HEIDENHAIN

Technical Manual

Inverter Systems and Motors

for the Contouring Controls

TNC 410 M
TNC 426 M
TNC 430 M
MANUALplusM

February 2001

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Foreword

This Technical Manual has been written for all machine tool manufacturers. It contains all of the information necessary for the mounting and electrical connection of HEIDENHAIN inverter systems and HEIDENHAIN motors.
With each update, you will receive a set of supplementary pages free-of-charge. Always sort these pages into your Technical Manual immediately. In this way, your manual will always be up-to-date.
You can use extracts from this manual to supplement your machine documentation. If you increase the size of the manual format (17 cm x 24 cm) by the factor 1.225, you will have DIN A4 format.
No documentation is perfect. Documentation is alive. It thrives on your comments and suggestions for improvement. Please help us by sending us your ideas.

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2.1 General Information

This Technical Manual describes all of the inverter components and motors that are necessary for a complete drive system. The drive systems can be used in connection with the HEIDENHAIN contouring controls TNC 410 M, TNC 426 M, TNC 430 M and the lathe control MANUALplusM.

You will find the specifications for the controls in the corresponding Technical Manuals for the TNC 410, TNC 426/TNC 430 and MANUALplusM.

2.2 Designations of the Inverters and Motors

Designation	Device
UE 2xx	Compact inverter for up to 4 axes and spindle (internal PWM interfaces)
UE 2xxB	Compact inverter for up to 4 axes and spindle (external PWM interfaces), an additional UM 111 power module can be connected
UV 102	Power supply unit for operating the LE 426M with the UE 2xx compact inverters (old)
PW 210	Braking resistor without fan
PW 110, PW 120	Braking resistor with fan
UV 130	Non-regenerative power module of the modular inverter system
UV 120, UV 140	Energy-recovery power modules of the modular inverter system
KDR 120, KDR 140	Commutating reactors for the UV 120 and UV 140 energy-recovery power supply modules
Line filter	Line filter for the UV 120 and UV 140 energy-recovery power modules
UP 110	UP 110 braking resistor module for the modular inverter system with regenerative power supply.
UM 1xx	Power module for the modular inverter system for up to 2 axes or spindle
QSY	Synchronous motor
QAN	Asynchronous motor

2.3 Compact inverter

For up to 4 axes and spindle, or up to 5 axes.

2.3.1 Components of the Compact Inverter

For operation with the HEIDENHAIN **UE 2xx** compact inverters, you need the following components:

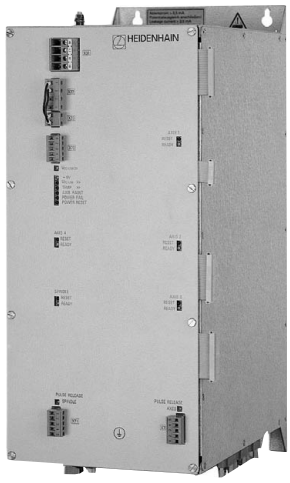
- UE 2xx compact inverter
- If required, PW 210 (or PW 110, PW 120) braking resistor
- Toroidal cores
- UV 102 power supply unit (only LE 426 M)

For operation with the HEIDENHAIN **UE 2xxB** compact inverters, you need the following components:

- UE 2xxB compact inverter
- If required, PW 210 (or PW 110, PW 120) braking resistor
- Toroidal cores
- One UM 111 power module (optional)
- Ribbon cables for PWM signals and supply voltage (and optional unit bus)
- Covers for the ribbon cables

2.3.2 UE 2xx compact inverter

With UE 2xx compact inverters, the power electronics for all of the axes and the spindle, as well as the power supply for the LE 41x M are all contained in a single unit.
The PWM signals are transferred via internal 20-pin ribbon cables.
If you are using a LE 426 M, you will require in addition the UV 102 power supply unit.



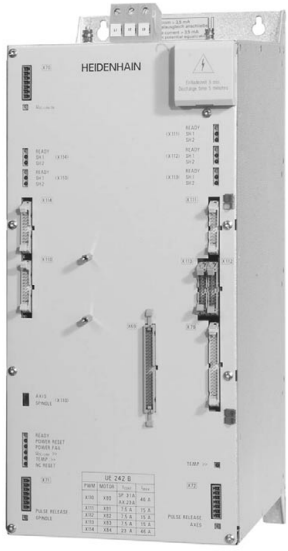
UE 212

Specifications	**UE 210**	**UE 212**	**UE 230**	**UE 240**	**UE 242**
Power Supply	400 Vac ± 10 % 50 Hz to 60 Hz				
Power consumption Rated power Peak power	 13 kW 18 kW		 20 kW 27.5 kW		
Power loss	Approx. 435 W	Approx. 555 W	Approx. 510 W	Approx. 580 W	Approx. 760 W
DC-link voltage	565 Vdc (at 400 V power supply)				
Continuous load 3 axes 1 axis spindle	 7.5 A – 19 A	 7.5 A 14 A 19 A	 2 x 7.5 A – 31 A	 7.5 A – 31 A	 7.5 A 23 A 31 A
Short-time load[a] 3 axes 1 axis spindle	 15 A – 28.5 A	 15 A 28.5 A 28.5 A	 2 x 15 A – 46 A	 15 A – 46 A	 15 A 46 A 46 A
Continuous power of the integral braking resistor	1 kW		–	–	–
Peak power of the integral braking resistor[b]	23 kW		–	–	–
Degree of protection	IP 20				
Weight	20 kg		23 kg		
ID number	313 500-xx	313 501-xx	329 037-xx	313 502-xx	313 503-xx

a. Axes: 40% cyclic duration factor for duration of 5 s
Spindle: 40 % cyclic duration factor for duration of 10 minutes (S6-40 %)
b. 0.4 % cyclic duration factor for duration of 120 s

2.3.3 UE 2xxB Compact Inverter

With UE 2xxB compact inverters, the power electronics for all of the axes and the spindle, as well as the power supply for the LE are all contained in a single unit. An additional UM 111 power module of the modular inverter system can be connected via conductor bar.
The PWM signals are transferred via external 20 pin ribbon cables.



UE 242B

Specifications	**UE 210B**	**UE 211B**	**UE 212B**	**UE 230B**
Power Supply	400 Vac ± 10 % 50 Hz to 60 Hz			
Power consumption Rated power Peak power	 15 kW 23 kW			 22 kW 30 kW
Power loss	Approx. 475 W	Approx. 525 W	Approx. 595 W	Approx. 520 W
DC-link voltage	565 Vdc (at 400 V power supply)			
Continuous load 3 axes 1 axis spindle	 7.5 A – 20 A	 2 x 7.5 A 15 A 20 A	 7.5 A 15 A 20 A	 2 x 7.5 A – 31 A
Short-time load[a] 3 axes 1 axis spindle	 15 A – 30 A	 2 x 15 A 30 A 30 A	 15 A 30 A 30A	 2 x 15 A – 46 A
Continuous power of the integral braking resistor	1 kW			–
Peak power of the integral braking resistor[b]	23 kW			–
Degree of protection	IP 20			
Weight	20 kg			23 kg
ID number	337 042-xx	337 043-xx	337 044-xx	337 038-xx

a. Axes: 40% cyclic duration factor for duration of 5 s
Spindle: 40 % cyclic duration factor for duration of 10 minutes (S6-40 %)
b. 0.4 % cyclic duration factor for duration of 120 s

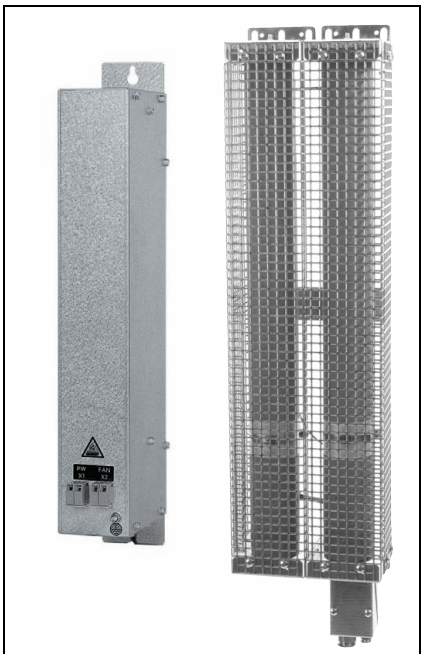
Specifications	UE 240B	UE 241B	UE 242B
Power Supply	400 Vac ± 10 % 50 Hz to 60 Hz		
Power consumption Rated power Peak power	 22 kW 30 kW		
Power loss	Approx. 590 W	Approx. 700 W	Approx. 770 W
DC-link voltage	565 Vdc (at 400 V power supply)		
Continuous load 3 axes 1 axis spindle	 7.5 A – 31 A	 2 x 7.5 A 23 A 31 A	 7.5 A 23 A 31 A
Short-time load[a] 3 axes 1 axis spindle	 15 A – 46 A	 2 x 15 A 46 A 46 A	 15 A 46 A 46 A
Continuous power of the integral braking resistor	–		
Peak power of the integral braking resistor	–		
Degree of protection	IP 20		
Weight	23 kg		
ID number	337 039-xx	337 040-xx	337 041-xx

a. Axes: 40% cyclic duration factor for duration of 5 s
Spindle: 40 % cyclic duration factor for duration of 10 minutes (S6-40 %)

Changes to the UE 2xxB	
337 xxx-x2	First issue UE 2xxB
337 xxx-x3	Only UE 230B and UE 24xB: new connections and sliding switch

2.3.4 PW 210 (PW 110, PW 120) Braking Resistor

The PW braking resistors convert the energy fed back into the dc-link during braking into heat.
The PW 110 and PW 120 have a cooling fan, the PW 210 cools only through heat radiation.
Either one PW x10 or two PW 120 switched in series can be connected to the UE 2xx compact inverters.
Either one PW 210, one PW 1x0 or two PW 210 in parallel can be connected to the UE 2xxB compact inverters and UV 130 power supply unit.



PW 1x0 **PW 210**

Specifications	**PW 210**
Continuous power	2 kW (4 kW)[a]
Peak power[b]	27 kW (54 kW)[a]
Resistance	18 Ω
Degree of protection	IP 20
Weight	5.5 kg
ID number	333 081-01

a. When two PW 210 are connected in parallel
b. 2 % cyclic duration factor for duration of 120 s

Specifications	PW 110	PW 120
Continuous power	2 kW	4 kW
Peak power[a]	27 kW	49 kW
Power consumption of fan	2,5 W	2.4 W
Resistance	18 Ω	10 Ω
Degree of protection	IP 20	IP 20
Weight	6 kg	11 kg
ID number	313 511-01	333 000-01

a. PW 110: 1.5 % cyclic duration factor for duration of 120 s
PW 120: 2 % cyclic duration factor for duration of 120 s

Danger

The surface of the braking resistor can attain temperatures of up to > 150 °C!

2.3.5 UV 102 power supply unit

The UV 102 power supply unit is necessary if you are using a UE 2xx (not UE 2xxB) compact inverter with an LE 426 M. It supplies the power to the LE 426 M and leads the external PWM connections of the logic unit to the UE 2xx compact inverter.

UV 102

Specifications	**UV 102**
Power Supply	400 Vac ± 10 % 50 Hz to 60 Hz
Power consumption	Approx. 100 W
Degree of protection	IP 20
Weight	3 kg
ID number	317 559-02

2.3.6 Toroidal Cores

Line interference can be suppressed by mounting toroidal cores in the motor leads, the power supply leads and the lead to the braking resistor (only UE 21x).

Terminal on the compact inverter	Toroidal core
Power supply (X31)	∅ 87 mm (309 694-02)
Braking resistor (X89)[a]	∅ 42 mm (309 694-01)
Axis 1 to 3 (X81 to X83)	∅ 42 mm (309 694-01)
Axis 4 (X84)	∅ 59 mm (309 694-03)
Spindle (X80)	∅ 59 mm (309 694-03)

a. Only with UE 21x; not with UE 230, UE 24x, UE 2xxB

2.3.7 Ribbon Cables and Covers (Only for UE 2xxB)

50-line ribbon cable (power supply to LE)

The 50-line ribbon cable connects the UE 2xxB with the LE and is responsible for voltage supply to the LE. It is available as an accessory with the UE 2xxB (length 300 mm, Id. Nr. 325 816-01).

20-line ribbon cable (PWM signals)

The 20-line ribbon cable connects the PWM outputs of the LE with the PWM connections on the UE 2xxB. One 20-line ribbon cable is required for each axis/spindle. The 20-line ribbon cables for the connections on the UE 2xxB are supplied as accessories with the UE 2xxB (length 200 mm, Id. Nr. 250 479-08; length 400 mm, Id. Nr. 250 479-10). If you are using an additional UM 111 power module, you will need an additional 20-line ribbon cable:

PWM connection on the UM 111 power module	Length of the 20-line ribbon cable	ID number
X111, X112	100 mm	250 479-07

40-line ribbon cable (unit bus)

The 40-line ribbon cable serves as the unit bus. It is required if an additional UM 111 power module is being operated with the UE 2xxB.

Unit bus connection	Length of the 40-line ribbon cable	ID number
X79	50 mm	325 817-09

Ribbon cable covers

The ribbon cables must be covered to protect against interference.

The cover for the LE is supplied with the LE.
The cover for the UE 2xxB is supplied with the UE 2xxB.

If you are using an additional power module, the cover for this module must be ordered separately:

Additional power module	Length of the cover	ID number
UM 111	50 mm	329 031-05

2.4 Modular Inverters

2.4.1 Components of the modular inverter

For operation with the modular HEIDENHAIN **non-regenerative** inverters, the following components are required:

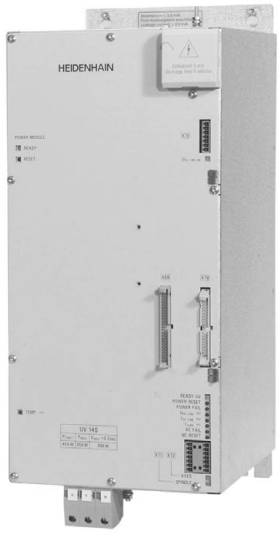
- UV 130 power supply unit
- UM 1xx power modules, depending on version
- PW 210 (or PW 110, PW 120) braking resistor
- Ribbon cables for PWM signals, unit bus and power supply
- Covers for the ribbon cables

For operation with the modular HEIDENHAIN **regenerative** inverters, the following components are required:

- UV 120 or UV 140 power supply unit
- KDR 120 or KDR 140 commutating reactor
- Line filter
- If required, UP 110 braking resistor module
- UM 1xx power modules, depending on version
- Ribbon cables for PWM signals, unit bus and power supply
- Covers for the ribbon cables

2.4.2 UV 1x0 power supply unit

The UV 1x0 power supply units supply the dc-link voltage as well as the power for the electronics of the LE and power modules. During braking, the motors feed energy into the dc-link. This energy is converted into heat by the UV 130 through the PW 210 (or PW 1x0) braking resistor, or returned to the power line through the UV 120 or UV 140. The UV 120 and UV 140 can be driven only with commutating reactor and line filter.



UV 140

Specifications	**UV 120**	**UV 130**	**UV 140**
Power Supply	400 Vac ± 10 % 50 Hz to 60 Hz		
DC-link power Continuous power Peak power (S6-40 %)	 22 kW 30 kW	 30 kW 40 kW	 45 kW 65 kW
Power loss	Approx. 300 W	Approx. 140 W	Approx. 570 W
DC-link voltage	650 Vdc	565 Vdc (with 400 V power voltage)	650 Vdc
Degree of protection	IP 20		
Weight	12 kg	9.8 kg	20 kg
ID number	344 504-xx	324 998-xx	335 009-xx

Changes to UV 120	
345 504-01	Initial version

Changes to UV 130	
324 998-01	Initial version
324 998-02	Modification
324 998-03	Modification

Changes to UV 140	
335 009-01	Initial version
335 009-02	Modification

2.4.3 KDR 1x0 commutating reactor and line filter

The UV 120 and UV 140 power recovery modules must be connected to the main power line via the KDR 140 commutating reactor and the line filter. This is important to keep the main line free of disruptive higher harmonics.

KDR 140

	KDR 120	**KDR 140**
Rated voltage	3 x 400 V	3 x 400 V
Rated frequency	50 Hz/60 Hz	50 Hz/60 Hz
Rated current	3 x 35 A	3 x 70 A
Power loss	Approx. 200 W	Approx. 340 W
Degree of protection	IP 00	IP 00
Weight	11 kg	22 kg
ID number	344 505-01	333 068-01

EPCOS 80 A line filter

	EPCOS 35 A line filter	**EPCOS 80 A line filter**
suitable for	UV 120	UV 140
Rated voltage	3 x 400 V	3 x 400 V
Rated frequency	50 Hz/60 Hz	50 Hz/60 Hz
Rated current	3 x 35 A	3 x 80 A
Degree of protection	IP 20	IP 20
Weight	5 kg	10 kg
ID number	340 691-01	340 651-01

2.4.4 UP 110 braking resistor module

In the energy-recovery inverter, the braking energy of the motors is normally returned to the line power. If in an exceptional case the line power is interrupted, the braking energy cannot be returned. This can lead to an excessive dc-link voltage that might switch off the inverter and let the motors coast without control. To prevent damage to the machine and workpiece resulting from uncontrolled machine movement, the axis motors must be equipped with brakes, or the energy must be dissipated with the UP 110 braking resistor module.

UP 110

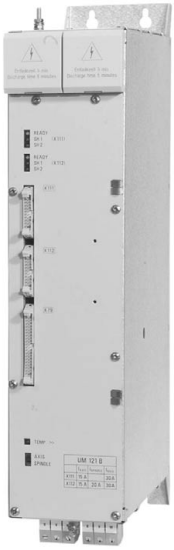
Specifications	**UP 110**
Power	60 kW (for 2 s)
Resistance	9 Ω
Degree of protection	IP 20
Weight	7 kg
ID number	341 516-01

2.4.5 PW 210 (PW 110, PW 120) braking resistor

You will find information on the UV 130 braking resistor under "2.3.4 PW 210 (PW 110, PW 120) Braking Resistor" on page 2 – 7.

2.4.6 UM 1xx power modules

The power modules differ in the number of axes and the permissible maximum currents. They can be combined at random. The PWM signals are transferred from the LE via external 20-line ribbon cables.



UM 121B

Specifications	**UM 111**	**UM 111B**	**UM 112**	**UM 113**	**UM 114**
Continuous load Axis spindle	 1 x 7.5 A –	 1 x 15 A 20 A	 1 x 23 A 31 A	 1 x 32 A 50 A	 1 x 48 A 75 A
Short-time load[a]	15 A	30 A	46 A	64 A	96 A
Power loss	60 W	120 W	250 W	420 W	650 W
Degree of protection	IP 20				
Weight	5.5 kg	9 kg	9 kg	9 kg	12 kg
ID number	325 000-xx	336 948-xx	325 001-xx	325 002-xx	325 005-xx

a. Axes: 40% cyclic duration factor for duration of 5 s
Spindle: 40% cyclic duration factor for duration of 10 minutes (S6-40%)

Specifications	UM 121	UM 121B	UM 122
Continuous load Axis spindle	 2 x 7.5 A –	 2 x 15 A 20 A	 2 x 23 A 31 A
Short-time load[a]	 15 A	 30 A	 46 A
Power loss	120 W	240 W	450 W
Degree of protection	IP20		
Weight	5.5 kg	9 kg	9 kg
ID number	325 003-xx	336 949-xx	325 004-xx

a. Axes: 40% cyclic duration factor for duration of 5 s
Spindle: 40 % cyclic duration factor for duration of 10 minutes (S6-40 %)

Changes to UM 1x1	
xxx xxx-01	Initial version
xxx xxx-02	New connections

Changes to UM 1x1B	
xxx xxx-02	Initial version
xxx xxx-03	New connections

Changes to UM 1x2	
xxx xxx-01	Initial version
xxx xxx-02	New connections

Changes to UM 113 and UM 114	
xxx xxx-01	Initial version
xxx xxx-02	New connections

2.4.7 Ribbon cables and covers

50-line ribbon cable (power supply to LE)

The 50-line ribbon cable connects the UV 1x0 with the LE and serve as voltage supply to the LE. With lengths of 600 mm and longer, the ribbon cable is led doubled to the LE to increase the line cross section. This cable is only required once.

When using the UV 130:

325 816-xx (order length [mm])		Number of modules with 50 mm width (including UP 110)					
		0	1	2	3	4	5
Number of modules with 100 mm width	1	–	**xx = 01** (300)	**xx = 02** (400)	**xx = 02** (400)	**xx = 03** (500)	**xx = 03** (500)
	2	**xx = 02** (400)	**xx = 02** (400)	**xx = 03** (500)	**xx = 03** (500)	**xx = 04** (600)	**xx = 04** (600)
	3	**xx = 03** (500)	**xx = 03** (500)	**xx = 04** (600)	**xx = 04** (600)	**xx = 05** (700)	–
	4	**xx = 04** (600)	**xx = 04** (600)	**xx = 05** (700)	**xx = 05** (700)	–	–
	5	**xx = 05** (700)	**xx = 05** (700)	**xx = 06** (800)	–	–	–
	6	**xx = 06** (800)	**xx = 06** (800)	–	–	–	–
	7	**xx = 07** (900)	–	–	–	–	–

When using the UV 120 or UV 140:

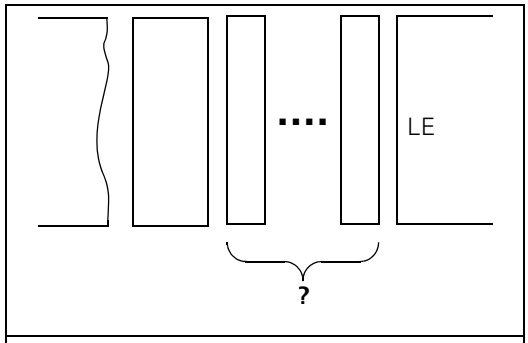
325 816-xx (order length [mm])		Number of modules with 50 mm width (including UP 110)					
		0	1	2	3	4	5
Number of modules with 100 mm width	1	–	**xx = 01** (300)	**xx = 01** (300)	**xx = 02** (400)	**xx = 02** (400)	**xx = 03** (500)
	2	**xx = 01** (300)	**xx = 02** (400)	**xx = 02** (400)	**xx = 03** (500)	**xx = 03** (500)	**xx = 04** (600)
	3	**xx = 02** (400)	**xx = 03** (500)	**xx = 03** (500)	**xx = 04** (600)	**xx = 04** (600)	–
	4	**xx = 03** (500)	**xx = 04** (600)	**xx = 04** (600)	**xx = 05** (700)	–	–
	5	**xx = 04** (600)	**xx = 05** (700)	**xx = 05** (700)	–	–	–
	6	**xx = 05** (700)	**xx = 06** (800)	–	–	–	–
	7	**xx = 06** (800)	–	–	–	–	–

20-line ribbon cable (PWM signals)

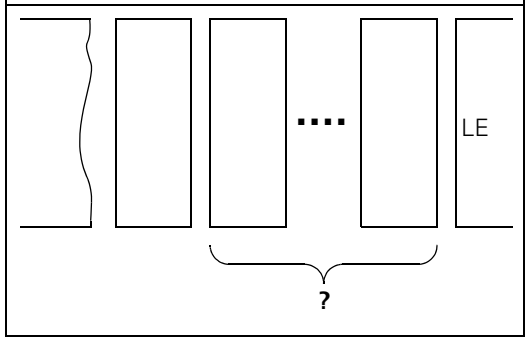
The 20-line ribbon cable connects the PWM outputs of the LE with the corresponding UM 1xx power modules. One 20-line ribbon cable is required for each axis or spindle.
The LE 430 M/9 axes was used as the basis for creating the tables, since this control requires the greatest cable length. These cables also can be used for all other controls.

The following table is for the connection between the LE and a module with 100 mm width.

The table rows indicate the number of modules with 50 mm width (incl. UP 110) between the LE and a module with 100 mm width

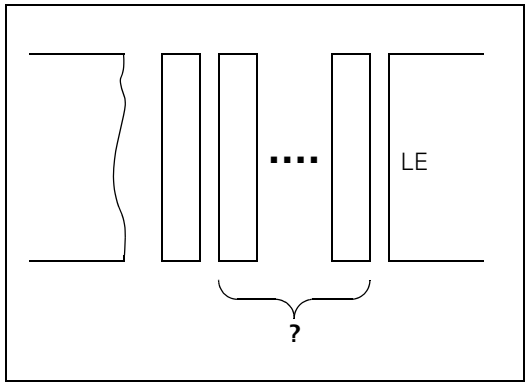


The table rows indicate the number of modules with 100 mm width between the LE and a module with 100 mm width



250 479-xx (order length [mm])		Number of modules with 50 mm width (incl. UP 110) between the LE and a module with 100 mm width					
		0	1	2	3	4	5
Number of modules with 100 mm width between the LE and a module with 100 mm width	0	**xx = 08** (200)	**xx = 09** (300)	**xx = 09** (300)	**xx = 10** (400)	**xx = 10** (400)	**xx = 11** (500)
	1	**xx = 09** (300)	**xx = 10** (400)	**xx = 10** (400)	**xx = 11** (500)	**xx = 11** (500)	**xx = 12** (600)
	2	**xx = 10** (400)	**xx = 11** (500)	**xx = 11** (500)	**xx = 12** (600)	**xx = 12** (600)	–
	3	**xx = 11** (500)	**xx = 12** (600)	**xx = 12** (600)	**xx = 13** (700)	–	–
	4	**xx = 12** (600)	**xx = 13** (700)	**xx = 13** (700)	–	–	–
	5	**xx = 13** (700)	**xx = 14** (800)	–	–	–	–
	6	**xx = 14** (800)	–	–	–	–	–

The following table is for the connection between the LE and a module with 50 mm width.



250 479-xx (order length [mm])	Number of modules with 50 mm width (incl. UP 110) between the LE and a module with 50 mm width				
	0	1	2	3	4
	xx = 08 (200)	**xx = 08** (200)	**xx = 09** (300)	**xx = 09** (300)	**xx = 10** (400)

40-line ribbon cable (unit bus)

The 40-line ribbon cable connects the UV 1x0 with all of the UM 1xx power modules, making the unit bus. This cable is only required once.

325 817-xx (order length [mm])		Number of modules with 50 mm width (including UP 110)					
		0	1	2	3	4	5
Number of modules with 100 mm width	1	**xx = 01** (300)	**xx = 01** (300)	**xx = 01** (300)	**xx = 01** (300)	**xx = 02** (400)	**xx = 02** (400)
	2	**xx = 01** (300)	**xx = 01** (300)	**xx = 02** (400)	**xx = 02** (400)	**xx = 03** (500)	**xx = 03** (500)
	3	**xx = 01** (300)	**xx = 02** (400)	**xx = 03** (500)	**xx = 03** (500)	**xx = 04** (600)	–
	4	**xx = 02** (400)	**xx = 03** (500)	**xx = 04** (600)	**xx = 04** (600)	–	–
	5	**xx = 03** (500)	**xx = 04** (600)	**xx = 05** (700)	–	–	–
	6	**xx = 04** (600)	**xx = 05** (700)	–	–	–	–
	7	**xx = 05** (700)	–	–	–	–	–

Ribbon cable covers The ribbon cables must be covered to protect against interference.

A cover is supplied as an accessory with the UV 1x0 (Id. Nr. 329 031-03), which protects the following modules:

- UV 1x0
- One UM 1xx (100 mm width)
- One UM 1xx (50 mm width)

The cover for the LE is supplied with the LE.

If further axis modules are used, the corresponding covers must be ordered separately:

Quantity y * 329 031-xx (Length [mm])		Number of modules with 50 mm width (including UP 110)					
		0	1	2	3	4	5
Number of modules with 100 mm width	1	–	–	**1 * 05** (50)	**1 * 10** (100)	**1 * 15** (150)	**1 * 20** (200)
	2	**1 * 05** (50)	**1 * 10** (100)	**1 * 15** (150)	**1 * 20** (200)	**1 * 20** (200) **1 * 05** (50)	**1 * 20** (200) **1 * 10** (100)
	3	**1 *15** (150)	**1 * 20** (200)	**1 * 20** (200) **1 * 05** (50)	**1 * 20** (200) **1 * 10** (100)	**1 * 20** (200) **1 * 15** (150)	–
	4	**1 * 20** (200) **1 * 05** (50)	**1 * 20** (200) **1 * 10** (100)	**1 * 20** (200) **1 * 15** (150)	**2 * 20** (200)	–	–
	5	**1 * 20** (200) **1 * 15** (150)	**2 * 20** (200)	**2 * 20** (200) **1 * 05** (50)	–	–	–
	6	**2 * 20** (200) **1 * 05** (50)	**2 * 20** (200) **1 * 10** (100)	–	–	–	–
	7	**2 * 20** (200) **1 * 15** (150)	–	–	–	–	–

3 Selection of Motors and Inverters

3 Selection of Motors and Inverters

3.1 Selection of the Axis Motor

Procedure

Selection of a synchronous motor and the proper inverter:

- Calculation of the static moment from the sum of
  - Frictional moment (with horizontal axes)
  - Moment for overcoming the force of gravity (for vertical axis)
  - Machining moment
- Calculation of the desired speed of the motor
- Selection of the motor according to
  - Stall torque of the motor ≥ static moment
  - Rated speed of the motor ≥ desired speed
- Selection of the inverter according to
  - Rated current of the inverter ≥ stall torque of the motor
- Calculation of the external moment of inertia
  - Moment of inertia of the table
  - Moment of inertia of the ballscrew
  - Moment of inertia of the gearwheel on the ballscrew
  - Moment of inertia of the gearwheel on the motor
- Calculation of the total moment of inertia from
  - External moment of inertia
  - Moment of inertia of the motor
- Checking the ratio of external moment of inertia to the moment of inertia of the motor
- Calculation of the acceleration moment
- Comparison of the acceleration moment with the
  - Maximum moment of the inverter
  - Maximum moment of the motor
- Calculation of the effective moment at a given load cycle
- Comparison of the effective moment at a given load cycle with the rated torque of the motor

Mathematical formulas for calculation

Data	Formulas	Variable
Frictional moment M_R	$M_R = \frac{m \cdot g \cdot \mu \cdot h \cdot \cos\alpha}{2 \cdot \pi \cdot i \cdot \eta}$	m: Mass [kg] g: Acceleration of gravity [m/s^2] μ: Coefficient of friction [-] h: Ballscrew pitch [m] α: Axis angle [°] (0° = horizontal axis) i: Gear ratio [-] ($n_{motor}/n_{ballscrew}$) η: Efficiency [-]
Moment for overcoming the force of gravity M_G	$M_G = \frac{m \cdot g \cdot h \cdot \sin\alpha}{2 \cdot \pi \cdot i \cdot \eta}$	m: Mass [kg] g: Acceleration of gravity [m/s^2] h: Ballscrew pitch [m] α: Axis angle [°] (90° = vertical axis) i: Gear ratio [-] ($n_{motor}/n_{ballscrew}$) η: Efficiency [-]
Machining moment M_B	$M_B = \frac{F_B \cdot h}{2 \cdot \pi \cdot i \cdot \eta}$	F_B: Machining force [N] h: Ballscrew pitch [m] i: Gear ratio [-] ($n_{motor}/n_{ballscrew}$) η: Efficiency [-]
Static moment M_{Stat}	$M_{Stat} = M_R + M_G + M_B$	M_R: Frictional moment [Nm] M_G: Moment for overcoming the force of gravity [Nm] M_B: Machining moment [Nm]
Rated speed of the motor n_S	$n_S = \frac{v_{max} \cdot i}{h}$	v_{max}: Rapid traverse [m/min] i: Gear ratio [-] ($n_{motor}/n_{ballscrew}$) h: Ballscrew pitch [m]
Selection of the motor	$M_{0Motor} \geq M_{Stat}$ $n_{NMotor} \geq n_S$	M_{0Motor}: Stall torque of the motor M_{Stat}: Static moment n_{NMotor}: Rated speed of the motor n_S: Desired speed of the motor
Modular inverter: Selection of the power module **Compact inverter:** Selection of the axis unit	$I_{NU} \geq I_{0Motor}$	I_{NU}: Rated current of the inverter I_{0Motor}: Stall current of the motor
Moment of inertia of the table J_T	$J_T = m \cdot \left(\frac{h}{2 \cdot \pi}\right)^2$	m: Table mass [kg] h: Ballscrew pitch [m]

Data	Formulas	Variable
Moment of inertia of the ballscrew J_S	$J_S = \frac{d_S^{\,4} \cdot \pi \cdot l \cdot \rho}{32}$	d_S: Diameter of the ballscrew [m] l: Length of the ballscrew [m] ρ: Density of the ballscrew material [kg/m^3]
Moment of inertia of the gearwheel on the ballscrew J_{GS}	$J_{GS} = \frac{d_{GS}^{\,4} \cdot \pi \cdot l \cdot \rho}{32}$	d_{GS}: Diameter of the gearwheel on the ballscrew [m] l: Length of the gearwheel on the spindle [m] ρ: Density of the gearwheel material [kg/m^3]
Moment of inertia of the gearwheel on the motor J_{GM}	$J_{GM} = \frac{d_{GM}^{\,4} \cdot \pi \cdot l \cdot \rho}{32}$	d_{GM} = Diameter of the gearwheel on the ballscrew [m] l = Length of the gearwheel on the spindle [m] ρ: Density of the gearwheel material [kg/m^3]
External moment of inertia J_F	$J_F = \frac{J_T + J_S + J_{GS}}{i^2} + J_{GM}$	J_T: Moment of inertia of the table [kgm^2] J_S: Moment of inertia of the ballscrew [kgm^2] J_{GS}: Moment of inertia of the gearwheel on the ballscrew [kgm^2] i = Gear ratio ($n_{motor}/n_{ballscrew}$) J_{GM}: Moment of inertia of the gearwheel on the motor [kgm^2]
Total moment of inertia of the machine slide with motor J_{tot}	$J_{tot} = \frac{J_T + J_S + J_{GS}}{i^2} + J_{GM} + J_M$	J_T: Moment of inertia of the table [kgm^2] J_S: Moment of inertia of the ballscrew [kgm^2] J_{GS}: Moment of inertia of the gearwheel on the ballscrew [kgm^2] i = Gear ratio ($n_{motor}/n_{ballscrew}$) J_{GM}: Moment of inertia of the gearwheel on the motor [kgm^2] J_M: Moment of inertia of the motor [kgm^2]
Ratio of external moment of inertia to the moment of inertia of the motor	$0{,}5 \le \frac{J_F}{J_M} \le 2$	J_F: External moment of inertia [kgm^2] J_M: Moment of inertia of the motor [kgm^2] **This ratio ensures a stable control response!**
Acceleration moment M_{acc}	$M_{acc} = \frac{J_{tot} \cdot 2 \cdot \pi \cdot n_M}{60 \cdot \eta \cdot t_{acc}}$	J_{tot}: Total moment of inertia [kgm^2] n_M: Desired speed of the motor [min^{-1}] η: Efficiency of the motor [-] t_{acc}: Desired acceleration time [s]
Maximum moment of the motor M_{Mmax}	M_{Mmax} from data sheet or $M_{Mmax} = 3 \cdot M_0$	M_0: Stall torque of the motor [Nm]

Data	Formulas	Variable
Maximum moment of the inverter M_{Umax}	$M_{Umax} = \frac{M_{Mmax}}{I_{Mmax}} \cdot I_{Umax}$ or $M_{Umax} = 0{,}8 \cdot \frac{M_{MN}}{I_{MN}} \cdot I_{Umax}$	M_{Mmax}: Maximum moment of the motors [Nm] I_{Mmax}: Maximum current of the motor [A] I_{Umax}: Maximum current of the inverter [A] M_{MN}: Rated torque of the motor [Nm] I_{MN}: Rated current of the motor [A]
Comparison of the acceleration moment with the maximum moment of the motor and inverter	$M_{Mmax} > M_{acc}$ $M_{Umax} > M_{acc}$	M_{Mmax}: Maximum moment of the motors [Nm] M_{acc}: Acceleration moment [Nm] M_{Umax}: Maximum moment of the inverter [Nm]
Weighting factors K_B, K_{Pos}, K_{acc}	$K_B = \frac{t_B}{t_{tot}}$ $K_{Pos} = \frac{t_{Pos}}{t_{tot}}$ $K_{acc} = \frac{t_{acc}}{t_{tot}}$ **Note:** $K_{Bearb} + K_{Pos} + K_{Beschl} = 1$	t_B: Machining time t_{tot}: Total running time t_{Pos}: Time for positioning operations t_{acc}: Time for acceleration **All times must be given in the same unit of measure!**
Effective moment at a given load cycle M_{eff}	M_{Stat}: Static moment [Nm] K_B: Weighting factor for machining operations [-] M_R: Frictional moment [Nm] M_G: Moment for overcoming the force of gravity [Nm] K_{Pos}: Weighting factor for positioning operations [-] M_{acc}: Acceleration moment [Nm] K_{acc}: Weighting factor for acceleration operations [-]	
$M_{eff} = \sqrt{(M_{Stat})^2 \cdot K_B + (M_R + M_G)^2 \cdot K_{Pos} + (M_R + M_G + M_{acc})^2 \cdot K_{acc}}$		
Comparison of the effective moment at a given load cycle with the rated torque of the motor	$M_{MN} \geq M_{eff}$	M_{MN}: Rated torque of the motor [Nm] M_{eff}: Effective moment at a given load cycle [Nm]

3.2 Selection of the Spindle Motor

Procedure

- Selection of the spindle motor for required torque and speed

3.3 Selection of the Inverter

Procedure

Modular inverter:

The power modules were already selected together with the axis motors. The power supply unit must still be selected.

- Calculation of the dc-link power
- Selecting the power supply unit

Compact inverter:

The number of axes and the requirement for current determine the compact inverter. It remains to be examined whether the dc-link power of the selected compact inverter suffices.

Mathematical formulas for calculation

Data	Formulas	Variable
DC-link power P_{DC}	$P_{DC} = \frac{P_{NS}}{\eta_S} + \frac{\Sigma P_{NA}}{\eta_A} \cdot F_{Mratio}$	P_{NS}: Power rating of the spindle motor [W] η_S: Efficiency of the spindle motor [-] ΣP_{NA}: Sum of the power ratings of the feed motors [W] η_A: Efficiency of the feed motors [-], unless indicated otherwise $\eta_A = 1$ F_{Mratio}: Ratio of mean power to rated power of the feed motors.
Selection of the power supply unit or examination of the compact inverter	$P_{DC} \leq P_{NU}$	P_{DC}: DC-link power [W] P_{NU}: Rated power of the power supply unit or the compact inverter [W]

3.4 Selection of the braking resistor

Procedure

- Calculation of braking power
- Calculation of braking power with a specified alternation of load
- Calculation of braking energy
- Selection of the braking resistor according to
  - Peak performance of the braking resistor
  - Reliable mean value of the braking power
  - Maximum braking energy of the braking resistor

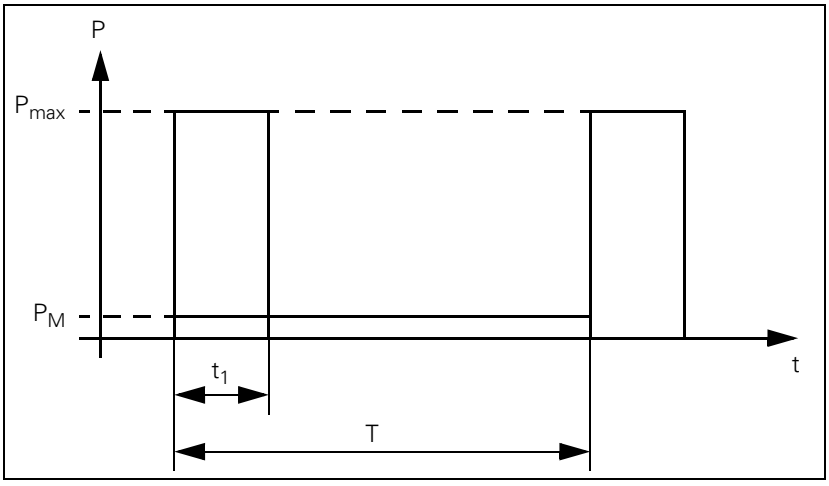
Mathematical formulas for calculation

Data	Formulas	Variable
Braking power P_{Br}	$P_{Br} = \frac{2 \cdot \pi \cdot M_{Br} \cdot n_{max}}{60}$	M_{Br}: Braking moment [Nm] n_{max}: Maximum speed at which braking occurs [rpm]
Braking energy E_{Br}	$E_{Br} = 2 \cdot J \cdot \pi^2 \cdot \left[\left(\frac{n_2}{60}\right)^2 - \left(\frac{n_1}{60}\right)^2\right]$	J: Moment of inertia, including the motor [kgm^2] n_2: Desired speed of the brakes [rpm] n_1: Desired speed after braking [rpm]
Mean value of the braking power with a specified alternation of load P_M	$P_M = P_{Br} \cdot \frac{t_1}{T}$	P_{Br}: Braking power [W] t_1: Load time [s] T: Cycle duration [s]
Selection of the braking resistor	$P_{Br} \leq P_{max}$ $P_M \leq P_{Mzul}$ $E_{Br} \leq E_{max}$	P_{max}: Peak performance of the braking resistor [W] P_{Mzul}: Permissible mean value of the braking performance according to the diagram as a function of E_{Br} [W] (see example on page 3 – 11) E_{max}: Maximum braking energy of the braking resistor [Ws]

Example of a braking with load time t_1 and cycle duration T. P_M is the mean value of the braking performance in this load alternation.

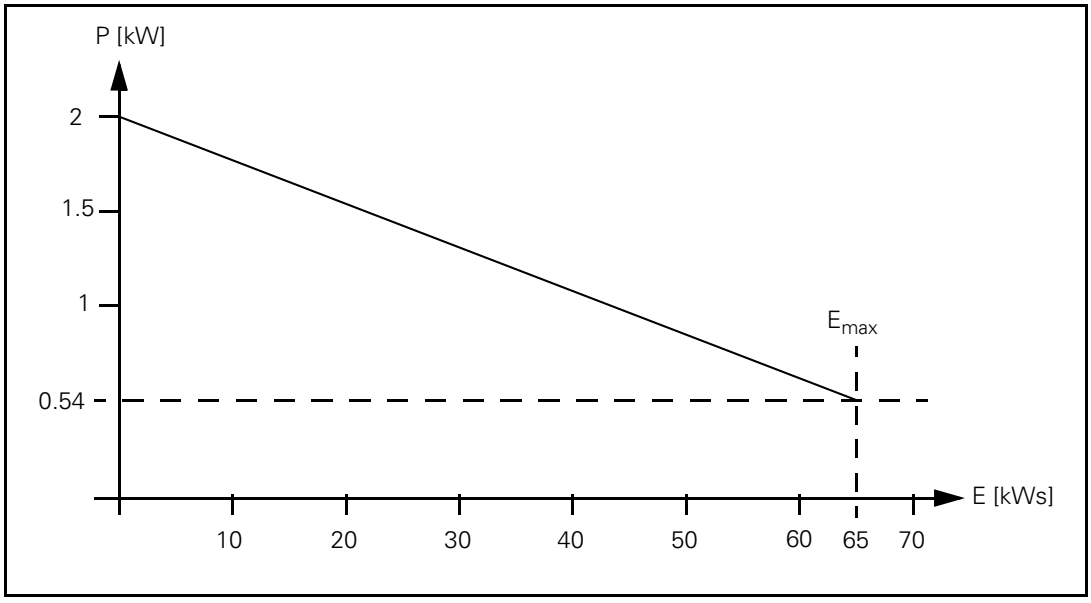
Since $E = P \cdot t$, the enclosed areas must be of equal size:

$$P_M = P_{max} \cdot \frac{t_1}{T}$$



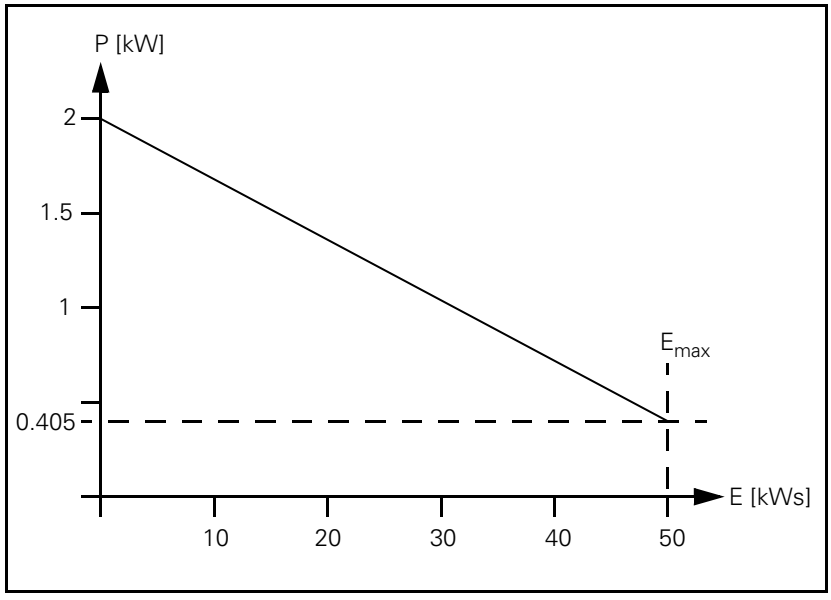
t_1	T	P_{max}	E_{max}
0.37 s	5 s	27 kW	10 kWs
0.7 s	10 s	27 kW	18.9 kWs
1.1 s	20 s	27 kW	29.7 kWs
1.5 s	50 s	27 kW	40.5 kWs
2.4 s	120 s	27 kW	65 kWs

Permissible mean value of the braking performance P_{Mzul} as a function of the braking energy E:



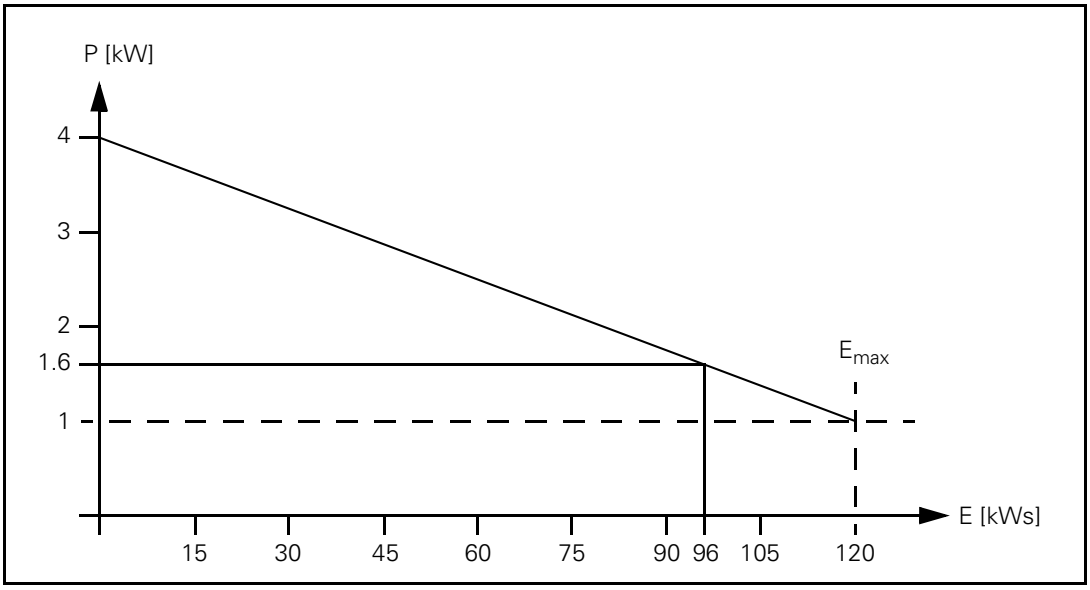
t_1	T	P_{max}	E_{max}
0.37 s	5 s	27 kW	10 kWs
0.6 s	10 s	27 kW	16.2 kWs
0.9 s	20 s	27 kW	24.3 kWs
1.3 s	50 s	27 kW	35.1 kWs
1.8 s	120 s	27 kW	50 kWs

Permissible mean value of the braking performance P_{Mzul} as a function of the braking energy E:



t_1	T	P_{max}	E_{max}
0.37 s	5 s	49 kW	18 kWs
0.7 s	10 s	49 kW	34.3 kWs
1.1 s	20 s	49 kW	53.9 kWs
1.5 s	50 s	49 kW	73.5 kWs
2.4 s	120 s	49 kW	120 kWs

Permissible mean value of the braking performance P_{Mzul} as a function of the braking energy E:



Example:
With the calculated braking energy E_{Br} = 96 kWs, the permissible mean value of the braking performance P_{Mzul} = 1.6 kW, meaning $P_M \leq 1.6$ kW.

4 Mounting and Operating Conditions

4 Mounting and Operating Conditions

4.1 General Information

Warning

Keep the following in mind during mounting and electrical installation:

- National regulations for power installations
- Interference and noise immunity
- Conditions of operation
- Mounting attitude

4.1.1 Degree of protection (IP code)

This refers to the amount of protection afforded by the housing against penetration of solid foreign bodies and/or water. The IP code indicates the degree of protection.

First number	Protection against penetration of solid foreign bodies	Second number	Protection against penetration of water with disruptive effect
0	No protection	0	No protection
1	≥ 50.0 mm	1	Perpendicular droplets
2	≥ 12.5 mm	2	Droplets (15° angle)
3	≥ 2.5 mm	3	Spray water
4	≥ 1.0 mm	4	Splash water
5	Dust-protected	5	Flowing water
6	Dust-proof	6	Heavily flowing water
		7	Temporary submersion
		8	Continuous submersion

Device	Degree of protection (IP code)
UE 2xx, UE 2xxB	IP 20
PW 1x0, PW 210	IP 20
UV 102	IP 20
UV 120, 130, 140	IP 20
KDR 120, 140	IP 00
Line filter	IP 20
UP 110	IP 20
UM 1xx	IP 20
QAN asynchronous motors	IP 54
QSY synchronous motors	IP 65 (shaft bore: IP 64)

4.1.2 Electromagnetic Compatibility

This unit fulfills the requirements for Class A according to EN 55022 and is intended for operation in industrially zoned areas.

Protect your equipment from interference by observing the following rules and recommendations.

Likely sources of interference

Noise is mainly produced by capacitive and inductive coupling from electrical conductors or from device inputs/outputs, such as:

- Strong magnetic fields from transformers or electric motors
- Relays, contactors and solenoid valves
- High-frequency equipment, pulse equipment and stray magnetic fields from switch-mode power supplies
- Power lines and leads to the above equipment

Protective measures

- A minimum distance of 20 cm from the logic unit and its leads to interfering equipment
- A minimum distance of 10 cm from the logic unit and its leads to cables that carry interference signals. For cables in metallic ducting, adequate decoupling can be achieved by using a grounded separation shield.
- Shielding according to IEC 742 EN 50 178
- Potential compensating lines ∅ 6 mm^2 /10 mm^2
- Use of genuine HEIDENHAIN cables, connectors and couplings
- The shield of the line for the holding brake is to be kept as closely as possible (< 30 mm) to ground. The best solution is to fasten the shield with a metal clamp directly onto the sheet-metal housing of the electrical cabinet
- **Only with UE 2xx and UE 2xxB compact inverters:** Mounting of toroidal cores in the motor leads (X80 to X84), in the voltage supply lead (X31) and in the lead to the PW 1x0 braking resistor (only with UE 21x), to suppress interference (system perturbation in accordance with EN 55011 / 55022 class A).
- **Only with modular inverters and UE 2xxB:** Use of covers for the ribbon cables between the modules

Danger

- The leakage current (current at the equipment grounding conductor) is sometimes higher than 3.5 mA.
- The equipment grounding conductor must therefore have a diameter of at least 10 mm^2 according to EN 50178.

