

ROBOTICS

Product specification

Motor Units and Gear Units



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Product specification

**MU 80, MU 100, MU 200, MU 250, MU 300, MU 400
MTD 250, MTD 500, MTD 750, MTD 2000, MTD 5000
MID 500, MID 1000**

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Revision: V

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Overview of this product specification

About this product specification

This specification describes the performance of the motor units and the gear units in terms of:

- The structure and dimensional prints
- The fulfilment of standards, safety and operating requirements
- The load diagrams, mounting of additional equipment, the motion and reach
- Customer connections
- The specification of variants and options available
- Control equipment
- Safety system

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.

Users

It is intended for:

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

References

Reference	Document ID
<i>Product specification - Controller IRC5</i> IRC5 with main computer DSQC1000.	3HAC047400-001
<i>Product specification - Controller software IRC5</i> IRC5 with main computer DSQC1000 and RobotWare 5.6x.	3HAC050945-001
<i>Product specification - Controller software IRC5</i> IRC5 with main computer DSQC1000 and RobotWare 6.	3HAC050945-001
<i>Product manual - Motor Units and Gear Units</i>	3HAC040148-001
<i>Circuit diagram - Motor Units and Gear Units</i>	3HAC039887-001
<i>Product specification - Robot user documentation, IRC5 with RobotWare 6</i>	3HAC052355-001

Revisions

Revision	Description
-	New Product Specification.
A	<ul style="list-style-type: none"> • Load diagram for MID 1000 corrected • Technical data motor units adjusted • Note for ambient temperature added

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Overview of this product specification

Continued

Revision	Description
B	<ul style="list-style-type: none"> • Dimensions for motor units adjusted • Info regarding mounting of Motor Units
C	<ul style="list-style-type: none"> • Information regarding mounting holes/screws added • Info regarding ordering units added • Data iMax for motor units added
D	<ul style="list-style-type: none"> • Accuracy for MID units changed • The formula for acceleration and deceleration values is corrected, see Dimensioning gear units on page 62. • Added information about template configuration files, see Configuration files on page 12, and Technical data on page 25.
E	<ul style="list-style-type: none"> • The values for $T_{\max\text{gear}}$ is updated with physical units, see Dimensioning gear units on page 62.
F	<ul style="list-style-type: none"> • Color options are added • Minor corrections and updates
G	<ul style="list-style-type: none"> • Max welding power values added to technical data for MTDs. • Measure for MU300 dimension added.
H	<ul style="list-style-type: none"> • Minor corrections/update
J	<ul style="list-style-type: none"> • Phrase <i>RobotWare DVD</i> in section <i>Communication/PC Interface</i>, is changed to <i>RobotWare Download package</i>.
K	<p>Published in release R17.1. The following updates are done in this revision:</p> <ul style="list-style-type: none"> • Note regarding that the support collar has the same hole pattern for fastening as the gearbox is added. • Changed dimensional drawings of MTD 500 and MTD 750. • Added MU 250. • New option for smooth shaft adaptor added. • Data of Minimum suitable DC-bus voltages (V DC)* changed.
L	<p>Published in release R17.2. The following updates are done in this revision:</p> <ul style="list-style-type: none"> • Updated list of applicable standards. • Added MU 80
M	<p>Published in release R18.1. The following updates are done in this revision:</p> <ul style="list-style-type: none"> • MID changed to IP65
N	<p>Published in release R18.2. The following updates are done in this revision:</p> <ul style="list-style-type: none"> • Added nominal inertia and note specifying the effective condition of stop time for gear units.
O	<p>Published in release R19B. The following updates are done in this revision:</p> <ul style="list-style-type: none"> • The color of MID 500 changed to basalt grey. • Added "Tbrake min" for MTD. • HV compatibility for MU 80 changed.
P	<p>Published in release R19D. The following updates are done in this revision:</p> <ul style="list-style-type: none"> • More details about MU 80 added. See details in Details of MU 80 on page 77.
Q	<p>Published in release 20A. The following updates are done in this revision:</p> <ul style="list-style-type: none"> • Minor corrections.
R	<p>Published in release 20C. The following updates are done in this revision:</p> <ul style="list-style-type: none"> • Modified SMB box graphic. • Added note that MU80 and MU250 is not compatible with RW version earlier than 6.06.

Continues on next page

Revision	Description
S	Published in release 20D. The following updates are done in this revision: <ul style="list-style-type: none">• Modified SMB box dimension.• Added tailstock hole pattern for MID 2000.• Warranty section updated.
T	Published in release 21A. The following updates are done in this revision: <ul style="list-style-type: none">• SMB box dimension section updated.
U	Published in release 21B. The following updates are done in this revision: <ul style="list-style-type: none">• Dimension of MU 400 updated.• Dimension for smooth shaft adaptor updated.
V	Published in release 21C. The following updates are done in this revision: <ul style="list-style-type: none">• Incorrect information regarding cable lengths is removed.

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1 Description

1.1 Motor Units and Gear Units

Introduction

This specification provides the characteristics and performance for the new Motor Units and Gear Units. The units are power-operated and function as external axes. They are controlled by drive units mounted in the IRC5 controller or drive modules. The units are designed for optimal performance and to facilitate installation and application.

The Motor Units and Gear Units described in this specification are not tested for compatibility by a configurator when ordering products, due to that these are components to be integrated into systems with a vast amount of possible combinations, both hardware and software-wise, which cannot be foreseen, allowing orders to contain non allowed/invalid configurations. This means, it is possible to place an order either manually or via ordering system containing units that cannot be connected together to obtain a fully functional system.

The motor- and gear units cannot be combined with other standard products from the supplying unit without additional engineering.

The following scenarios will always require a quotation, please contact your local ABB organization:

- If flexible power- and signal cables are required between robot and controller.
- MU & GU combined with track motions (IRBT, RTT) and positioners (IRBP).
- MU & GU used in MultiMove systems.

Kinematic models are not included. Kinematic models for limited combinations of MU & GU can be set up by using the **External Axis Wizard**, which is an add in to RobotStudio.

Kinematic models can also be quoted on request, please contact your local ABB organization.

ABB will not take any functional responsibility for systems ordered.

Operating system

The motor units and gear units are controlled by the IRC5 controller and robot control software, RobotWare. The RobotWare supports every aspect of the system, including the units, such as motion control, development and execution of application programs, communication and so on. For more information, see *Product specification - Controller IRC5 with FlexPendant*.

Safety

Safety standards valid for complete robot, manipulator, external units and controller.

Continues on next page

1 Description

1.1 Motor Units and Gear Units

Continued

Serial Measurement Box

The SMB box (optional) contains a serial measurement board (with battery backup) and push buttons (optional) for releasing the brakes. The SMB box can be located up to maximum 30meters from the controller and maximum 15meters from the motor units or gear units.

If only one motor unit is used, the SMB board in the manipulator can be used, see [Scenarios on page 13](#), Scenario A.

Brakes

All motors, both in motor units and in gear units, are equipped with electromagnetic brakes. The brakes are "on" when they are not energized. They can be released with push buttons (optional) on the SMB box or by customer installed button at the Motor Unit/Gear Unit.

Thermal supervision

The motor units (except MU 100 and MU 80) and gear units are protected from overload, by thermal supervision. Warnings are provided if the motor is close to maximum temperature. The unit will stop if maximum temperature is exceeded. The thermal supervision should be tuned for the environment for optimal efficiency.

Limitations

- Can not be combined with IRBP positioners (if needed contact Robotics Sales Support for a quotation).
- *Electronic Position Switches (EPS)* or *SafeMove* is not valid for motor units or gear units.
- IRC5 controller without SMB box allows maximum one motor unit.
- IRC5 controller with SMB box allows maximum 3 motor units or gear units.
- IRC5 drive module with SMB box allows maximum 3 motor units.
- Only motor unit connected to manipulator SMB, option 864-1.
- When using 3rd party motors are PTC functionality (supervision of motor temperature) not available.

How to order

As a basic rule when adding Motor Units or Gear Units to already installed systems, always place a separate order for each system, to secure that correct number of cables/contacts for the controllers are delivered. When adding Motor Units and Gear Units to an existing system, already equipped with external axes, please contact your local ABB Organization.

Configuration files

Template configuration files are included in the delivery with the motor units and gear units. The configurations for motor units and gear units can be tuned before running in production to optimize performance.

1.2 Scenarios

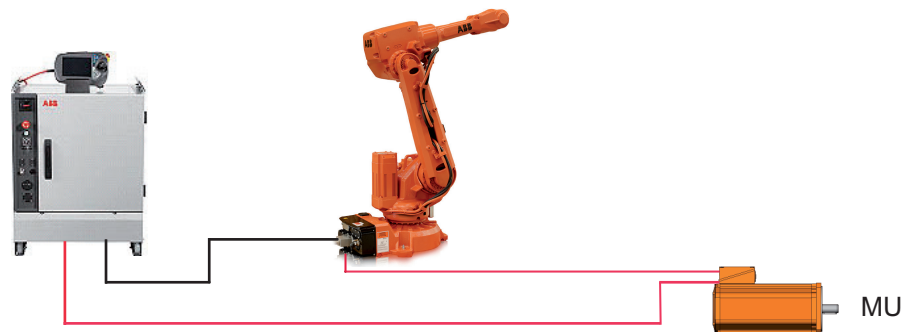
Introduction

Below are different scenarios described for installation of the units. The axis selector, available as an option inside the controller, allowing to cut the power to the motor units and gear units, will not be shown in the scenarios below.

Motor units

Scenario A, Lean concept:

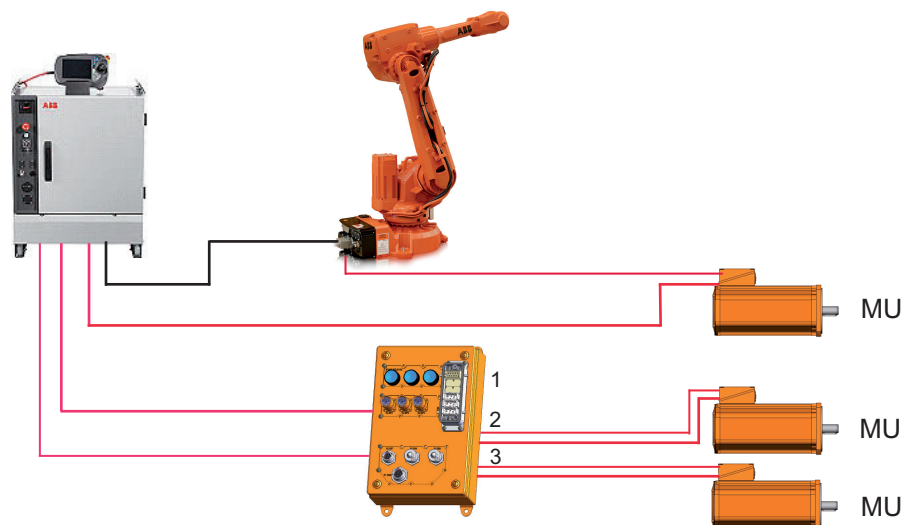
- One motor unit
- No SMB box
- Motor power connected to the IRC5 controller and resolver connected to FB7 at manipulator.



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Scenario B:

- One motor unit connected to the IRC5 controller, according to Lean concept above
- SMB box connected to the IRC5 controller
- Two motor units connected to SMB box



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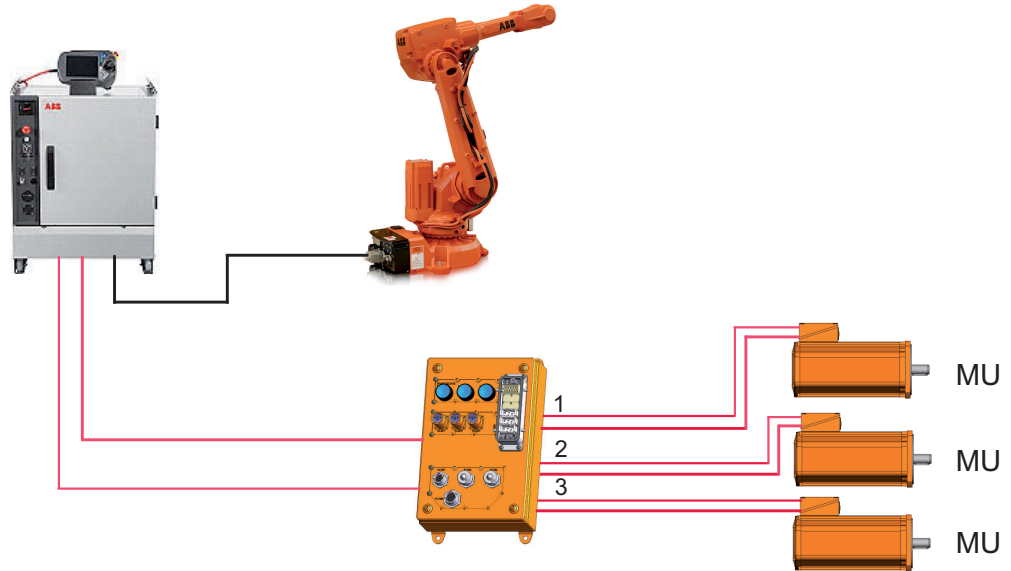
1 Description

1.2 Scenarios

Continued

Scenario C:

- SMB box connected to the IRC5 controller
- Three motor units connected to one SMB box

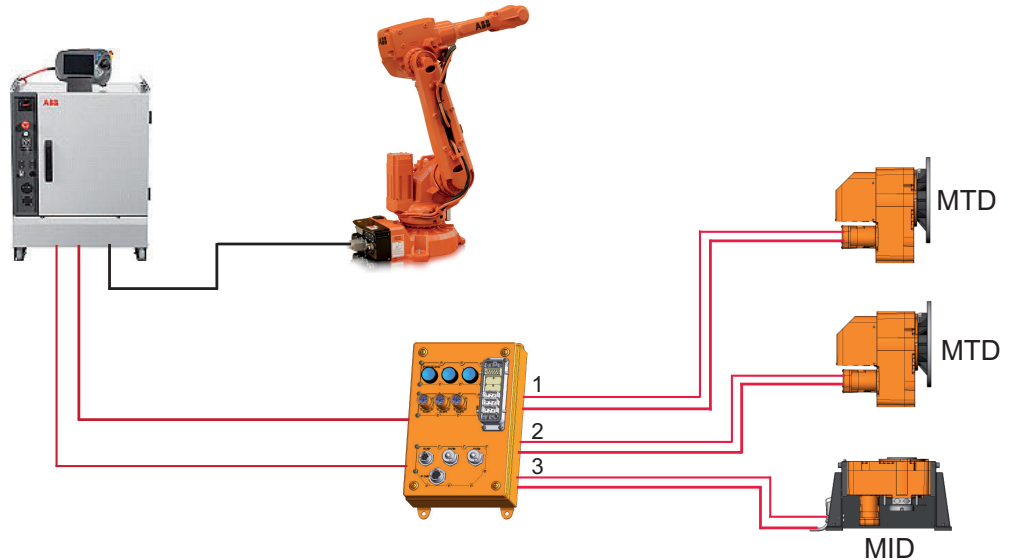


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Gear units

Scenario A:

- SMB box connected to the IRC5 controller
- Three gear units connected to one SMB box

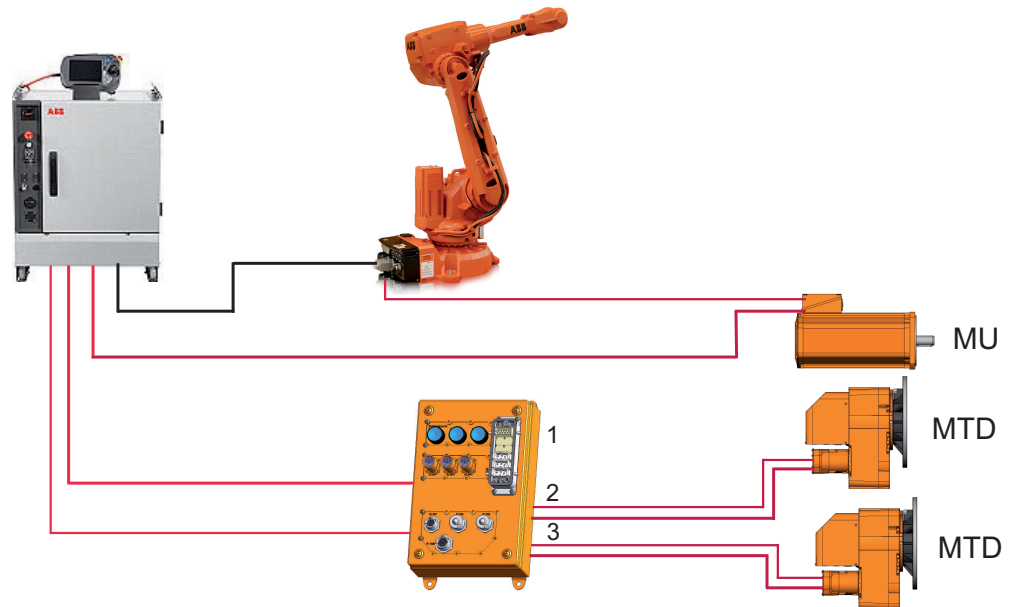


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Scenario B:

- One motor unit connected to the IRC5 controller, according to Lean concept
- SMB box connected to the IRC5 controller
- Two gear units connected to one SMB box



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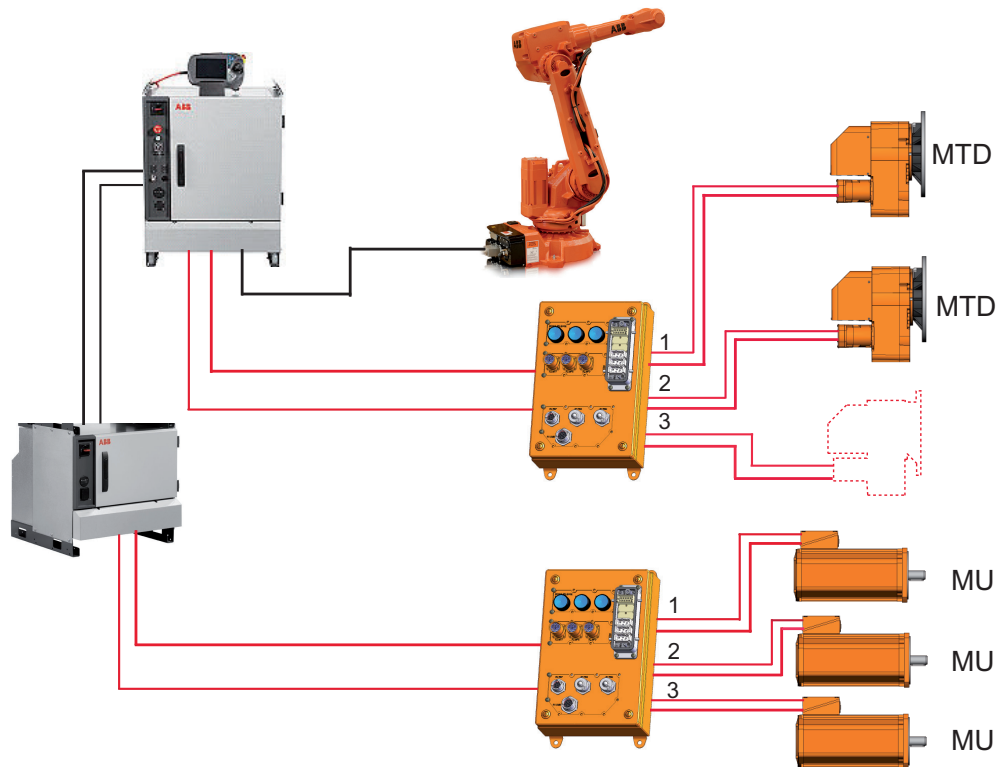
1 Description

1.2 Scenarios

Continued

Scenario C:

- One SMB box connected to the IRC5 controller
- Two gear units connected to the IRC5 controller, through the SMB box
- One SMB box connected to IRC5 drive module
- Three motor units connected to the IRC5 drive module through the SMB box



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1.3 Motor units

1.3.1 Introduction

General

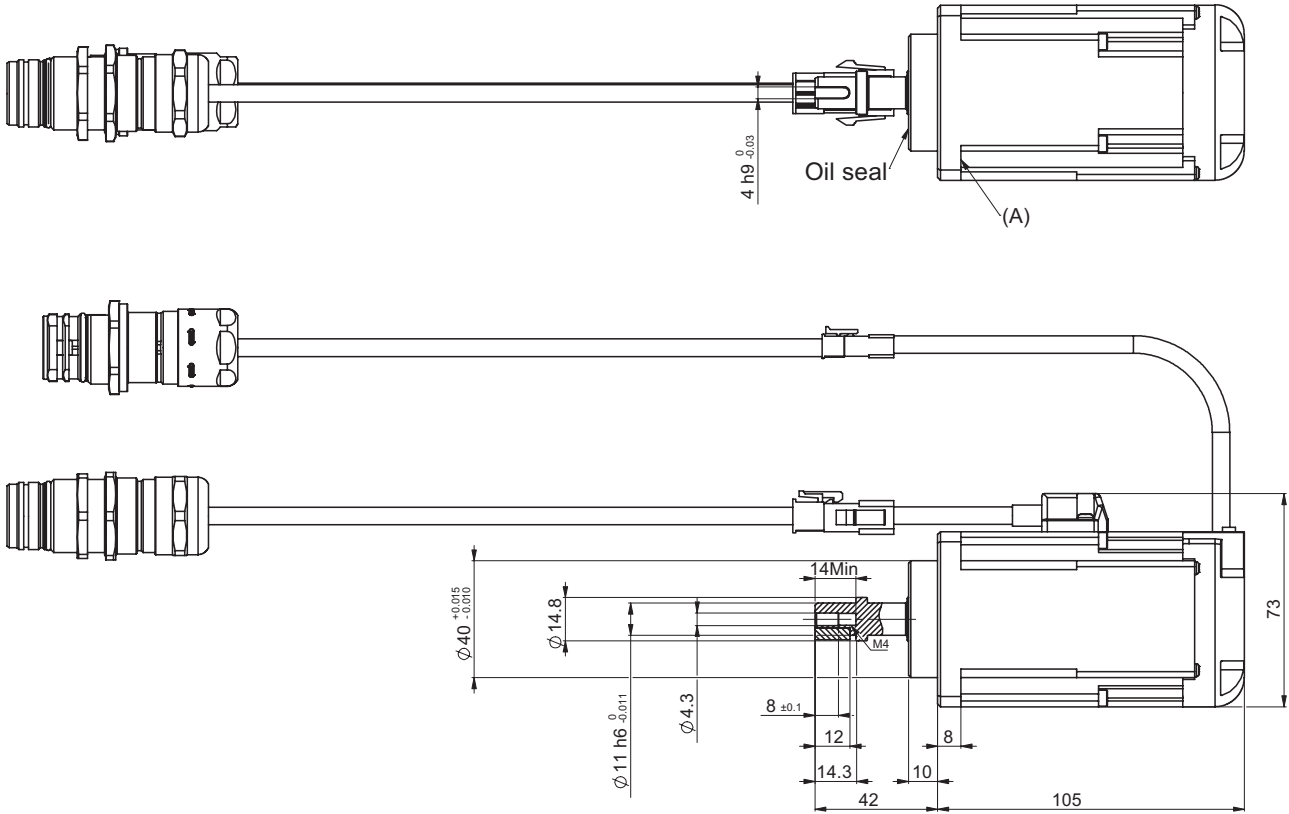
The motor units are intended to be used for peripheral equipment requiring power controlled motors synchronized with the robot movement.

