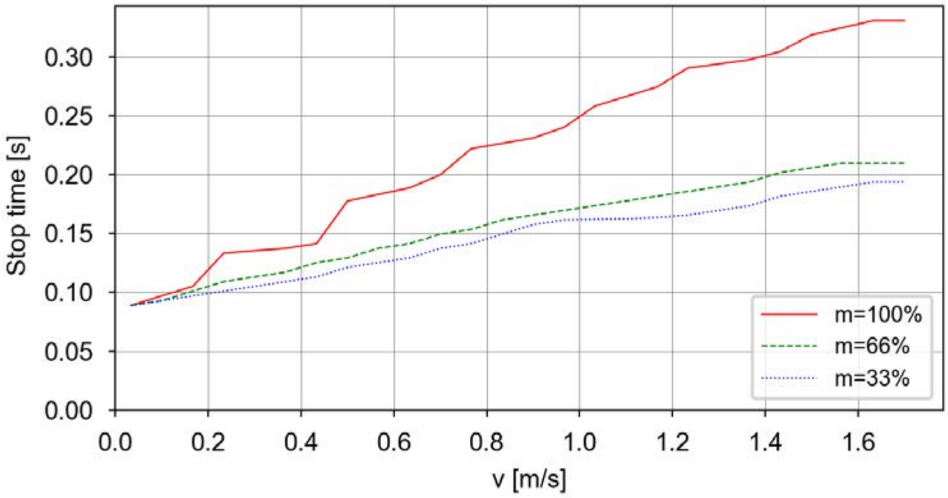
Category 1, Axis 2, Extension zone 0, stopping distance and stopping time





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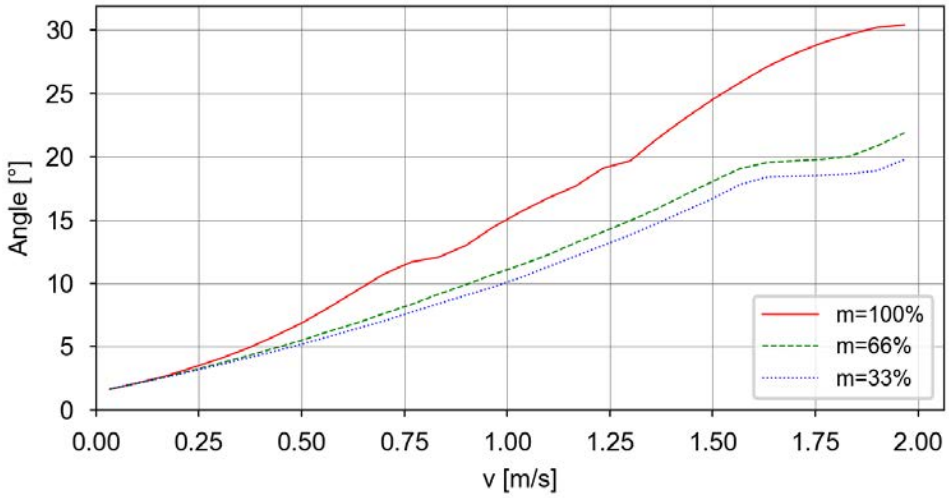
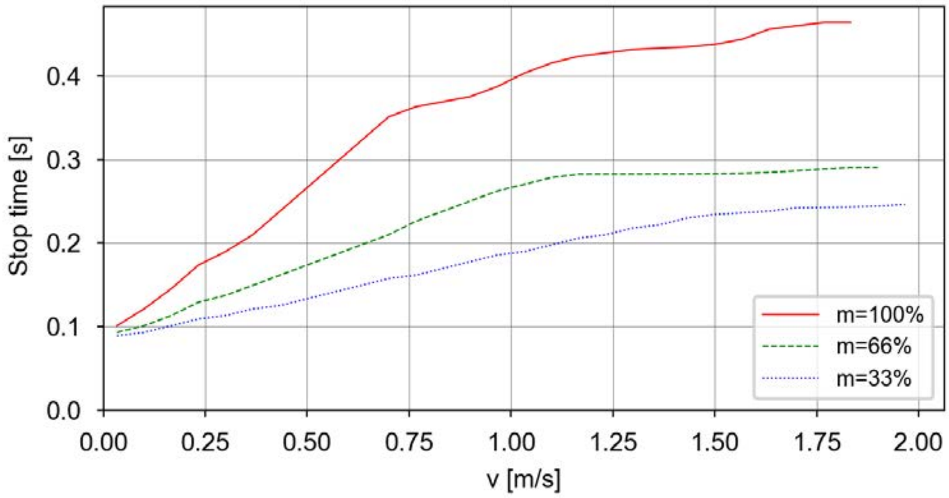
Category 1, Axis 2, Extension zone 1, stopping distance and stopping time





