

ROBOTICS

Product specification

CRB 1920



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Product specification

CRB 1920-30/1.35

CRB 1920-20/1.67

CRB 1920-16/1.96

OmniCore

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Revision: A

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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
<i>Product manual - CRB 1920</i>	<i>3HAC097951-001</i>
<i>Product specification - OmniCore E line RobotWare 8</i>	<i>3HAC098716-001</i>
<i>Product specification - OmniCore C line RobotWare 8</i>	<i>3HAC098715-001</i>
<i>Product manual - OmniCore E10 Type A</i>	<i>3HAC095278-001</i>
<i>Product manual - OmniCore C30 Type B</i>	<i>3HAC097281-001</i>



Tip

All documents can be found via ABB Robotics One, <https://one.robotics.abb.com/en/knowledge-hub>.

Revisions

Revision	Description
A	First edition.

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1 Description of CRB 1920

1.1 About the CRB 1920

General introduction

The CRB 1920 is a flexible, agile 6-axis articulated robot, which is applicable to work in both industrial and collaborative applications. It is available in three variants:

- CRB 1920-30/1.35 with payload of 30 kg in wrist reach of 1.35 m (flange reach of 1.52 m)
- CRB 1920-20/1.67 with payload of 20 kg in wrist reach of 1.67 m (flange reach of 1.82 m)
- CRB 1920-16/1.96 with payload of 16 kg in wrist reach of 1.96 m (flange reach of 2.1 m)

The robot is designed specifically for manufacturing industries that use flexible robot-based automation. It has an open structure that is especially adapted for flexible use, and can communicate extensively with external systems.

Intended use

The CRB 1920 robot from ABB is engineered for high-speed industrial environments. For other fields of use, verify whether this robot fulfills the standards required, see [Applicable standards on page 12](#).



CAUTION

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



Note

If contact with humans is likely for the robot, the use of power and force limiting functionality is recommended. See *ISO/TS15066* and *ISO10218-2* for guidance.

Available variants

The CRB 1920 is available in the following variants.

Robot type	Handling capacity	Wrist reach	Flange reach
CRB 1920-30/1.35	30 kg	1.35 m	1.52 m
CRB 1920-20/1.67	20 kg	1.67 m	1.82 m
CRB 1920-16/1.96	16 kg	1.96 m	2.1 m

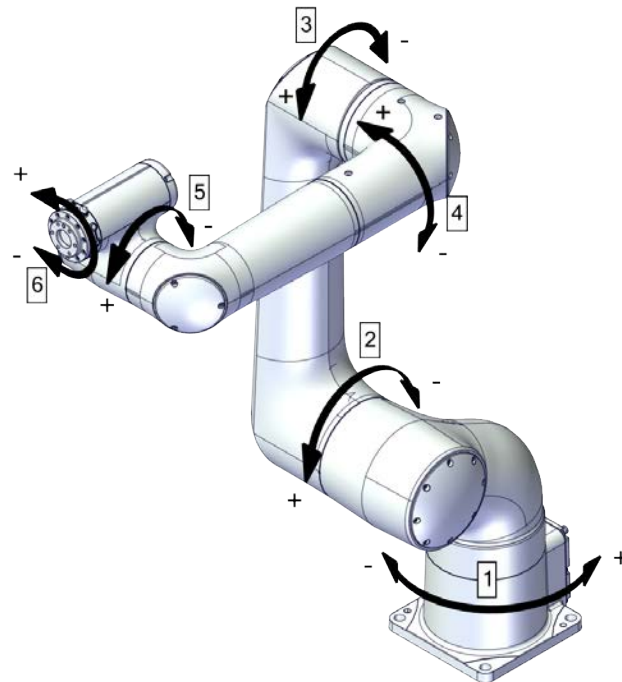
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1 Description of CRB 1920

1.1 About the CRB 1920

Continued

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

Control system

The robot is equipped with the OmniCore 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*.

The CRB 1920 manipulator can be connected to the following robot controllers:

- OmniCore C30
- OmniCore E10

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 30 kg, the CRB 1920 offers 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

Continues on next page

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, the product specification for the robot controller.

1 Description of CRB 1920

1.2.1 Applicable standards

1.2 Standards

1.2.1 Applicable standards

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
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
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
IEC 61326-3-1	Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) – General industrial applications
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.

1.3 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:

- 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 1920*.

Troubleshooting

The robot has built-in communication that shows information on the FlexPendant. These messages facilitates troubleshooting and are an integral part of the control system. Troubleshooting procedures are describes in the product manual for the manipulator and the controller respectively.

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2 Technical data for CRB 1920

2.1 Technical data

Weight, robot

The table shows the weight of the robot.

Robot model	Nominal weight
CRB 1920-30/1.35	61 kg
CRB 1920-20/1.67	63 kg
CRB 1920-16/1.96	63 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.

On robots running RobotWare 8, it is also possible to configure the mounting position on the FlexPendant, see the integrator's guide for the controller.

Loads on foundation, robot

The illustration shows the directions of the robots stress forces.

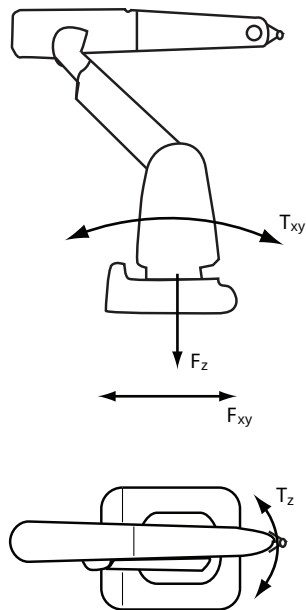
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2 Technical data for CRB 1920

2.1 Technical data

Continued

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)		
	-30/1.35	-20/1.67	-16/1.96	-30/1.35	-20/1.67	-16/1.96
Force xy	±830 N	±801 N	±734 N	±2185 N	±1980 N	±1879 N
Force z	±1155 N	±1052 N	±1188 N	±2440 N	±2212 N	±2092 N
Torque xy	±979 Nm	±975 Nm	±964 Nm	±3,194 Nm	±3,206 Nm	±3,237 Nm
Torque z	±691 Nm	±710 Nm	±666 Nm	±1,610 Nm	±1,638 Nm	±1,665 Nm

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Wall mounted

Force	Endurance load (in operation)			Maximum load (emergency stop)		
	-30/1.35	-20/1.67	-16/1.96	-30/1.35	-20/1.67	-16/1.96
Force xy	±1152 N	±1150 N	±1052 N	±2642 N	±2481 N	±2382 N
Force z	±749 N	±681 N	±598 N	±1854 N	±1665 N	±1556 N
Torque xy	±995 Nm	±1,061 Nm	±1,038 Nm	±3,161 Nm	±3,305 Nm	±3,370 Nm
Torque z	±726 Nm	±724 Nm	±724 Nm	±1,698 Nm	±1,736 Nm	±1,759 Nm

Suspended

Force	Endurance load (in operation)			Maximum load (emergency stop)		
	-30/1.35	-20/1.67	-16/1.96	-30/1.35	-20/1.67	-16/1.96
Force xy	±886 N	±800 N	±706 N	±2208 N	±2012 N	±1862 N
Force z	±1150 N	±1053 N	±1167 N	±2500 N	±2248 N	±2158 N
Torque xy	±946 Nm	±954 Nm	±931 Nm	±3,035 Nm	±3,255 Nm	±3,261 Nm
Torque z	±662 Nm	±687 Nm	±665 Nm	±1,621 Nm	±1,651 Nm	±1,676 Nm

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
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 <i>Motion Process Mode</i> in the manual that describes the controller software option, see References on page 7 .
Minimum foundation material yield strength	180 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 possible 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.

Continues on next page

2 Technical data for CRB 1920

2.1 Technical data

Continued

Storage conditions, robot

The table shows the allowed storage conditions for the robot:

Parameter	Value
Minimum ambient temperature	-25 °C
Maximum ambient temperature	55 °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 (100-70 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	45 °C
Maximum ambient humidity	<95%, non-condensing, at constant temperature
Maximum ambient altitude	0-2,000 m (100-84 kPa)

ⁱ At low environmental temperature < 10°C 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.

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	IP67

ⁱ According to IEC 60529.

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)	At velocity 100%: ISO Class 5 ⁱ

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

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.*

Continues on next page

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		
	CRB 1920-30/1.35	CRB 1920-20/1.67	CRB 1920-16/1.96
1	724.5 Nm	724.5 Nm	724.5 Nm
2	724.5 Nm	724.5 Nm	724.5 Nm
3	363.6 Nm	363.6 Nm	363.6 Nm
4	121.2 Nm	121.2 Nm	121.2 Nm
5	85.85 Nm	85.85 Nm	55.55 Nm
6	60.6 Nm	60.6 Nm	50.5 Nm

2 Technical data for CRB 1920

2.2 Other technical data

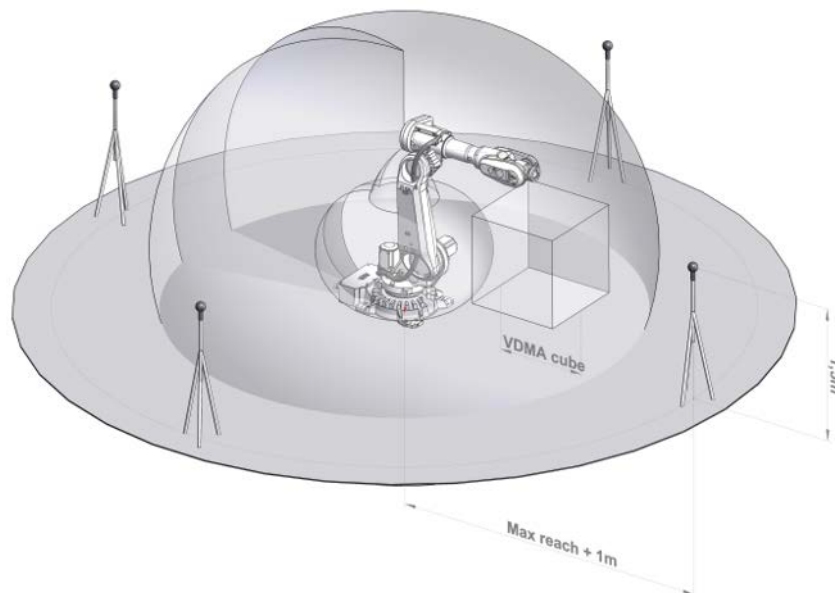
2.2 Other technical data

Airborne noise level

Description	Note	Value
Airborne noise level	The sound pressure level outside the working space.	< 65 dB(A) Leq (acc. to machinery directive 2006/42/EC) Movement: ISO cube (ISO 9283)

The noise emission is measured at four points on a radius 1 m outside the robots maximum working range and at 1.5 m above the robot base level, while the manipulator follows a defined cycle according to VDMA 24608, at max performance and payload.

The following illustration shows the IRB 6710, but the same principle applies for CRB 1920.



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Note

The noise emission from a robot, in an actual application, depends on the programmed path, payload, cycle time, mounting position, environment, etc.

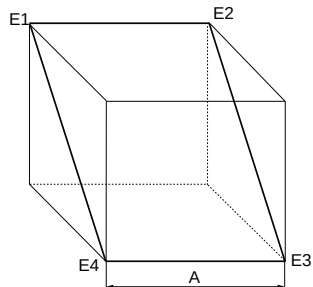
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Power consumption at max load

**Note**

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

Type of movement	CRB 1920 (all variants)
ISO cube Max. velocity	0.55 kW
Robot in calibration position	CRB 1920 (all variants)
Brakes engaged	0.06 kW
Brakes disengaged	0.23 kW



xx1000000101

Pos	Description
A	630 mm

**Note**

If measuring the power consumption at the installation site, the returned power to the grid needs to be taken into account.

2 Technical data for CRB 1920

2.3.1 Introduction to installation

2.3 Mechanical data for installation

2.3.1 Introduction to installation

Detailed installation instructions

The detailed information for installing the CRB 1920 at the working site is found in *Product manual - CRB 1920* and the product manual for the robot controller.

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 ABB Robotics One, <https://one.robots.ics.abb.com/en/knowledge-hub>.

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.

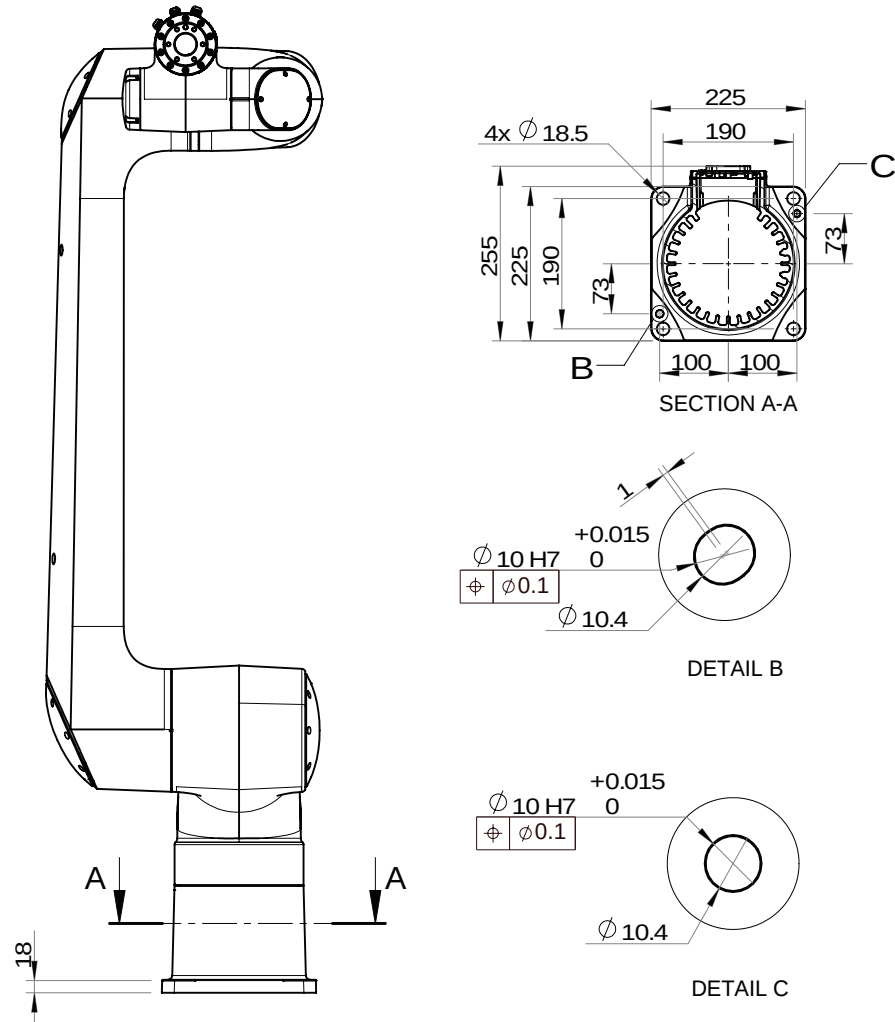
All hardware is enclosed in the robot delivery.

Suitable screws	M16x50
Quantity	4 pcs
Quality	8.8
Suitable washer	30/17/3 mm Steel
Guide pins	ISO 2338, hardened steel Ø10x30 mm, 2 pcs
Tightening torque	155 Nm ±10%
Length of thread engagement	Minimum 24 mm for ground with material yield strength 180 MPa
Level surface requirements	0.1/500 mm

Continues on next page

Hole configuration, base

This illustration shows the hole configuration used when securing CRB 1920.



Explosive environments

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

More information for the arm-side interface

The arm-side interface has configurable buttons and a light ring that indicates status, see [Configuring arm-side interface on page 36](#). More details on how to configure this is described in *Product manual - CRB 1920*.

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 (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).

Continues on next page

2 Technical data for CRB 1920

2.3.1 Introduction to installation

Continued

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.

2.3.2 Fitting equipment on the robot (robot dimensions)



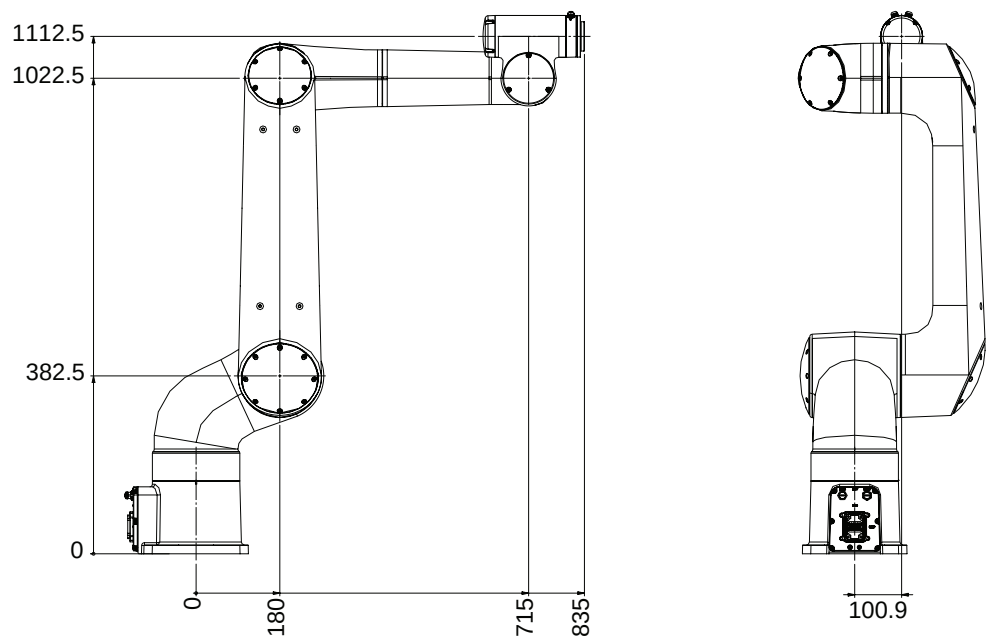
Note

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 1920-30/1.35



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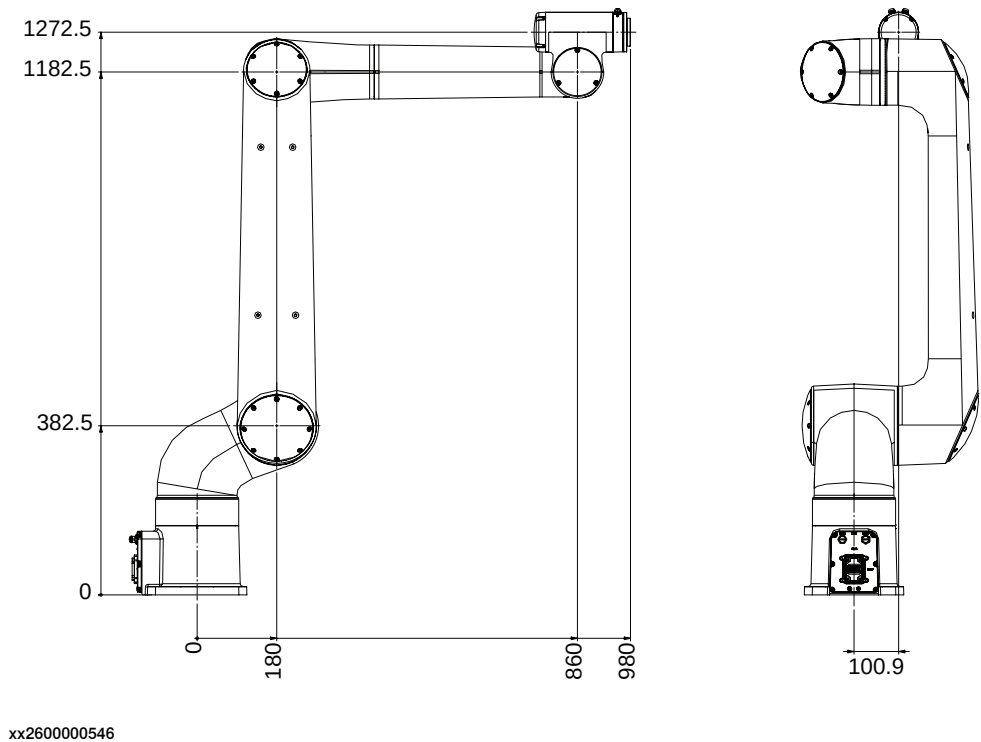
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2 Technical data for CRB 1920

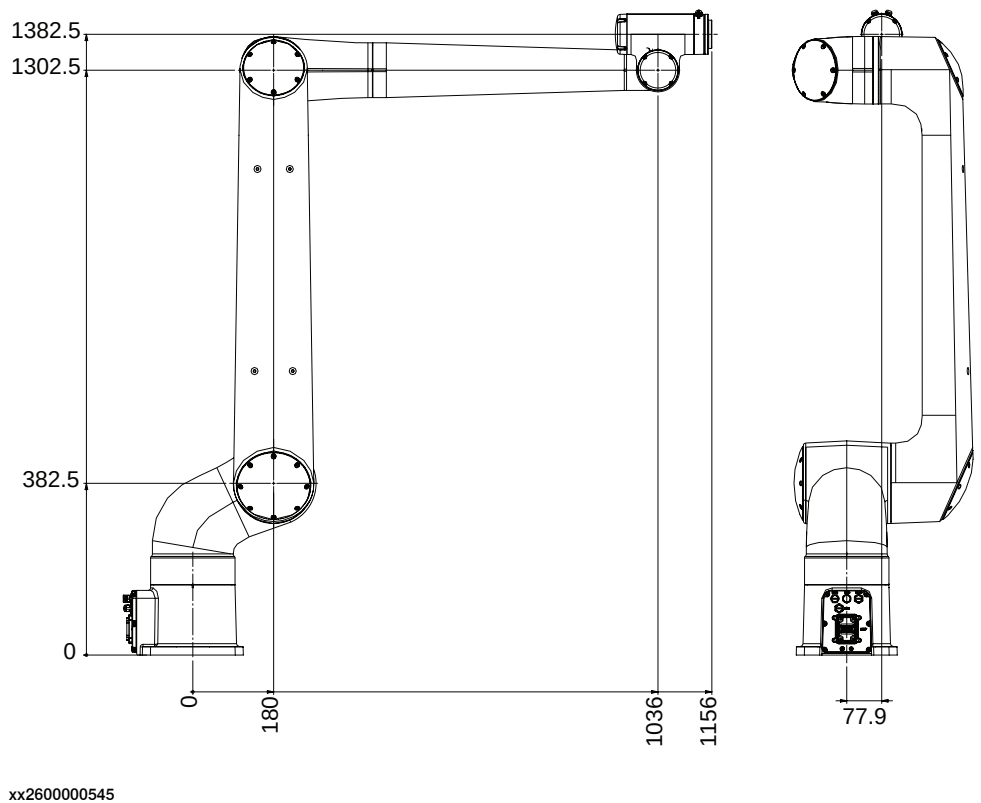
2.3.2 Fitting equipment on the robot (robot dimensions)

Continued

CRB 1920-20/1.67

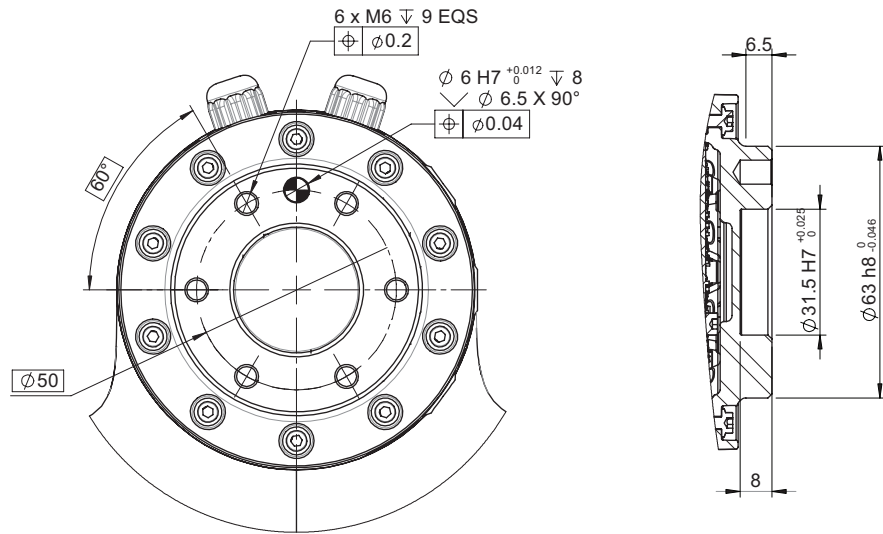


CRB 1920-16/1.96



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Tool flange dimensions



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Fitting equipment on the robot arm

The robot wrist unit and tubular are not designed with attachment holes for any arm load. However, for light loads such as cables, it is possible to bind them directly on the arm.