1 Description

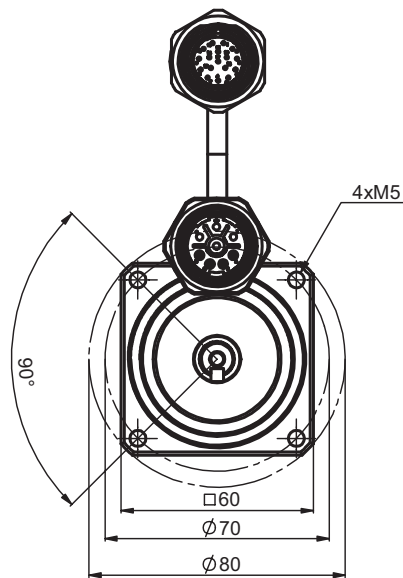
1.3.2 Dimensions

1.3.2 Dimensions

MU 80



xx1700001334



xx1700001335

Rs	Description	Tightening torque [Nm] $\pm 10\%$
A	Mounting screw M 4 (quality 8.8), max. washer $\varnothing 9$ mm.	4

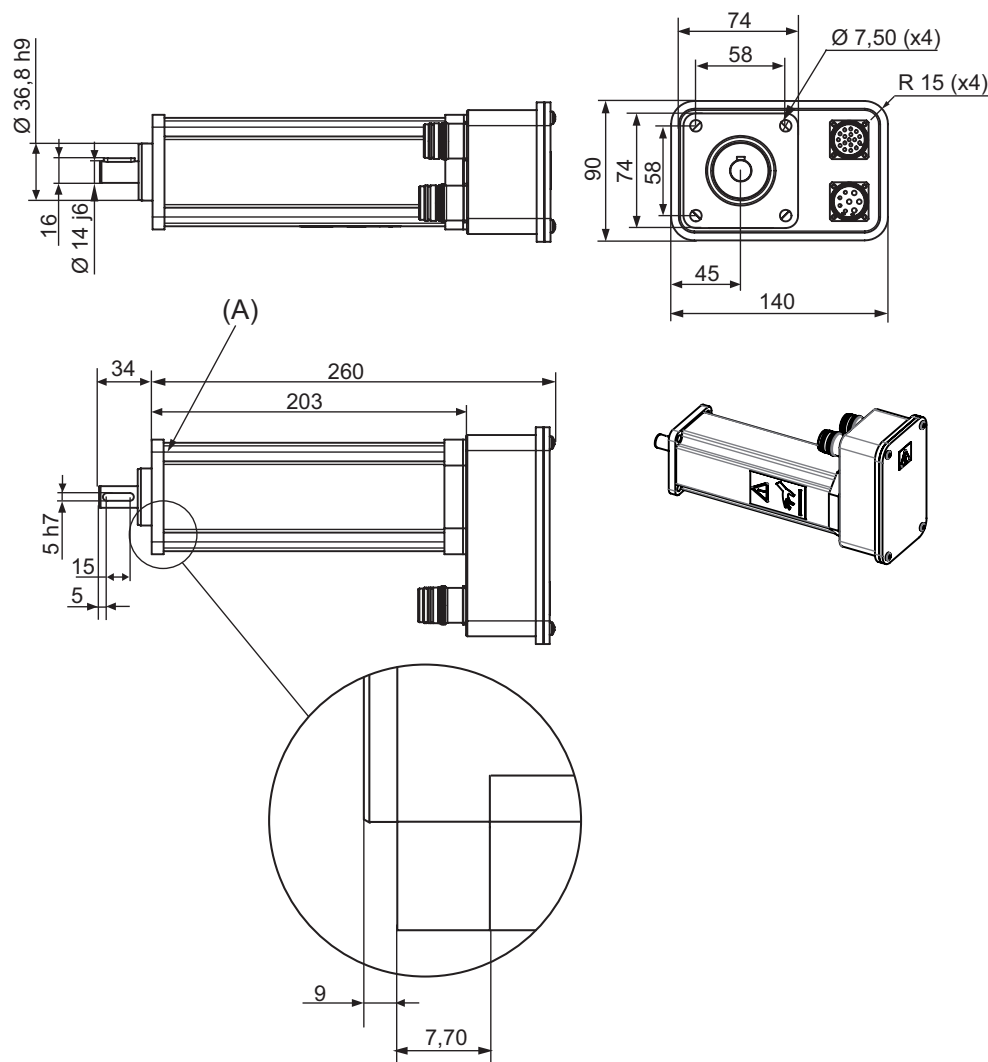
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1 Description

1.3.2 Dimensions

Continued

MU 100



xx1000001206

Rs	Description	Tightening torque [Nm] ±10%
A	Mounting screw M 6 (quality 8.8), max. washer Ø 11 mm.	10

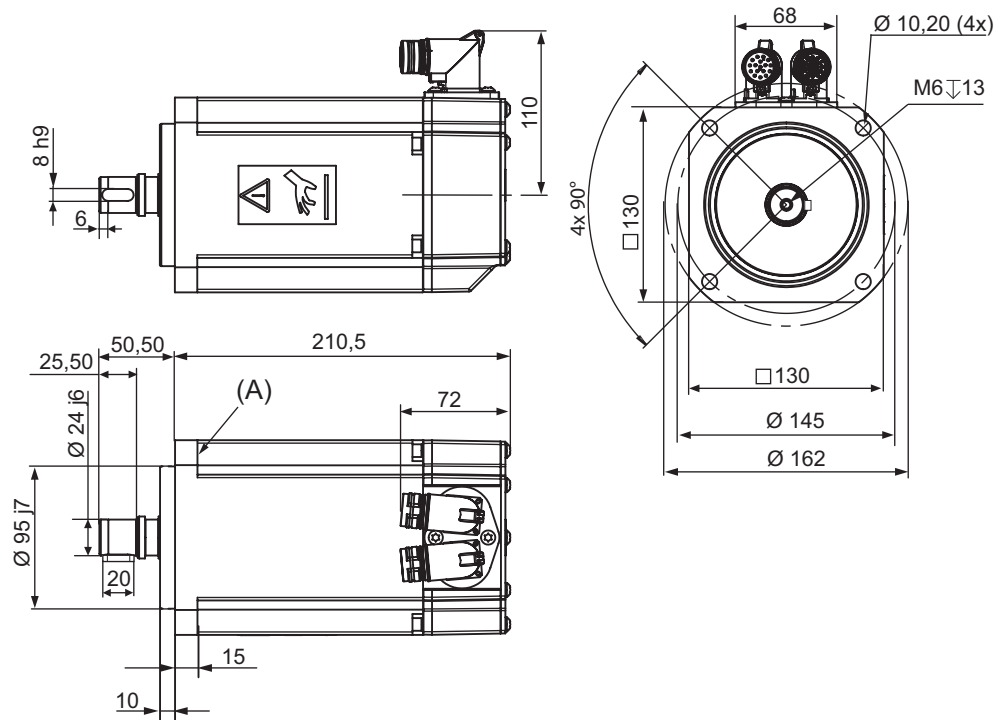
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1 Description

1.3.2 Dimensions

Continued

MU 200



xx110000099

Rs	Description	Tightening torque [Nm] ±10%
A	The thread in the mounting holes in the motor flange are intended for disassemble of the motor, by removing the fixing screws and inserting a screw to press the motor out. Holes in motor flange M 12, free diameter Ø 10.2 mm. Mounting screw M 8 (quality 8.8), max. washer Ø 17 mm.	24

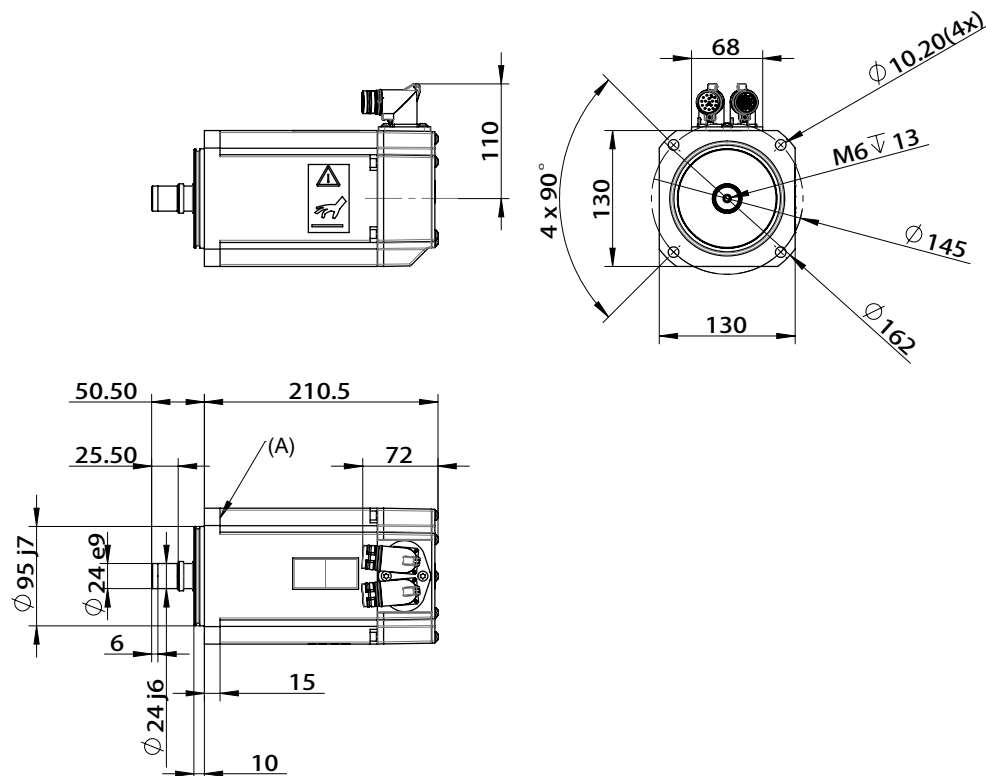
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1 Description

1.3.2 Dimensions

Continued

Smooth shaft adaptor



xx170000812

Rs	Description	Tightening torque [Nm] ±10%
A	The smooth shaft adaptor has a smooth surface without a keyhole slot. The diameter and the length are the same as the standard shaft adaptor with keyhole slot. The purpose of removing the keyhole slot is to meet the requirements from some integrators who prefer this design. This option is for the moment only available for MU 200.	24

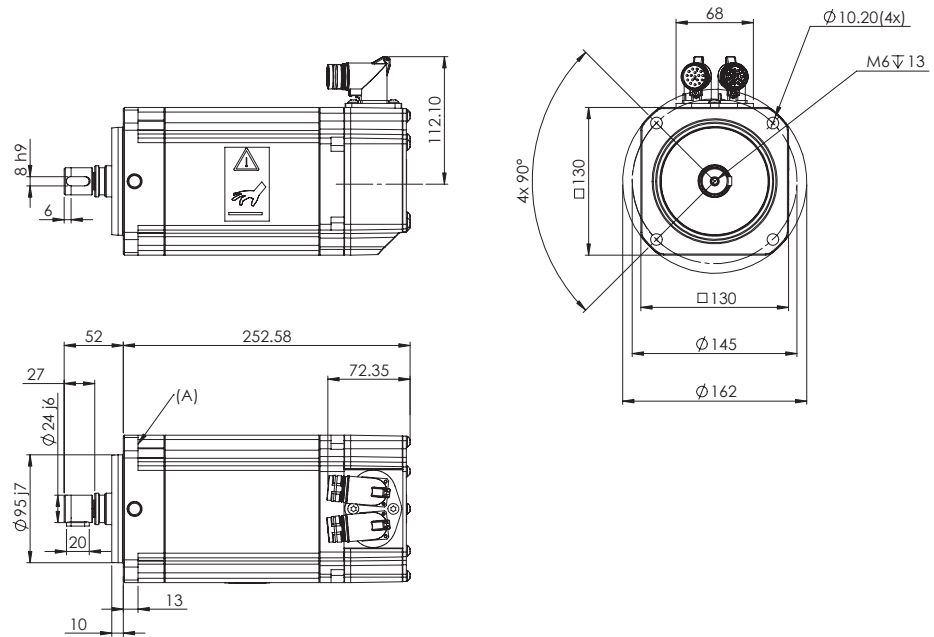
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1 Description

1.3.2 Dimensions

Continued

MU 250



xx170000042

Rs	Description	Tightening torque [Nm] ±10%
A	The thread in the mounting holes in the motor flange are intended for disassemble of the motor, by removing the fixing screws and inserting a screw to press the motor out. Holes in motor flange M 12, free diameter Ø 10.2 mm. Mounting screw M 8 (quality 8.8), max. washer Ø 17 mm.	11.8

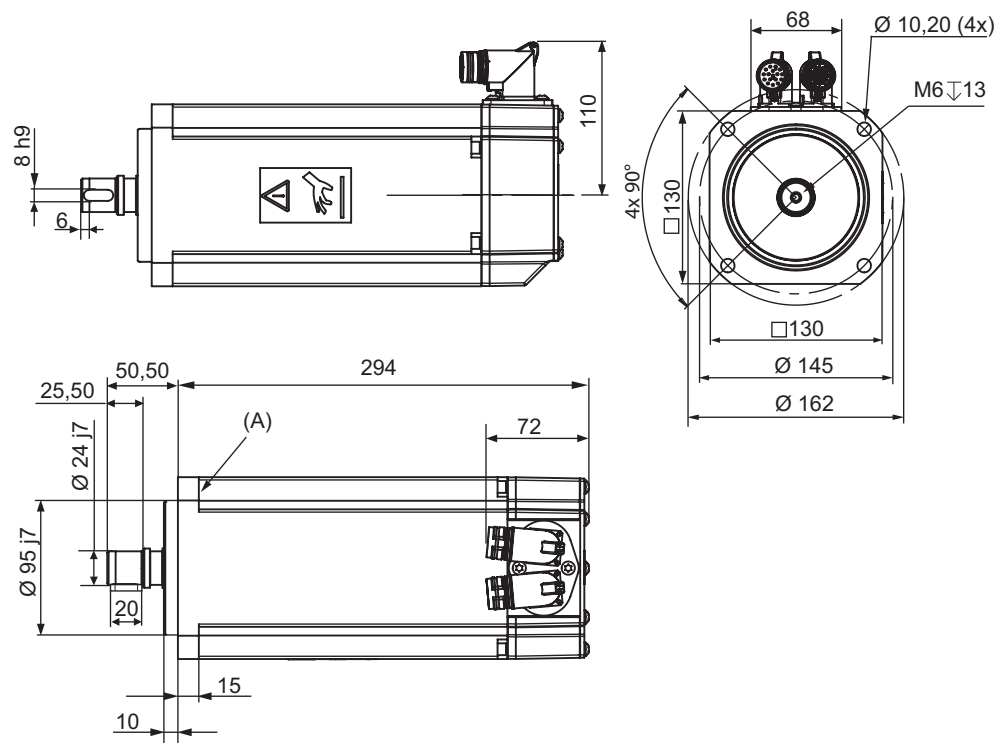
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1 Description

1.3.2 Dimensions

Continued

MU 300



xx110000100

Rs	Description	Tightening torque [Nm] ±10%
A	<p>The thread in the mounting holes in the motor flange are intended for disassemble of the motor, by removing the fixing screws and inserting a screw to press the motor out. Holes in motor flange M 12, free diameter Ø 10.2 mm.</p> <p>Mounting screw M 8 (quality 8.8), max. washer Ø 17 mm.</p>	24

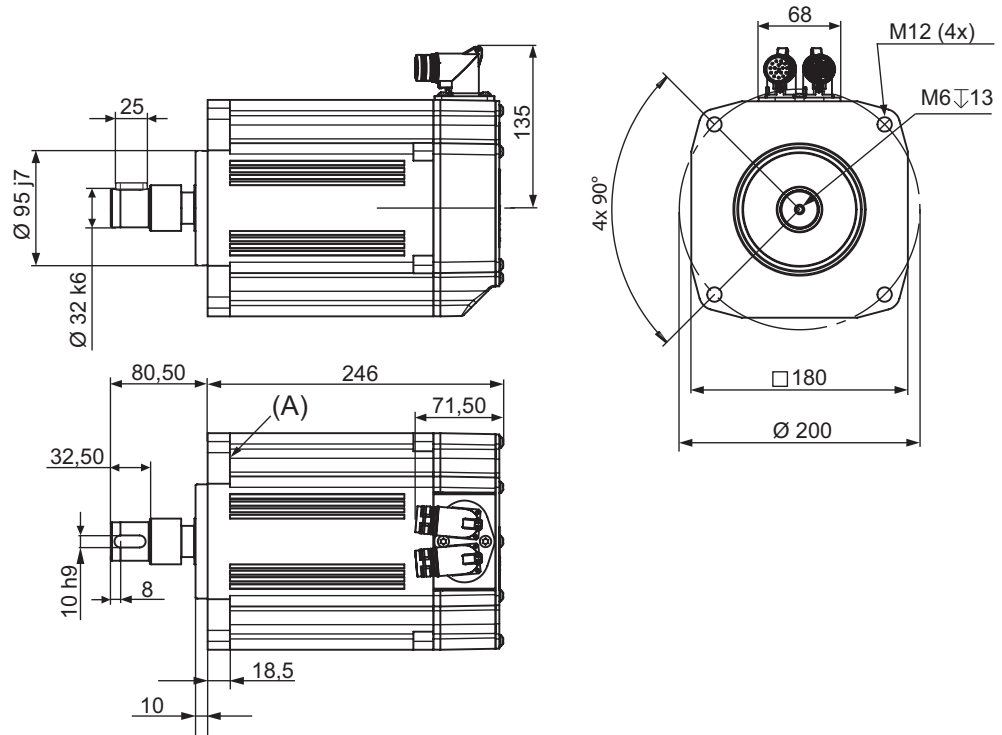
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1 Description

1.3.2 Dimensions

Continued

MU 400



xx1100000101

Rs	Description	Tightening torque [Nm] ±10%
A	The thread in the mounting holes in the motor flange are intended for disassemble of the motor, by removing the fixing screws and inserting a screw to press the motor out. Holes in motor flange M 12, max. washer Ø 21 mm.	47

1.3.3 Technical data

Technical data

Parameter	MU 80	MU 100	MU 200	MU 250	MU 300	MU 400
Minimum suitable bus voltage in IRC5 (V DC) ⁱ	280	280/453	280/453	280/453	280/453	280/453
N _{nom} : nominal speed (rpm)	6,000	3,300	5,000	4,750	5,000	4,700
N _{rms} : speed @ rms torque (rpm)	3,000	1,650	2,000	1,800	2,000	1,880
T ₀ : Low speed torque 0 to 10 rpm (Nm) ⁱⁱ	0.96	1.5	7	13	17	26
T _{rms} : torque @ rms speed (Nm) ⁱⁱ	0.96	1.4	6.4	12	12.5	20
T _{nom} : torque @nominal speed (Nm) ⁱⁱ	0.96	1.0	1.0	2	2.6	10
T _{acc} : max dynamic torque (Nm) (Torque absolute max)	2.5	4.3	14 ⁱⁱⁱ	28 ^{iv}	35 ^v	50 ^{vi}
K _t : torque constant (Nm/A) ^{vii}	0.39	0.453	0.76	1.11	0.967	1.17
i _{Max} (A)	8.7	11	30.5	39.3	58	68.4
Temp max: max allowed average winding temperature (deg C)	140	140	140	140	140	140
Temp amb: allowed ambient temperature (deg C)	-5 to 55	0 to +52	0 to +52	0 to +52	0 to +52	0 to +52
J _{tot} : total inertia motor unit (kgm ²)	0.36x10 ⁻⁴	0.8x10 ⁻⁴	7.5x10 ⁻⁴	10.74x10 ⁻⁴	16.6x10 ⁻⁴	49.3x10 ⁻⁴
m: mass (kg)	1.37	4.4	10.3	13.2	15	27
Sealing class: IP rating acc. to IEC529	IP 40	IP 67	IP 67	IP 67	IP 67	IP 67

- ⁱ The minimum suitable DC bus voltage affects the available torque at high speed.
- ⁱⁱ During normal conditions. If ambient temperature > 40 degrees C, or poor cooling conditions, reductions may apply.
Conversion factor if the ambient temperature is higher than 40 degrees C:
- Ambient temperature = 45 degrees C => 0.97
 - Ambient temperature = 52 degrees C => 0.94
- ⁱⁱⁱ The value in the template configuration file is 7.5. See *Product manual - Motor Units and Gear Units*.
- ^{iv} The value in the template configuration file is 14. See *Product manual - Motor Units and Gear Units*.
- ^v The value in the template configuration file is 17.5. See *Product manual - Motor Units and Gear Units*.
- ^{vi} The value in the template configuration file is 25. See *Product manual - Motor Units and Gear Units*.
- ^{vii} Nominal value. Variations (from +5% to -20%) due to tolerances, winding temperature, and other factors may apply.

Brake data

Brake data	MU 80	MU 100	MU 200	MU 250	MU 300	MU 400
T _{brake min} : minimum brake torque (Nm)	0.8	0.7	7.3	11.8	15	24
T _{brake max} : maximum brake torque (Nm)	2	1.4	17	25	30	60
Brake voltage: brake voltage requirement (V DC)	24±10%	24±10%	24±10%	24±10%	24±10%	24±10%
Brake power consumption (W)	<12	8	<22	<28	<28	<34
Max inertia: max allowed load inertia at N _{nom} (kgm ²) ⁱ	0.64	0.0031	0.036	0.036	0.036	0.035

- ⁱ Warning! This represents the maximum brake energy that the brake is tested for.

1 Description

1.3.4 Performance diagrams

1.3.4 Performance diagrams

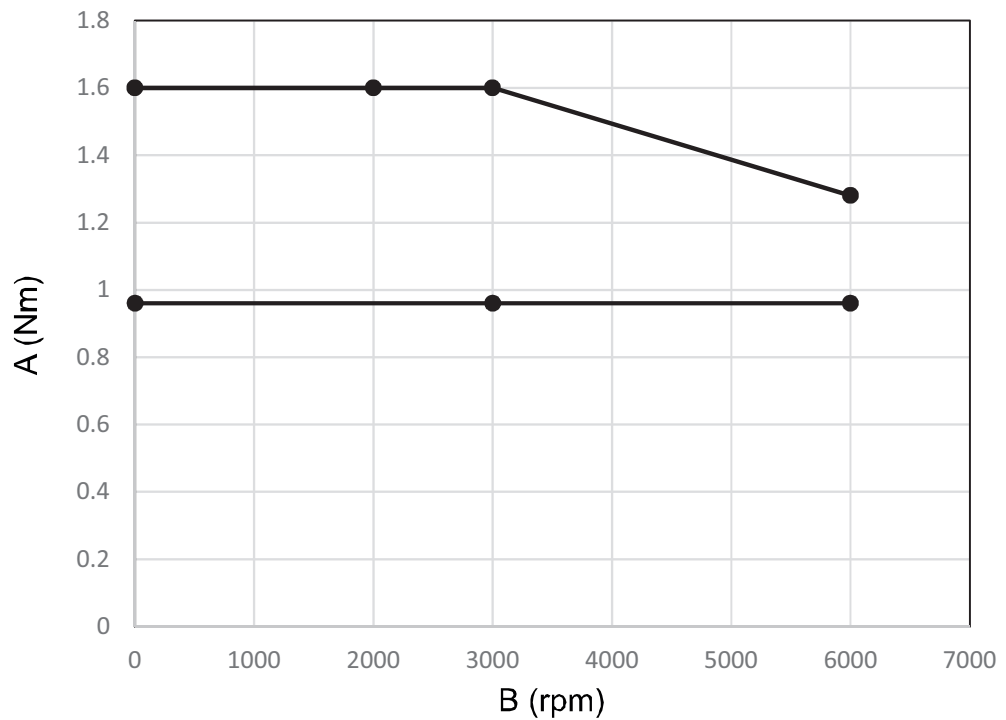
Introduction

The following diagrams shows the torque curve for the motor units.