Note

When using the UV 120 and UV 140 regenerative power supply units, you **must** use the HEIDENHAIN KDR 120 or KDR 140 commutating reactors, as well as the EPCOS 35 A or 80 A line filters.
High-frequency disturbances in the line power may occur with other commutating reactors or line filters.

Using the three-phase current capacitor

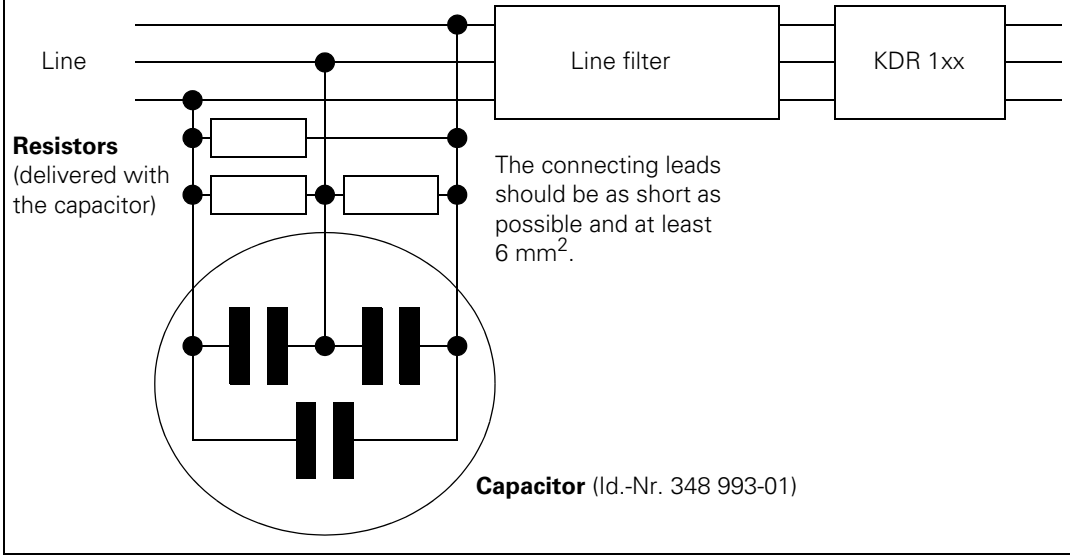
If disturbances in the line power occur even though HEIDENHAIN commutating reactors and line filters are being used, the three-phase current capacitor 3 x 24.1 µF/525 V (Id. Nr. 348 993-01) from HEIDENHAIN must be used. You will find the overall dimensions on page 6 – 43.

Three-phase current capacitor

Note

The three-phase current capacitor is only necessary in exceptional cases. It does not need to be included as a standard part.

Switching on the three-phase current capacitor:



Stability requirements of the power supply

Regenerative power supply unit	Minimum short-circuit current	Minimum short-circuit power
UV 120	I_{SC} = 50 * I_N = 1600 A	S_K = 1.10 MVA
UV 140	I_{SC} = 50 * I_N = 3300 A	S_K = 2.15 MVA

Fault-current circuit breaker

Power supply companies require fault-current circuit breakers for TT and IT networks. A type B fault-current circuit breaker (trigger threshold 300 mA) with frequency weighting is to be used. These are available up to the rated current I_N = 63 A. This is enough for compact and modular inverters with UV 120 and UV 130 power supply units. If the UV 140 power supply unit is used at full capacity, the 63 A of the fault-current circuit breaker are exceeded (65 A); in this case an isolation transformer must be used.
For TN networks, HEIDENHAIN recommends connecting the inverter without the fault-current circuit breaker. Ensure that the grounding conductor has a large enough cross section.

Power supply unit	Rated power output of the isolation transformer	Short-circuit voltage
UV 140	$S_N \geq$ 58.3 kVA	$U_K \geq$ 3 %

Line voltage

In case no line power with 400 Vac ±10 % is available, an autotransformer may be used for adjusting the line voltage.

Device	Rated power output of the autotransformer
UE 21x	$S_N \geq$ 16.9 kVA
UE 21xB	$S_N \geq$ 19.5 kVA
UE 230, UE 24x	$S_N \geq$ 25.9 kVA
UE 230B, UE 24xB	$S_N \geq$ 28.5 kVA
UV 120	$S_N \geq$ 28.5 kVA
UV 130	$S_N \geq$ 44 kVA
UV 140	$S_N \geq$ 58.3 kVA

4.1.3 Cross sections of the power cables

A permissible current load value I_Z is assigned to each cable cross section.

This permissible current load value must be corrected with two factors:

- Correction factor C_1 for increased ambient air temperature
- Correction factor C_2 for insulation material with increased operating temperature

The permissible current load I_Z assumes an ambient air temperature of +40 °C. The type of installation is B2 (cables and lines in protective armor and installation channels).

If the ambient air temperature is increased to +45 °C, correction factor $C_1 = 0.91$; if the operating temperature of the insulation material is max. +90 °C, correction factor $C_2 = 1.13$.

$$I_{Zkorr} = 0,91 \cdot 1,13 \cdot I_Z$$

Cable cross section	**Permissible current load I_Z**	**Corrected current load capacity I_{Zkorr}**
1.0 mm^2	9.6 A	9.8 A
1.5 mm^2	12.2 A	12.5 A
2.5 mm^2	16.5 A	17.0 A
4.0 mm^2	23.0 A	23.7 A
6.0 mm^2	29.0 A	29.8 A
10.0 mm^2	40.0 A	41.2 A
16.0 mm^2	53.0 A	54.6 A

4.2 Environmental Conditions

4.2.1 Heat generation and cooling

The permissible ambient temperature in operation is between 0 °C and 45 °C. Any deviation from this will impair the operating safety of the machine.

The following measures can ensure adequate heat removal:

- Provide sufficient space for air circulation.
- Build in a fan to intensify the natural convection. The fan should extract the warm air. No pre-warmed air should be blown into the unit. The warmed air should flow over surfaces that have good thermal conductivity to the external surroundings.
- For a closed steel housing without assisted cooling,the figure for heat conduction is 3 W/m^2 of surface per °C air temperature difference between inside and outside.
- Use of a heat exchanger with separate internal and external circulation.

HEIDENHAIN advises against blowing external air through the control cabinet to replace the internal air. Electronic assemblies may be adversely affected by fine dust or vapors. If no other method of cooling is possible, then ensure that the fan extracts the warmed air from the electrical cabinet and that the air drawn in is adequately filtered. Regular servicing of the filter is essential.

4.2.2 Air humidity

Permissible humidity

- Maximum 75 % in continuous operation
- Maximum 95 % for not more than 30 days a year (randomly distributed)

In tropical areas it is recommended that the units not be switched off, so that condensation is avoided on the circuit boards.

4.2.3 Mechanical vibration

Permissible vibration:	± 0.075 mm, 10 to 41 Hz 5 m/s^2, 41 Hz to 500 Hz
Permissible shock:	50 m/s^2, 11 ms

4.2.4 Contamination

EN 50 178 permits contamination level 2.

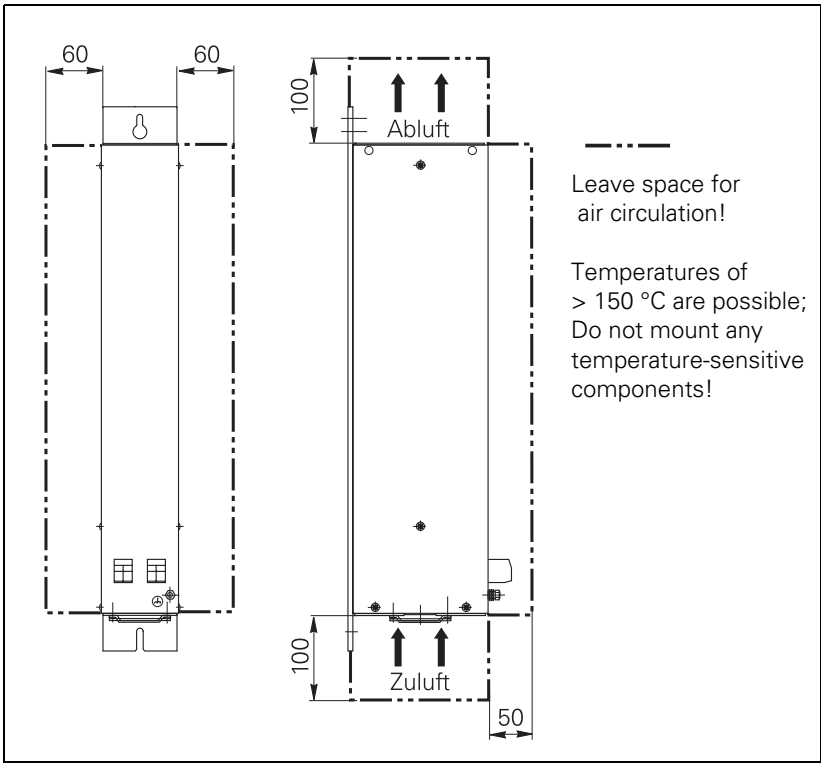
4.3 Mounting conditions

Warning

When mounting, please observe proper minimum clearance, space requirements, and length of connecting cable.

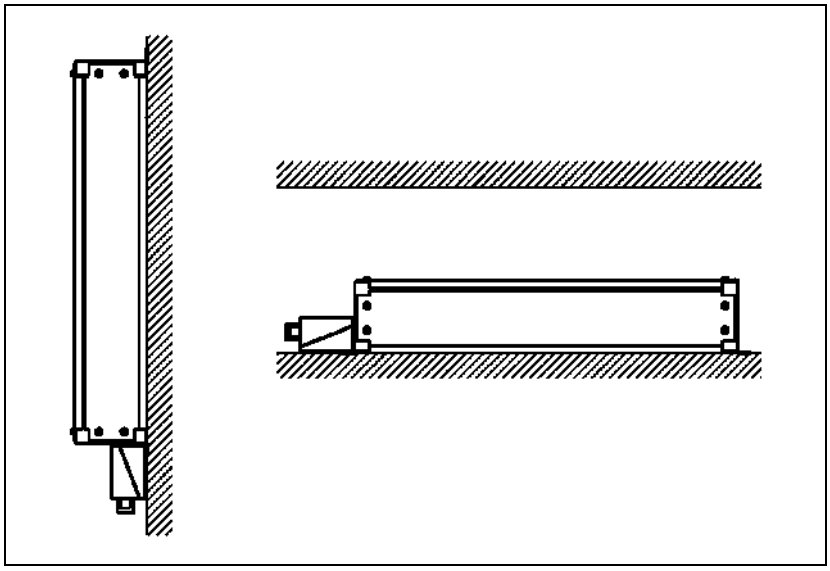
Mounting attitude of the PW 1x0 braking resistor

Because of its high heat generation, the PW 1x0 must be mounted outside the control cabinet in a vertical position (with the fan at the bottom.) Mount the braking resistor in a way that prevents the ingress of splashing water (coolant) and makes unintentional personal contact impossible.

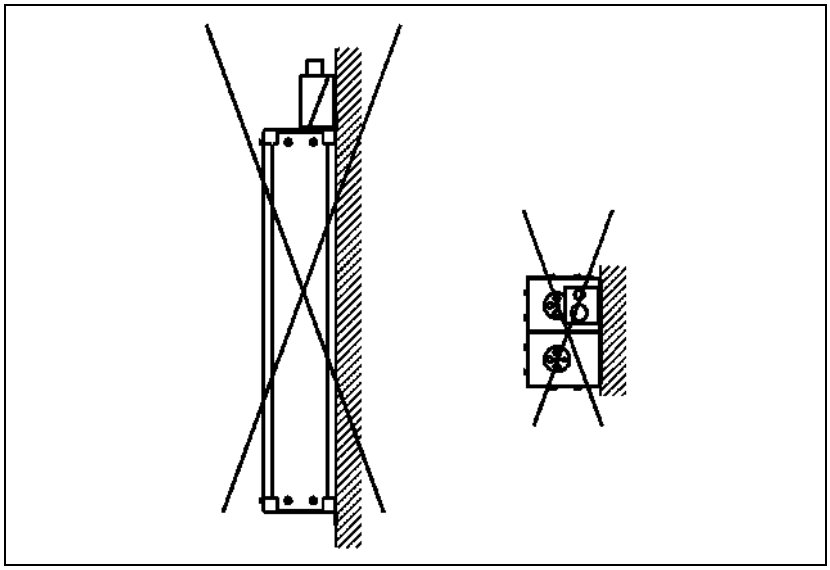


Mounting attitude of the PW 210 braking resistor

Because of the large amount of heat generated, the PW 210 must be mounted outside the electrical cabinet, either vertically (connections at bottom) or horizontally (connections at rear).

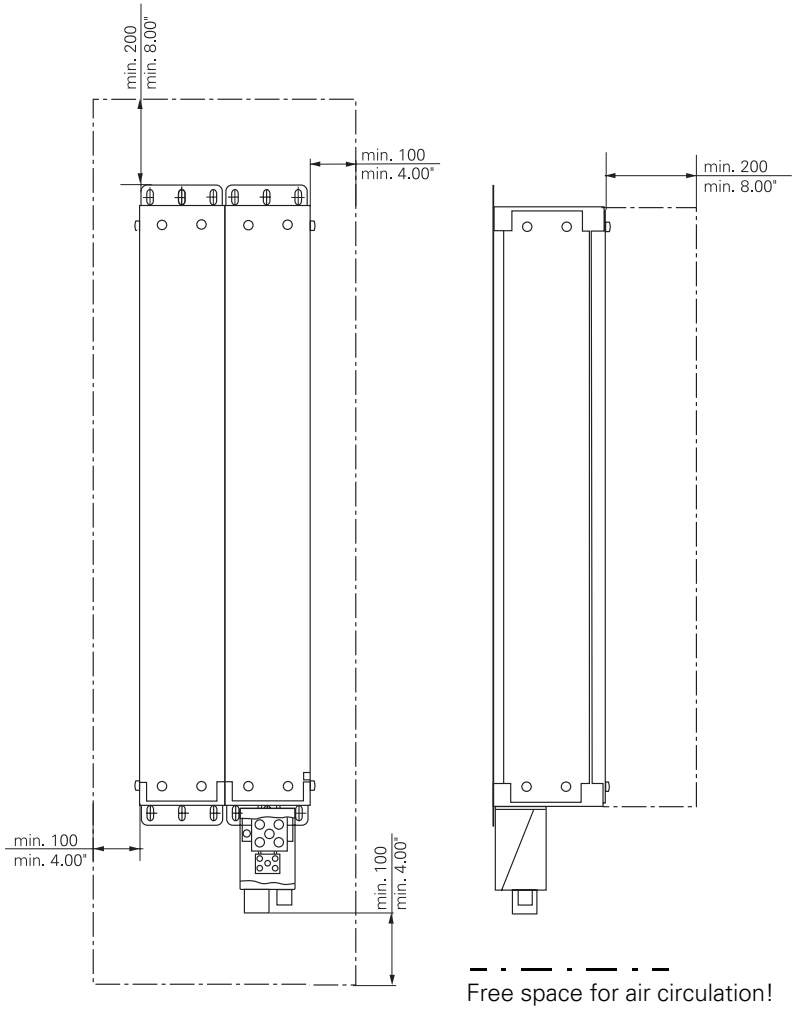


The braking resistor may not be positioned so that the connections face upwards, since the heat produced rises.



Warning

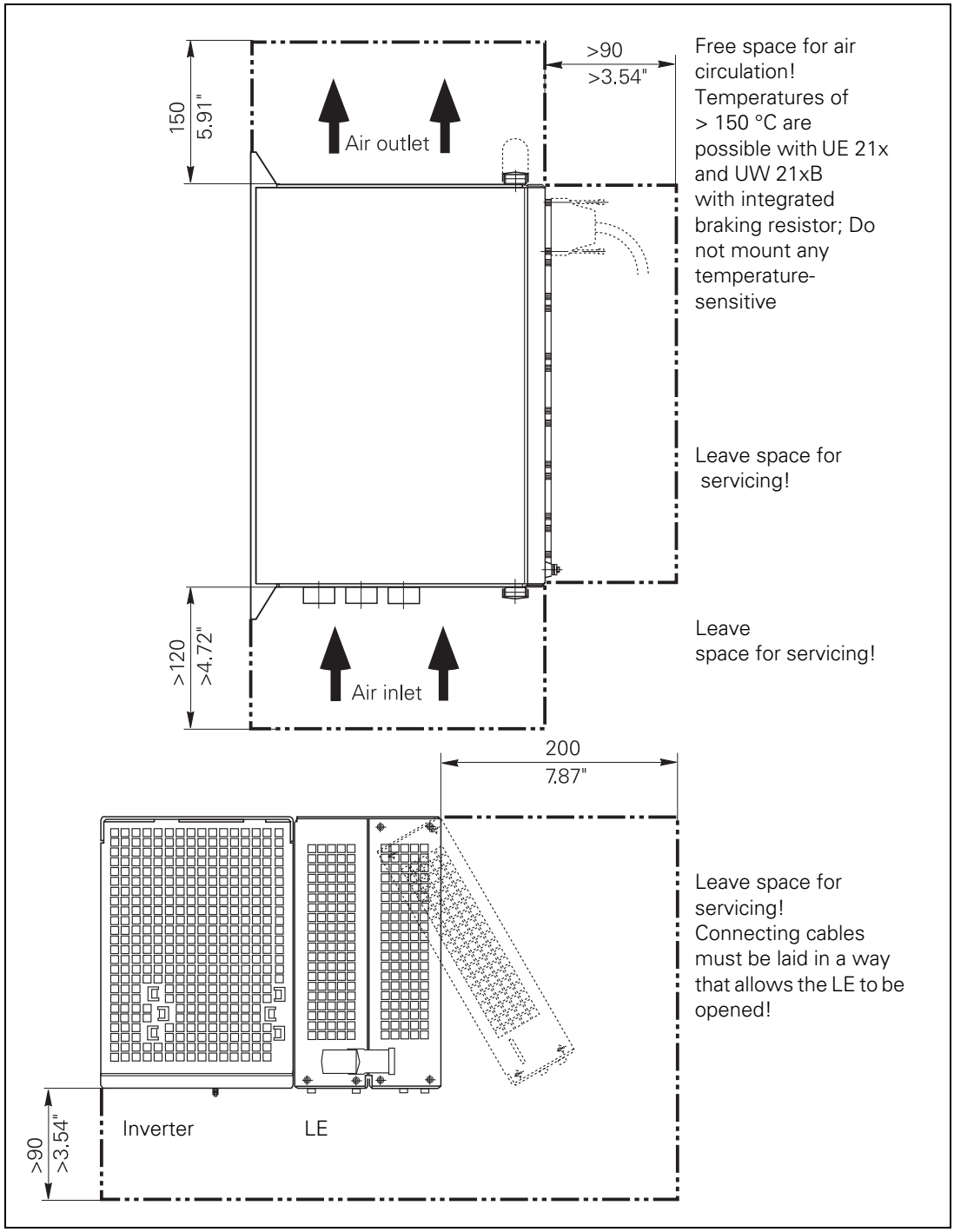
Mount the braking resistor in a way that prevents the ingress of splashing water (coolant). At the same time, a cover must be mounted to make personal contact with the braking resistor impossible.



Free space for air circulation!

Temperatures of > 150 °C are possible; Do not mount any temperature-sensitive components!

Mounting attitude of the HEIDENHAIN inverter



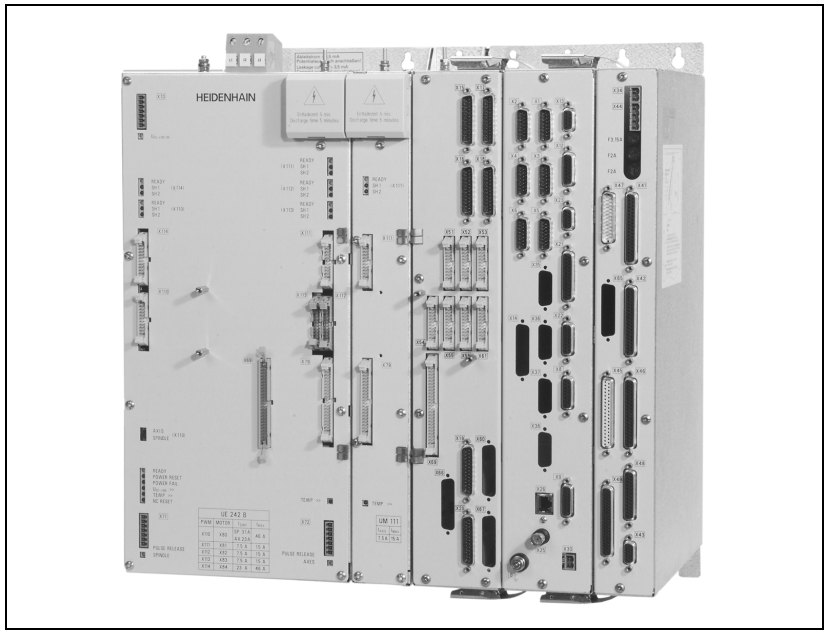
5 UE 2xx and UE 2xxB Compact Inverters

5 UE 2xx and UE 2xxB Compact Inverters

5.1 Connection Overview

LE 410 M "compact" with UE 212

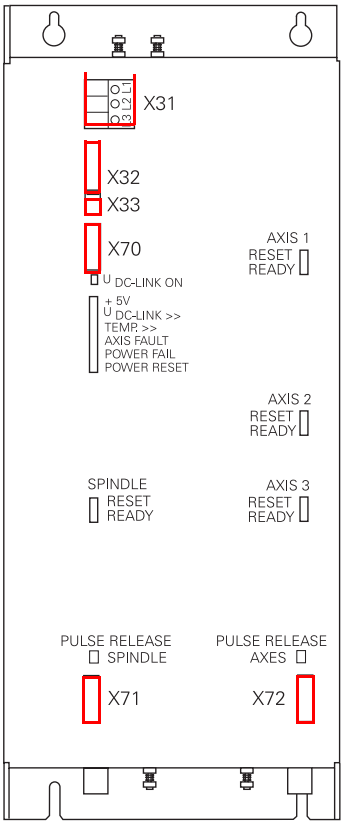
LE 426 M with UE 2xxB compact inverter and UM 111 power module



5.1.1 Compact inverter UE 210

Danger

Do not engage or disengage any connecting elements while the unit is under power!

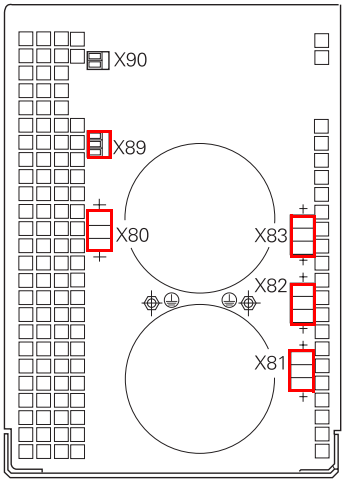


X31 Power supply for inverter

X32 Output for power supply (L1, L2, $+U_Z$, $-U_Z$)
X33 Power supply for supply unit (L1, L2)

X70 Main contactor

X71 Safety relay for spindle
X72 Safety relay for axes



X90 24 V output

X89 Braking resistor

X80 Motor connection for spindle (19 A)
X83 Motor connection for axis 3 (7.5 A)

X82 Motor connection for axis 2 (7.5 A)

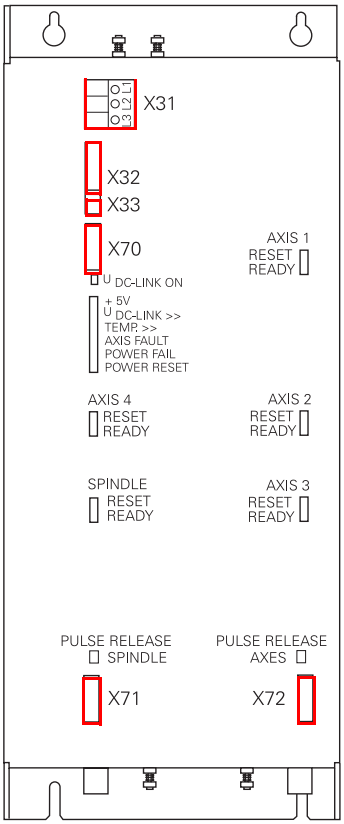
X81 Motor connection for axis 1 (7.5 A)

Equipment ground

5.1.2 Compact inverter UE 212

Danger

Do not engage or disengage any connecting elements while the unit is under power!

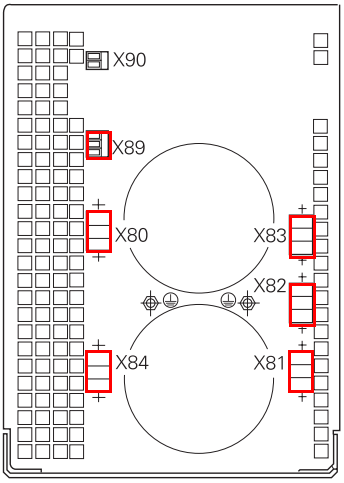


X31 Power supply for inverter

X32 Output for power supply (L1, L2, $+U_Z$, $-U_Z$)
X33 Power supply for supply unit (L1, L2)

X70 Main contactor

X71 Safety relay for spindle
X72 Safety relay for axes



X90 24 V output

X89 Braking resistor

X80 Motor connection for spindle (19 A)
X83 Motor connection for axis 3 (7.5 A)

X82 Motor connection for axis 2 (7.5 A)

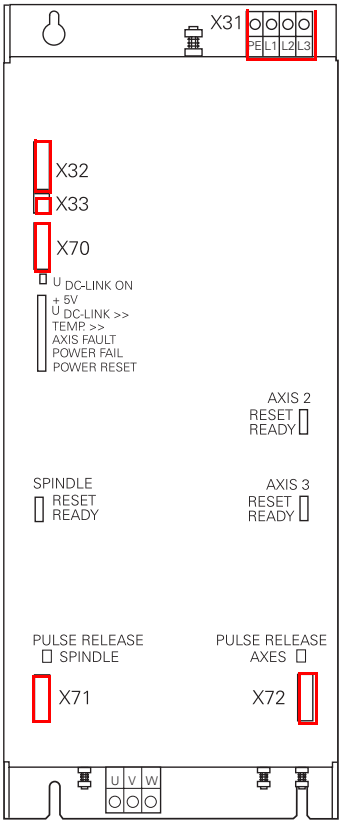
X84 Motor connection for axis 4 (14 A)
X81 Motor connection for axis 1 (7.5 A)

Equipment ground

5.1.3 Compact inverter UE 230

Danger

Do not engage or disengage any connecting elements while the unit is under power!



X31 Power supply for inverter

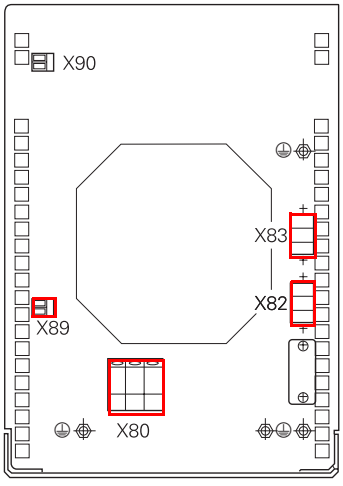
X32 Output for power supply (L1, L2, $+U_Z$, $-U_Z$)

X33 Power supply for supply unit (L1, L2)

X70 Main contactor

X71 Safety relay for spindle

X72 Safety relay for axes



X90 24 V output

X83 Motor connection for axis 3 (7.5 A)

X82 Motor connection for axis 2 (7.5 A)

X89 Braking resistor

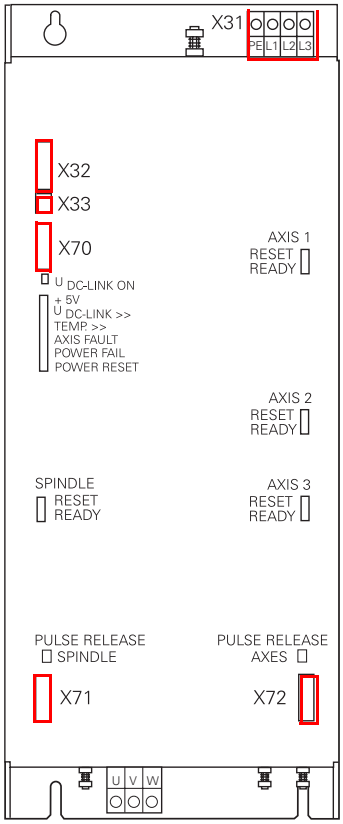
X80 Motor connection for spindle (31 A)

Equipment ground

5.1.4 Compact inverter UE 240

Danger

Do not engage or disengage any connecting elements while the unit is under power!



X31 Power supply for inverter

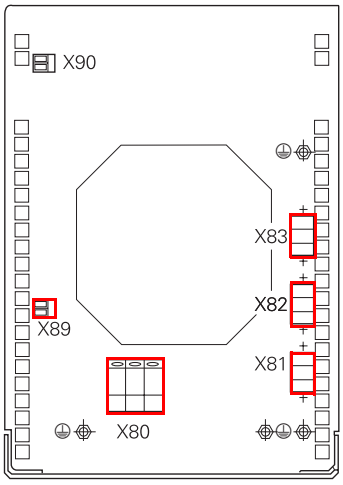
X32 Output for power supply (L1, L2, $+U_Z$, $-U_Z$)

X33 Power supply for supply unit (L1, L2)

X70 Main contactor

X71 Safety relay for spindle

X72 Safety relay for axes



X90 24 V output

X83 Motor connection for axis 3 (7.5 A)

X82 Motor connection for axis 2 (7.5 A)

X89 Braking resistor

X81 Motor connection for axis 1 (7.5 A)

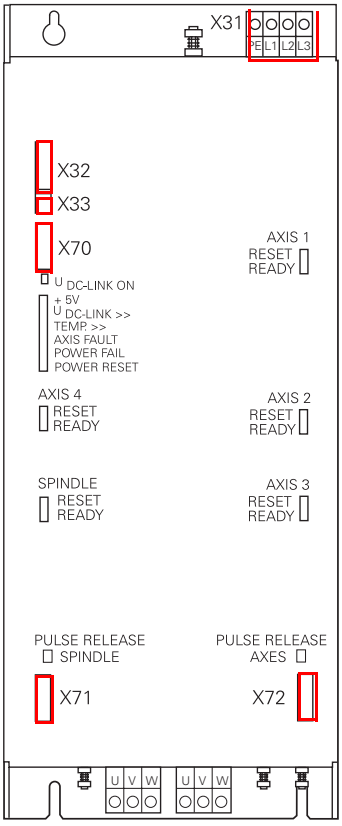
X80 Motor connection for spindle (31 A)

Equipment ground

5.1.5 Compact inverter UE 242

Danger

Do not engage or disengage any connecting elements while the unit is under power!



X31 Power supply for inverter

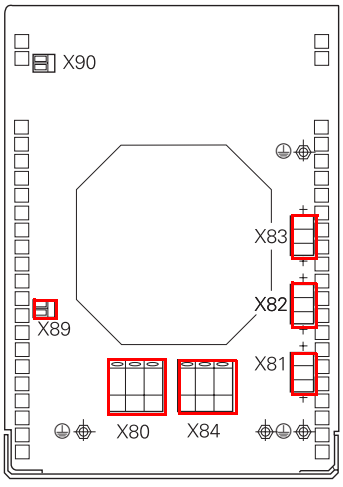
X32 Output for power supply (L1, L2, $+U_Z$, $-U_Z$)

X33 Power supply for supply unit (L1, L2)

X70 Main contactor

X71 Safety relay for spindle

X72 Safety relay for axes



X90 24 V output

X83 Motor connection for axis 3 (7.5 A)

X82 Motor connection for axis 2 (7.5 A)

X89 Braking resistor

X81 Motor connection for axis 1 (7.5 A)

X80 Motor connection for spindle (31 A)

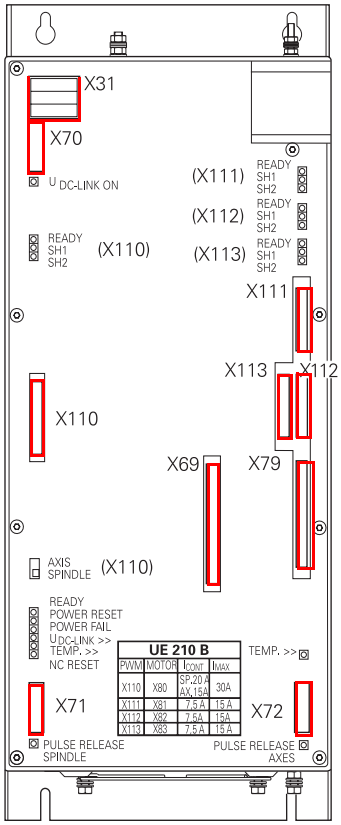
X84 Motor connection for axis 4 (23 A)

Equipment ground

5.1.6 Compact inverter UE 210B

Danger

Do not engage or disengage any connecting elements while the unit is under power!



X31 Power supply for inverter

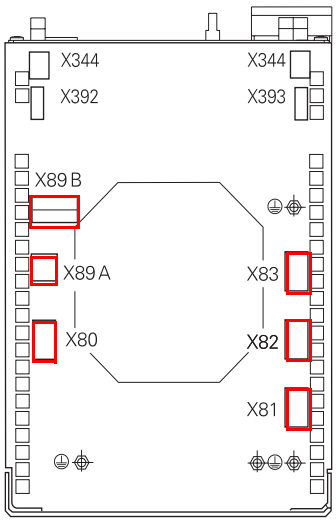
X70 Main contactor

X110 to
X113 PWM connection for axes/spindle

X69 Power supply for LE
X79 Unit bus

Sliding switch:
AXIS: X110 is used as axis
SPINDLE: X110 is used as spindle

X71 Safety relay for spindle
X72 Safety relay for axes



X344 Reserved (do not use)
X392 Reserved (do not use)
X393 Reserved (do not use)

X89B Internal braking resistor
X89A PW 210 external braking resistor (or PW 1x0)

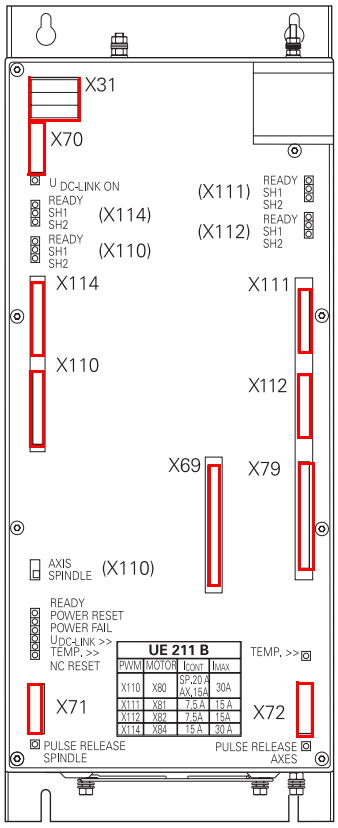
X83 Motor connection for axis 3 (7.5 A)
X80 Motor connection for spindle (20 A)
X82 Motor connection for axis 2 (7.5 A)
X81 Motor connection for axis 1 (7.5 A)

⏚ Equipment ground

5.1.7 Compact inverter UE 211B

Danger

Do not engage or disengage any connecting elements while the unit is under power!



X31 Power supply for inverter

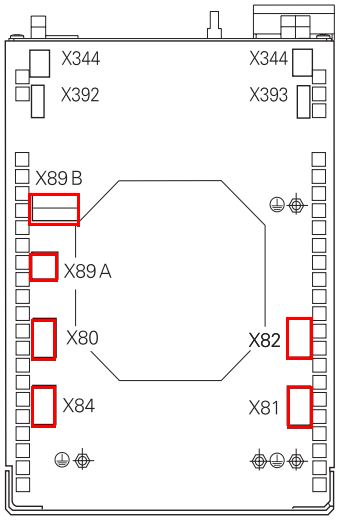
X70 Main contactor

X110 to
X114 PWM connection for axes/spindle

X69 Power supply for LE
X79 Unit bus

Sliding switch:
AXIS: X110 is used as axis
SPINDLE: X110 is used as spindle

X71 Safety relay for spindle
X72 Safety relay for axes



X344 Reserved (do not use)
X392 Reserved (do not use)
X393 Reserved (do not use)

X89B Internal braking resistor
X89A PW 210 external braking resistor (or PW 1x0)

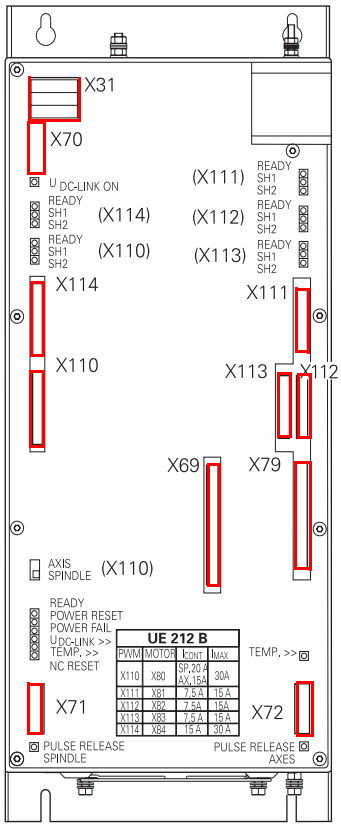
X80 Motor connection for spindle (20 A)
X82 Motor connection for axis 2 (7.5 A)
X84 Motor connection for axis 3 (15 A)
X81 Motor connection for axis 1 (7.5 A)

⏚ Equipment ground

5.1.8 Compact inverter UE 212B

Danger

Do not engage or disengage any connecting elements while the unit is under power!



X31 Power supply for inverter

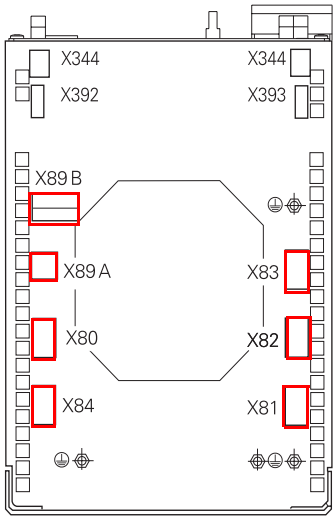
X70 Main contactor

X110 to
X114 PWM connection for axes/spindle

X69 Power supply for LE
X79 Unit bus

Sliding switch:
AXIS: X110 is used as axis
SPINDLE: X110 is used as spindle

X71 Safety relay for spindle
X72 Safety relay for axes



X344 Reserved (do not use)
X392 Reserved (do not use)
X393 Reserved (do not use)

X89B Internal braking resistor
X89A PW 210 external braking resistor (or PW 1x0)

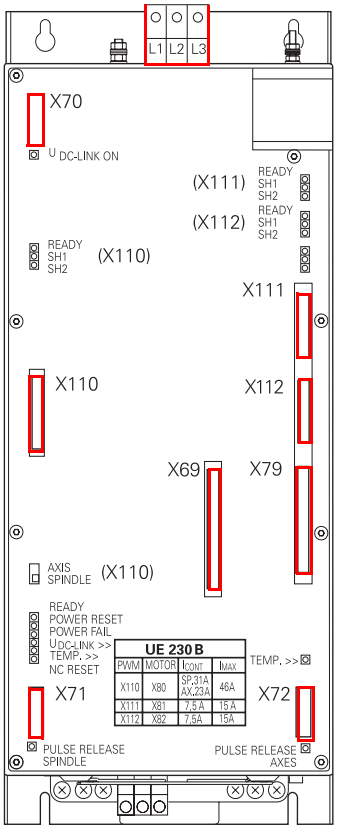
X83 Motor connection for axis 3 (7.5 A)
X80 Motor connection for spindle (20 A)
X82 Motor connection for axis 2 (7.5 A)
X84 Motor connection for axis 4 (15 A)
X81 Motor connection for axis 1 (7.5 A)

⏚ Equipment ground

5.1.9 Compact inverter UE 230B

Danger

Do not engage or disengage any connecting elements while the unit is under power!



X31 Power supply for inverter

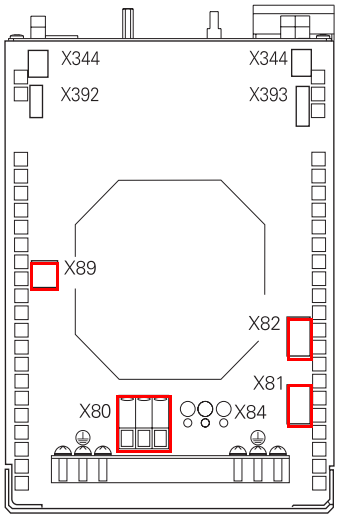
X70 Main contactor

X110 to
X112 PWM connection for axes/spindle

X69 Power supply for LE
X79 Unit bus

Sliding switch:
AXIS: X110 is used as axis
SPINDLE: X110 is used as spindle

X71 Safety relay for spindle
X72 Safety relay for axes



X344 Reserved (do not use)
X392 Reserved (do not use)
X393 Reserved (do not use)

X89 Braking resistor

X82 Motor connection for axis 2 (7.5 A)

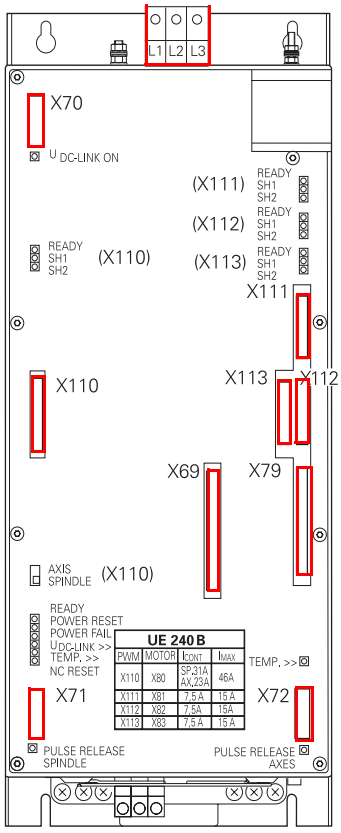
X81 Motor connection for axis 1 (7.5 A)
X80 Motor connection for spindle (31 A)

⏚ Equipment ground

5.1.10 Compact inverter UE 240B

Danger

Do not engage or disengage any connecting elements while the unit is under power!



X31 Power supply for inverter

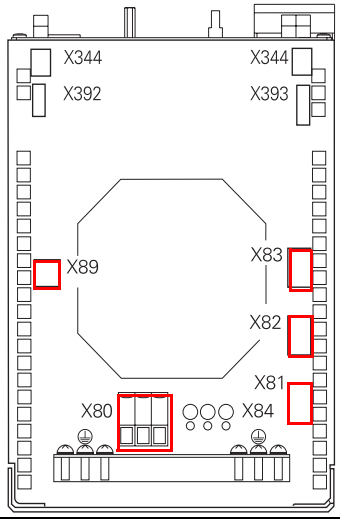
X70 Main contactor

X110 to
X113 PWM connection for axes/spindle

X69 Power supply for LE
X79 Unit bus

Sliding switch:
AXIS: X110 is used as axis
SPINDLE: X110 is used as spindle

X71 Safety relay for spindle
X72 Safety relay for axes



X344 Reserved (do not use)
X392 Reserved (do not use)
X393 Reserved (do not use)

X89 Braking resistor
X83 Motor connection for axis 3 (7.5 A)

X82 Motor connection for axis 2 (7.5 A)

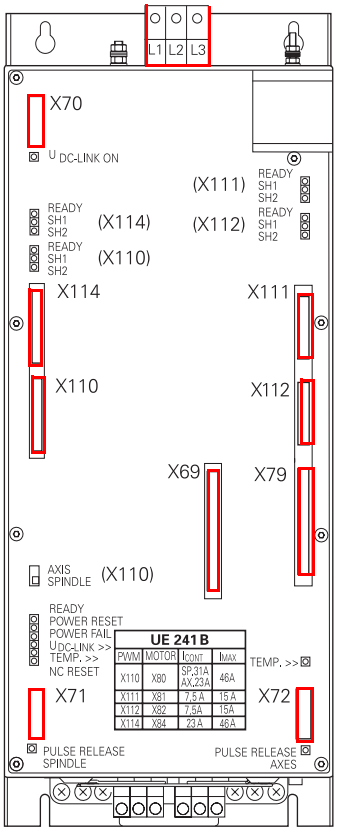
X81 Motor connection for axis 1 (7.5 A)
X80 Motor connection for spindle (31 A)

⏚ Equipment ground

5.1.11 Compact inverter UE 241B

Danger

Do not engage or disengage any connecting elements while the unit is under power!



X31 Power supply for inverter

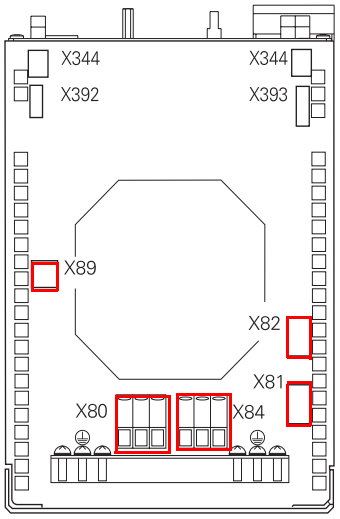
X70 Main contactor

X110 to
X114 PWM connection for axes/spindle

X69 Power supply for LE
X79 Unit bus

Sliding switch:
AXIS: X110 is used as axis
SPINDLE: X110 is used as spindle

X71 Safety relay for spindle
X72 Safety relay for axes



X344 Reserved (do not use)
X392 Reserved (do not use)
X393 Reserved (do not use)

X89 Braking resistor

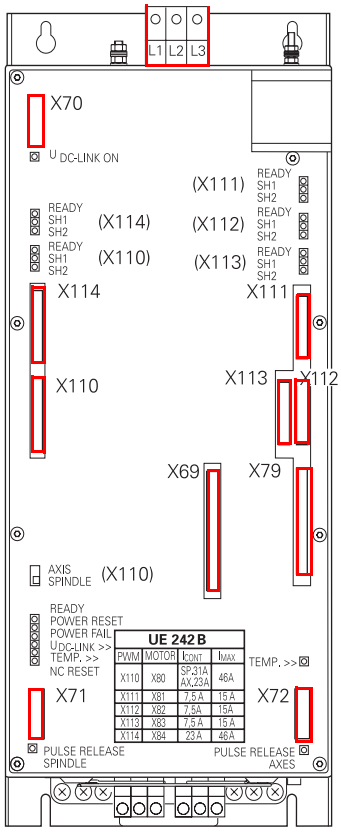
X82 Motor connection for axis 2 (7.5 A)
X81 Motor connection for axis 1 (7.5 A)
X80 Motor connection for spindle (31 A)
X84 Motor connection for axis 3 (23 A)

⏚ Equipment ground

5.1.12 Compact inverter UE 242B

Danger

Do not engage or disengage any connecting elements while the unit is under power!



X31 Power supply for inverter

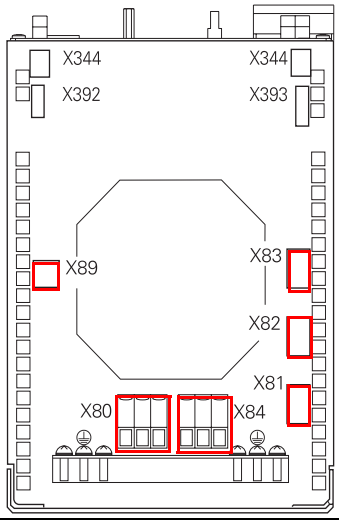
X70 Main contactor

X110 to
X114 PWM connection for axes/spindle

X69 Power supply for LE
X79 Unit bus

Sliding switch:
AXIS: X110 is used as axis
SPINDLE: X110 is used as spindle

X71 Safety relay for spindle
X72 Safety relay for axes



X344 Reserved (do not use)
X392 Reserved (do not use)
X393 Reserved (do not use)

X89 Braking resistor
X83 Motor connection for axis 3 (7.5 A)
X82 Motor connection for axis 2 (7.5 A)
X81 Motor connection for axis 1 (7.5 A)
X80 Motor connection for spindle (31 A)
X84 Motor connection for axis 4 (23 A)

Equipment ground

5.1.13 Meaning of the LEDs

On the front of the compact inverter are several LEDs for functional control, with the following meaning:

UE 2xx

LED	Meaning	Signal direction	Signal
$U_{DC\ LINK\ ON}$	Main contactor on	–	–
+5 V	Supply voltage exists for logic unit (internal power supply unit)	–	–
$U_{DC\ LINK}$ >>	U_Z too high (> approx. 800 V); Power modules are switched off	UE → LE	$\overline{\text{ERR.UZ.GR}}$
TEMP >>	Temperature of heat sink too high (> 100 °C)	UE → LE	$\overline{\text{ERR.TEMP}}$
AXIS FAULT	Short circuit between a phase of the motor output and U_Z (axes only)	UE → LE	$\overline{\text{AXISFAULT}}$
POWER FAIL	U_Z too low, U_Z < 410 V (e.g. caused by the failure of a phase under load, power < 290 V)	UE → LE	$\overline{\text{PF.PS}}$
POWER RESET	Reset signal from UE to LE	UE → LE	$\overline{\text{RES.PS}}$
PULSE RELEASE SPINDLE	Safety relay for spindle on	–	–
PULSE RELEASE AXES	Safety relay for axes on	–	–
AXIS/SPINDLE RESET	Axes/spindle disabled by LE	LE → UE	$\overline{\text{SH2}}$
AXIS/SPINDLE READY	Inverter ready	LE → UE	$\overline{\text{RDY}}$

UE 2xxB

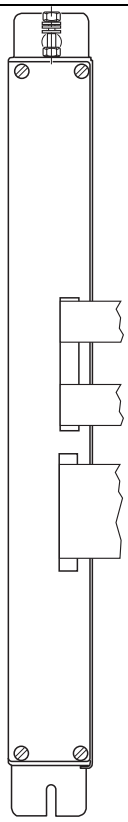
LED	Meaning	Signal direction	Signal
$U_{DC\ LINK\ ON}$	Main contactor on	–	–
READY	Inverter ready	UE → LE	RDY
POWER RESET	Reset signal from UE to LE	UE → LE	$\overline{RES.PS}$
POWER FAIL	U_Z too low, U_Z < 410 V (e.g. caused by the failure of a phase under load, power < 290 V)	UE → LE	$\overline{PF.PS}$
$U_{DC\ LINK}$ >>	U_Z too high (> approx. 800 V); Power modules are switched off	UE → LE	$\overline{ERR.UZ.GR}$
TEMP >> (left)	Heat sink temperature too high for axis 4 and spindle (> 100 °C)	UE → LE	$\overline{ERR}$
TEMP >> (right)	Heat sink temperature too high for axis 1 to axis 3 (> 100 °C)	UE → LE	$\overline{ERR}$
NC RESET	Reset signal from the LE to the UE	LE → UE	$\overline{RES.LE}$
SPINDLE	Safety relay for spindle on	–	–
AXES	Safety relay for axes on	–	–
X11x READY	Inverter ready	LE → UE	RDY
X11x SH1	Flashing DSP error, PLC error with Emergency Stop, LE hardware or software error	LE → UE	$\overline{SH1B}$
X11x SH2	No drive enable (e.g. by the PLC, active via external signal or SH1)	LE → UE	$\overline{SH2}$

5.1.14 UV 102 power supply unit

Only for LE 426 M used with UE 2xx compact inverter.