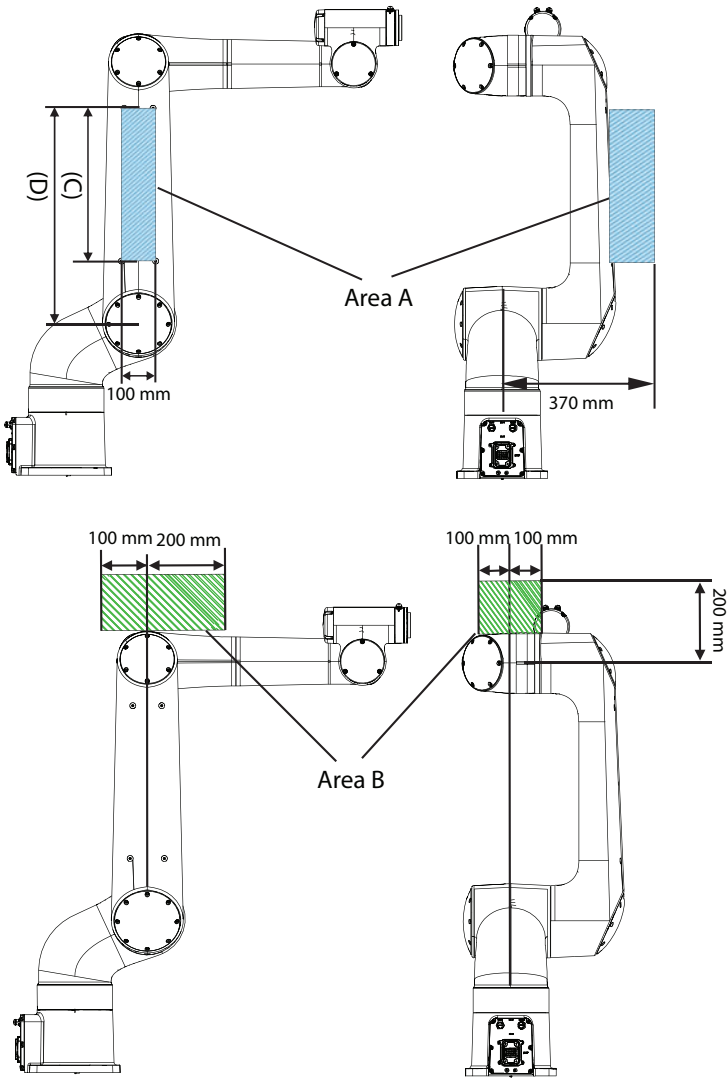
Extra loads can be mounted on the robot housing and lower arm. The center of gravity of the extra load shall be within the marked load areas (CRB 1920-30/1.35 is illustrated as an example). The robot housing and lower arm are supplied with holes for mounting of extra equipment. (See [Holes for fitting extra equipment on page 29](#).) Maximum allowed arm load depends on center of gravity of arm load and robot tool-and payload. When an armload is attached, the payload on the wrist is reduced. Use RobotLoad in RobotStudio to verify individual cases.

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2 Technical data for CRB 1920

2.3.2 Fitting equipment on the robot (robot dimensions)

Continued



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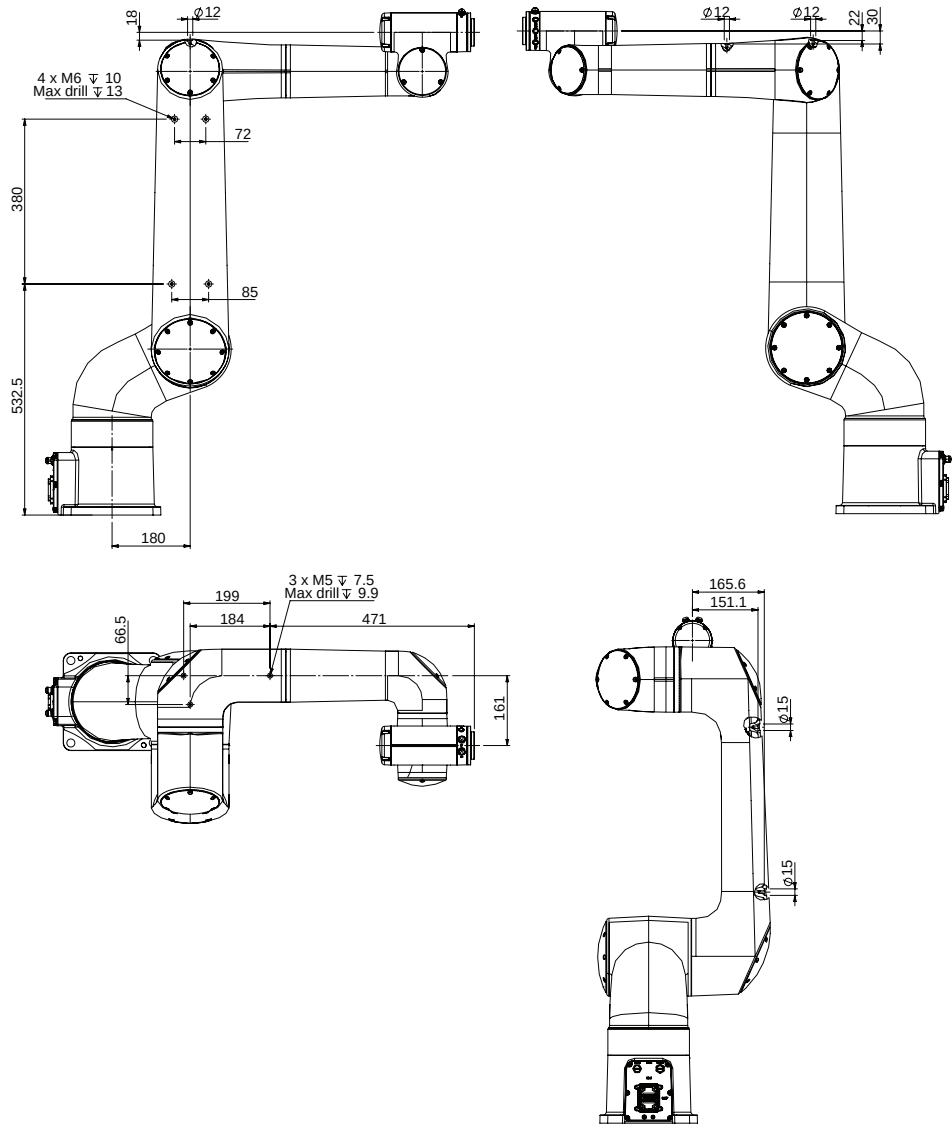
Load area robot		Max load		
		A	B	A+B
CRB 1920		10 kg	10 kg	10 kg

Pos	Dimension		
	-30/1.35	-20/1.67	-16/1.96
C	400 mm	400 mm	450 mm
D	530 mm	630 mm	700 mm

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Holes for fitting extra equipment

CRB 1920-30/1.35



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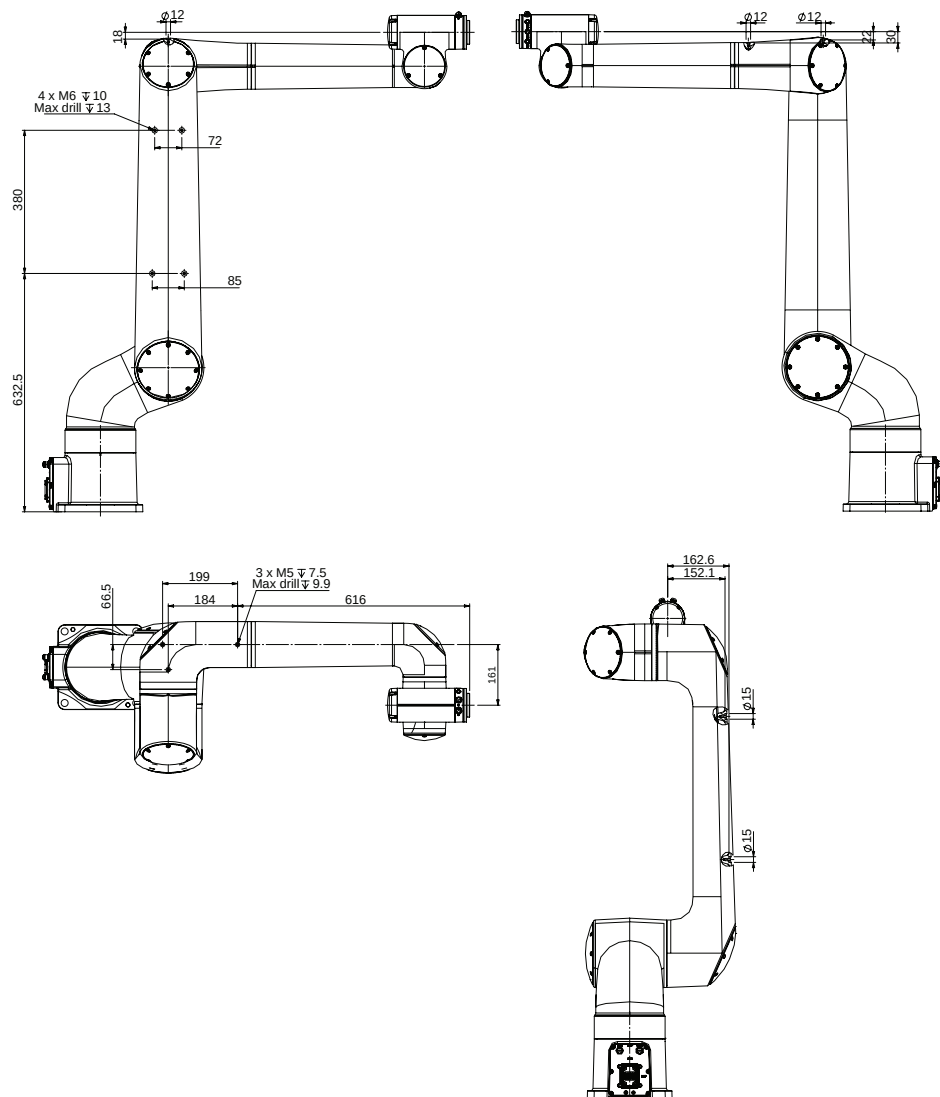
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2 Technical data for CRB 1920

2.3.2 Fitting equipment on the robot (robot dimensions)

Continued

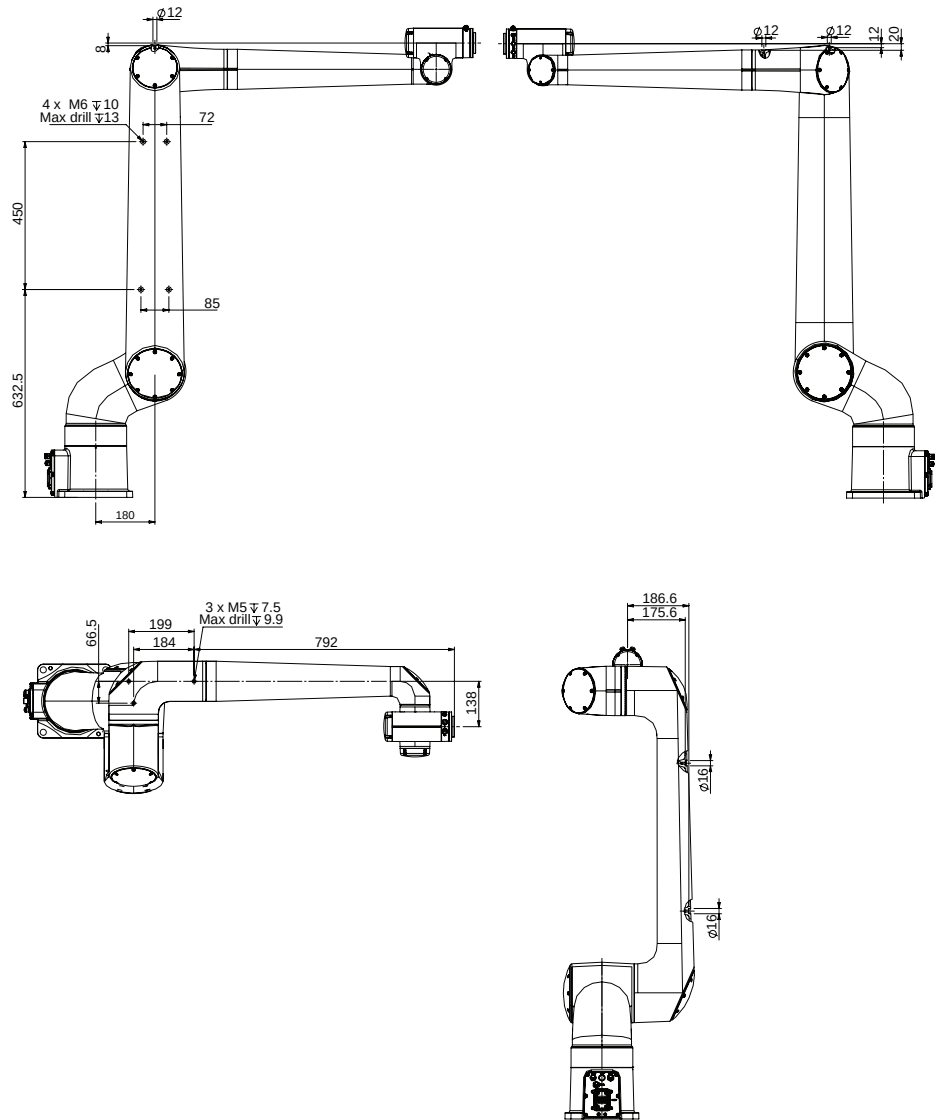
CRB 1920-20/1.67



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CRB 1920-16/1.96



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Fastener quality on tool flange

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

Screws of Grade 10.9 or higher should be used.

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.

2 Technical data for CRB 1920

2.3.3 Robot cabling and connection points

2.3.3 Robot cabling and connection points

Introduction

Connect the robot and controller to each other after securing them to the foundation. The lists below specify which cables to use for each respective application.



DANGER

Turn off the main power before connecting any cables.



CAUTION

Connect the male and female connectors perfectly aligned horizontally to avoid any kind of tilt or skew.



CAUTION

Verify that the serial number is according to the number(s) in the *Declaration of Incorporation* (DoI).

Robot cables

These cables are included in the standard delivery. They are completely pre-manufactured and ready to plug in.

Cable sub-category	Description	Connection point, cabinet	Connection point, robot
Robot cables, power	Transfers power from the drive units in the control cabinet to the robot motors, and also power supply to the arm-side interface.	X1	R1.MP
Robot cable, signals	Transfers resolver data from and power supply to the serial measurement board.	X2	R1.SMB
Robot cable, ASI	Transfers signal data from and to the arm-side interface.	DEVICE	R1.ASI

Robot cable, power

Power cable length	Article number
Power cable, 2 m	3HAC098180-004
Power cable, 5 m	3HAC098180-005

Robot cable, signals

Signal cable length	Article number
Signal cable, shielded: 2 m	3HAC094940-001
Signal cable, shielded: 5 m	3HAC094940-004
Signal cable, shielded, with UL: 3 m	3HAC084767-001
Signal cable, shielded, with UL: 7 m	3HAC084767-002

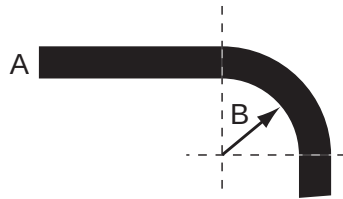
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Robot cable, ASI

Signal cable length	Article number
Control cable ASI, 2 m	3HAC094942-001
Control cable ASI, 5 m	3HAC094942-004
Control cable ASI, with UL, 2 m	3HAC096268-001
Control cable ASI, with UL, 5 m	3HAC096268-004

Bending radius for static floor cables

The minimum bending radius is 10 times the cable diameter for static floor cables.

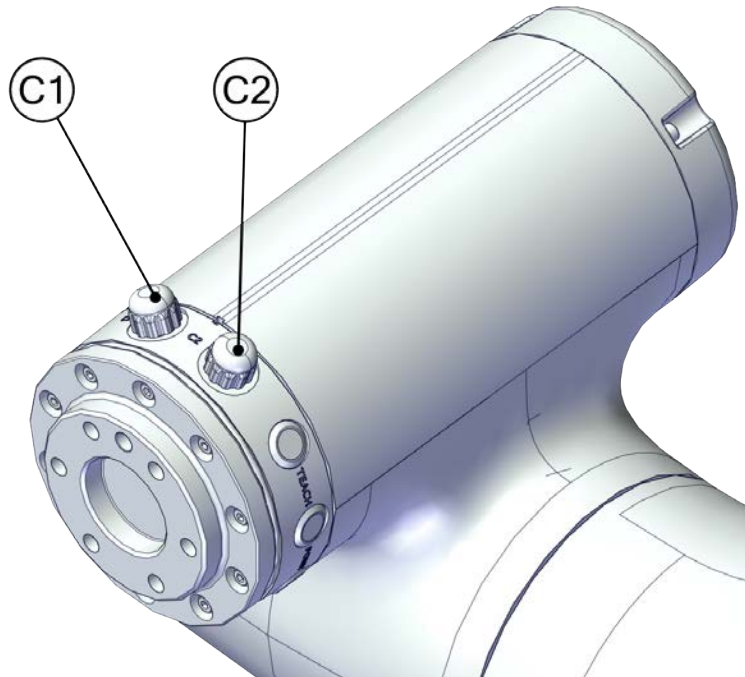


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A	Diameter
B	Diameter x10

Customer connectors on the manipulator

Connectors at the tool flange



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Continues on next page

2 Technical data for CRB 1920

2.3.3 Robot cabling and connection points

Continued



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/unmating	Layout	Pin rating
C1	M8, A-code, 8 pole, female (IEC 61076-2-104)	0.4 Nm		24V 1.5A
C2	M8, A-code, 8 pole, female (IEC 61076-2-104)	0.4 Nm		24V 1.5A

Pin specification on connector C1

C1 is an 8-pin connector used for custom power/signal connections. The pin assignment on connector C1 is configurable to support different functions of digital input (DI), digital output (DO), analog input (AI), 24V power supply, grounding (GND), and connections to Modbus RTU devices. The table lists the configuration possibilities for each pin. How to configure the pin assignment is detailed in *Product manual - CRB 1920*.

Pin	Function							
	DI	DO SINK	AI voltage	AI current	RS485 - ⁱ	RS485 + ⁱ	GND	DO SRC
1	Y		Y	Y	Y			
2	Y		Y	Y		Y		
3	Y	Y					Y	Y
4	Y	Y					Y	Y
5	Y	Y						Y
6	Y	Y	Y	Y				Y
7	Y	Y	Y	Y				Y
8	Y	Y					Y	Y

ⁱ RS485- and RS485+ functions are configured in pair.

When configured for AI voltage,

- Rated specification: 10 V

When configured for AI current,

- Rated specification: 4-20mA

Continues on next page

When configured for digital output (DO),

- It can be set to DO SINK or DO SRC.
 - DO SINK is a low side DO switch and is equivalent to an NPN output.
 - DO SRC is equivalent to a PNP output and also to 24V PWR.

When the DO is used for 24V PWR, benefits of more control and flexibility over the 24V tool supply can be obtained.

For more details about how to use the ASI for DO, see *Product manual - CRB 1920*.



Note

The total current of the pins on the arm-side interface (including C1 and C2) used for power supply are limited by the capability of the connected controller.

When an OmniCore E10 controller is connected, the total current for these pins will not exceed 4 A.

When an OmniCore C30 controller is connected, the total current for the pins can reach up to 5 A. However, if the total current exceeds 4 A, the power supply voltage of C1 and C2, as well as the DO output voltage of C1, may drop from 24 V to below 19.2 V.

Pin specification on connector C2

Connector C2 provides custom power and integrated Ethernet connection to the controller DEVICE network. Ethernet-based devices such as Modbus TCP grippers, Integrated Vision cameras, and other smart cameras can be connected on C2.

Pin	Function	Specification
1	Ethernet	Cat5, 100Mbit, Tx+
2	Ethernet	Cat5, 100Mbit, Tx-
3	Ethernet	Cat5, 100Mbit, Rx+
4	Ethernet	Cat5, 100Mbit, Rx-
5	Power	24V ⁱ
6	Power	24V ⁱ
7	Grounding	0V
8	Grounding	0V

ⁱ The total current of the pins on the arm-side interface (including C1 and C2) used for power supply are limited by the capability of the connected controller.

When an OmniCore E10 controller is connected, the total current for these pins will not exceed 4 A.

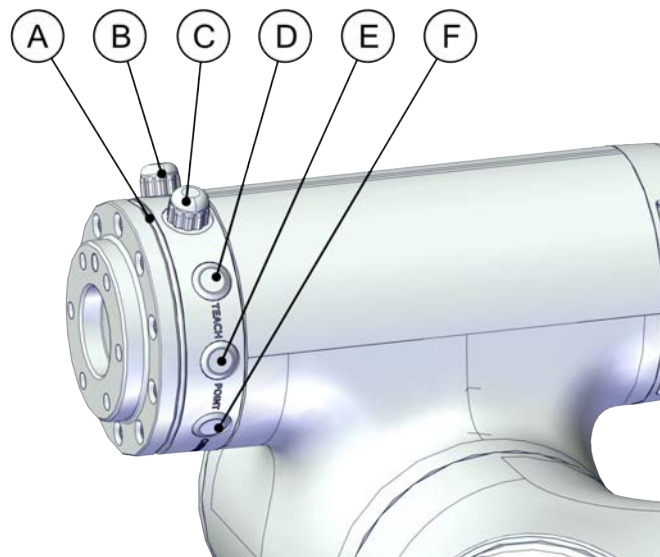
When an OmniCore C30 controller is connected, the total current for the pins can reach up to 5 A. However, if the total current exceeds 4 A, the power supply voltage of C1 and C2, as well as the DO output voltage of C1, may drop from 24 V to below 19.2 V.

2.3.4 Configuring arm-side interface

Introduction

The arm-side interface is located on axis 6, around the tool flange. The configuration of the arm-side interface can be done in either of the following ways:

- using the **ASI Setting** app on the FlexPendant
- setting parameters of the ASI-related types under the **Man-Machine Communication** topic in **Configuration Editor** of RobotStudio



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A	Light ring
B	C1 connector, CPCS and multifunctional pins
C	C2 connector, CP and Ethernet
D	TEACH button
E	POINT button
F	CUSTOM button

Prerequisites

Arm-side interface buttons can be used only when the FlexPendant is connected and has write access. When connected, the arm-side interface functions as an extension of the local control station. The connectors and light ring on the arm-side interface operate regardless of the FlexPendant connection and write access.

A validated safety configuration must be set up before using the arm-side interface in Auto mode. 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*.

Continues on next page



Note

The application **Wizard** on the FlexPendant must be open when using the buttons configured with programming functions on Wizard, especially if the buttons are configured differently than default.

2.3.5 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

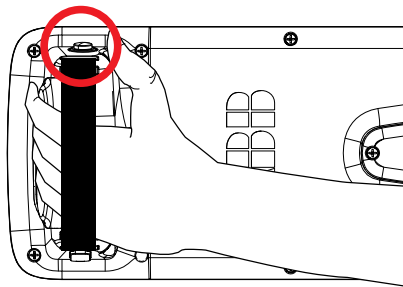


Note

For best performance when using lead-through functionality, it is recommended to calibrate the joint parameters for lead-through first in the application. Calibration information is detailed in *Product manual - CRB 1920*.

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.



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



Note

Lead-through can only be enabled when the FlexPendant has write access. See *Operating manual - Integrator's guide* and the product manual for the robot.



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 Gently pull the robot arm to the desired position.
The robot moves to the selected position.

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.

4 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.

If varying loads from cables and other disturbances are causing the robot to drift during lead-through,

- For the GoFa, 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*.
- For the PoWa, this can often be increasing *Lead through load compensation deadband*. See *Technical reference manual - System parameters*, section *Motion*, type *Arm*.

For the CRB 1920, if varying loads from cables and other disturbances are causing the robot to drift during lead-through, this can often be increasing *Lead through load compensation deadband*. See *Technical reference manual - System parameters*, section *Motion*, type *Arm*.

**Note**

For Yumi robots with SafeMove, some different behaviors apply, see the product manual for the robot.

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.

2 Technical data for CRB 1920

2.3.6 Installation of laser scanner

2.3.6 Installation of laser scanner

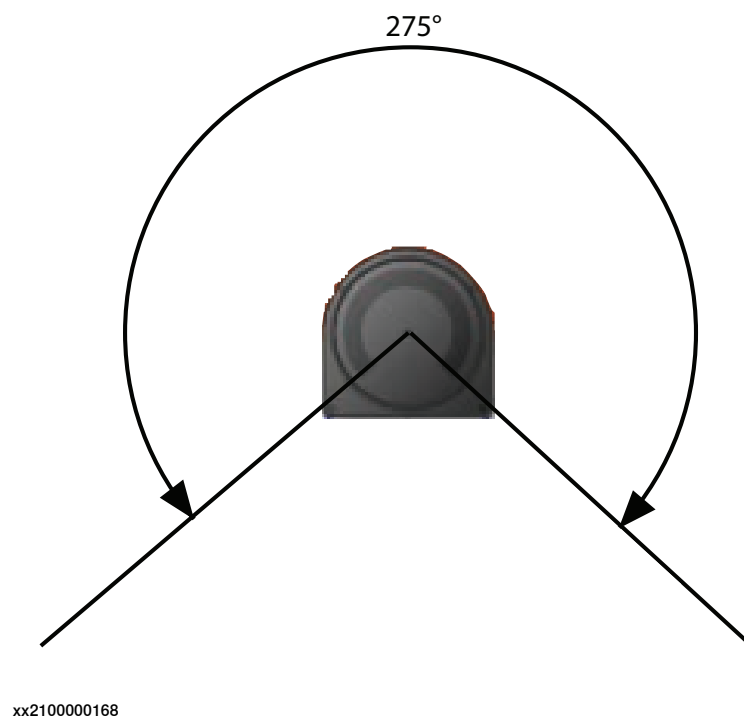
Overview

ABB provides safety separation and speed control functions to CRB 1920 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 PROFSafe-based laser scanner (option 3051-1 PROFSafe scanner)
- 2 PROFSafe-based laser scanners (option 3051-3 Dual PROFSafe scanner)
- 1 Safety IO-based laser scanner (option 3051-2 I/O scanner)
- 2 Safety IO-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.

Safety IO-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 Safety IO-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 and safety information for 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)

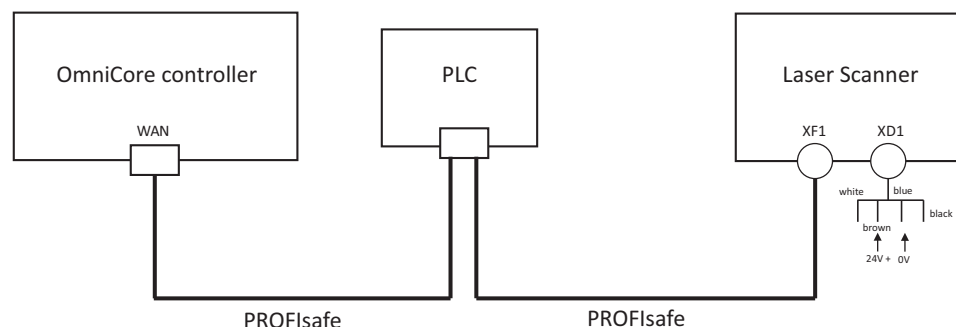
Safety laser scanners shall be connected properly according to the scanner type and system setup.