Below is a list of required DC Link for each robot:

Type of DC Link	Robot
High voltage DC Link	IRB460, IRB660, IRB4600, IRB66X0, IRB6700, IRB7600
Low voltage DC Link	IRB120, IRB140, IRB360, IRB1200, IRB1400, IRB1520, IRB1600, IRB2400, IRB2600, IRB4400

MU 80

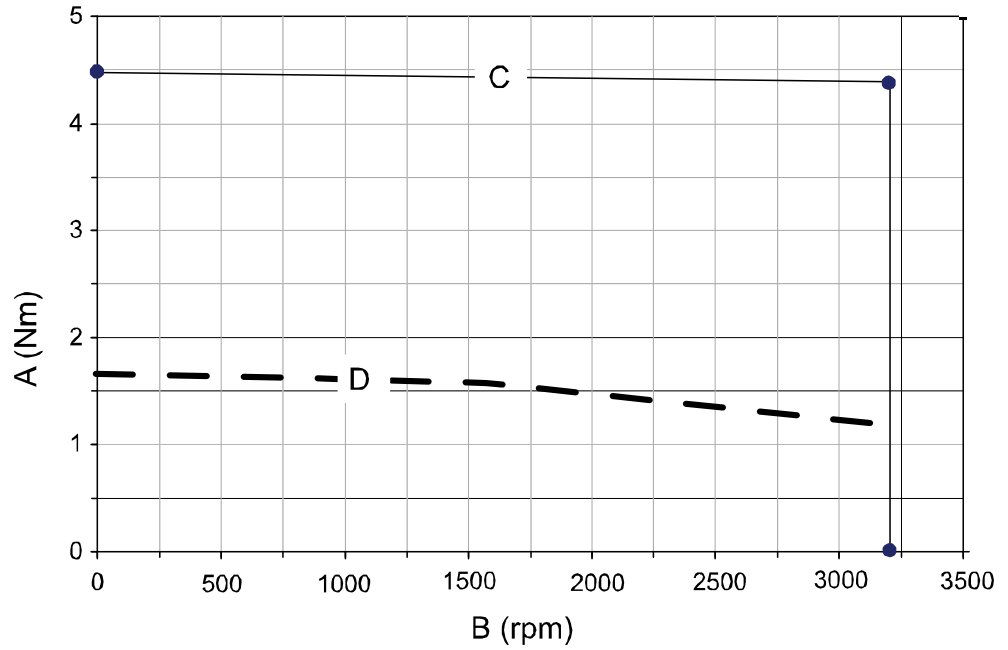


xx1700001336

Pos	Description
A	Motor torque
B	Motor speed
C	Acceleration Torque LV
D	Constant Torque

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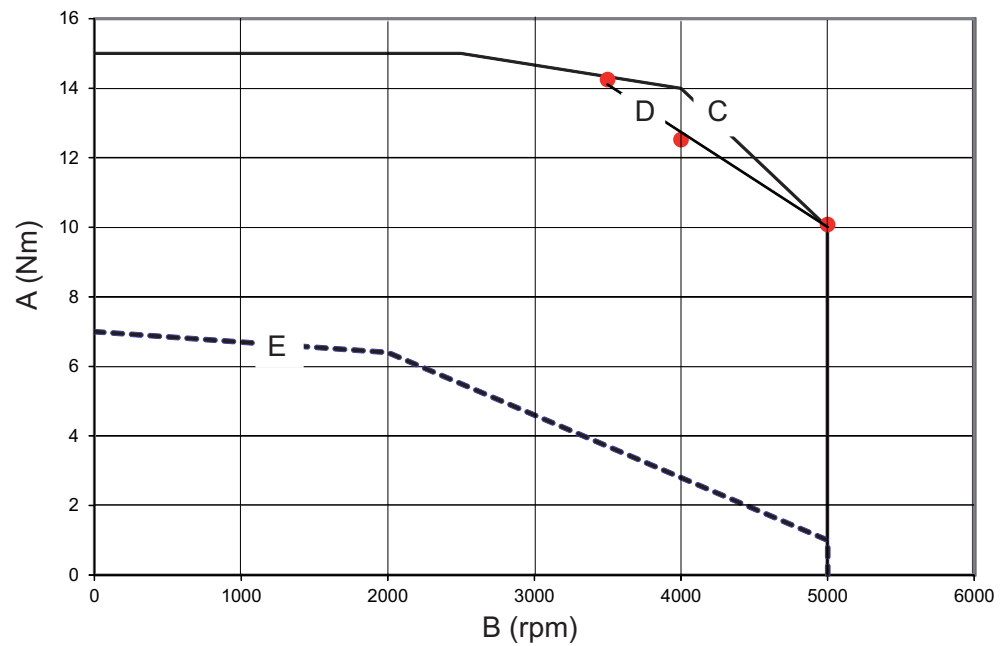
MU 100



xx1000001219

Pos	Description
A	Motor torque
B	Motor speed
C	T _{acc} = torque at acceleration
D	T _{average} = average torque

MU 200



xx1000001220

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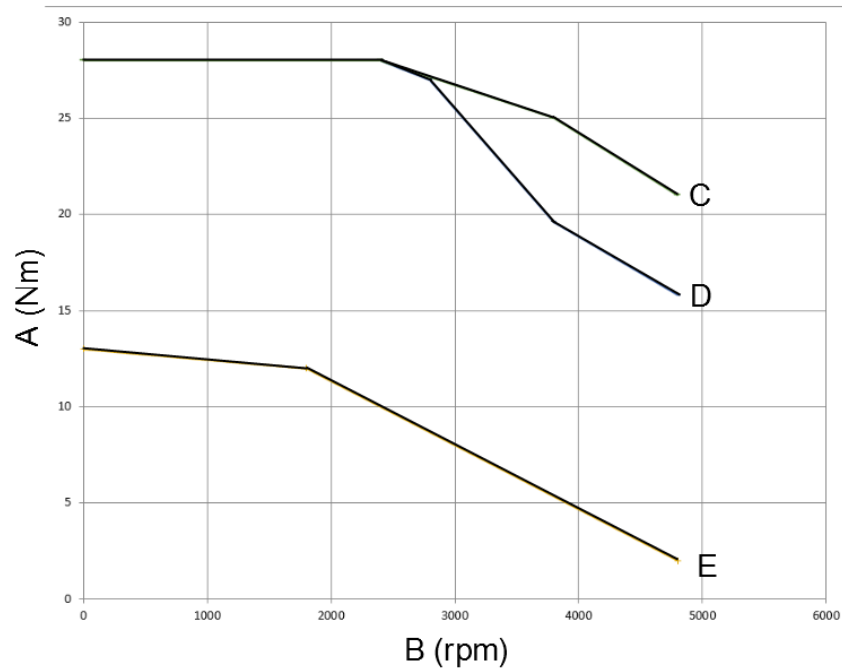
1 Description

1.3.4 Performance diagrams

Continued

Pos	Description
A	Motor torque
B	Motor speed
C	T_{acc} = torque at acceleration
D	T_{acc} = torque at acceleration for low voltage DC-link
E	$T_{average}$ = average torque

MU 250

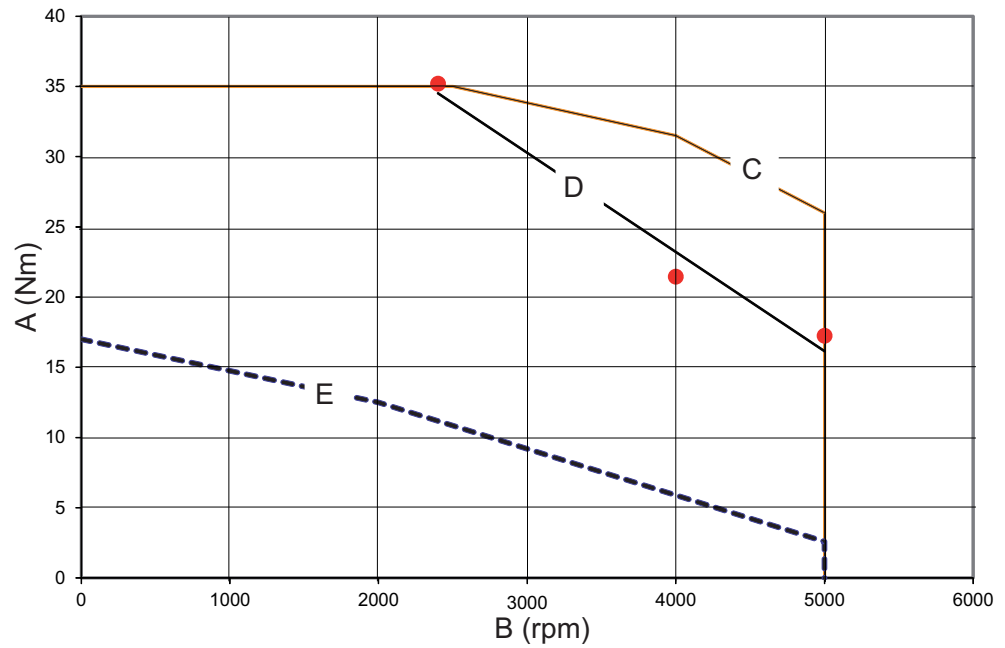


xx170000043

Pos	Description
A	Motor torque
B	Motor speed
C	Torque at acceleration for high voltage DC link
D	Torque at acceleration for low voltage DC link
E	Constant torque

Continues on next page

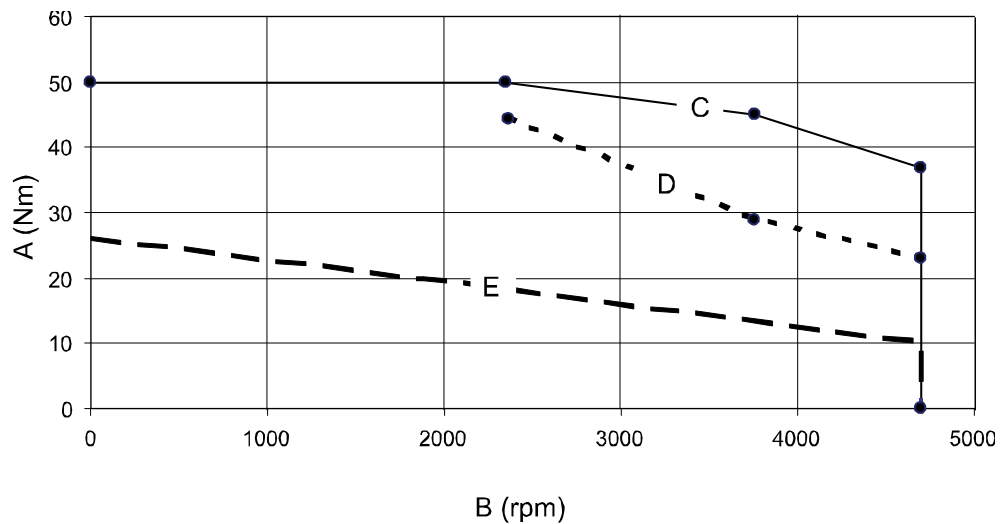
MU 300



xx1000001221

Pos	Description
A	Motor torque
B	Motor speed
C	T_{acc} = torque at acceleration
D	$T_{average}$ = average torque

MU 400



xx1000001222

Pos	Description
A	Motor torque

Continues on next page

1 Description

1.3.4 Performance diagrams

Continued

Pos	Description
B	Motor speed
C	T_{acc} = torque at acceleration
D	T_{acc} = torque at acceleration for low voltage DC-link
E	$T_{average}$ = average torque

1.3.5 Permissible loads at motor shaft

Introduction

The following section provides information regarding permissible loads on the output shaft of the motor units. The loads stated here do not apply to installation or assembly. See *Product manual - Motor Units and Gear Units* for instructions.

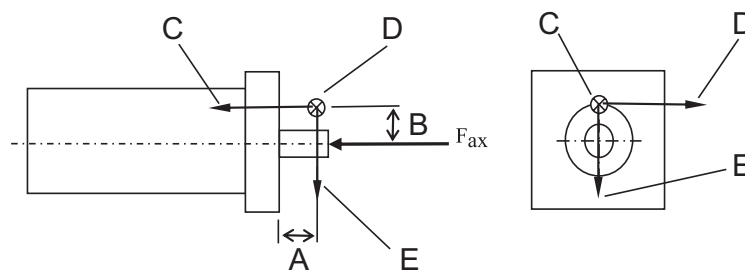


Note

Couplings, pulley, and motor pinion (transmission elements) must be assembled using adequate tools. Otherwise the motor shaft can be distorted which damage the resolver. Never use a hammer, as this will damage the equipment.
Grease the shaft after assembly to avoid oxidation.

Geometry

The graphic below shows the geometry of the motor.



xx170000044

Pos	Description
A	Axial distance between motor flange and load point
B	Radial distance between motor shaft center and load point
C	Axial force
D	Tangential force
E	Radial force

Motor	Load point		Design speed (rpm)	Lifetime (hour)
	Distance A (mm)	Distance B (mm)		
MU 80	40	30	3,000	16,000
MU 100	20	20	1,650	16,000
MU 200	41	8.08	2,000	12,000
MU 250	41	9.49	1,800	12,000
MU 300	43	10.8	1,800	12,000
MU 400	50	22	1,850	12,000

Continues on next page

1 Description

1.3.5 Permissible loads at motor shaft

Continued

Loads

Design load

The design load is calculated based on bearing life.

	Axial force (N)	Tangential force (N)	Radial force (N)
MU 80	78	32	123
MU 100	60	130	60
MU 200	321	871	400
MU 250	516	1,391	670
MU 300	539	1,454	700
MU 400	474	1,279	558

Peak load

The peak load is calculation of motor shaft.

	Axial force (N)	Tangential force (N)	Radial force (N)
80	122	50	126
MU 100	N/A	N/A	N/A
MU 200	616	1,671	766
MU 250	985	2,656	1,279
MU 300	1,077	2,910	1,382
MU 400	761	2,052	896

Maximum load

The maximum load is static calculation of shaft, bearing and joints.

	Axial force (N)	Tangential force (N)	Radial force (N)
MU 80	187	77	263
MU 100	125	250	125
MU 200	1,163	3,156	1,447
MU 250	1,759	4,742	2,285
MU 300	1,759	4,742	2,285
MU 400	1,648	4,446	1,940



Note

For load cases with combined axial and radial loads please contact your local ABB organization.

1.3.6 Using the motor unit in direct contact with gearbox oil/grease



WARNING

Oil leakage into motor unit will cause drastic reduction of brake torque. The rotational seal performance and lifetime must be assured in the customer application.

Sealing in the front flange

The motor units has a groove in the front flange for an O-ring sealing.

Recommended sealing:

Motor unit	O-ring inner diameter	Cross section diameter
MU 100	37 mm	3 mm
MU 200, MU 250, MU 300, MU 400	102 mm	3 mm

Sealing on motor shaft

The motor shaft on MU 200/MU 250/MU 300/MU 400 has a rotational sealing that is tested and designed for the following environment:

- Lifetime: 16,000 hours @ n_{rms} speed
- Oil temperature: $< 60^{\circ}\text{C}$
- Gearbox pressure: 0-0.2 bar
- Speed range: 0- n_{nom}
- Oil type: Mineral or Polyglycol based



Note

The MU 100 motor shaft has a rotational sealing, but should not be used in direct contact with gearbox oil/grease.

1 Description

1.4.1 Introduction

1.4 Gear units

1.4.1 Introduction

General

The gear units are available in two variants, five MTD and two MID, for handling loads of 250, 500, 750, 1000, 2000 and 5000 kg (including possible fixture). There is a faceplate fitted on the outgoing shaft of the units. The faceplate has plain holes and guide holes for securing fixtures. The drive equipment for the units is placed in the IRC5 controller.



WARNING

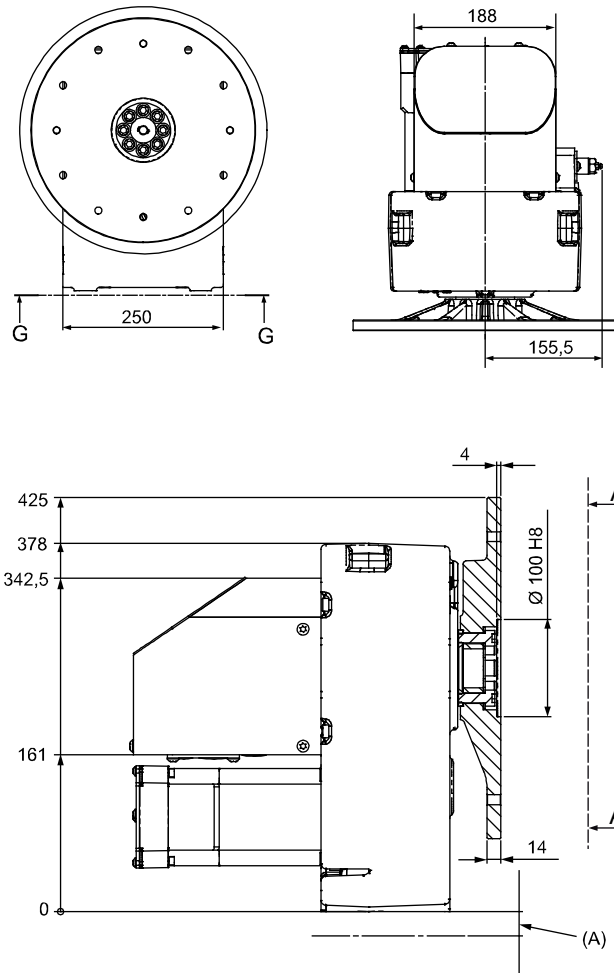
No current selector is available for gear units. Suitable arrangements for avoiding current through the gear units must be taken in installations for welding.

MID 500 and MID 1000

The MID 500 and MID 1000 gear units are equipped with a position indicator switch, that operates via a cam disc on the outgoing shaft. This gives the possibility to indicate the position of the outgoing shaft. The connection is done via a connection block in the controller. For detailed information, see *Product manual - Motor Units and Gear Units*.

1.4.2 Dimensional drawings

MTD 250



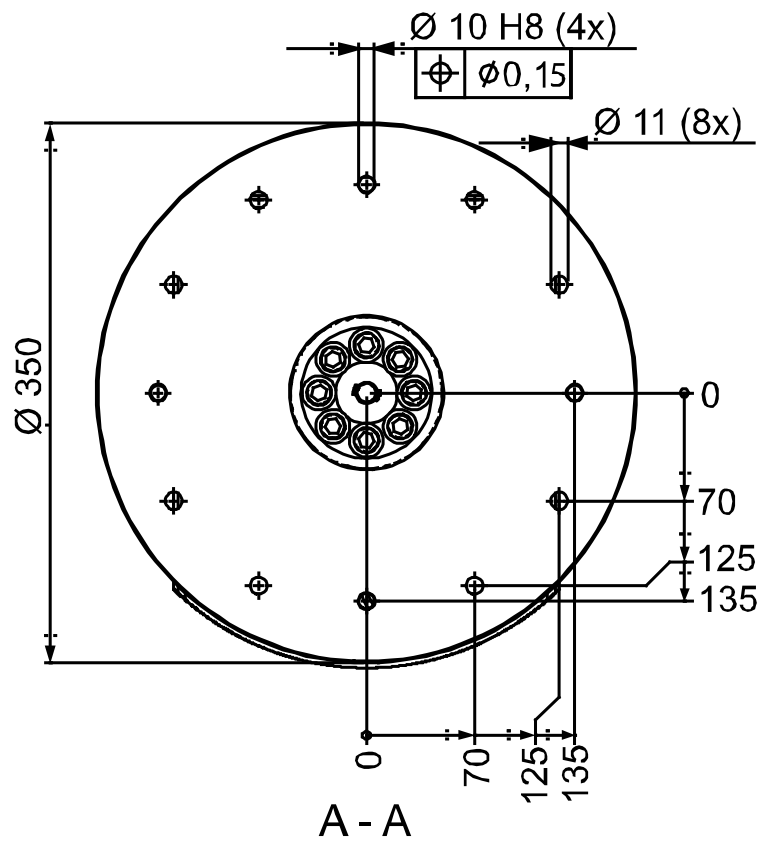
xx1000001244

Continues on next page

1 Description

1.4.2 Dimensional drawings

Continued

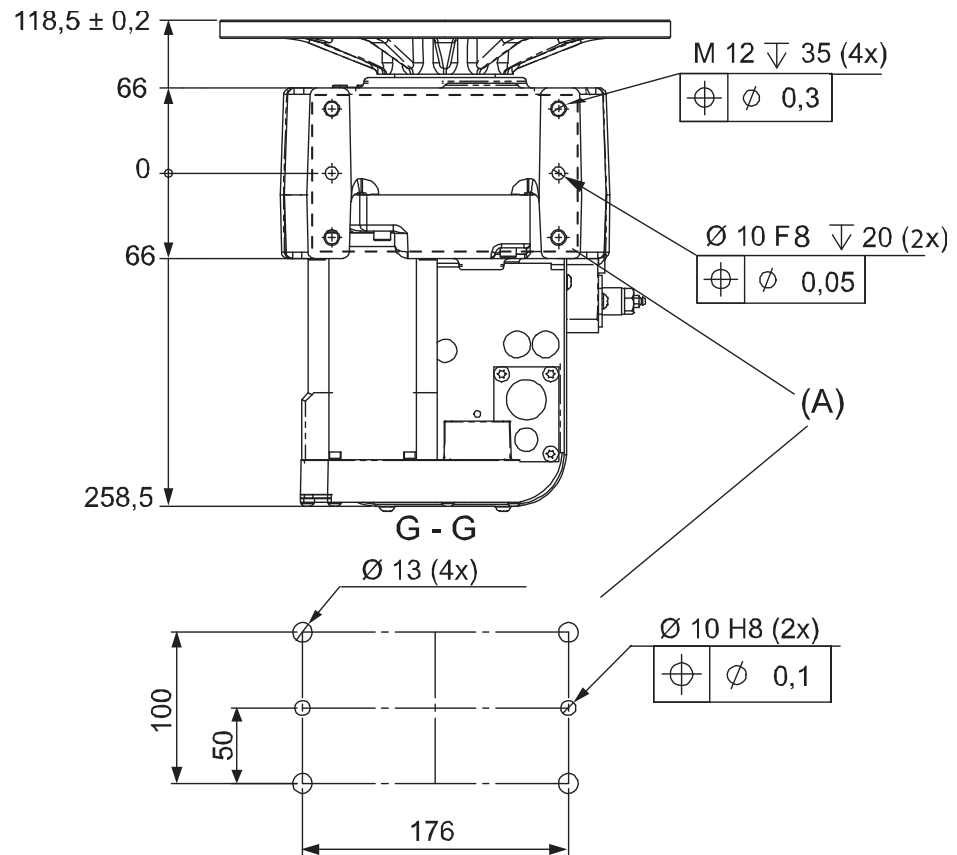


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1 Description

1.4.2 Dimensional drawings Continued



xx100000730



Note

The support collar has the same hole configuration for mounting as the gear unit.