Danger

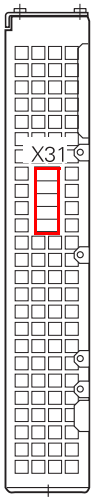
Do not engage or disengage any connecting elements while the unit is under power!



PWM, axis
(Connection on the LE: X51 to X53)

PWM, axis/spindle
(Connection on the LE: X54 to X56, or X61)

Power supply for the LE
(connection to X69 on the LE)

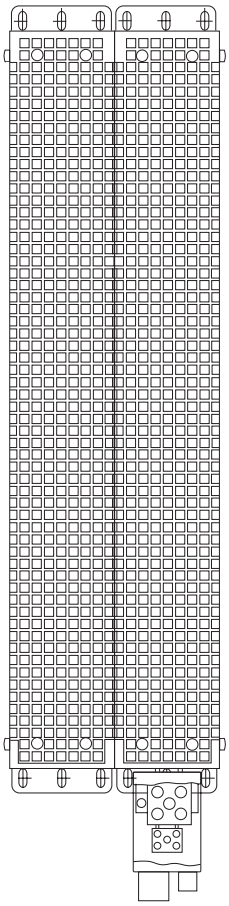


X31 Supply voltage for UV 102

5.1.15 PW 210 braking resistor

Danger

Do not engage or disengage any connecting elements while the unit is under power!



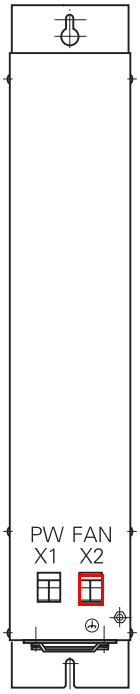
RB1, RB2
: Compact inverter UE 2xx or UE 2xxB

T1, T2
: Temperature switch

5.1.16 PW 1x0 braking resistor

Danger

Do not engage or disengage any connecting elements while the unit is under power!



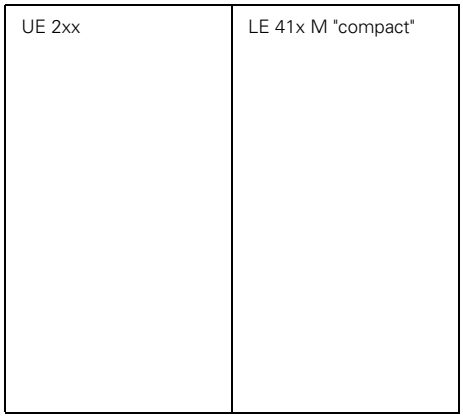
X1 Compact inverter UE 2xx or UE 2xxB
X2 Supply voltage for the fan of the braking resistor

5.2 Mounting and Connecting the Compact Inverter

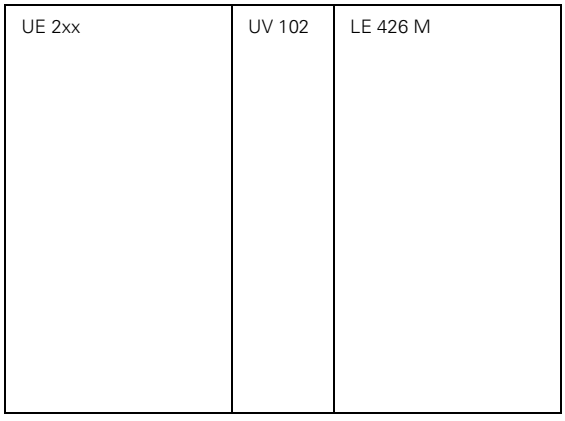
5.2.1 UE 2xx compact inverter

Arranging the modules

If a LE 41x M "compact" (with internal PWM interfaces) is to be operated with a UE 2xx compact inverter, the compact inverter is arranged to the left of the LE.



If a LE 426 M is to be operated with a compact inverter, the UV 102 power supply module must be placed between the two modules.



Connecting the modules

LE 41x M "compact": The compact inverter and LE are connected via ribbon cables, which are connected with plug-in PCBs at the LE end. Once this connection has been established, the protective cover (supplied as accessory with LE) must still be screwed onto the LE and the compact inverter.

LE 426 M: The front panel of the UV 102 must be removed. Then the compact inverter and the UV 102 are connected to each other via ribbon cables, which are connected with plug-in PCBs at the UV 102 end. The ribbon cables from the UV 102 are connected to the LE. Once these connections have been made, the front panel is replaced on the UV 102 housing.

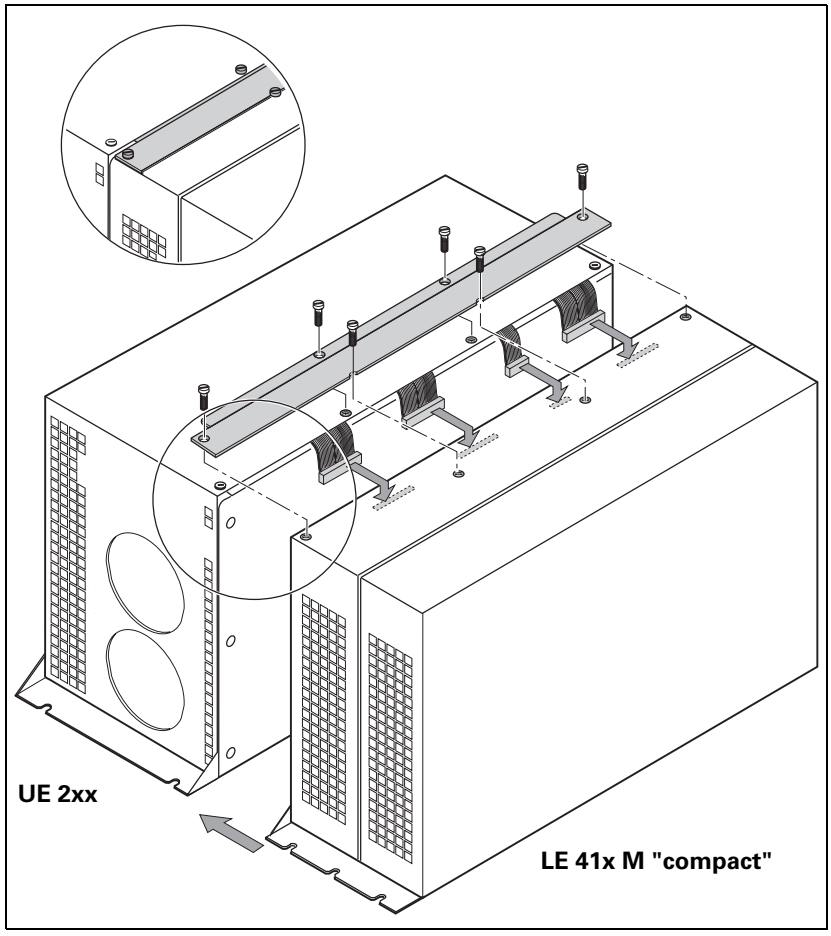
Module covers

LE 41x M "compact": No covers are required.

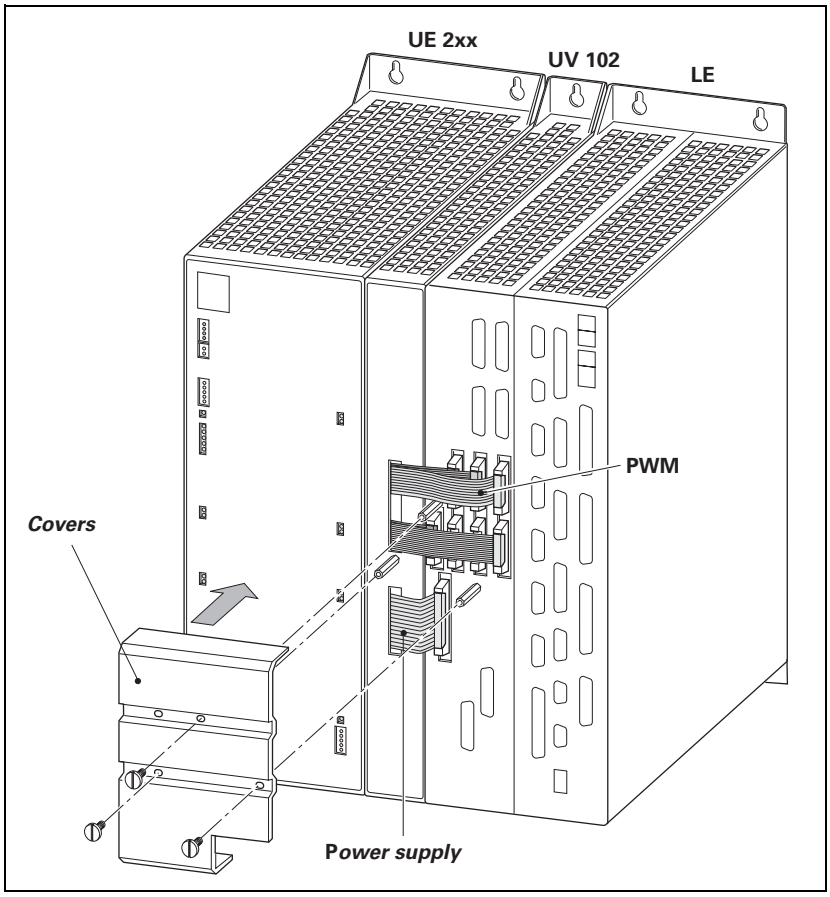
LE 426 M: The ribbon cables must be covered to protect against interference. The protective cover for the LE is supplied as an accessory with the LE, and that for the UV 102 as an accessory with the UV 102.

Mounting the HEIDENHAIN UE 2xx compact inverter

LE 41x M "compact":

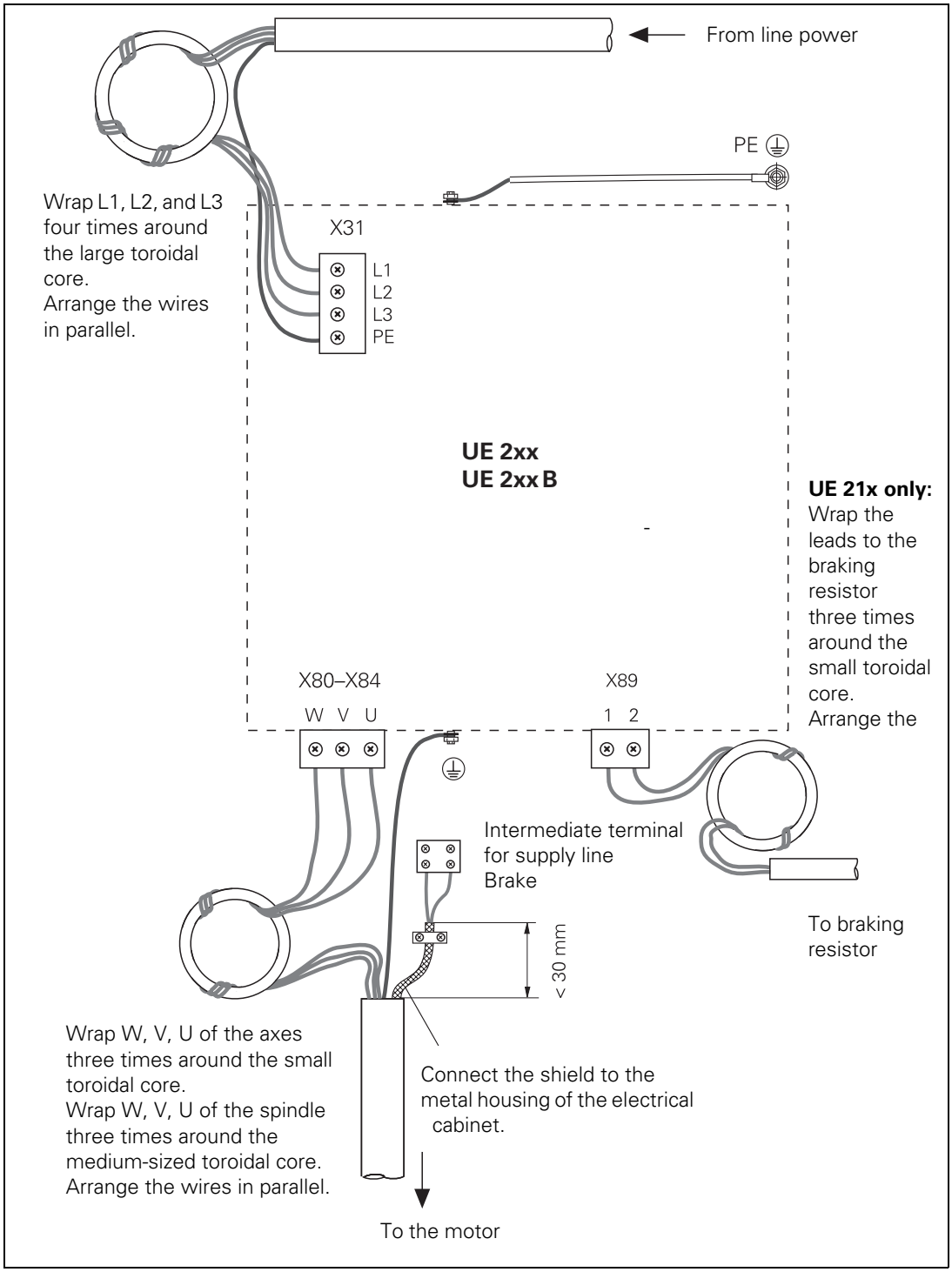


LE 426 M:



Mounting the toroidal cores

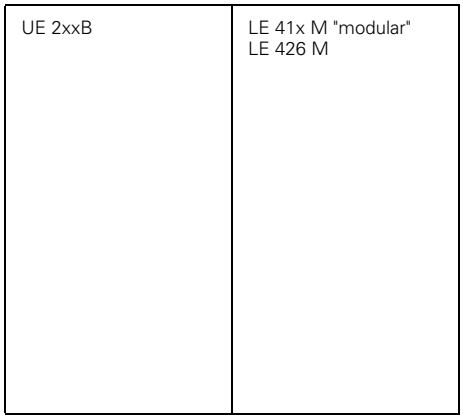
To suppress occurrence of interference, toroidal cores must be mounted in the motor leads (X80 to X84), in the voltage supply lead (X31) and in the lead to the braking resistor (only with UE 21x).



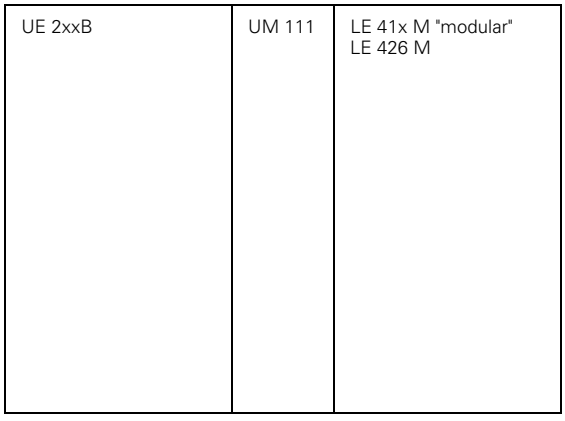
5.2.2 UE 2xxB compact inverter

Arranging the modules

The UE 2xxB compact inverter can only be operated with the LE 426 M or the LE 41x M "modular" (with external PWM interfaces). The compact inverter must be arranged to the left of the LE.



An additional UM 111 power module **can** be connected to the UE 2xxB compact inverters. This must be placed between the LE and the UE 2xxB compact inverter.



Connecting the modules

A 50-line ribbon cable connects the LE with the UE 2xxB and supplies the power to the LE.

The 20-line ribbon cables connect the LE and the UE 2xxB and supply the PWM signals of the axes and spindle(s).

U_Z dc-link power is supplied to the additional UM 111 power module from the UE 2xxB compact inverter via a conductor bar, which is screwed to the power module and the compact inverter. A second power conductor establishes the ground connection between the UE 2xxB and the UM 111.
The power bars are supplied as accessories with the power modules.

A 40-line ribbon cable connects the UE 2xxB with the UM 111 power module, forming the unit bus.

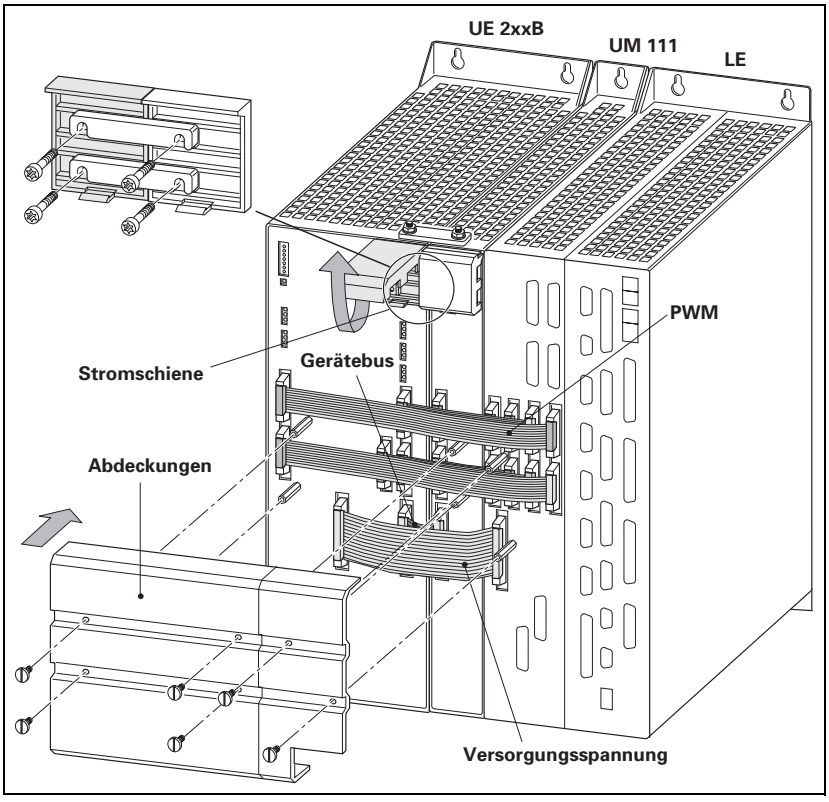
Module covers

The ribbon cables must be covered to protect against interference.

The covers for the LE and the UE 2xxB compact inverter are included with each as accessories.

The cover for an optional UM 111 power module must be ordered separately.

Mounting the HEIDENHAIN UE 2xxB compact inverter



Mounting the toroidal cores

Mounting the toroidal cores is the same as for the UE 2xx compact inverter.
See "Mounting the toroidal cores" on page 5– 24

5.3 Connections on the UE 2xx compact inverters

Danger

Danger of electrical shock!
The compact inverters may be opened only by HEIDENHAIN service engineers.
Do not engage or disengage any terminals while they are under power.

5.3.1 Power supplies

X31 Supply voltage for U_Z

With a power supply of 400 V, the inverter voltage U_Z is 565 Vdc.

Power supply for a defined setup speed:

$$U_{VersorgungEinricht} = \left(\frac{U_{N,\,Motor} \cdot n_{Einricht}}{n_{N,\,Motor} \cdot \sqrt{3}} \right) \cdot 2$$

Pin layout:

Terminals	UE 210, UE 212	UE 230, UE 240, UE 242
L1 L2 L3	400 Vac ± 10 % 50 Hz to 60 Hz	400 Vac ± 10 % 50 Hz to 60 Hz
	Cable: Wire cross section: 6 mm^2 Line fuse: 36 A slow (gL/gG) or 50 A fast (aM) Grounding terminal: ≥ 10 mm^2	Cable: Wire cross section: 10 mm^2 Line fuse: 50 A slow (gL/gG) or 63 A fast (aM) Grounding terminal: ≥ 10 mm^2

Note

If the power supply is other than 400 V, an autotransformer is required. It must comply at least with the connection specifications of the subsequent compact inverter.

X33 Supply voltage for the inverter supply unit

Pin layout:

Terminals	Assignment
1	Jumper to X32/pin 1 (with setup operation L1 from line power 290 Vac to 440 Vac, 50 Hz to 60 Hz
2	Jumper to X32/pin 2 (with setup operation L2 from line power

X32 Output for supply voltage of power unit

Pin layout:

Terminals	Assignment
1	Jumper to X33/pin 1 (short-circuit protection with 4 A)
2	Jumper to X33/pin 2 (short-circuit protection with 4 A)
3	$+U_Z$ (short-circuit protection with 4 A)
4	$-U_Z$ (short-circuit protection with 4 A)

5.3.2 Motor connections

X80 Spindle motor
X81 Axis motor 1
X82 Axis motor 2
X83 Axis motor 3
X84 Axis motor 4

Pin layout:

Terminals	Assignment
U	Motor connection U
V	Motor connection V
W	Motor connection W

For information on synchronous motors, asynchronous motors and power cables, refer to the "Motors" chapter."Motors for Axis and Spindle Drives" on page 7 – 2

5.3.3 Main contactor and safety relay

X70 Main contactor
X71 Safety relay spindle
X72 Safety relay axes

For information on the wiring and function, see the Basic Circuit Diagram for your control

Terminals X70 to X72	Assignment
1	+24 V output (max. 250 mA)
2	24 V input for U_Z ON, Axis ON, Spindle ON
3	Not assigned
4	Normally closed contact 1
5	Normally closed contact 2

5.3.4 PW 210 (or PW 1x0) braking resistor for UE 2xx compact inverter

An external braking resistor must be connected to the UE 230 and UE 24x compact inverters, as these inverters are not equipped with internal braking resistors.
An external braking resistor can also be connected to the UE 210 and UE 212 compact inverters instead of the internal braking resistance. This may be necessary if the internal braking resistor is no longer able to absorb all of the braking energy, because it is too much, or if the braking resistor needs to be mounted outside the electrical cabinet.

Either one PW x10 or two PW 120 switched in series can be connected to all UE 2xx compact inverters.

The braking resistor is switched on when the inverter voltage U_Z exceeds 700 V and is switched off again as soon as it falls below 670 V.

Note

If no braking resistor is connected, the inverter voltage U_Z can increase and at U_Z > 760 V all power stages will be switched off (LED for $U_{DC\text{-}LINK}$ >> lights up)!

Cross section

The following cross section is required for connecting the braking resistor:

Braking resistor	Cross section
1 x PW 210	1.5 mm^2
1 x PW 110	1.5 mm^2
2 x PW 120 in series	4.0 mm^2

X89 Braking resistor

Pin layout on UE 21x:

Connecting terminal X89 UE 21x	Assignment	Internal braking resistor	PW 210	PW 1x0; connecting terminal X1
1	$+U_Z$	Jumper	RB1	1
2	Internal braking resistor		Do not assign	Do not assign
3	Switch against $-U_Z$	Do not assign	RB2	2

Pin layout on UE 230 and UE 24x:

Connecting terminal X89 UE 230 UE 24x	Assignment	PW 210	PW 1x0; connecting terminal X1
1	$+U_Z$	RB1	1
2	Switch against $-U_Z$	RB2	2

Temperature switch on the PW 210

The temperature switch is a normally closed contact and is set to protect the braking resistor from being damaged. It can have maximum load 250 V, 5 A. The switch can be connected to a PLC input on the LE and evaluated via the PLC.
Pin layout:

Connecting terminal on the PW 210	Assignment
T1	1
T2	2

X2 Fan for the external braking resistor PW 1x0

Pin layout:

Connecting terminal X2	Assignment
+	+24 V (PLC)
–	0 V

5.4 Connections on the UV 102 power supply unit

The UV 102 has a 50-line ribbon cable for the power supply to the LE 426 M and 5 20-pin ribbon cables for the PWM signals of the axes and the spindle from the LE.

X31 Power supply Pin layout:

Terminals	Assignment
⏚	Equipment ground (YL/GY)
U1	Phase 1 / 400 Vac ±10 % / 50 Hz to 60 Hz
U2	Phase 2 / 400 Vac ±10 % / 50 Hz to 60 Hz
$-U_Z$	dc-link voltage –
$+U_Z$	dc-link voltage +
	Cable: Wire cross section 1.5 mm^2 Line fuse: 16 A (use smaller fuse with smaller wire cross section) Grounding terminal: ≥ 10 mm^2

Note

The voltage at the terminals U1 and U2 must be supplied via an isolating transformer (250 VA, basic insulation in accordance with EN 50178 or VDE 055)

5.5 Connections on the UE 2xxB compact inverters

Danger

Danger of electrical shock!
The compact inverters may be opened only by HEIDENHAIN service engineers.
Do not engage or disengage any terminals while they are under power.

5.5.1 Supply voltages

X31 Supply voltage for U_Z

With a power supply of 400 V, the inverter voltage U_Z is 565 Vdc.

Pin layout:

Terminals	UE 21xB	UE 230B, UE 24xB
L1	400 Vac ± 10 % 50 Hz to 60 Hz	400 Vac ± 10 % 50 Hz to 60 Hz
L2		
L3		
	Cable: Wire cross section: 6 mm^2 Line fuse: 40 A slow (gL/gG) or 50 A fast (aM) Grounding terminal: ≥ 10 mm^2	Cable: Wire cross section: 10 mm^2 Line fuse: 63 A slow (gL/gG) or 80 A fast (aM) Grounding terminal: ≥ 10 mm^2

Note

EN 50 178 requires a non-detachable connection to the line power supply.

Note

If the power supply is other than 400 V, an autotransformer is required. It must comply at least with the connection specifications of the subsequent compact inverter.

5.5.2 Motor connections

X80 Spindle motor
X81 Axis motor 1
X82 Axis motor 2
X83 Axis motor 3
X84 Axis motor 4

Pin layout:

Terminals	Assignment
U	Motor connection U
V	Motor connection V
W	Motor connection W

For information on synchronous motors, asynchronous motors and power cables, refer to the chapter "Motors for Axis and Spindle Drives" on page 7 – 2.

Motor connections	PWM input
X80	X110
X81	X111
X82	X112
X83	X113
X84	X114

5.5.3 Main contactor and safety relay

X70 Main contactor
X71 Safety relay spindle
X72 Safety relay axes

For information on the wiring and function, see the Basic Circuit Diagram for your control

Terminals X70 to X72	Assignment
1	+24 V output (max. 250 mA)
2	0 V
3	+24 V input for U_Z ON, Axis ON, Spindle ON
4	Do not assign
5	Do not assign
6	Normally closed contact (OE1, OE1A or OE1S)
7	Normally closed contact (OE2, OE2A or OE2S)

5.5.4 PWM connection to the LE

X110 to X114 PWM connection to LE

Pin layout:

Ribbon connector 20-pin	Assignment
1a	PWM U1
1b	0 V U1
2a	PWM U2
2b	0 V U2
3a	PWM U3
3b	0 V U3
4a	$\overline{SH2}$
4b	0 V ($\overline{SH2}$)
5a	$\overline{SH1}$
5b	0 V ($\overline{SH1}$)
6a	$+I_{actl\ 1}$
6b	$-I_{actl\ 1}$
7a	0 V (analog)
7b	$+I_{actl\ 2}$
8a	$-I_{actl\ 2}$
8b	0 V (analog)
9a	Do not assign
9b	$\overline{BRK}$
10a	$\overline{ERR}$
10b	RDY

Note

The interface complies with the requirements of EN 50 178 for low voltage electrical separation.

5.5.5 NC Power Supply and Control Signals

X69: NC supply voltage and control signals

Pin layout:

50-line ribbon connector	Assignment	50-line ribbon connector	Assignment
1a to 5b	+5 V	16b	GND
6a to 7b	+12 V	17a	RDY.PS
8a	+5 V (low-voltage separation)	17b	GND
8b	0 V (low-voltage separation)	18a	$\overline{\text{ERR.ILEAK}}$
9a	+15 V	18b	GND
9b	–15 V	19a	Do not assign
10a	UZAN	19b	GND
10b	0 V	20a	Do not assign
11a	IZAN	20b	GND
11b	0 V	21a	Do not assign
12a	$\overline{\text{RES.PS}}$	21b	GND
12b	0 V	22a	Do not assign
13a	$\overline{\text{PF.PS}}$	22b	GND
13b	GND	23a	Reserved (SDA)
14a	$\overline{\text{ERR.UZ.GR}}$	23b	GND
14b	GND	24a	Reserved (SCL)
15a	$\overline{\text{ERR.IZ.GR}}$	24b	GND
15b	GND	25a	$\overline{\text{RES.LE}}$
16a	$\overline{\text{ERR.TEMP}}$	25b	GND

Note

The interface complies with the requirements of EN 50 178 for low voltage electrical separation.

5.5.6 Unit bus

The unit bus connection is between the compact inverter and a UM 111 power module. If you are not using a UM 111, you do not need to make the unit bus connection.

X79 Unit bus

Pin layout:

40-line ribbon connector	Assignment	
1a to 3b	0 V *1	These voltages must not be linked with other voltages (only basic insulation)!
4a	+24 V *1	
4b	+24 V *1	
5a	+15 V *1	
5b	+24 V *1	
6a	+15 V *1	
6b	+15 V *1	
7a to 8b	Do not assign	
9a	Reserved (SDA)	
9b	Do not assign	
10a	Reserved (SCL)	
10b	$\overline{\text{ERR.TEMP}}$	
11a	$\overline{\text{PF.PS}}$	
11b	0 V	
12a	$\overline{\text{RES.PS}}$	
12b	0 V	
13a	$\overline{\text{PWR.OFF}}$	
13b	0 V	
14a	5 V FS (spindle enable)	
14b	0 V	
15a	5 V FA (axes enable)	
15b to 16b	0 V	
17a and 17b	–15 V	
18a and 18b	+15 V	
19a to 20b	+5 V	

Note

The interface complies with the requirements of EN 50 178 for low voltage electrical separation (except for 1a to 6b).

5.5.7 PW 1x0 and PW 210 braking resistors for UE 2xxB compact inverter

An external braking resistor must be connected to the UE 230B and E 24xB compact inverters, as these inverters are not equipped with internal braking resistors.
An external braking resistor can also be connected to the UE 21xB compact inverters instead of the internal braking resistance. This may be necessary if the internal resistor can no longer fully absorb the excessive braking energy, or if the braking resistor needs to be mounted outside the control cabinet.

Either one PW 1x0, one PW 210 or two PW 210 in parallel can be connected to the UE 2xxB compact inverters.

The braking resistor is switched on when the inverter voltage U_Z exceeds 700 V and is switched off again as soon as it falls below 670 V.

Note

If no braking resistor is connected, the inverter voltage U_Z can increase and at U_Z > 760 V all power stages will be switched off (LED for $U_{DC\text{-}LINK}$ >> lights up)!

Cross section

The following cross section is required for connecting the braking resistor:

Braking resistor	Cross section
1 x PW 210	1.5 mm^2
2 x PW 120 in parallel	4.0 mm^2
1 x PW 110	1.5 mm^2
1 x PW 120	4.0 mm^2

X89 Braking resistor

Pin layout on UE 21xB for internal braking resistor:

Connecting terminal X89A UE 21xB	Assignment	Connecting terminal X89B UE 21xB	Assignment
1	Do not assign	1	Jumper
2	Do not assign	2	

Connecting terminal X89B UE 21xB	Assignment	Connecting terminal X89A UE 21xB	Assignment	PW 210	PW 1x0; connecting terminal X1
1	Do not assign	1	$+U_Z$	RB 1	1
2	Do not assign	2	Switch against $-U_Z$	RB 2	2

Warning

The internal and an external braking resistor must **not** be operated in parallel!

Pin layout on UE 230B and UE 24xB:

Connecting terminal X89 UE 230B UE 24xB	Assignment	PW 210	PW 1x0 connecting terminal X1
1	$+U_Z$	RB 1	1
2	Switch against $-U_Z$	RB 2	2

Temperature switch on the PW 210

The temperature switch is a normally closed contact and is set to protect the braking resistor from being damaged. It can have maximum load 250 V, 5 A. The switch can be connected to a PLC input on the LE and evaluated via the PLC.

Pin layout:

Connecting terminal on the PW 210	Assignment
T1	1
T2	2

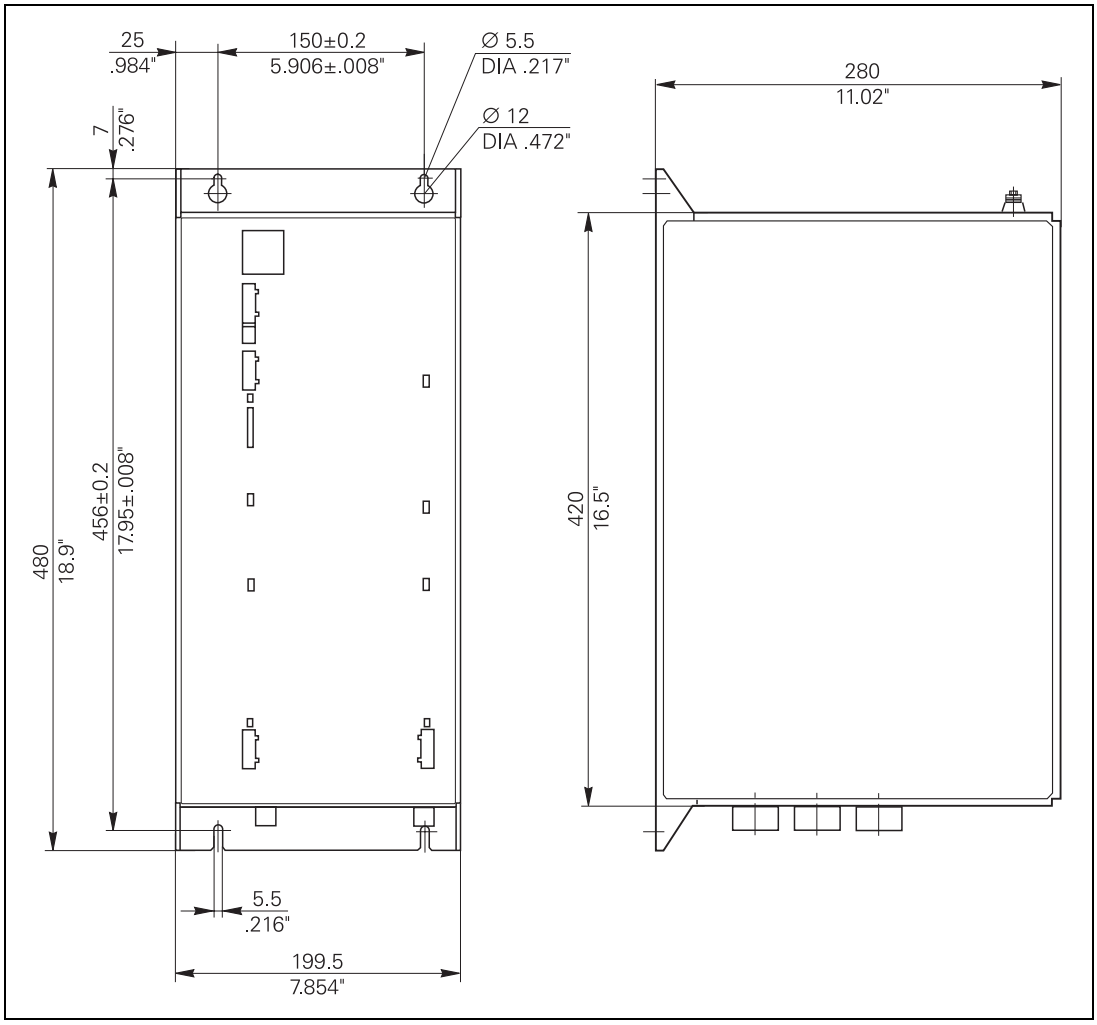
X2 Fan for the external braking resistor PW 1x0

Pin layout:

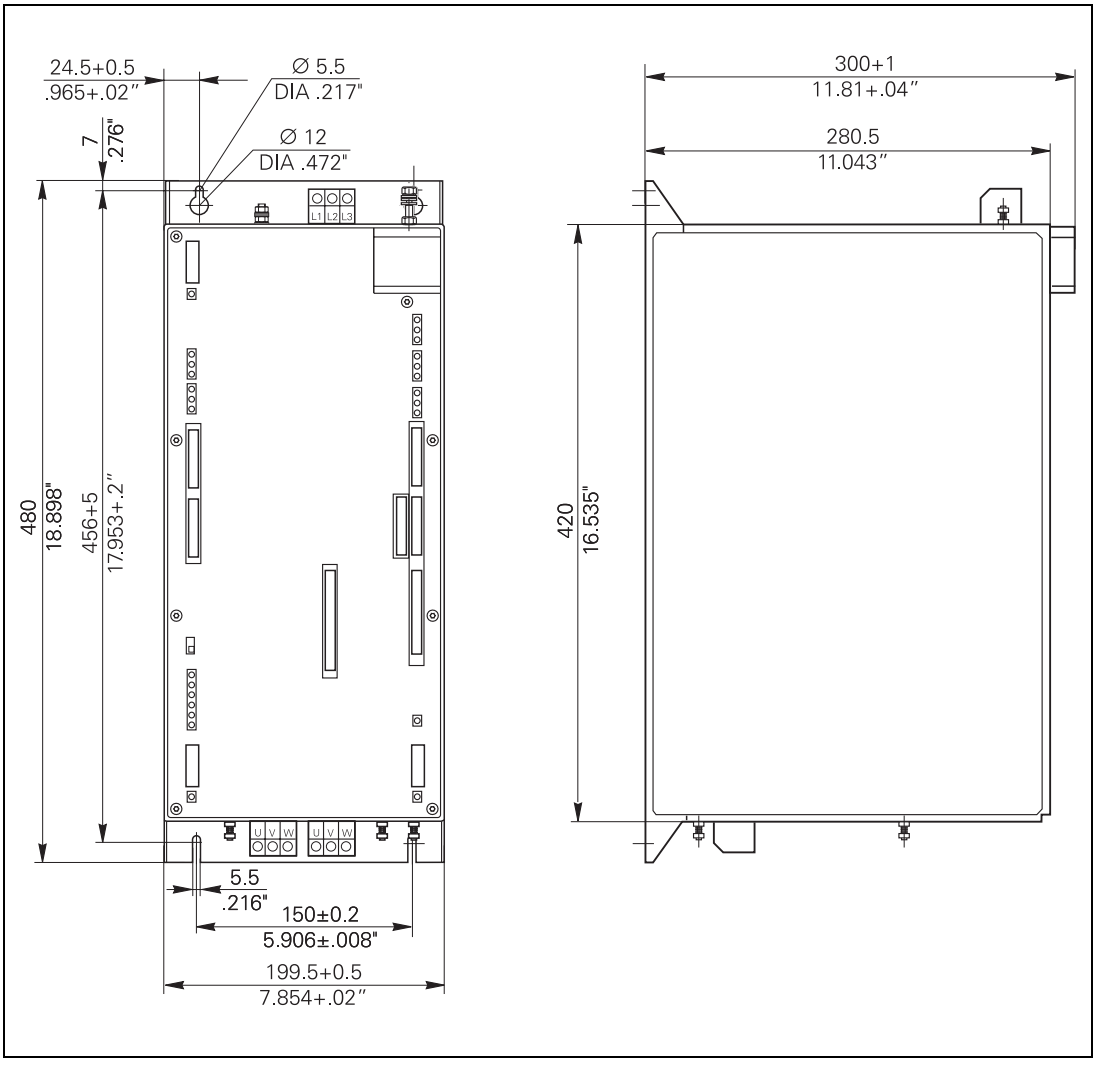
Connecting terminal X2	Assignment
+	+24 V (PLC)
–	0 V

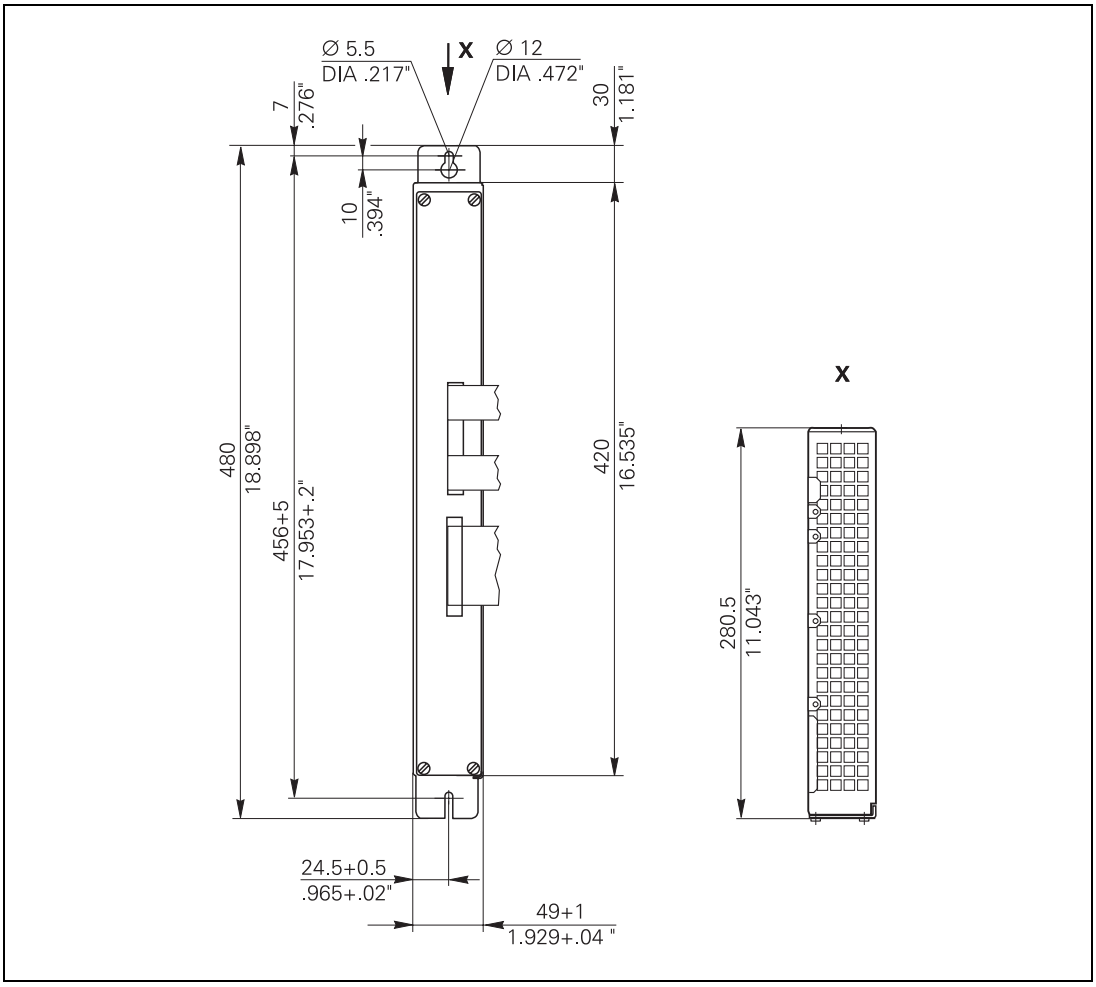
5.6 Dimensions

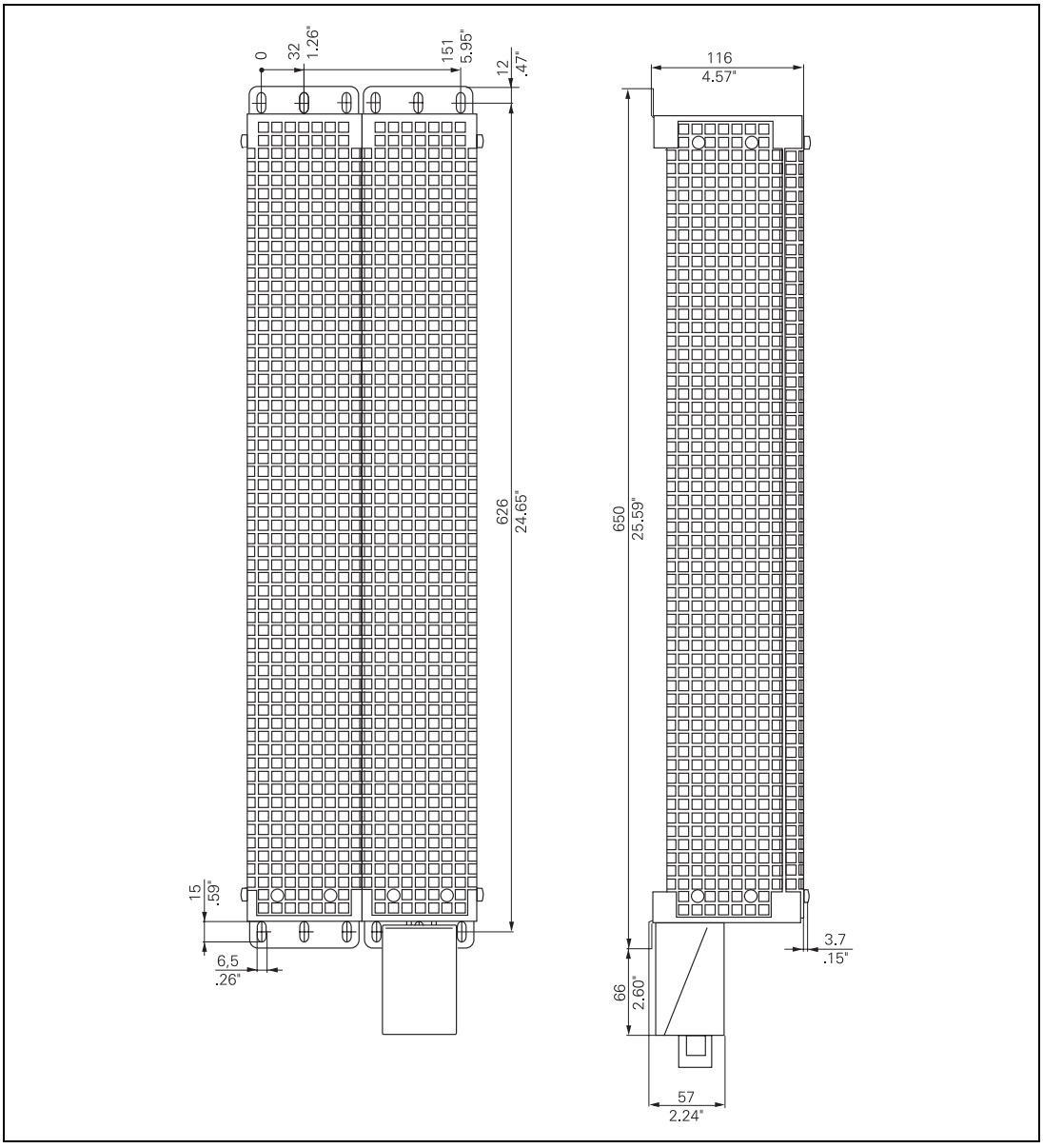
5.6.1 UE 2xx



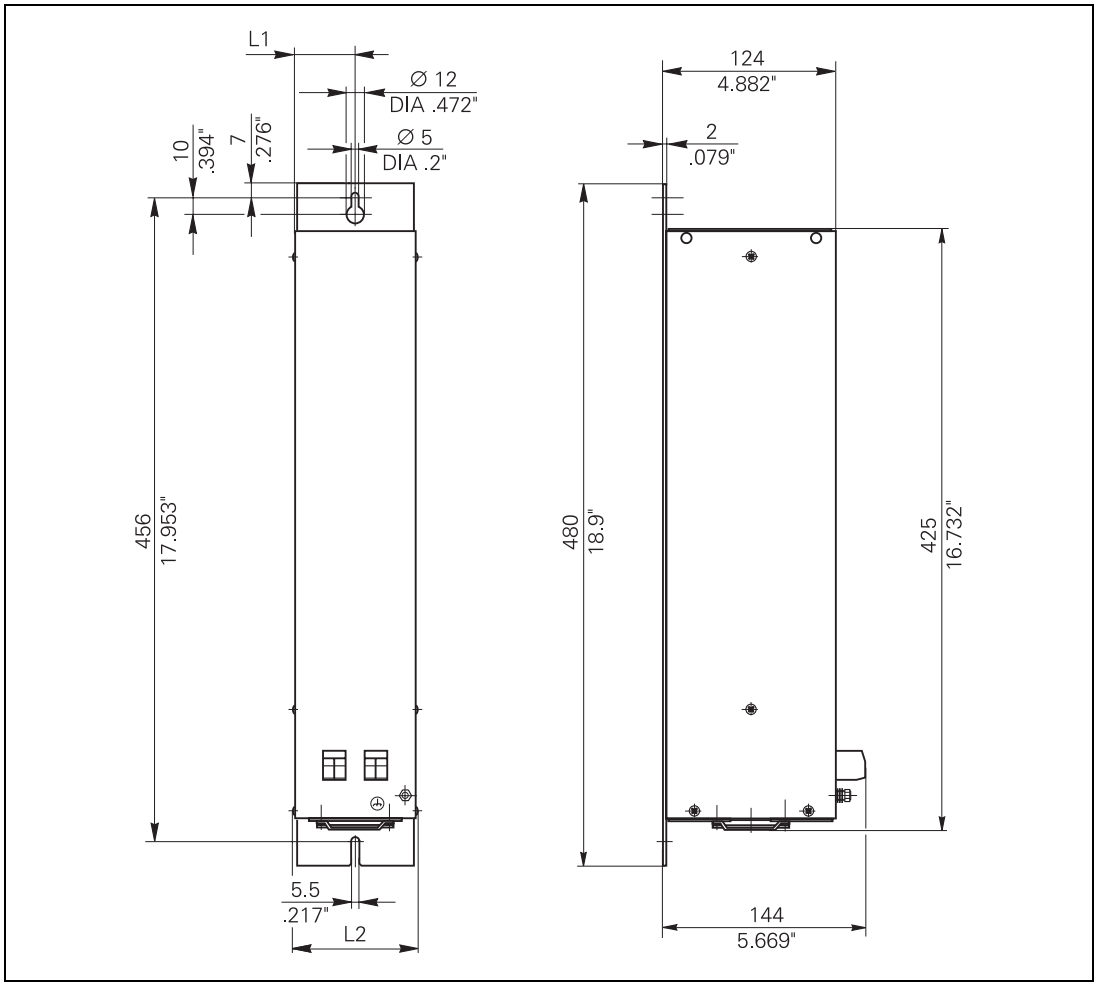
5.6.2 UE 2xxB


24.5+0.5
.965+.02″
Ø 5.5
DIA .217"
Ø 12
DIA .472"
7
.276"
480
18.898"
456+5
17.953+.2″
L1 L2 L3
U V W
U V W
5.5
.216"
150±0.2
5.906±.008"
199.5+0.5
7.854+.02″
300+1
11.81+.04″
280.5
11.043″
420
16.535"


Ø 5.5
DIA .217"
X
Ø 12
DIA .472"
7
.276"
30
1.181"
10
.394"
480
18.898"
456+5
17.953+.2"
420
16.535"
X
280.5
11.043"
24.5+0.5
.965+.02"
49+1
1.929+.04 "


0
32
1.26"
151
5.95"
12
.47"
626
24.65"
15
.59"
6,5
.26"
116
4.57"
650
25.59"
3.7
.15"
66
2.60"
57
2.24"

5.6.5 PW 1x0



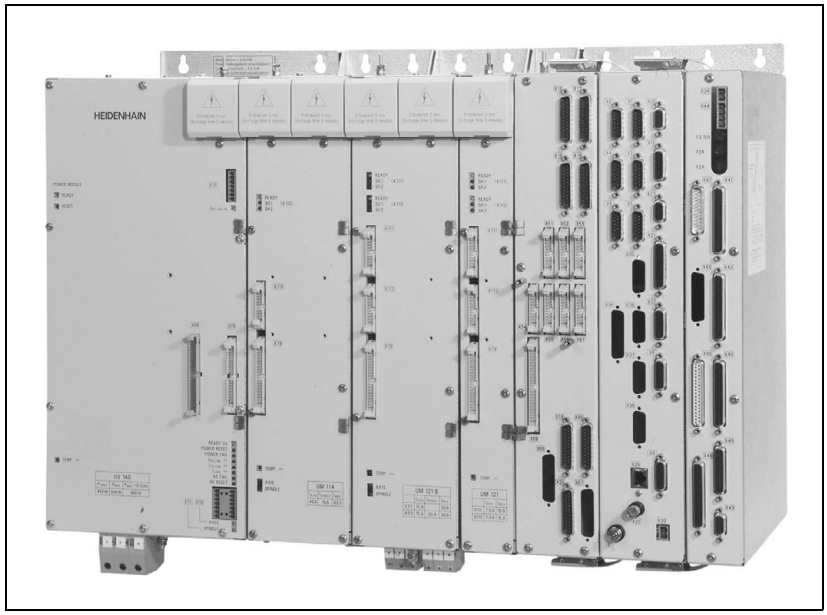
Value	PW 110	PW 120
L1	38.5 1.516″	62.5 2.461″
L2	77 3.031″	125 4.921″

6 Modular Inverters

6 Modular Inverters

6.1 Connection Overview

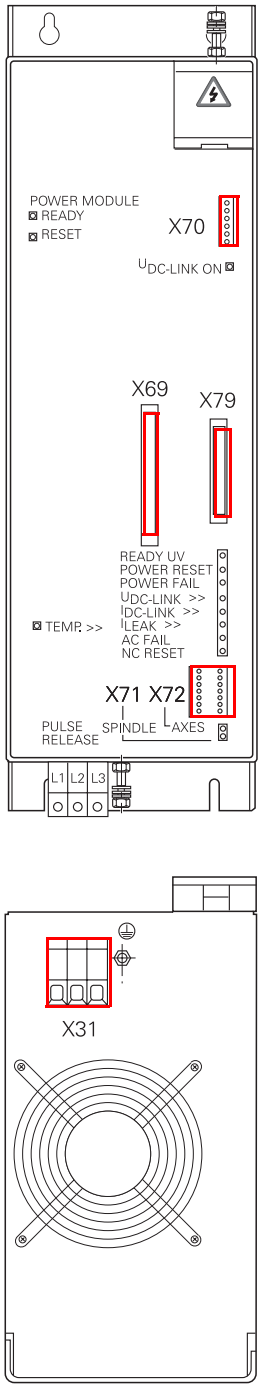
LE 430 M with modular inverter



6.1.1 UV 120 power supply unit

Danger

Do not engage or disengage any connecting elements while the unit is under power!