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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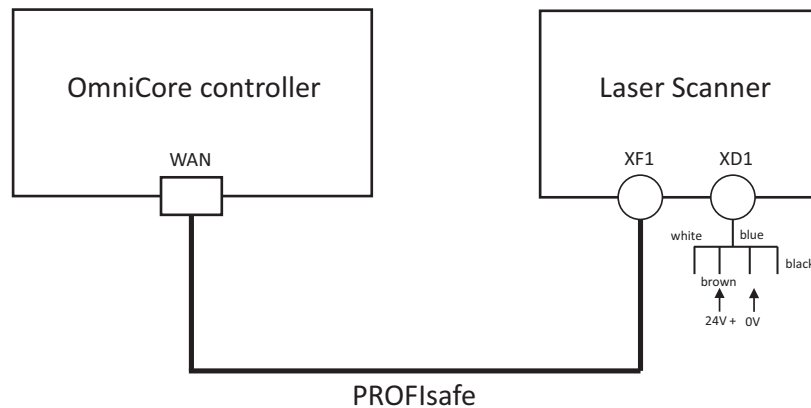
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2 Technical data for CRB 1920

2.3.6 Installation of laser scanner

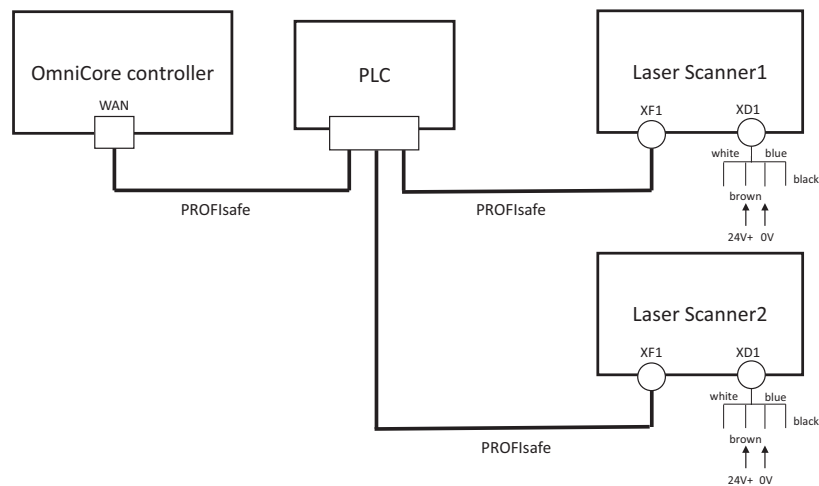
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1 PROFIsafe-based laser scanner (option 3051-1), without PLC connected



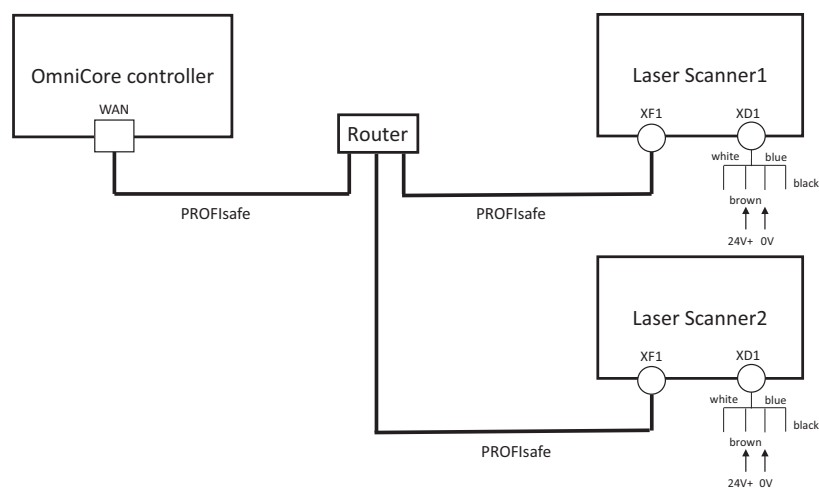
xx2500001230

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



xx2500001229

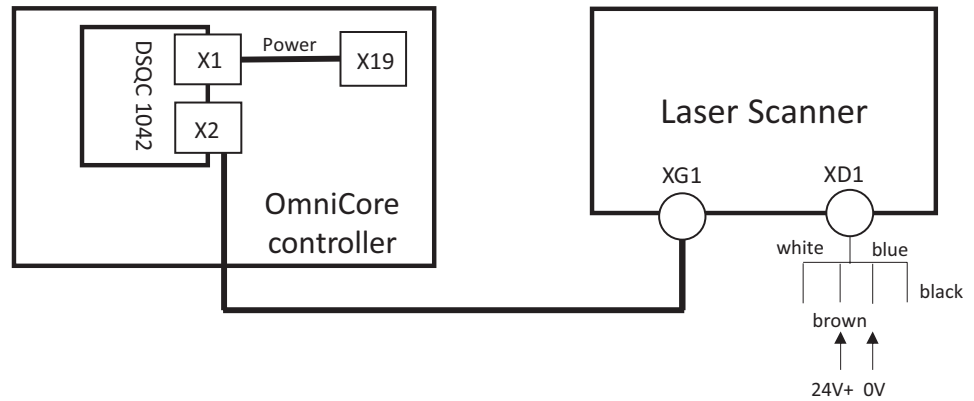
2 PROFIsafe-based laser scanners (option 3051-3), without PLC connected



xx2500001231

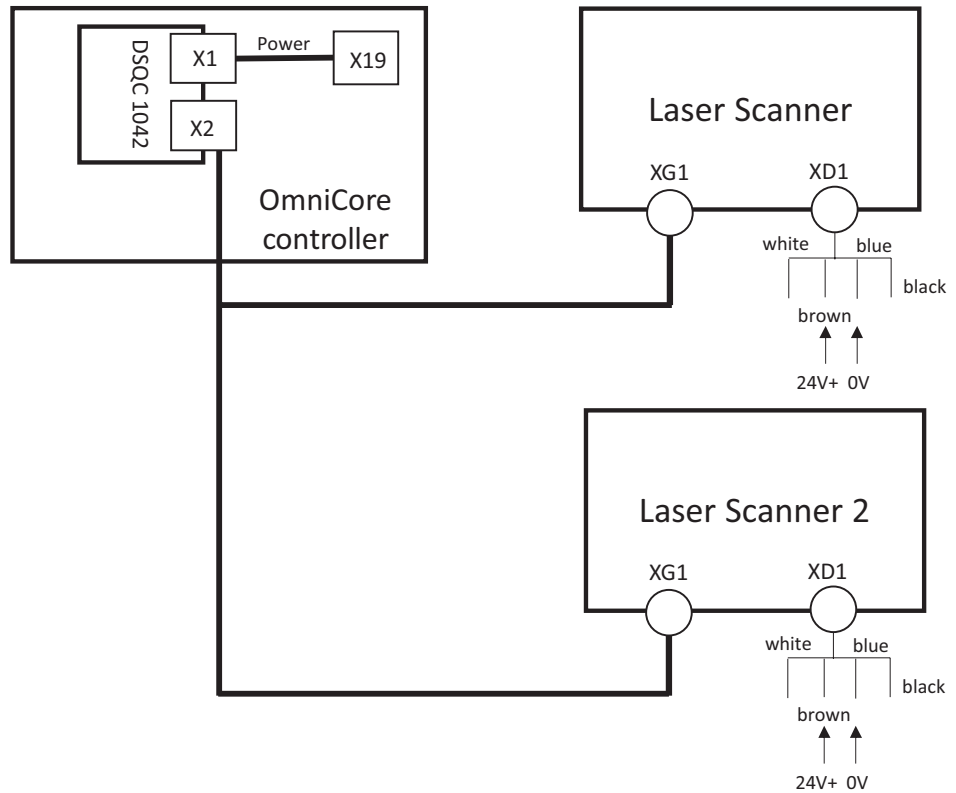
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1 Safety IO-based laser scanner (option 3051-2)



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2 Safety IO-based laser scanners (option 3051-4)



xx2200000300



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*.

Continues on next page

2 Technical data for CRB 1920

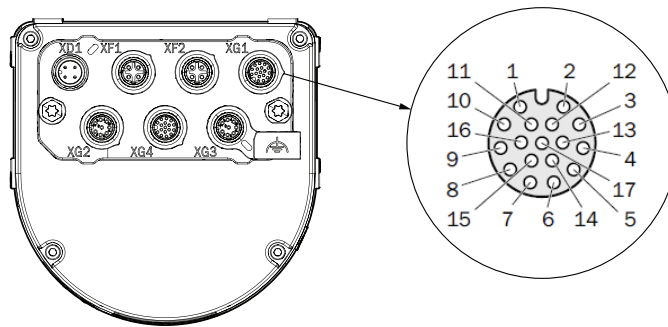
2.3.6 Installation of laser scanner

Continued

Connector information

Pin assignment on XG1 of Safety IO-based laser scanners

XG1 connector on Safety IO-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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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... Collaborative Speed Control add-in
	PLC	Scalable I/O device DSQC1042	OmniCore controller with SafeMove			
PROFINET-based	Y	N	Y	1	RobotWare 7.19.1 or later	Y
	Y	N	Y	2	RobotWare 7.19.1 or later	Y
	N	N	Y	1	RobotWare 7.19.1 or later	Y
	N	N	Y	2	RobotWare 7.19.1 or later	Y
Safety IO-based	N	Y	Y	1	RobotWare 7.19.1 or later	Y
	N	Y	Y	2	RobotWare 7.19.1 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*.

2.3.7 Setting the system parameters for an inverted or a tilted robot

General

The robot is configured for mounting parallel to the floor, without tilting, on delivery. If the robot is mounted in any other angle than 0° , then the system parameters that describe the mounting angle (how the robot is oriented relative to the gravity) must be re-defined.



Note

With inverted installation, make sure that the gantry or corresponding structure is rigid enough to prevent unacceptable vibrations and deflections, so that optimum performance can be achieved.



Note

The mounting positions are described in [Mounting positions on page 15](#), and the requirements on the foundation are described in [Requirements, foundation on page 17](#).

System parameters



Note

The mounting angle must be configured correctly in the system parameters so that the robot system can control the movements in the best possible way. An incorrect definition of the mounting angle will result in:

- Overloading the mechanical structure.
- Lower path performance and path accuracy.
- Some functions will not work properly, for example *Load Identification* and *Collision detection*.

Gravity Beta

When the robot is mounted other than floor-standing (rotated around the y-axis), the robot base frame and the system parameter *Gravity Beta* must be redefined. If the robot is mounted upside down (inverted), then *Gravity Beta* should be π (+3.141593).

If the robot is mounted on a wall, then *Gravity Beta* should be $\pm\pi/2$ (± 1.570796).

The *Gravity Beta* is a positive rotation direction around the y-axis in the base coordinate system. The value is set in radians.

Gravity Alpha

If the robot is mounted on a wall (rotated around the x-axis), then the robot base frame and the system parameter *Gravity Alpha* must be redefined. The value of *Gravity Alpha* should then be $\pm\pi/2$ (± 1.570796).

The *Gravity Alpha* is a positive rotation direction around the x-axis in the base coordinate system. The value is set in radians.

Continues on next page



Note

The system parameter *Gravity Alpha* is not supported for all robot types.
If the robot does not support *Gravity Alpha*, then use *Gravity Beta* along with the re-calibration of axis 1 to define the rotation of the robot around the x-axis.



Note

The parameter is supported for all robots on track when the system parameter *7 axes high performance motion* is set, see *Technical reference manual - System parameters*.

Gamma Rotation

Gamma Rotation defines the orientation of the robot foot on the travel carriage (track motion).

Mounting angles and values

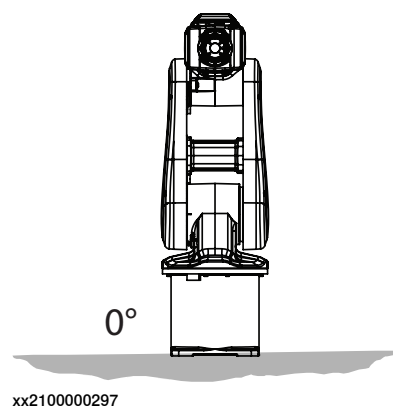
The parameter *Gravity Beta* (or *Gravity Alpha*) specifies the mounting angle of the robot in radians. It is calculated in the following way.

$\text{Gravity Beta} = A^\circ \times 3.141593/180 = B \text{ radians}$, where A is the mounting angle in degrees and B is the mounting angle in radians.

Example of position	Mounting angle (A °)	Gravity Beta
Floor mounted	0°	0.000000 (Default)
Wall mounted	90°	1.570796
Inverted mounting	180°	3.141593

Examples of mounting angles tilted around the X axis (*Gravity Alpha*)

The following illustration shows the IRB 120, but the same principle applies for all robots.

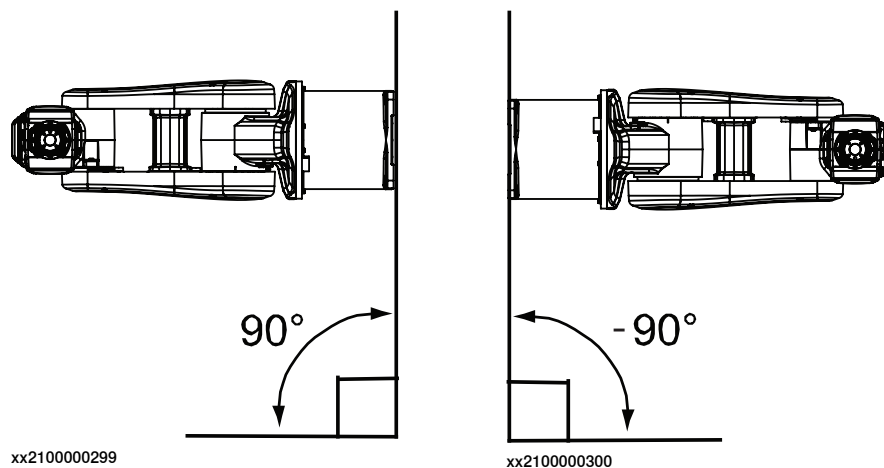


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2 Technical data for CRB 1920

2.3.7 Setting the system parameters for an inverted or a tilted robot

Continued



Mounting angle	Gravity Alpha
0° (Floor mounted)	0
90° (Wall)	1.570796
-90° (Wall)	-1.570796



Note

For suspended robots (180°), it is recommended to use *Gravity Beta* instead of *Gravity Alpha*.

Limitations in working area

If mounting the robot on a wall, the working range of axis 1 is limited. These limitations are specified in the table [Working range on page 76](#).

Defining the system parameters in RobotWare

The value of the system parameters that define the mounting angle must be redefined when changing the mounting angle of the robot. The parameters belong to the type *Robot*, in the topic *Motion*.

The system parameters are described in *Technical reference manual - System parameters*.

The system parameters are configured in RobotStudio or on the FlexPendant.

2.4 Calibration and references

2.4.1 Calibration methods and when to calibrate

Types of calibration

Type of calibration	Description	Calibration method
Standard calibration	The calibrated robot is positioned at calibration position. Standard calibration data is found on the SMB (serial measurement board) or EIB in the robot.	Manual calibration
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
PFL joint parameter calibration	The CRB 1920 joint parameters for power and force limiting (PFL) are calibrated with the PFL service action in service routine <i>PflJointCalibration</i> , for best performance when using PFL safety functions. No external calibration tools are required.	PFL joint parameter calibration
Lead-through calibration	The CRB 1920 joint parameters for lead-through function are calibrated with the Lead Through service action in service routine <i>Pfl-JointCalibration</i> , for best performance when using lead-through. No external calibration tools are required.	Lead-through calibration

Continues on next page

2 Technical data for CRB 1920

2.4.1 Calibration methods and when to calibrate

Continued

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 do the wrist optimization using the RAPID instruction <code>WristOpt</code>, see <i>Technical reference manual - RAPID Instructions, Functions and Data types</i>. This instruction is only available for OmniCore robots.	Wrist Optimization

Brief description of calibration methods

PFL joint parameter calibration

The CRB 1920 joint parameters for power and force limiting (PFL) are calibrated with the service action PFL in service routine *PflJointCalibration*.

The actual instructions of how to perform the calibration procedure and what to do at each step is given on the FlexPendant. You will be guided through the calibration procedure, step by step.

Lead-through calibration

The CRB 1920 joint parameters for lead-through function are calibrated with the Lead Through service action in service routine *PflJointCalibration*.

The actual instructions of how to perform the calibration procedure and what to do at each step is given on the FlexPendant. You will be guided through the calibration procedure, step by step.

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.

Manual calibration method

The manual calibration of CRB 1920 is using the methods for updating revolution counters and synchronizing safety controller. See the *Calibration* chapter in manipulator product manual.

CalibWare - Absolute 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*.

If a service operation is done to a robot with the option Absolute Accuracy, a new absolute accuracy calibration is required in order to establish full performance.

Continues on next page

For most cases after replacements that do not include taking apart the robot structure, standard calibration is sufficient.

The Absolute 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.

2.4.2 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, for example, vision systems 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.

Continues on next page

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
- Additional axes
- Track motion



Note

In a robot system with, for example, an additional axis or track motion, the Absolute Accuracy is active for the manipulator but not for the additional axis or track motion.

RAPID instructions

There are no RAPID instructions included in this option.

2.4.3 Calibrating the PFL joint parameters

PFL joint parameter calibration routine

The CRB 1920 joint parameters for power and force limiting (PFL) are calibrated with the PFL service action in service routine *PflJointCalibration*, for best performance when using PFL safety functions. No external calibration tools are required.

Features in the service routine

The service routine for PFL joint parameter calibration includes the following features.

Feature	Description
Calibrate all axes	This feature calibrates the PFL joint parameters of all robot joints using pre-defined test movements.
Calibrate one axis	This feature calibrates the PFL joint parameters of a selected robot joint. This is used when it is not possible to calibrate all joints at the same time, for example, due to workspace constraints.

For both features,

- For joint 1, the current position is used as the starting point of every test movement, while joints 2 to 6 have pre-defined starting positions.
- For joints 2 and 3, movements covering a significant part of the working space are required to calibrate the joint parameters for both high and low gravity.

Preparations before calibration

The PFL joint parameter calibration routine must be run in manual operating mode.



Note

For best performance when using PFL safety functions, it is recommended to calibrate the joint torque model after running the application cycle for at least 30 minutes to achieve thermal equilibrium.

If the ambient temperature varies in the application, it is recommended to calibrate the joint torque model at the highest ambient temperature.

2.4.4 Calibrating the joint parameters for lead-through

Lead-through calibration

The CRB 1920 joint parameters for lead-through function are calibrated with the Lead Through service action in service routine *PflJointCalibration*, for best performance when using lead-through. No external calibration tools are required.

Features in the service routine

The service routine for lead-through calibration includes the following features.

Feature	Description
Fully automatic	This feature calibrates the joint parameters of all robot joints using pre-defined test movements at once.
Joint-by-joint	This feature calibrates the joint parameters of a selected robot joint. This is used when it is not possible to calibrate all joints at the same time, for example, due to workspace constraints.

Preparations before calibration

During calibration process of joints 2 and 3, the robot can move to its maximum working range. Before calibrating, always identify potential collision risks within the working space.

2.4.5 Calibrating with Wrist Optimization method

When to run Wrist Optimization

Wrist Optimization routine is run to improve TCP reorientation performance.

Calibrating the robot with standard calibration method overwrites the optimized positions of axes 4, 5. Re-run the Wrist Optimization routine after standard calibration to re-achieve the optimized positions of the wrist axes.

Overview of the calibration procedure on the FlexPendant

The actual instructions of how to perform the calibration procedure and what to do at each step is given on the FlexPendant. You will be guided through the calibration procedure, step by step.

Use the following list to learn about the calibration procedure before running the RobotWare program on the FlexPendant. It gives you a brief overview of the calibration procedure sequence.

After the calibration method has been called for on the FlexPendant, the following sequence will be run.

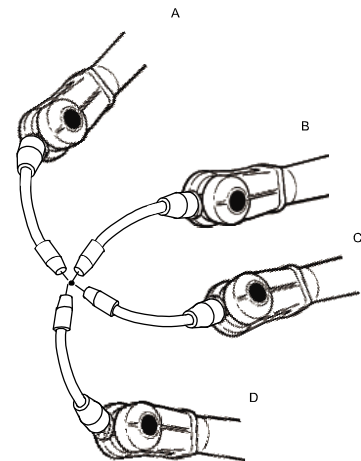
- 1 Choose calibration routine Wrist Optimization.
- 2 Modify targets for 4-point tool frame definition, in Wrist Optimization routine.



Tip

Select positions with large reorientations around the TCP. For best results, make sure that axis 4 and 5 have large movements.

- a Jog the robot to an appropriate position, A, for the first approach point.
Use small increments to accurately position the tool tip as close to the reference point as possible.
- b Tap **Modify Position** to define the point.
- c Repeat for each approach point to be defined, positions B, C, and D.
Jog away from the fixed world point to achieve the best result. Just changing the tool orientation will not give as good a result.



en0400000906

- 3 Improved calibration data to the wrist axes is identified and presented.
- 4 Optimized positions for the wrist axes are presented.
- 5 The robot moves to the optimized positions for the wrist axes and automatically overwrites previous calibration data.

Continues on next page



WARNING

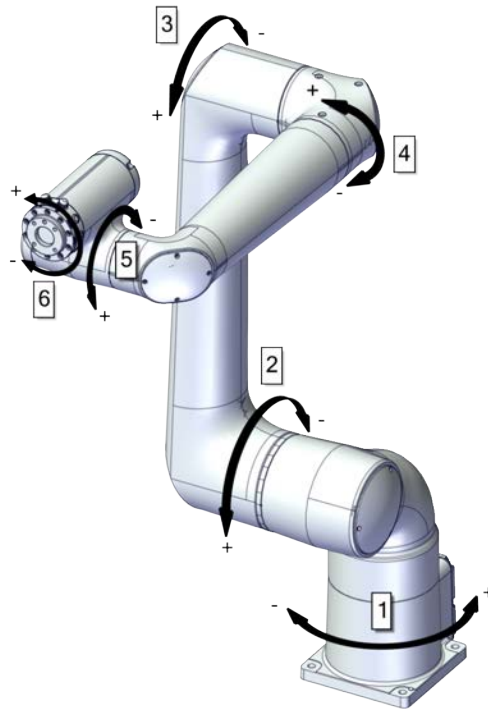
Robot moves automatically when pressing **Calibrate**.

- 6 Wrist optimization is finished.
- 7 Redefine / verify TCP for all tools.

2.4.6 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.



xx2500000228

2.5 Load diagrams

2.5.1 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

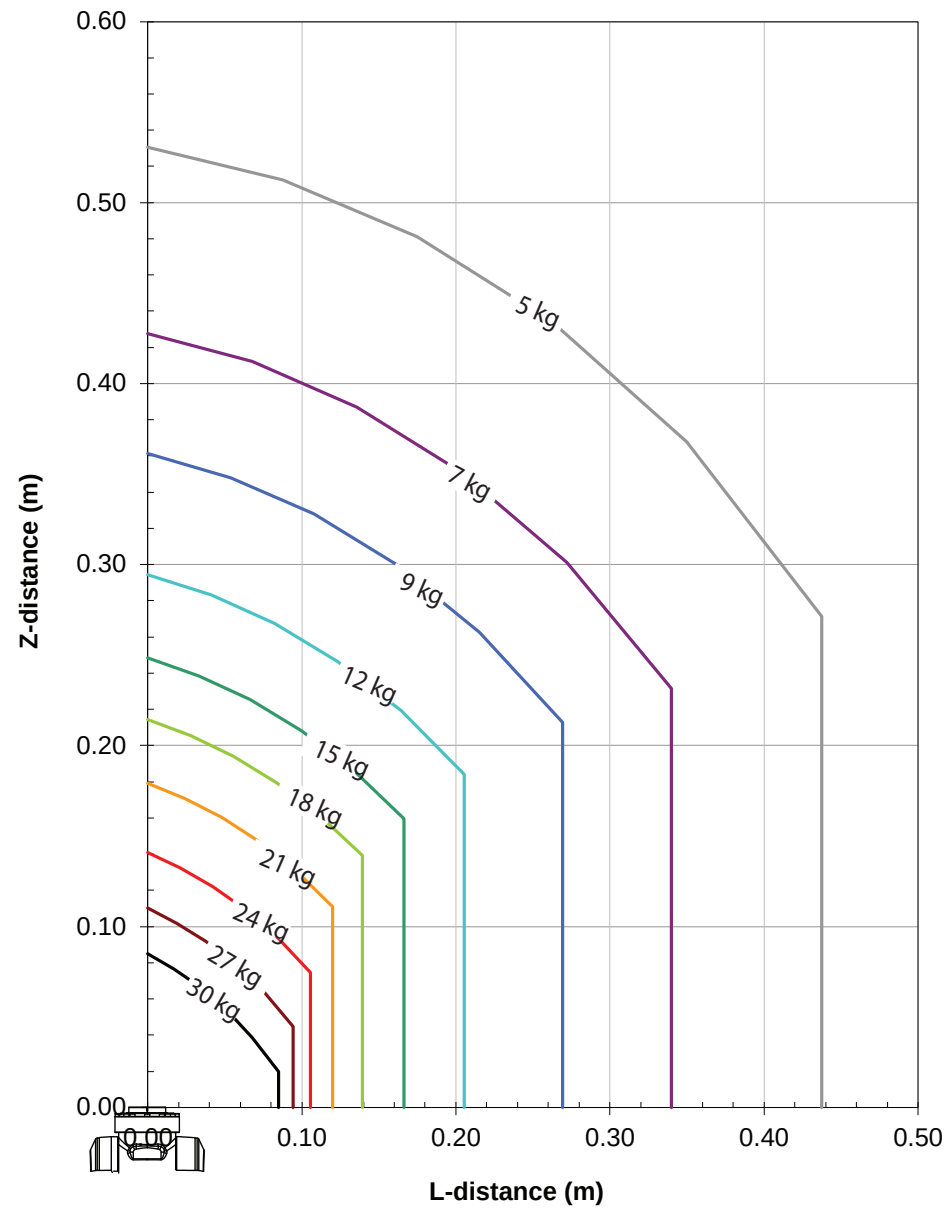
The CRB 1920 load diagrams include a nominal payload inertia, J_o of 0.243 kgm^2 , 0.124 kgm^2 and 0.085 kgm^2 for CRB 1920-30/1.35, CRB 1920-20/1.67 and CRB 1920-16/1.96 respectively.