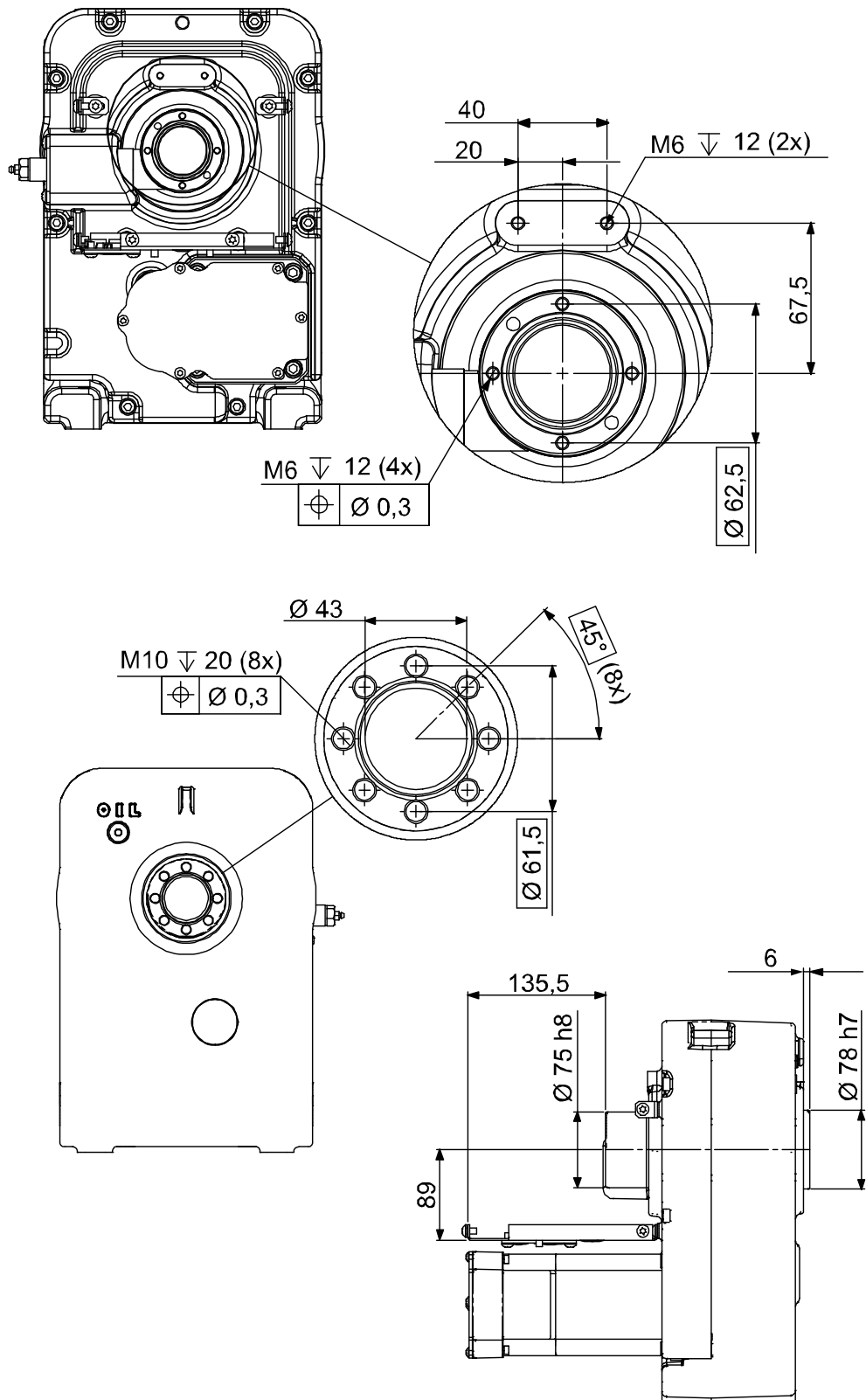
Pos	Description
A	Hole configuration for mounting base

Continues on next page

1 Description

1.4.2 Dimensional drawings

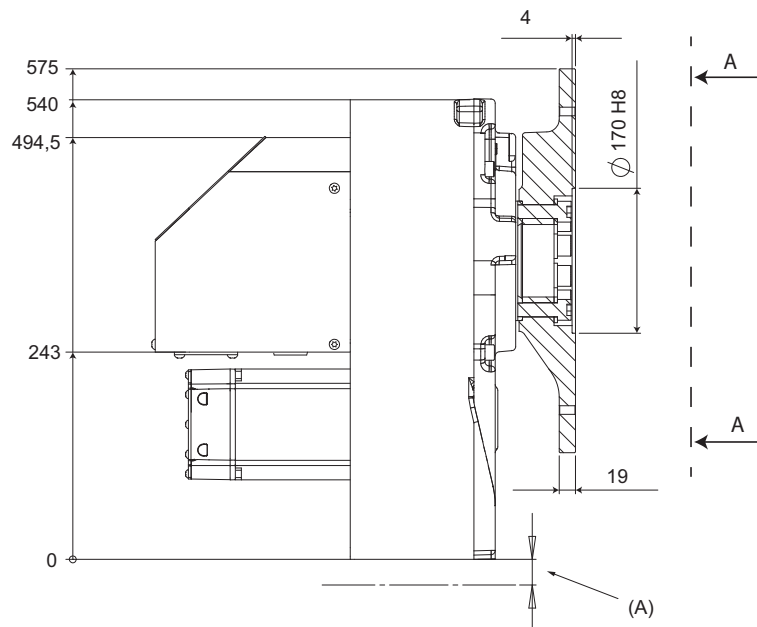
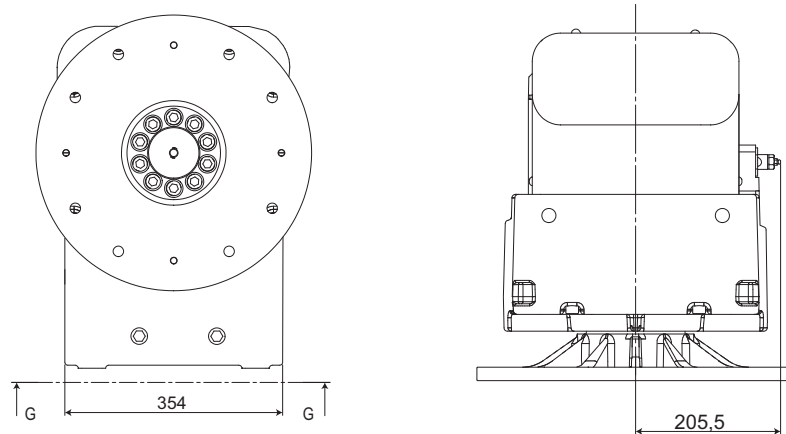
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MTD 500 and MTD 750



xx1000001246

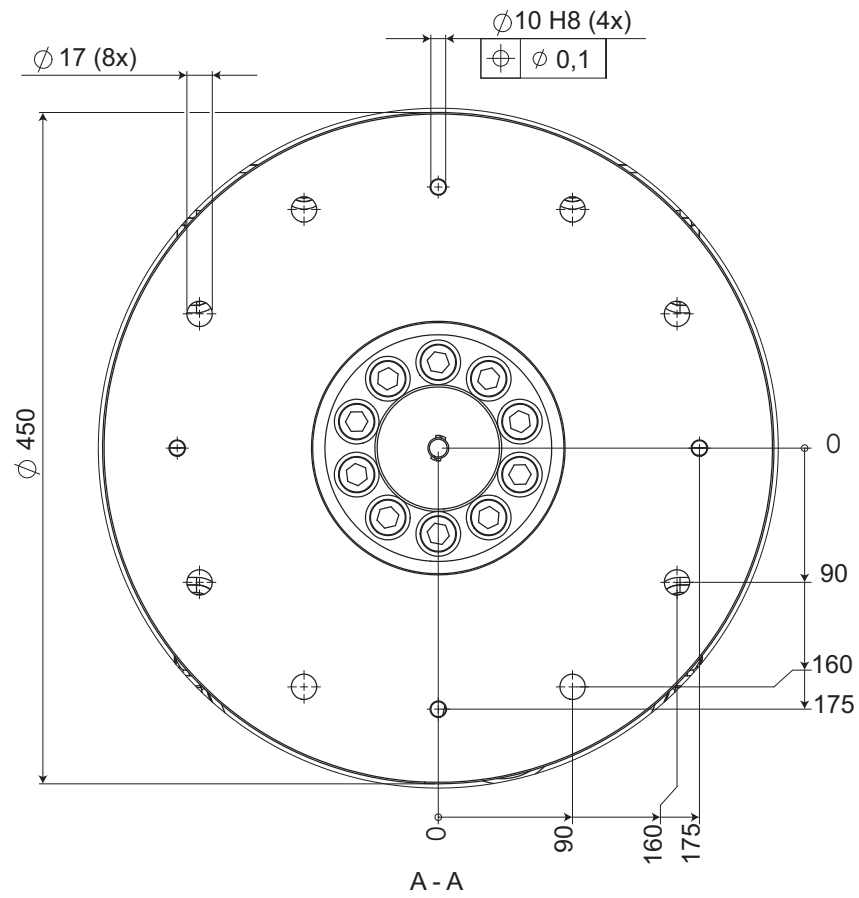
Pos	Description
A	30 mm recommended minimum clamping length

Continues on next page

1 Description

1.4.2 Dimensional drawings

Continued

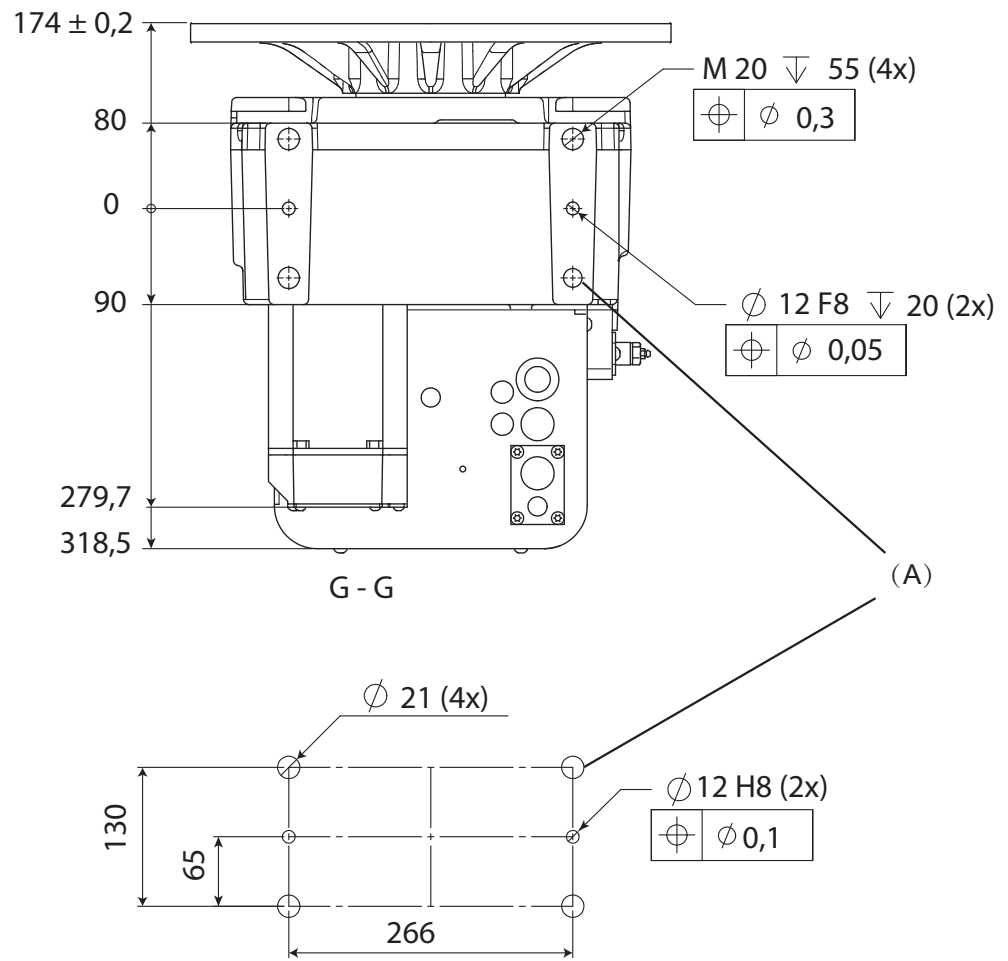


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Continues on next page

1 Description

1.4.2 Dimensional drawings Continued



xx100000735



Note

The support collar has the same hole configuration for mounting as the gear unit.

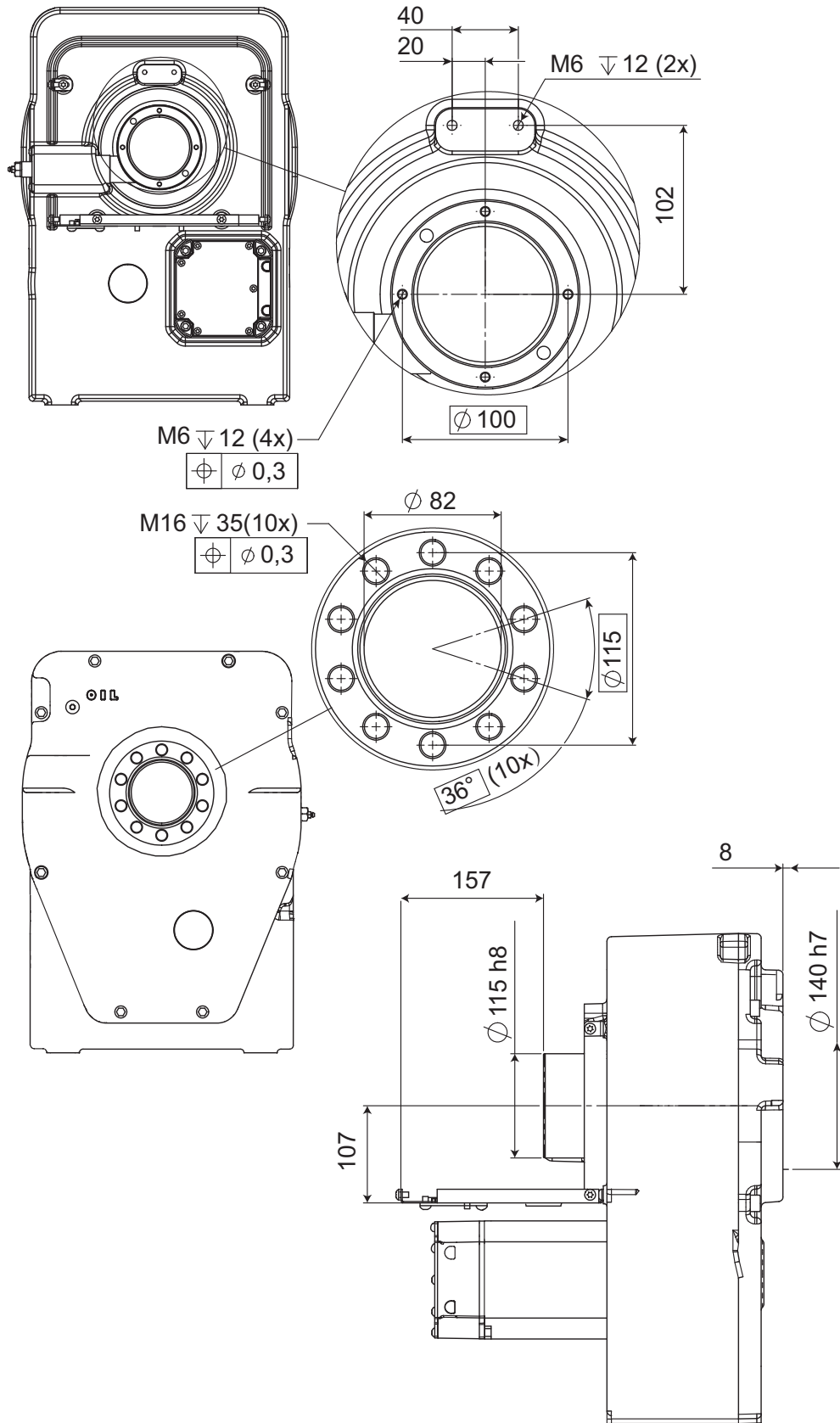
Pos	Description
A	Hole configuration for mounting hole

Continues on next page

1 Description

1.4.2 Dimensional drawings

Continued



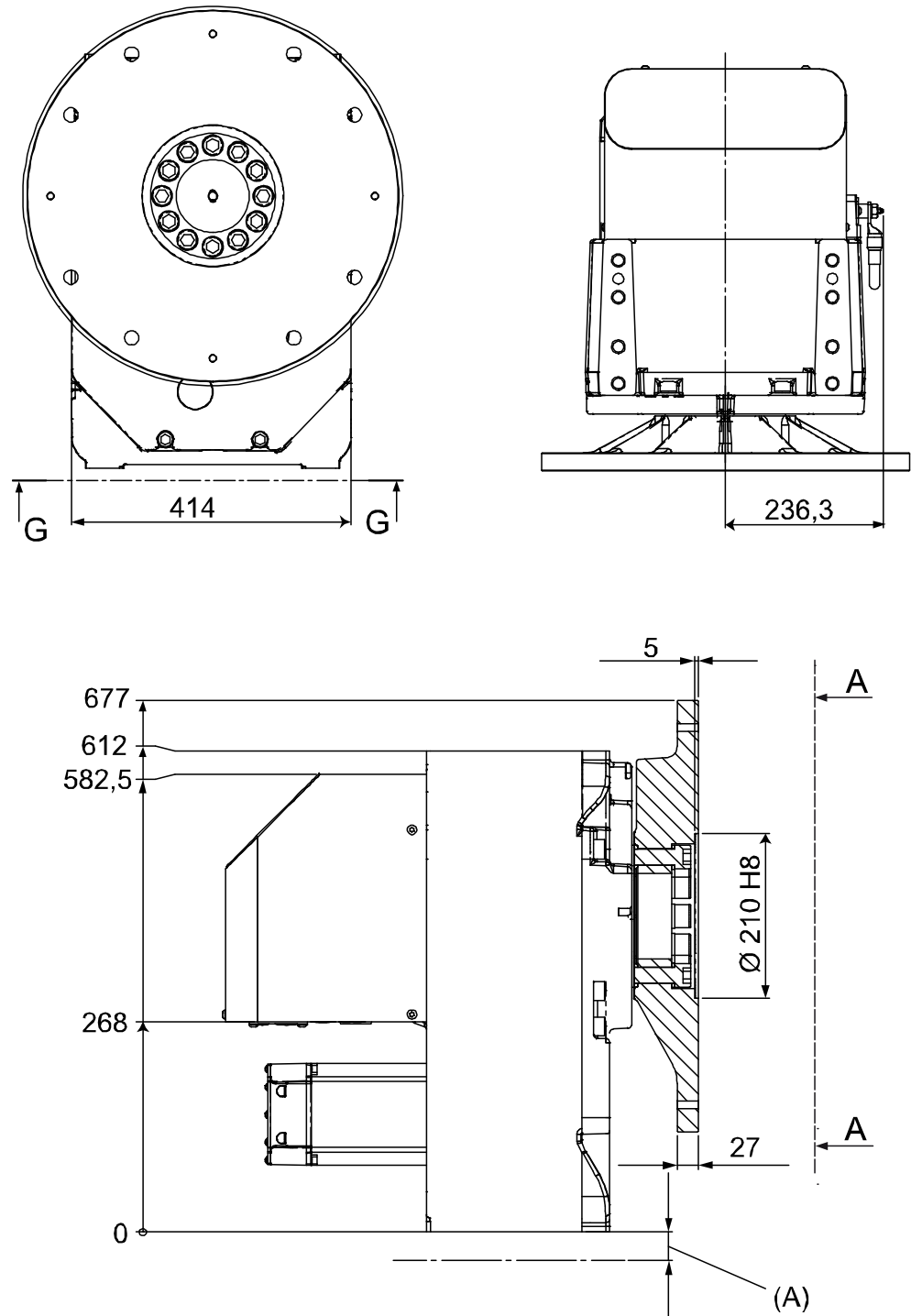
xx1000000736

Continues on next page

1 Description

1.4.2 Dimensional drawings Continued

MTD 2000



xx1000001248

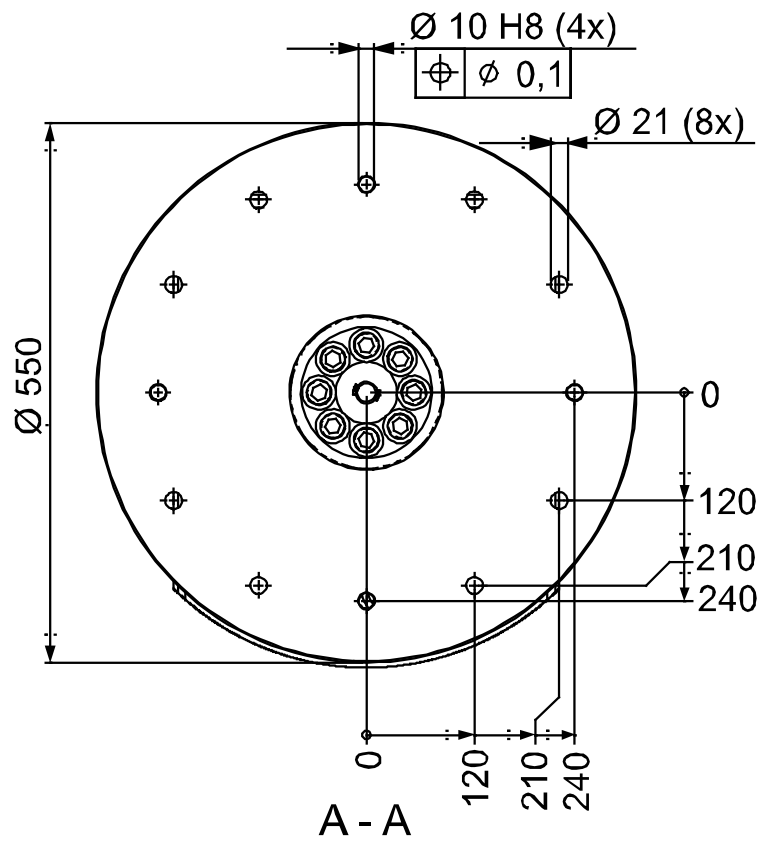
Pos	Description
A	36 mm recommended minimum clamping length

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1 Description

1.4.2 Dimensional drawings

Continued



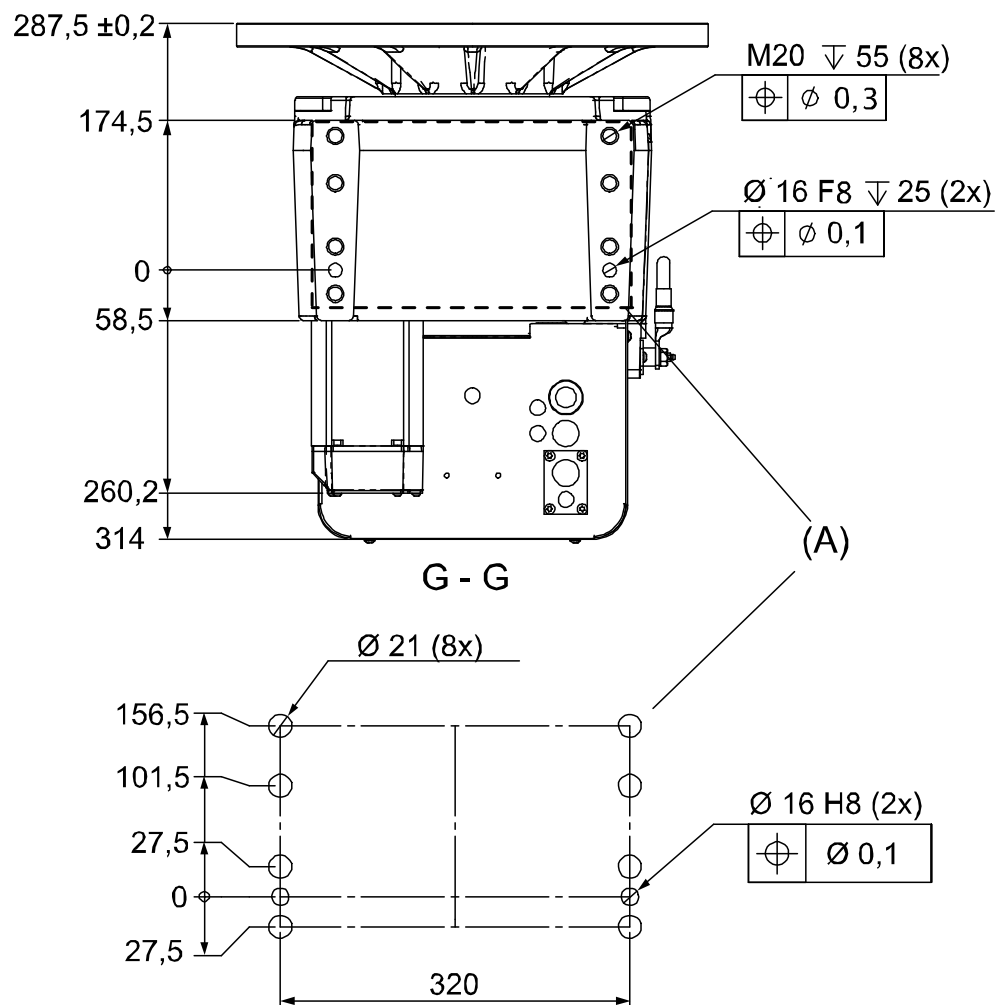
xx1000001247

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1 Description

1.4.2 Dimensional drawings

Continued



xx100000740



Note

The support collar has the same hole configuration for mounting as the gear unit.