X70 Main contactor

X69 Power supply for the LE (in double for lengths over 0.5 m)

X79 Unit bus

X71 Safety relay for spindle (pulse disable for the spindle)

X72 Safety relay for the axes (pulse disable for all axes)

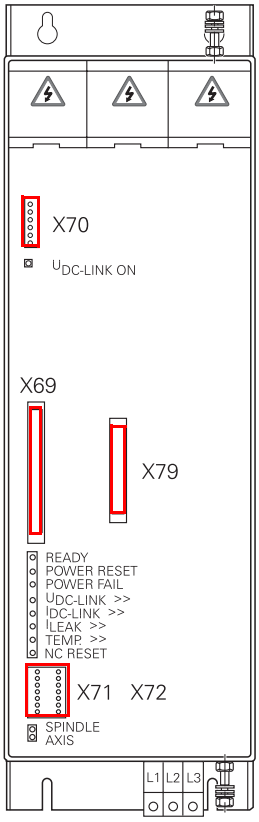
X31 Supply voltage for inverter (3 x 400 V ±10 %)

Equipment ground

6.1.2 UV 130 power supply unit

Danger

Do not engage or disengage any connecting elements while the unit is under power!



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...
7

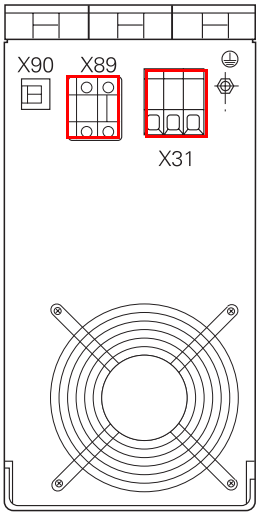
X70 Main contactor

X69 Power supply for the LE
(in double for lengths over 0.5 m)

X79 Unit bus

X71 Safety relay for spindle (pulse disable for the spindle)

X72 Safety relay for the axes (pulse disable for all axes)



X31 Supply voltage for inverter (3 x 400 V ±10 %)

X89 Braking resistor

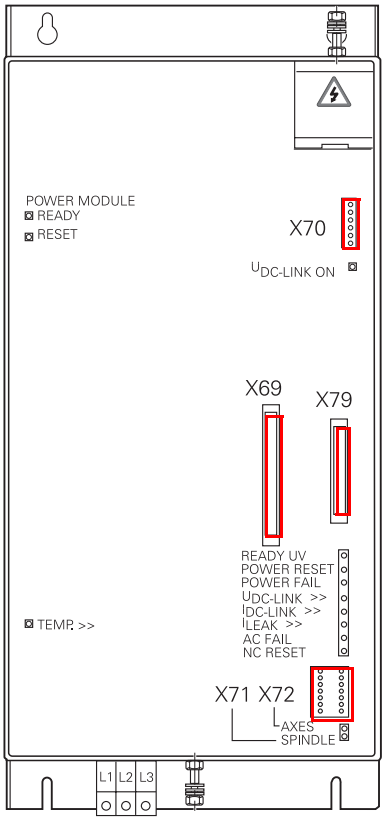
X90 24 V output

⏚ Equipment ground

6.1.3 UV 140 power supply unit

Danger

Do not engage or disengage any connecting elements while the unit is under power!



X70 Main contactor

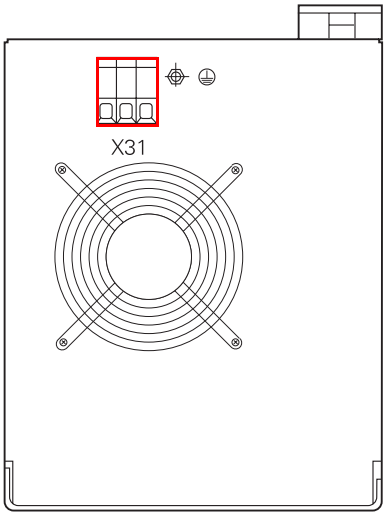
X69 Power supply for the LE (in double for lengths over 0.5 m)

X79 Unit bus

7 … 1

X71 Safety relay for spindle (pulse disable for the spindle)

X72 Safety relay for the axes (pulse disable for all axes)



X31 Supply voltage for inverter (3 x 400 V ±10 %)

Equipment ground

6.1.4 Meaning of LEDs on the UV 1x0

UV 120

LED	Meaning	Signal direction	Signal
$U_{DC\ LINK\ ON}$	Main contactor on	–	–
READY	End stage ready (only for services purposes)	–	–
RESET	Reset for end stage (only for service purposes)	–	–
READY UV	Supply unit ready	UV → LE	RDY.PS
POWER RESET	Reset signal from the UV 120 to LE	UV → LE	$\overline{\text{RES.PS}}$
POWER FAIL	U_Z too low, U_Z < 410 V (e.g. line power < 290 V)	UV → LE	$\overline{\text{PF.PS}}$
$U_{DC\ LINK}$ >>	U_Z too high (> approx. 800 V); Power modules are switched off	UV → LE	$\overline{\text{ERR.UZ.GR}}$
$I_{DC\ LINK}$ >>	I_Z > 52 A, Warning signal to control at 58 A	UV → LE	$\overline{\text{ERR.IZ.GR}}$
I_{LEAK} >>	Error current, e.g. through short to earth; warning signal to control	UV → LE	$\overline{\text{ERR.ILEAK}}$
AC FAIL	One phase is missing	–	–
NC RESET	Reset signal from the LE to the UV 120	LE → UV	$\overline{\text{RES.LE}}$
TEMP >>	Temperature of heat sink too high (> 95 °C)	UV → LE	$\overline{\text{ERR.TEMP}}$
SPINDLE	Safety relay for spindle on	–	–
AXES	Safety relay for axes on	–	–

UV 130

LED	Meaning	Signal direction	Signal
$U_{DC\ LINK\ ON}$	Main contactor on	–	–
READY	Supply unit ready	UV → LE	RDY.PS
POWER RESET	Reset signal from the UV 130 to LE	UV → LE	$\overline{\text{RES.PS}}$
POWER FAIL	U_Z too low, U_Z < 410 V (e.g. line power < 290 V)	UV → LE	$\overline{\text{PF.PS}}$
$U_{DC\ LINK}$ >>	U_Z too high (> approx. 760 V); Power modules are switched off	UV → LE	$\overline{\text{ERR.UZ.GR}}$
$I_{DC\ LINK}$ >>	I_Z > 75 A, Warning signal to control at 88 A	UV → LE	$\overline{\text{ERR.IZ.GR}}$
I_{LEAK} >>	Error current, e.g. through short to earth; warning signal to control	UV → LE	$\overline{\text{ERR.ILEAK}}$
TEMP >>	Temperature of heat sink too high (> 95 °C)	UV → LE	$\overline{\text{ERR.TEMP}}$
NC RESET	Reset signal from the LE to the UV 130	LE → UV	$\overline{\text{RES.LE}}$
SPINDLE	Safety relay for spindle on	–	–
AXES	Safety relay for axes on	–	–

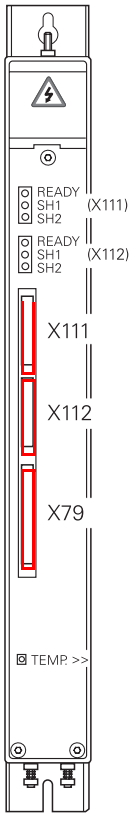
UV 140

LED	Meaning	Signal direction	Signal
$U_{DC\ LINK\ ON}$	Main contactor on	–	–
READY	End stage ready (only for services purposes)	–	–
RESET	Reset for end stage (only for service purposes)	–	–
READY UV	Supply unit ready	UV → LE	RDY.PS
POWER RESET	Reset signal from the UV 140 to LE	UV → LE	$\overline{\text{RES.PS}}$
POWER FAIL	U_Z too low, U_Z < 410 V (e.g. line power < 290 V)	UV → LE	$\overline{\text{PF.PS}}$
$U_{DC\ LINK}$ >>	U_Z too high (> approx. 800 V); Power modules are switched off	UV → LE	$\overline{\text{ERR.UZ.GR}}$
$I_{DC\ LINK}$ >>	I_Z > 103 A, Warning signal to control at 116 A	UV → LE	$\overline{\text{ERR.IZ.GR}}$
I_{LEAK} >>	Error current, e.g. through short to earth; warning signal to control	UV → LE	$\overline{\text{ERR.ILEAK}}$
AC FAIL	One phase is missing	–	–
NC RESET	Reset signal from the LE to the UV 140	LE → UV	$\overline{\text{RES.LE}}$
TEMP >>	Temperature of heat sink too high (> 95 °C)	UV → LE	$\overline{\text{ERR.TEMP}}$
SPINDLE	Safety relay for spindle on	–	–
AXES	Safety relay for axes on	–	–

6.1.5 UM 1x1 power module

Danger

Do not engage or disengage any connecting elements while the unit is under power!



X111 PWM, axis 1

X112 PWM, axis 2
(with UM 111 one-axis module only X111 available)

X79 Unit bus

X344 Reserved (do not use)
X392 Reserved (do not use)

X82 Motor connection for axis 2 (X112);
not on the UM 111

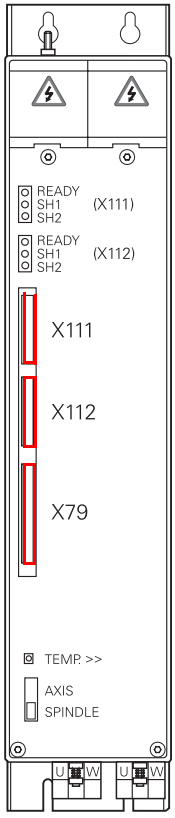
Equipment ground

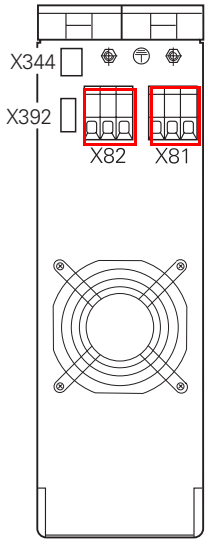
X81 Motor connection for axis 1 (X111)

6.1.6 Power modules UM 1x2, UM 111B, UM 121B

Danger

Do not engage or disengage any connecting elements while the unit is under power!





X111 (X112) PWM, axis 1

X112 PWM, axis 2 / spindle
(UM 112, UM 111B: X112 can be connected above or below, internally both of these inputs are switched in parallel)

X79 Unit bus

Sliding switch:
UM 112, UM 111B: AXIS: axis module
Enabling through X72 of the UV 1xx
SPINDLE: spindle module
Enabling through X71 of the UV 1xx

UM 122: AXIS: X112 = axis
Enabling through X72 of the UV 1xx
SPINDLE: X112 = spindle
Enabling through X71 of the UV 1xx
The upper PWM input (X111) is always an axis.

X344 Reserved (do not use)
X392 Reserved (do not use)

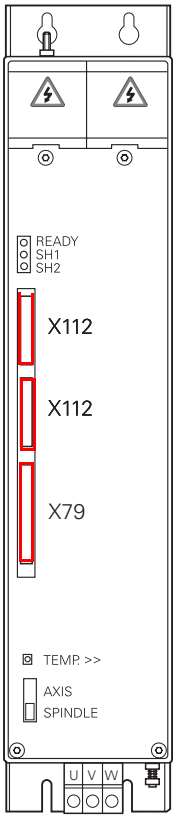
X82 Motor connection for axis 2 / spindle (X112)
X81 Motor connection for axis 1 (X111);
not on the UM 112 and UM 111B

Equipment ground

6.1.7 Power modules UM 113 and UM 114

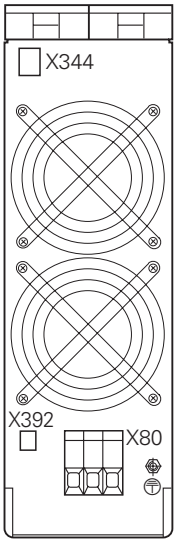
Danger

Do not engage or disengage any connecting elements while the unit is under power!



X112 PWM, axis/spindle
(UM 11x: X112 can be connected above or below.
Internally both of these inputs are switched in parallel.)
X79 Unit bus

Sliding switch:
UM 11x: AXIS: axis module
Enabling through X72 of the UV 1xx
SPINDLE: spindle module
Enabling through X71 of the UV 1xx



X344 Reserved (do not use)

X392 Reserved (do not use)

X80 Motor connection for axis / spindle (X112)

Equipment ground

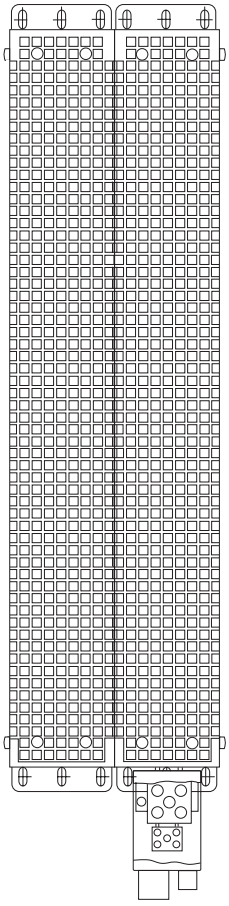
6.1.8 Meaning of LEDs on the UM 1xx

LED	Meaning	Signal direction	Signal
READY	Power module is ready	UM → LE	RDY
SH 1	Flashing DSP error, PLC error with Emergency Stop, LE hardware or software error	LE → UM	$\overline{\text{SH1}}$
SH 2	No drive enable (e.g. by the PLC, active via external signal or SH1)	LE → UM	$\overline{\text{SH2}}$
TEMP >>	Warning signal for IGBT temperature too high	UM → LE	$\overline{\text{ERR}}$

6.1.9 PW 210 braking resistor

Danger

Do not engage or disengage any connecting elements while the unit is under power!

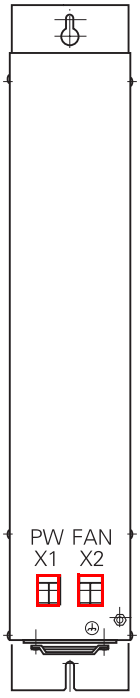


RB1, RB2
UV 130 power supply unit
T1, T2
Temperature switch

6.1.10 PW 1x0 braking resistor

Danger

Do not engage or disengage any connecting elements while the unit is under power!

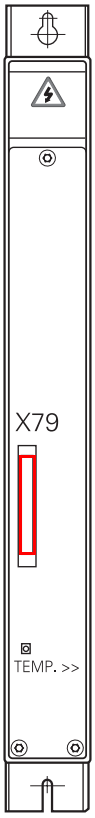


X1 UV 130 power supply module
X2 Supply voltage for the fan of the braking resistor

6.1.11 UP 110 braking resistor module

Danger

Do not engage or disengage any connecting elements while the unit is under power!



X79 Unit bus

TEMP. >>
Warning signal for excessive temperature of braking resistor

6.2 Mounting and Connection of the Modular Inverter System

Arranging the modules

The power modules are arranged between the UV 1x0 power supply unit and the logic unit. The power module for the spindle is placed next to the UV 1x0 power supply unit, and the power modules for the axes are then placed in order of decreasing rated current.
If the UP 110 braking resistor module is used together with the UV 120 and UV 140 energy-recovery power modules, the braking resistor is arranged between the weakest power module and the LE.
The power module for a second spindle (LE 426 M, LE 430 M) is placed between the power module for the first spindle and the strongest power module for the axes.

UV 1x0	UM 1xx for the first spindle	UM 1xx for the second spindle (only LE 426 M and LE 430 M)	UM 1xx	UM 1xx	If reqd. UP 110 (only UV 120 or UV 140)	LE 41x M "modular" LE 426 M LE 430 M

Connecting the modules

The dc-link power supply U_Z is supplied to the inverter modules from the UV 1x0 power supply unit via power bars (screwed onto each module, and if required, the UP 110).
A further power conductor establishes the ground connection between the individual modules.
Three power bars are included as accessories with the power modules (two for the dc-link, one for the ground).

A 50-line ribbon cable connects the LE with the UV 1x0 and supplies the power to the LE.

A 40-line ribbon cable connects the UV 1x0 with the power modules UM 1xx and, if required, the UP 110, forming the unit bus.

The 20-line ribbon cables connect the LE and the power modules and supply the PWM signals of the axes and the spindle(s).

Module covers

The ribbon cables must be covered to protect against interference.

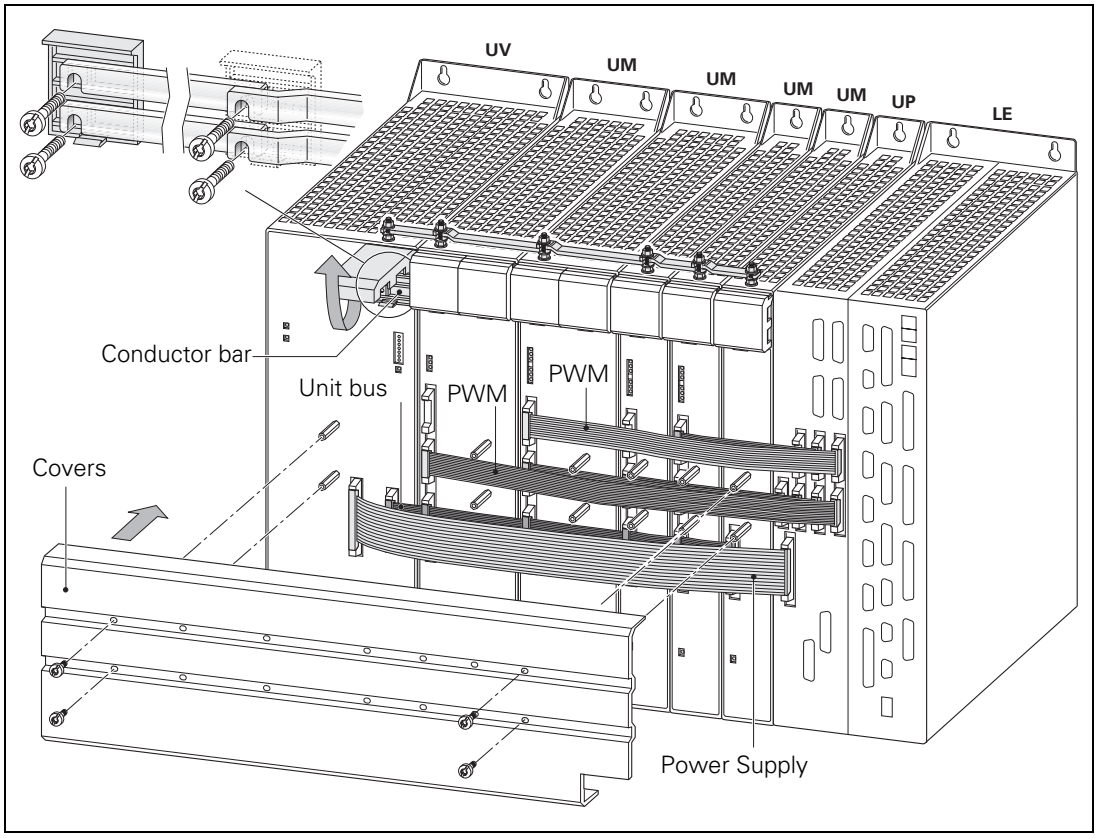
A cover is supplied as an accessory with the UV 1x0 (Id. Nr. 329 031-03), which protects the following modules

- UV 1x0
- One UM 1xx (100 mm width)
- One UM 1xx (50 mm width)

The cover for the LE is supplied with the LE.

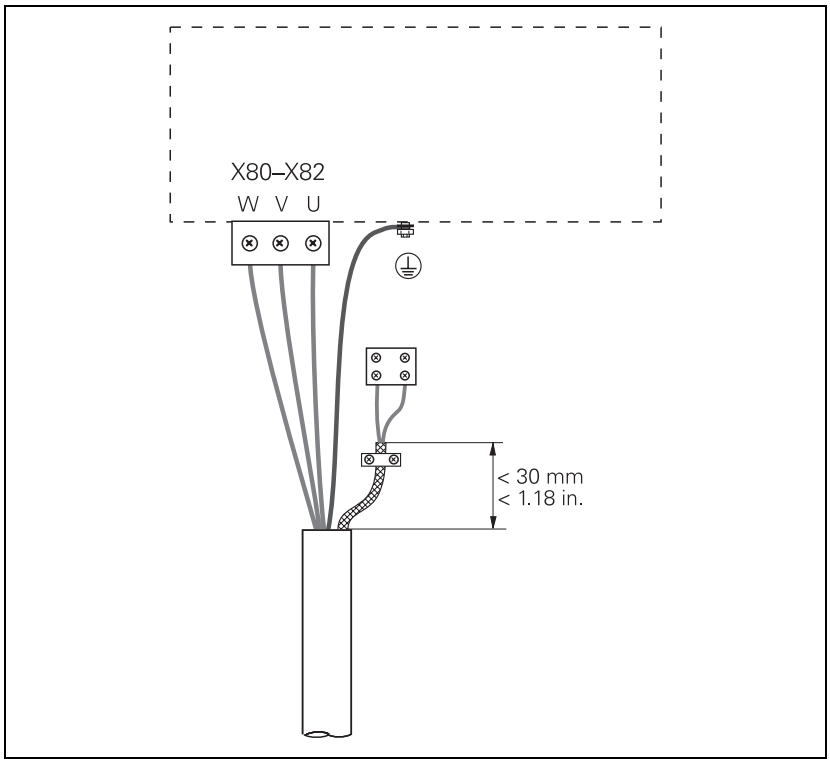
If further power modules are used, the corresponding covers must be ordered separately.

Mounting the modular HEIDENHAIN inverter system



Connecting the motors

The shield of the lines for the holding brake is to be kept as close as possible (< 30 mm) to ground. The best solution is to fasten the shield with a metal clamp directly onto the sheet-metal housing of the electrical cabinet.



6.3 Connections on the UV 130 power supply unit

Danger

Danger of electrical shock!
The UV 130 power supply unit must be opened only by HEIDENHAIN service engineers.
Do not engage or disengage any terminals while they are under power.

6.3.1 Power Supply

X31 Supply voltage for U_Z

With a power supply of 400 V, the inverter voltage U_Z is 565 Vdc.
Pin layout:

Terminals	Assignment
L1	400 Vac ± 10 %
L2	50 Hz to 60 Hz
L3	
	Cable: Wire cross section 16 mm^2 Line fuse: 80 A slow (gL/gG) or 100 A fast (aM) Grounding terminal: ≥ 10 mm^2

Note

EN 50 178 requires a non-detachable connection to the line power supply.

Note

If the power supply is other than 400 V, an autotransformer is required. It must comply at least with the connection specifications of the subsequent power supply unit.

6.3.2 Main contactor and safety relay

X70 Main contactor Pin layout:

Connection Terminal X70	Assignment
1	+24 V output (max. 250 mA)
2	0 V
3	+24 V input for U_Z ON
4	Do not assign
5	Do not assign
6	Normally closed contact (OE1)
7	Normally closed contact (OE2)

X71 Safety relay spindle
X72 Safety relay axes

Pin layout:

Terminals X71 and X72	Assignment
1	+24 V output (max. 250 mA)
2	0 V
3	+24 V input for Axis ON, Spindle ON
4	Do not assign
5	Do not assign
6	Normally closed contact (OE1A or OE1S)
7	Normally closed contact (OE2A or OE2S)

6.3.3 NC Power Supply and Control Signals

X69: NC supply voltage and control signals

With lengths of 600 mm and longer, the 50-line ribbon cable for the NC power supply and control signals is led doubled to the LE to increase the wire cross section.

50-line ribbon connector	Assignment
1a to 5b	+5 V
6a to 7b	+12 V
8a	+5 V (low-voltage separation)
8b	0 V (low-voltage separation)
9a	+15 V
9b	–15 V
10a	UZAN
10b	0 V
11a	IZAN
11b	0 V
12a	$\overline{\text{RES.PS}}$
12b	0 V
13a	–PF.PS
13b	GND
14a	$\overline{\text{ERR.UZ.GR}}$
14b	GND
15a	$\overline{\text{ERR.IZ.GR}}$
15b	GND
16a	$\overline{\text{ERR.TEMP}}$

50-line ribbon connector	Assignment
16b	GND
17a	RDY.PS
17b	GND
18a	$\overline{\text{ERR.ILEAK}}$
18b	GND
19a	Do not assign
19b	GND
20a	Do not assign
20b	GND
21a	Do not assign
21b	GND
22a	Do not assign
22b	GND
23a	Reserved (SDA)
23b	GND
24a	Reserved (SCL)
24b	GND
25a	$\overline{\text{RES.LE}}$
25b	GND

Note

The interface complies with the requirements of EN 50 178 for low voltage electrical separation.

6.3.4 Unit bus

X79 Unit bus Pin layout:

40-line ribbon connector	Assignment	
1a to 3b	0 V *1	These voltages may not be linked with other voltages (only basic insulation)!
4a	+24 V *1	
4b	+24 V *1	
5a	+15 V *1	
5b	+24 V *1	
6a	+15 V *1	
6b	+15 V *1	
7a to 8b	Do not assign	
9a	Reserved (SDA)	
9b	Do not assign	
10a	Reserved (SCL)	
10b	$\overline{\text{ERR.TEMP}}$	
11a	$\overline{\text{PF.PS}}$	
11b	0 V	
12a	$\overline{\text{RES.PS}}$	
12b	0 V	
13a	$\overline{\text{PWR.OFF}}$	
13b	0 V	
14a	5 V FS (spindle enable)	
14b	0 V	
15a	5 V FA (axes enable)	
15b to 16b	0 V	
17a and 17b	–15 V	
18a and 18b	+15 V	
19a to 20b	+5 V	

Note

The interface complies with the requirements of EN 50 178 for low voltage electrical separation (except for 1a to 6b).

6.3.5 PW 1x0 (or PW 1x0) braking resistors on the UV 130 power supply unit

A PW 210, PW 1x0 or two PW 210 braking resistors in parallel **must** be connected with the UV 130 power supply unit.

The braking resistor is switched on when the inverter voltage U_Z exceeds 700 V and is switched off again as soon as it falls below 670 V.

Note

If no braking resistor is connected, the inverter voltage U_Z can increase and at U_Z > 800 V all power stages will be switched off (LED for $U_{DC\text{-}LINK}$ >> lights up)!

Cross section

The following cross section is required for connecting the braking resistor:

Braking resistor	Cross section
PW 210	1.5 mm^2
2 x PW 120 in parallel	4.0 mm^2
PW 110	1.5 mm^2
PW 120	4.0 mm^2

X89 Braking resistor

Pin layout for PW 210:

Connecting terminal X89	Assignment	PW 210 braking resistor
1	$+U_Z$	RB1
2	Switch against $-U_Z$	RB2

Pin layout for PW 1x0:

Connecting terminal X89	Assignment	PW 1x0 braking resistor; connecting terminal X1
1	$+U_Z$	1
2	Switch against $-U_Z$	2

Temperature switch on the PW 210

The temperature switch is a normally closed contact and is set to protect the braking resistor from being damaged. It can have maximum load 250 V, 5 A. The switch can be connected to a PLC input on the LE and evaluated via the PLC.

Pin layout:

Connecting terminal on the PW 210	Assignment
T1	1
T2	2

X2 Fan for the external braking resistor PW 1x0

Pin layout:

Connecting terminal X2	Assignment
+	+24 V (PLC)
–	0 V

6.4 Connections on the UV 120 and UV 140 Power Supply Units

Danger

Danger of electrical shock!
The UV 120 and UV 140 power supply units must be opened only by HEIDENHAIN service engineers.
Do not engage or disengage any terminals while they are under power.

6.4.1 Power supply

X31 Supply voltage for U_Z

The inverter voltage U_Z is 650 Vdc.
Pin layout:

Terminals	Assignment UV 120	Assignment UV 140
L1	400 Vac ± 10 %	
L2	50 Hz to 60 Hz	
L3		
	Cable: Wire cross section 16 mm^2 Line fuse: 40 A slow (gL/gG) or 50 A fast (aM) Grounding terminal: ≥ 10 mm^2	Cable: Wire cross section 25 mm^2 Line fuse: 80 A slow (gL/gG) or 100 A fast (aM) Grounding terminal: ≥ 16 mm^2

Note

EN 50 178 requires a non-detachable connection to the line power supply.

Note

If the power supply is other than 400 V, an autotransformer is required. It must comply at least with the connection specifications of the subsequent power supply unit.

6.4.2 Main contactor and safety relay

X70 Main contactor Pin layout:

Connection Terminal X70	Assignment
1	+24 V output (max. 250 mA)
2	0 V
3	+24 V input for U_Z ON
4	Do not assign
5	Do not assign
6	Normally closed contact (OE1)
7	Normally closed contact (OE2)

X71 Safety relay spindle
X72 Safety relay axes

Pin layout:

Terminals X71 and X72	Assignment
1	+24 V output (max. 250 mA)
2	0 V
3	+24 V input for Axis ON, Spindle ON
4	Do not assign
5	Do not assign
6	Normally closed contact (OE1A or OE1S)
7	Normally closed contact (OE2A or OE2S)

6.4.3 X90 24 V output

Pin layout:

Connecting terminal X90	Assignment
+	+24 V (max. 250 mA)
–	0 V

6.4.4 NC Power Supply and Control Signals

X69: NC supply voltage and control signals

With lengths of 600 mm and longer, the 50-line ribbon cable for the NC power supply and control signals is led doubled to the LE to increase the wire cross section.

50-line ribbon connector	Assignment
1a to 5b	+5 V
6a to 7b	+12 V
8a	+5 V (low-voltage separation)
8b	0 V (low-voltage separation)
9a	+15 V
9b	–15 V
10a	UZAN
10b	0 V
11a	IZAN
11b	0 V
12a	$\overline{\text{RES.PS}}$
12b	0 V
13a	$\overline{\text{PF.PS.ZK}}$
13b	GND
14a	$\overline{\text{ERR.UZ.GR}}$
14b	GND
15a	$\overline{\text{ERR.IZ.GR}}$
15b	GND
16a	$\overline{\text{ERR.TEMP}}$

50-line ribbon connector	Assignment
16b	GND
17a	RDY.PS
17b	GND
18a	$\overline{\text{ERR.ILEAK}}$
18b	GND
19a	$\overline{\text{PF.PS.AC}}$
19b	GND
20a	Do not assign
20b	GND
21a	Do not assign
21b	GND
22a	Do not assign
22b	GND
23a	Reserved (SDA)
23b	GND
24a	Reserved (SCL)
24b	GND
25a	$\overline{\text{RES.LE}}$
25b	GND

Note

The interface complies with the requirements of EN 50 178 for low voltage electrical separation.

6.4.5 Unit bus

X79 Unit bus Pin layout:

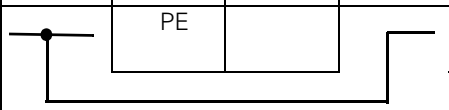
40-line ribbon connector	Assignment	
1a to 3b	0 V *1	These voltages may not be linked with other voltages (only basic insulation)!
4a	+24 V *1	
4b	+24 V *1	
5a	+15 V *1	
5b	+24 V *1	
6a	+15 V *1	
6b	+15 V *1	
7a to 8b	Do not assign	
9a	Reserved (SDA)	
9b	Do not assign	
10a	Reserved (SCL)	
10b	$\overline{\text{ERR.TEMP}}$	
11a	$\overline{\text{PF.PS}}$	
11b	0 V	
12a	$\overline{\text{RES.PS}}$	
12b	0 V	
13a	$\overline{\text{PWR.OFF}}$	
13b	0 V	
14a	5 V FS (spindle enable)	
14b	0 V	
15a	5 V FA (axes enable)	
15b to 16b	0 V	
17a and 17b	–15 V	
18a and 18b	+15 V	
19a to 20b	+5 V	

Note

The interface complies with the requirements of EN 50 178 for low voltage electrical separation (except for 1a to 6b).

6.4.6 Connection of Commutating Reactor and Line Filter

The UV 120 and UV 140 energy-recovery modules must be connected to the main power line via the KDR 120 or KDR 140 commutating reactor and the line filter. This is important to keep the main line free of disruptive higher harmonics.

Supply voltage		**Line filter (EPCOS) Power**	**Device**		**KDR 120 KDR 140**			**UV 1xx X31**
L1	———	L1	L1′	———	1U1	1U2	———	L1
L2	———	L2	L2′	———	1V1	1V2	———	L2
L3	———	L3	L3′	———	1W1	1W2	———	L3
PE		PE			⏚		———	
400 Vac ± 10 % 50 Hz to 60 Hz		**UV 120:** Cable: Wire cross section 16 mm^2 Line fuse: 40 A slow (gL/gG) or 50 A fast (aM) Grounding terminal: ≥ 10 mm^2 **UV 140:** Cable: Wire cross section 25 mm^2 Line fuse: 80 A slow (gL/gG) or 100 A fast (aM) Grounding terminal: ≥ 16 mm^2						

Note

The cables between the power supply and line filter and between the commutating reactor and line filter must be as short as possible (< 0.4 m)!

6.5 Connections with UP 110 Braking Resistor Module

The UP 110 braking resistor module must be used when axis motors without brakes are used. In the event of power failure, it dissipates the energy returned by the motors to the dc link. The UP 110 is switched on when the inverter voltage U_Z exceeds 740 V and is switched off again as soon as it falls below 720 V.

Danger

Danger of electrical shock!
The UP 110 braking resistor module must be opened only by HEIDENHAIN service engineers.
Do not engage or disengage any terminals while they are under power.

X79 Unit bus

Pin layout:

40-line ribbon connector	Assignment	
1a to 3b	0 V *1	These voltages may not be linked with other voltages (only basic insulation)!
4a	+24 V *1	
4b	+24 V *1	
5a	+15 V *1	
5b	+24 V *1	
6a	+15 V *1	
6b	+15 V *1	
7a to 8b	Do not assign	
9a	Reserved (SDA)	
9b	Do not assign	
10a	Reserved (SCL)	
10b	$\overline{\text{ERR.TEMP}}$	
11a	$\overline{\text{PF.PS}}$	
11b	0 V	
12a	$\overline{\text{RES.PS}}$	
12b	0 V	
13a	$\overline{\text{PWR.OFF}}$	
13b	0 V	
14a	5 V FS (spindle enable)	
14b	0 V	
15a	5 V FA (axes enable)	
15b to 16b	0 V	
17a and 17b	–15 V	
18a and 18b	+15 V	
19a to 20b	+5 V	

Note

The interface complies with the requirements of EN 50 178 for low voltage electrical separation (except for 1a to 6b).

6.6 Connections on the UM 1xx power modules

Danger

Danger of electrical shock!
The UM 1xx power supply unit must be opened only by HEIDENHAIN service personnel.
Do not engage or disengage any terminals while they are under power.

6.6.1 PWM connection to the LE

X111, X112 PWM connection to the LE

Pin layout:

Ribbon connector 20-pin	Assignment
1a	PWM U1
1b	0 V U1
2a	PWM U2
2b	0 V U2
3a	PWM U3
3b	0 V U3
4a	$\overline{SH2}$
4b	0 V ($\overline{SH2}$)
5a	$\overline{SH1}$
5b	0 V ($\overline{SH1}$)
6a	+Iactl 1
6b	–Iactl 1
7a	0 V (analog)
7b	+Iactl 2
8a	–Iactl 2
8b	0 V (analog)
9a	Do not assign
9b	$\overline{BRK}$
10a	$\overline{ERR}$
10b	RDY

Note

The interface complies with the requirements of EN 50 178 for low voltage electrical separation.

6.6.2 Unit bus

X79 Unit bus Pin layout:

40-line ribbon connector	Assignment	
1a to 3b	0 V *1	These voltages must not be inked with other voltages (only basic insulation)!
4a	+24 V *1	
4b	+24 V *1	
5a	+15 V *1	
5b	+24 V *1	
6a	+15 V *1	
6b	+15 V *1	
7a to 8b	Do not assign	
9a	Reserved (SDA)	
9b	Do not assign	
10a	Reserved (SCL)	
10b	$\overline{\text{ERR.TEMP}}$	
11a	$\overline{\text{PF.PS}}$	
11b	0 V	
12a	$\overline{\text{RES.PS}}$	
12b	0 V	
13a	$\overline{\text{PWR.OFF}}$	
13b	0 V	
14a	5 V FS (spindle enable)	
14b	0 V	
15a	5 V FA (axes enable)	
15b to 16b	0 V	
17a and 17b	–15 V	
18a and 18b	+15 V	
19a to 20b	+5 V	

Note

The interface complies with the requirements of EN 50 178 for low voltage electrical separation (except for 1a to 6b).

6.6.3 Motor connections

X81 Axis/spindle motor
X82 Axis/spindle motor

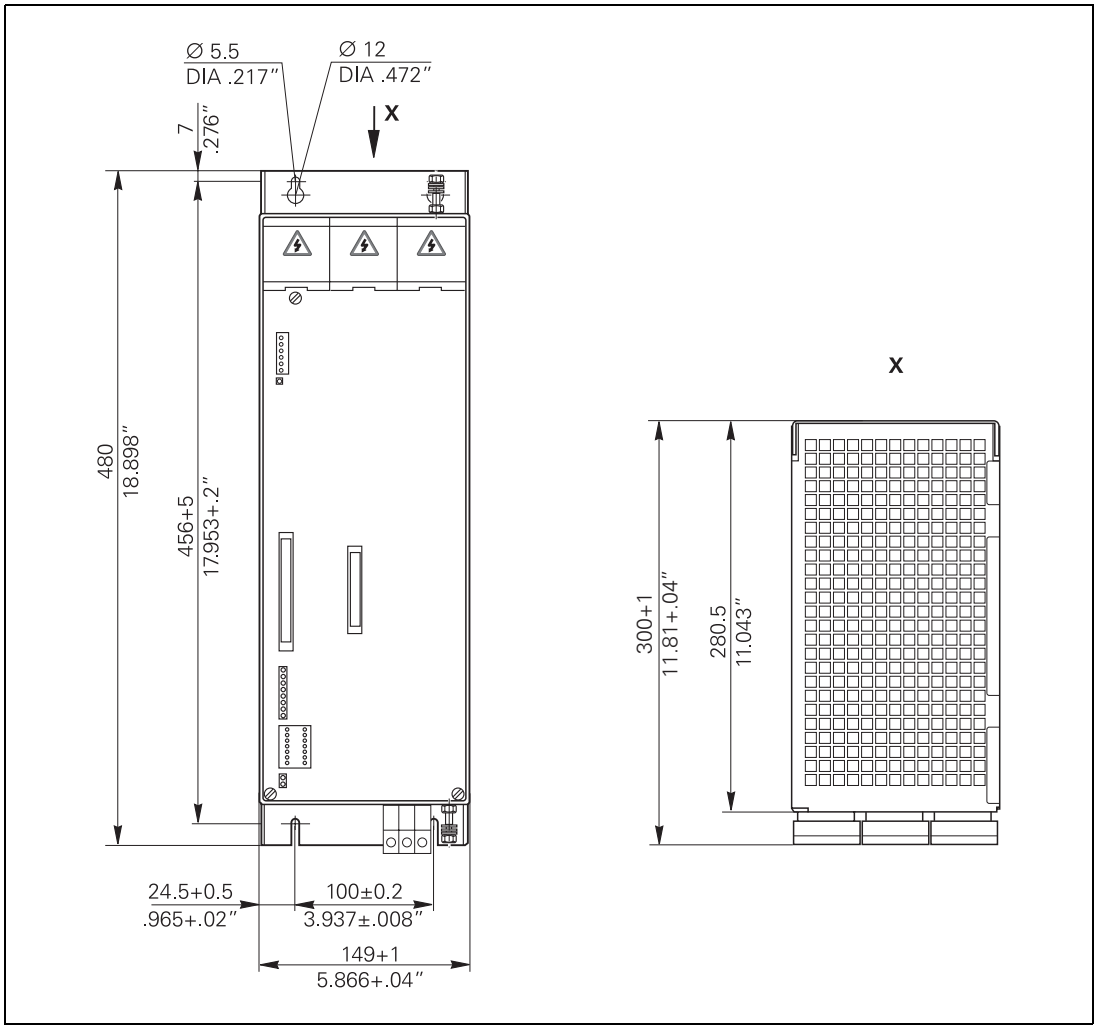
Pin layout:

Terminals	Assignment
U	Motor connection U
V	Motor connection V
W	Motor connection W

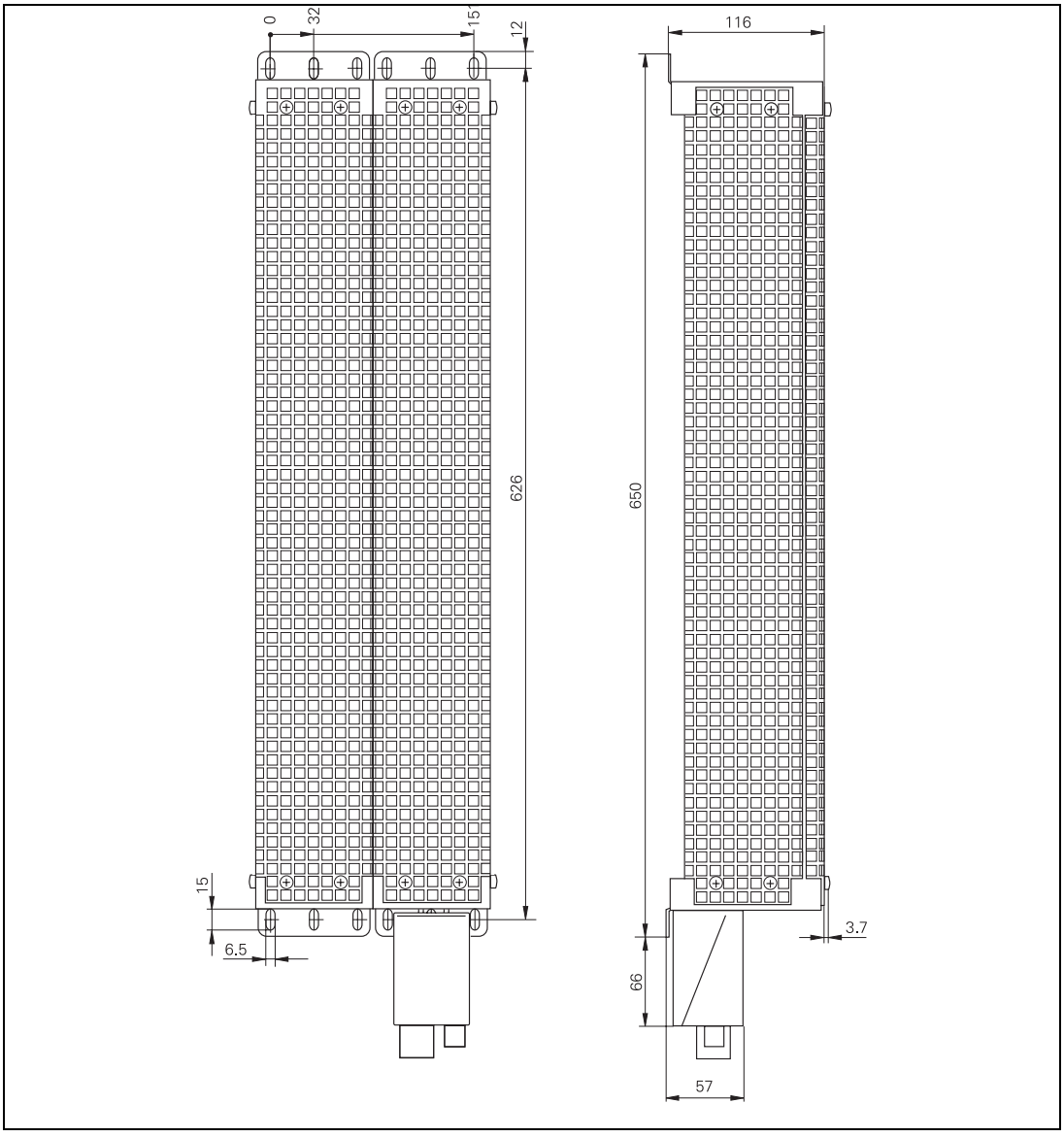
For information on synchronous motors, asynchronous motors and power cables, refer to the chapter "Motors for Axis and Spindle Drives" on page 7 – 2.