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.

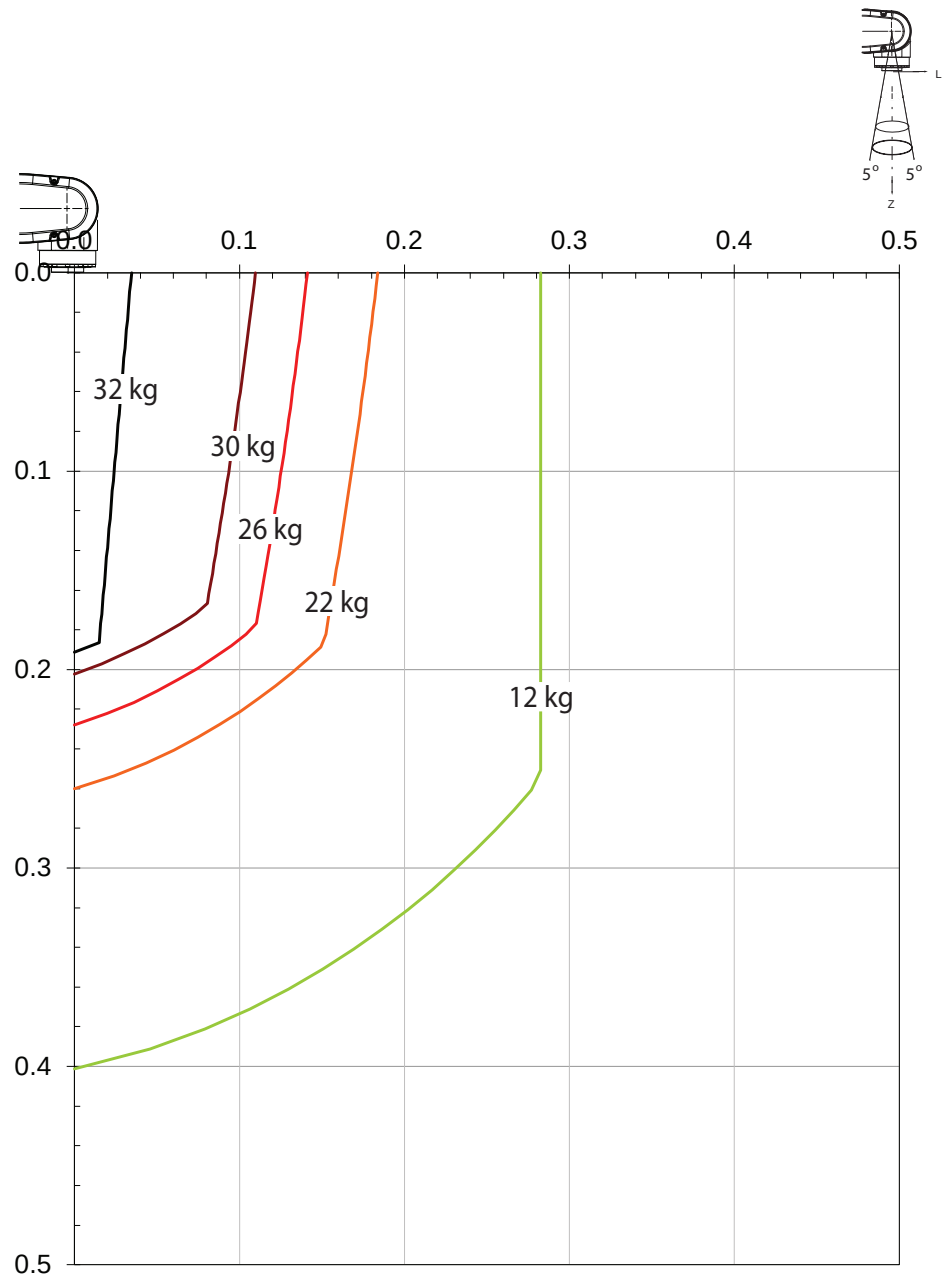
2.5.2 Diagrams

CRB 1920-30/1.35



Continues on next page

CRB 1920-30/1.35 "Vertical wrist" ($\pm 5^\circ$)



xx2600000556

For wrist down (5° deviation from the vertical line).

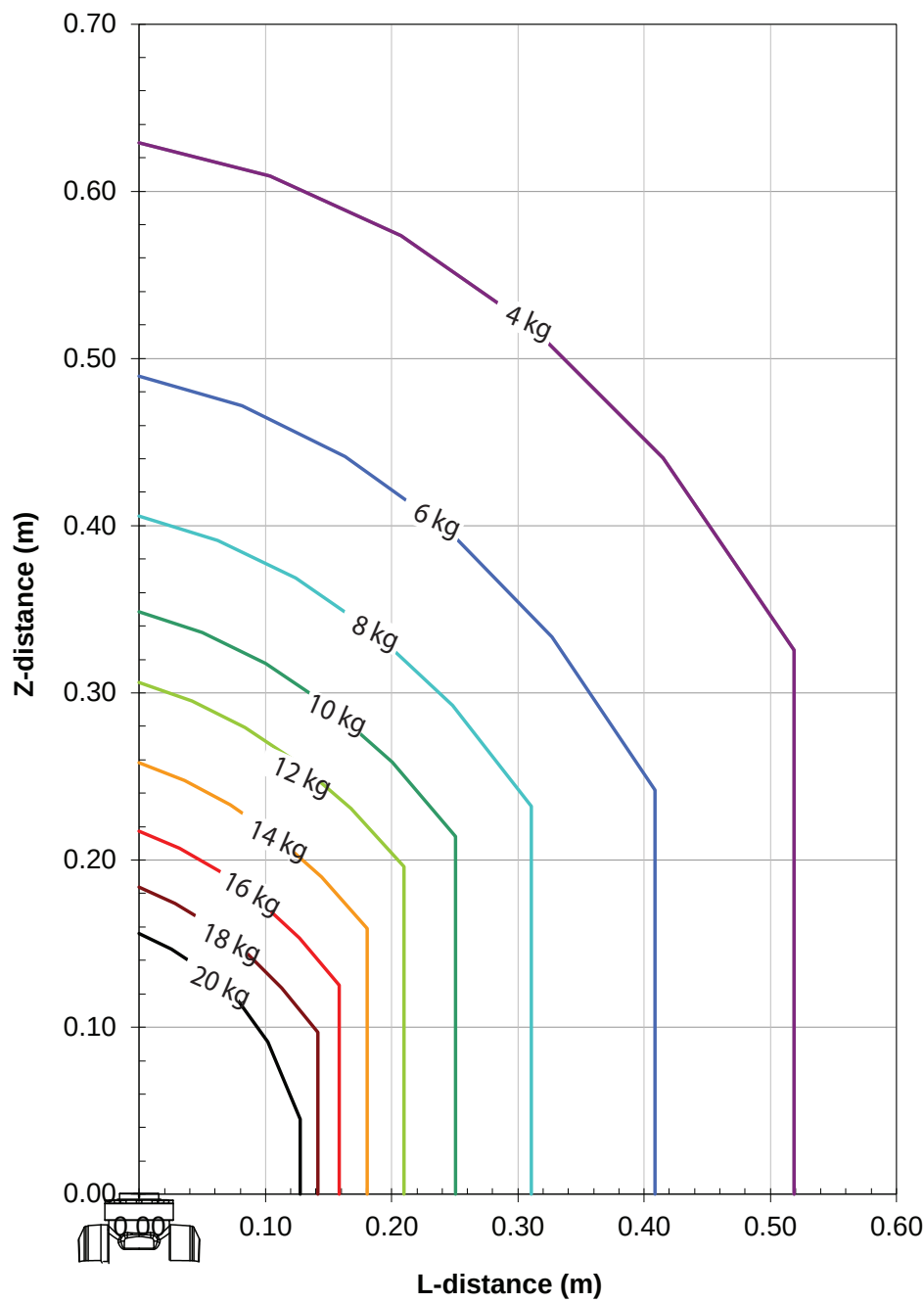
	Description
Max load	32 kg
Z _{max}	0.191 m
L _{max}	0.035 m

Continues on next page

2 Technical data for CRB 1920

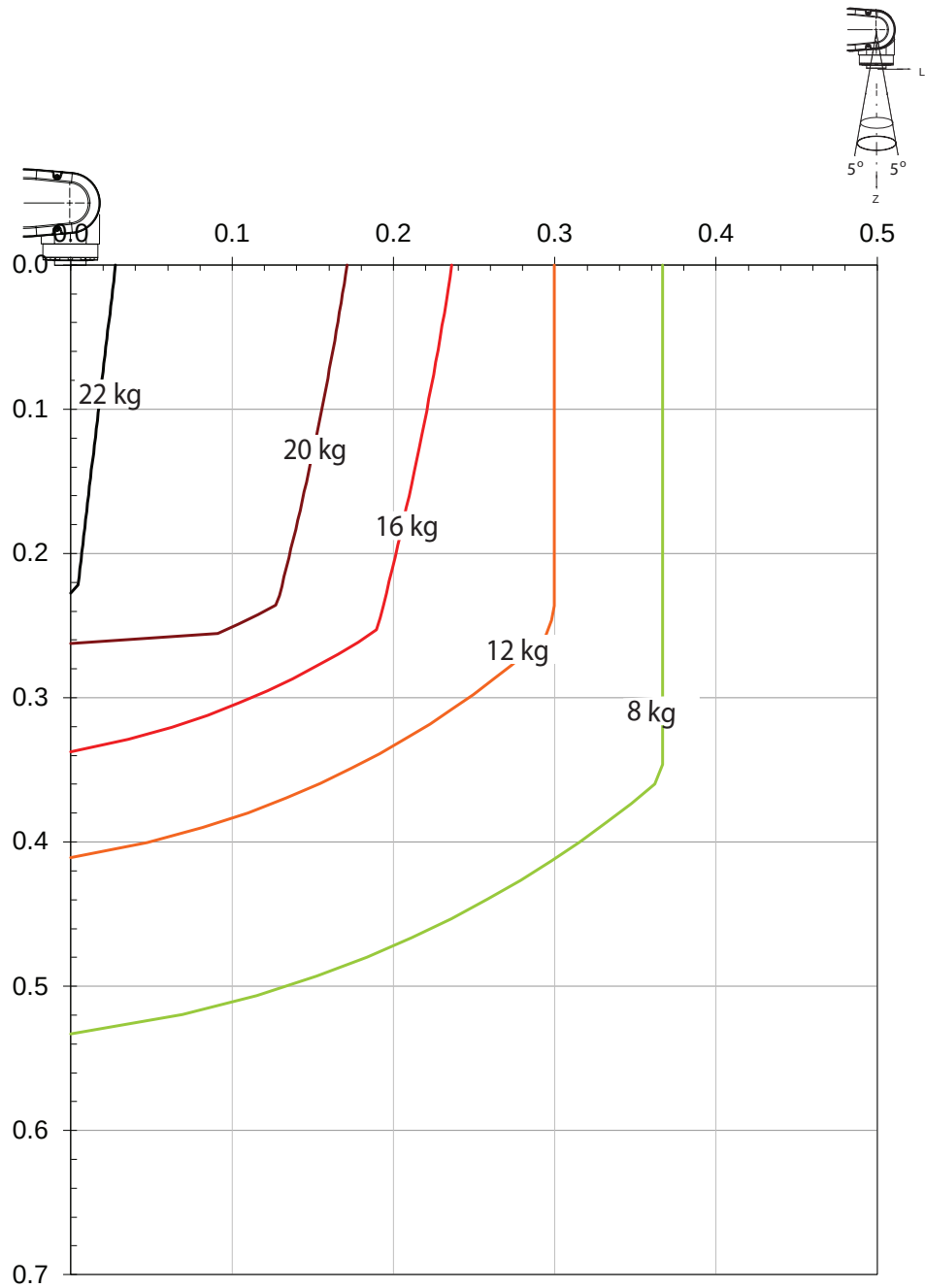
2.5.2 Diagrams
Continued

CRB 1920-20/1.67



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CRB 1920-20/1.67 "Vertical wrist" ($\pm 5^\circ$)



For wrist down (5° deviation from the vertical line).

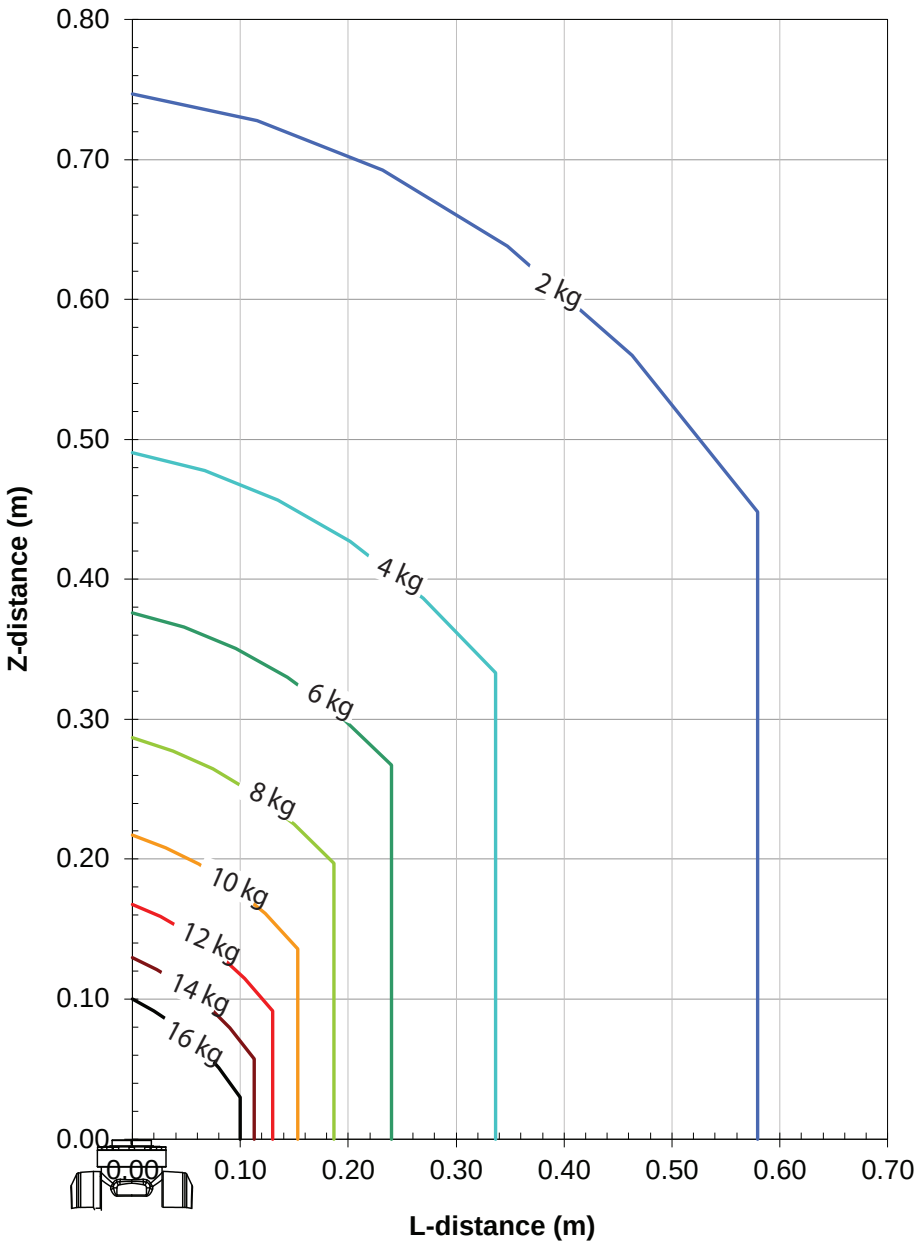
	Description
Max load	22 kg
$Z_{\max}$	0.0227 m
$L_{\max}$	0.028 m

Continues on next page

2 Technical data for CRB 1920

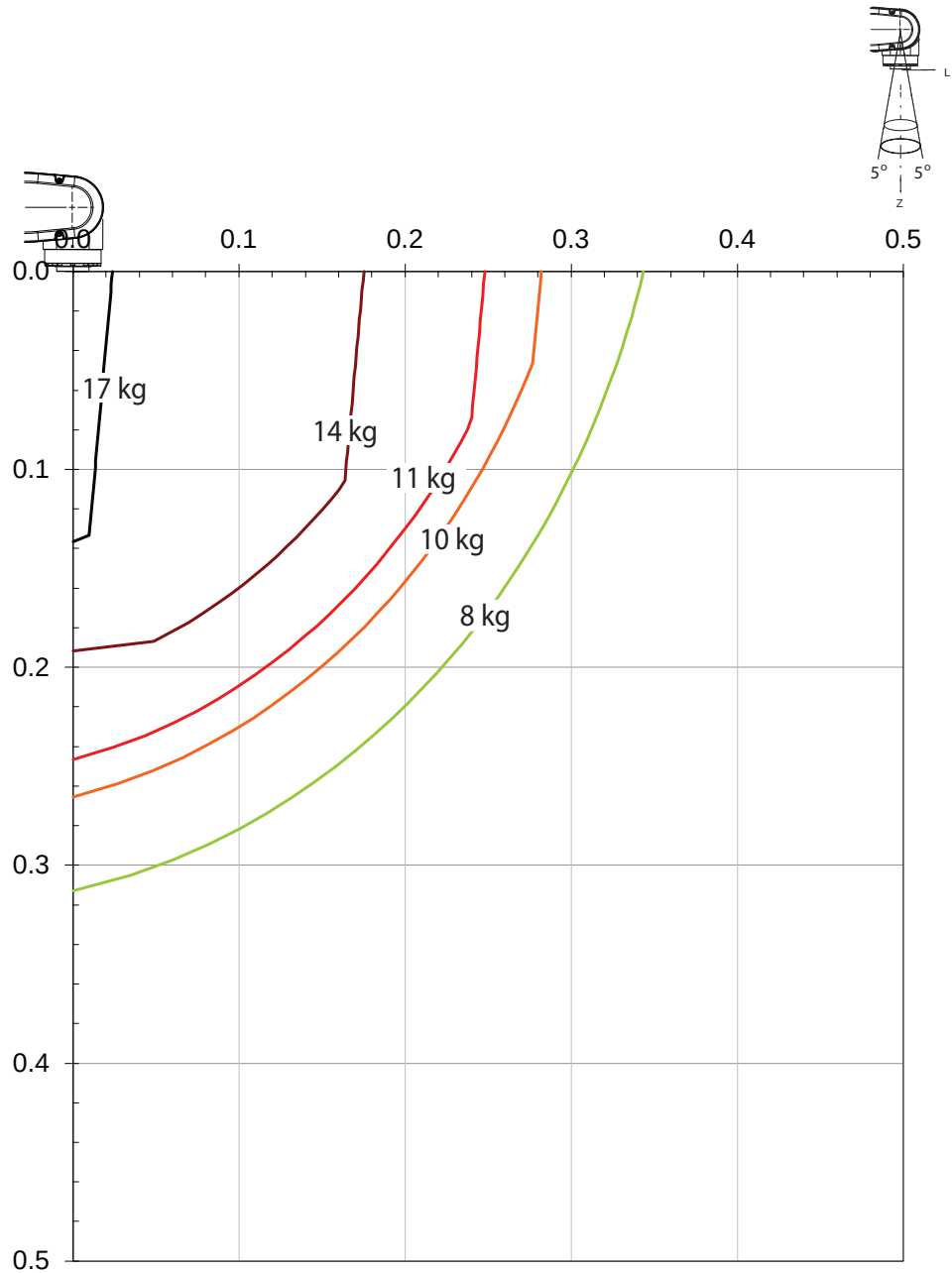
2.5.2 Diagrams
Continued

CRB 1920-16/1.96



Continues on next page

CRB 1920-16/1.96 "Vertical wrist" ($\pm 5^\circ$)



xx2600000554

For wrist down (5° deviation from the vertical line).

	Description
Max load	17 kg
Z _{max}	0.137 m
L _{max}	0.024 m

2 Technical data for CRB 1920

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

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

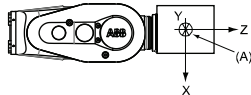


Note

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 . $L = \sqrt{X^2 + Y^2}$, see the following figure.

Full movement of axis 5 (-180°/+180°)

Axis	Robot type	Maximum moment of inertia
5	CRB 1920-30/1.35	$Ja_5 = \text{Load} \times (Z+0.12)^2 + \max(J_{ox}, J_{oy}) \leq 2.4 \text{ kgm}^2$
	CRB 1920-20/1.67	$Ja_5 = \text{Load} \times (Z+0.12)^2 + \max(J_{ox}, J_{oy}) \leq 2.4 \text{ kgm}^2$
	CRB 1920-16/1.96	$Ja_5 = \text{Load} \times (Z+0.12)^2 + \max(J_{ox}, J_{oy}) \leq 1.6 \text{ kgm}^2$
6	CRB 1920-30/1.35	$Ja_6 = \text{Load} \times L^2 + J_{oz} \leq 1.2 \text{ kgm}^2$
	CRB 1920-20/1.67	$Ja_6 = \text{Load} \times L^2 + J_{oz} \leq 1.2 \text{ kgm}^2$
	CRB 1920-16/1.96	$Ja_6 = \text{Load} \times L^2 + J_{oz} \leq 1 \text{ kgm}^2$



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.

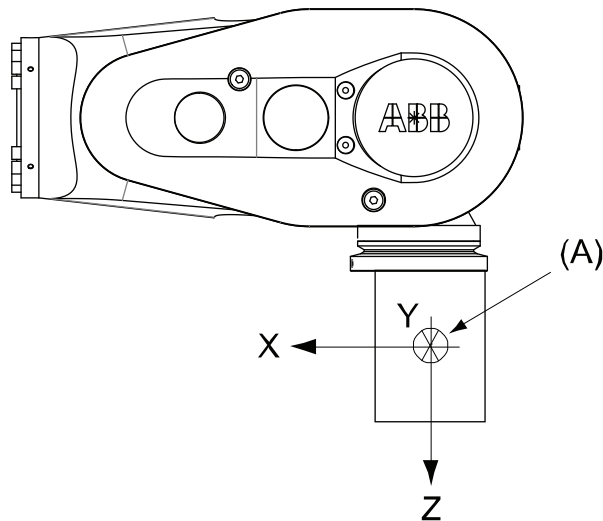
Continues on next page

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

Continued

Limited axis 5, center line down

Axis	Robot type	Maximum moment of inertia
5	CRB 1920-30/1.35	$Ja_5 = \text{Load} \times (Z + 0.12)^2 + \max(J_{0x}, J_{0y}) \leq 3.6 \text{ kgm}^2$
	CRB 1920-20/1.67	$Ja_5 = \text{Load} \times (Z + 0.12)^2 + \max(J_{0x}, J_{0y}) \leq 3.6 \text{ kgm}^2$
	CRB 1920-16/1.96	$Ja_5 = \text{Load} \times (Z + 0.12)^2 + \max(J_{0x}, J_{0y}) \leq 1.6 \text{ kgm}^2$
6	CRB 1920-30/1.35	$Ja_6 = \text{Load} \times L^2 + J_{0z} \leq 1.2 \text{ kgm}^2$
	CRB 1920-20/1.67	$Ja_6 = \text{Load} \times L^2 + J_{0z} \leq 1.2 \text{ kgm}^2$
	CRB 1920-16/1.96	$Ja_6 = \text{Load} \times L^2 + J_{0z} \leq 1 \text{ kgm}^2$



xx1400002029

Pos	Description
A	Center of gravity
Description	
J_{0x}, J_{0y}, J_{0z}	Max. moment of inertia around the X, Y and Z axes at center of gravity.

2 Technical data for CRB 1920

2.5.4 Wrist torque

2.5.4 Wrist torque



Note

The values are for reference only, and should not be used for calculating permitted load offset (position of center of gravity) within the load diagram, since those also are limited by main axes torques as well as dynamic loads. Also arm loads will influence the permitted load diagram.

Torque

The table below shows the maximum permissible torque due to payload.

Robot type	Max wrist torque axis 4 and 5	Max wrist torque axis 6	Max torque valid at load
CRB 1920-30/1.35	65.89 Nm	25 Nm	30 kg
CRB 1920-20/1.67	57 Nm	25 Nm	20 kg
CRB 1920-16/1.96	36.74 Nm	15.7 Nm	16 kg

2.5.5 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 1920-30/1.35	69	22
CRB 1920-20/1.67	82	32
CRB 1920-16/1.96	90	30



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).