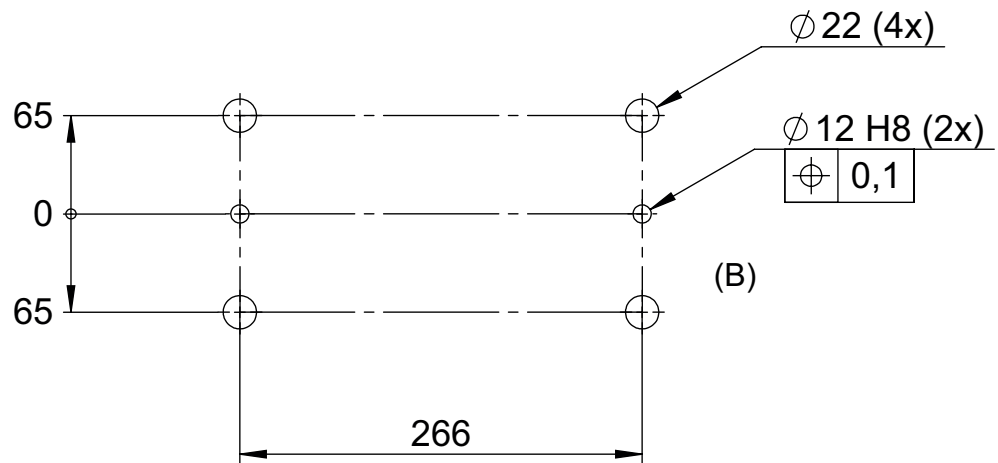
Pos	Description
A	Hole configuration for mounting base

Continues on next page

1 Description

1.4.2 Dimensional drawings

Continued



xx2000002065



Note

The support collar has the same hole configuration as the bearing house.

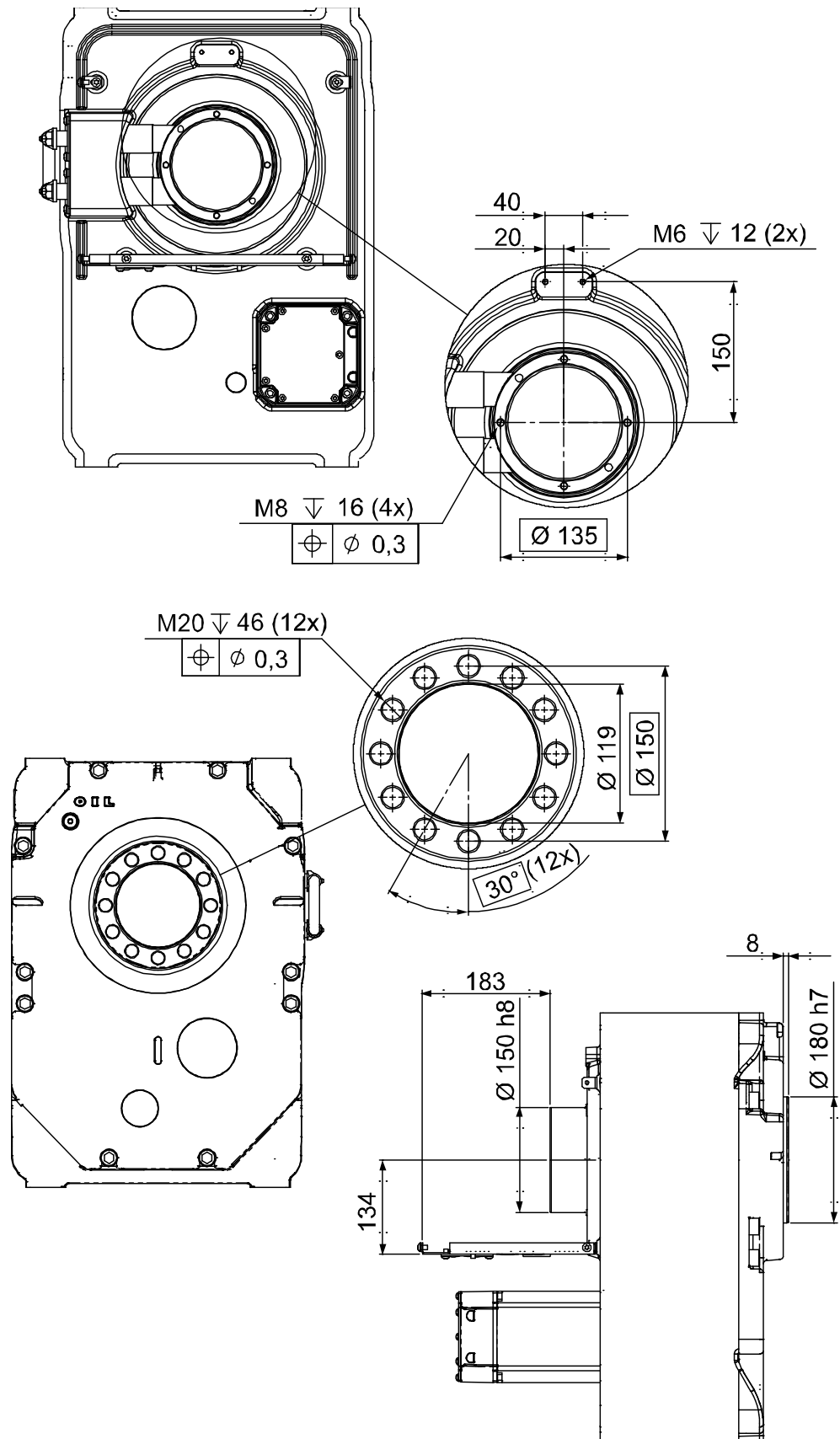
Pos	Description
B	Hole configuration for tailstock.

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1 Description

1.4.2 Dimensional drawings

Continued



xx1000000741

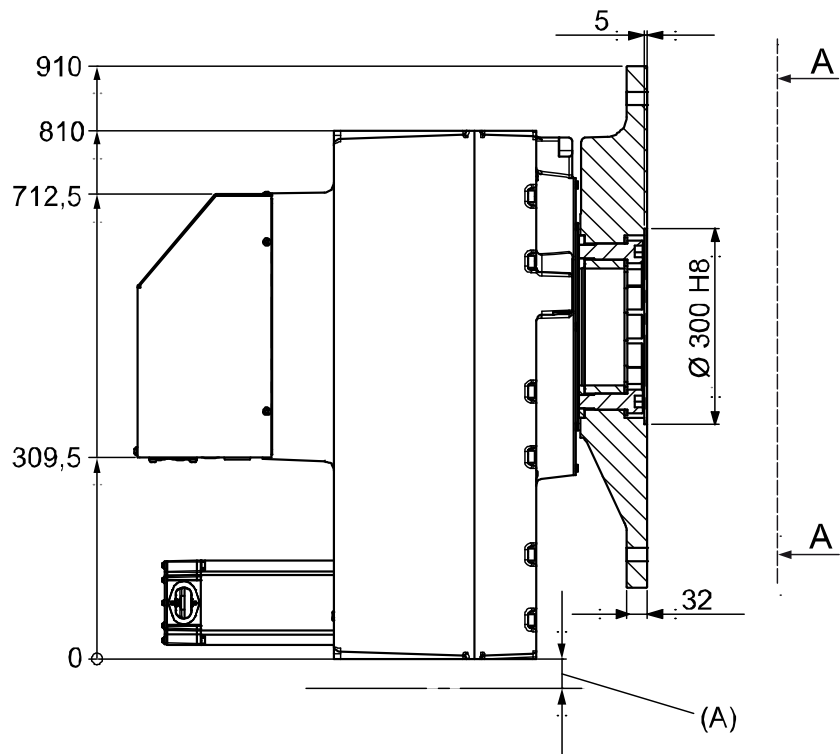
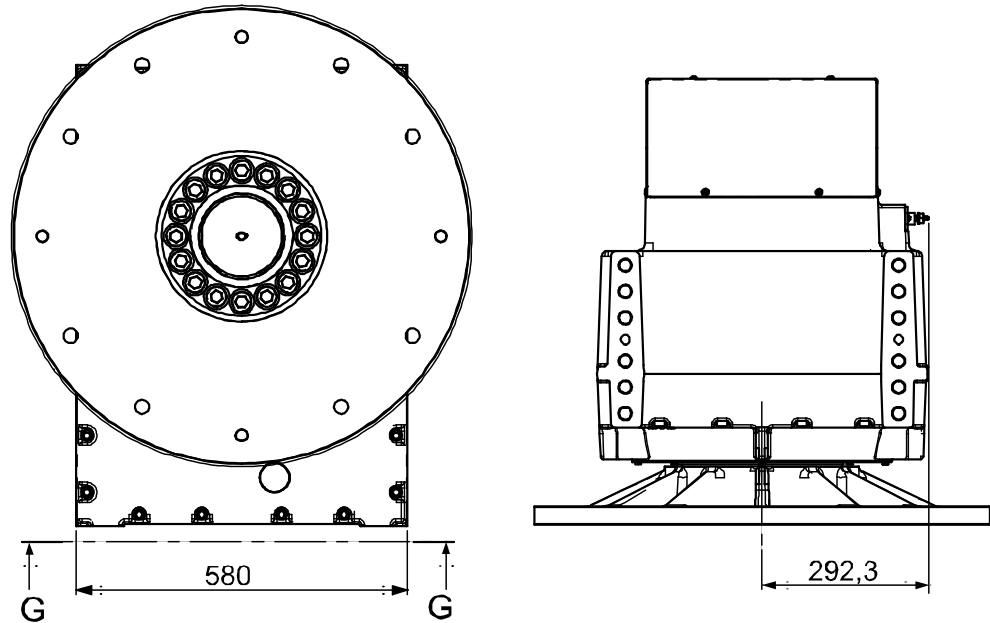
Continues on next page

1 Description

1.4.2 Dimensional drawings

Continued

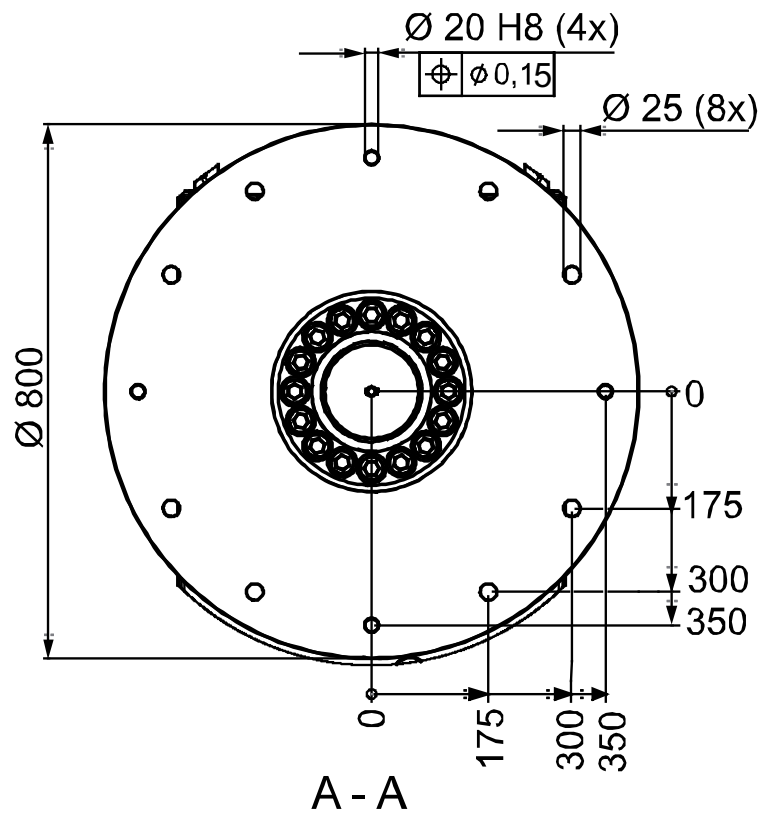
MTD 5000



xx1000001250

Pos	Description
A	46 mm recommended minimum clamping length

Continues on next page



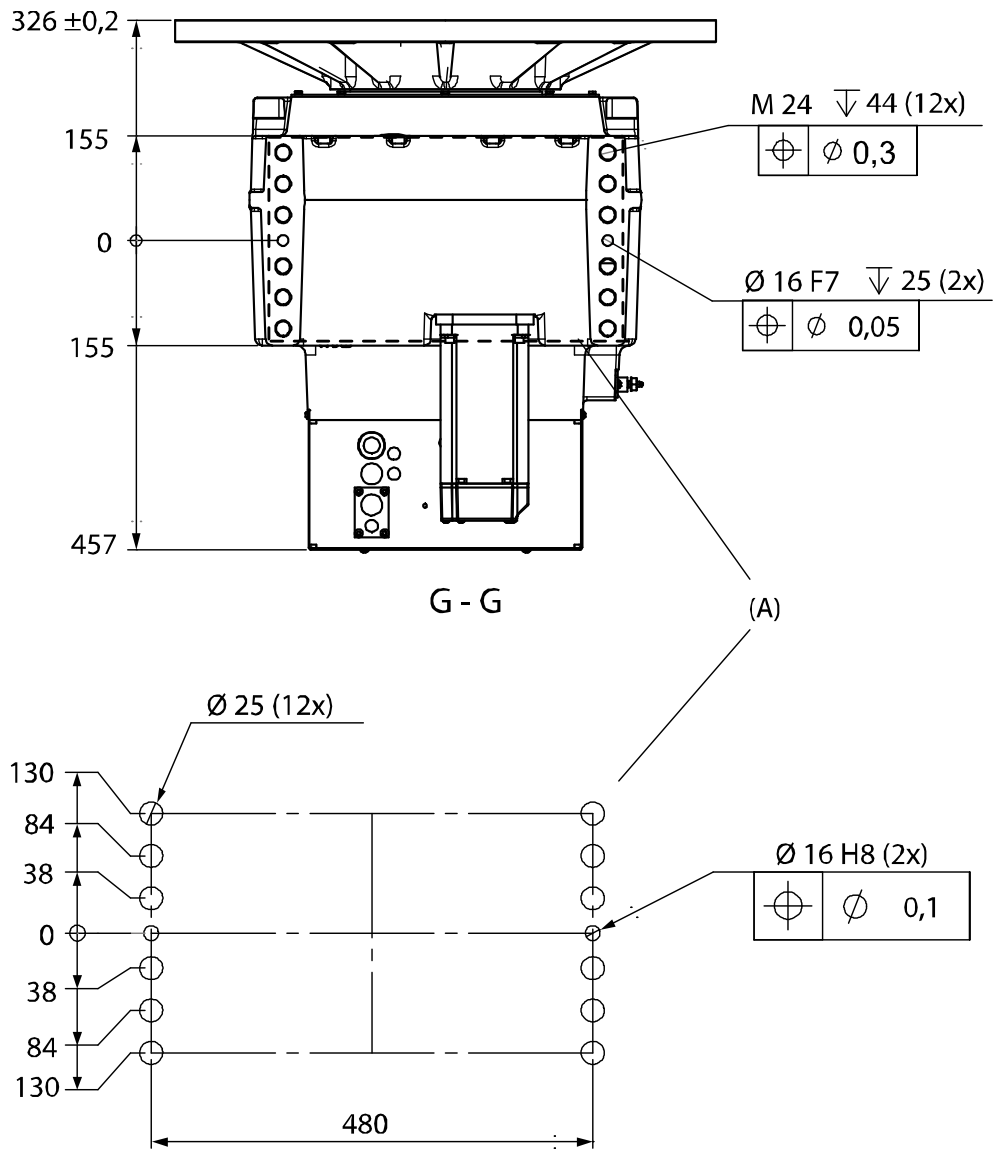
xx1000001249

Continues on next page

1 Description

1.4.2 Dimensional drawings

Continued



xx100000745

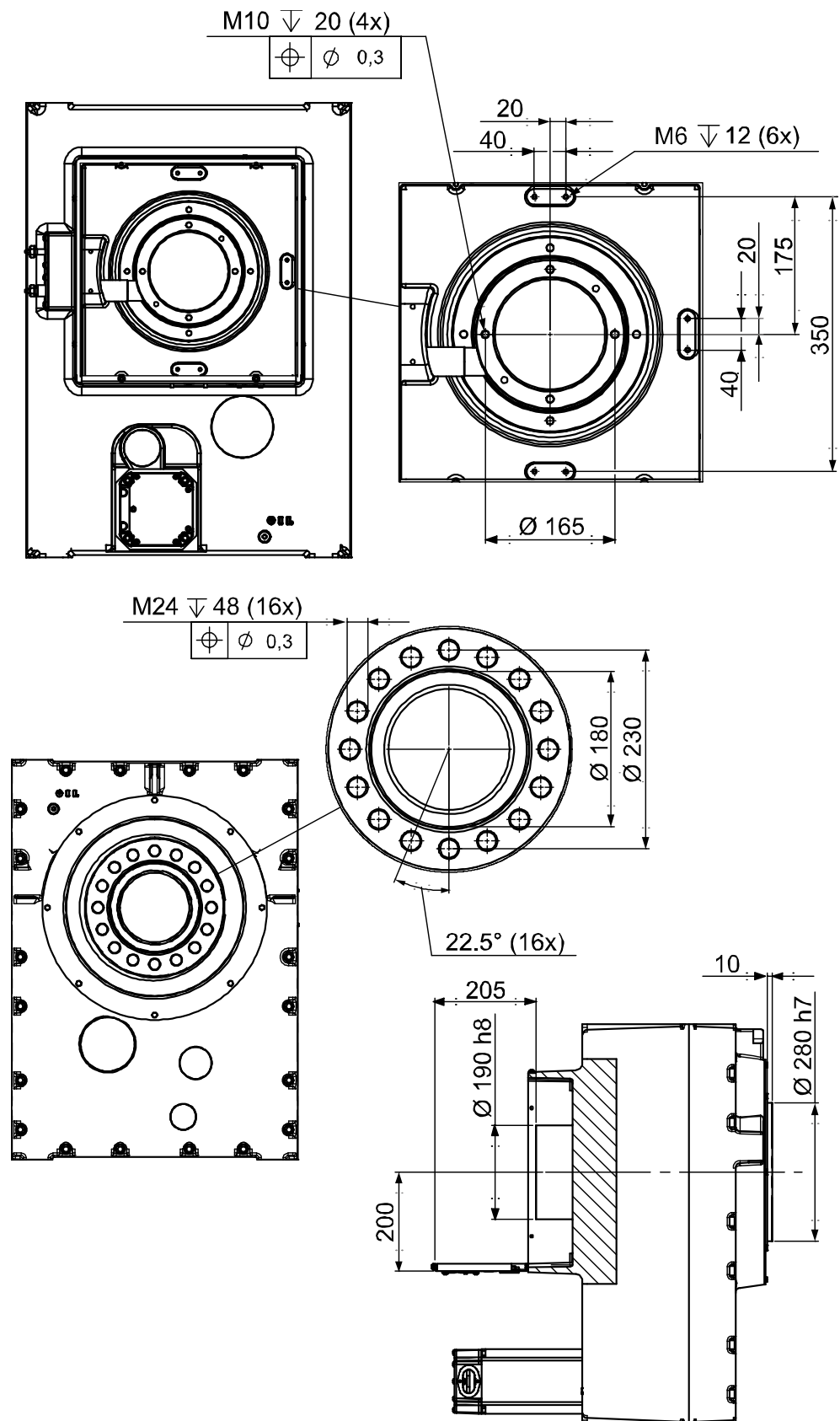
Pos	Description
A	Hole configuration for mounting base.