6.7 Dimensions

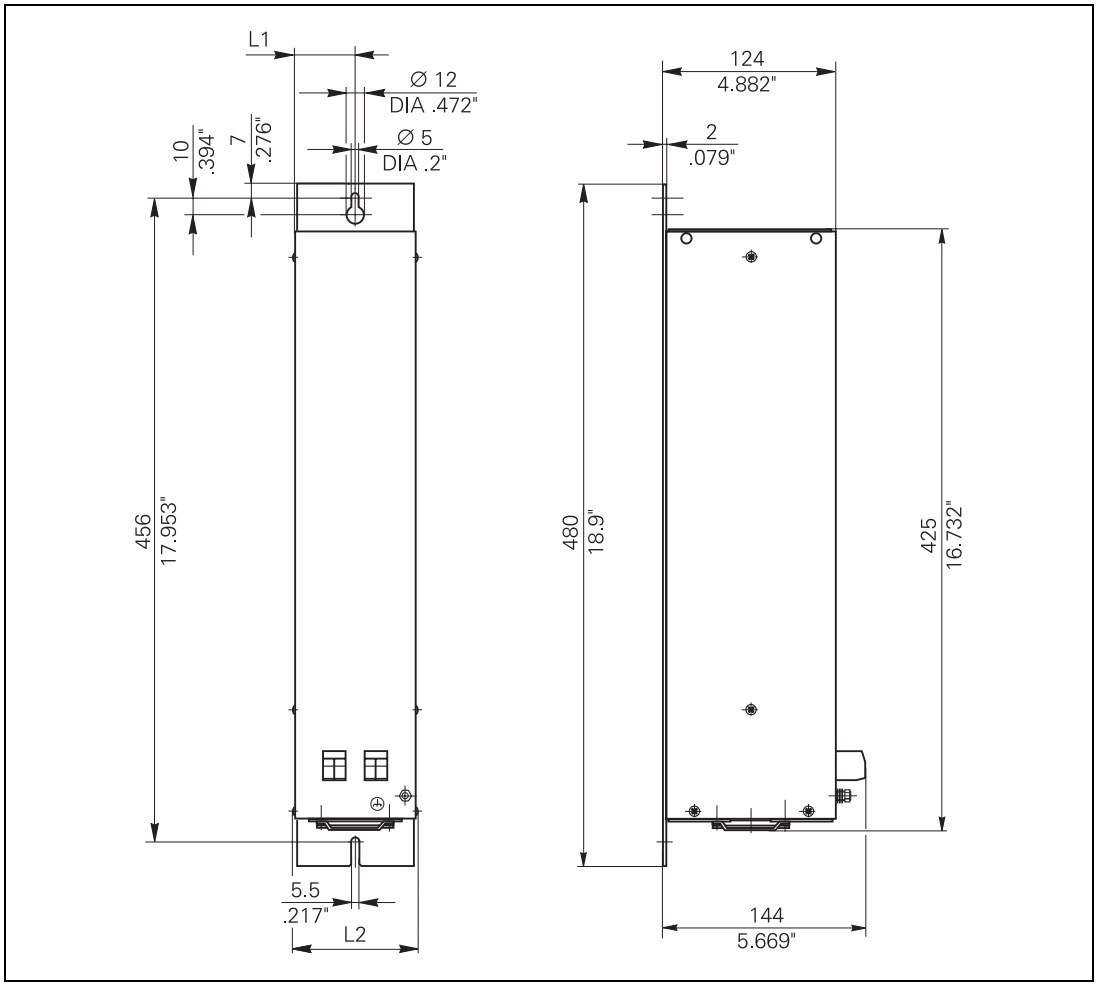
6.7.1 UV 130 power supply unit



6.7.2 PW 210 braking resistor

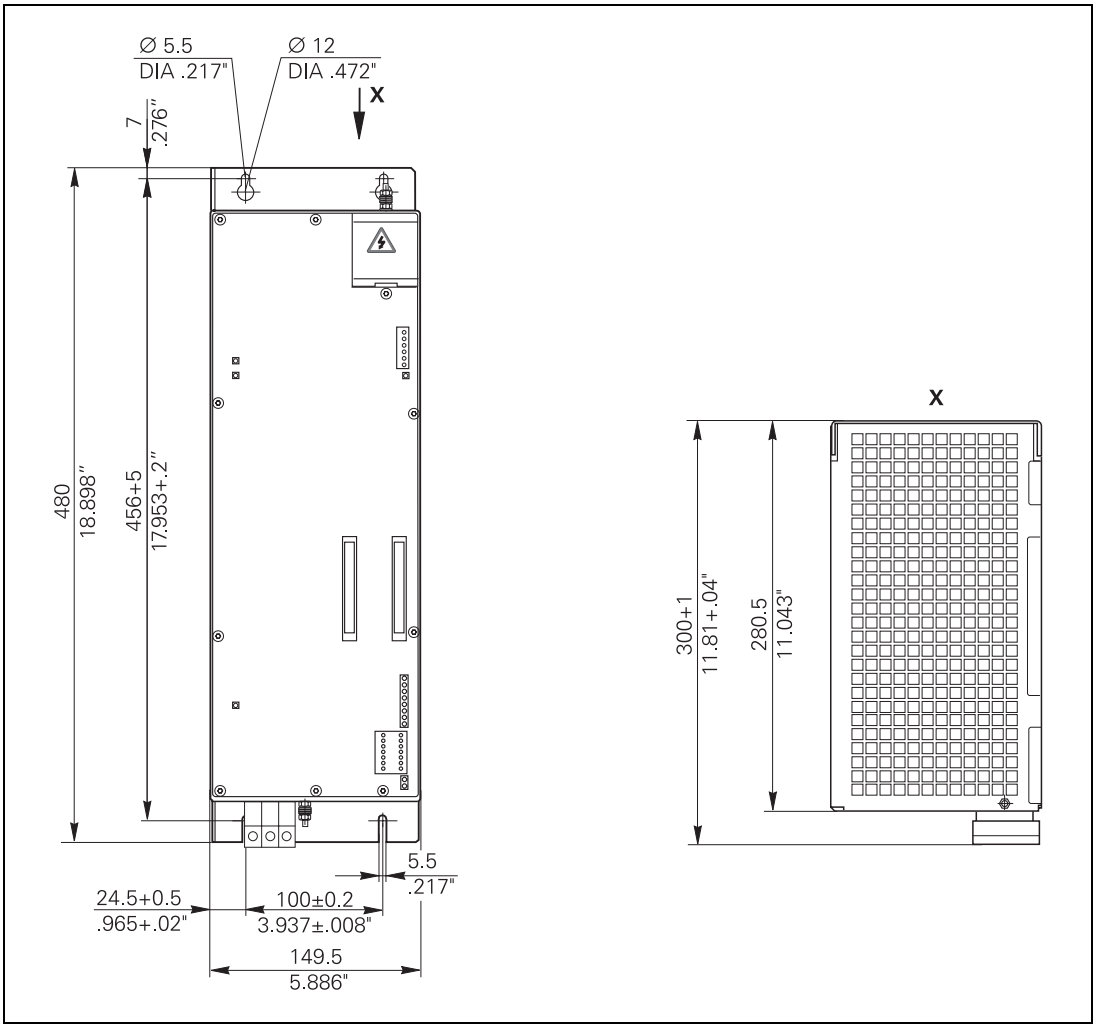


6.7.3 PW 1x0 braking resistor

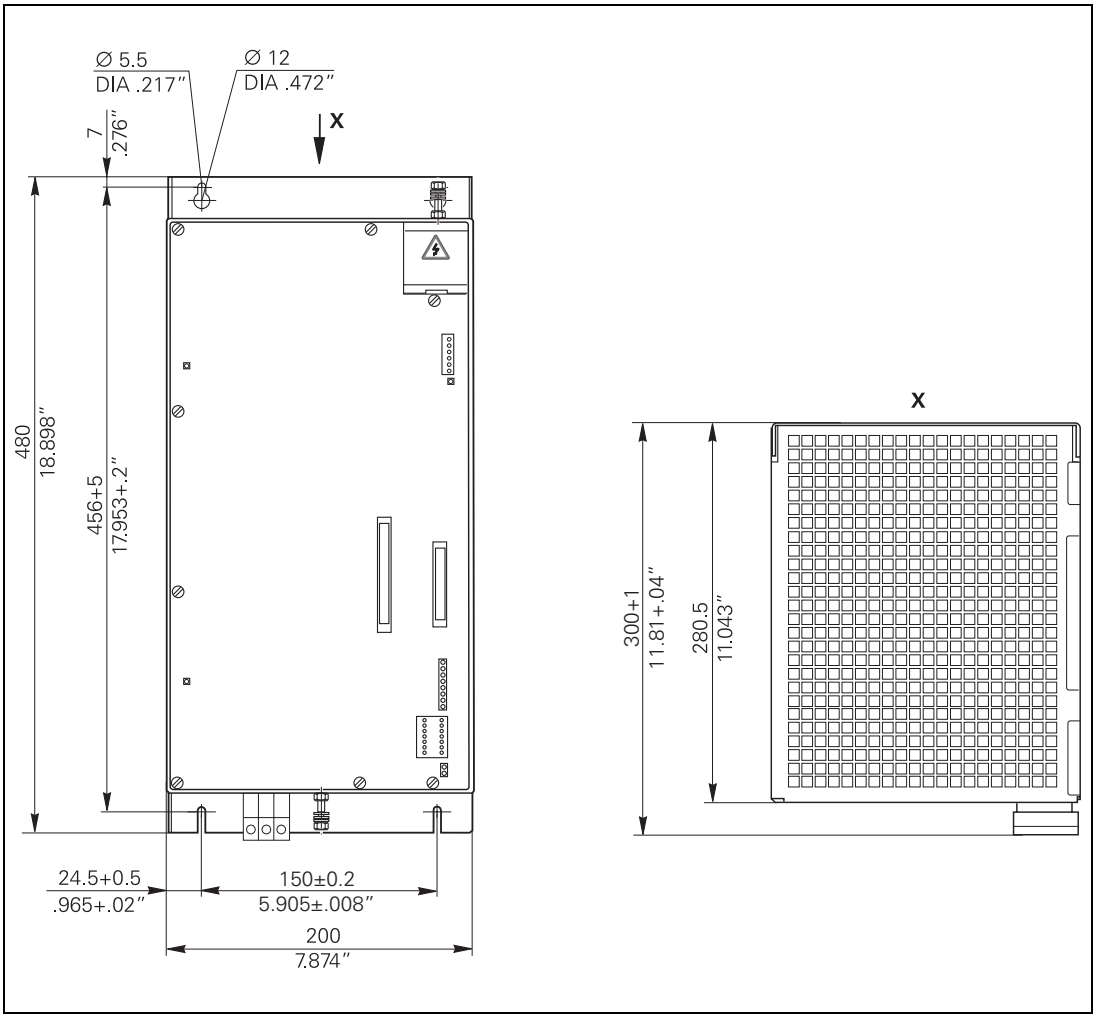


Value	PW 110	PW 120
L1	38,5 1,516″	62,5 2,461″
L2	77 3,031″	125 4,921″

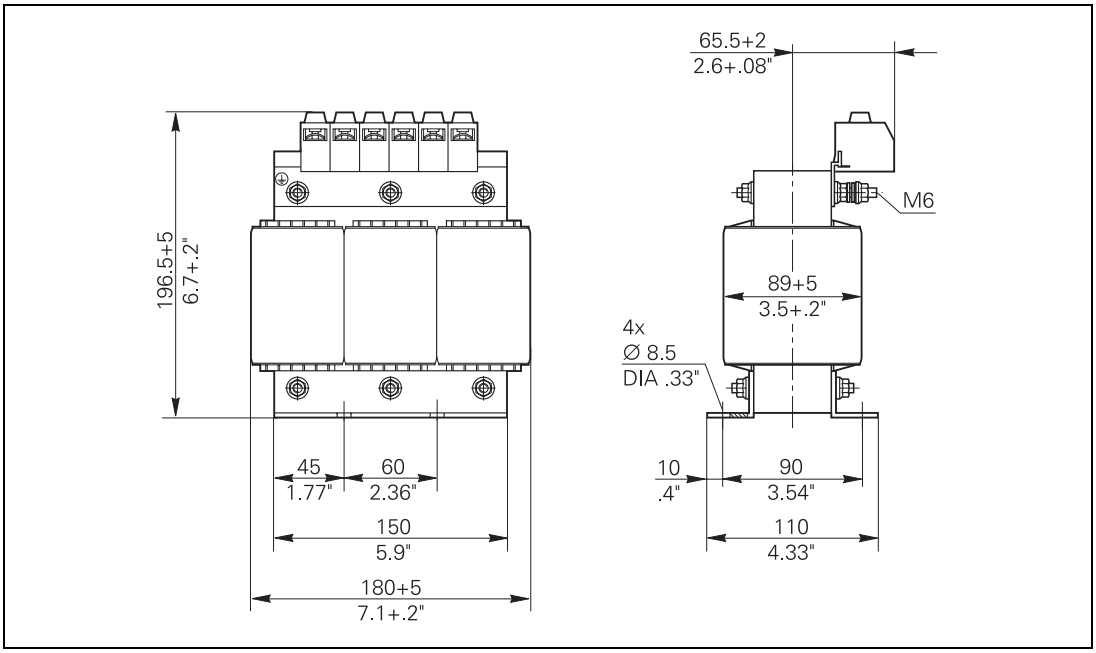
6.7.4 UV 120 power supply unit

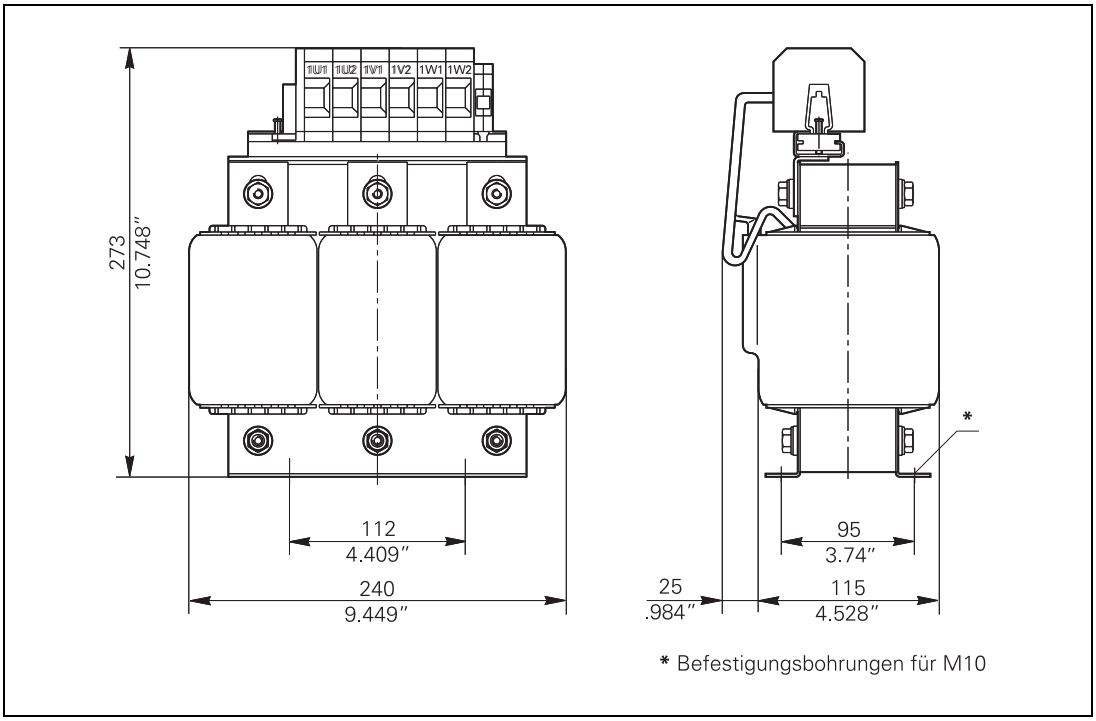


6.7.5 UV 140 power supply unit



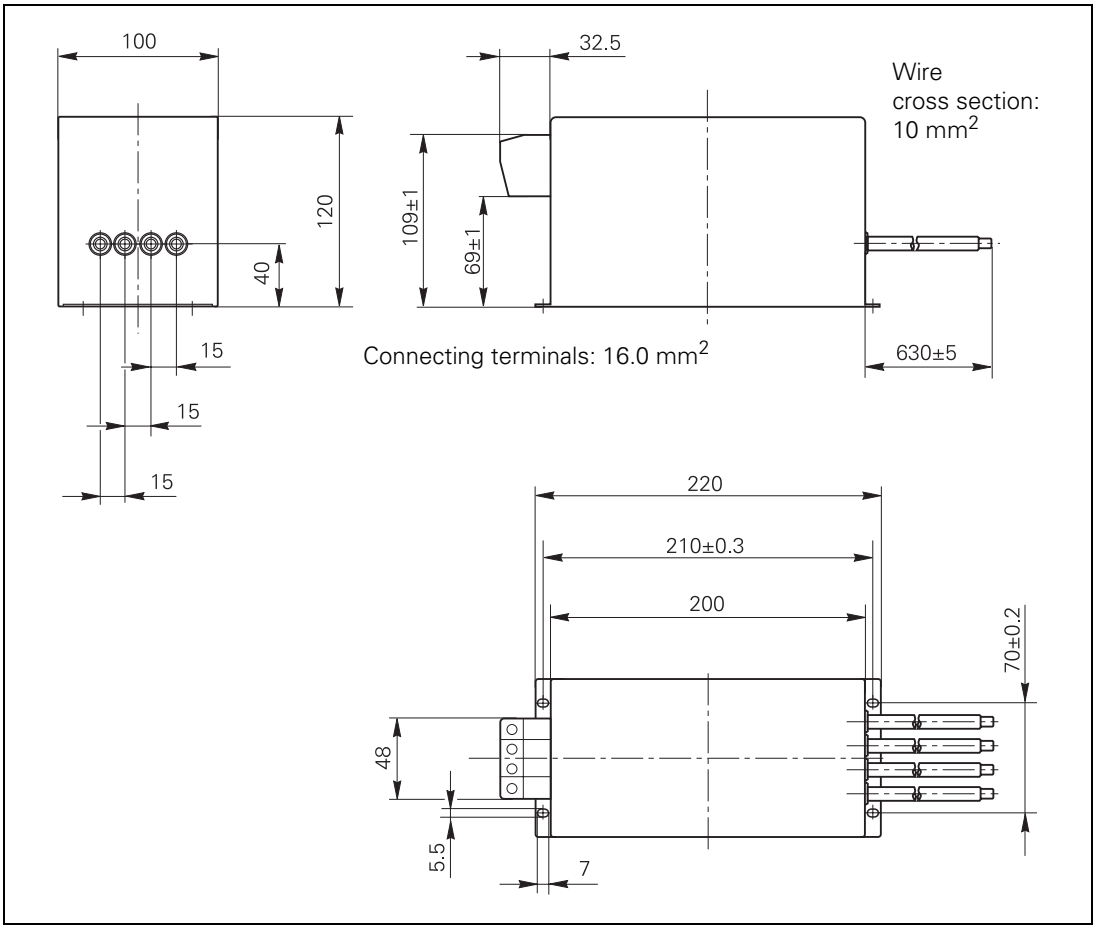
6.7.6 KDR 120

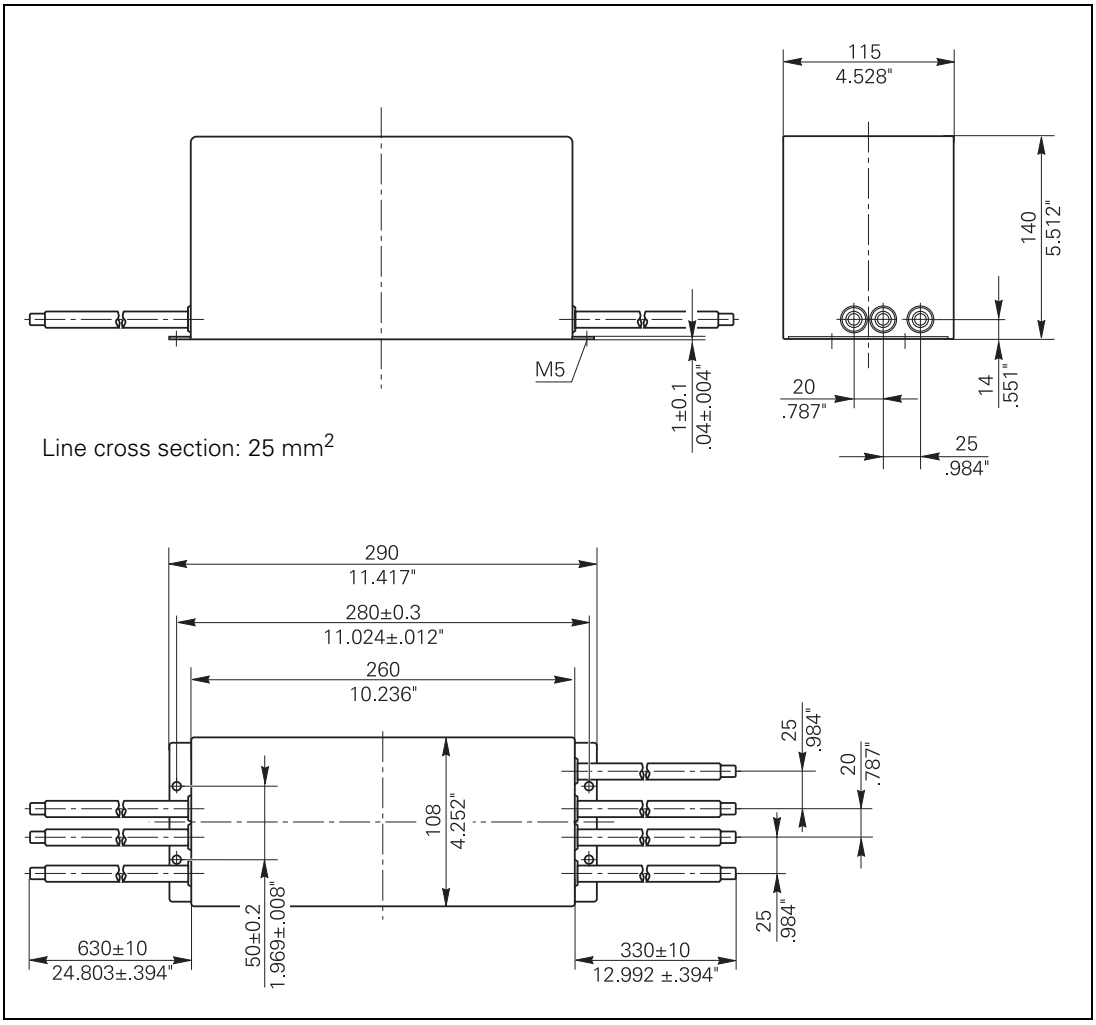

65.5+2
2.6+.08"
M6
196.5+5
6.7+.2"
89+5
3.5+.2"
4x
Ø 8.5
DIA .33"
45
1.77"
60
2.36"
10
.4"
90
3.54"
150
5.9"
110
4.33"
180+5
7.1+.2"


1U1
1U2
1V1
1V2
1W1
1W2
273
10.748″
112
4.409″
240
9.449″
95
3.74″
25
.984″
115
4.528″
*
* Befestigungsbohrungen für M10

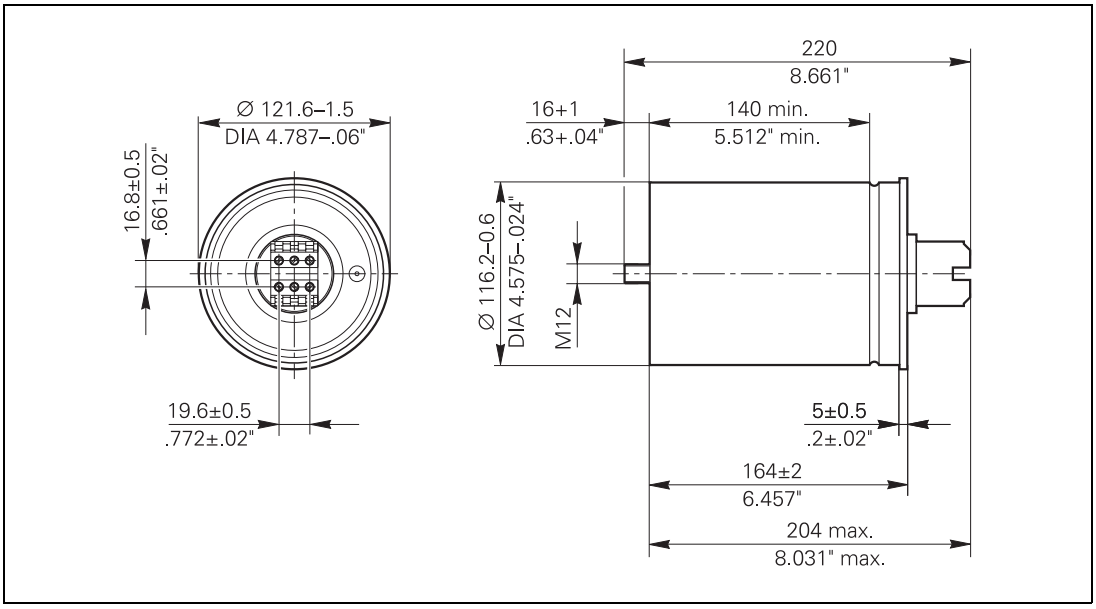
6.7.8 Line filter

EPCOS 35 A line filter

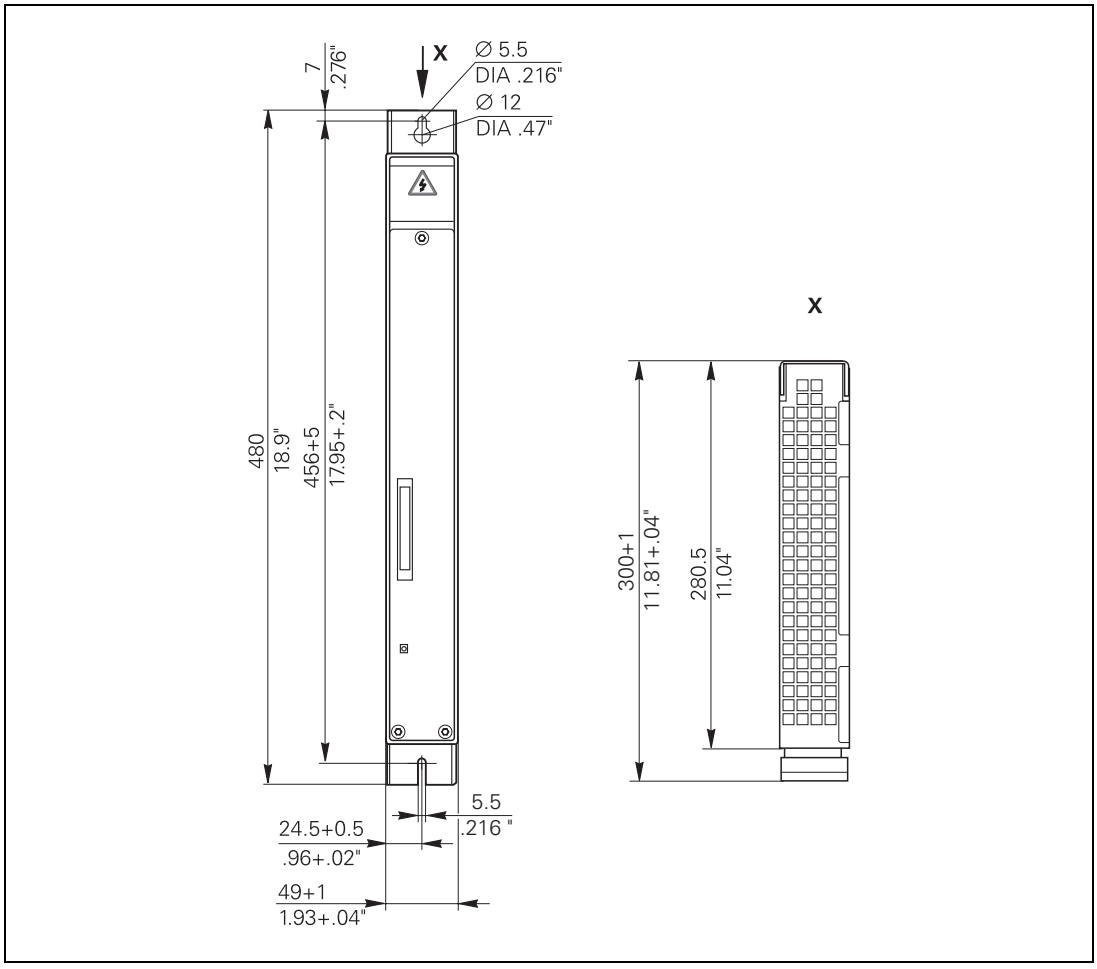



115
4.528"
140
5.512"
M5
1±0.1
.04±.004"
20
.787"
14
.551"
25
.984"
Line cross section: 25 mm2
290
11.417"
280±0.3
11.024±.012"
260
10.236"
25
.984"
20
.787"
108
4.252"
25
.984"
50±0.2
1.969±.008"
630±10
24.803±.394"
330±10
12.992 ±.394"

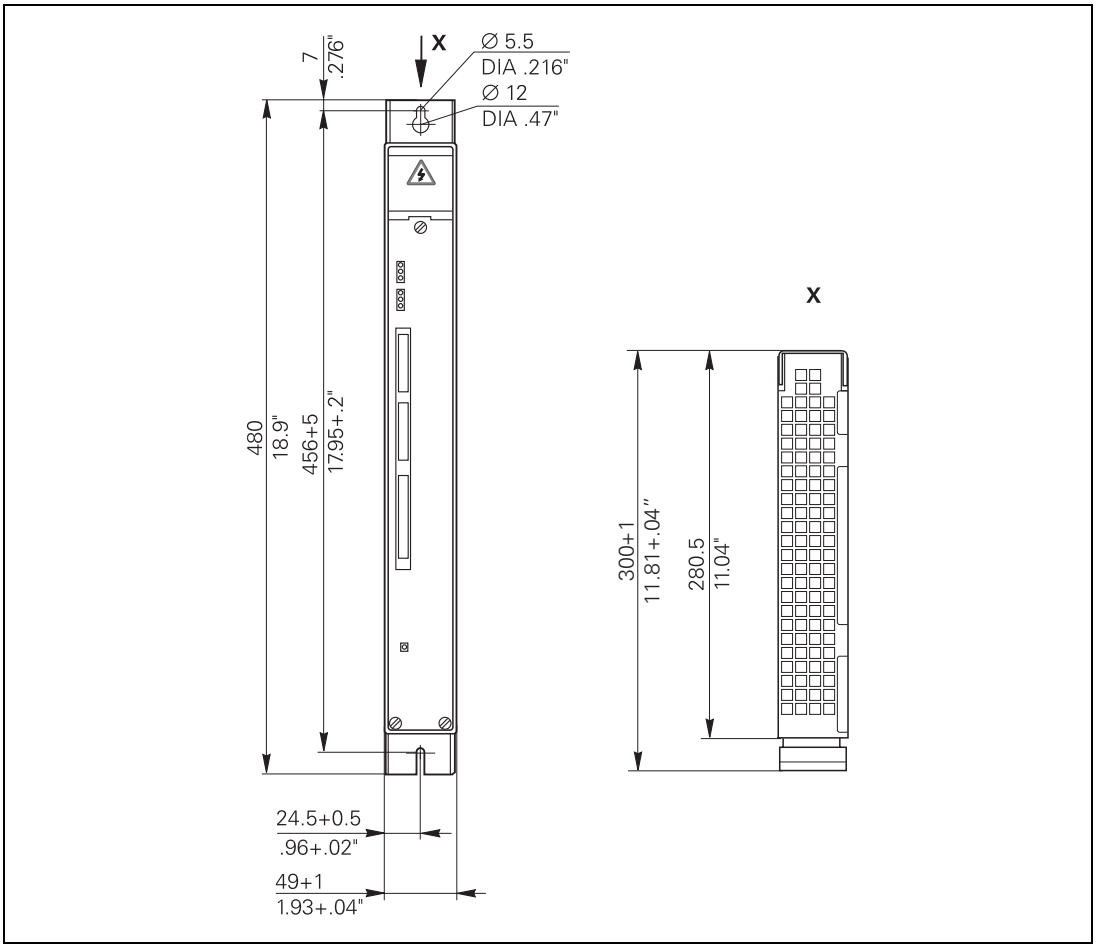
6.7.9 Three-Phase Current Capacitor



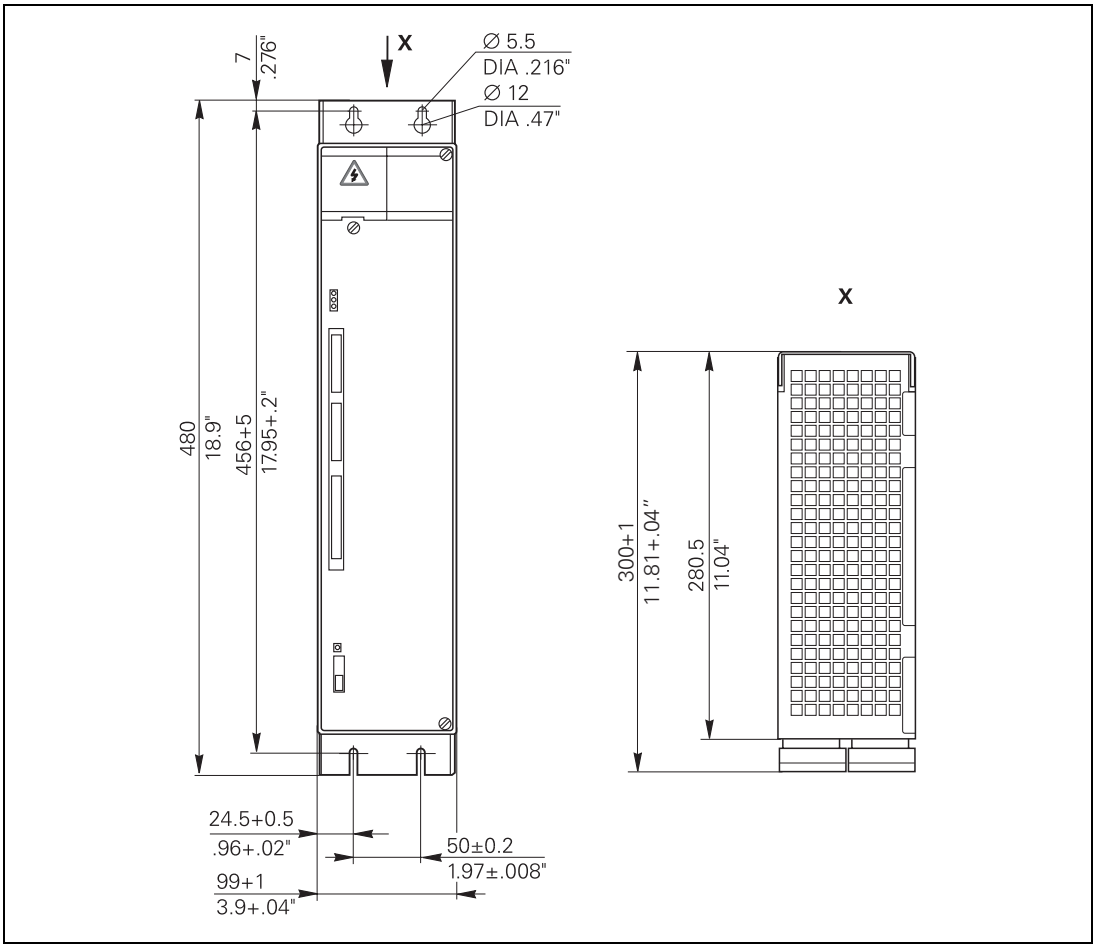
6.7.10 UP 110 braking resistor module



6.7.11 Power module UM 1x1



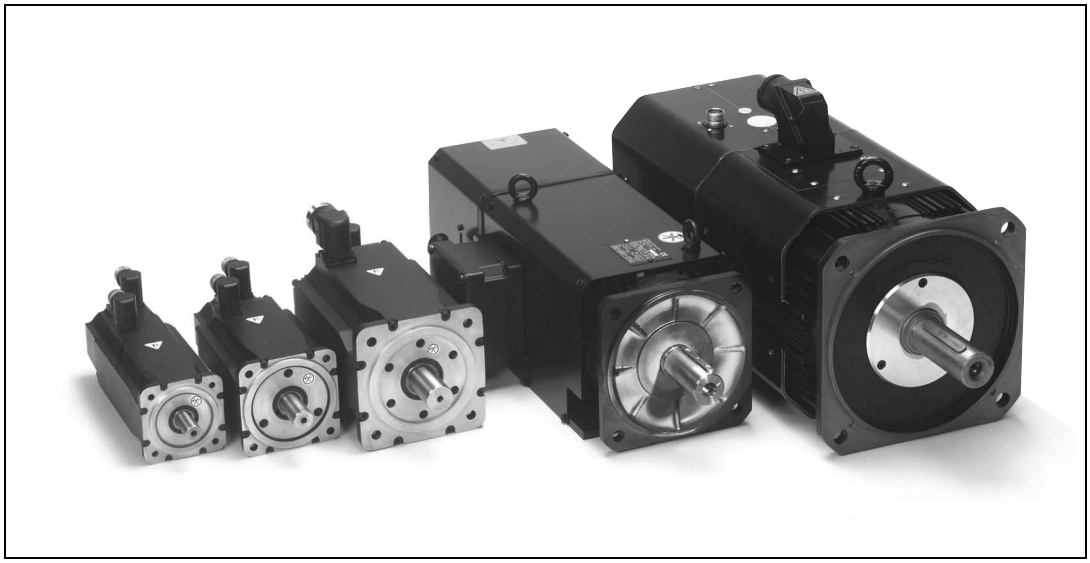
6.7.12 Power module UM 111B, UM 1x2, UM 121B, UM 113, UM 114



7 Motors for Axis and Spindle Drives

7 Motors for Axis and Spindle Drives

7.1 Overview of Synchronous and Asynchronous Motors



7.1.1 Asynchronous motors, QAN series

Designation	Rated power	Rated speed	ID number
QAN 104B	4.5 kW	1500 rpm	331 146-01
QAN 104C	7.5 kW	1500 rpm	331 147-01
QAN 104D	10.0 kW	1500 rpm	331 148-01
QAN 3M	5.5 kW	1500 rpm	316 006-31
QAN 3L	7.5 kW	1500 rpm	316 007-31
QAN 3U	10.0 kW	1500 rpm	316 008-31
QAN 134B	12.0 kW	1500 rpm	331 149-01
QAN 134C	18.0 kW	1500 rpm	331 150-01
QAN 134D	22.0 kW	1250 rpm	331 151-01
QAN 4S	15.0 kW	1800 rpm	317 449-31
QAN 164B	31.5 kW	1350 rpm	331 152-11

7.1.2 Synchronous motors, QSY series

Designation	Stall torque (100 K)	Rated speed	ID Number
QSY 041B with brake without brake	3.0 Nm	3000 rpm	 331 140-04 331 140-03
QSY 1A with brake without brake	3.5 Nm	3000 rpm	 317 122-44 317 122-43
QSY 1C with brake without brake	6.5 Nm	3000 rpm	 317 123-44 317 123-43
QSY 1E with brake without brake	9.3 Nm	3000 rpm	 317 124-44 317 124-43
QSY 96A with brake without brake	1.5 Nm	4500 rpm	344 512-04 344 512-03
QSY 96G with brake without brake	5.2 Nm	4500 rpm	 339 875-04 339 875-03
QSY 071B with brake without brake	9.0 Nm	3000 rpm	 331 141-04 331 141-03
QSY 116C with brake without brake	5.2 Nm	3000 rpm	 339 876-04 339 876-03

Designation	Stall torque (100 K)	Rated speed	ID Number
QSY 116E	7.2 Nm	3000 rpm	
with brake			339 877-04
without brake			339 877-03
QSY 116J	10.0 Nm	3000 rpm	
with brake			339 878-04
without brake			339 878-03
QSY 2C	10.8 Nm	3000 rpm	
with brake			317 125-44
without brake			317 125-43
QSY 2E-2000	15.3 Nm	2000 rpm	
with brake			317 126-44
without brake			317 126-43
QSY 2E-3000	15.3 Nm	3000 rpm	
with brake			317 126-54
without brake			317 126-53
QSY 2G	20.0 Nm	2000 rpm	
with brake			317 127-44
without brake			317 127-43
QSY 155A	8.3 Nm	3000 rpm	
with brake			339 879-04
without brake			339 879-03
QSY 155B	12.2 Nm	3000 rpm	
with brake			339 880-04
without brake			339 880-03
QSY 155D	21.6 Nm	3000 rpm	
with brake			339 881-03
without brake			339 881-04
QSY 155F	26.1 Nm	3000 rpm	
with brake			339 882-04
without brake			339 882-03
QSY 090B-2000	13.0 Nm	2000 rpm	
with brake			331 142-14
without brake			331 142-13
QSY 090B-3000	13.0 Nm	3000 rpm	
with brake			331 142-04
without brake			331 142-03
QSY 093B	20.0 Nm	3000 rpm	
with brake			331 143-04
without brake			331 143-03
QSY 112B	32.0 Nm	3000 rpm	
with brake			331 144-04
without brake			331 144-03
QSY 112C	44.0 Nm	3000 rpm	
with brake			331 145-04
without brake			331 145-03
QSY 112D	72.0 Nm	2000 rpm	
with brake			344 736-13
without brake			344 736-14

7.1.3 Cables and connectors

Danger

Ensure appropriate strain relief of the connecting lines!

Never perform any work on the unit while it is under power!

Make sure the motor is properly grounded!

Make sure the toroidal cores are mounted correctly (only when using HEIDENHAIN UE 2xx and UE 2xxB compact inverters)!

For cable lengths longer than 15 m between motor and inverter, it may be necessary to take additional noise suppression measures.

Motor power cables with and without UL certification are available. Cables with UL certification contain no PVC, silicone or halogen. They are recognizable in their black covering (without UL certification: gray covering).

Power cable for the HEIDENHAIN synchronous motors

The following cables are available from HEIDENHAIN for connecting the synchronous motors:

Without UL certification:

Motor	Cross section	Diameter	Cable with connector at one end	Cable without connector (connector)
QSY 10, 96, QSY 2C, 2E-2000, 2E-3000, 2G QSY 116	4 x 1.5 mm^2 + (2 x 1 mm^2)	12.2 mm	315 068-xx[a]	309 686-01 (325 165-02)
QSY 155	4 x 4 mm^2 + (2 x 1 mm^2)	15.1 mm	340 258-xx[a]	309 686-02 (333 090-02)
QSY 041B, 071B, QSY 090B-2000, 090B-3000	4 x 1.5 mm^2 + (2 x 1 mm^2)	12.2 mm	331 748-xx[a]	309 686-01 (325 165-04)
QSY 093B	4 x 2.5 mm^2 + (2 x 1 mm^2)	13.5 mm	332 420-xx[a]	–
QSY 112B	4 x 6 mm^2 + (2 x 1 mm^2)	16.9 mm	332 421-xx[a]	309 686-04
QSY 112C, 112D	4 x 10 mm^2 + (2 x 1 mm^2)	21.0 mm	332 422-xx[a]	309 686-05

With UL certification:

Motor	Cross section	Diameter	Cable with connector at one end	Cable without connector (connector)
QSY 10, 96, QSY 2C, 2E-2000, 2E-3000, 2G QSY 116	4 x 1.5 mm^2 + (2 x 1 mm^2)	12.5 mm	352 960-xx[a]	348 948-01 (325 165-02)
QSY 155A, 155B	4 x 1.5 mm^2 + (2 x 1 mm^2)	12.5 mm	352 962-xx[a]	348 948-01 (333 090-02)
QSY 155D, 155F	4 x 4 mm^2 + (2 x 1 mm^2)	14.8 mm	352 963-xx[a]	348 948-03 (333 090-02)
QSY 041B, 071B, QSY 090B-2000, 090B-3000	4 x 1.5 mm^2 + (2 x 1 mm^2)	12.5 mm	352 961-xx[a]	348 948-01 (325 165-04)
QSY 093B	4 x 2.5 mm^2 + (2 x 1 mm^2)	13.3 mm	352 950-xx[a]	–
QSY 112B	4 x 6 mm^2 + (2 x 1 mm^2)	16.4 mm	352 952-xx[a]	348 948-04
QSY 112C, 112D	4 x 10 mm^2 + (2 x 1 mm^2)	21.0 mm	352 953-xx[a]	348 948-05

a. The following cable lengths are available:
5 m: xx = 05
7 m: xx = 07
10 m: xx = 10
12 m: xx =12
15 m: xx = 15

Power cable for the HEIDENHAIN asynchronous motors

The following cables are available from HEIDENHAIN for connecting the asynchronous motors:

Without UL certification:

Motor	Cross section	Diameter	Cable
QAN 104B, 104C	4 x 4 mm^2	14.5 mm	332 546-xx (with connector)[a]
QAN 104D	4 x 6 mm^2	15.8 mm	332 547-xx (with connector)[a]
QAN 3M	4 x 2.5 mm^2	12.5 mm	309 687-07 (in meters)
QAN 3L	4 x 4 mm^2	14.5 mm	309 687-01 (in meters)
QAN 3U	4 x 6 mm^2	15.8 mm	309 687-05 (in meters)
QAN 4S	4 x 10 mm^2	19.9 mm	309 687-2 (in meters)
QAN 134B	4 x 6 mm^2	15.8 mm	332 547-xx (with connector)[a]
QAN 134C, 134D	4 x 16 mm^2	23.4 mm	332 549-xx (with connector)[a]
QAN 164B	4 x 25 mm^2	28.3 mm	332 550-xx (with connector)

a. The following cable lengths are available:
5 m: xx = 05
7 m: xx = 07
10 m: xx = 10
12 m: xx =12
15 m: xx = 15

With UL certification:

Motor	Cross section	Diameter	Cable
QAN 104B, 104C	4 x 4 mm^2	13.7 mm	352 956-xx (with connector)[a]
QAN 104D	4 x 6 mm^2	15.1 mm	352 957-xx (with connector)[a]
QAN 3M	4 x 2.5 mm^2	13.3 mm	348 949-07 (in meters)
QAN 3L	4 x 4 mm^2	13.7 mm	348 949-01 (in meters)
QAN 3U	4 x 6 mm^2	15.1 mm	348 949-05 (in meters)
QAN 4S	4 x 10 mm^2	20.9 mm	348 949-06 (in meters)
QAN 134B	4 x 6 mm^2	15.1 mm	352 957-xx (with connector)[a]
QAN 134C, 134D	4 x 16 mm^2	26.5 mm	352 958-xx (with connector)[a]
QAN 164B	4 x 25 mm^2	30.5 mm	352 959-xx (with connector)

a. The following cable lengths are available:
5 m: xx = 05
7 m: xx = 07
10 m: xx = 10
12 m: xx =12
15 m: xx = 15

Other cables and connectors

Designation	ID number
Connecting cable between speed encoder output and input	289 440-xx
Female contact for connecting the motor to the power module (supplied as an accessory with the UM 1xx)	282 177-01
Fan cable for QAN 30, 4S, 134B, 134C, 134D, 164B (4 x 1 mm^2, in meters, diameter 9.7 mm)	309 683-01
Fan cable for QAN 104, QSY 112D (3 x 1 mm^2, in meters)	309 683-02
Fan cable for QAN 104, 30, 4S, 134, 164B with UL certification (4 x 0.75 mm^2, in meters, diameter 7.7 mm)	348 949-01
Connectors for QSY 10, 96G, 116, 20	325 165-02
Connectors for QSY 041B, 071B, 090B	325 165-04

Maximum bend radii of the power cables

Cross section	Maximum bend radius
4 x 1.5 mm^2 + (2 x 1 mm^2)	≥ 60 mm
4 x 2.5 mm^2 + (2 x 1 mm^2)	≥ 70 mm
4 x 6 mm^2 + (2 x 1 mm^2)	≥ 85 mm
4 x 10 mm^2 + (2 x 1 mm^2)	≥ 105 mm
4 x 2.5 mm^2	≥ 65 mm
4 x 4 mm^2	≥ 75 mm
4 x 6 mm^2	≥ 80 mm
4 x 10 mm^2	≥ 100 mm
4 x 16 mm^2	≥ 120 mm
4 x 25 mm^2	≥ 140 mm

7.1.4 Required Power Modules or Compact Inverters

Synchronous motors

Motor	Power module		Compact inverter
	1-axis	2-axis	
QSY 10, 96, QSY 2C, 2E-2000, QSY 116	UM 111	UM 121	Axis 1 to 4
QSY 2E-3000, 2G	UM 111B	UM 121B	Axis 4
QSY 155A	UM 111	UM 121	Axis 1 to 4
QSY 155B, 155D	UM 111B	UM 121B	Axis 4
QSY 155F	UM 112	UM 122	Axis 4 (only UE 242, UE 241B, UE 242B)
QSY 041B, 071B, QSY 090B-2000	UM 111	UM 121	Axis 1 to 4
QSY 090B-3000	UM 111B	UM 121B	Axis 4
QSY 093B	UM 111B	UM 121B	Axis 4
QSY 112B	UM 113	–	–
QSY 112C, 112D	UM 113	–	–

Asynchronous motors

Motor	Power module		Compact inverter
	1-axis	2-axis	
QAN 104B, 104C	UM 112	UM 122	Spindle
QAN 104D	UM 112	UM 122	Spindle (UE 24x, UE 24xB)
QAN 3M	UM 112	UM 122	Spindle
QAN 3L	UM 112	UM 122	Spindle
QAN 3U	UM 112	UM 122	Spindle (UE 24x, UE 24xB)
QAN 4S	UM 112	UM 122	Spindle (UE 24x, UE 24xB)
QAN 134B	UM 112	UM 122	Spindle
QAN 134C	UM 113	–	–
QAN 134D	UM 114	–	–
QAN 164B	UM 114	–	–

7.2 General Information

7.2.1 Safety and commissioning regulations

Please note the following regulations for safety and commissioning. Damage caused by careless treatment or use of goods will not be covered in the warranty.

Danger

During operation several of the motor parts may be either live or moving.

Never perform any kind of work on the motor (open of terminal box, make or break connections) while it is under power.

Repairs or other kind of service to the motor may only be carried out by trained personnel.

Close the motor as shown in the accompanying instructions diagram. Establish a safe electrical connection, making sure the motor is properly grounded.

The motors are not intended for direct connection to three-phase line power. They must be operated via an electronic power converter. Connecting the motor directly to line power may destroy the motor!

Warning

Temperatures of over 100 °C may occur on the motor surfaces.

When connecting the fan, ensure that the direction of rotation is correct. The arrow symbol on the fan housing indicates the correct direction.

Warning

The standstill brake that can be installed as an option is designed only for a limited number of emergency stops.

After mounting the motor you must verify the trouble-free functioning of the brake.

On motors with plug-in connection and built-in brake, you must install the varistor required for wiring the brake when commissioning the motor. See "Connecting the Holding Brake for the HEIDENHAIN Motors" on page 7–20

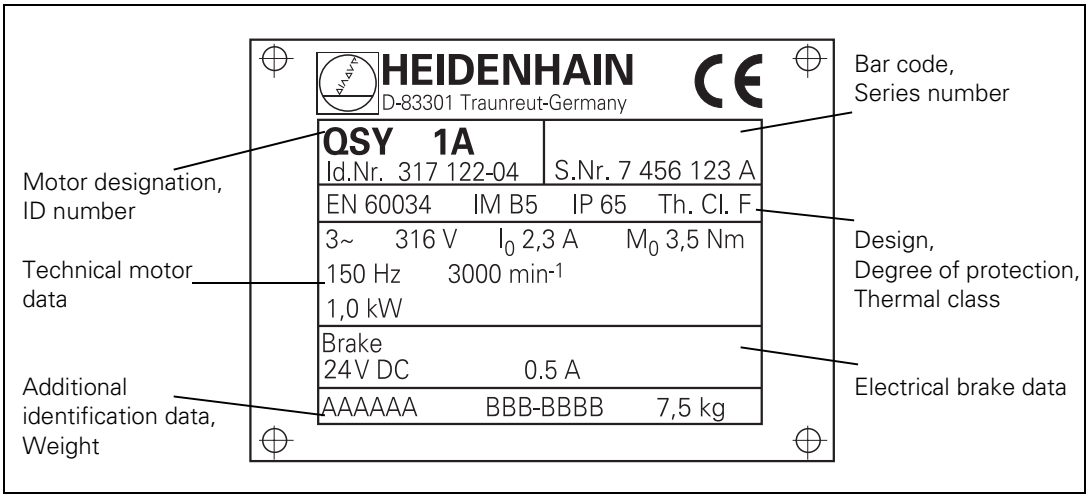
Danger

Before the commissioning of motors equipped with a feather key at the shaft end, the feather key must be secured against ejection.

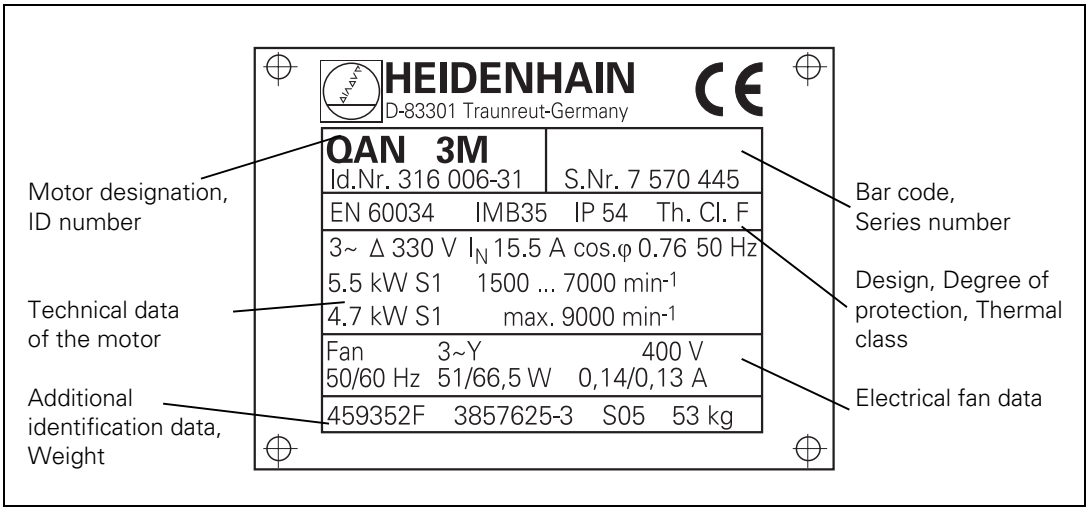
You will find further information on the safe and trouble-free functioning of your motor in the operating instructions that accompany each unit.