2 Technical data for CRB 1920

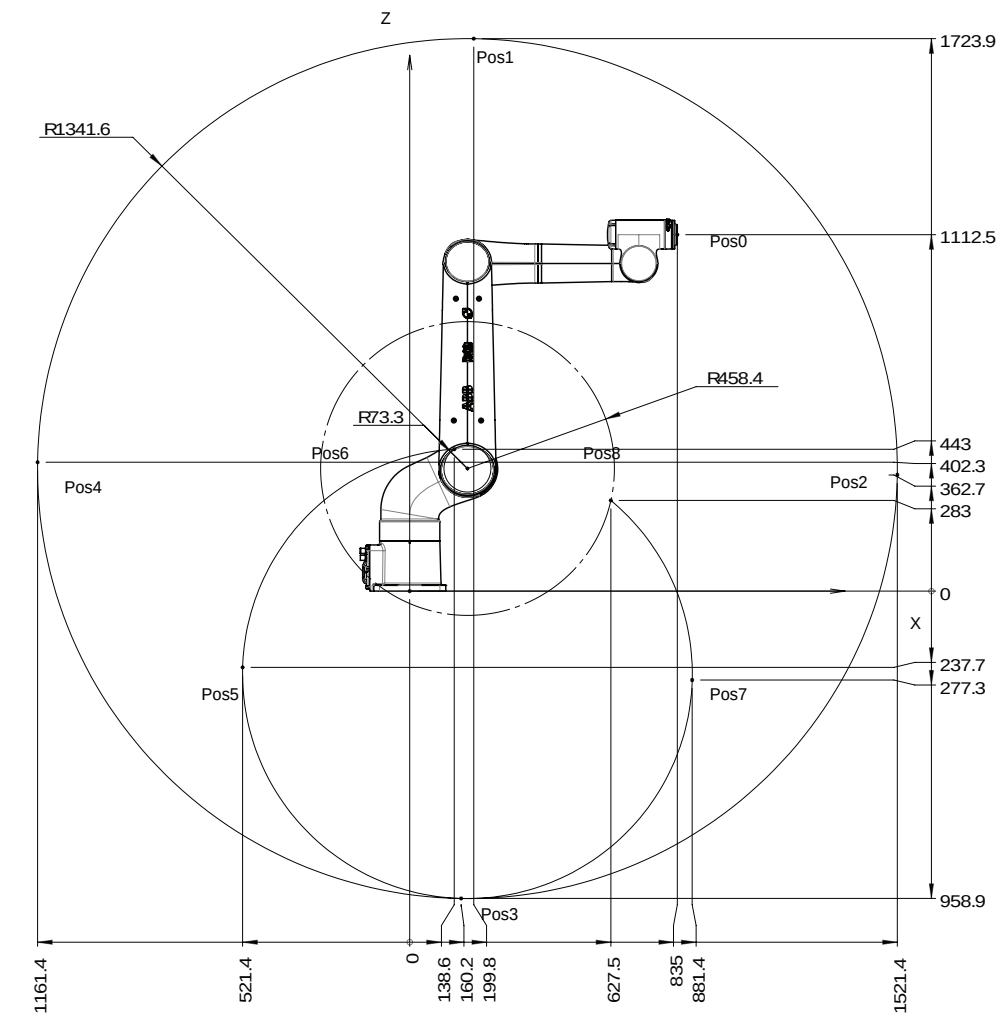
2.6.1 Working range

2.6 Working range

2.6.1 Working range

Illustration, working range CRB 1920-30/1.35

This illustration shows the unrestricted working range of the robot.



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Positions at TCP and angle of axes 2, 3, 4 and 5

Position in the figure	Positions at TCP (mm)			Angle (degrees)			
	X	Y	Z	axis 2	axis 3	axis 4	axis 5
pos0	835	-100.9	1112.5	0°	0°	0°	0°
pos1	199.8	-23	1723.9	0°	-101°	111°	33.7°
pos2	1521.4	-23	362.7	90°	-101°	111°	33.7°
pos3	160.2	-23	-958.9	180°	-101°	111°	33.7°
pos4	-1161.4	-23	402.3	-90°	-101°	111°	33.7°

Continues on next page

Position in the figure	Positions at TCP (mm)			Angle (degrees)			
	X	Y	Z	axis 2	axis 3	axis 4	axis 5
pos5	-521.4	-23	-237.7	180°	-11°	111°	33.7°
pos6	138.6	-23	443	180°	74°	111°	33.7°
pos7	881.4	-23	-277.3	180°	-191°	111°	33.7°
pos8	627.5	-23	283	180°	-243°	111°	33.7°

Continues on next page

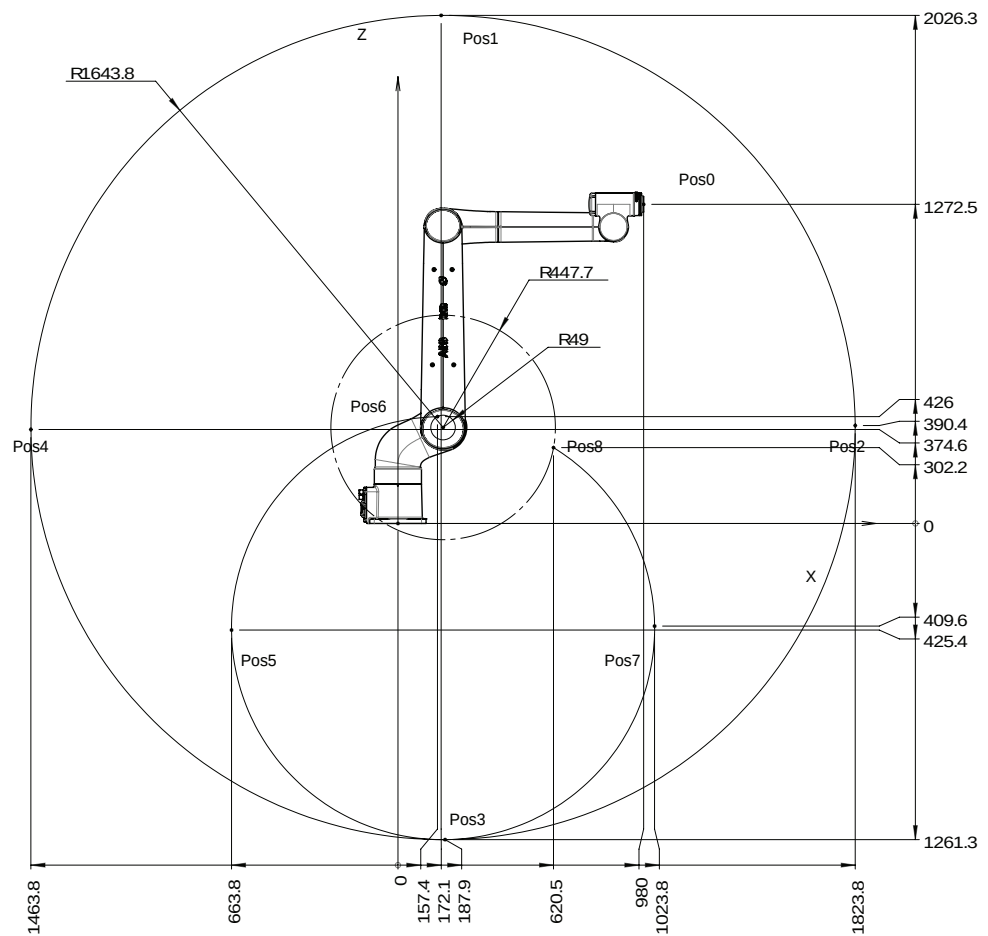
2 Technical data for CRB 1920

2.6.1 Working range

Continued

Illustration, working range CRB 1920-20/1.67

This illustration shows the unrestricted working range of the robot.



xx2600000562

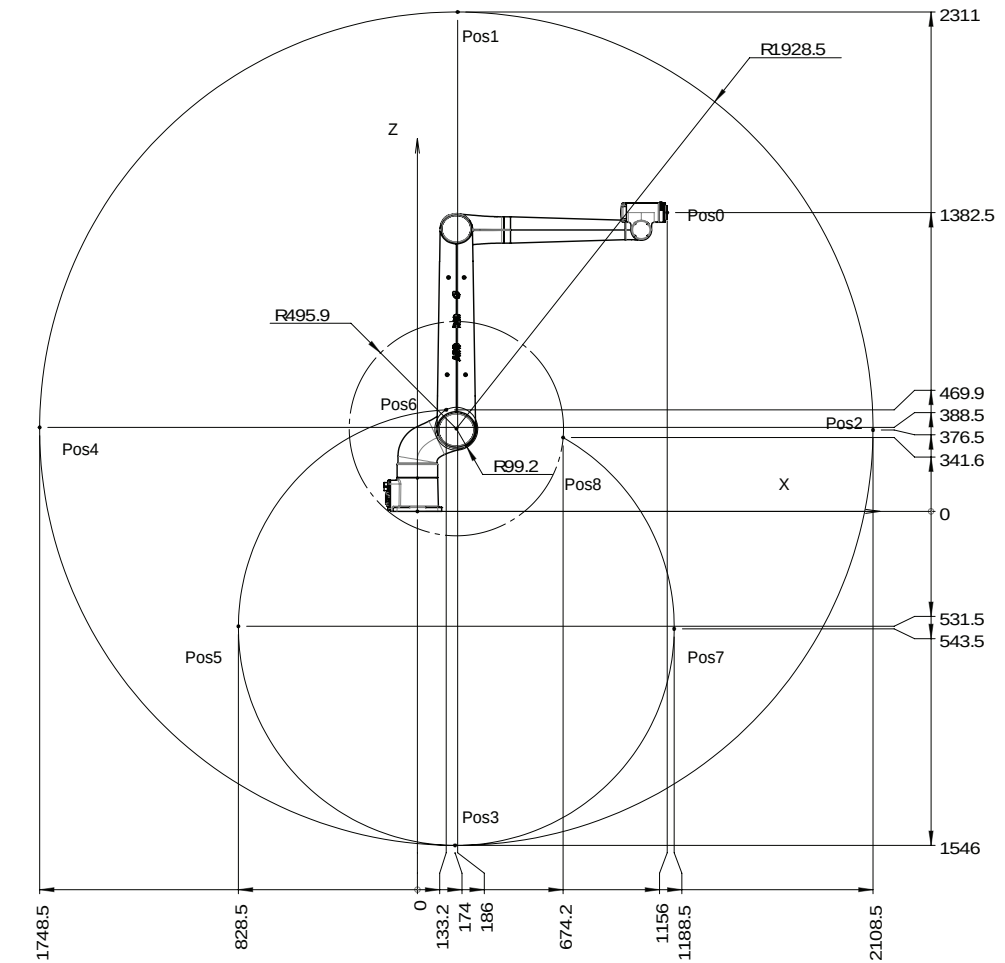
Positions at TCP and angle of axes 2, 3, 4 and 5

Position in the figure	Positions at TCP (mm)			Angle (degrees)			
	X	Y	Z	axis 2	axis 3	axis 4	axis 5
pos0	980	-100.9	1272.5	0°	0°	0°	0°
pos1	172.1	110.1	2026.3	0°	-101°	111°	33.7°
pos2	1823.8	110.1	390.4	90°	-101°	111°	33.7°
pos3	187.9	110.1	-1261.3	180°	-101°	111°	33.7°
pos4	-1463.8	-110.1	374.6	-90°	-101°	111°	33.7°
pos5	-663.8	-110.1	-425.4	180°	-11°	111°	33.7°
pos6	157.4	110.1	426	180°	78°	111°	33.7°
pos7	1023.8	110.1	-409.6	180°	-191°	111°	33.7°
pos8	620.5	110.1	303.2	180°	-249°	111°	33.7°

Continues on next page

Illustration, working range CRB 1920-16/1.96

This illustration shows the unrestricted working range of the robot.



xx2600000561

Positions at TCP and angle of axes 2, 3, 4 and 5

Position in the figure	Positions at TCP (mm)			Angle (degrees)			
	X	Y	Z	axis 2	axis 3	axis 4	axis 5
pos0	1156	-77.9	1382.5	0°	0°	0°	0°
pos1	186	109.6	2311	0°	-97°	111°	33.7°
pos2	2108.5	109.6	376.5	90°	-97°	111°	33.7°
pos3	174	109.6	-1546	180°	-97°	111°	33.7°
pos4	-1748.5	109.6	388.5	-90°	-97°	111°	33.7°
pos5	-828.5	109.6	-531.5	180°	-7°	111°	33.7°
pos6	133.2	109.6	469.9	180°	80°	111°	33.7°
pos7	1188.5	109.6	-543.5	180°	-187°	111°	33.7°
pos8	674.2	109.6	341.6	180°	-248°	111°	33.7°

Continues on next page

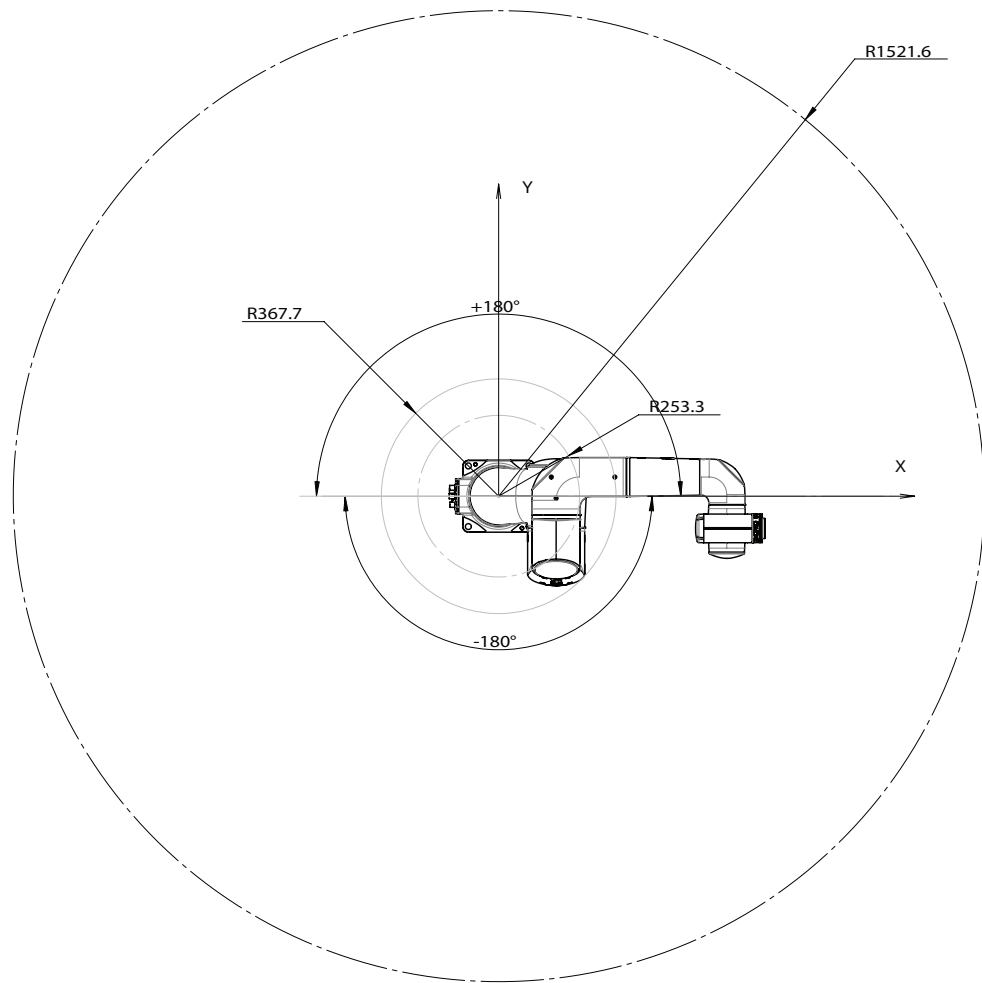
2 Technical data for CRB 1920

2.6.1 Working range

Continued

Top view of working range

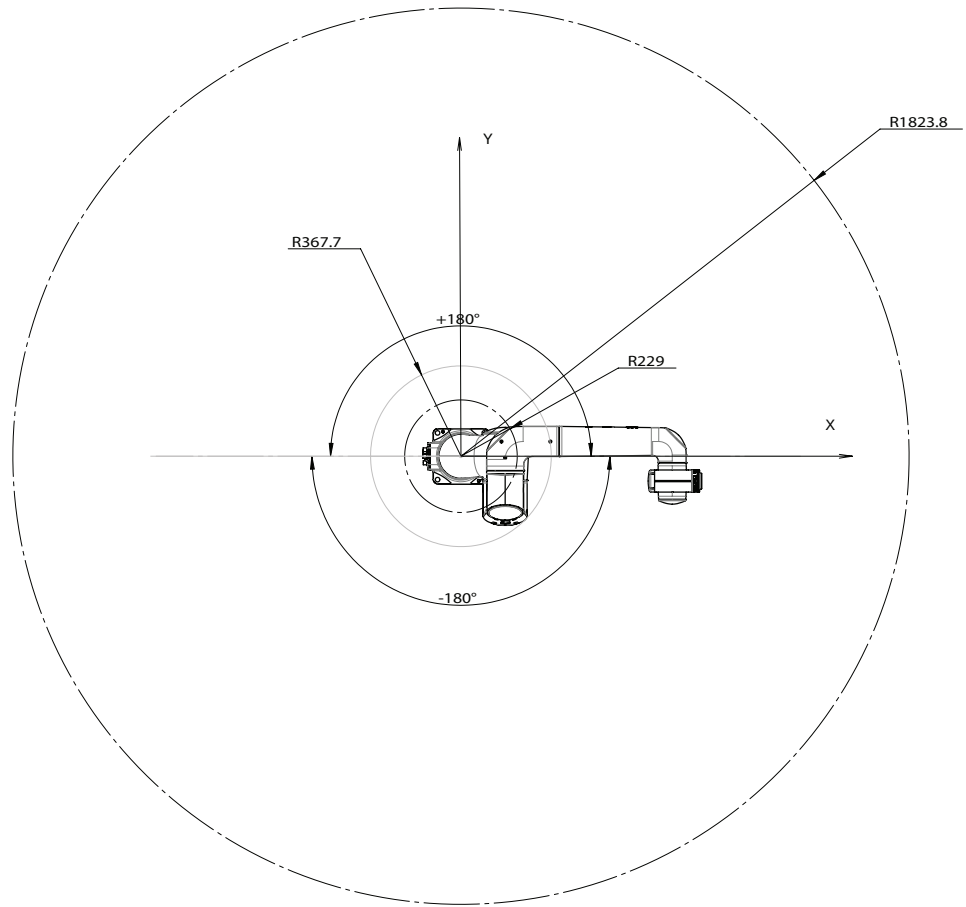
CRB 1920-30/1.35



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CRB 1920-20/1.67



xx2600000565

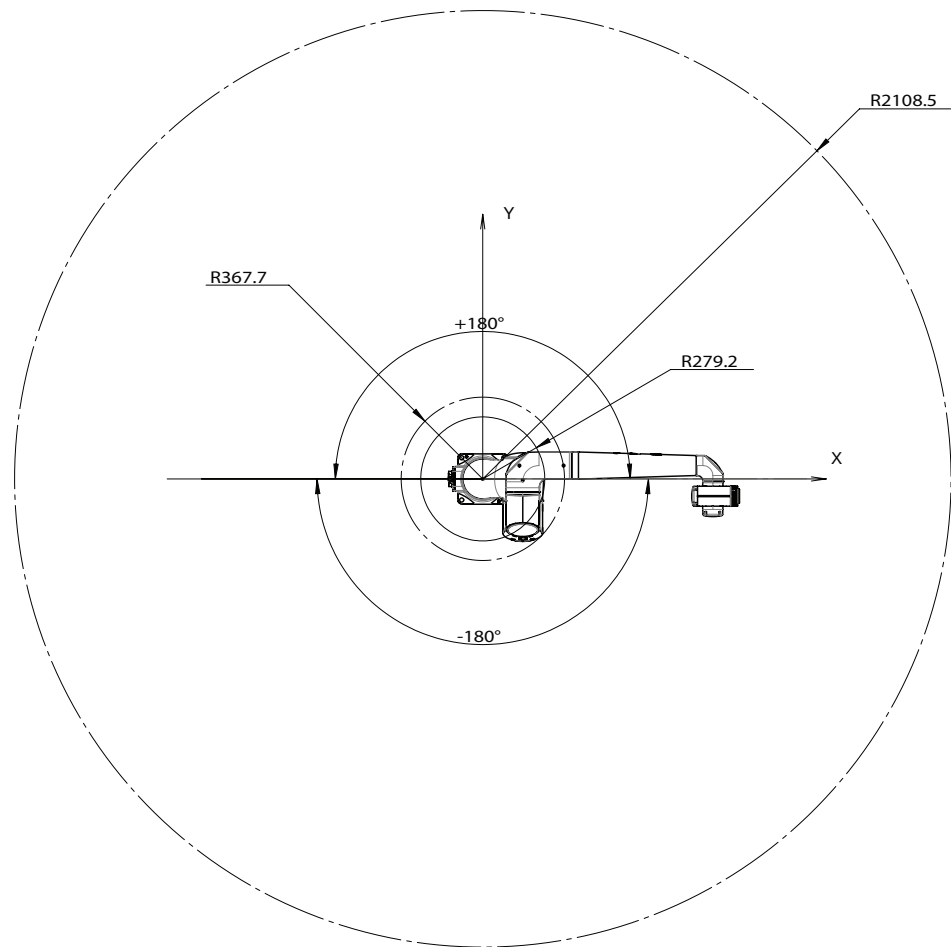
Continues on next page

2 Technical data for CRB 1920

2.6.1 Working range

Continued

CRB 1920-16/1.96



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Working range

Axis	Working range	Note
Axis 1	$\pm 360^\circ$	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	$\pm 180^\circ$	
Axis 3	CRB 1920-30/1.35: -243° to +74° CRB 1920-20/1.67: -249° to +78° CRB 1920-16/1.96: -248° to +80°	
Axis 4	$\pm 360^\circ$	

Continues on next page

Axis	Working range	Note
Axis 5	$\pm 180^\circ$	Default value.
	$\pm 270^\circ$	Maximum revolution value. The default working range for axis 5 can be extended by changing parameter values in the software.
Axis 6	$\pm 400^\circ$	



Note

Some regions inside the working range of the robot (close to singularities) can only be reached using a restricted orientation range due to mechanical limitations of the wrist.

In those regions, the strong dependency between position and orientation might prevent to keep the joint six rotation axis close to the plane containing axis one rotation axis. When this happens, the user programmed orientation might not be reachable and the controller will raise the event message 50550. It is always possible to compensate the missing orientation using a properly designed tool.

2.6.2 Adjusting the working range

Reasons for adjusting the manipulator working range

The working range of each manipulator axis is configured in the software. If there is a risk that the manipulator may collide with other objects at installation site, its working space should be limited. The manipulator must always be able to move freely within its entire working space.

Space limiting can also be used, see *Product manual - CRB 1920*.

Working range configurations

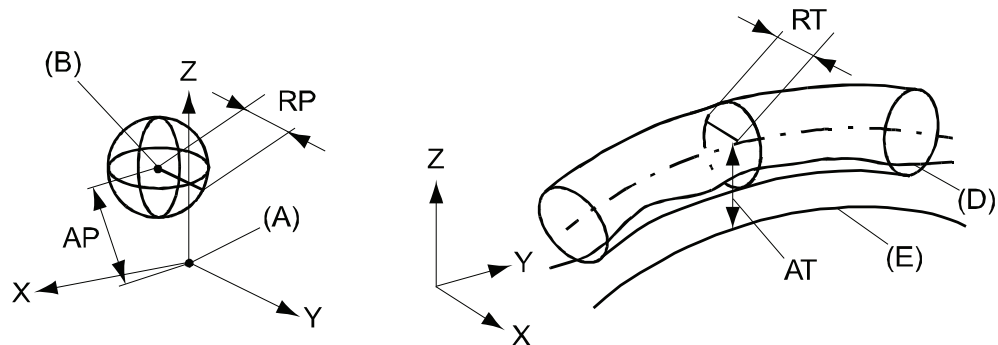
The parameter values for the axes working range can be altered within the allowed working range and according to available options for the robot, either to limit or to extend a default working range. Allowed working ranges and available options for each manipulator axis are specified in [Working range on page 76](#).

2.7 Performance according to ISO 9283

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 1920	CRB 1920-30/1.35	CRB 1920-20/1.67	CRB 1920-16/1.96
Pose accuracy, AP^i (mm)	0.02	0.02	0.02
Pose repeatability, RP (mm)	0.03	0.03	0.03
Pose stabilization time, PSt (s) within 0.1 mm of the position	0.51	1.30	0.85
Path accuracy, AT (mm)	2.02	1.90	2.74
Path repeatability, RT (mm)	0.10	0.10	0.10

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

2 Technical data for CRB 1920

2.8 Velocity

2.8 Velocity

Maximum axis speed

Robot type	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
CRB 1920-30/1.35	149 °/s	149 °/s	230 °/s	300 °/s	300 °/s	300 °/s
CRB 1920-20/1.67	149 °/s	149 °/s	230 °/s	300 °/s	300 °/s	300 °/s
CRB 1920-16/1.96	149 °/s	149 °/s	230 °/s	283 °/s	300 °/s	300 °/s

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

2.9 Robot stopping distances and times

2.9.1 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 83](#).

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 category 1 is according to IEC 60204-1.



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 59](#).