Continues on next page

1 Description

1.4.2 Dimensional drawings

Continued



xx100000746

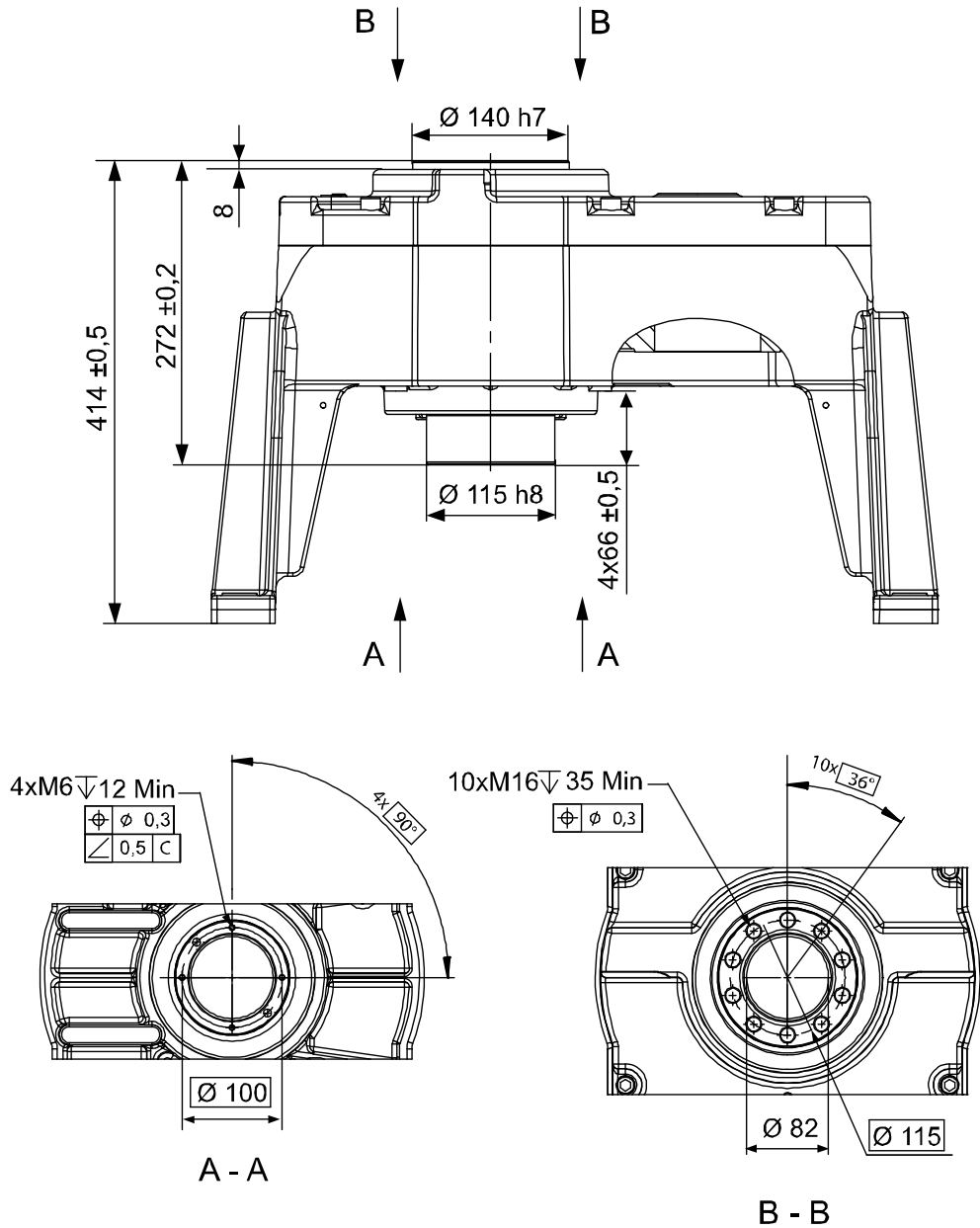
Continues on next page

1 Description

1.4.2 Dimensional drawings

Continued

MID 500



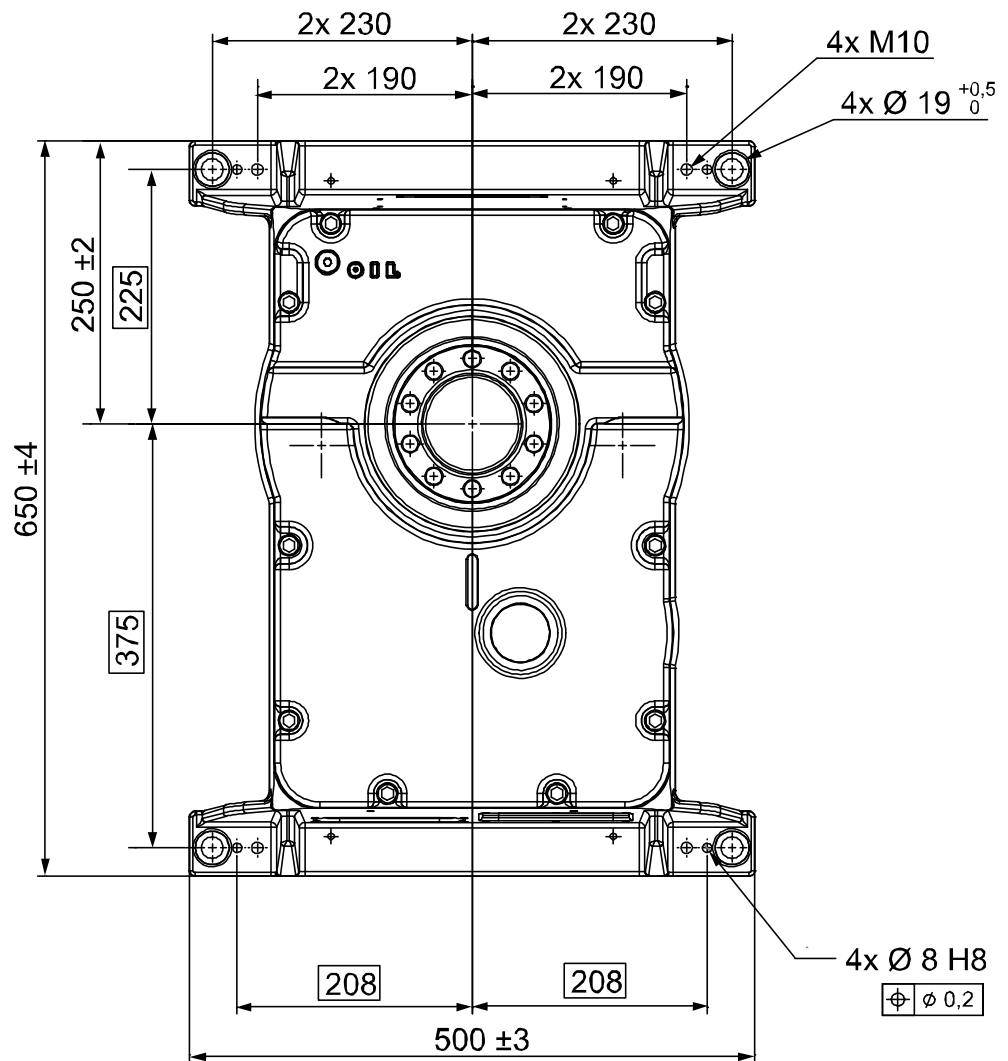
xx110000001

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1 Description

1.4.2 Dimensional drawings

Continued



xx110000002

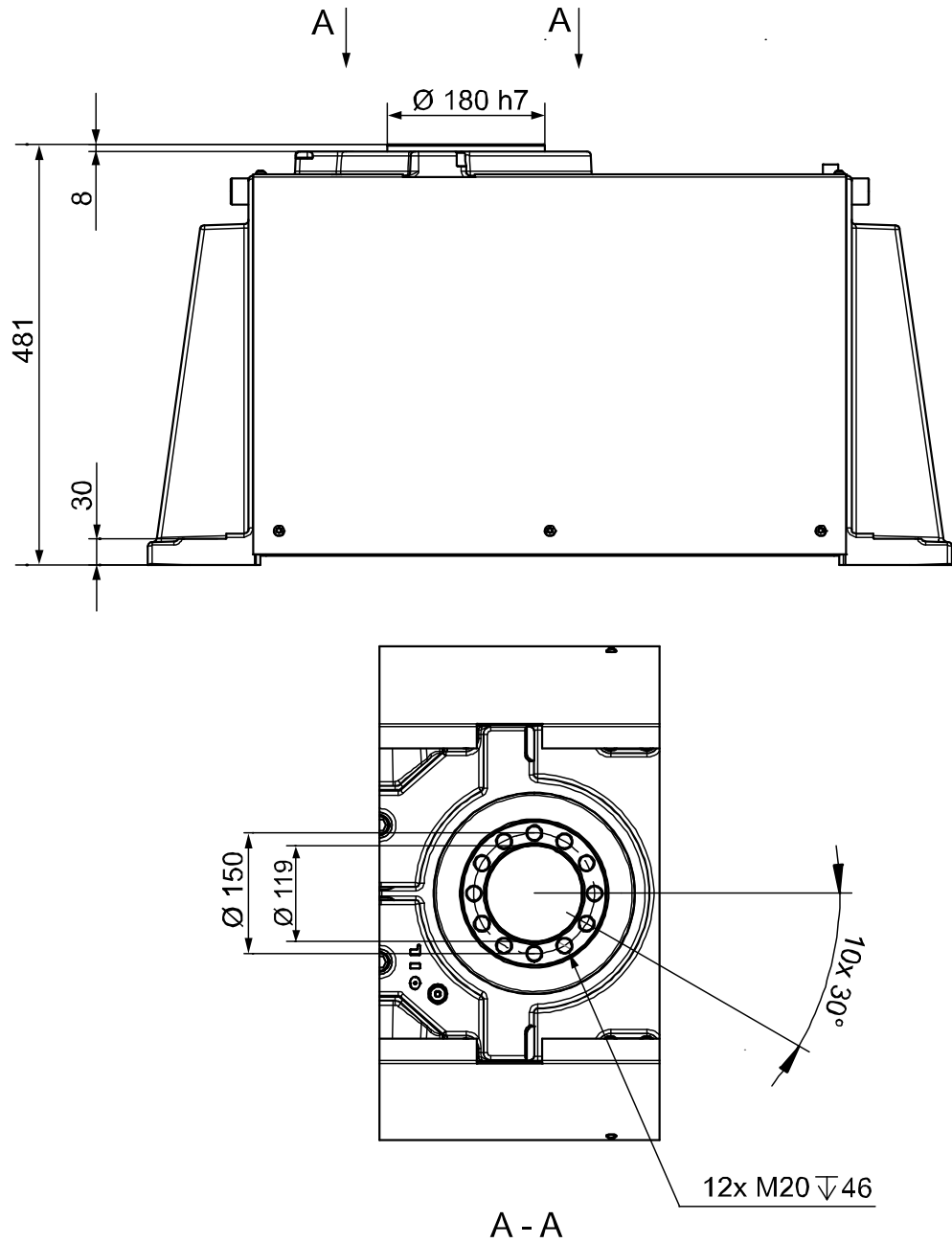
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1 Description

1.4.2 Dimensional drawings

Continued

MID 1000



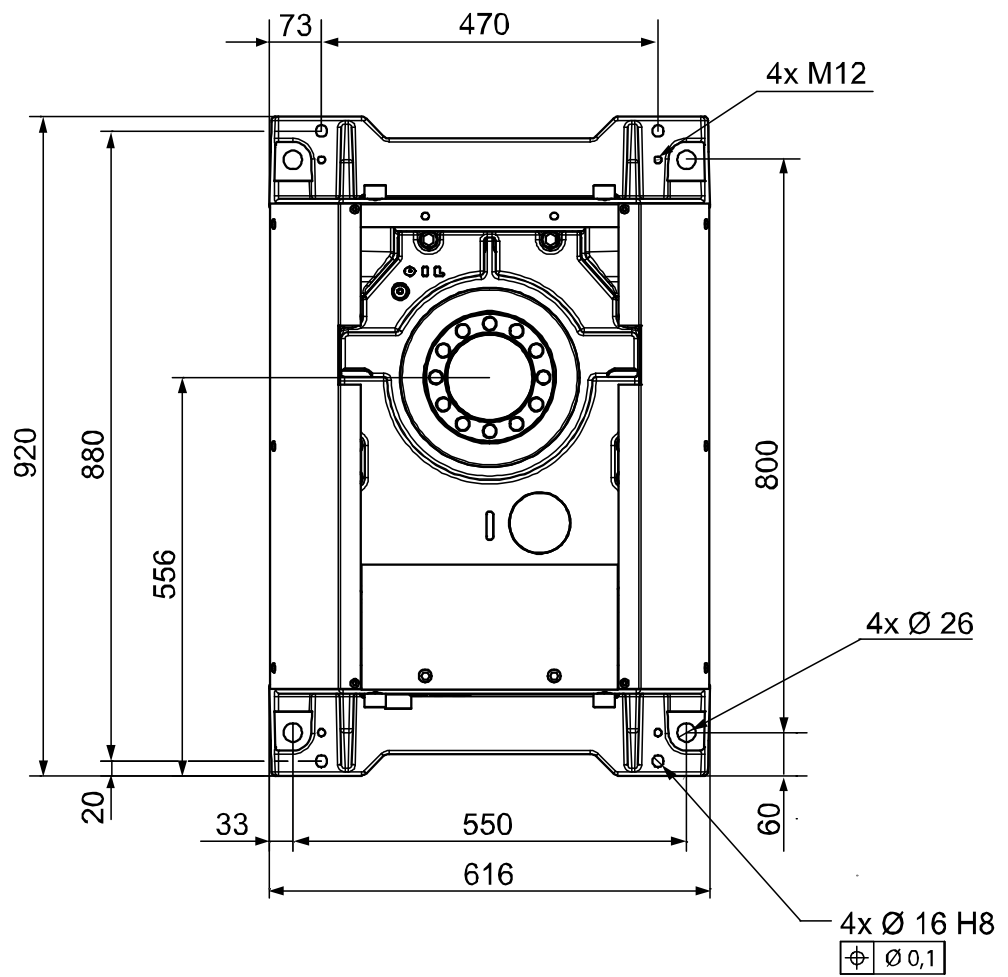
xx110000003

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1 Description

1.4.2 Dimensional drawings

Continued



xx110000004

1 Description

1.4.3 Technical data

1.4.3 Technical data

Introduction

The gear units are available in seven variants, see tables below for technical data.

MTD 250, MTD 500, MTD 750

Technical data	MTD 250	MTD 500	MTD 750
Max. handling capacity (see load diagram)	300 kg	600 kg	1,000 kg
Max. continuous torque	350 Nm	650 Nm	900 Nm
Center of gravity	See Load diagrams on page 58		
Max bending moment	650 Nm	3,300 Nm	5,000 Nm
Positioning time 90 degrees	1.25 s	1.45 s	1.45 s
Positioning time 180 degrees	1.79 s	2.07 s	2.07 s
Positioning time 360 degrees	2.79 s	3.27 s	3.27 s
Repetition accuracy with equal loads and radius 500 mm	±0.05 mm	±0.05 mm	±0.05 mm
Max. speed of rotation	180 deg/s	150 deg/s	150 deg/s
Nominal inertia	37 kg/m ²	260 kg/m ²	375 kg/m ²
Stop time with an emergency stop ⁱ	0.5 s	0.5 s	0.5 s
Max welding power, 60% duty cycle	600 Amp	600 Amp	600 Amp
Weight	70 kg	180 kg	180 kg

ⁱ The stop time is specified at the nominal inertia. The actual stop time depends on the actual load inertia and configuration of the gear unit.

MTD 2000, MTD 5000

Technical data	MTD 2000	MTD 5000
Max. handling capacity	2,000 kg	5,000 kg
Max continuous torque	3,800 Nm	9,000 Nm
Center of gravity	See Load diagrams on page 58	
Max bending moment	15,000 Nm	60,000 Nm
Positioning time 90 degrees	2.8 s	3.67 s
Positioning time 180 degrees	3.96 s	5.98 s
Positioning time 360 degrees	5.96 s	10.59 s
Repetition accuracy with equal loads and radius 500 mm	±0.05 mm	±0.05 mm
Max. speed of rotation	90 deg/s	39 deg/s
Nominal inertia	1250 kg/m ²	7000 kg/m ²
Stop time with an emergency stop ⁱ	0.5 s	0.9 s
Max welding power, 60% duty cycle	2 x 600 Amp	2 x 600 Amp

Continues on next page

1 Description

1.4.3 Technical data

Continued

Technical data	MTD 2000	MTD 5000
Weight	340 kg	770 kg

ⁱ The stop time is specified at the nominal inertia. The actual stop time depends on the actual load inertia and configuration of the gear unit.

MID 500, MID 1000

Technical data	MID 500	MID 1000
Max. handling capacity	1,300 kg	3,300 kg
Max continuous torque	1,400 Nm	3,800 Nm
Max acceleration torque	1,950 Nm	5,000 Nm
Center of gravity	See Load diagrams on page 58	
Max bending moment	5,000 Nm	15,000 Nm
Positioning time 90 degrees	1.65 s	2.43 s
Positioning time 180 degrees	2.65 s	3.43 s
Positioning time 360 degrees	4.65 s	5.43 s
Repetition accuracy with equal loads and radius 500 mm	±0.07 mm	±0.05 mm
Max. speed of rotation	90 deg/s	90 deg/s
Nominal inertia	450 kg/m ²	2000 kg/m ²
Stop time with an emergency stop ⁱ	0.6 s	<0.9 s
Weight	170 kg	395 kg

ⁱ The stop time is specified at the nominal inertia. The actual stop time depends on the actual load inertia and configuration of the gear unit.

Brake data

Brake data	MTD 250	MTD 500	MTD 750	MTD 2000	MTD 5000	MID 500	MID 1000
T _{brake min} : minimum brake torque (Nm)	3.6	7.3	7.3	10.4	15	7.3	10.4

1 Description

1.4.4 Load diagrams

1.4.4 Load diagrams

Information



WARNING

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

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



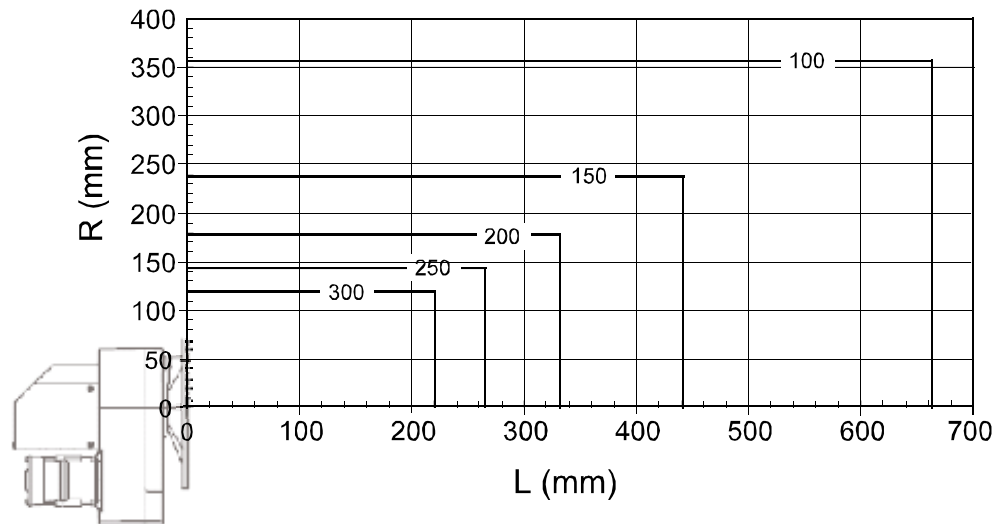
WARNING

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

Introduction

The following load diagrams show the maximum permitted center of gravity displacement from the center of rotation at different loads.