7.2.2 Data on the name plate

QSY synchronous motors



QAN asynchronous motors



7.3 Different dc-link voltages for HEIDENHAIN motors

The HEIDENHAIN inverter systems supply different dc-link voltages:

- Compact inverters UE 2xx, UE 2xxB: 565 V
- Modular inverters with UV 130: 565 V
- Modular inverters with UV 120 or UV 140: 650 V

QSY synchronous motors

The characteristic curves for the HEIDENHAIN synchronous motors were determined with a dc-link voltage of 565 V or 650 V.

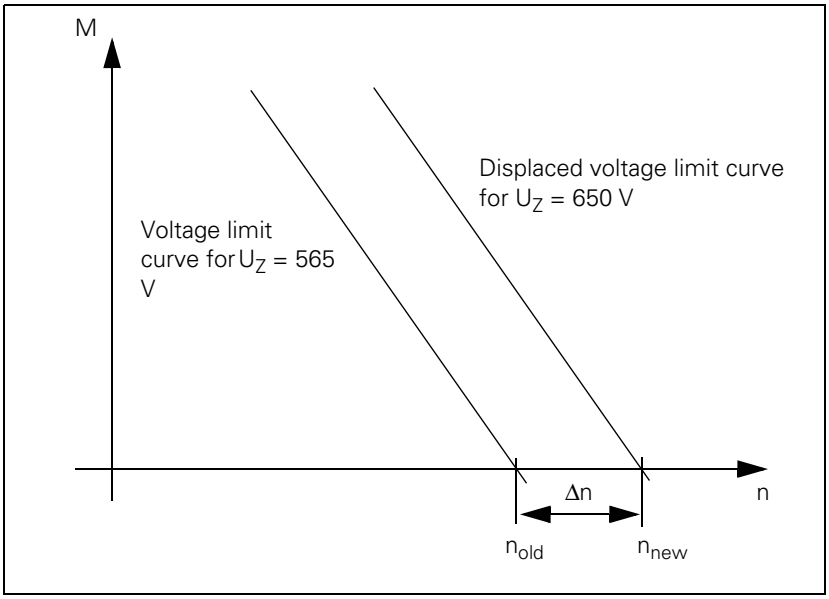
If a synchronous motor is operated at a different dc-link voltage, the voltage limit curve must be displaced in parallel.
The displacement is calculated as follows:

$$\Delta n = n_{alt} \cdot \frac{U_{Zneu}}{U_{Zalt}} - n_{alt}$$

Example: U_{Zold} = 565 V, U_{Znew} = 650 V, n_{old} = 3300 rpm, Δn = ?, n_{new} = ?

$$\Delta n = 3300\ \text{min}^{-1} \cdot \frac{650\ \text{V}}{565\ \text{V}} - 3300\ \text{min}^{-1} = 497\ \text{min}^{-1}$$

$$n_{neu} = n_{alt} + \Delta n = 3300\ \text{min}^{-1} + 497\ \text{min}^{-1} = 3797\ \text{min}^{-1}$$



QAN asynchronous motors

The characteristic curves for the HEIDENHAIN asynchronous motors were determined with a dc-link voltage of 565 V and 650 V. If a motor is operated at a different dc-link voltage, the characteristic curve must be adjusted.

If the power characteristic lies above the breakdown-torque speed, it must be multiplied by a factor k.

$$P_{neu} = P_{alt} \cdot k$$

with

$$k = \frac{(U_{Zneu})^2}{(U_{Zalt})^2}$$

The torque characteristic above the breakdown-torque speed must be newly calculated as follows:

$$M_{neu} = \frac{P_{neu} \cdot 60}{2 \cdot \pi \cdot n}$$

Example:

QAN 134B: P_{old} = 10.5 kW with n = 7000 rpm (see diagram) with 565 V

P_{new} with n = 7000 rpm with 650 V?
M_{new} with n = 7000 rpm with 650 V?

$$k = \frac{(650\ \text{V})^2}{(565\ \text{V})^2} = 1{,}32$$

$$P_{neu} = 10{,}5\ \text{kW} \cdot 1{,}32 = 13{,}9\ \text{kW}$$

$$M_{neu} = \frac{13900\ \text{W} \cdot 60}{2 \cdot \pi \cdot 7000\ \text{min}^{-1}} = 19\ \text{Nm}$$

7.4 Connecting the speed encoders to the HEIDENHAIN motors

All HEIDENHAIN motors are equipped with HEIDENHAIN speed encoders. The encoder signals and the signals from the temperature sensors are transmitted via a 17-pin flange socket.

Motor flange socket (male) 17-pin	**Assignment**	**Cable for speed encoder (Id.-Nr. 289 440-xx)**		
		connector (female) 17-pin	**Color**	**D-sub connector (male) 25-pin**
1	A+	1	Green/Black	3
2	A–	2	Yellow/Black	4
3	R+	3	Red	17
4	D–	4	Pink	22
5	C+	5	Green	19
6	C–	6	Brown	20
7	0 V	7	White/Green	
8	Temperature +	8	Yellow	13
9	Temperature–	9	Violet	25
10	5 V	10	Brown/Green	1
11	B+	11	Blue/Black	6
12	B–	12	Red/Black	7
13	R–	13	Black	18
14	D+	14	Gray	21
15	0 V sensor	15	White	16
16	5 V sensor	16	Blue	14
17	Internal shield	17	Internal shield	8
Housing	External shield	Housing	External shield	Housing
			Free	5, 9, 10, 11, 12, 15, 23, 24

Note

The interface complies with the requirements of EN 50 178 for low voltage electrical separation.

7.5 Power connection of the HEIDENHAIN motors

7.5.1 Power Connection for the HEIDENHAIN Synchronous Motors

Note

The shielded line for the holding brake included in the power cable must have intermediate terminals and the shield should be kept as close as possible to ground.

Series QSY 96, QSY 10, QSY 20, QSY 116 and QSY 155

The power connection of the HEIDENHAIN synchronous motors QSY 96G as well as QSY 10, QSY 20, QSY 116 and QSY 155 is made via a 6-pin flange socket.

Flange socket (male) 6-pin	Assign-ment	Connec-tor (female) 6-pin	Power cable (Id.-Nr. 315 068-xx, 340 258-xx)	Inverter Terminal 3-pin
1	U	1	Black 1	U
2	V	2	Black 2	V
⏚	PE		Green/Yellow	
4	+24 V (brake)	4	Black 6	Intermediate terminals
5	0 V (brake)	5	Black 5	Intermediate terminals
6	W	6	Black 3	W

QSY 041B, QSY 071B and QSY 090B

The power connection of the HEIDENHAIN synchronous motors QSY 041B, QSY 071B and QSY 090B is made via a 9-pin flange socket.

Flange socket (male) 9-pin	Assign-ment	Connec-tor (female) 9-pin	Power cable (Id.-Nr. 331 748-xx)	Inverter Terminal 3-pin
A	U	A	Black 1	U
B	V	B	Black 2	V
C	W	C	Black 3	W
D	PE	⏚	Green/Yellow	
F	+24 V (brake)	F	Black 6	Intermediate terminals
G	0 V (brake)	G	Black 5	Intermediate terminals
E, H, L	Do not assign	E, H, L	Do not assign	Do not assign

QSY 093B and QSY 112 motors

The power connection of the HEIDENHAIN synchronous motors QSY 093B and QSY 112 is made via an 11-pin flange socket.

Flange socket (male) 11-pin	**Assign-ment**	**Connec-tor (female) 11-pin**	**Power cable (Id.-Nr. 332 420-xx, 332 421-xx, 332 422-xx)**	**Inverter Terminal 3-pin**
A	U	A	Black 1	U
B	V	B	Black 2	V
C	W	C	Black 3	W
D	PE	⏚	Green/Yellow	
F	+24 V (brake)	F	Black 6	Intermediate terminals
G	0 V (brake)		Black 5	Intermediate terminals
E, H, J, K	Do not assign	E, H, J, K	Do not assign	Do not assign
L	Internal shield	L	Internal shield	Intermediate terminals

7.5.2 Power Connection for the HEIDENHAIN Asynchronous Motors

Series QAN 30 and QAN 4S

The power connection of the HEIDENHAIN asynchronous motors QAN 30 and QAN 4S is made via a terminal box. The connections for the fan are also to be found in the terminal box. See "Connecting the Fan to the HEIDENHAIN Motors" on page 7–22

Terminal row for motors	Power cable	Inverter Connecting terminal 3-pin
U	Black 1	U
V	Black 2	V
W	Black 3	W
⏚	Green/Yellow	

Terminal box:

Warning

Do not use connections 11, 12 and 13.
They only serve the purpose of leading the lines of the temperature sensors out of the motor.

Series QAN 104, QAN 134 and QAN 164B

The power connection of the HEIDENHAIN asynchronous motors of the series QAN 104, QAN 134 and QAN 164B is made via a 11-pin flange socket.

Flange socket (male) 11-pin	**Assign-ment**	**Connec-tor (female) 11-pin**	**Power cable**	**Inverter Terminal 3-pin**
A	U	A	Black 1	U
B	V	B	Black 2	V
C	W	C	Black 3	W
D	PE	D	Green/Yellow	⏚
E to L	Do not assign			

7.6 Connecting the Holding Brake for the HEIDENHAIN Motors

The HEIDENHAIN synchronous motors can be supplied with a holding brake (option).
The brake is a permanent-magnet single-disk brake, operated by direct current. It serves to hold the motor shaft without backlash at standstill.
The electrical connection of the brake is made via the power connection. See "Power connection of the HEIDENHAIN motors" on page 7–16

Note

The brake is a holding brake and not a service brake!

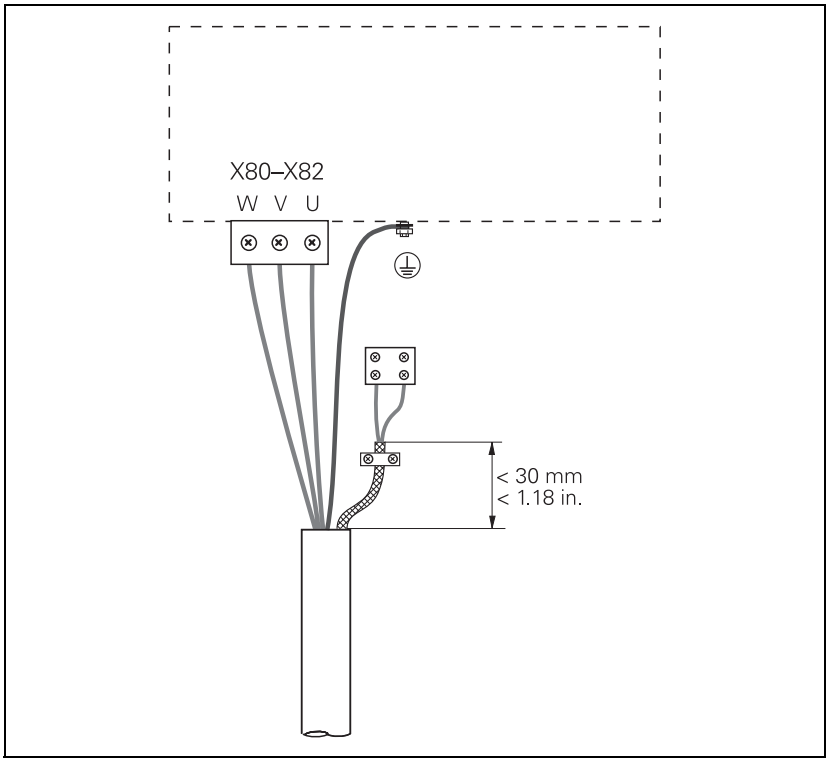
When connecting the brake, particular attention should be paid to electrical noise immunity!

The brake is engaged when it is not under power. The rated voltage for releasing the brake is 24 V (± 10 %).

Warning

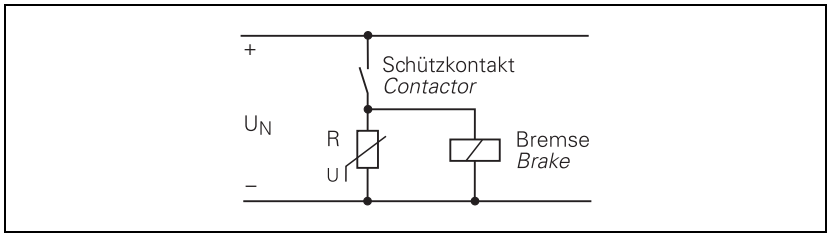
The holding brakes are permanent-magnet brakes! Observe the correct polarity of the dc voltage. Otherwise the brake will not be released.

The shield of the lines for the holding brake is to be kept as close as possible (< 30 mm) to ground. The best solution is to fasten the shield with a metal clamp directly onto the sheet-metal housing of the electrical cabinet.



Due to the inductance of the holding brake, a voltage peak that may exceed 1000 V occurs when the exciting current is switched off. To avoid this voltage peak, use a protective circuit with an R varistor, recommended type Q69-X3022.

The following circuitry is suggested for the protective circuit of the brake:



Note

After mounting the motor you must verify the trouble-free functioning of the brake.

7.7 Connecting the Fan to the HEIDENHAIN Motors

The HEIDENHAIN asynchronous motors are fitted with axial fans (standard).

Note

When connecting the fan, you must pay attention that the turning direction is correct: check the direction arrow on the fan housing.

You will find the electrical connecting values for the fan under the technical data of the HEIDENHAIN asynchronous motors (see chapter on HEIDENHAIN asynchronous motors, QAN series).

The fan can be supplied via a line with a cross section of only 1 mm^2.

QAN 30, QAN 4S

With the HEIDENHAIN asynchronous motors of the series QAN 30 and QAN 4S, the fan is connected via the terminal box of the power connection. See "Power connection of the HEIDENHAIN motors" on page 7–16

Terminal row for fan	Assignment	Fan cable (Id. Nr. 309 683-01)
U1 / L1	U	Black 1
V1 / L2	V	Black 2
W1 / L3	W	Black 3
⏚	PE	Green/Yellow

QAN 104, QSY 112D

With the HEIDENHAIN asynchronous motors of the series QAN 104 and the HEIDENHAIN synchronous motor QSY 112D, the fan is connected via a connector according to EN 175301-803 type A on the upper side of the motor. This connector is supplied as an accessory with the motor. The fan may only be operated with 230 V!

Connector (female) 4-pin	Assignment	Fan cable (Id. Nr. 309 683-02)
1	L1	Black 1
2	Do not assign	
3	N	Black 2
⏚	PE	Green/Yellow

QAN 134 and QAN 164B

With the HEIDENHAIN asynchronous motors of the series QAN 134 and with QAN 164B, the fan is connected via a STAK3 Hirschmann connector on the B side of the motor. This connector is supplied as an accessory with the motor.

Connector (female) 4-pin	**Assignment**	**Fan cable (Id. Nr. 309 683-01)**
1	U	Black 1
2	V	Black 2
3	W	Black 3
⏚	PE	Green/Yellow

7.8 Mechanical data of the HEIDENHAIN motors

7.8.1 Mounting flange and design

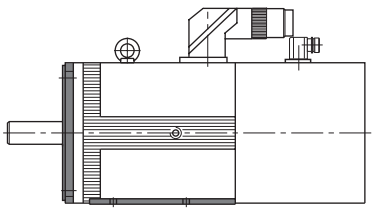
All HEIDENHAIN motors, except QSY 041B, QSY 071B and the QAN 104 series, are equipped with a mounting flange according to DIN 42948 and IEC 72.

By mounting the motor via the flange, a part of the power loss is dissipated. If the motor is mounted so that it is thermally insulated, which means it cannot dissipate any heat through the flange, it is necessary to reduce the motor torque by approx. 5 % to 15 % to avoid overheating of the motor.

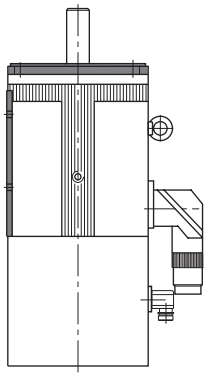
All indicated motor operating data refer to a maximum ambient temperature of +40 °C.
If you are using a motor with natural cooling, you must therefore ensure adequate heat dissipation. If the space in which the motor is mounted is too narrow (e.g. from a narrow frame or shaft) the dissipation of heat may be obstructed and this can lead to excessive heating of the motor.

HEIDENHAIN motors with design IM B5 according to EN60 034-7 as well as asynchronous motors with design IM B35 according to EN 60 034-7 are supplied on request.

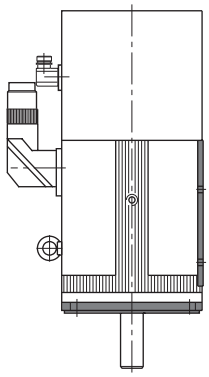
Design B35



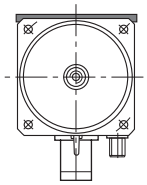
IM B35



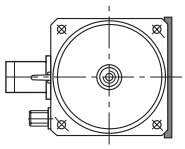
IM V36



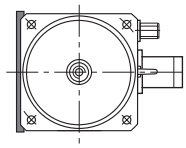
IM V15



IM B8

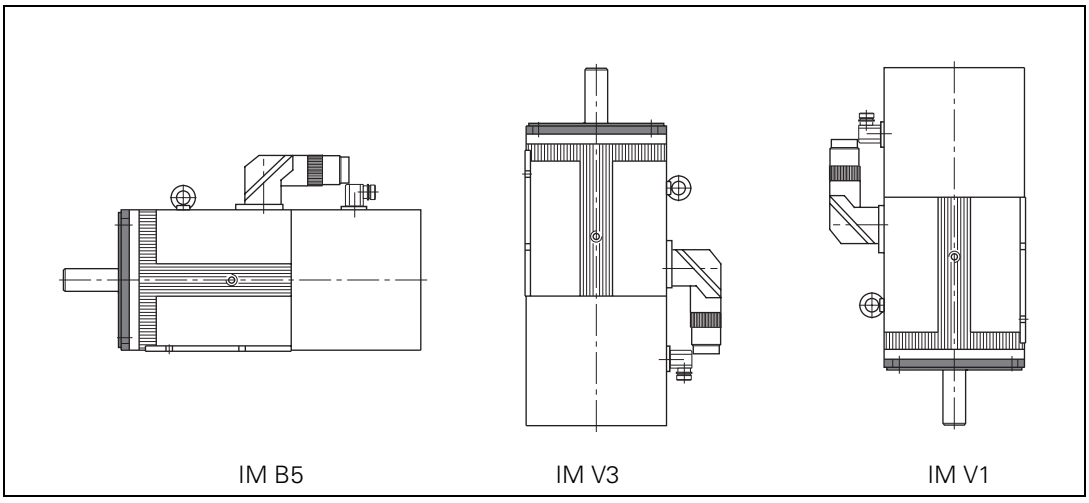


IM B7



IM B6

Design B5



7.8.2 Securing the Motor

We recommend using the following screws according to EN 24017 or ISO 4762 for securing the motors:

Motor	To secure flange	To secure block
QSY 041B	M10	–
QSY 10	EN 24017 – M8 x 30 EN 24017 – M8 x 25	–
QSY 96	M6	–
QSY 116	M8	–
QSY 071B	M10	–
QSY 20	EN 24017 – M10 x 35 EN 24017 – M10 x 35	–
QSY 155	M10	–
QSY 090B	M10	–
QSY 093B	M10	–
QSY 112	M12	–
QAN 104	M12	
QAN 30, QAN 4S	EN 24017 – M12 x 30	EN 24017 – M10 x 30
QAN 134	M16	
QAN 164B	M16	M12

7.8.3 Shaft End

HEIDENHAIN motors have cylindrical shaft ends according to ISO-R775 and IEC 72.
Exceptions: QSY 041B and QSY 071B see dimension drawings

Vibration severity grade

The shaft of the motor has vibration severity grade S according to EN 60034.

Center holes

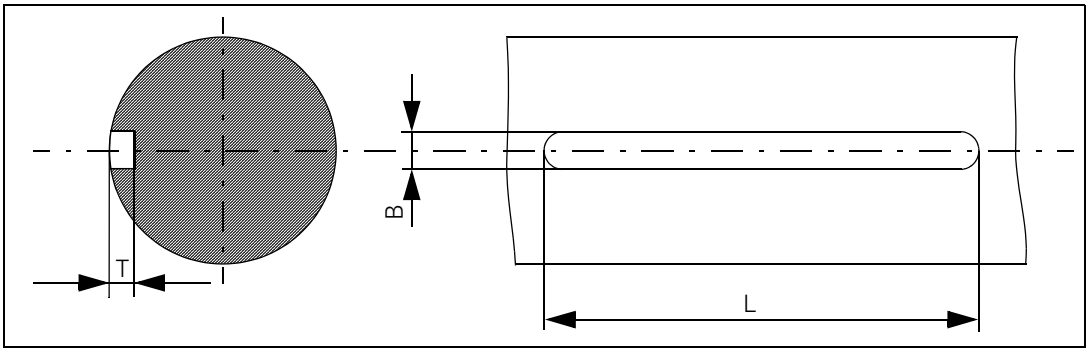
HEIDENHAIN motors have one center hole in the drive shaft.

Motor	Central bore hole
QSY 041B	ISO 866 BS 5 M5 x 12.5
Series QSY 10, QSY 96	ISO 866 BS 5
QSY 071B	ISO 866 BS 5 M6 x 16
Series QSY 20, QSY 116, QSY 155	ISO 866 BS 5
QSY 090B	ISO 866 BS 5 M8 x 19
Series QSY 112, QSY 093B	ISO 866 BS 5 M10 x 22
Series QSY 104	DIN 332 - DR M8 x 19
Series QSY 30	DIN 332 - DR M12 x 28
Series QAN 134, QAN 4S	DIN 332 - DR M16 x 36
QAN 164B	DIN 332 - DS M20 x 42

Feather key

HEIDENHAIN synchronous motors are supplied without feather key as standard, and HEIDENHAIN asynchronous motors with feather key. Motors can be supplied with or without feather upon request.

Motor	Feather key	Slot dimensions		
		L	B	T
Series QAN 104	DIN 6885 – A 10 x 8 x 45	45	10	5
Series QSY 30	DIN 6885 – E 10 x 8 x 70	70	10	5
Series QSY 134	DIN 6885 – A 12 x 8 x 80	80	12	5
QAN 4S	DIN 6885 – A 12 x 8 x 100	100	12	5
QAN 164B	DIN 6885 – A 16 x 10 x 80	0	16	6

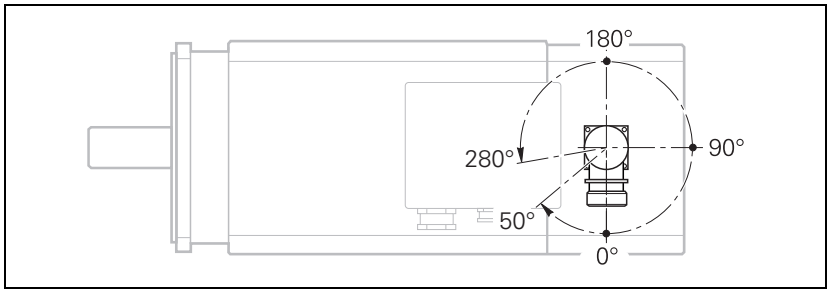


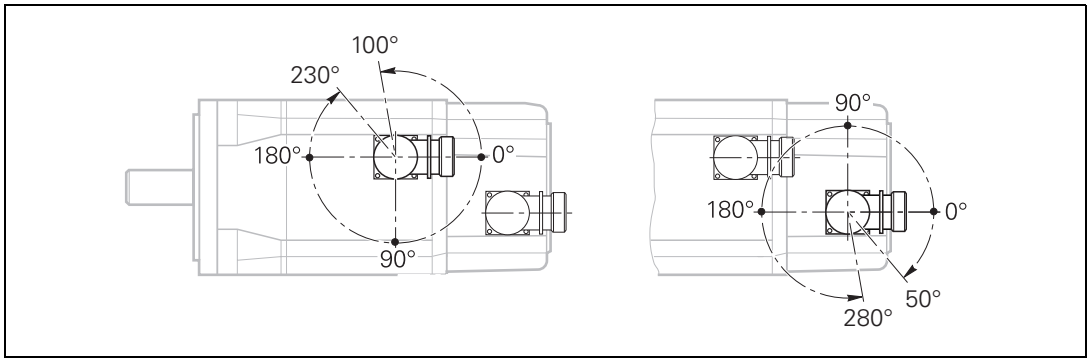
7.8.4 Rotatable Flange Sockets

The flange sockets in some HEIDENHAIN motors are rotatable within certain limits.

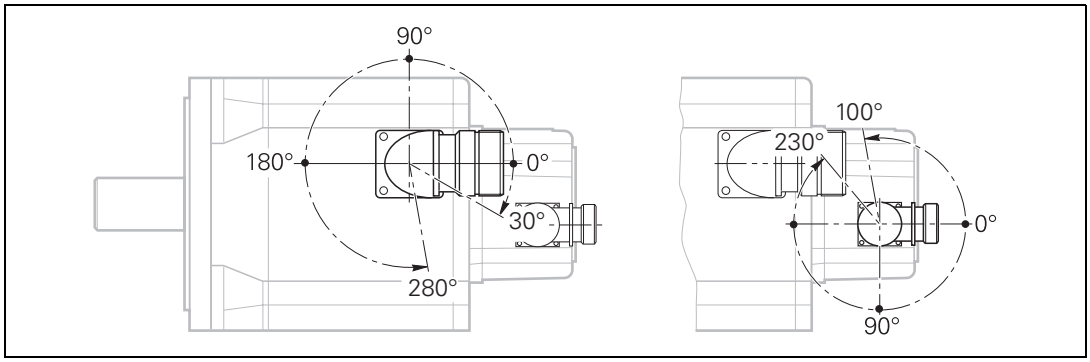
Asynchronous motors

QAN 30 series and QAN 4S

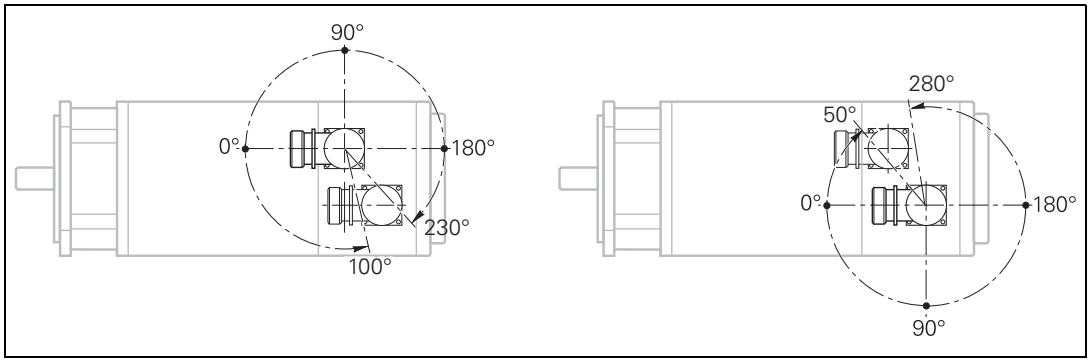




Series QSY 96, QSY 155



Series QSY 10, QSY 20



7.9 HEIDENHAIN synchronous motors, QSY series

The HEIDENHAIN synchronous motors have the following features:

- Sine commutation
- HEIDENHAIN ERN 1387 motor encoder for speed measurement (QSY 093B: RON 487)
- IM B5 design (mounting via flange) according to EN 60 034-7
- Protection class IP65 according to EN60 60.529 (shaft bushing IP 64)
- Cylindrical shaft end according to ISO-R775 and IEC 72 (QSY 041B and QSY 071B see dimension drawing) with central bore hole according to ISO 866 with thread
- QSY 096, QSY 116, QSY 155: Flange dimensions according to DIN 42 948 and IEC 72
- Maintenance-free bearing
- Natural cooling
- KTY 84-130 resistor probe for temperature monitoring in the stator winding
- Thermal class F
- Option: integrated preloaded holding brake

Note

In the performance diagrams, the characteristic curves from the data sheet are shown in an interrupted, lightface line.

In addition, each performance diagram shows the characteristic curves determined on a test stand for **one** motor mounted without thermal insulation.

7.9.1 Specifications of the HEIDENHAIN synchronous motors, QSY series

QSY 041B

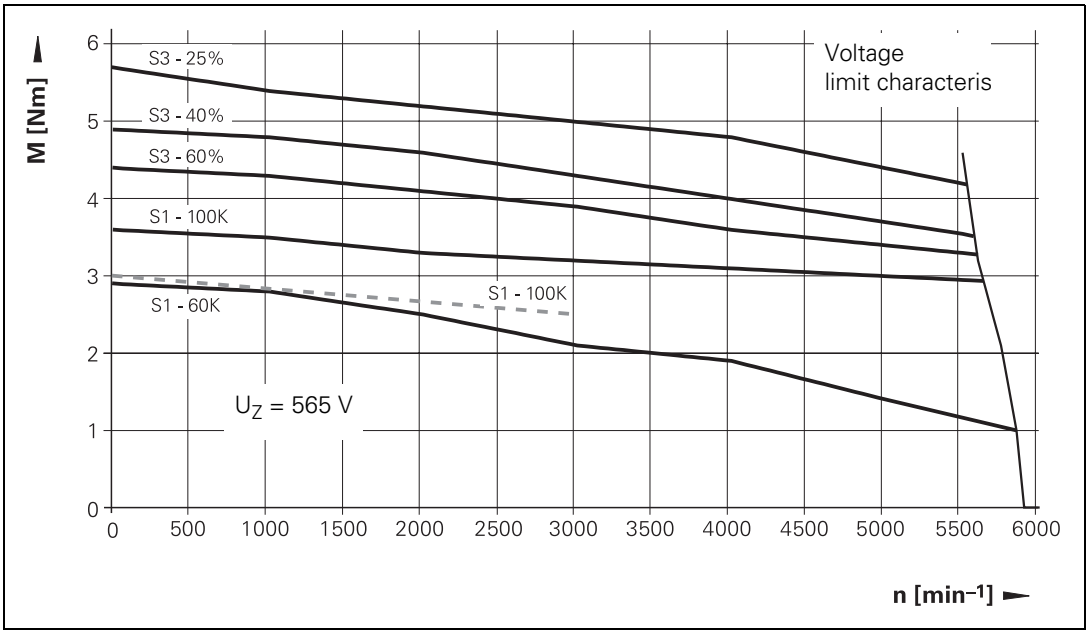
	QSY 041B with brake	QSY 041B without brake
ID number	331 140-04	331 140-03
Rated voltage U_N	244 V	
Rated power output P_N	0.8 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	2.5 Nm	
Rated current (100 K) I_N	2.8 A	
Stall torque (100 K) M_0	3.0 Nm	
Stall current (100 K) I_0	3.3 A	
Maximum current (for ≤ 200 ms) I_{max}	13.5 A	
Maximum torque (for ≤ 200 ms) M_{max}	11.3 Nm	
Pole pairs PZ	3	
Weight m	4.65 kg	4.40 kg
Rotor inertia J	1.86 kgcm^2	1.70 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	0.4 A	–
Holding torque for brake M_{Br}	2.2 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curves determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 041B



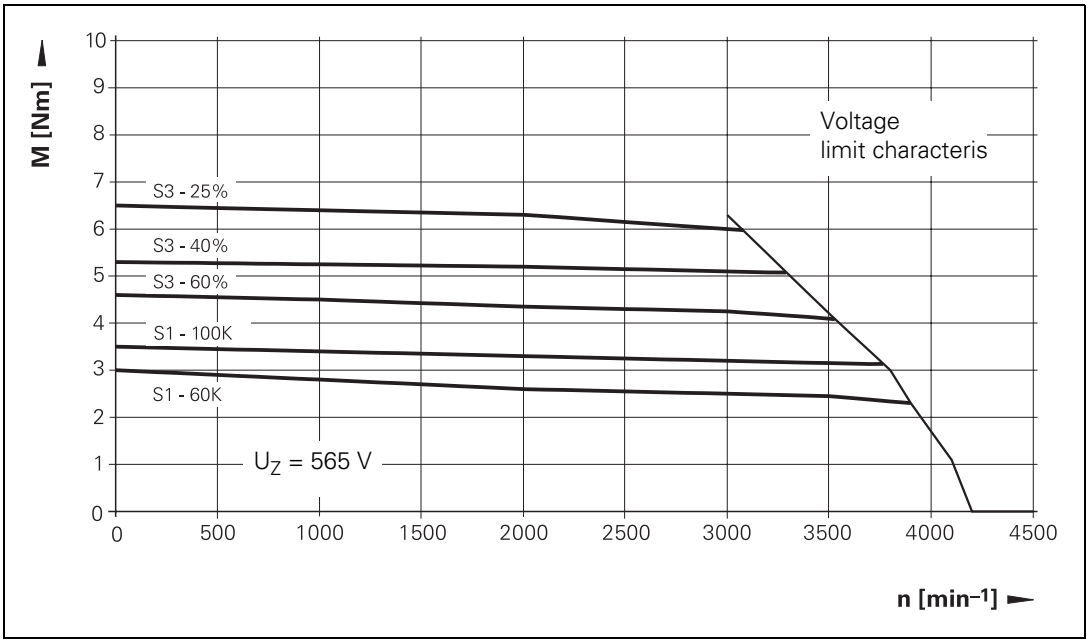
	QSY 1A with brake	QSY 1A without brake
ID number	317 122-44	317 122-43
Rated voltage U_N	316 V	
Rated power output P_N	1.0 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	3.2 Nm	
Rated current (100 K) I_N	2.1 A	
Stall torque (100 K) M_0	3.5 Nm	
Stall current (100 K) I_0	2.3 A	
Maximum current (for ≤ 200 ms) I_{max}	8.6 A	
Maximum torque (for ≤ 200 ms) M_{max}	11.0 Nm	
Pole pairs PZ	3	
Weight m	8.20 kg	7.40 kg
Rotor inertia J	4.60 kgcm^2	4.30 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	0.5 A	–
Holding torque for brake M_{Br}	5.0 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curves determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 1A



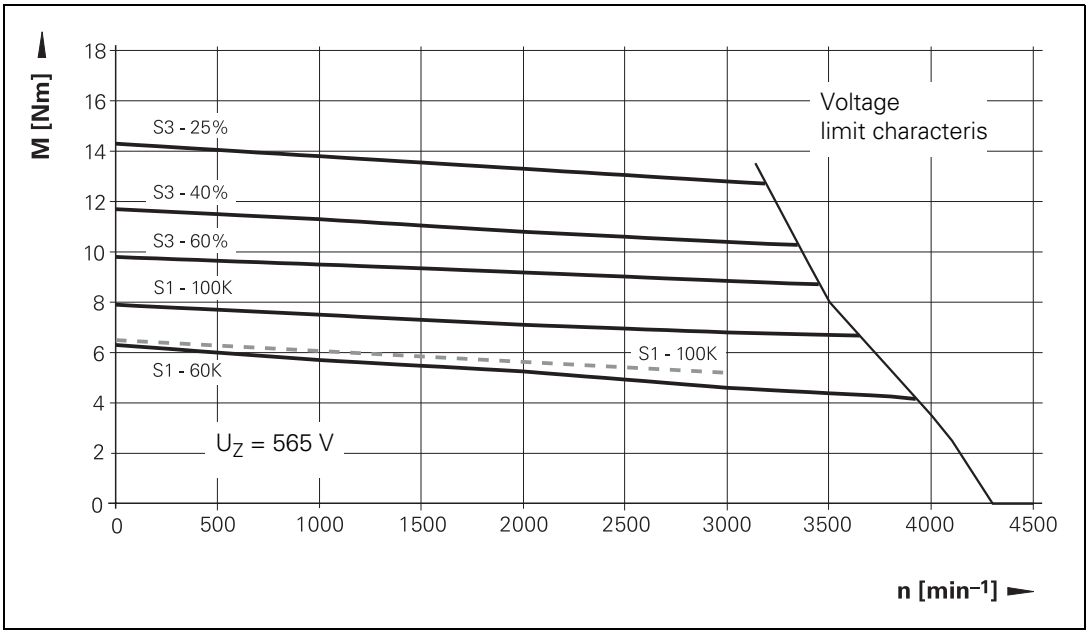
	QSY 1C with brake	QSY 1C without brake
ID number	317 123-44	317 123-43
Rated voltage U_N	299 V	
Rated power output P_N	1.6 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	5.2 Nm	
Rated current (100 K) I_N	3.4 A	
Stall torque (100 K) M_0	6.5 Nm	
Stall current (100 K) I_0	4.2 A	
Maximum current (for ≤ 200 ms) I_{max}	17.0 A	
Maximum torque (for ≤ 200 ms) M_{max}	22.0 Nm	
Pole pairs PZ	3	
Weight m	10.70 kg	9.80 kg
Rotor inertia J	7.40 kgcm^2	7.00 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	0.5 A	–
Holding torque for brake M_{Br}	10.0 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curves determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 1C



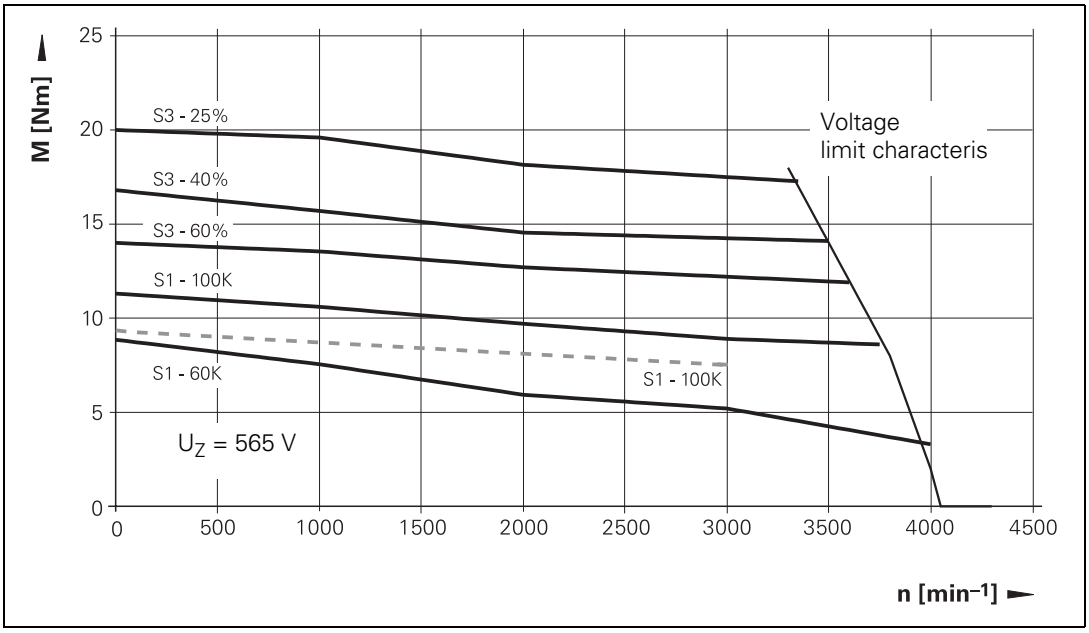
	QSY 1E with brake	QSY 1E without brake
ID number	317 124-44	317 124-43
Rated voltage U_N	295 V	
Rated power output P_N	2.4 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	7.6 Nm	
Rated current (100 K) I_N	4.9 A	
Stall torque (100 K) M_0	9.3 Nm	
Stall current (100 K) I_0	6.1 A	
Maximum current (for ≤ 200 ms) I_{max}	25.4 A	
Maximum torque (for ≤ 200 ms) M_{max}	33.0 Nm	
Pole pairs PZ	3	
Weight m	13.10 kg	12.20 kg
Rotor inertia J	10.40 kgcm^2	10.00 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	0.5 A	–
Holding torque for brake M_{Br}	10.0 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curves determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 1E



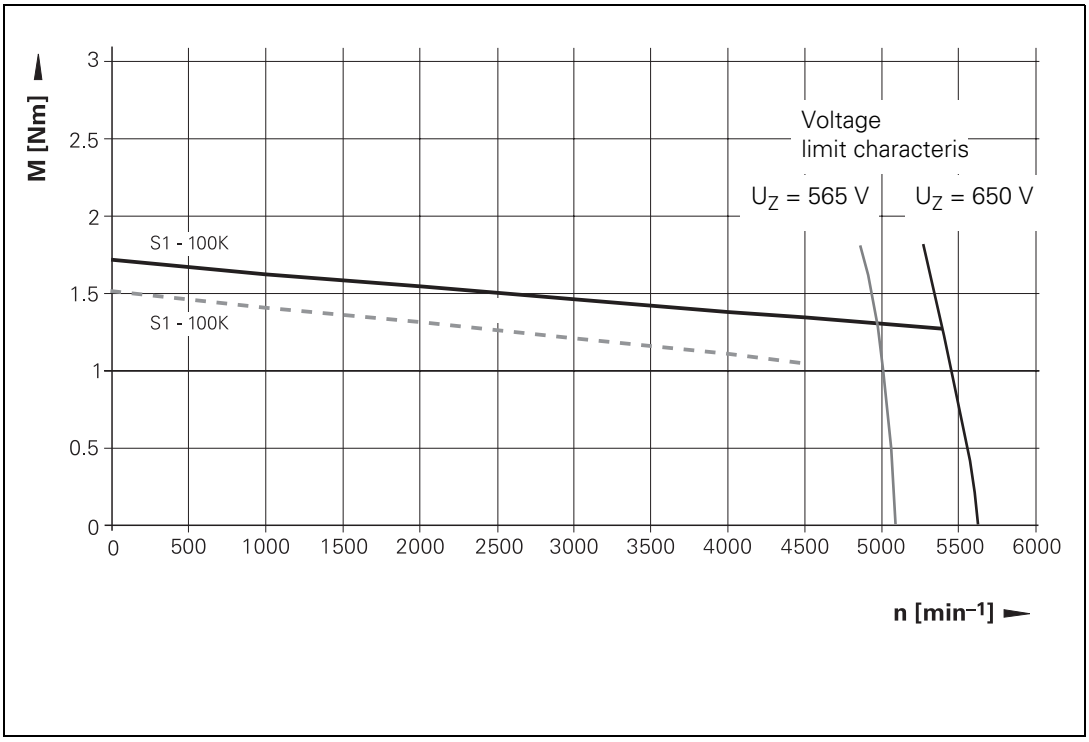
	QSY 96A with brake	QSY 96A without brake
ID number	344 512-04	344 512-03
Rated voltage U_N	329 V	
Rated power output P_N	0.5 kW	
Rated speed n_N	4500 rpm	
Rated torque (100 K) M_N	1.05 Nm	
Rated current (100 K) I_N	1.1 A	
Stall torque (100 K) M_0	1.5 Nm	
Stall current (100 K) I_0	1.5 A	
Maximum current (for ≤ 200 ms) I_{max}	6.3 A	
Maximum torque (for ≤ 200 ms) M_{max}	5.5 Nm	
Pole pairs PZ	3	
Winding resistance (in one phase)	10.5 Ω	
Winding inductance (in one phase)	15 mH	
Weight m	4.50 kg	3.60 kg
Rotor inertia J	2.10 kgcm^2	1.80 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	0.5 A	–
Holding torque for brake M_{Br}	5.0 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curve determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 96A



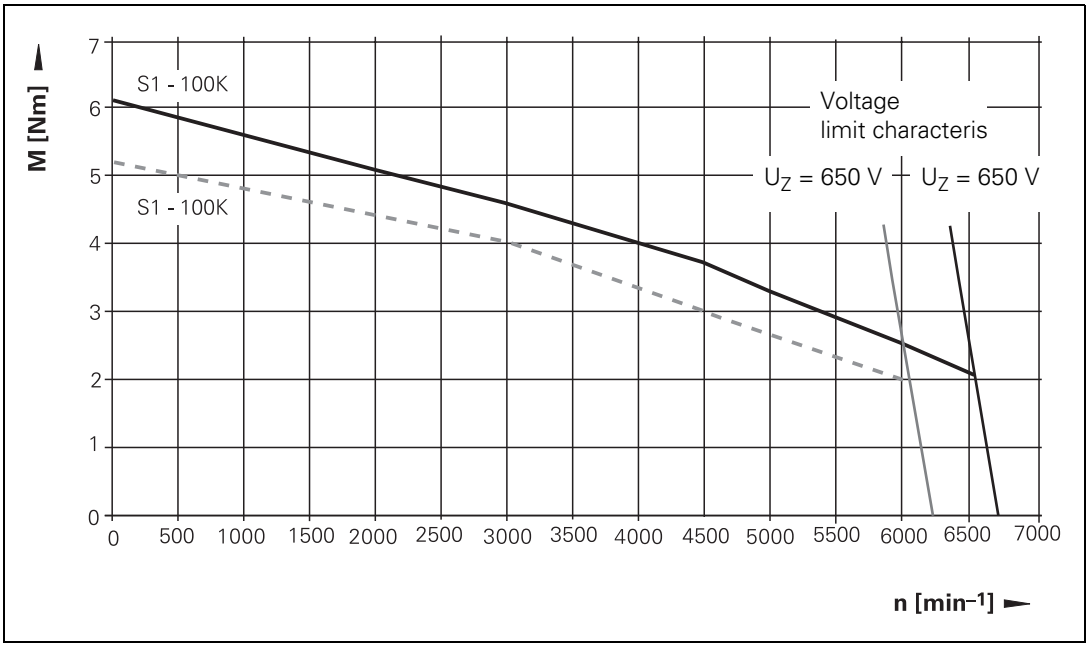
	QSY 96G with brake	QSY 96G without brake
ID number	339 875-04	339 875-03
Rated voltage U_N	305 V	
Rated power output P_N	1.4 kW	
Rated speed n_N	4500 rpm	
Rated torque (100 K) M_N	3.0 Nm (4.1 Nm with 3000 rpm)	
Rated current (100 K) I_N	3.3 A	
Stall torque (100 K) M_0	5.2 Nm	
Stall current (100 K) I_0	5.2 A	
Maximum current (for ≤ 200 ms) I_{max}	25.4 A	
Maximum torque (for ≤ 200 ms) M_{max}	22.0 Nm	
Pole pairs PZ	3	
Winding resistance (in one phase)	1.20 Ω	
Winding inductance (in one phase)	3.20 mH	
Weight m	8.10 kg	7.20 kg
Rotor inertia J	6.60 kgcm^2	6.30 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	0.5 A	–
Holding torque for brake M_{Br}	5.0 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curve determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 96G



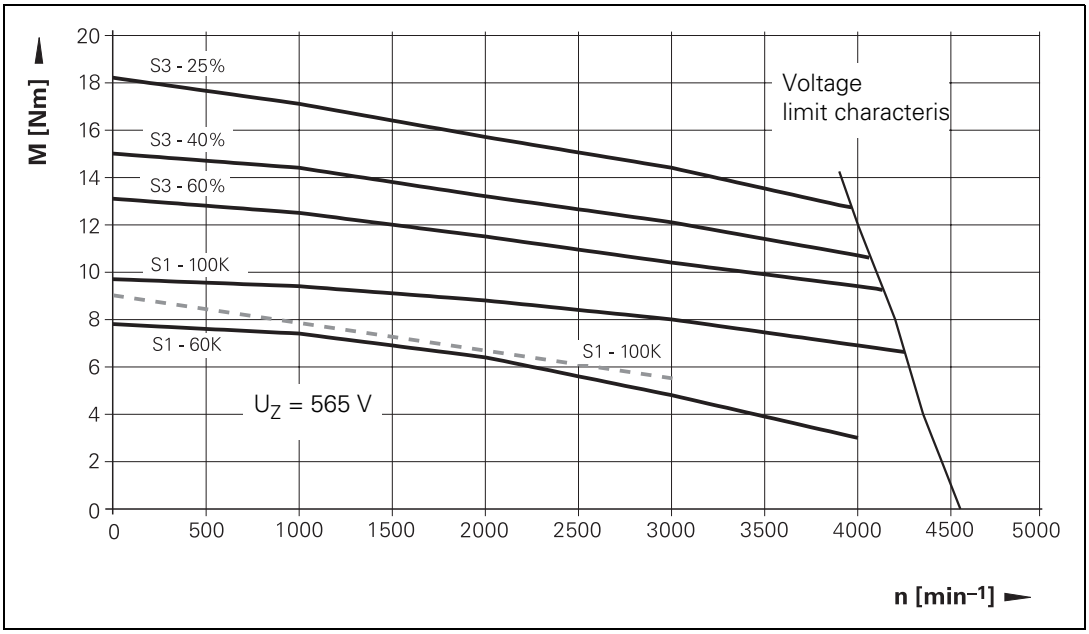
	QSY 071B with brake	QSY 071B without brake
ID number	331 141-04	331 141-03
Rated voltage U_N	323 V	
Rated power output P_N	1.7 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	5.5 Nm	
Rated current (100 K) I_N	4.4 A	
Stall torque (100 K) M_0	9.0 Nm	
Stall current (100 K) I_0	7.2 A	
Maximum current (for ≤ 200 ms) I_{max}	29.0 A	
Maximum torque (for ≤ 200 ms) M_{max}	32.0 Nm	
Pole pairs PZ	4	
Weight m	9.17 kg	8.80 kg
Rotor inertia J	9.08 kgcm^2	8.70 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	0.6 A	–
Holding torque for brake M_{Br}	6.5 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curves determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 071B



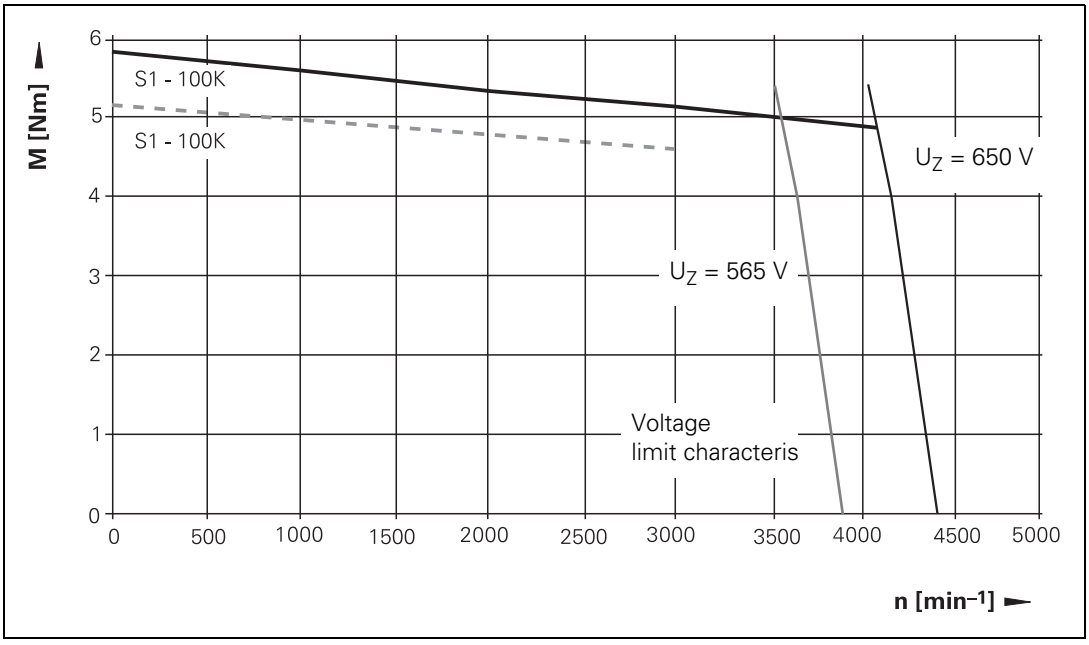
	QSY 116C with brake	QSY 116C without brake
ID number	339 876-04	339 876-03
Rated voltage U_N	315 V	
Rated power output P_N	1.45 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	4.6 Nm	
Rated current (100 K) I_N	3.3 A	
Stall torque (100 K) M_0	5.2 Nm	
Stall current (100 K) I_0	3.4 A	
Maximum current (for ≤ 200 ms) I_{max}	12.7 A	
Maximum torque (for ≤ 200 ms) M_{max}	16.0 Nm	
Pole pairs PZ	3	
Winding resistance (in one phase)	3.80 Ω	
Winding inductance (in one phase)	13.50 mH	
Weight m	7.80 kg	6.90 kg
Rotor inertia J	7.90 kgcm^2	7.50 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	0.6 A	–
Holding torque for brake M_{Br}	13.5 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curve determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 116C