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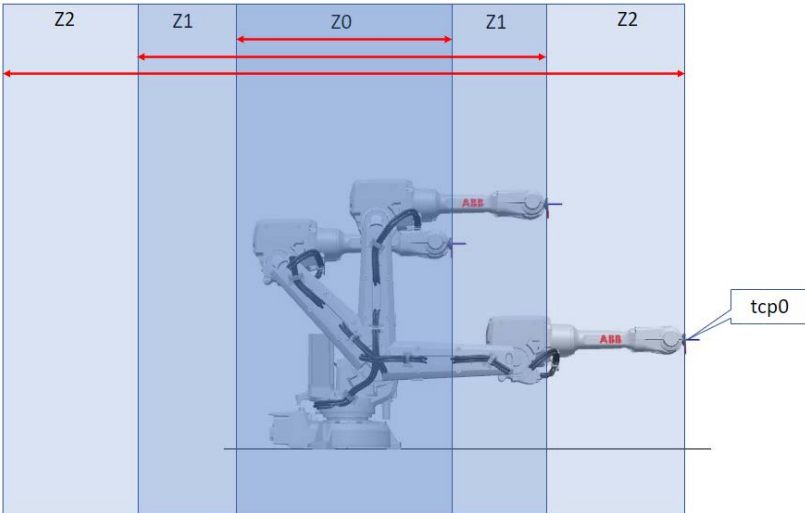
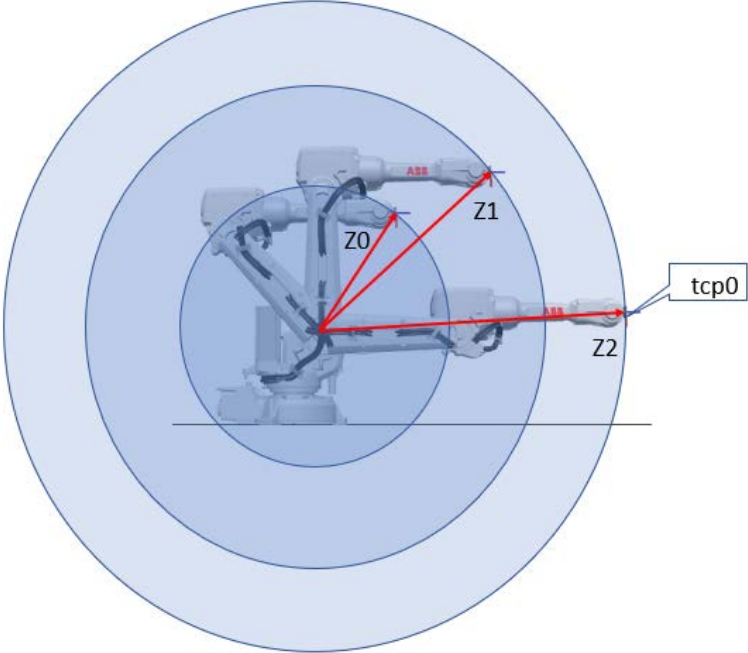
2 Technical data for CRB 1920

2.9.1 Robot stopping distances according to ISO 10218-1
Continued

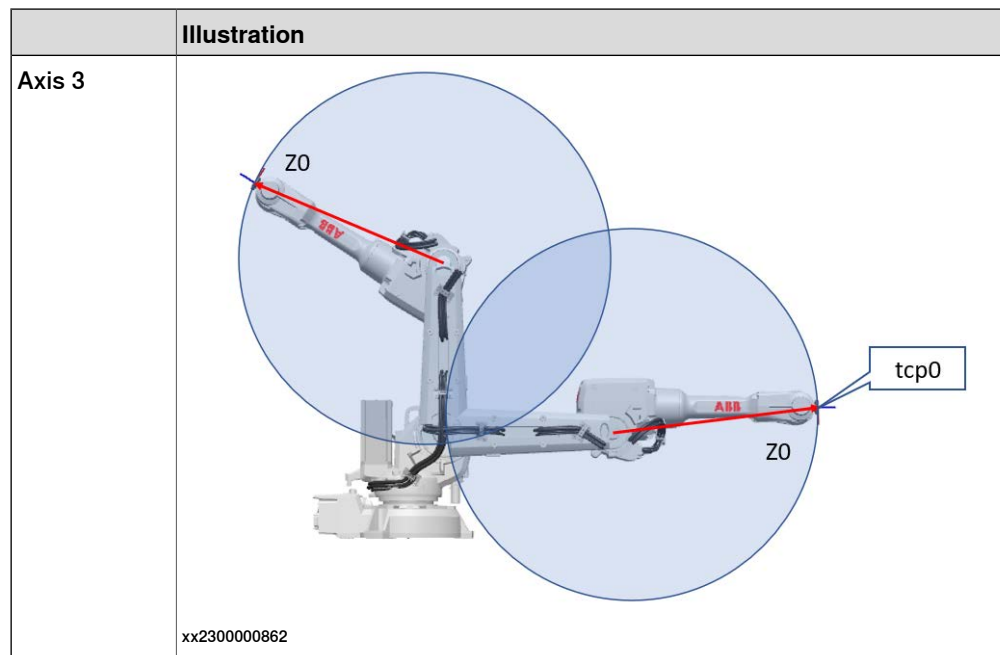
Extension zones

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

Continues on next page



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.

Reading the data

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

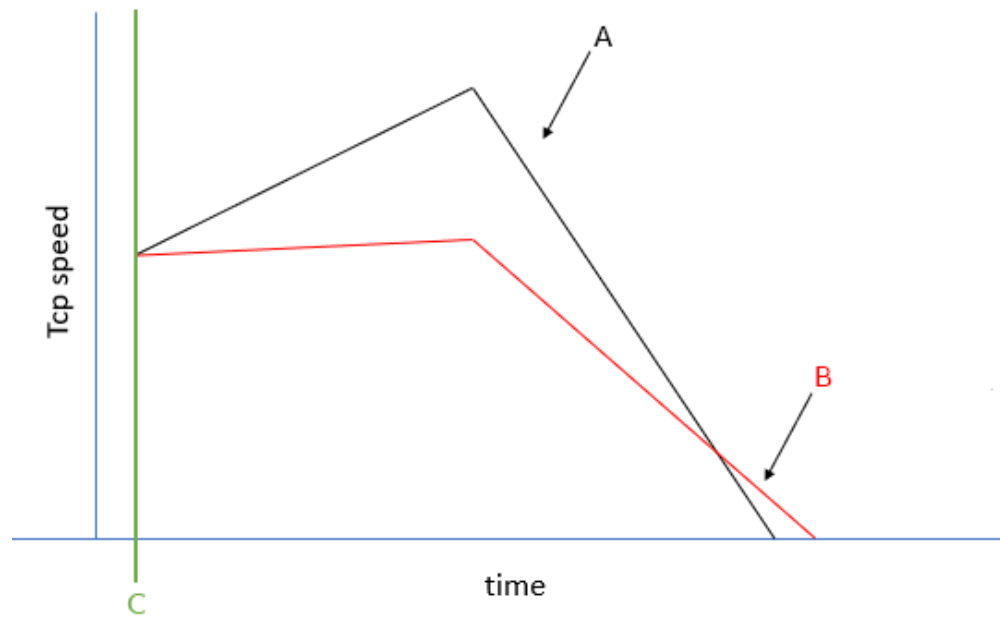
There is a short delay in the stop, which means that if the axis is accelerating when the stop is initiated (C), it will continue to accelerate during this delay time. This can result in graphs where a higher load (A) gives shorter stopping distance than a smaller load (B).

Continues on next page

2 Technical data for CRB 1920

2.9.1 Robot stopping distances according to ISO 10218-1

Continued



xx2300001041

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

2.9.2 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.

The measurement and calculation can also be included in a yearly maintenance.



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.

Continues on next page

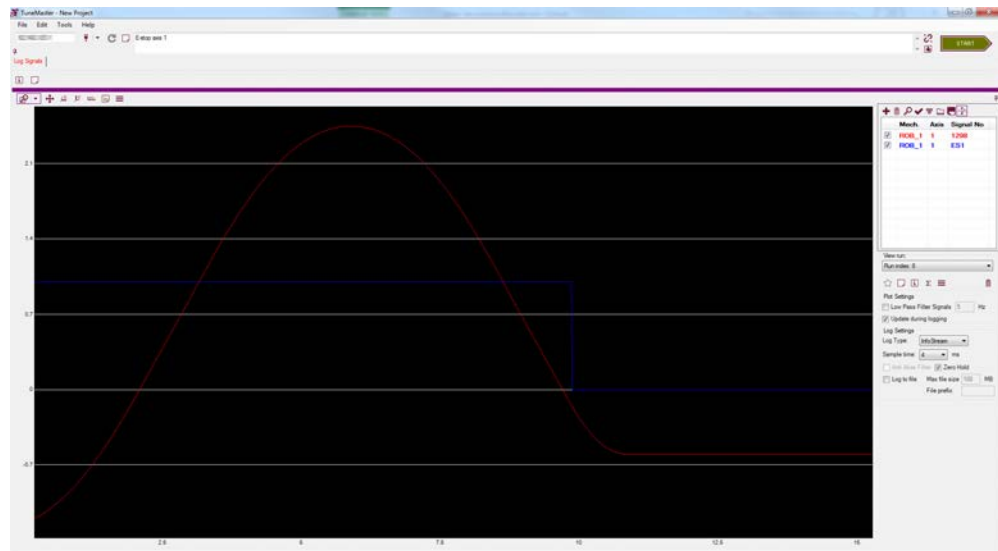
2 Technical data for CRB 1920

2.9.2 Measuring stopping distance and time

Continued

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

2.9.3 CRB 1920-30/1.35

Used tooldata

```
PERS tooldata P100:= [ TRUE, [[0, 0, 0], [1, 0, 0, 0]], [30, [0,
0, 85], [1, 0, 0, 0], 0.036125, 0.036, 0.036]];
PERS tooldata P66:= [ TRUE, [[0, 0, 0], [1, 0, 0, 0]], [20, [0, 0,
57], [1, 0, 0, 0], 0.0107037, 0.011, 0.011]];
PERS tooldata P33:= [ TRUE, [[0, 0, 0], [1, 0, 0, 0]], [10, [0, 0,
28], [1, 0, 0, 0], 0.00133796, 0.0013, 0.0013]];
```

Category 1, extension zones

For definitions of the zones, see [Extension zones on page 82](#).

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°

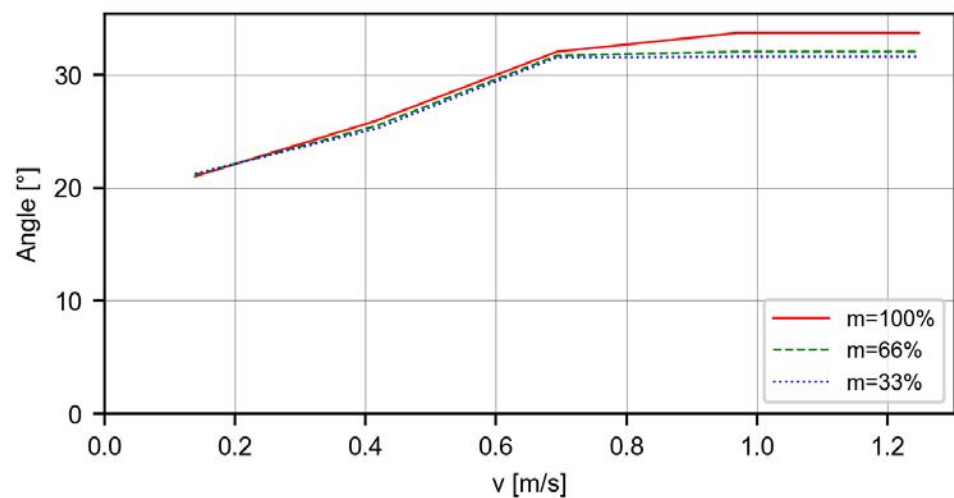
Axis 2

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

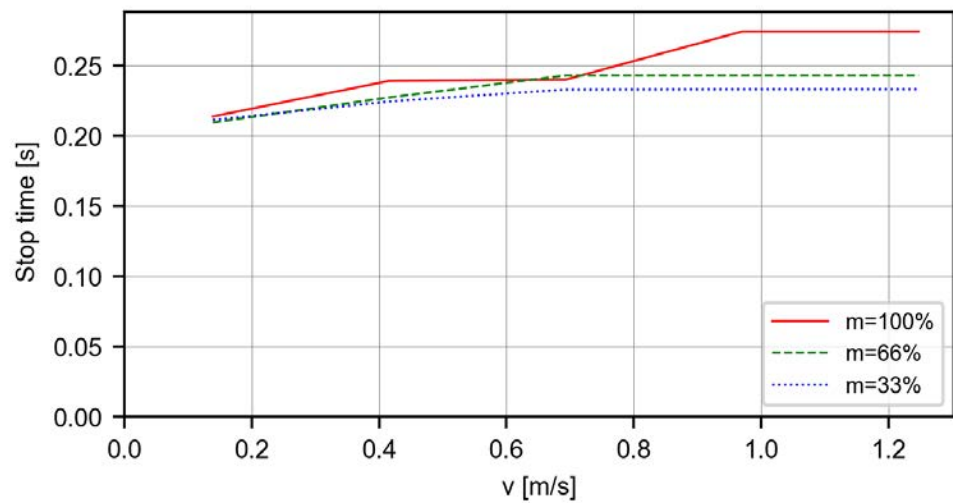


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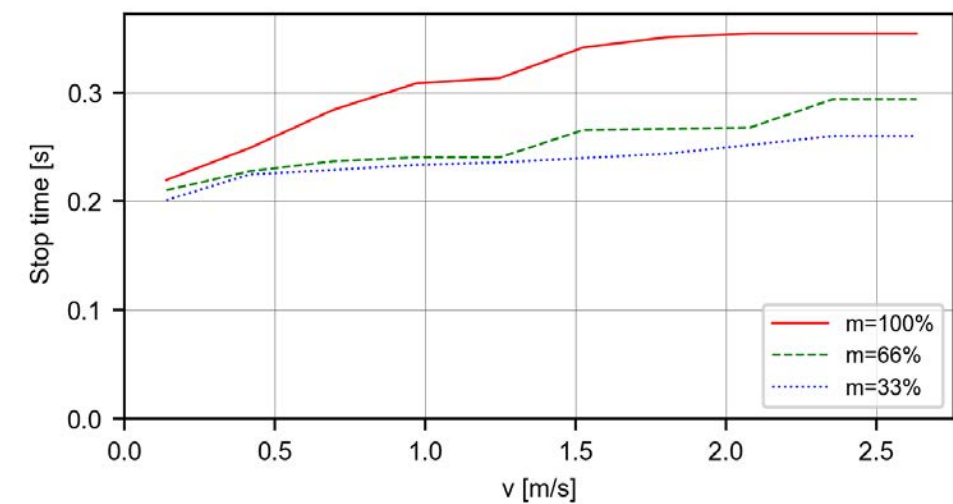
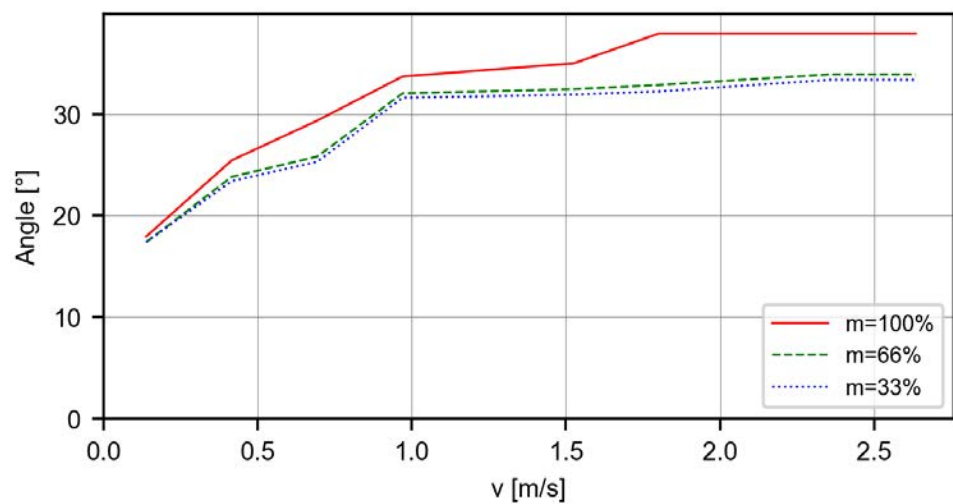
2 Technical data for CRB 1920

2.9.3 CRB 1920-30/1.35

Continued

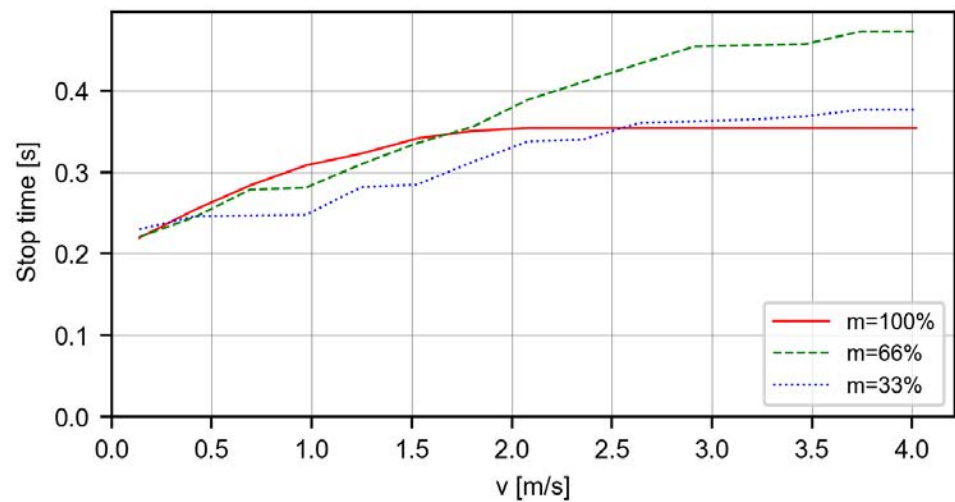
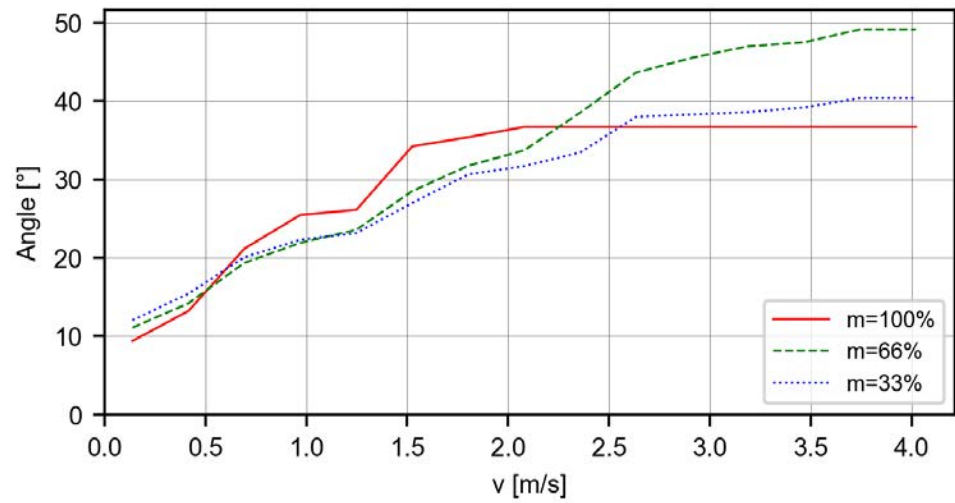


Category 1, Axis 1, Extension zone 1, stopping distance and stopping time



Continues on next page

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



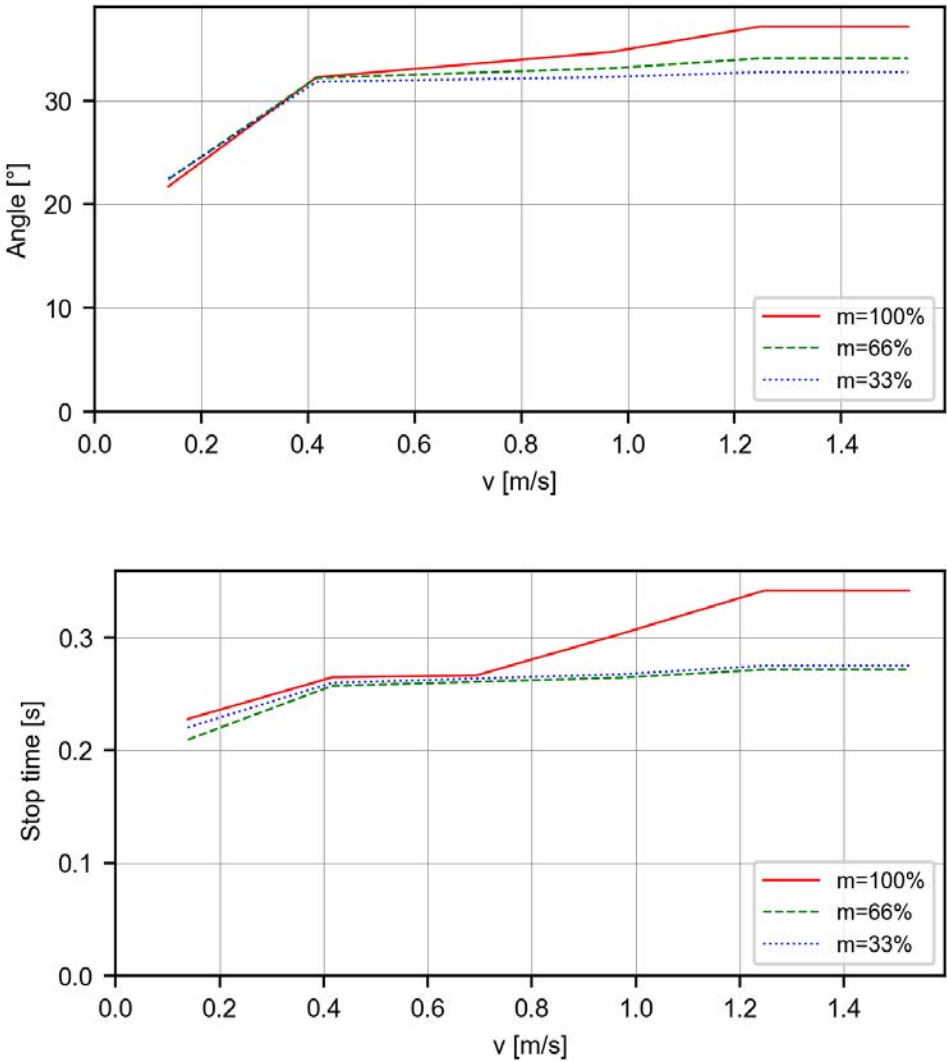
Continues on next page

2 Technical data for CRB 1920

2.9.3 CRB 1920-30/1.35

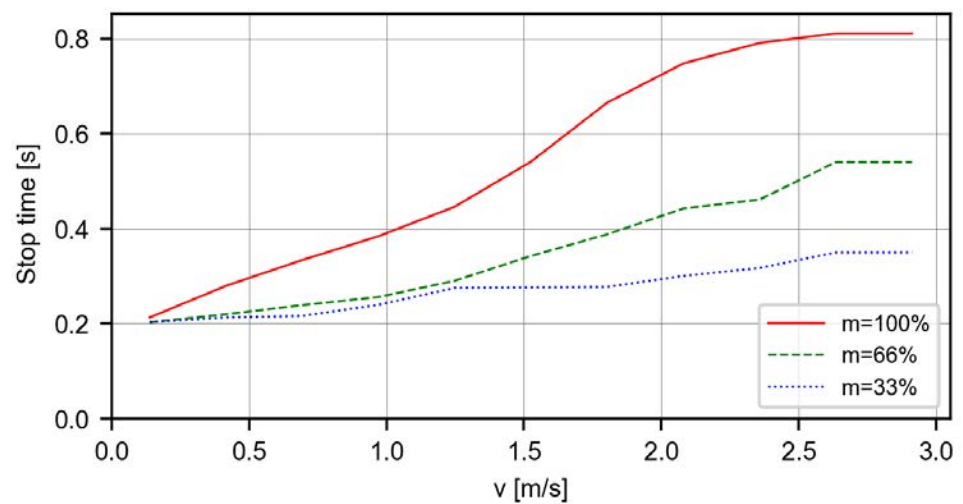
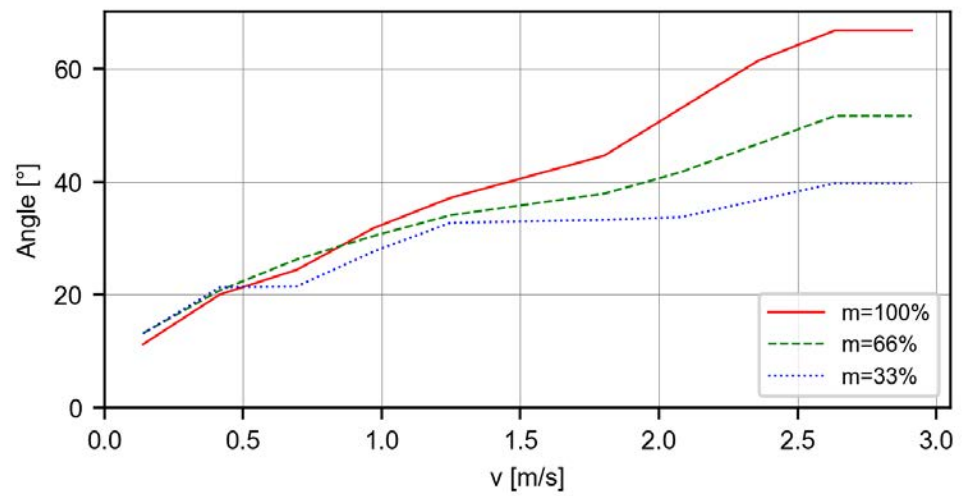
Continued

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



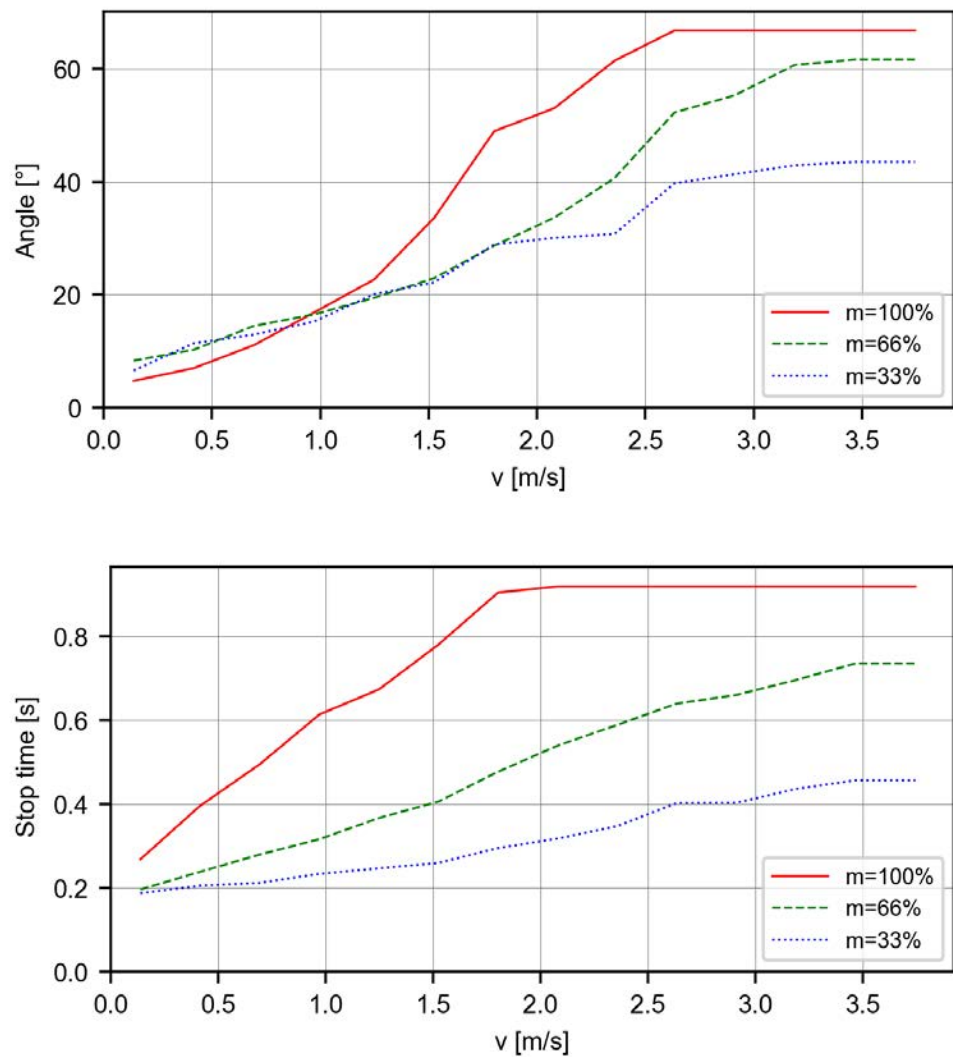
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2 Technical data for CRB 1920