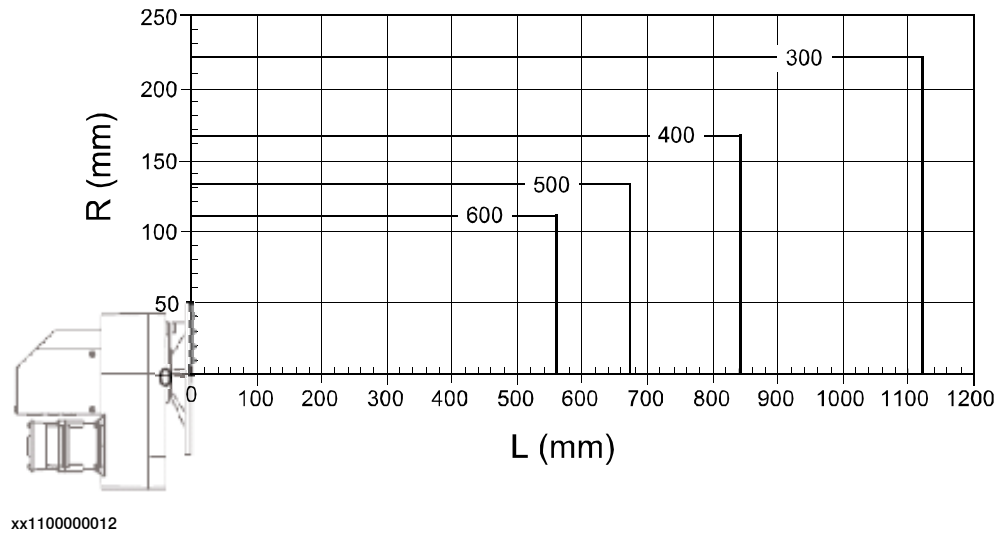
MTD 250



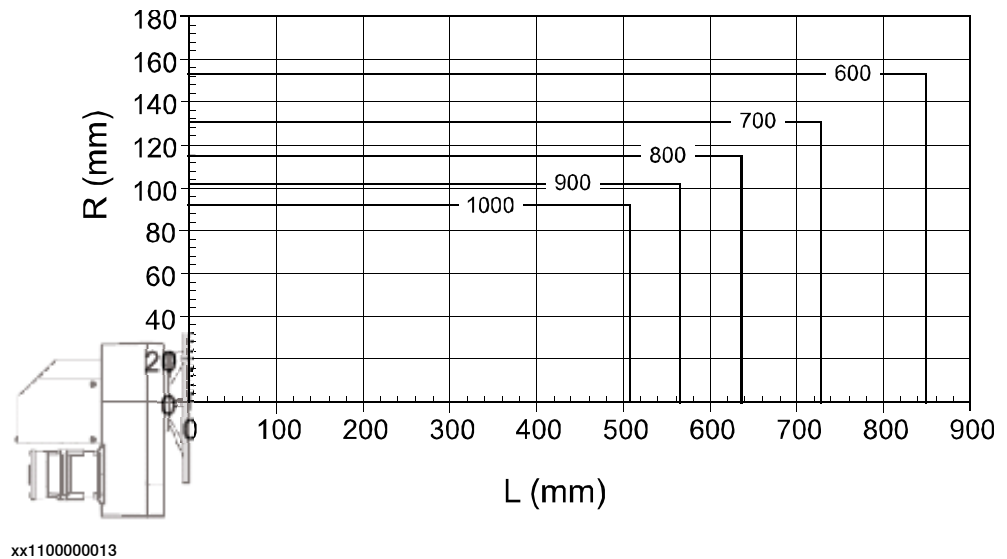
xx110000011

Continues on next page

MTD 500



MTD 750



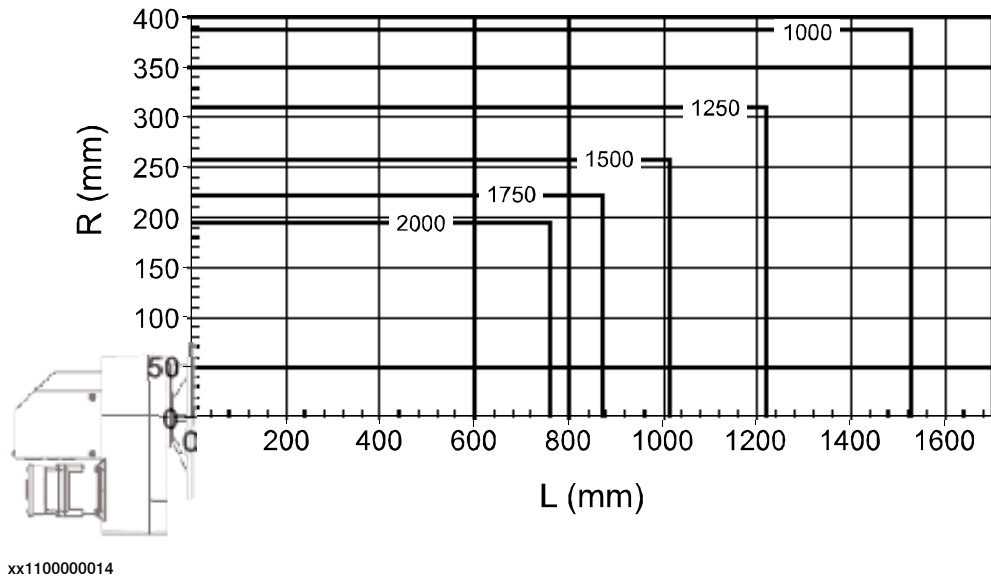
Continues on next page

1 Description

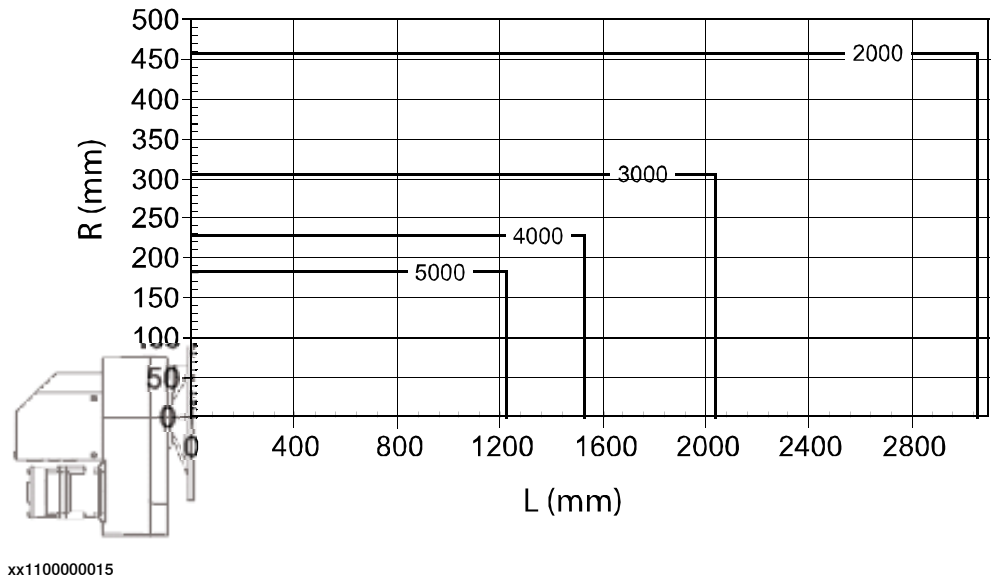
1.4.4 Load diagrams

Continued

MTD 2000

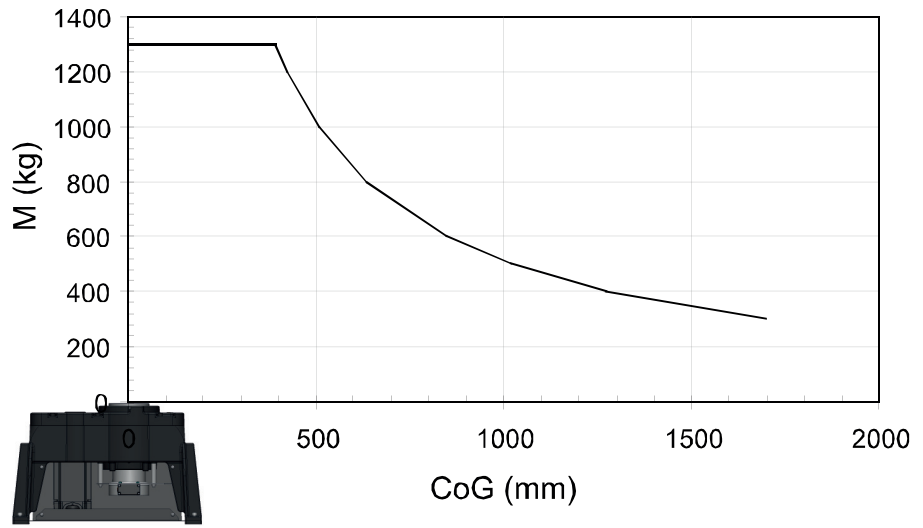


MTD 5000



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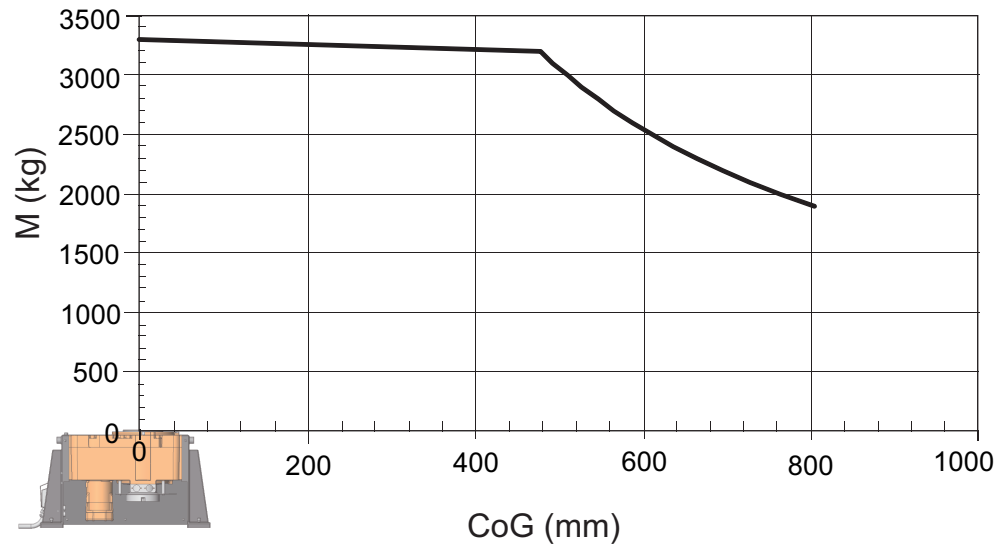
MID 500



xx1000001229

CoG	Center of gravity
-----	-------------------

MID 1000



xx1000001230

CoG	Center of gravity
-----	-------------------

1 Description

1.4.5 Dimensioning gear units

1.4.5 Dimensioning gear units

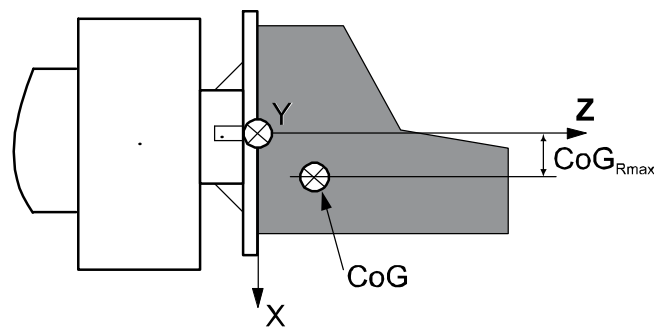
Acceleration and deceleration values

To secure that gear units will not run too hard and damage the gear box, the acceleration and deceleration of the axis on the arm side must be calculated.

This calculation will give a maximum value for the system parameters *Nominal Acceleration* and *Nominal Deceleration*. The value can be lowered if the acceleration is too fast, see *Application manual - Additional axes and stand alone controller*.

Do not use values higher than the recommended maximum acceleration, see [Maximum gearbox torques on page 62](#).

$$(T_{\max\text{gear}} - m * g * \text{CoG}_{\text{Rmax}}) / (m * \text{CoG}_{\text{Rmax}}^2 + J_{0z})$$



xx1100000104

J_{0z} is the moment of inertia around the Z axis at the center of gravity (CoG).

CoG_{Rmax} is the radial distance in X and Y directions between the Z axis and the center of gravity (CoG).

Define the system parameters *Nominal Acceleration* and *Nominal Deceleration* in the type *Acceleration Data* in the topic *Motion*, based on the calculations.

Maximum gearbox torques

Use the $T_{\max\text{gear}}$ values from the table for the calculation.

Gear unit	$T_{\max\text{gear}}$ (max torque on arm side) (Nm)	Recommended maximum acceleration and deceleration (rad/s ²)
MTD 250	480	4
MTD 500	1,100	3
MTD 750	1,950	3
MTD 2000	5,000	0.8
MTD 5000	11,400	0.5
MID 500	1,950	2.4
MID 1000	5,000	1.1

Related information

Dimensioning of motors is described in *Application manual - Additional axes and stand alone controller*.

1.5 SMB box

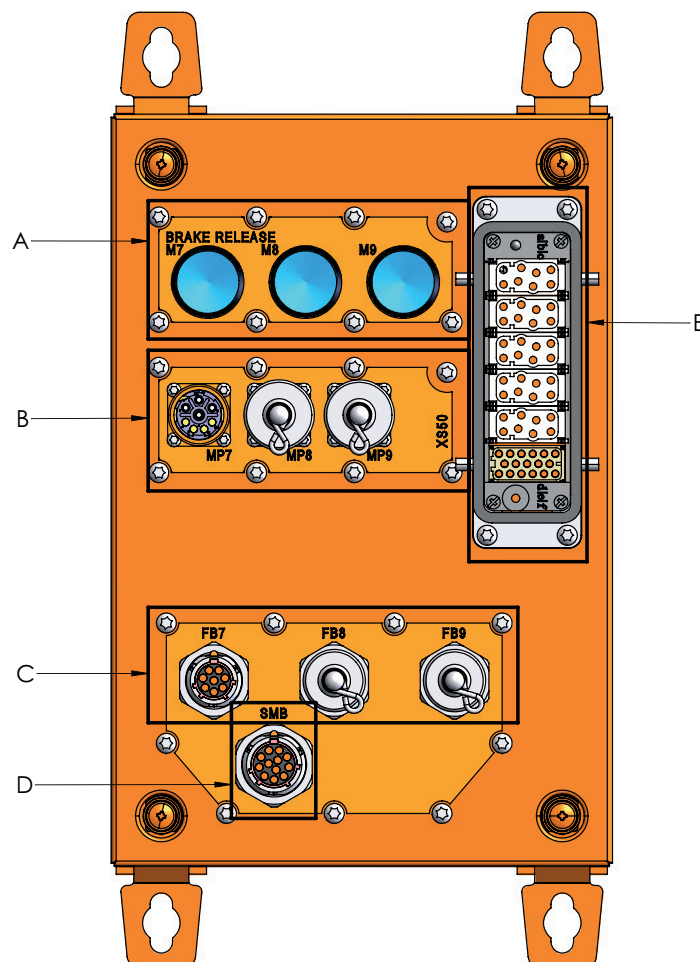
Introduction

The SMB box allows the connection of three motor units and/or gear units to the IRC5 controller (drive module).

The SMB box can be located 7, 15, or 30 meters from the IRC5 cabinet. Motor units and gear units can be connected to the SMB box through flexible cables with lengths of 3, 7, or 15 meters. The SMB box can be equipped with three brake release buttons (option), one for each unit.

SMB box

Below is a illustrations of the SMB box.



xx1000001204

Pos	Description
A	Brake release buttons (option)
B	Motor cables to motor units and/or gear units
C	Resolver cables to motor units and/or gear units

Continues on next page

1 Description

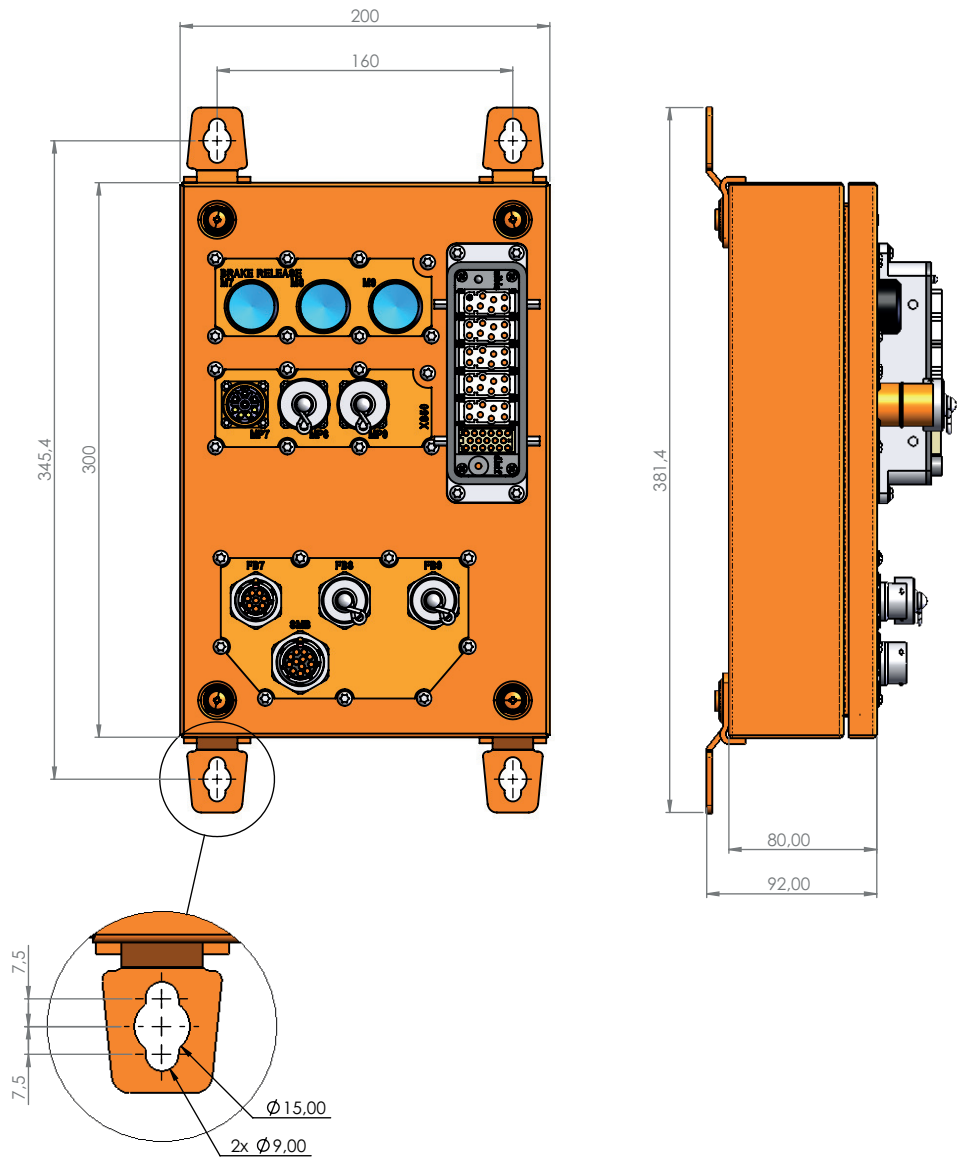
1.5 SMB box

Continued

Pos	Description
D	SMB cable from IRC5 controller
E	Motor cable from IRC5 controller

SMB box dimensions

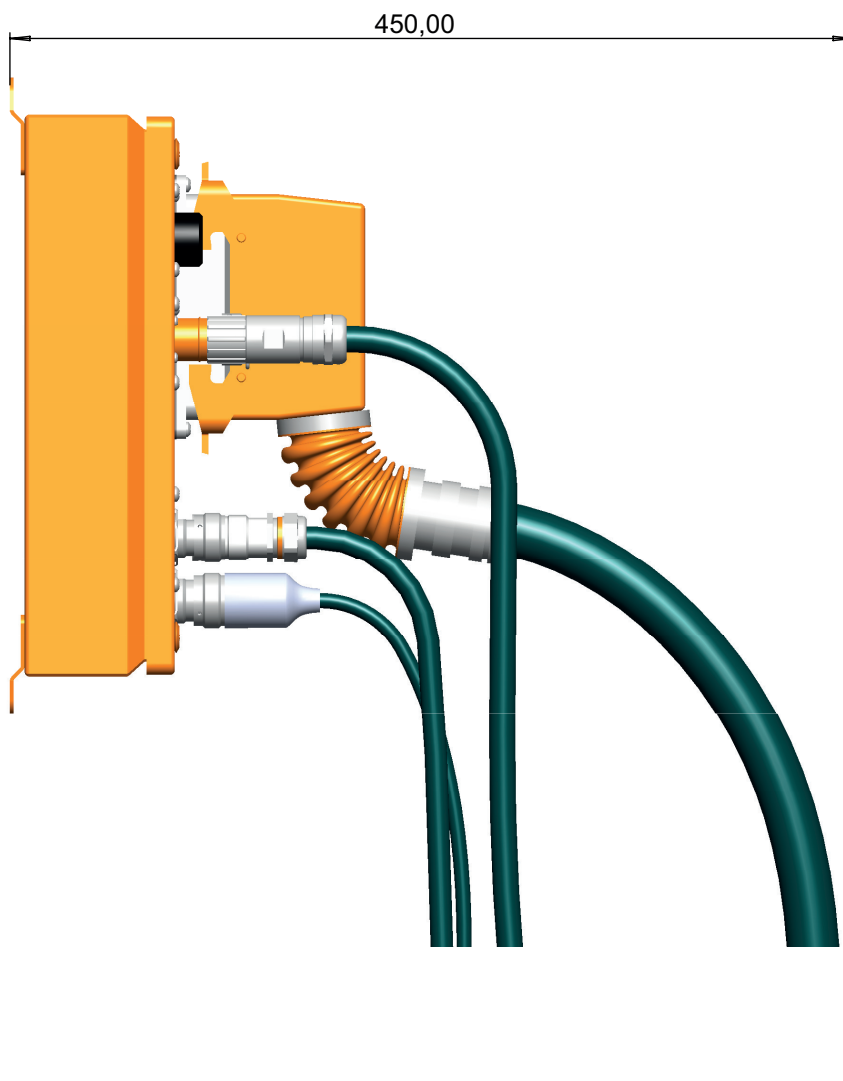
The graphic below shows the dimensions of the SMB box.



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Minimum required space in front of the SMB box is shown below.



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1 Description

1.6 Axis selector

1.6 Axis selector

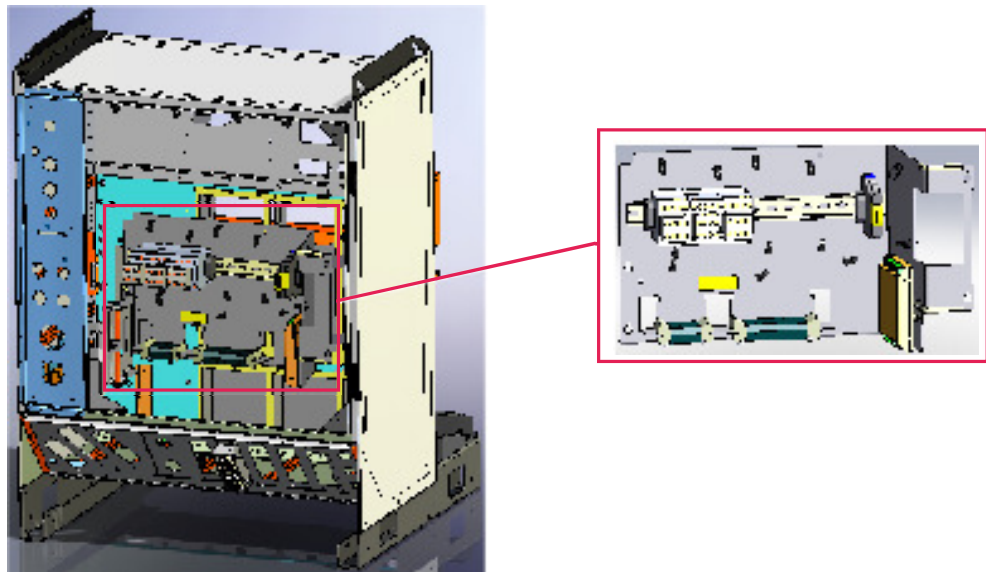
Introduction

The axis selector is mounted inside the IRC5 controller and makes it possible to cut the power for selected connected external units. To obtain safety for personal to load/unload the work station, the signal *Supervision active relays* in the axis selector must be supervised by external safety equipment.

See the circuit diagram for motor units and gear units, for detailed information. See [References on page 7](#).

The function is controlled by instructions in the robot program.

The location of the axis selector, inside the IRC5 controller is shown below:



xx110000005

1.7 Cables

Introduction

There are three types of cables:

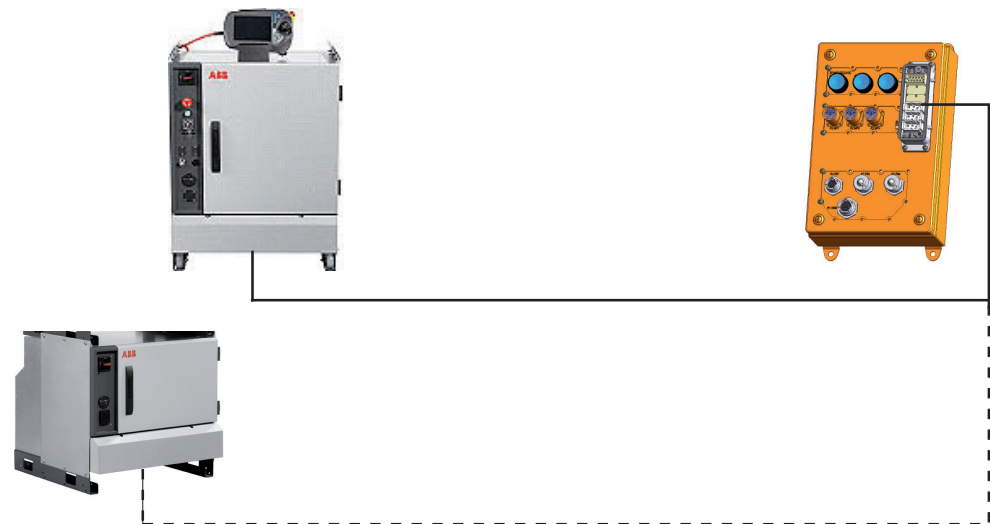
- motor
- SMB
- resolver

Cable	Name	Note
Motor cable	IRC5 - SMB box POW	From IRC5 controller or IRC5 drive module to SMB box.
Motor cable	IRC5 - MU POW	Flex cable from IRC5 controller to motor unit.
Motor cable	SMB box - MU/GU POW	Flex cable from SMB box to motor unit or gear unit.
SMB cable	IRC5 - SMB box SIGN	From IRC5 controller or IRC5 drive module to SMB box.
Resolver cable	SMB - MU/GU SIGN	Flex cable from SMB box to motor unit/gear unit or from IRB to motor unit.