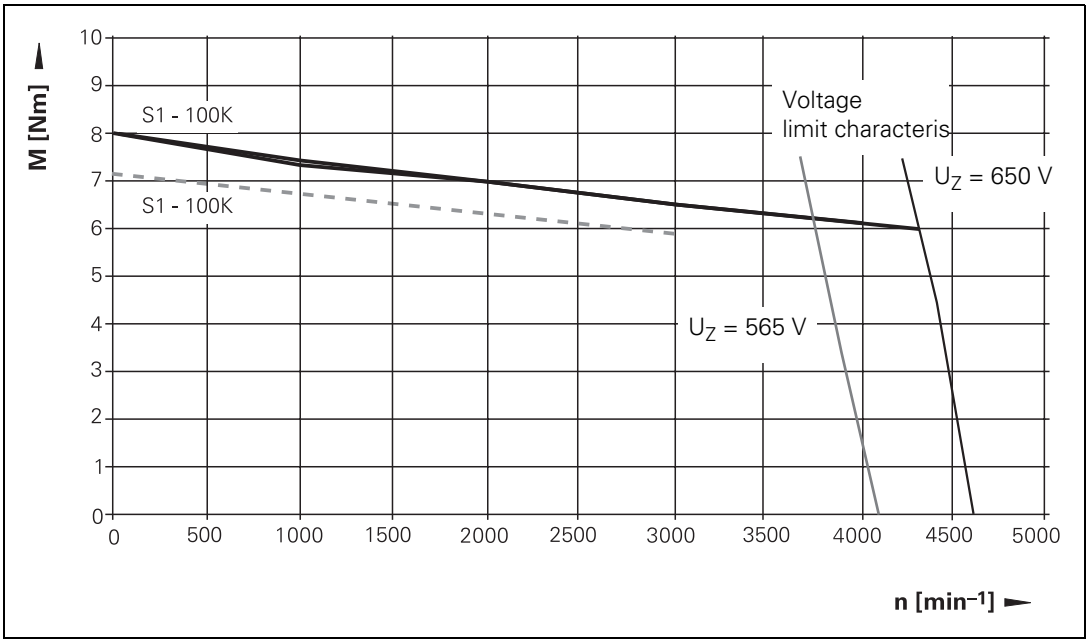
	QSY 116E with brake	QSY 116E without brake
ID number	339 877-04	339 877-03
Rated voltage U_N	294 V	
Rated power output P_N	1.85 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	5.9 Nm	
Rated current (100 K) I_N	4.1 A	
Stall torque (100 K) M_0	7.2 Nm	
Stall current (100 K) I_0	4.8 A	
Maximum current (for ≤ 200 ms) I_{max}	19.0 A	
Maximum torque (for ≤ 200 ms) M_{max}	25.0 Nm	
Pole pairs PZ	3	
Winding resistance (in one phase)	2.05 Ω	
Winding inductance (in one phase)	8.50 mH	
Weight m	9.50 kg	8.60 kg
Rotor inertia J	10.30 kgcm^2	9.90 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	
Rated current for brake I_{Br}	0.6 A	–
Holding torque for brake M_{Br}	13.5 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curve determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 116E



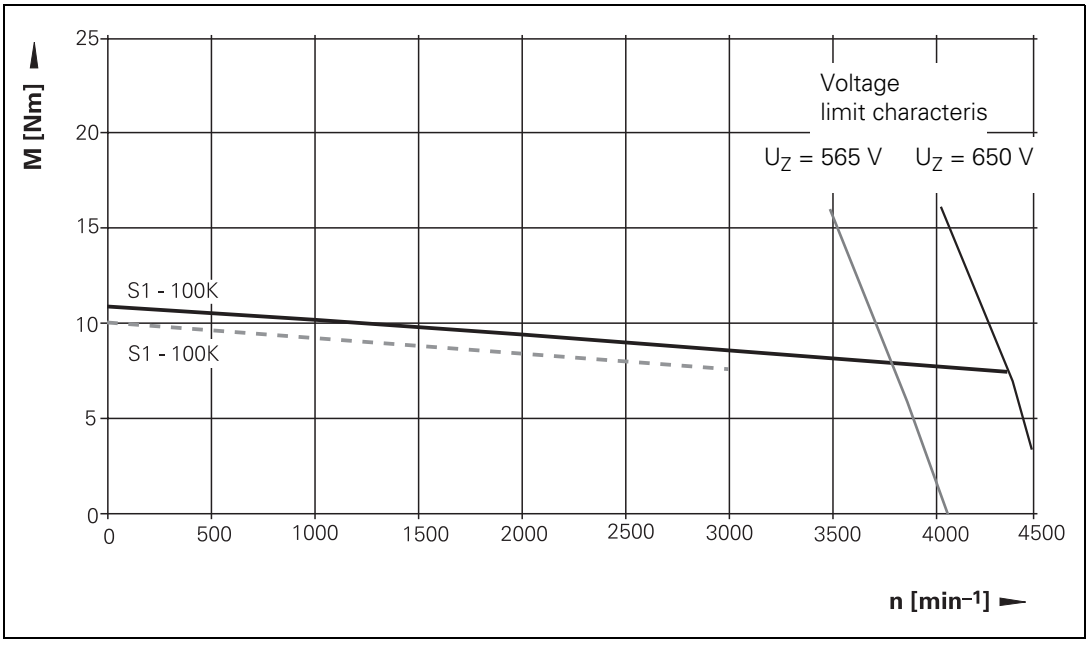
	QSY 116J with brake	QSY 116J without brake
ID number	339 878-04	339 878-03
Rated voltage U_N	303 V	
Rated power output P_N	2.42 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	7.7 Nm	
Rated current (100 K) I_N	5.35 A	
Stall torque (100 K) M_0	10.0 Nm	
Stall current (100 K) I_0	6.8 A	
Maximum current (for ≤ 200 ms) I_{max}	32.6 A	
Maximum torque (for ≤ 200 ms) M_{max}	41.0 Nm	
Pole pairs PZ	3	
Winding resistance (in one phase)	0.85 Ω	
Winding inductance (in one phase)	4.75 mH	
Weight m	12.90 kg	12.00 kg
Rotor inertia J	15.40 kgcm^2	15.00 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	0.6 A	–
Holding torque for brake M_{Br}	13.5 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curves determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 116J



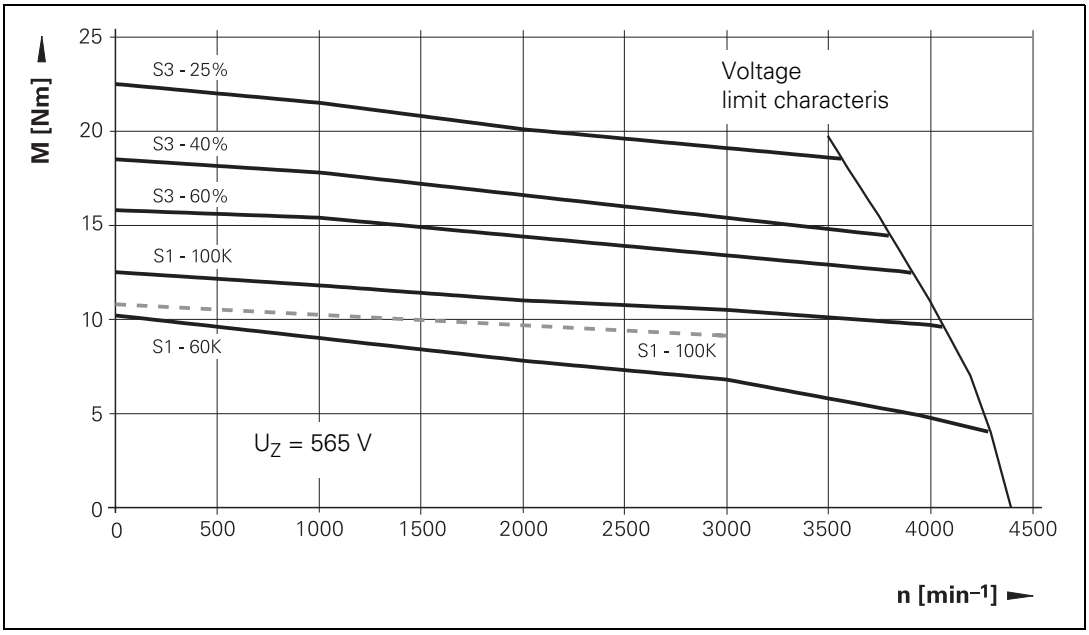
	QSY 2C with brake	QSY 2C without brake
ID number	317 125-44	317 125-43
Rated voltage U_N	299 V	
Rated power output P_N	2.7 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	8.6 Nm	
Rated current (100 K) I_N	5.9 A	
Stall torque (100 K) M_0	10.8 Nm	
Stall current (100 K) I_0	7.0 A	
Maximum current (for ≤ 200 ms) I_{max}	24.7 A	
Maximum torque (for ≤ 200 ms) M_{max}	30.0 Nm	
Pole pairs PZ	3	
Weight m	17.40 kg	15.00 kg
Rotor inertia J	16.00 kgcm^2	14.00 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	1.0 A	–
Holding torque for brake M_{Br}	18.0 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curves determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 2C



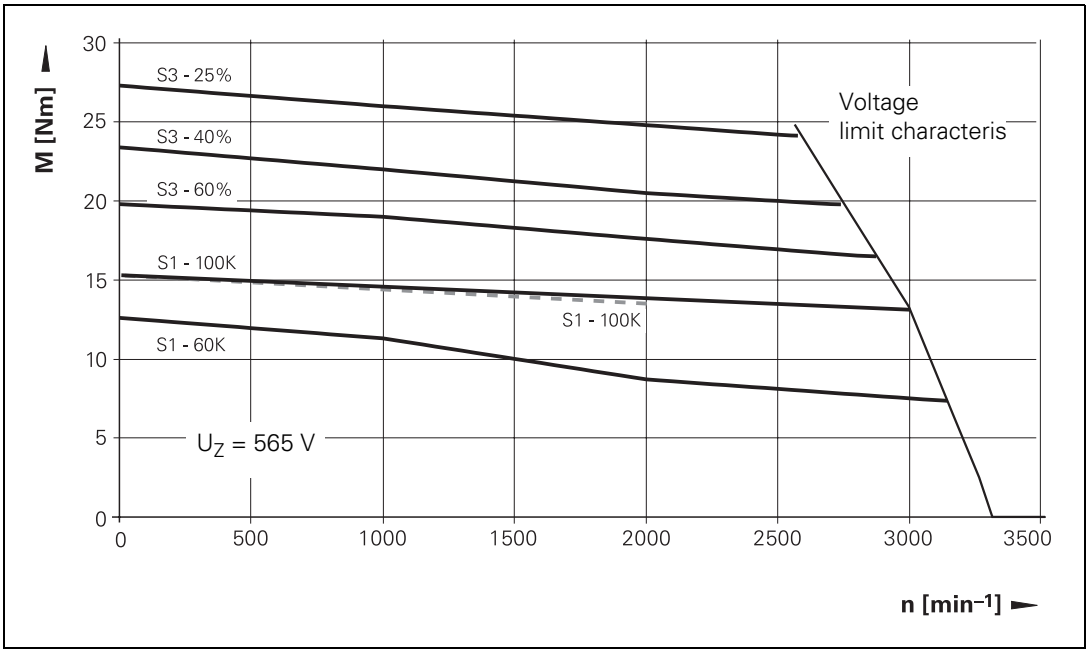
	QSY 2E-2000 with brake	QSY 2E-2000 without brake
ID number	317 126-44	317 126-43
Rated voltage U_N	275 V	
Rated power output P_N	2.8 kW	
Rated speed n_N	2000 rpm	
Rated torque (100 K) M_N	13.5 Nm	
Rated current (100 K) I_N	6.5 A	
Stall torque (100 K) M_0	15.3 Nm	
Stall current (100 K) I_0	7.3 A	
Maximum current (for ≤ 200 ms) I_{max}	28.3 A	
Maximum torque (for ≤ 200 ms) M_{max}	45.0 Nm	
Pole pairs PZ	3	
Weight m	21.40 kg	19.00 kg
Rotor inertia J	24.00 kgcm^2	22.00 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	1.0 A	–
Holding torque for brake M_{Br}	18.0 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curves determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 2E-2000



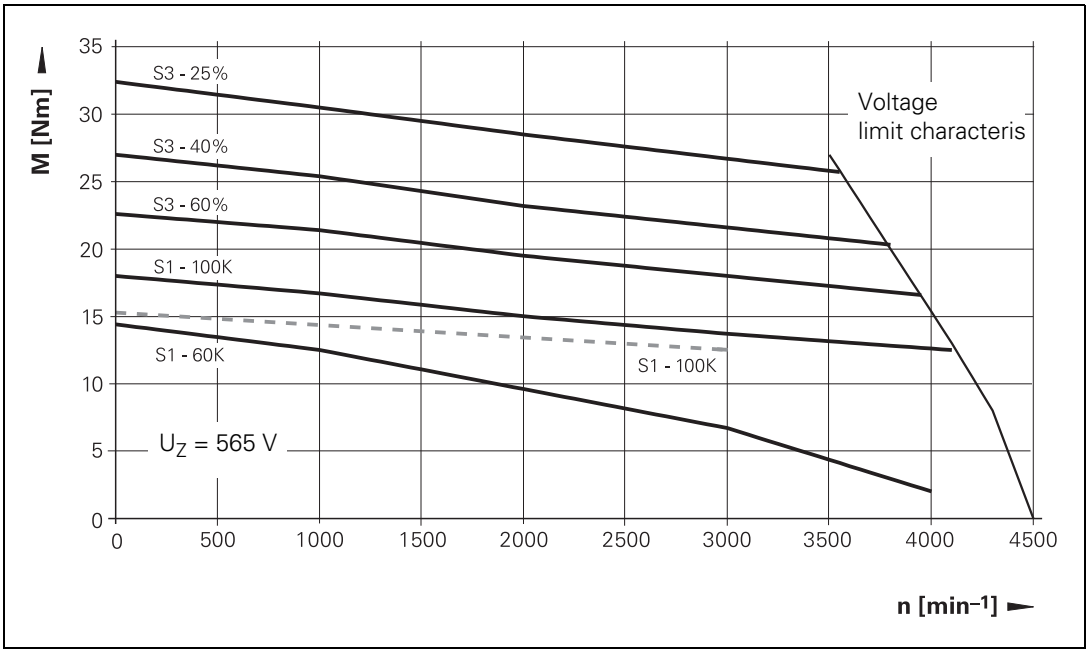
	QSY 2E-3000 with brake	QSY 2E-3000 without brake
ID number	317 126-54	317 126-53
Rated voltage U_N	295 V	
Rated power output P_N	4.0 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	12.7 Nm	
Rated current (100 K) I_N	8.3 A	
Stall torque (100 K) M_0	15.3 Nm	
Stall current (100 K) I_0	10.0 A	
Maximum current (for ≤ 200 ms) I_{max}	37.5 A	
Maximum torque (for ≤ 200 ms) M_{max}	45.0 Nm	
Pole pairs PZ	3	
Weight m	21.40 kg	19.00 kg
Rotor inertia J	24.00 kgcm^2	22.00 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	1.0 A	–
Holding torque for brake M_{Br}	18.0 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curves determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 2E-3000



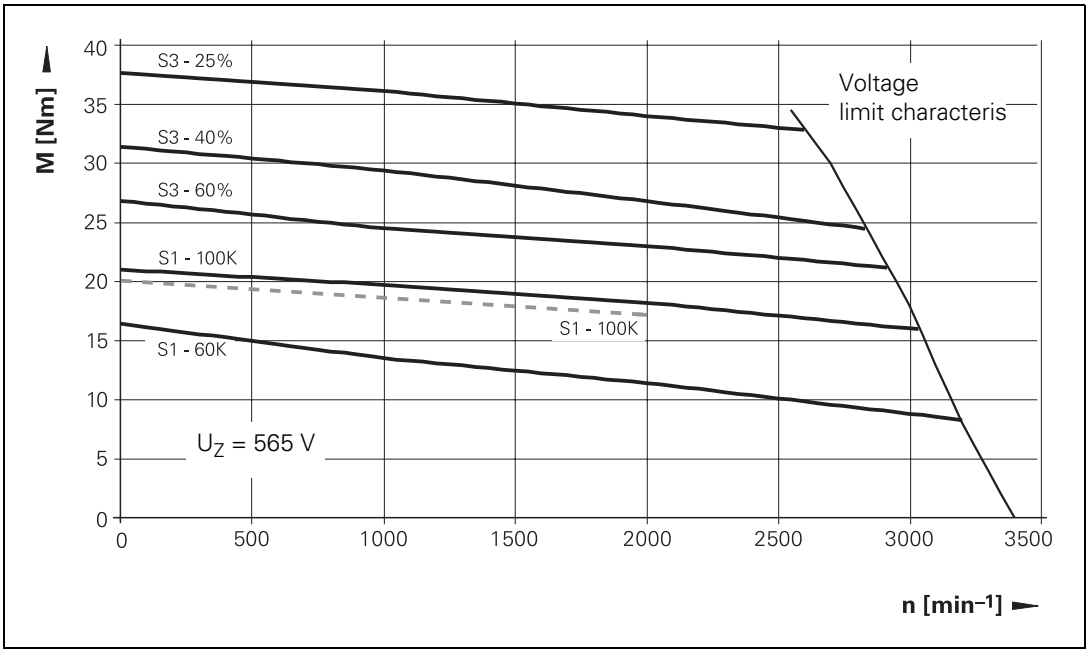
	QSY 2G with brake	QSY 2G without brake
ID number	17 127-44	317 127-43
Rated voltage U_N	272 V	
Rated power output P_N	3.6 kW	
Rated speed n_N	2000 rpm	
Rated torque (100 K) M_N	17.2 Nm	
Rated current (100 K) I_N	8.2 A	
Stall torque (100 K) M_0	20.0 Nm	
Stall current (100 K) I_0	9.5 A	
Maximum current (for ≤ 200 ms) I_{max}	35.4 A	
Maximum torque (for ≤ 200 ms) M_{max}	60.0 Nm	
Pole pairs PZ	3	
Weight m	24.40 kg	22.00 kg
Rotor inertia J	29.00 kgcm^2	27.00 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	
Rated current for brake I_{Br}	1.0 A	–
Holding torque for brake M_{Br}	40.0 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curves determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 2G



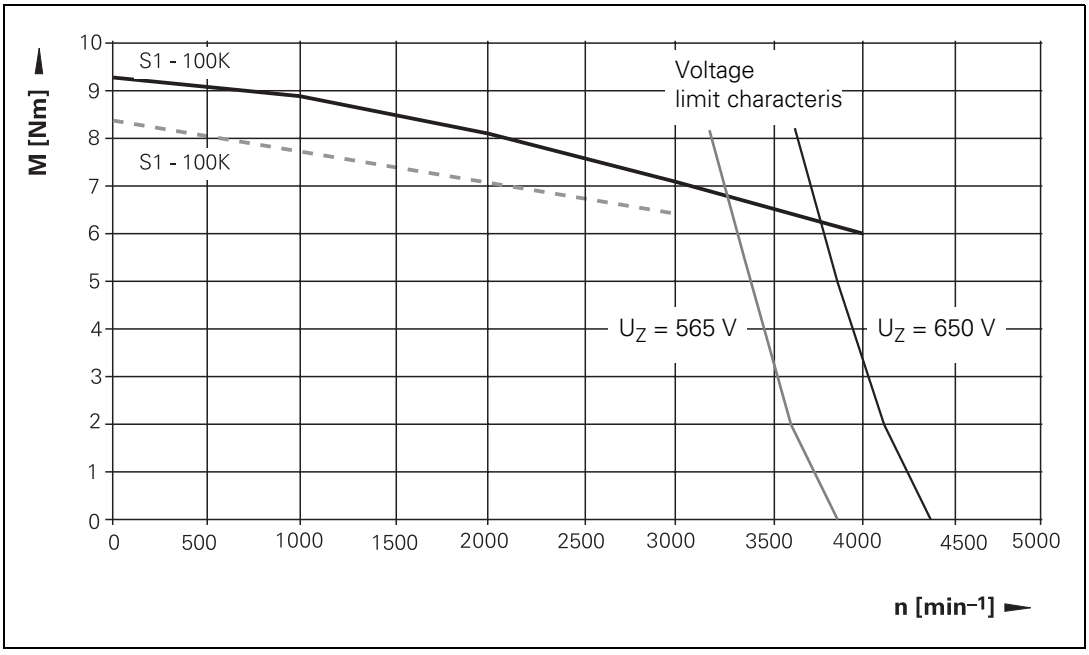
	QSY 155A with brake	QSY 155A without brake
ID number	339 879-03	339 879-04
Rated voltage U_N	336 V	
Rated power output P_N	2.0 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	6.4 Nm	
Rated current (100 K) I_N	5.1 A	
Stall torque (100 K) M_0	8.3 Nm	
Stall current (100 K) I_0	6.0 A	
Maximum current (for ≤ 200 ms) I_{max}	17.7 A	
Maximum torque (for ≤ 200 ms) M_{max}	23.9 Nm	
Pole pairs PZ	4	
Winding resistance (in one phase)	1.25 Ω	
Winding inductance (in one phase)	8.50 mH	
Weight m	14.90 kg	12.50 kg
Rotor inertia J	24.00 kgcm^2	22.00 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	1.1 A	–
Holding torque for brake M_{Br}	40 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curve determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 155A



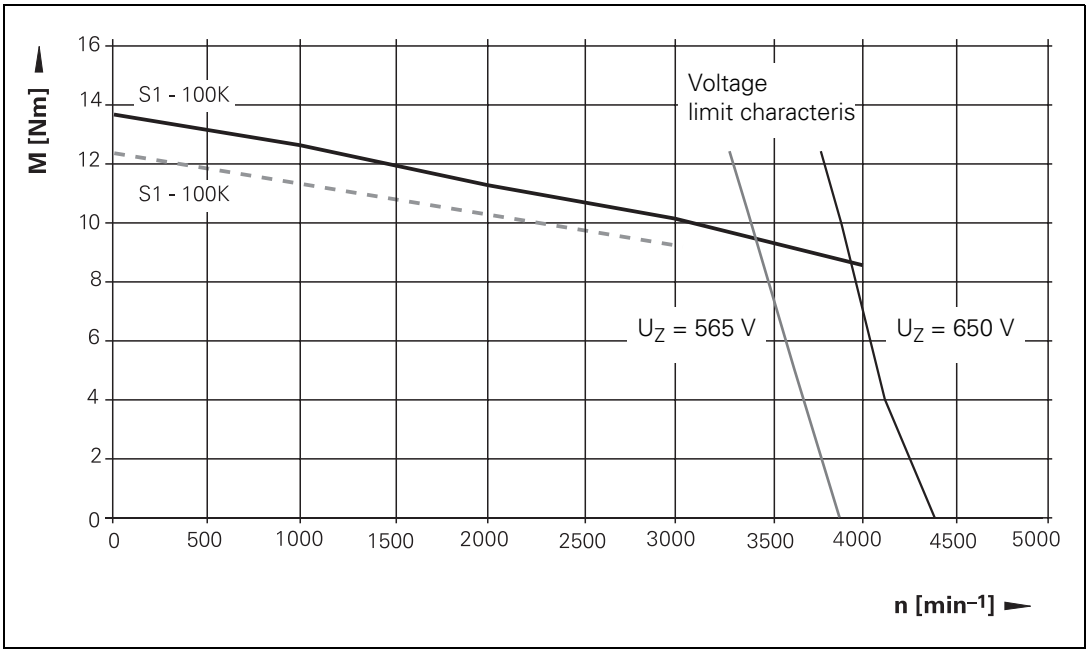
	QSY 155B with brake	QSY 155B without brake
ID number	339 880-03	339 880-04
Rated voltage U_N	310 V	
Rated power output P_N	2.9 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	9.2 Nm	
Rated current (100 K) I_N	6.9 A	
Stall torque (100 K) M_0	12.2 Nm	
Stall current (100 K) I_0	8.4 A	
Maximum current (for ≤ 200 ms) I_{max}	26.9 A	
Maximum torque (for ≤ 200 ms) M_{max}	36.3 Nm	
Pole pairs PZ	4	
Winding resistance (in one phase)	0.67 Ω	
Winding inductance (in one phase)	5.40 mH	
Weight m	17.40 kg	15.00 kg
Rotor inertia J	35.00 kgcm^2	33.00 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	1.1 A	–
Holding torque for brake M_{Br}	40 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curve determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 155B



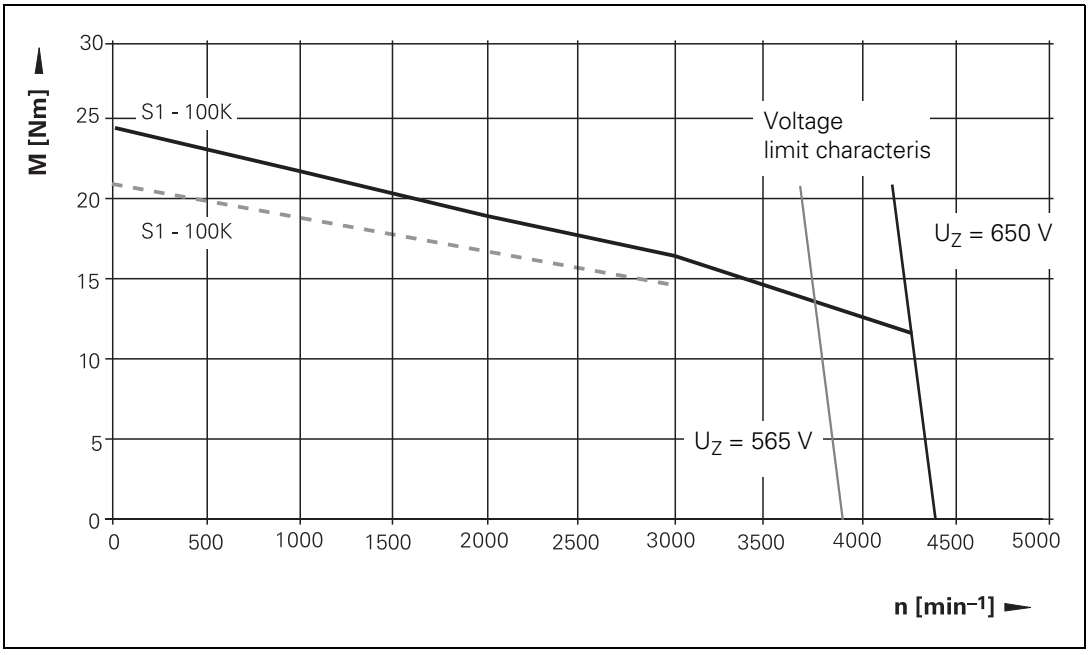
	QSY 155D with brake	QSY 155D without brake
ID number	339 881-03	339 881-04
Rated voltage U_N	298 V	
Rated power output P_N	4.6 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	14.8 Nm	
Rated current (100 K) I_N	10.6 A	
Stall torque (100 K) M_0	21.6 Nm	
Stall current (100 K) I_0	14.6 A	
Maximum current (for ≤ 200 ms) I_{max}	44.6 A	
Maximum torque (for ≤ 200 ms) M_{max}	60.2 Nm	
Pole pairs PZ	4	
Winding resistance (in one phase)	0.32 Ω	
Winding inductance (in one phase)	3.10 mH	
Weight m	22.40 kg	20.00 kg
Rotor inertia J	56.00 kgcm^2	54.00 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	1.1 A	–
Holding torque for brake M_{Br}	40 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curve determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 155D



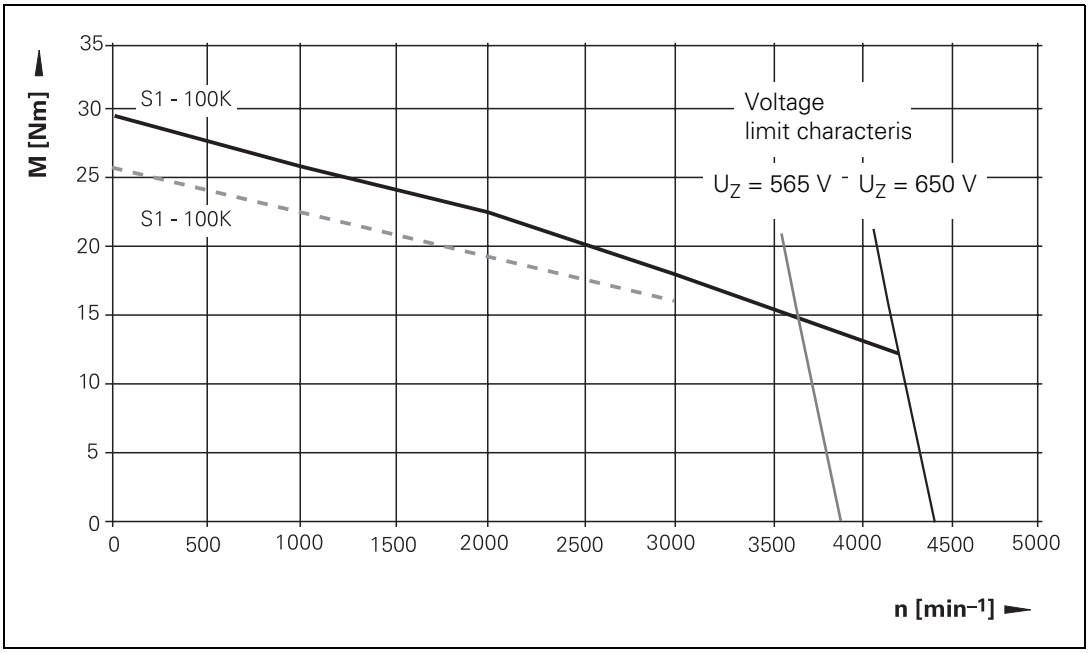
	QSY 155F with brake	QSY 155F without brake
ID number	339 882-03	339 882-04
Rated voltage U_N	289 V	
Rated power output P_N	5.2 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	16.7 Nm	
Rated current (100 K) I_N	12.0 A	
Stall torque (100 K) M_0	26.1 Nm	
Stall current (100 K) I_0	18.0 A	
Maximum current (for ≤ 200 ms) I_{max}	62.0 A	
Maximum torque (for ≤ 200 ms) M_{max}	84.0 Nm	
Pole pairs PZ	4	
Winding resistance (in one phase)	0.23 Ω	
Winding inductance (in one phase)	2.25 mH	
Weight m	27.40 kg	25.00 kg
Rotor inertia J	77.00 kgcm^2	75.00 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	1.1 A	–
Holding torque for brake M_{Br}	40 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curve determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 155F



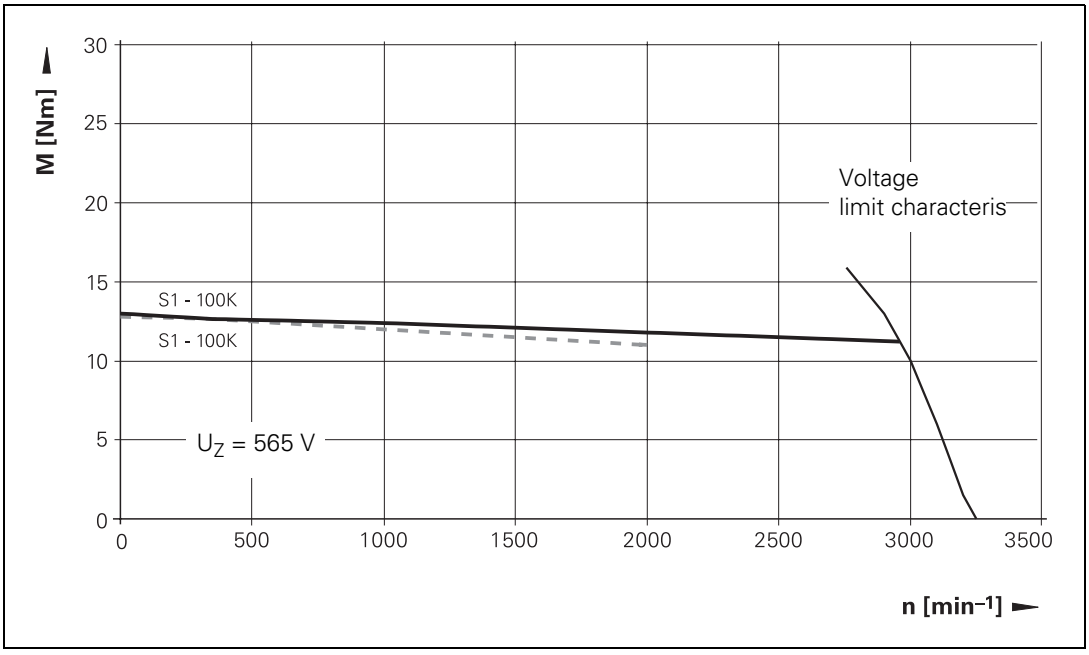
	QSY 090B-2000 with brake	QSY 090B-2000 without brake
ID number	331 142-14	331 142-13
Rated voltage U_N	305 V	
Rated power output P_N	2.3 kW	
Rated speed n_N	2000 rpm	
Rated torque (100 K) M_N	11.0 Nm	
Rated current (100 K) I_N	6.0 A	
Stall torque (100 K) M_0	13.0 Nm	
Stall current (100 K) I_0	7.2 A	
Maximum current (for ≤ 200 ms) I_{max}	30.0 A	
Maximum torque (for ≤ 200 ms) M_{max}	43.5 Nm	
Pole pairs PZ	4	
Weight m	14.60 kg	14.00 kg
Rotor inertia J	43.60 kgcm^2	43.00 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	0.7 A	–
Holding torque for brake M_{Br}	11.0 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curves determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 090B-2000



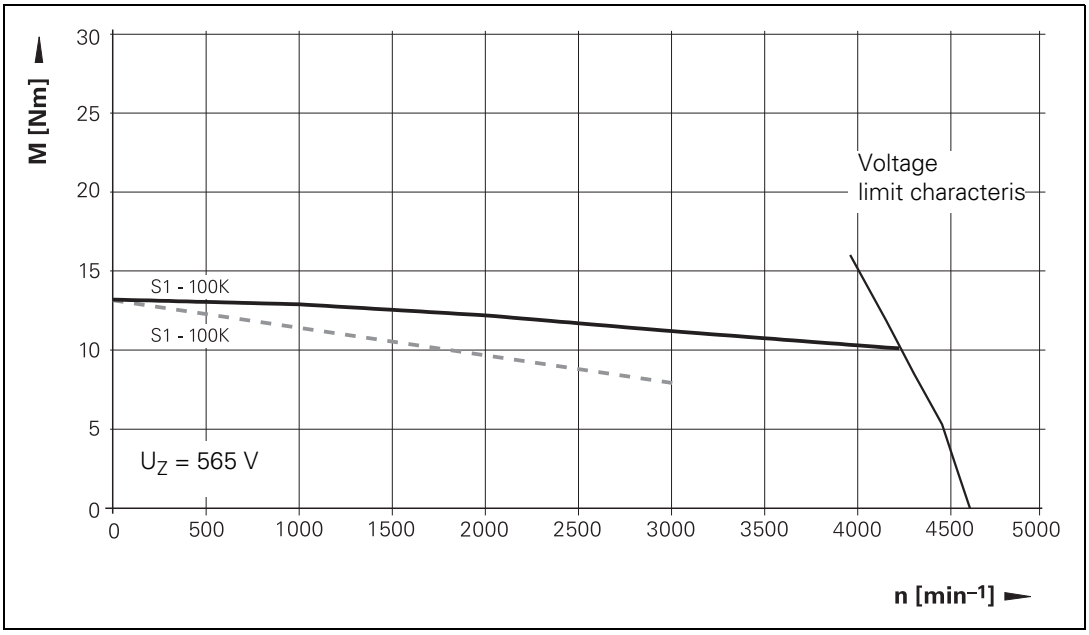
	QSY 090B-3000 with brake	QSY 090B-3000 without brake
ID number	331 142-04	331 142-03
Rated voltage U_N	330 V	
Rated power output P_N	2.7 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	8.5 Nm	
Rated current (100 K) I_N	6.6 A	
Stall torque (100 K) M_0	13.0 Nm	
Stall current (100 K) I_0	10.1 A	
Maximum current (for ≤ 200 ms) I_{max}	42.0 A	
Maximum torque (for ≤ 200 ms) M_{max}	43.5 Nm	
Pole pairs PZ	4	
Weight m	14.60 kg	14.00 kg
Rotor inertia J	43.60 kgcm^2	43.00 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	0.7 A	–
Holding torque for brake M_{Br}	11.0 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curves determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 090B-3000



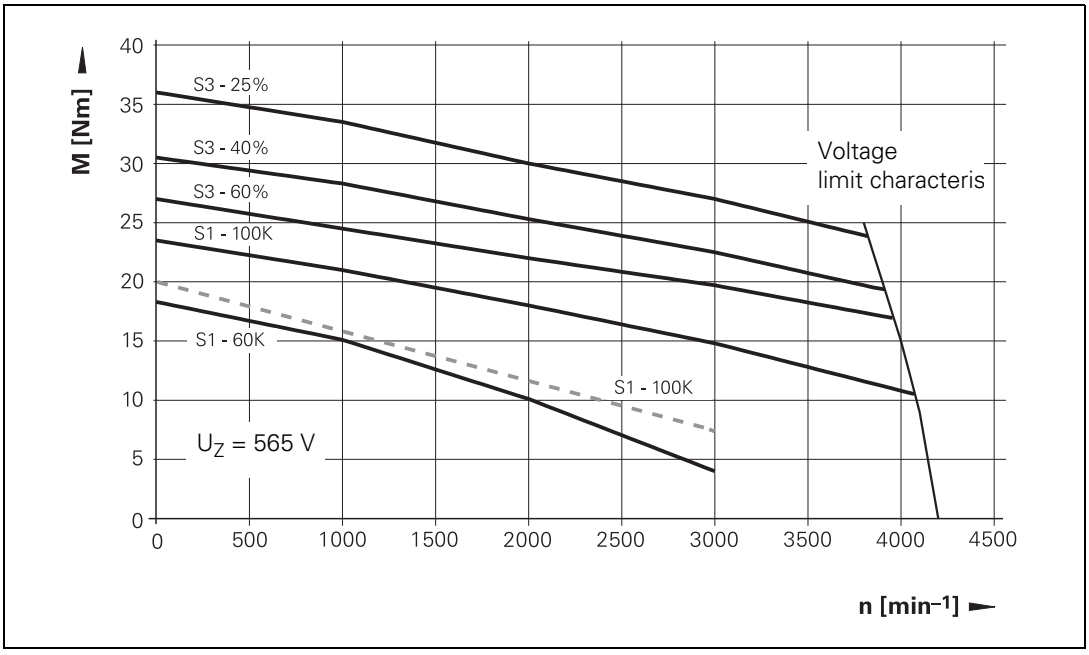
	QSY 093B with brake	QSY 093B without brake
ID number	331 143-04	331 143-03
Rated voltage U_N	356 V	
Rated power output P_N	2.3 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	7.2 Nm	
Rated current (100 K) I_N	4.7 A	
Stall torque (100 K) M_0	20.0 Nm	
Stall current (100 K) I_0	13.0 A	
Maximum current (for ≤ 200 ms) I_{max}	51.0 A	
Maximum torque (for ≤ 200 ms) M_{max}	66.0 Nm	
Pole pairs PZ	4	
Weight m	19.10 kg	18.00 kg
Rotor inertia J	29.10 $kgcm^2$	25.50 $kgcm^2$
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	0.7 A	–
Holding torque for brake M_{Br}	22.0 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curves determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristics for QSY 093B



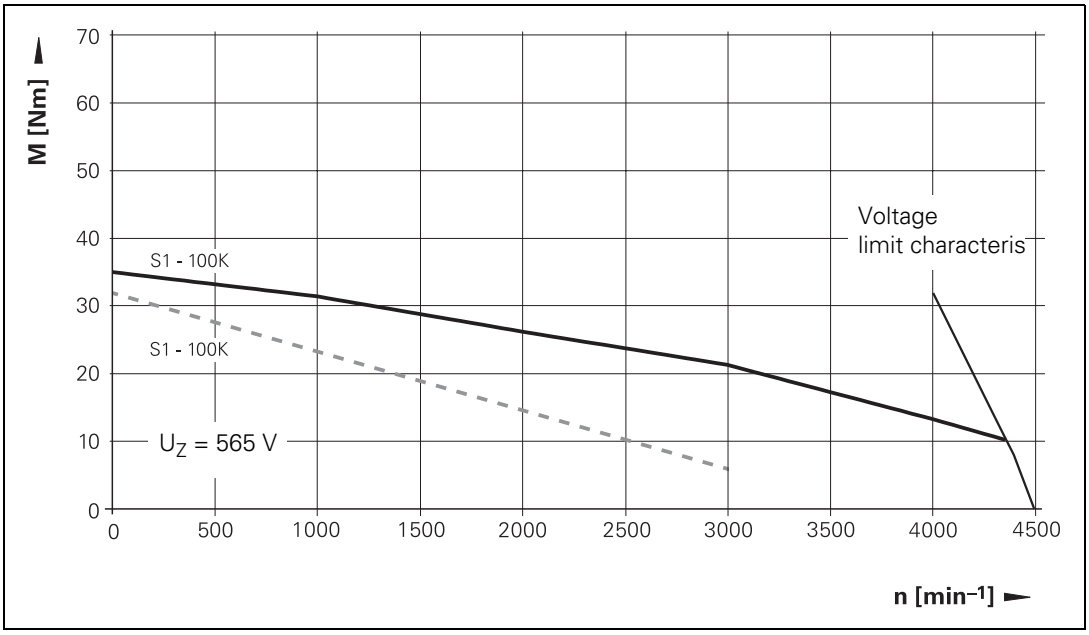
	QSY 112B with brake	QSY 112B without brake
ID number	331 144-03	331 144-04
Rated voltage U_N	278 V	
Rated power output P_N	1.9 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	6.0 Nm	
Rated current (100 K) I_N	5.4 A	
Stall torque (100 K) M_0	32.0 Nm	
Stall current (100 K) I_0	28.8 A	
Maximum current (for ≤ 200 ms) I_{max}	113.5 A	
Maximum torque (for ≤ 200 ms) M_{max}	102.0 Nm	
Pole pairs PZ	4	
Weight m	35.40 kg	34.00 kg
Rotor inertia J	196.00 kgcm^2	192.00 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	0.7 A	–
Holding torque for brake M_{Br}	20.0 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curves determined on a test stand for **one** motor mounted without thermal insulation.

Speed-torque characteristic for QSY 112B



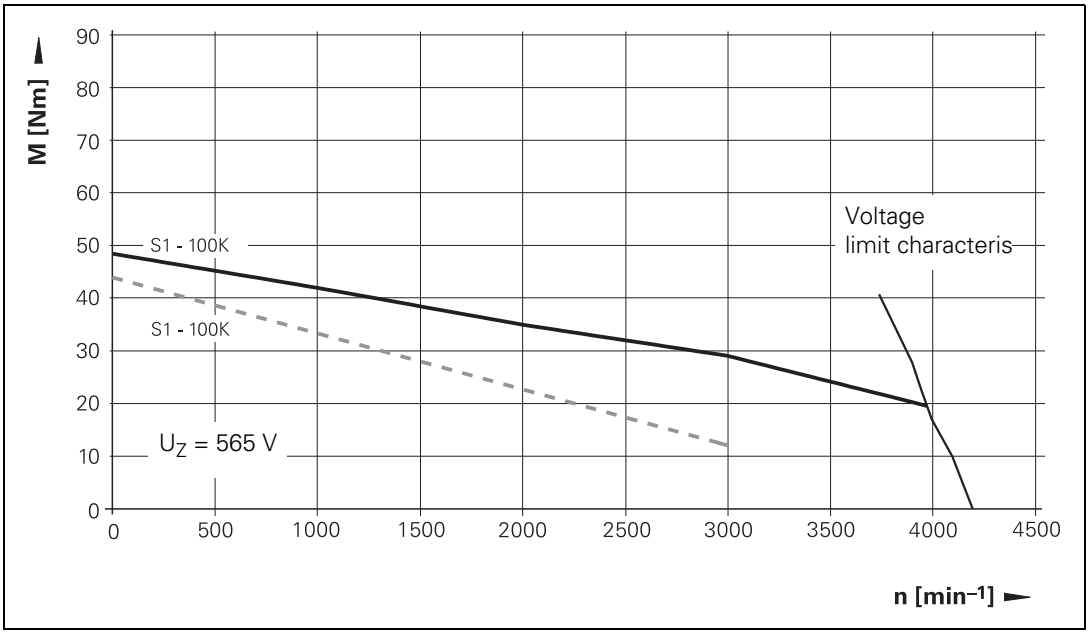
	QSY 112C with brake	QSY 112C without brake
ID number	331 145-04	331 145-03
Rated voltage U_N	336 V	
Rated power output P_N	3.8 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	12.0 Nm	
Rated current (100 K) I_N	8.5 A	
Stall torque (100 K) M_0	44.0 Nm	
Stall current (100 K) I_0	31.3 A	
Maximum current (for ≤ 200 ms) I_{max}	121.5 A	
Maximum torque (for ≤ 200 ms) M_{max}	148.0 Nm	
Pole pairs PZ	4	
Weight m	45.00 kg	41.00 kg
Rotor inertia J	303.00 kgcm^2	273.00 kgcm^2
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	1.3 A	–
Holding torque for brake M_{Br}	70.0 Nm	–

Note

In the performance diagram, the characteristic curve from the data sheet is shown in an interrupted, lightface line.

In addition, it shows the characteristic curves determined on a test stand for **one** motor mounted without thermal insulation.