2.9.3 CRB 1920-30/1.35

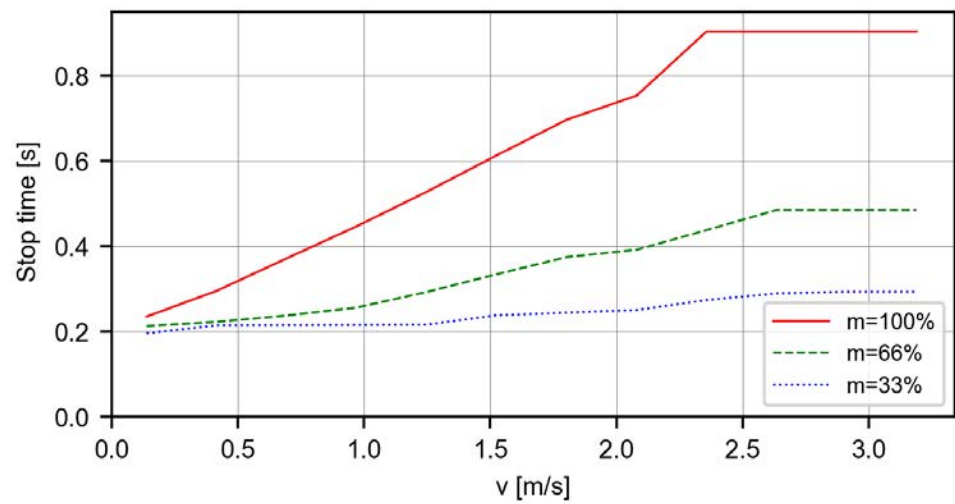
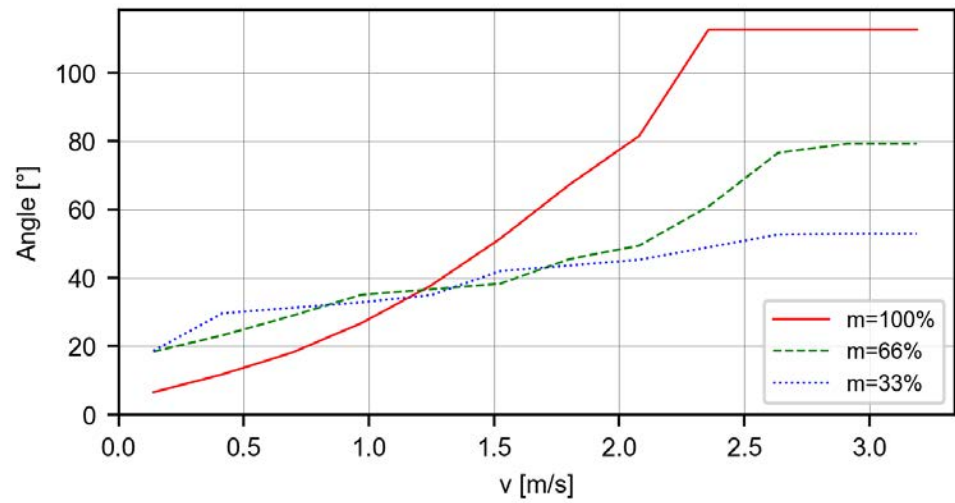
Continued

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



Continues on next page

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



2 Technical data for CRB 1920

2.9.4 CRB 1920-20/1.67

2.9.4 CRB 1920-20/1.67

Used tooldata

```
PERS tooldata P100:= [ TRUE, [[0, 0, 0], [1, 0, 0, 0]], [20, [0, 0, 100], [1, 0, 0, 0], 0.03333333, 0.033, 0.033]];  
PERS tooldata P66:= [ TRUE, [[0, 0, 0], [1, 0, 0, 0]], [13, [0, 0, 67], [1, 0, 0, 0], 0.00987654, 0.0099, 0.0099]];  
PERS tooldata P33:= [ TRUE, [[0, 0, 0], [1, 0, 0, 0]], [6.7, [0, 0, 33], [1, 0, 0, 0], 0.00123457, 0.0012, 0.0012]];
```

Category 1, extension zones

For definitions of the zones, see [Extension zones on page 82](#).

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°

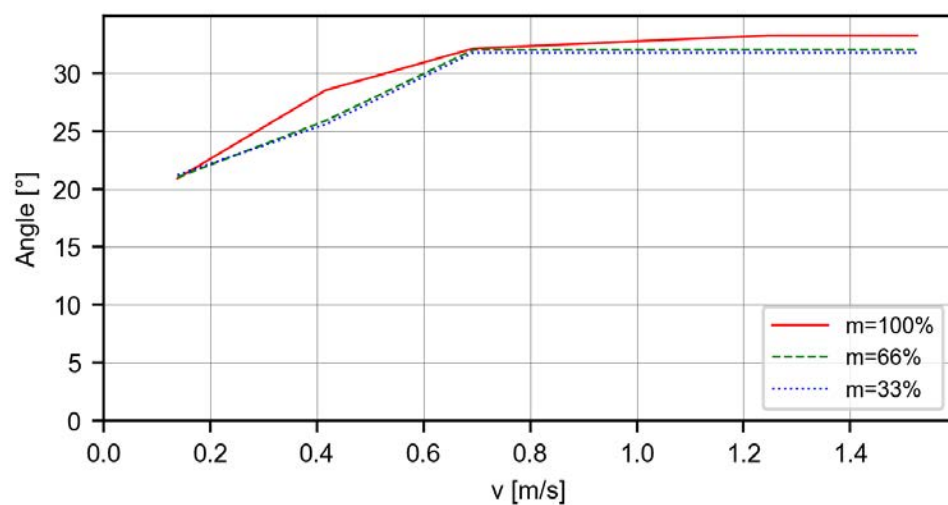
Axis 2

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

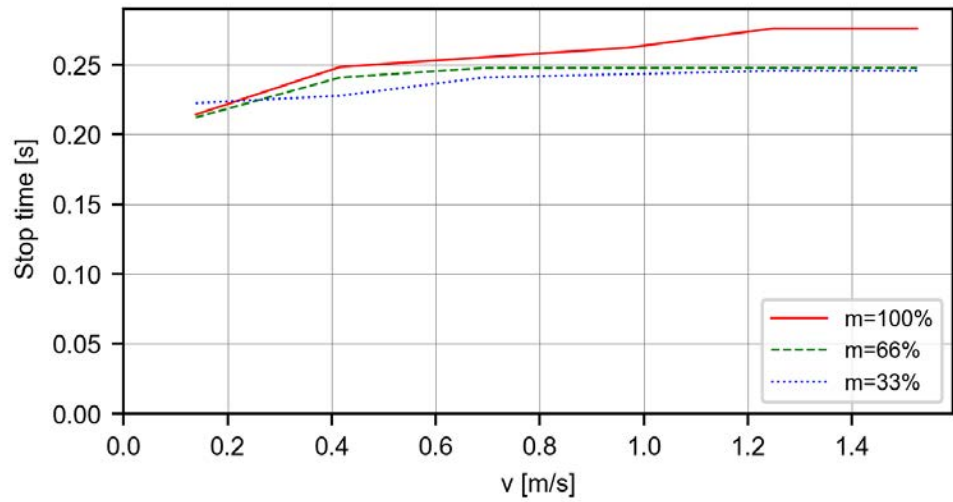
Axis 3

Only one zone exists.

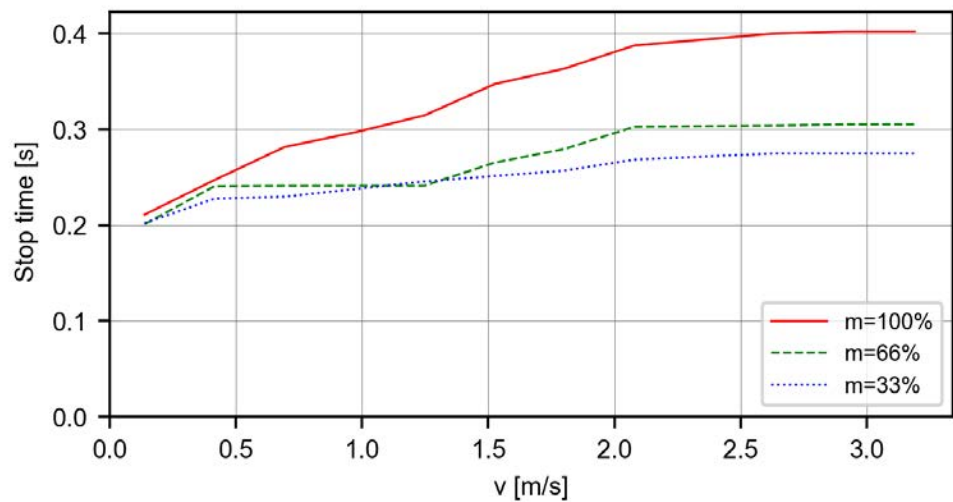
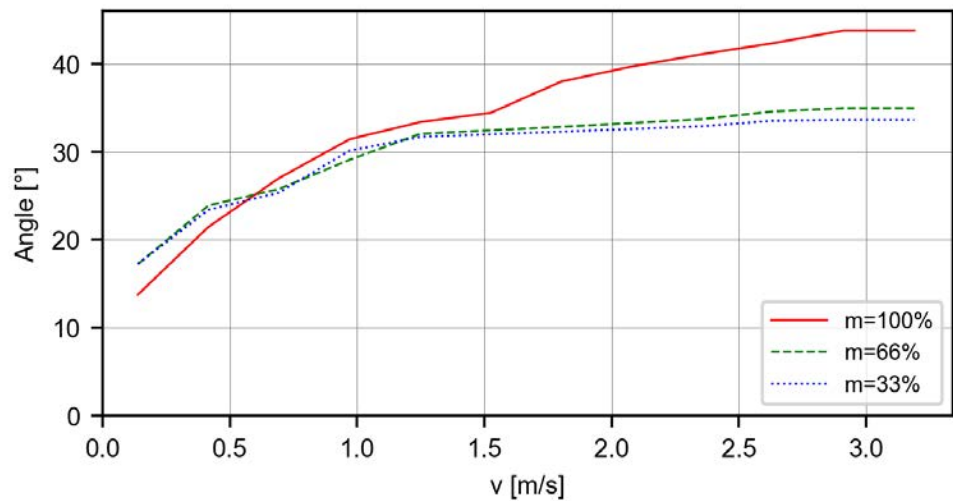
Category 1, Axis 1, Extension zone 0, stopping distance and stopping time



Continues on next page



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



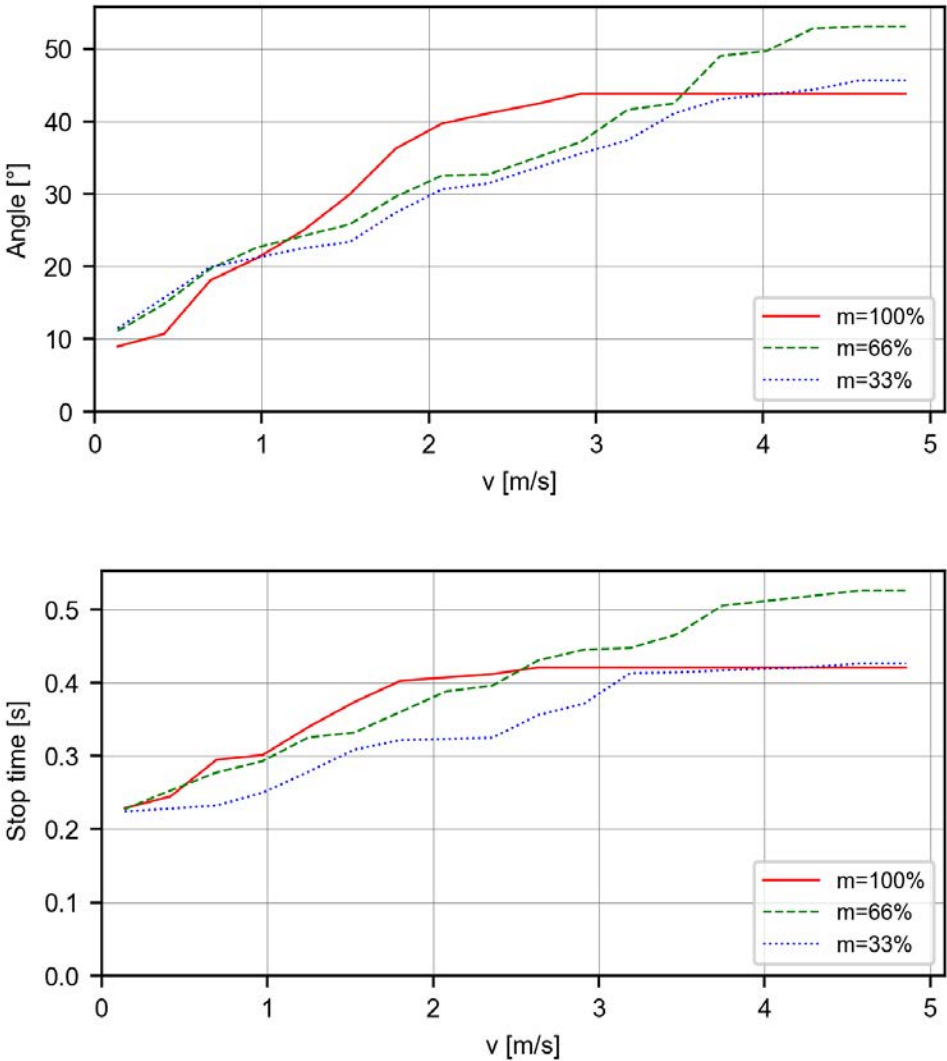
Continues on next page

2 Technical data for CRB 1920

2.9.4 CRB 1920-20/1.67

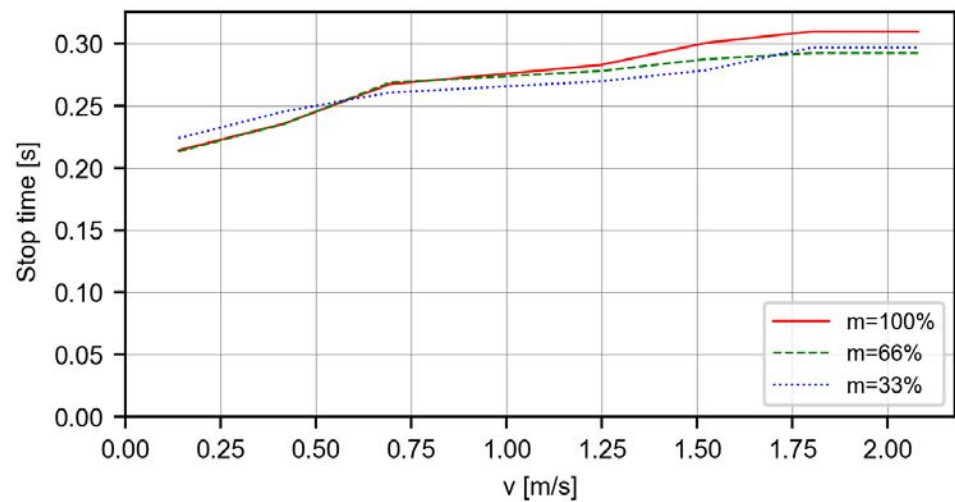
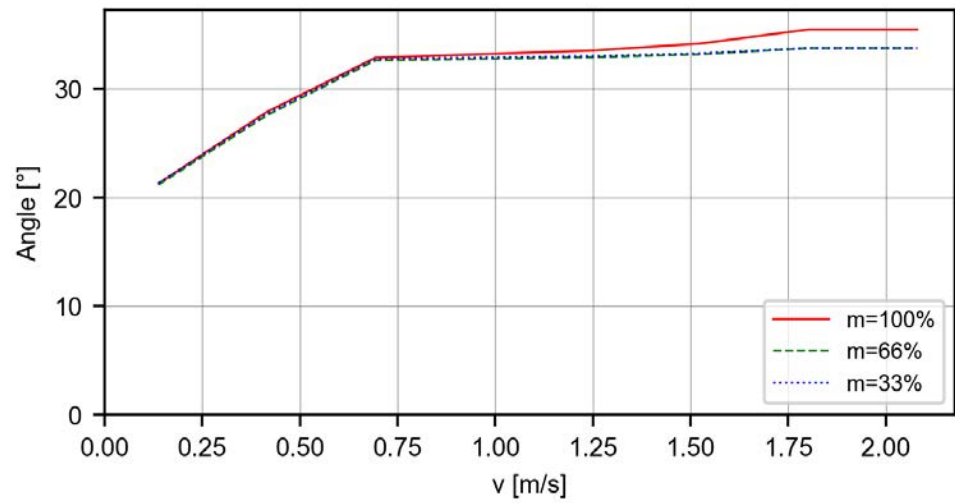
Continued

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



Continues on next page

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



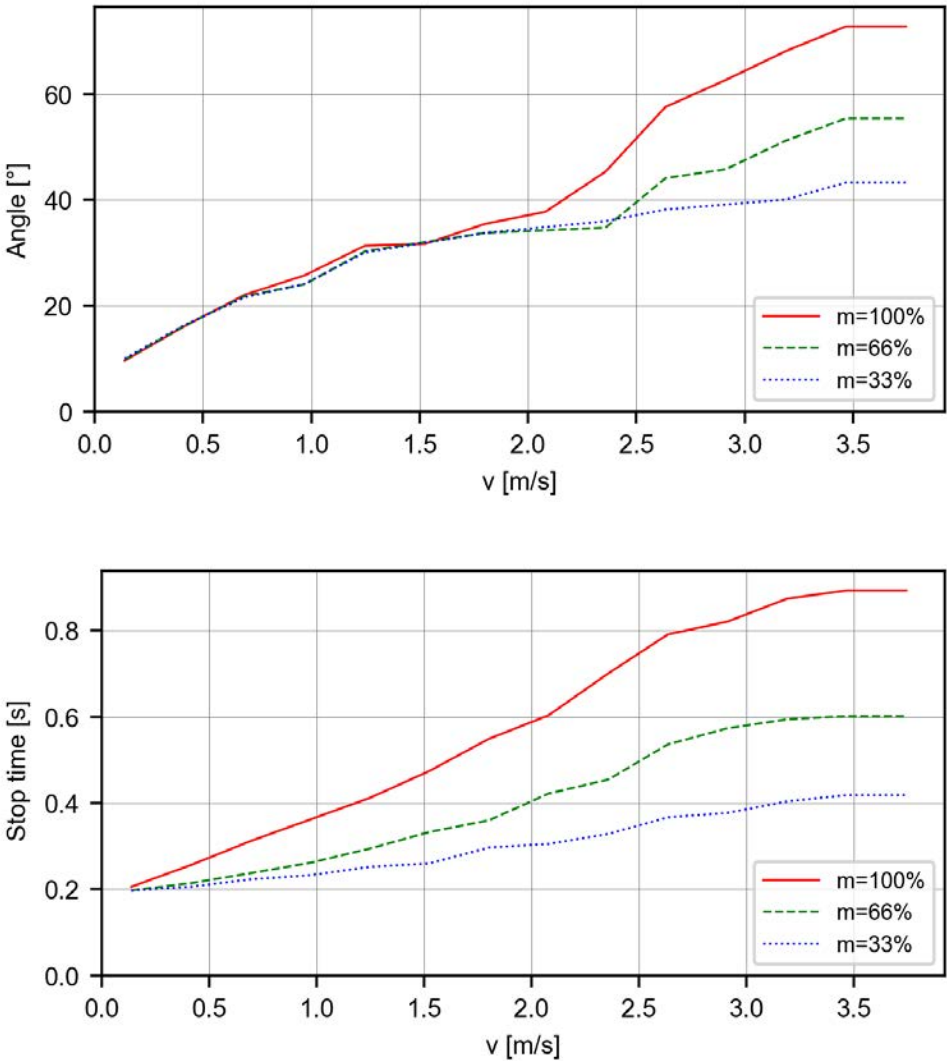
Continues on next page

2 Technical data for CRB 1920

2.9.4 CRB 1920-20/1.67

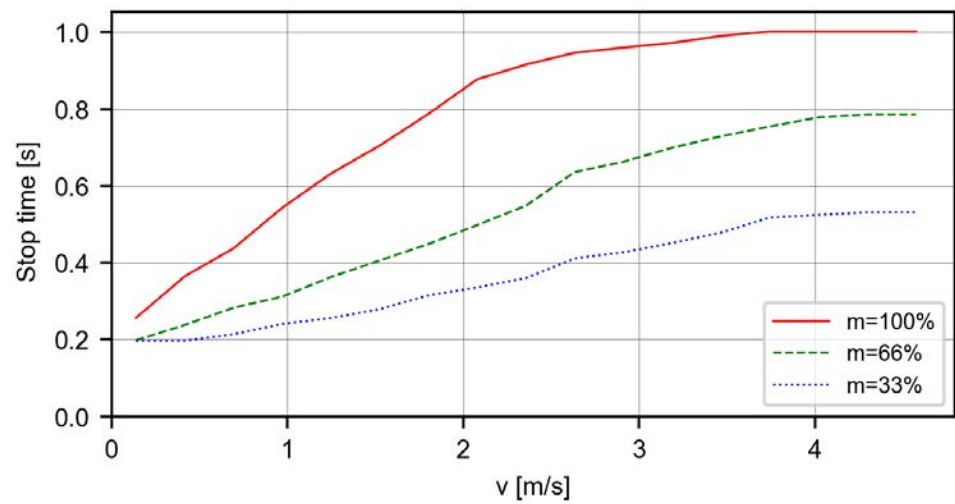
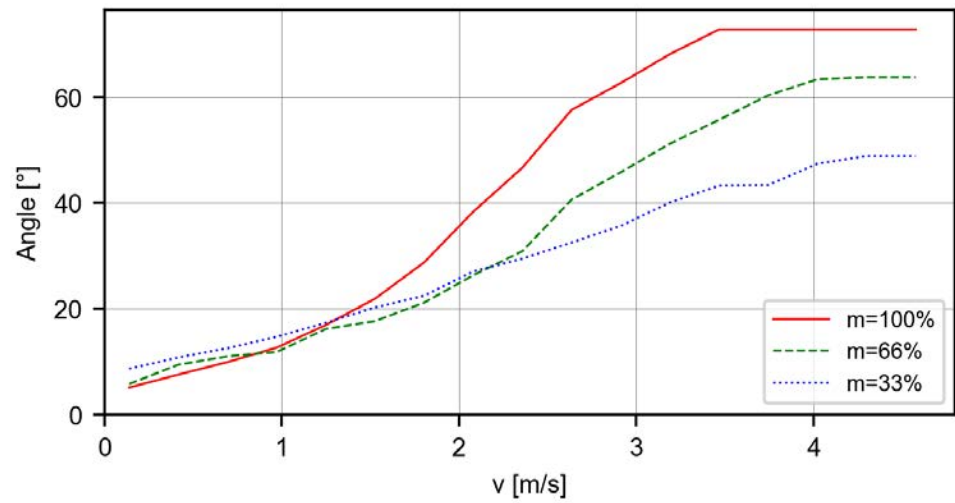
Continued

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



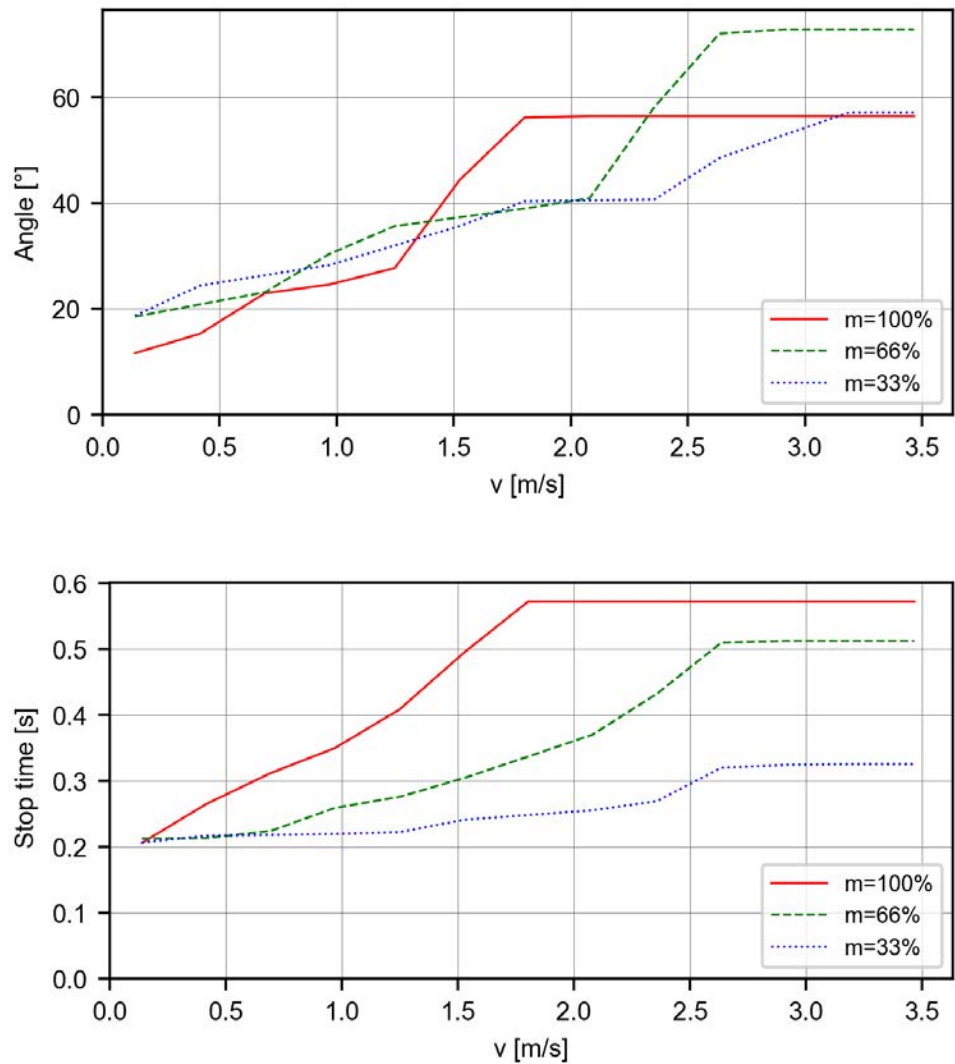
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2 Technical data for CRB 1920

2.9.4 CRB 1920-20/1.67

Continued

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



2.9.5 CRB 1920-16/1.96

Used tooldata

```

PERS tooldata P100:= [ TRUE, [[0, 0, 0], [1, 0, 0, 0]], [16, [0,
0, 100], [1, 0, 0, 0], 0.0266667, 0.027, 0.027]];
PERS tooldata P66:= [ TRUE, [[0, 0, 0], [1, 0, 0, 0]], [11, [0, 0,
67], [1, 0, 0, 0], 0.00790123, 0.0079, 0.0079]];
PERS tooldata P33:= [ TRUE, [[0, 0, 0], [1, 0, 0, 0]], [5.3, [0,
0, 33], [1, 0, 0, 0], 0.000987654, 0.00099, 0.00099]];

```

Category 1, extension zones

For definitions of the zones, see [Extension zones on page 82](#).