Illustrations below shows the routing of the cables.

IRC5 - SMB box POW

Option 1314-1, 1315-1, 1316-1. For cable lengths, see [Cables](#).



xx1000001233

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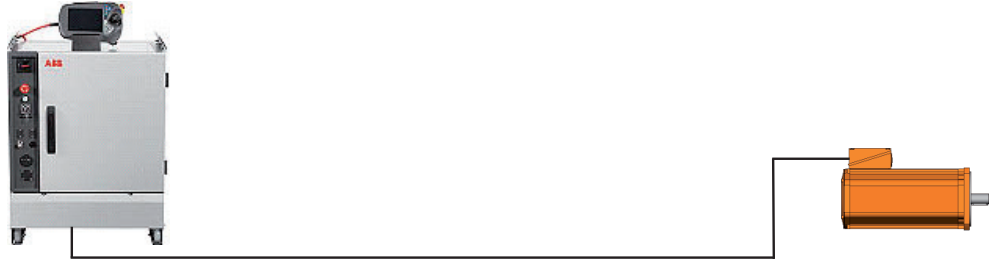
1 Description

1.7 Cables

Continued

IRC5 - MU POW

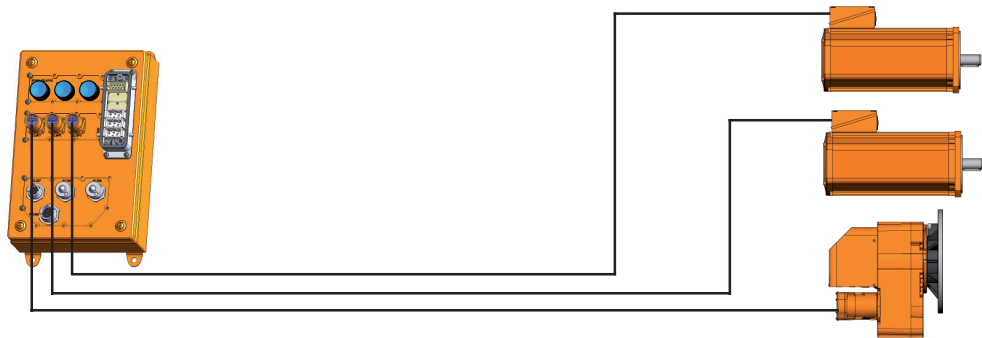
Option 1317-1, -2, -3. For cable lengths, see [Cables](#).



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SMB box - MU/GU POW

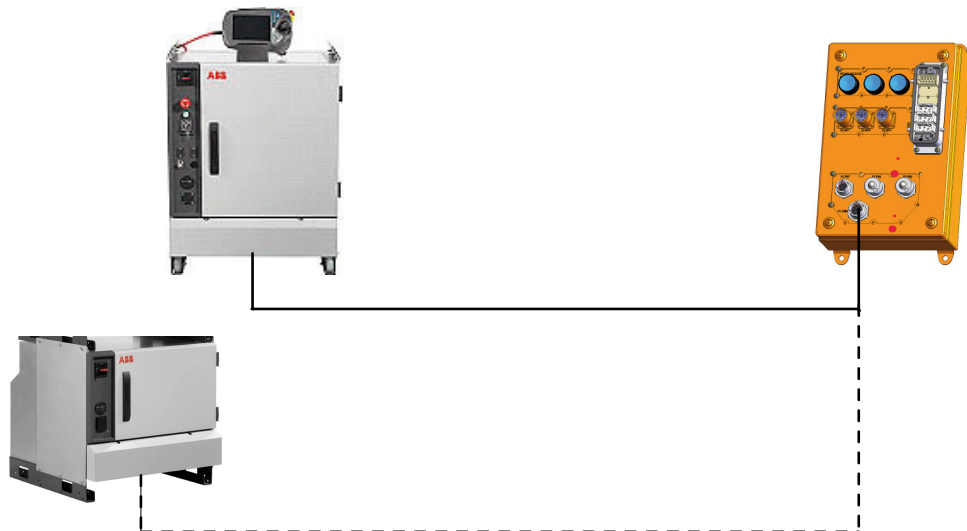
Option 1318-1, 1319-1, 1320-1. For cable lengths, see [Cables](#).



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IRC5 - SMB box SIGN

Option 1321-1, 1322-1, 1323-1. For cable lengths, see [Cables](#).

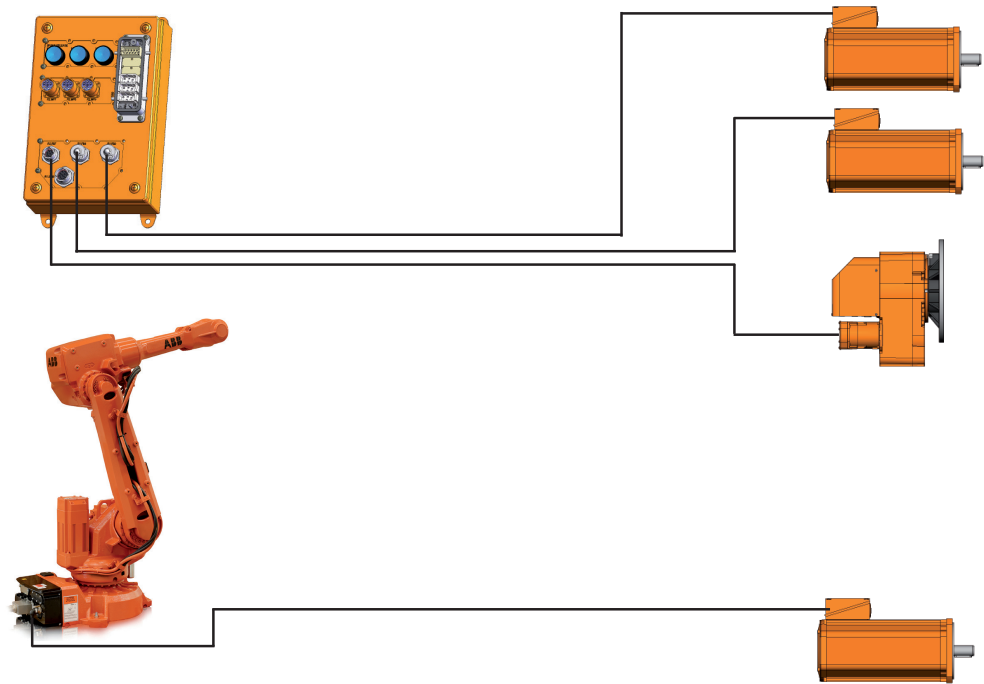


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Continues on next page

SMB - MU/GU SIGN

Option 1324-1, 1325-1, 1326-1. For cable lengths, see [Cables](#).



xx1000001232

1 Description

1.8 Applicable standards

1.8 Applicable standards



Note

The listed standards are valid at the time of the release of this document. Phased out or replaced standards are removed from the list when needed.

General

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

Normative standards as referred to from ISO 10218-1

Standard	Description
ISO 9283:1998	Manipulating industrial robots - Performance criteria and related test methods
ISO 10218-2	Robots and robotic devices - Safety requirements for industrial robots - Part 2: Robot systems and integration
ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
ISO 13849-1:2006	Safety of machinery - Safety related parts of control systems - Part 1: General principles for design
ISO 13850	Safety of machinery - Emergency stop - Principles for design
IEC 60204-1:2005	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
IEC 62061:2005	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems

Other standards used in design

Standard	Description
ISO 9787:2013	Robots and robotic devices -- Coordinate systems and motion nomenclatures
IEC 61000-6-2	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
IEC 61000-6-4 (option 129-1)	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
ISO 13732-1:2006	Ergonomics of the thermal environment - Part 1
IEC 60974-1:2012 ⁱ	Arc welding equipment - Part 1: Welding power sources
IEC 60974-10:2014 ^j	Arc welding equipment - Part 10: EMC requirements
ISO 14644-1:2015 ⁱⁱ	Classification of air cleanliness
IEC 60529:1989 + A2:2013	Degrees of protection provided by enclosures (IP code)

ⁱ Only valid for arc welding robots. Replaces IEC 61000-6-4 for arc welding robots.

ⁱⁱ Only robots with protection Clean Room.

1.9 Installation

1.9.1 Installation

Introduction

Detailed information regarding mechanical installation can be found in *Product manual - Motor Units and Gear Units*.

The system parameter configuration files for the motor units and gear units are included in RobotWare Download package. The files suit the most common combinations of drive and measuring systems. The parameters can be loaded either via:

- FlexPendant
- RobotStudio

Select suitable files depending on the location of the drive unit and then depending on the size of motor. The parameters are a basis for continued work. It is therefore necessary to configure either the name or the acceleration data, transmission (gear ratio), etc.

1 Description

1.9.2 Operating requirements

1.9.2 Operating requirements

Protection standards

Product	Protection standard IEC60529
MU 100, MU 200, MU 250, MU 300, MU 400	IP67
MTD 250, MTD 500, MTD 750, MTD 2000, MTD 5000	IP65
MID 500, MID 1000	IP65

Explosive environments

The motor units and gear units must not be located or operated in an explosive environment.

Ambient temperature

Description	Standard/Option	Temperature
Motor unit during operation	Standard	+ 5°C (41°F) to + 52°C (126°F)
Gear unit during operation	Standard	+ 5°C ⁱ (41°F) to + 52°C (126°F)
For short periods (not exceeding 24 hours)	Standard	up to + 70°C (158°F)

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

Relative humidity

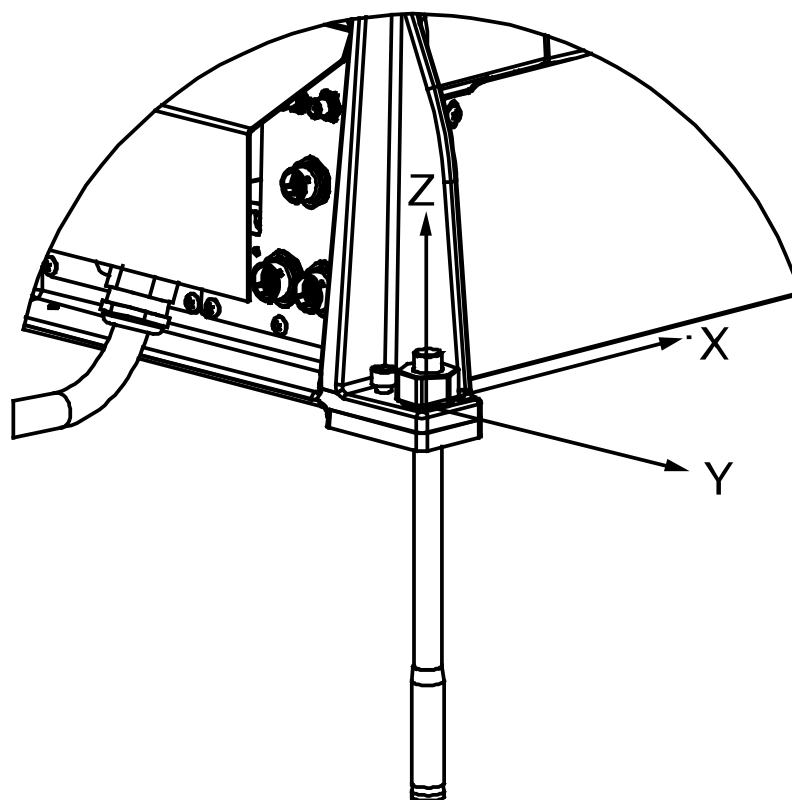
Description	Relative humidity
During transportation and storage	Max. 95% at constant temperature
During operation	Max. 95% at constant temperature

1.9.3 On site installation

Forces for MID units

Maximum floor loads in relation to the base coordination system for the MID 500 and MID 1000 units and indicated per each screw of the base on the unit. See graphic below.

Type	Endurance load in operation (kN)		Max. load at emergency stop (kN)	
	Fxy	Fz (\pm)	Fxy	Fz (\pm)
MID 500	1.5	6	3	8
MID 1000	2.7	15	6.4	22.3



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Installation of MID units

It is important to ensure that the floor withstand the forces stated above for MID units.

	MID 500	MID 1000
Recommended screws	4 x M16	4 x M20
Class	8.8	8.8

Continues on next page

1 Description

1.9.3 On site installation

Continued

Installation of MTD units

It is important to ensure that the frame carrying the MTD unit provides sufficient rigidity and strength to support the loads. For recommended min clamping thickness of frame see [Dimensional drawings on page 35](#).

	MTD 250	MTD 500	MTD 750	MTD 2000	MTD 5000
Recommended screws	4 x M12	4 x M20	4 x M20	8 x M20	12 x M24
Class	12.9	12.9	12.9	12.9	12.9
Tightening torque (Nm) ±10%	120	550	550	550	950
Min. used threads of screw in the gearbox (mm)	> 29	> 47	> 47	> 50	> 37

2 Variants and options

2.1 Introduction to variants and options

General

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

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

2 Variants and options

2.2 Motor units and Gear units

2.2 Motor units and Gear units



Note

If the total quantity of motor units and gear units are more than 3 must a IRC5 drive module be ordered on the specification form for IRC5 controller, for HV, options 751-3, 751-5, and 751-6.

Assembly instructions are included in the cable kit for mounting in the IRC5 drive module. The article number for kit is 3HAC040089-001.

Motor units

Option	Description	Type
1371-1	(1-6) Choose quantity	MU 80
1300-1	(1-6) Choose quantity	MU 100
1301-1	(1-6) Choose quantity	MU 200
1369-1	(1-6) Choose quantity	MU 250
1302-1	(1-6) Choose quantity	MU 300
1303-1	(1-6) Choose quantity	MU 400



Note

MU 80 and MU 250 is not compatible with RW version earlier than 6.06.



CAUTION

MU 80 cannot be selected with robots using high-voltage control cabinets, that is, IRB 460, IRB 4600, IRB 660, IRB 66XX, IRB 67XX, IRB 760, IRB 7600, IRB 8700. Otherwise, there is a risk of motor burnt.

Continues on next page

Details of MU 80



Note

The black part of the motor should be unpainted.



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2 Variants and options

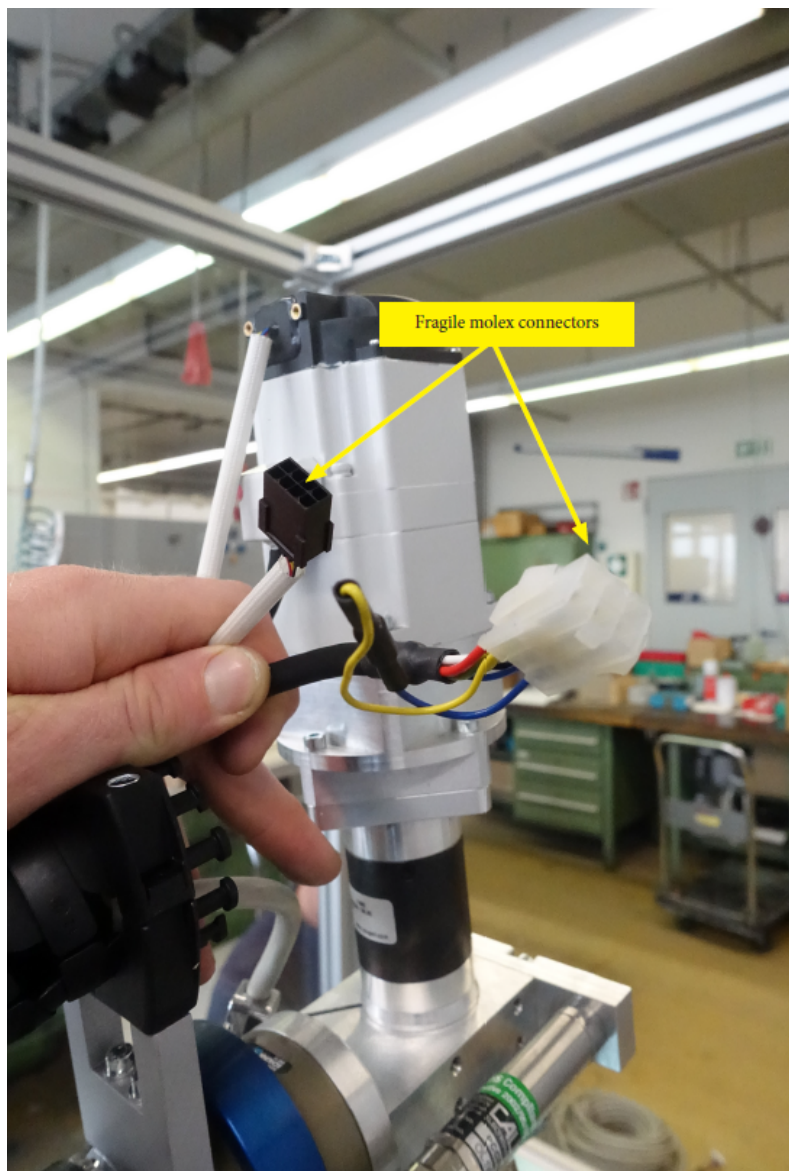
2.2 Motor units and Gear units

Continued



Note

The black part of the motor should be unpainted.



Gear units

Option	Description	Type
1304-1	(1-3) Choose quantity	MTD 250
1305-1	(1-3) Choose quantity	MTD 500
1306-1	(1-3) Choose quantity	MTD 750
1307-1	(1-3) Choose quantity	MTD 2000
1308-1	(1-3) Choose quantity	MTD 5000
1309-1	(1-3) Choose quantity	MID 500
1310-1	(1-3) Choose quantity	MID 1000

Continues on next page

Smooth shaft adaptor

Option	Description	Type
1370-1	(1-6) Choose quantity	Smooth shaft adaptor

SMB box

SMB box to be connected between IRC5 controller/drive module and motor units/gear units, see [Scenarios on page 13](#) for different scenarios and [SMB box on page 63](#) for more detail information.

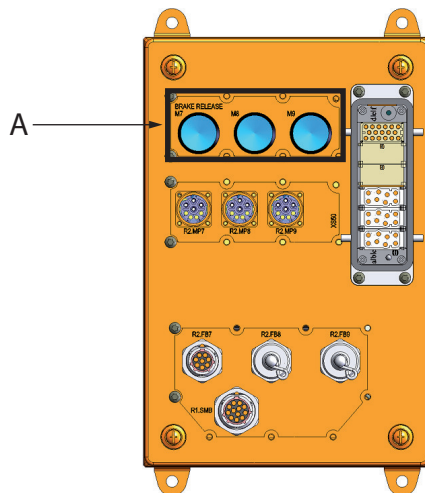


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Brake release buttons

Brake release buttons on SMB box. Possible to select buttons on one or two boxes.

Option	Description	Note
1311-1	(1-2) Choose quantity	Requires: SMB box, option 1312-1. Brake release buttons on one or two SMB box(es)



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Continues on next page

2 Variants and options

2.2 Motor units and Gear units

Continued

Axis selector MU/GU

To make it possible to cut power to connected units, for example for safe load/unloading. See [Axis selector on page 66](#).

Option	Description	Note
1313-1	Axis selector	

Harness, axis selector

Internal harness to axis selector. To be used when motors from other suppliers or existing ABB motors are to be used. See [Axis selector on page 66](#).

Option	Description	Note
1340-1	(1-2) Choose quantity	

Manipulator color

Option	Description	Note
209-1	ABB Orange Standard	
209-202	ABB Graphite White Standard	Standard color



Note

MID 500 only available color is grey, despite if orange or white is chosen.

Warranty

For the selected period of time, ABB will provide spare parts and labour 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 in the ABB Ability service *Condition Monitoring & Diagnostics* 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.
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.

Continues on next page

2 Variants and options

2.2 Motor units and Gear units

Continued

Option	Type	Description
438-4	Standard warranty + 18 months	Standard warranty extended with 18 months from end date of the standard warranty. Warranty terms and conditions apply. Contact Customer Service in case of other requirements.
438-5	Standard warranty + 24 months	Standard warranty extended with 24 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.
438-7	Standard warranty + 30 months	Standard warranty extended with 30 months from end date of the standard warranty. Warranty terms and conditions apply.
438-8	Stock warranty	<p>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.</p> <p> Note</p> <p>Special conditions are applicable, see <i>Robotics Warranty Directives</i>.</p>

2 Variants and options

2.3 Cables

2.3 Cables

Motor cables

From IRC5 controller or IRC5 drive module to SMB box, see [Cables on page 67](#).
Maximum total number of selectable cables are 2.

Option	Description	Note
1314-1	(1-2) Choose quantity	IRC5 - SMB box POW 7 m
1315-1	(1-2) Choose quantity	IRC5 - SMB box POW 15 m
1316-1	(1-2) Choose quantity	IRC5 - SMB box POW 30 m

Flex cable from IRC5 controller to motor unit, see [Cables on page 67](#).

Option	Description	Note
1317-1	IRC5 - MU POW 7 m	Max. 1 Motor unit
1317-2	IRC5 - MU POW 15 m	Max. 1 Motor unit
1317-3	IRC5 - MU POW 30 m	Max. 1 Motor unit

Flex cable from SMB box to motor unit or gear unit, see [Cables on page 67](#).
Maximum total number of selectable cables are 6.

Option	Description	Note
1318-1	(1-6) Choose quantity	SMB box - MU/GU POW 3 m
1319-1	(1-6) Choose quantity	SMB box - MU/GU POW 7 m
1320-1	(1-6) Choose quantity	SMB box - MU/GU POW 15 m

SMB cables

From IRC5 controller or IRC5 drive module to SMB box, see [Cables on page 67](#).
Maximum total number of selectable cables are 2.

Option	Description	Note
1321-1	(1-2) Choose quantity	IRC5 - SMB box SIGN 7 m
1322-1	(1-2) Choose quantity	IRC5 - SMB box SIGN 15 m
1323-1	(1-2) Choose quantity	IRC5 - SMB box SIGN 30 m

Resolver cables

Flex cable from SMB box to motor unit or gear unit or from IRB to motor unit, see [Cables on page 67](#). Maximum total number of selectable cables are 6.

Option	Description	Note
1324-1	(1-6) Choose quantity	SMB - MU/GU SIGN 3 m
1325-1	(1-6) Choose quantity	SMB - MU/GU SIGN 7 m
1326-1	(1-6) Choose quantity	SMB - MU/GU SIGN 15 m

2.4 User documentation

User documentation

The user documentation describes the robot in detail, including service and safety instructions.



Tip

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

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ABB AB

Robotics & Discrete Automation

S-721 68 VÄSTERÅS, Sweden

Telephone +46 (0) 21 344 400

ABB AS

Robotics & Discrete Automation

Nordlysvegen 7, N-4340 BRYNE, Norway

Box 265, N-4349 BRYNE, Norway

Telephone: +47 22 87 2000

ABB Engineering (Shanghai) Ltd.

Robotics & Discrete Automation

No. 4528 Kangxin Highway

PuDong District

SHANGHAI 201319, China

Telephone: +86 21 6105 6666

ABB Inc.

Robotics & Discrete Automation

1250 Brown Road

Auburn Hills, MI 48326

USA

Telephone: +1 248 391 9000

abb.com/robotics