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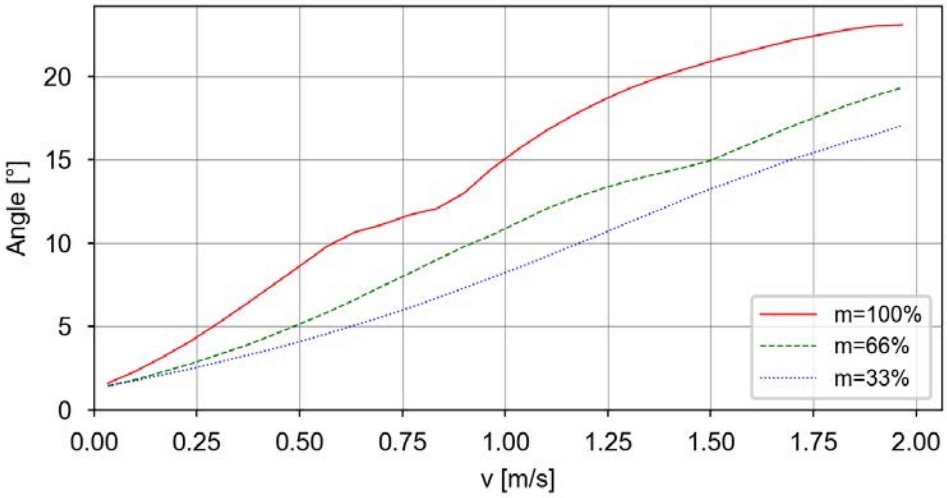
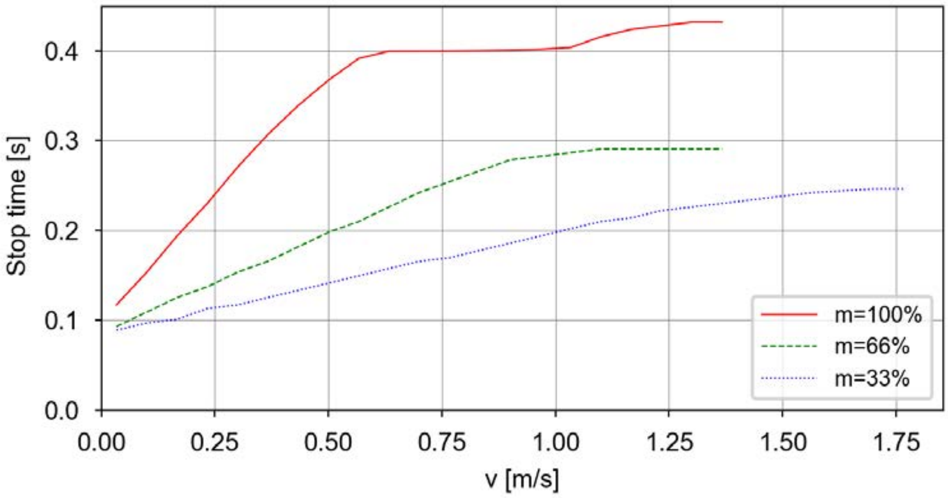
Category 1, Axis 2, Extension zone 2, stopping distance and stopping time