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°

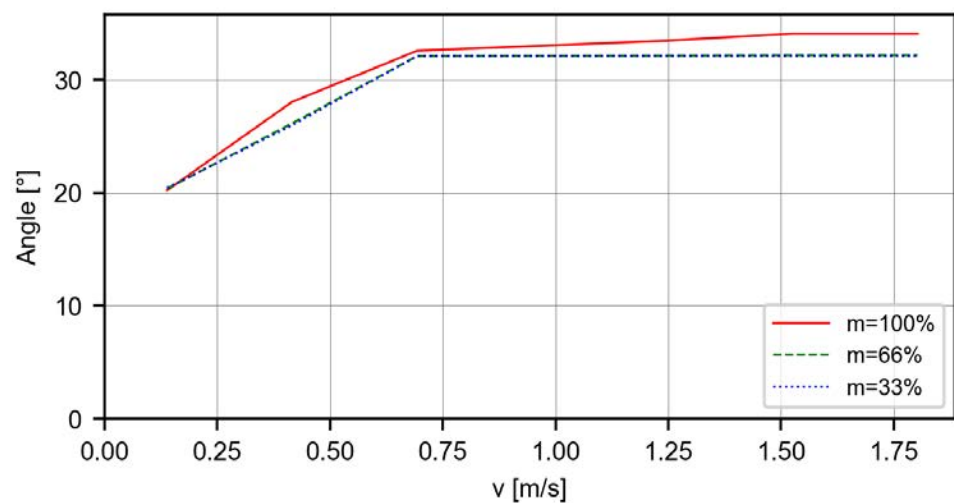
Axis 2

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

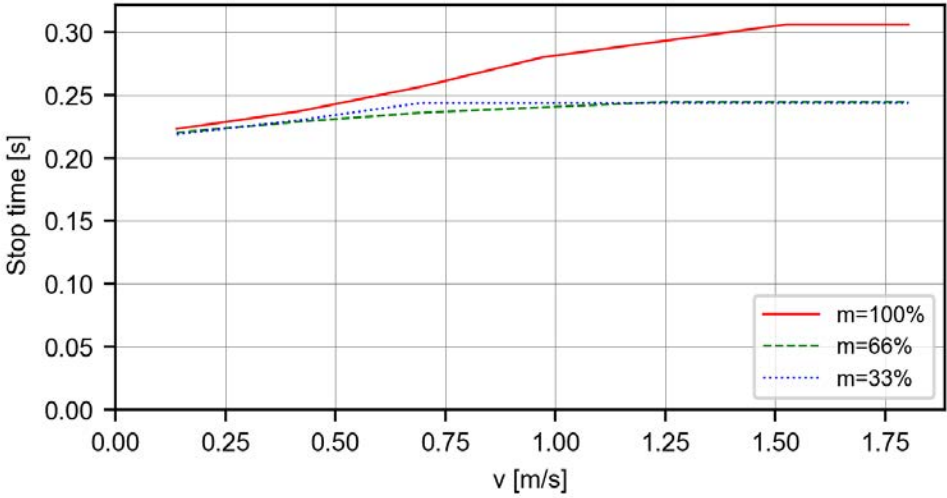


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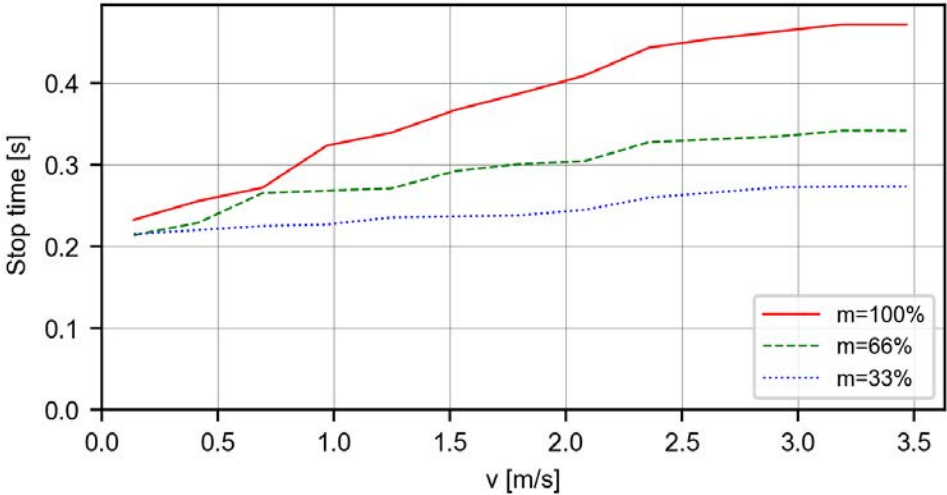
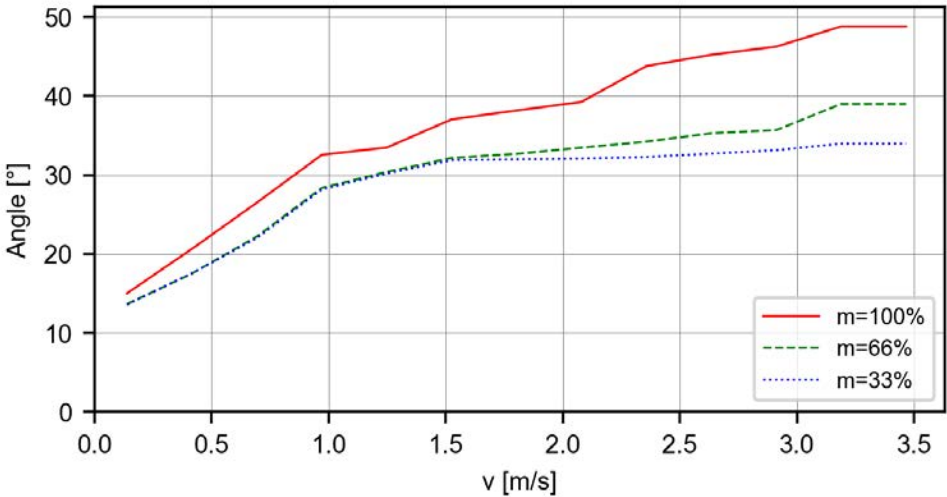
2 Technical data for CRB 1920

2.9.5 CRB 1920-16/1.96

Continued

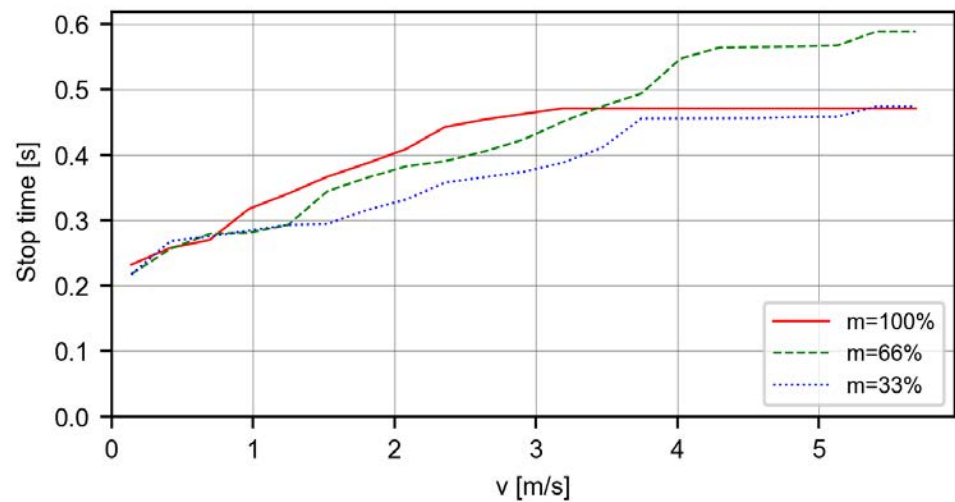
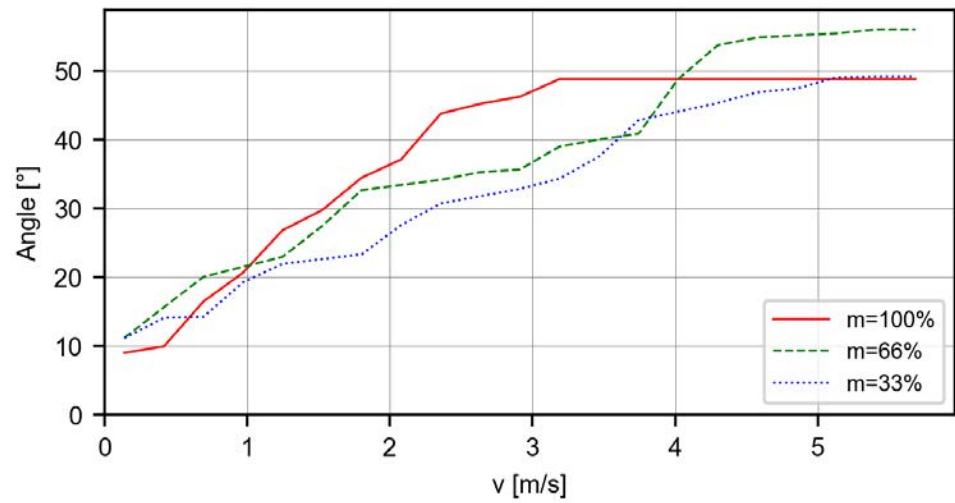


Category 1, Axis 1, Extension zone 1, stopping distance and stopping time



Continues on next page

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



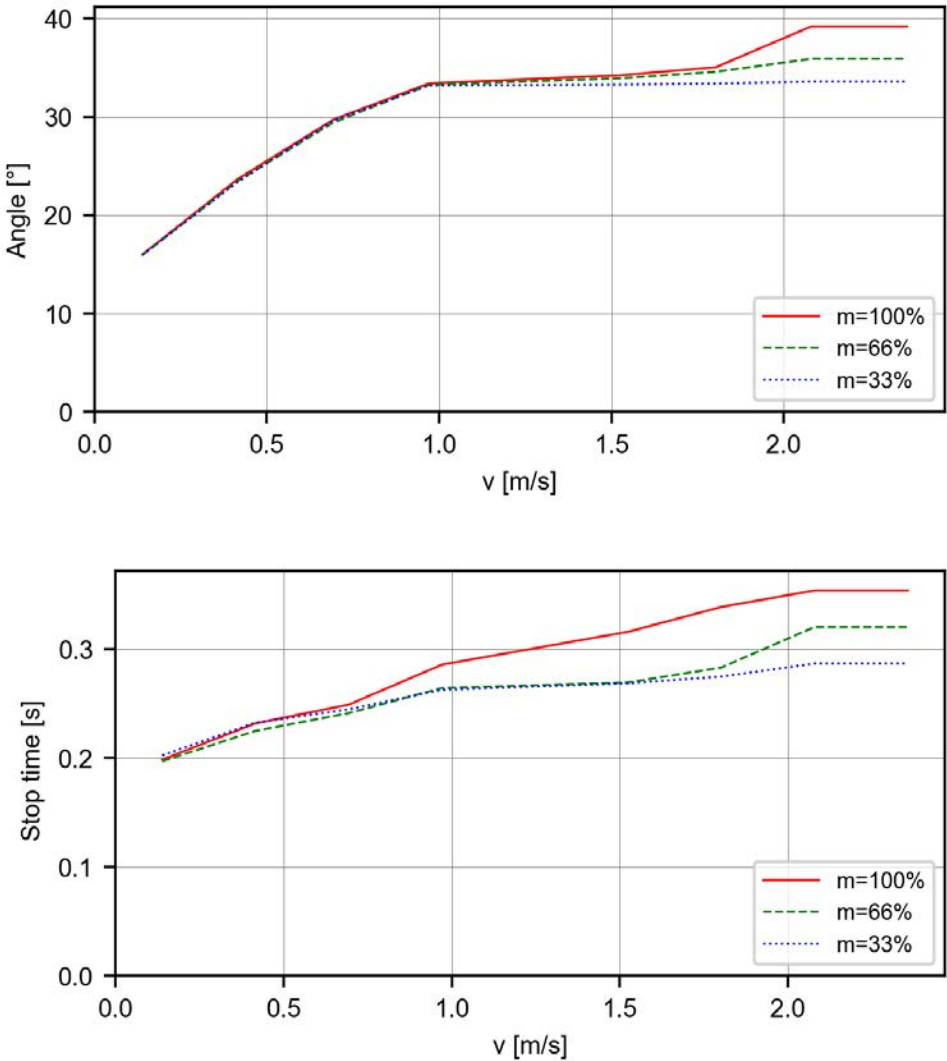
Continues on next page

2 Technical data for CRB 1920

2.9.5 CRB 1920-16/1.96

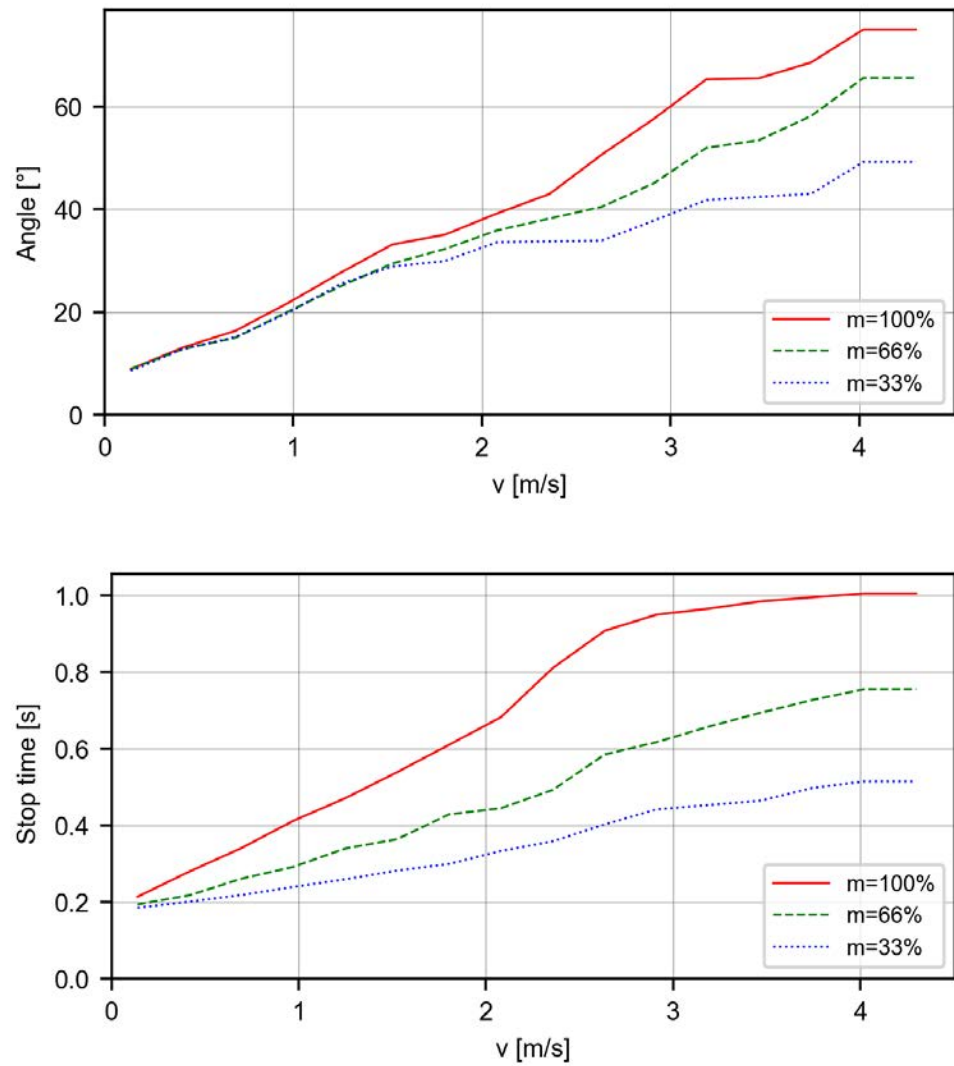
Continued

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



Continues on next page

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



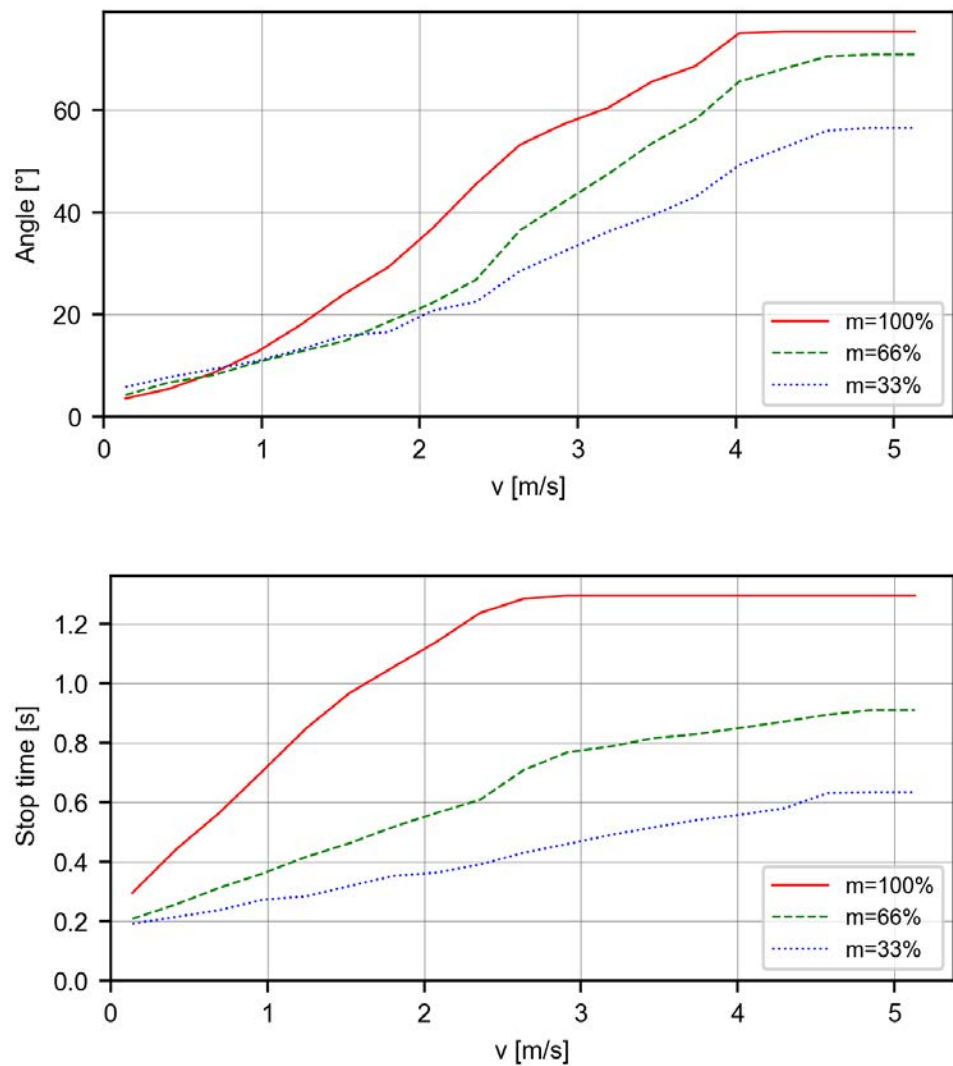
Continues on next page

2 Technical data for CRB 1920

2.9.5 CRB 1920-16/1.96

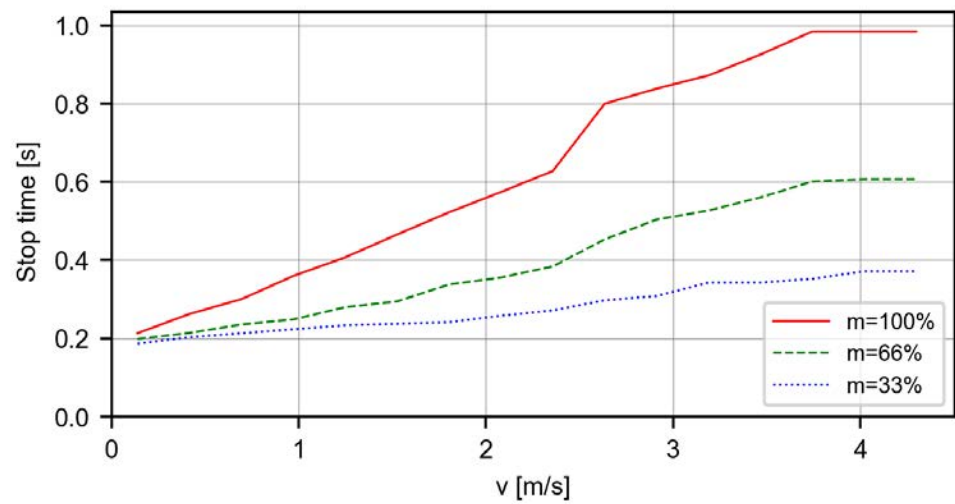
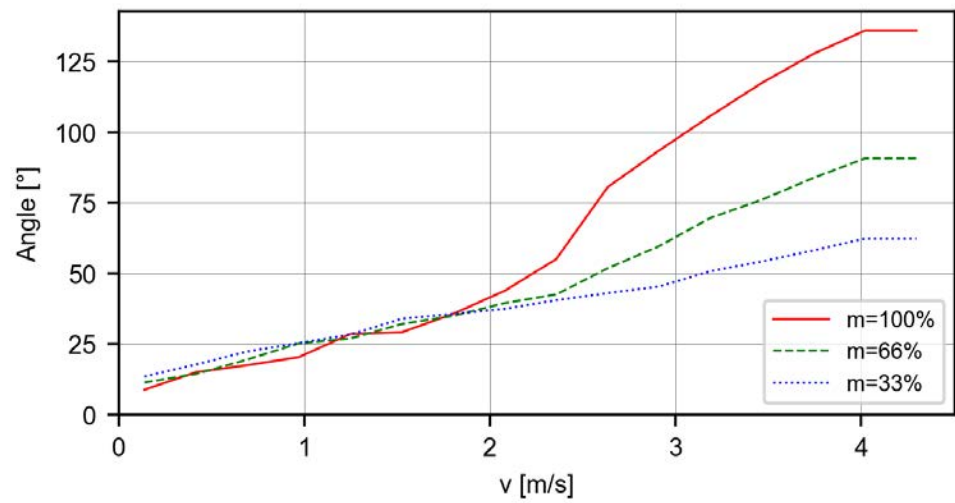
Continued

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



Continues on next page

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



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3 Specification of variants and options

3.1 Introduction to variants and options

General

The different variants and options for the CRB 1920 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.

3 Specification of variants and options

3.2 Manipulator

3.2 Manipulator

Manipulator variants

Option	Variant	Handling capacity	Wrist Reach
3300-132	CRB 1920-30/1.35	30 kg	1.35 m
3300-133	CRB 1920-20/1.67	20 kg	1.67 m
3300-134	CRB 1920-16/1.96	16 kg	1.96 m

Manipulator color

Option	Description	RAL code ⁱ
209-202	ABB Graphite White std Standard color	RAL 7035

ⁱ The colors can differ depending on supplier and the material on which the paint is applied.

Manipulator protection

Option	Description
3350-670	Base 67



Note

Base 67 includes IP67, according to standard IEC 60529.

Robot cabling routing

Option	Description
3309-2	From side of base

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 <i>Customer Delivery Date</i> or latest 18 months after <i>Factory Shipment Date</i> , whichever occurs first. Warranty terms and conditions apply.

Continues on next page

Option	Type	Description
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.
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 <i>Factory Shipment Date</i> or from activation date of standard warranty in WebConfig.  Note Special conditions are applicable, see <i>Robotics Warranty Directives</i>.

3 Specification of variants and options

3.3 Floor cables

3.3 Floor cables

Manipulator cable length

Option	Lengths
3200-7	2 m
3200-8	5 m

Mains cable

Option	Lengths	Description
3203-1	EU mains cable, 3 m	Cable assembly with CEE7/VII line-side plug
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

4 Accessories

General

There is a range of tools and equipment available.

Basic software and software options for robot and PC

For more information, see the application manual for the controller software and the product specification for the robot controller.

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