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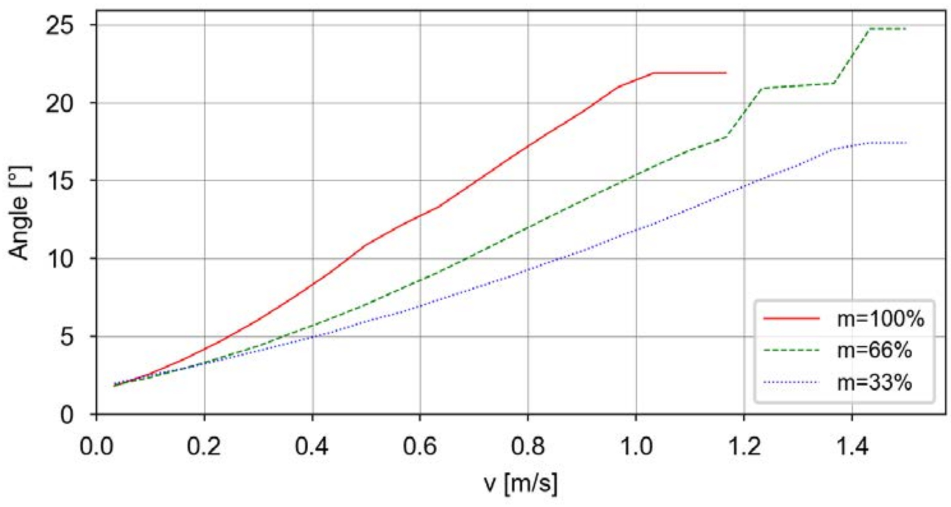
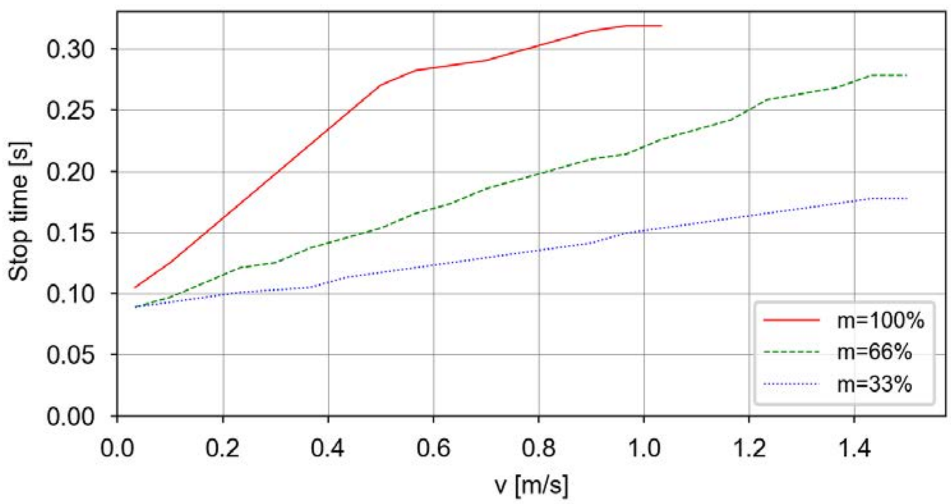
Category 1, Axis 3, Extension zone 0, stopping distance and stopping time





1.9 Customer connections on the manipulator

Introduction

The customer cables are routed internally with the manipulator cable harness.

Customer cabling

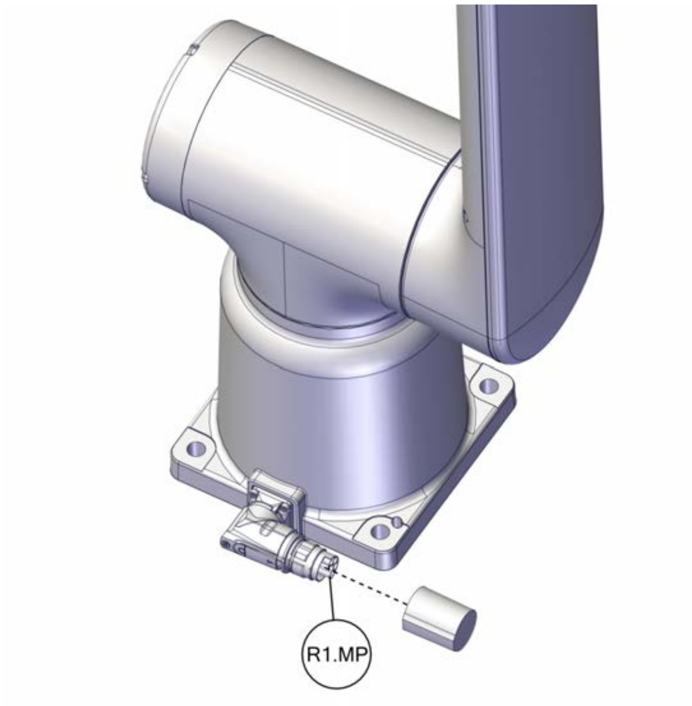
Customer connection	Cable specification	Article number	Rating in each wire[i]	Note
Customer power (CP)	Raw cable is twisted pair 1x2xAWG24	See *Product manual, spare parts - CRB 15000*	24V[ii] 3A	Routed internally with the manipulator cable harness.
Customer signal (CS)	2x2xAWG26 in 4x2XAWG26 cable	See *Product manual, spare parts - CRB 15000*	24V[iii] 500mA	Routed internally with the manipulator cable harness.

i Stresses above the limitation may cause permanent damage to the manipulator.
ii Rated 24V, max 30V
iii Rated 24V, max 30V

Customer connectors on the manipulator

Connectors at the base

The R1.MP on the base is used for transferring DC bus, EtherCat and customer signals (CP/CS).



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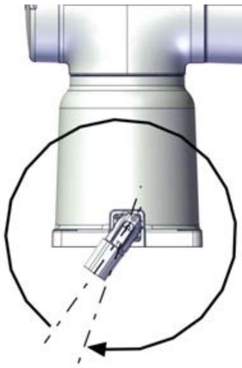
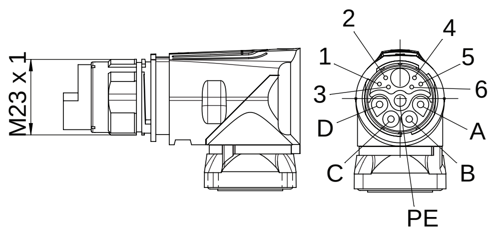
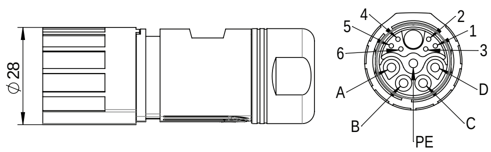
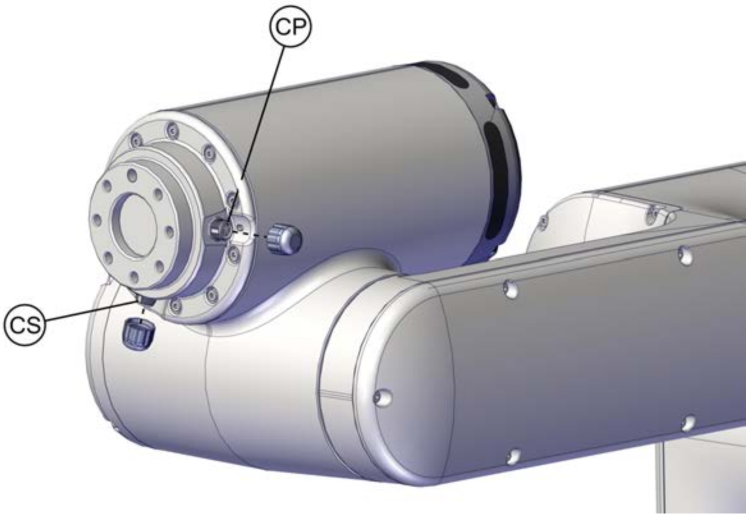


xx2100002065

-	The connector can be rotated 330° clockwise.

Pos	Connector type	Layout
R1.MP	Receptacle angled rotatable male connector with housing and insert.	 xx2100000221
-	Plug with female connector includes housing and insert.	 xx2100000229

Connectors at the tool flange



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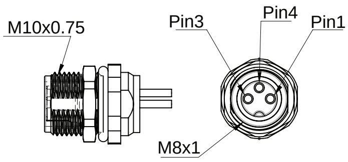
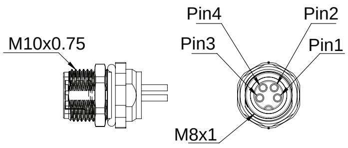
CAUTION

Always use protective caps on unused customer connectors to protect the connector and to cover sharp connector edges.

Note

Always inspect the connector for dirt or damage before connecting it. Clean or replace any damaged parts.

Pos	Connector type	Torque for mating/un-mating	Layout	Pin specification
CP	M8 3 pin female, 200 mm wire, straight (two pins for use, one pin is spare)	0.4 Nm	 xx2100000220	Pins on R2.CP: 1: CP+ 3: CP- 4: NC
CS	M8 4 pin female, 200 mm wire, straight	0.4 Nm	 xx2100000219	Pins on R2.CS: 1: CS Pair_1 + 2: CS Pair_1 - 3: CS Pair_2 + 4: CS Pair_2 -

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2 Specification of variants and options

2.1 Introduction to variants and options

General

The different variants and options for the CRB 15000 are described in the following sections. The same option numbers are used here as in the specification form.

The variants and options related to the robot controller are described in the product specification for the controller.

2.2 Manipulator

Manipulator variants

Option	Variant	Handling capacity	Wrist Reach	Flange Reach
3300-19	CRB 15000-5/0.95	5 kg	0.95 m	1.05 m
3300-69	CRB 15000-12/1.27	12 kg	1.27 m	1.38 m
3300-70	CRB 15000-10/1.52	10 kg	1.52 m	1.63 m

Manipulator protection

Option	Description
3350-540	Base 54, IP54 (standard for CRB 15000-5/0.95)
3350-670	Base 67, IP67 (standard for CRB 15000-10/1.52 and CRB 15000-12/1.27)

Note

Base 54 includes IP54, according to standard IEC 60529.

Base 67 includes IP67, according to standard IEC 60529.

Warranty

For the selected period of time, ABB will provide spare parts and labor to repair or replace the non-conforming portion of the equipment without additional charges. During that period, it is required to have a yearly *Preventative Maintenance* according to ABB manuals to be performed by ABB. If due to customer restrains no data can be analyzed with ABB Connected Services for robots with OmniCore controllers, and ABB has to travel to site, travel expenses are not covered. The *Extended Warranty* period always starts on the day of warranty expiration. Warranty Conditions apply as defined in the *Terms & Conditions*.

Note

This description above is not applicable for option *Stock warranty* [438-8]

Option	Type	Description
438-1	Standard warranty	Standard warranty is 12 months from *Customer Delivery Date* or latest 18 months after *Factory Shipment Date*, whichever occurs first. Warranty terms and conditions apply.
438-2	Standard warranty + 12 months	Standard warranty extended with 12 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-6	Standard warranty + 6 months	Standard warranty extended with 6 months from end date of the standard warranty. Warranty terms and conditions apply.

Continues on next page

Option	Type	Description
438-8	Stock warranty	Maximum 6 months postponed start of standard warranty, starting from factory shipment date. Note that no claims will be accepted for warranties that occurred before the end of stock warranty. Standard warranty commences automatically after 6 months from *Factory Shipment Date* or from activation date of standard warranty in WebConfig. **Note** Special conditions are applicable, see *Robotics Warranty Directives*.

2.3 Floor cables

Manipulator cable length

Option	Lengths
3200-1	3 m
3200-2	7 m
3200-3	15 m
3200-6	15 m drag chain cable

Mains cable

Option	Lengths	Description
3203-1	EU mains cable, 3 m	Cable assembly with CEE7/VII line-side plug
3203-2	UK mains cable, 3 m	Cable assembly with BS1363 line-side plug, 5A fused
3203-3	US mains cable, 9ft	Cable assembly with NEMA5-15 line-side plug
3203-4	JP mains cable, 3 m	Cable assembly with JIS8303 line-side plug
3203-5	CN mains cable, 3 m	Cable assembly with CPCS-CCC line-side plug
3203-6	AU mains cable, 3 m	Cable assembly with AS/NZS 3112 line-side
3203-7	All regions cable, 5 m	Cable assembly without line-side plug

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