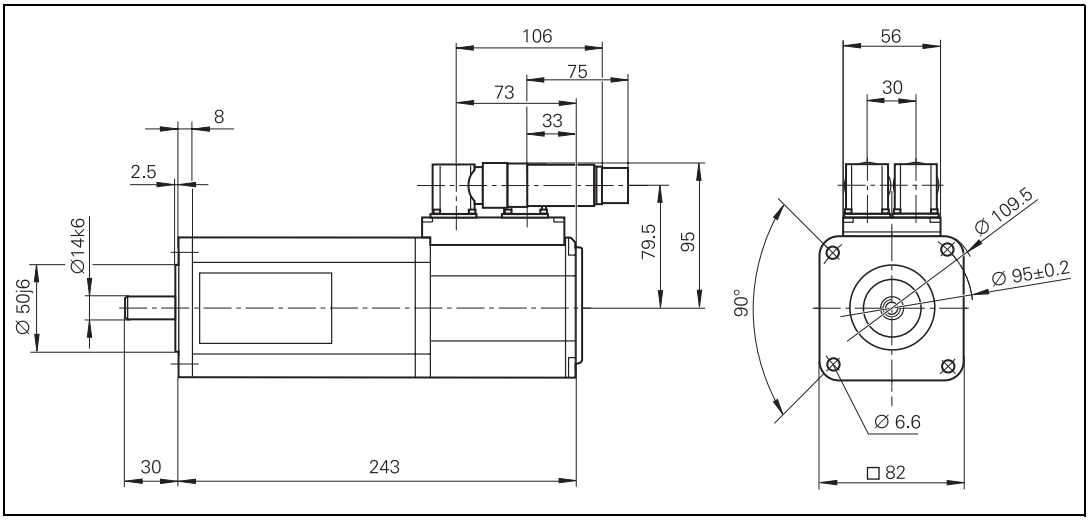
Speed-torque characteristic for QSY 112C



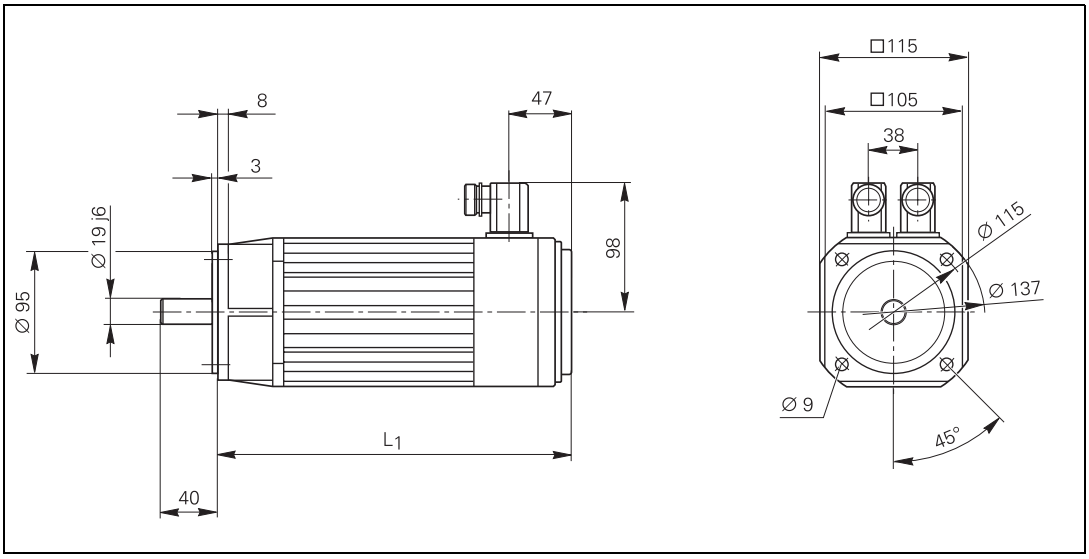
	QSY 112D with fan with brake	QSY 112D with fan without brake
ID number	344 736-14	344 736-13
Rated voltage U_N	328 V	
Rated power output P_N	12.0 kW	
Rated speed n_N	2000 rpm	
Rated torque (100 K) M_N	57.1 Nm	
Rated current (100 K) I_N	23.4 A	
Stall torque (100 K) M_0	72.0 Nm	
Stall current (100 K) I_0	33.3 A	
Maximum current (for ≤ 200 ms) I_{max}	100.0 A	
Maximum torque (for ≤ 200 ms) M_{max}	185.0 Nm	
Pole pairs PZ	4	
Weight m	55.00 kg	51.00 kg
Rotor inertia J	390.00 kgcm^2	360.00 kgcm^2
Rated voltage for fan U_L	230 V	
Rated current for fan I_L	0.3 A	
Frequency f_L	50 Hz/60 Hz	
Rated voltage for brake U_{Br}	24 Vdc	–
Rated current for brake I_{Br}	1.3 A	–
Holding torque for brake M_{Br}	70.0 Nm	–

7.9.2 Dimensions of HEIDENHAIN synchronous motors, QSY series

QSY 041B

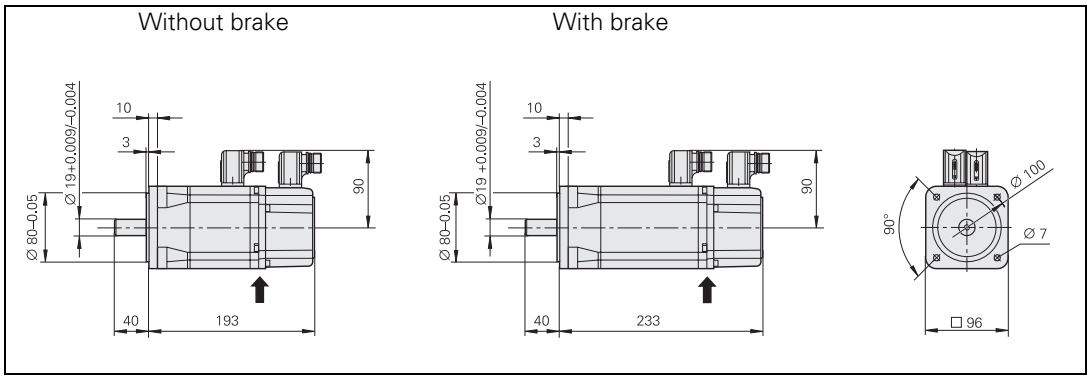


Series QSY 10



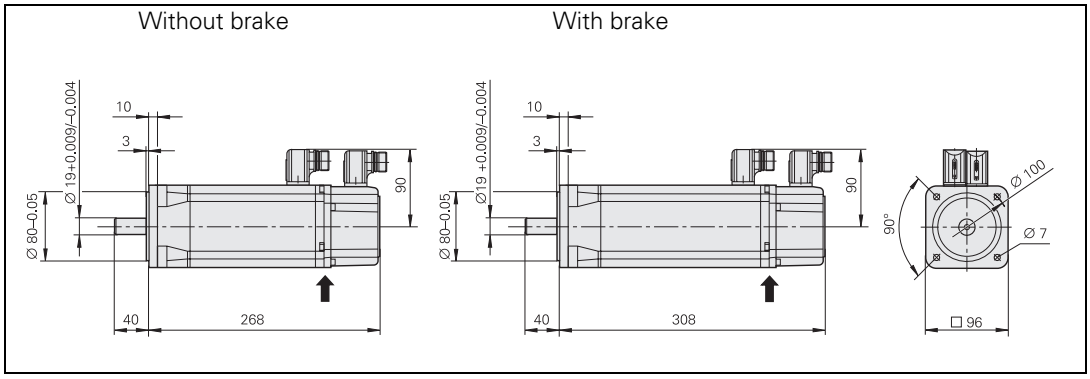
Motor	L_1
QSY 1A	235 mm
QSY 1C	275 mm
QSY 1E	315 mm

QSY 96A



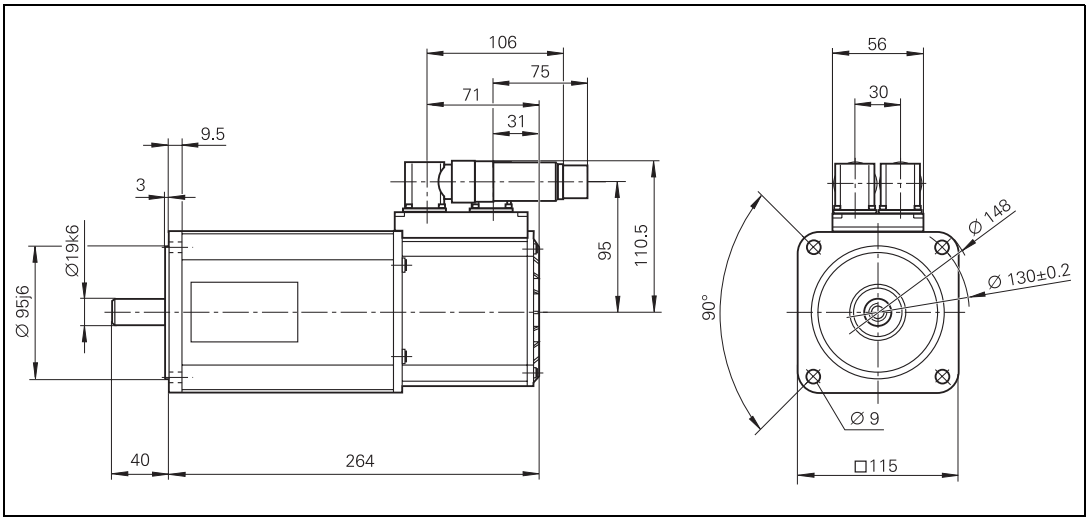
Fixed bearing

QSY 96G

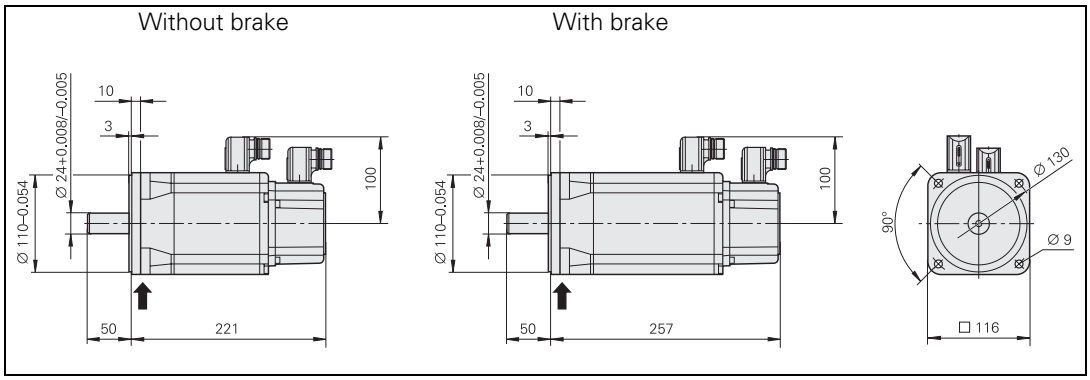


Fixed bearing

QSY 071B

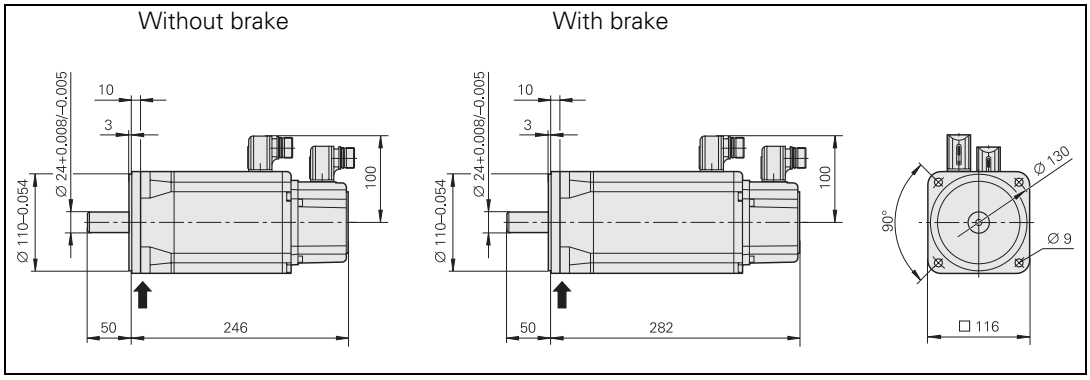

106
75
71
31
9.5
3
Ø19k6
Ø 95j6
95
110.5
40
264
56
30
Ø 148
Ø 130±0.2
90°
Ø 9
□115

QSY 116C



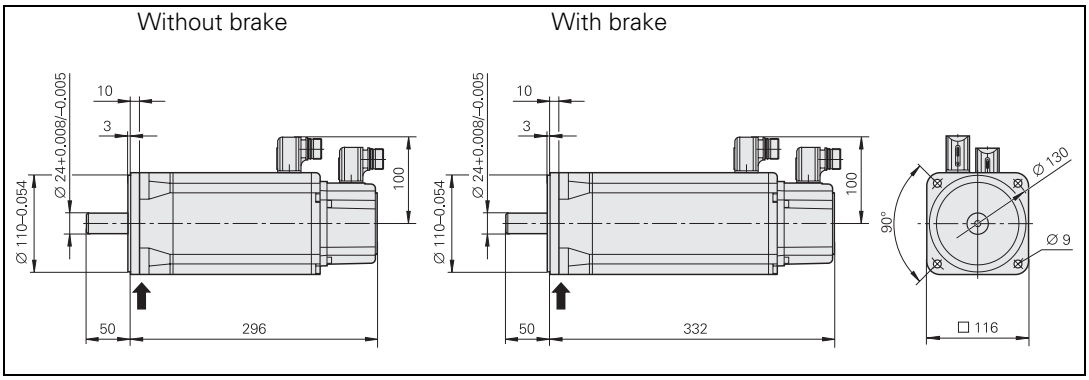
Fixed bearing

QSY 116E

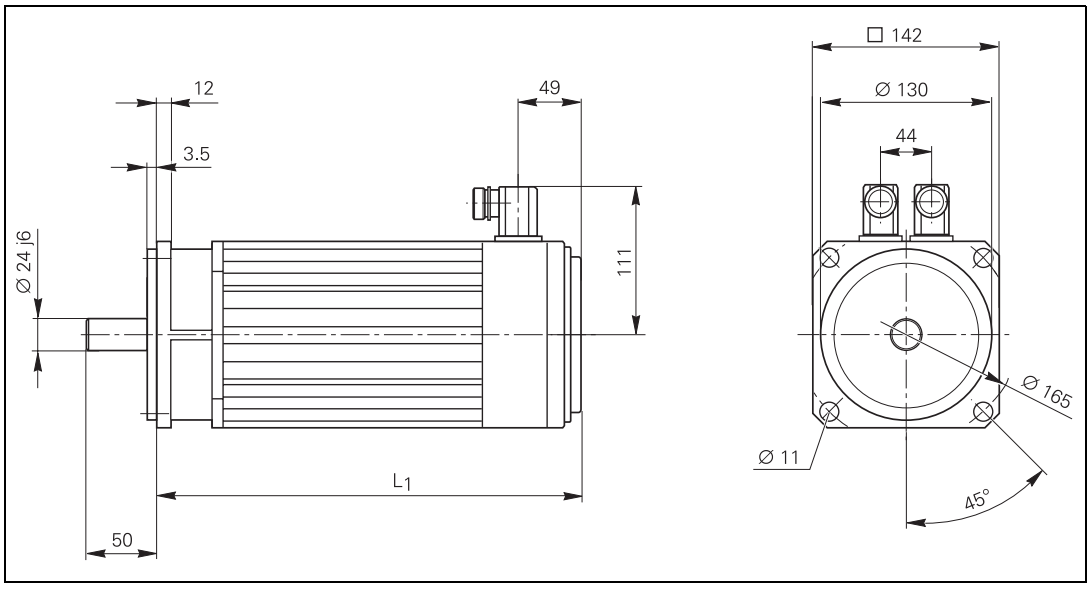


Fixed bearing

QSY 116J

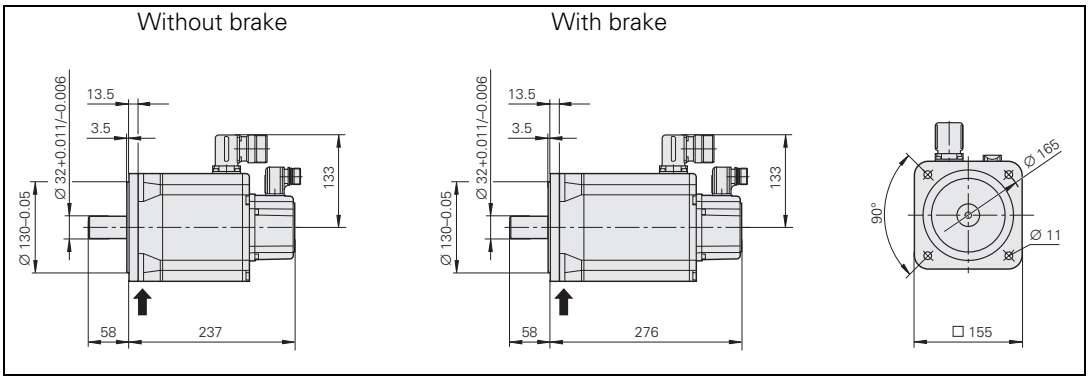


Fixed bearing



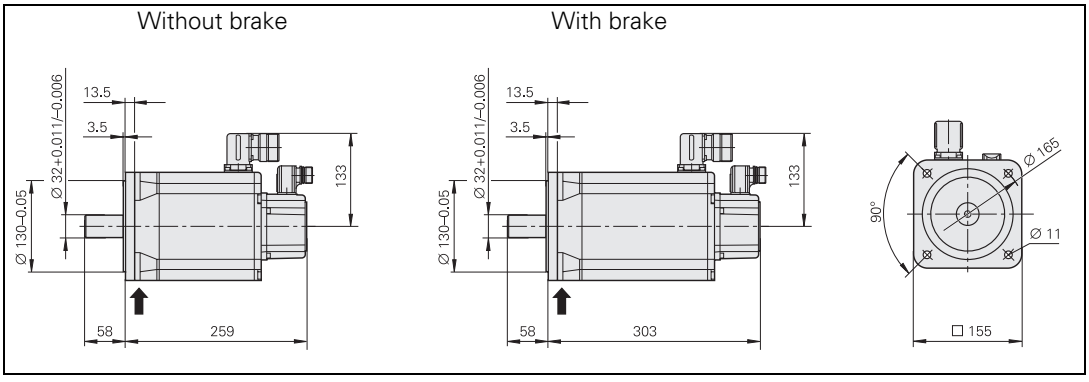
Motor	**L_1**
QSY 2C	312 mm
QSY 2E	352 mm
QSY 2G	392 mm

QSY 155A



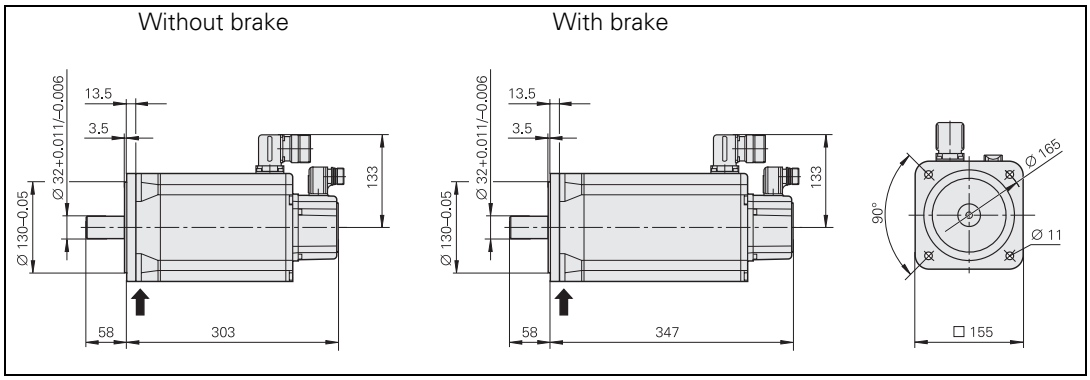
Fixed bearing

QSY 155B



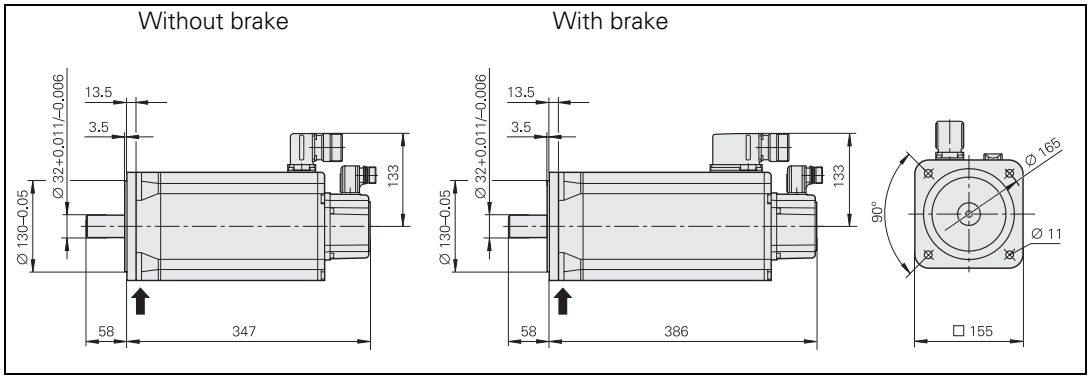
Fixed bearing

QSY 155D



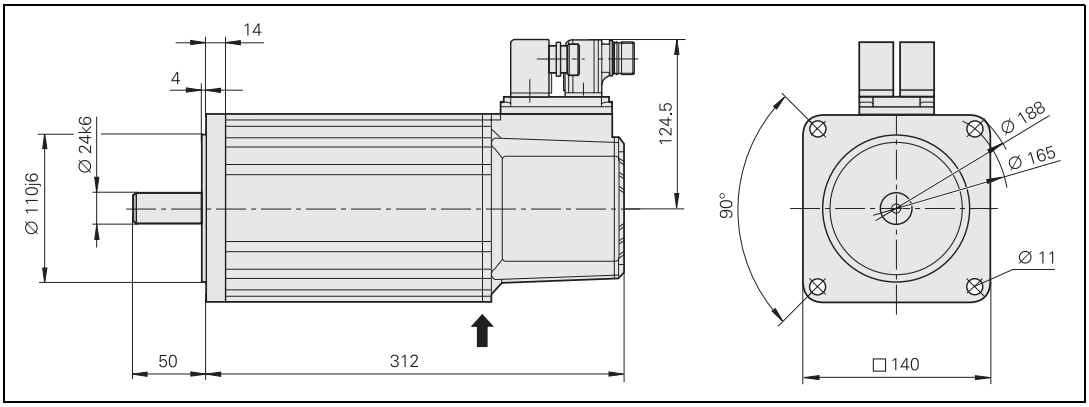
Fixed bearing

QSY 155F



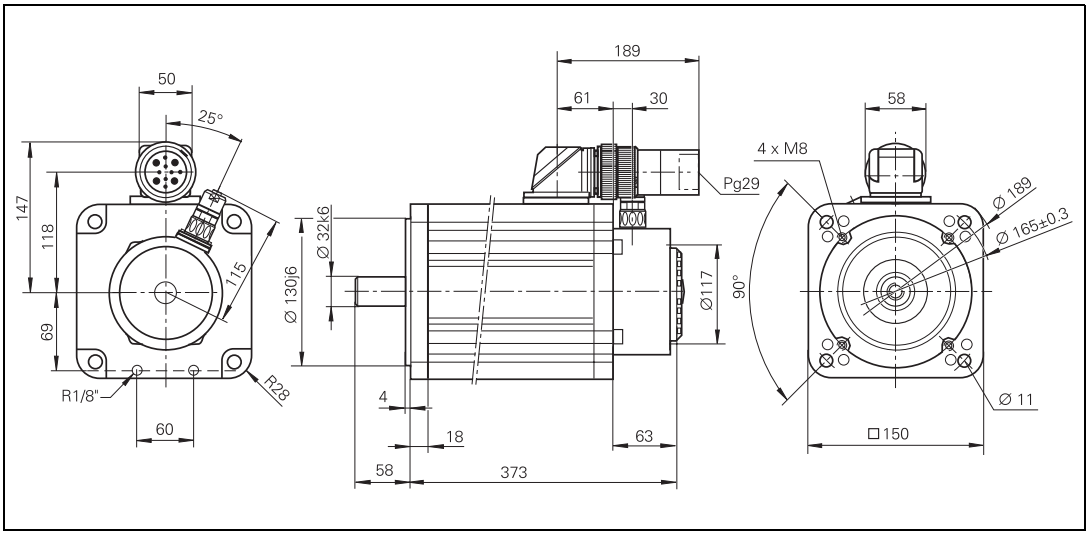
Fixed bearing

QSY 090B

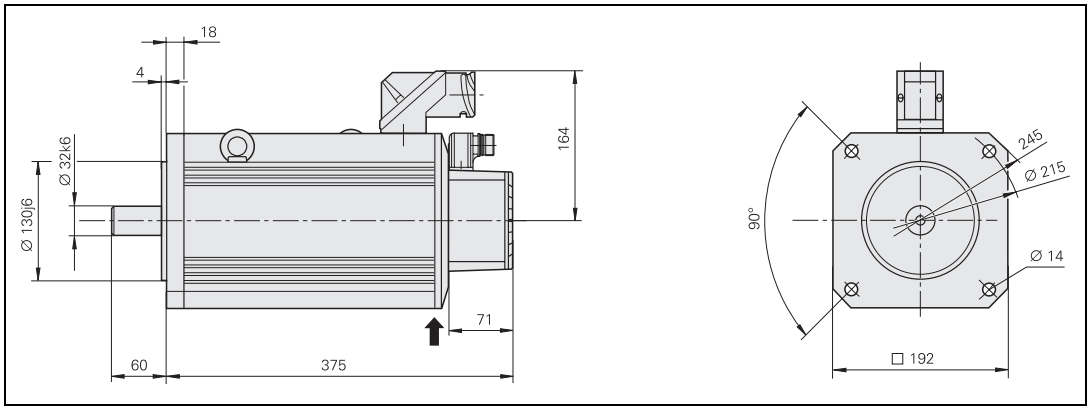


Fixed bearing

QSY 093B

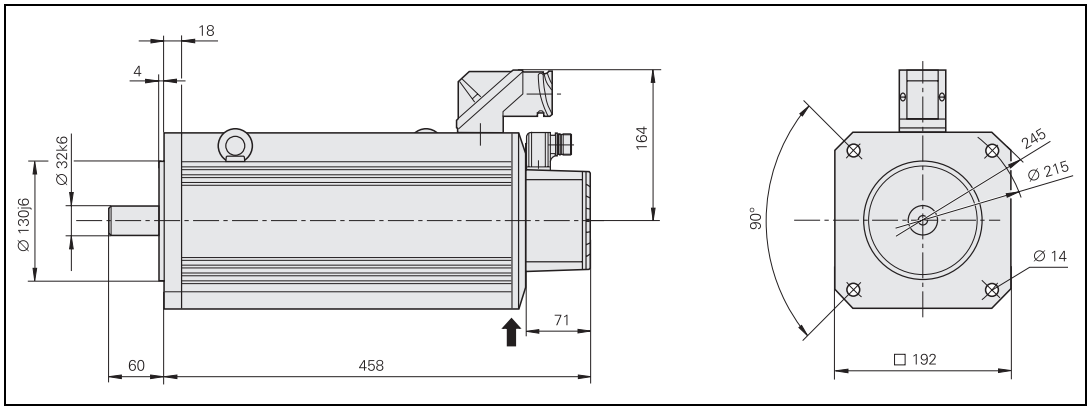


QSY 112B



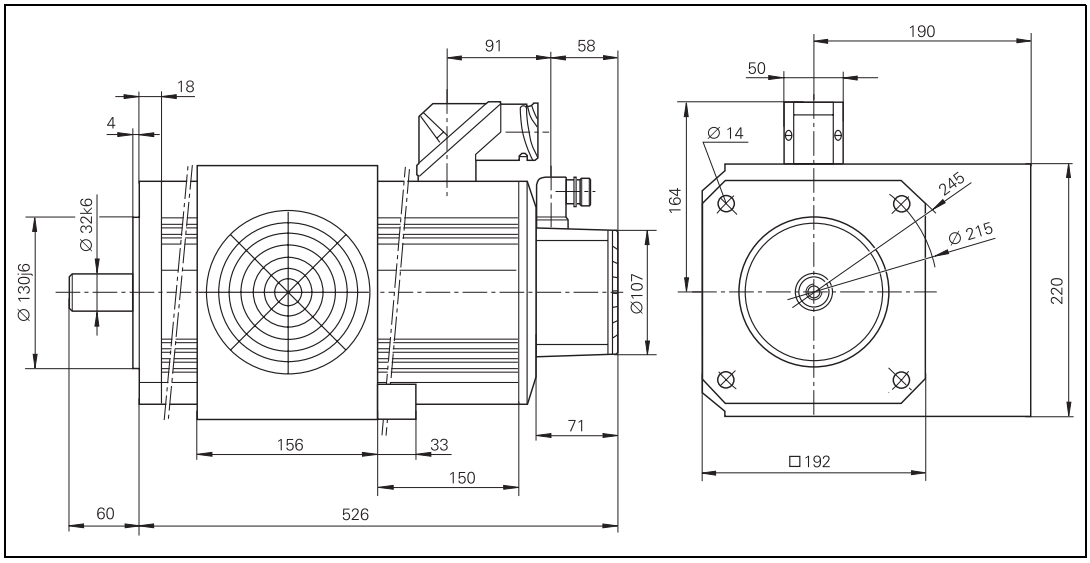
Fixed bearing

QSY 112C



Fixed bearing

QSY 112D


91
58
18
4
Ø 32k6
Ø 130j6
Ø107
156
33
71
150
60
526
190
50
Ø 14
164
245
Ø 215
220
□192

7.10 HEIDENHAIN asynchronous motors, QAN series

The HEIDENHAIN asynchronous motors have the following features:

- HEIDENHAIN ERN 1381 motor encoder for speed measurement (QAN 104, QAN 134, QAN 164B: RON 481)
- Separate cooling via fan
- Design IM B5 (mounting via flange) according to EN60 034-7, design IM B35 (mounting via mounting block) on request
- Protection class IP54 according to EN 60 529
- Cylindrical shaft end according to ISO-R775 with feather key and threaded central bore hole according to DIN 332-DR (QAN 134 and QAN 164B: DIN 332-DS)
- Flange dimensions according to DIN 42 948 and IEC 72 (not QAN 104)
- Maintenance-free bearing
- KTY 84-130 resistor probe for temperature monitoring in the stator winding
- Thermal class F
- Vibration severity grade S
- Feather-key balanced

7.10.1 Specifications of the HEIDENHAIN asynchronous motors, QAN series

Series QAN 104

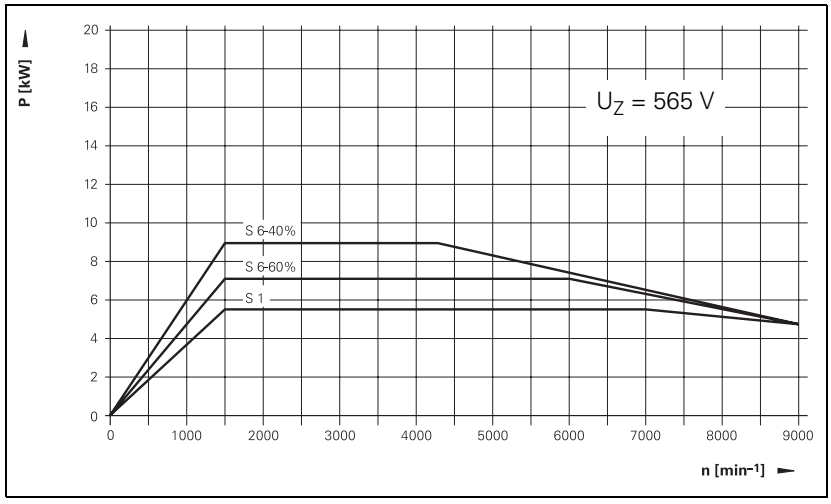
	QAN 104B	**QAN 104C**	**QAN 104D**
ID number	331 146-01	331 147-01	331 148-01
Fan	+	+	+
Brake	–	–	–
Rated voltage U_N	330 V	321 V	303 V
Rated power output P_N	4.5 kW	7.5 kW	10 kW
Rated speed n_N	1500 rpm		
Rated torque M_N	29 Nm	48 Nm	64 Nm
Rated current I_N	12 A	19.9 A	28.4 A
Operation ratio η	0.85		
Maximum speed n_{max}	9000 rpm		
Pole pairs PZ	2		
Weight m	37 kg	49 kg	60 kg
Rotor inertia J	140 $kgcm^2$	210 $kgcm^2$	280 $kgcm^2$
Rated voltage for fan U_L	230 V		
Rated current for fan I_L	0.3 A		
Frequency f_L	50 Hz/60 Hz		

	QAN 3M	**QAN 3L**	**QAN 3U**
ID number	316 006-31	316 007-31	316 008-31
Fan	+	+	+
Brake	–	–	–
Rated voltage U_N	330 V		
Rated power output P_N	5.5 kW	7.5 kW	10 kW
Rated speed n_N	1500 rpm		
Rated torque M_N	35 Nm	48 Nm	63.5 Nm
Rated current I_N	15.5 A	21 A	26 A
Operation ratio η	0.83		0.82
Maximum speed n_{max}	9000 rpm		
Pole pairs PZ	2		
Weight m	53 kg	64 kg	73 kg
Rotor inertia J	184 $kgcm^2$	242 $kgcm^2$	291 $kgcm^2$
Rated voltage for fan U_L	3 x 400 V		
Rated current for fan I_L	0.14 A		0.17 A
Frequency f_L	50 Hz/60 Hz		

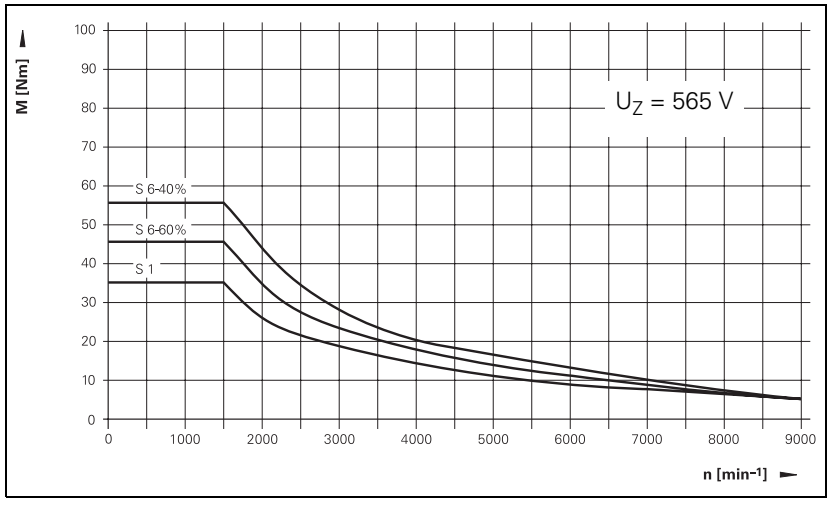
Power and torque characteristic QAN 3M

Operating mode	S1	S6-60%	S6-40 %
Speed n	1500 rpm 7000 rpm 9000 rpm	1500 rpm 6000 rpm 9000 rpm	500 rpm 4300 rpm 9000 rpm
Power P	5.5 kW 5.5 kW 4.7 kW	7.2 kW 7.2 kW 4.7 kW	8.8 kW 8.8 kW 4.7 kW
Torque M	35 Nm 7.5 Nm 5 Nm	45.8 Nm 11.5 Nm 5 Nm	56 Nm 19.5 Nm 5 Nm
Current I (for 1500 rpm)	15.5 A	18.5 A	22 A

Power characteristic



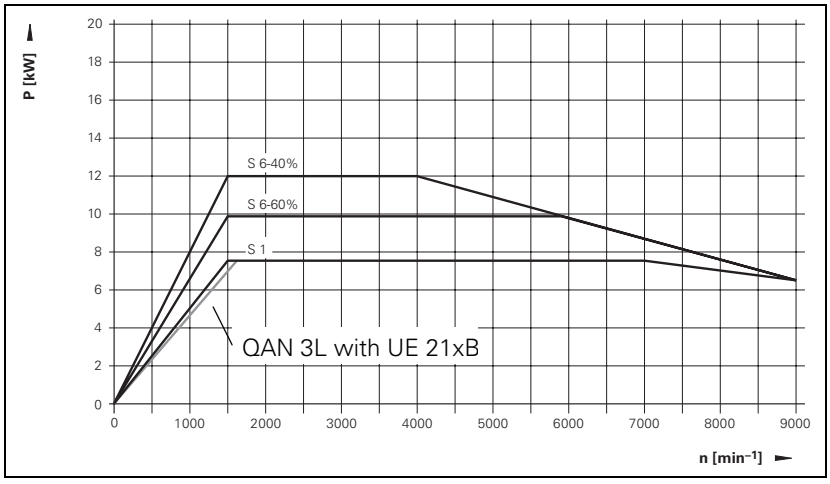
Torque characteristic



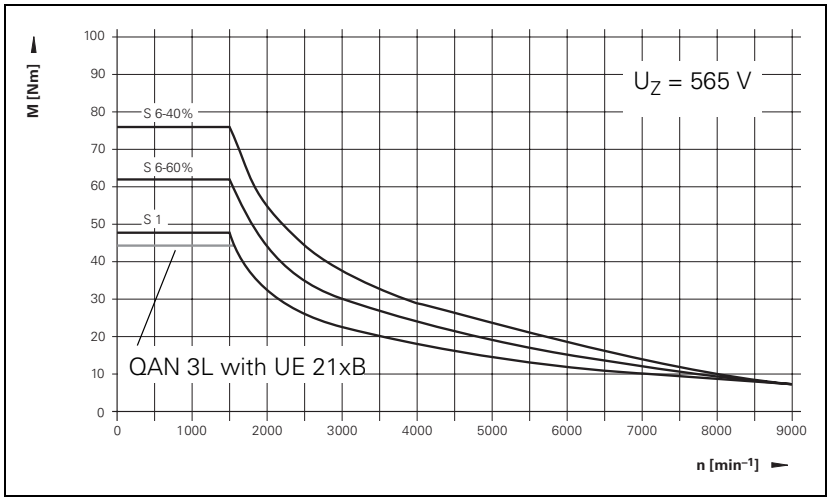
Power and torque characteristic QAN 3L

Operating mode	S1	S6-60%	S6-40 %
Speed n	1500 rpm 7000 rpm 9000 rpm	1500 rpm 5800 rpm 9000 rpm	1500 rpm 4300 rpm 9000 rpm
Power P	7.5 kW 7.5 kW 6.5 kW	9.8 kW 9.8 kW 6.5 kW	12 kW 12 kW 6.5 kW
Torque M	48 Nm 10.2 Nm 6.9 Nm	62.4 Nm 16.1 Nm 6.9 Nm	76.4 Nm 28.6 Nm 6.9 Nm
Current I (for 1500 rpm)	21 A	24.5 A	30 A

Power characteristic



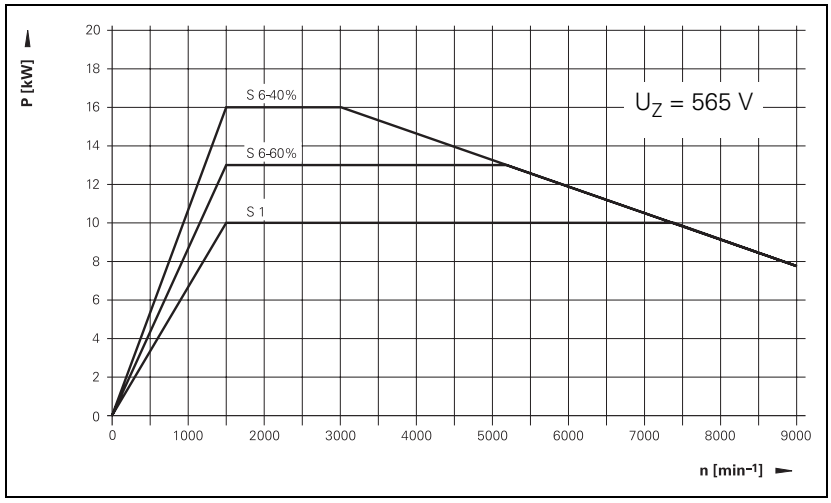
Torque characteristic



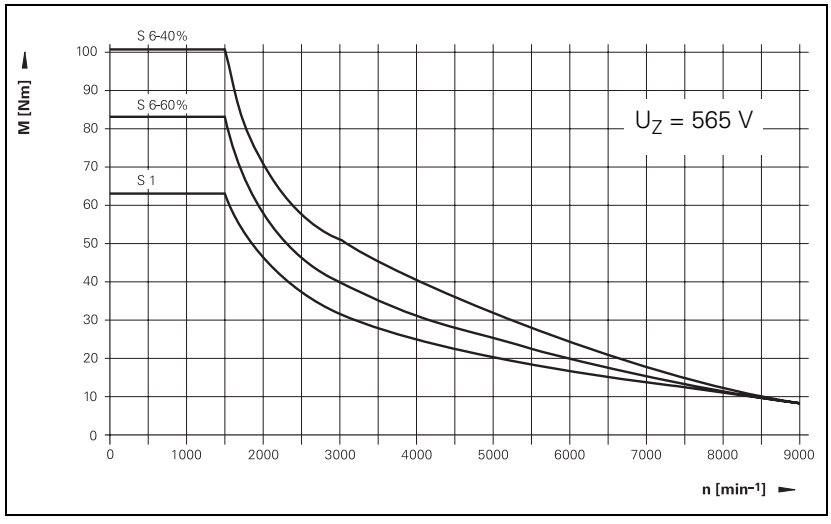
Power and torque characteristic QAN 3U

Operating mode	S1	S6-60%	S6-40 %
Speed n	1500 rpm 7400 rpm 9000 rpm	1500 rpm 5200 rpm 9000 rpm	1500 rpm 3000 rpm 9000 rpm
Power P	10 kW 10 kW 7.8 kW	13 kW 13 kW 7.8 kW	16 kW 16 kW 7.8 kW
Torque M	63.5 Nm 13.6 Nm 8.3 Nm	82.8 Nm 22.6 Nm 8.3 Nm	101.9 Nm 50.9 Nm 8.3 Nm
Current I (for 1500 rpm)	26 A	32 A	38 A

Power characteristic



Torque characteristic

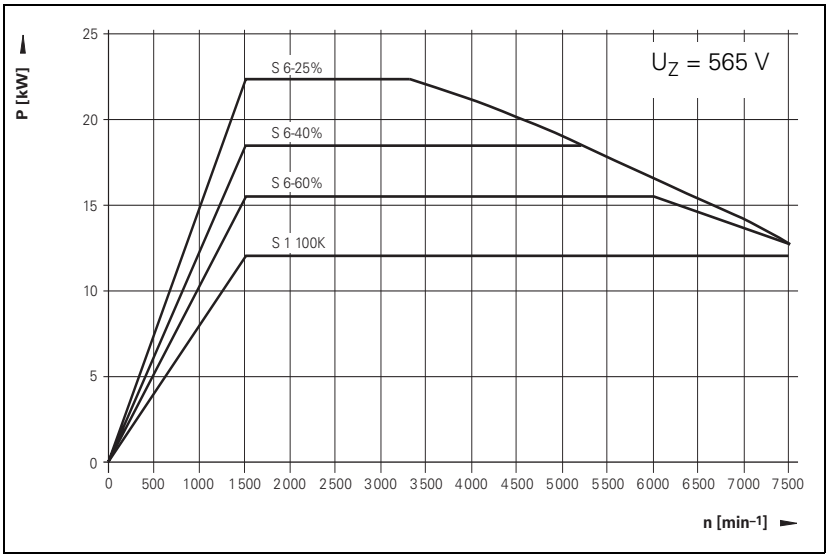


	QAN 134B	**QAN 134C**	**QAN 134D**
ID number	331 149-01	331 150-01	331 151-31
Fan	+	+	+
Brake	–	–	–
Rated voltage U_N	328 V	321 V	387 V
Rated power output P_N	12 kW	18 kW	22 kW
Rated speed n_N	1500 rpm		1250 rpm
Rated torque M_N	76 Nm	115 Nm	166 Nm
Rated current I_N	27.8 A	42 A	51.6 A
Operation ratio η	0.85		
Maximum speed n_{max}	7500 rpm		
Pole pairs PZ	2		
Weight m	90 kg	115 kg	135 kg
Rotor inertia J	540 kgcm^2	60 kgcm^2	1180 kgcm^2
Rated voltage for fan U_L	3 x 400 V		
Rated current for fan I_L	0.2 A		
Frequency f_L	50 Hz/60 Hz		

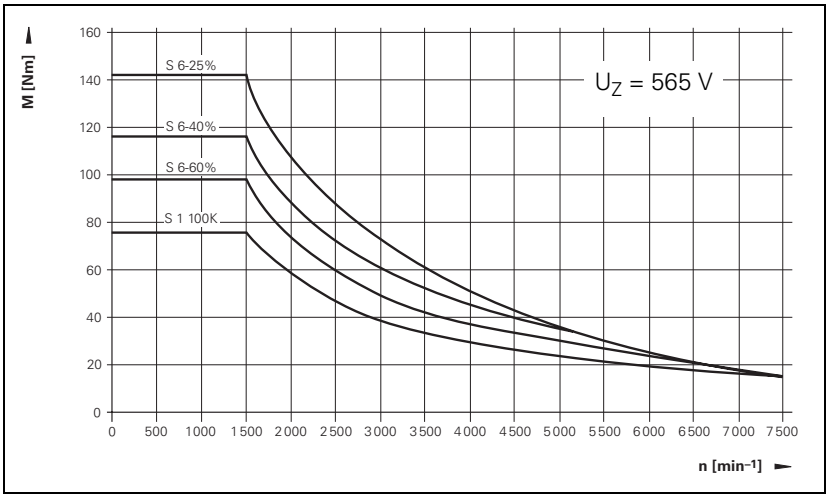
Power and torque characteristic for QAN 134B

Operating mode	S1	S6-60%	S6-40 %
Speed n	1500 rpm 6000 rpm 7500 rpm	1500 rpm 5200 rpm 7500 rpm	1500 rpm 3300 rpm 7500 rpm
Power P	12 kW 12 kW 12 kW	15 kW 15 kW 13 kW	18 kW 18 kW 13 kW
Torque M	76 Nm 21 Nm 18 Nm	98 Nm 28 Nm 24 Nm	117 Nm 34 Nm 36 Nm
Current I (for 1500 rpm)	27.8 A	34.0 A	40.0 A

Power characteristic



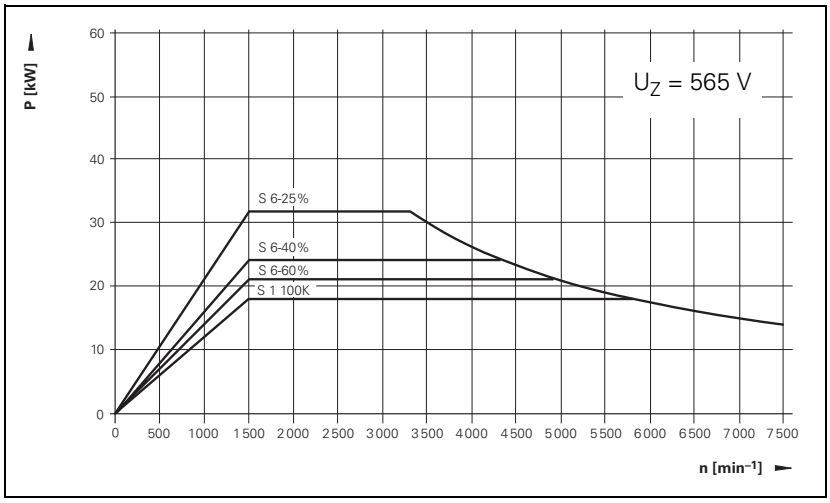
Torque characteristic



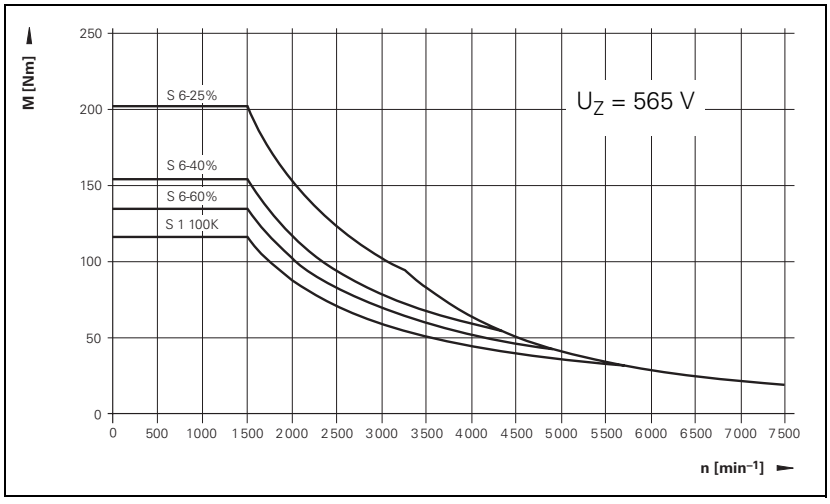
Power and torque characteristic for QAN 134C

Operating mode	S1	S6-60%	S6-40 %
Speed n	1500 rpm 5800 rpm 7500 rpm	1500 rpm 4900 rpm 7500 rpm	1500 rpm 4300 rpm 7500 rpm
Power P	18 kW 18 kW 13 kW	21 kW 21 kW 13 kW	24 kW 24 kW 13 kW
Torque M	115 Nm 30 Nm 18 Nm	134 Nm 41 Nm 18 Nm	154 Nm 53 Nm 18 Nm
Current I (for 1500 rpm)	42.0 A	43.0 A	55.0 A

Power characteristic



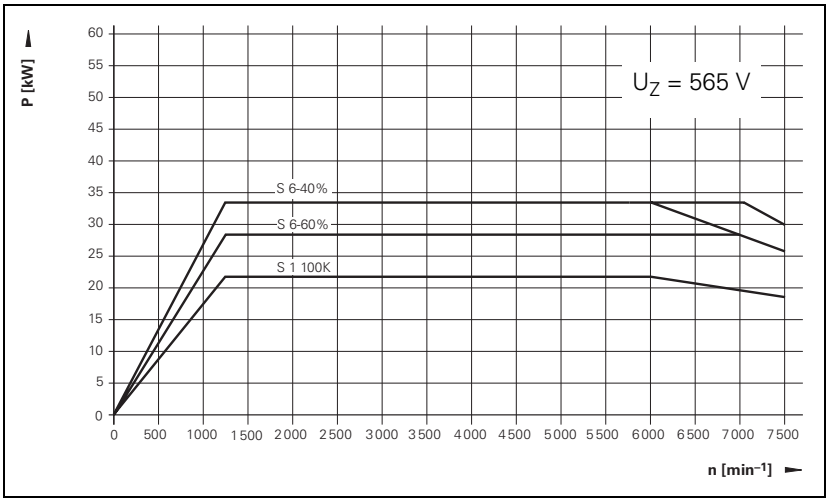
Torque characteristic



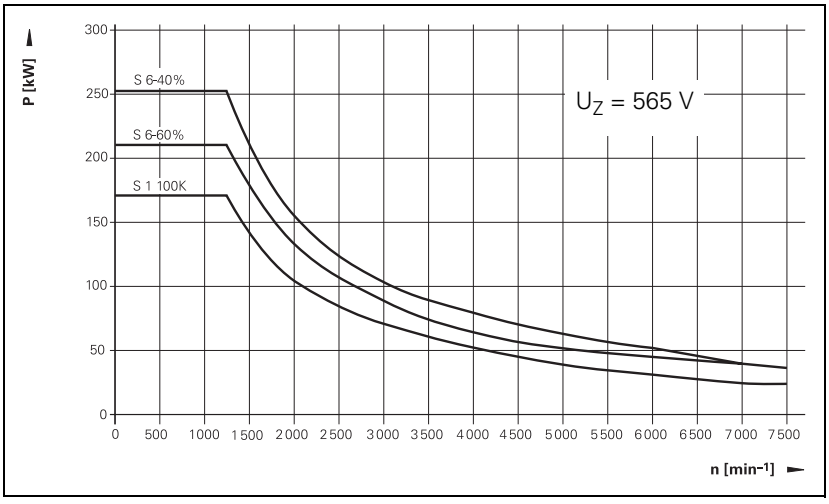
Power and torque characteristic for QAN 134D

Operating mode	S1	S6-60%	S6-40 %
Speed n	1250 rpm 6000 rpm 7500 rpm	1250 rpm 7000 rpm 7500 rpm	1250 rpm 6000 rpm 7500 rpm
Power P	22 kW 22 kW 16 kW	28 kW 28 kW 26 kW	33 kW 33 kW 26 kW
Torque M	166 Nm 35 Nm 23 Nm	213 Nm 38 Nm 33 Nm	252 Nm 45 Nm 38 Nm
Current I (for 1250 rpm)	51.6 A	63.0 A	73.0 A

Power characteristic



Torque characteristic

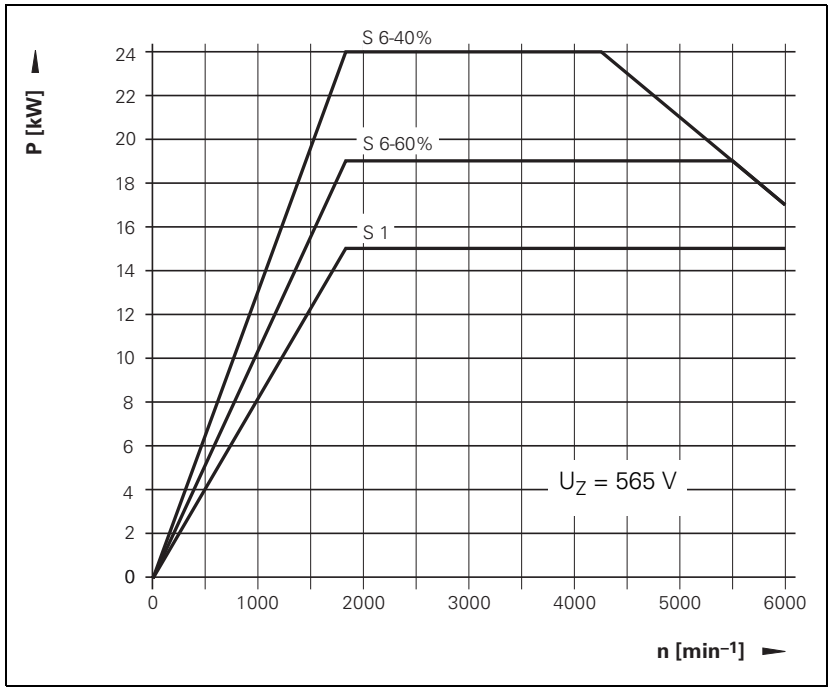


	QAN 4S
ID number	317 449-31
Fan	+
Brake	–
Rated voltage U_N	380 V
Rated power output P_N	15 kW
Rated speed n_N	1800 rpm
Rated torque M_N	80 Nm
Rated current I_N	31 A
Operation ratio η	0.85
Maximum speed n_{max}	6000 rpm
Pole pairs PZ	2
Weight m	5 kg
Rotor inertia J	827 kgcm^2
Rated voltage for fan U_L	3 x 400 V
Rated current for fan I_L	0.19 A 0.22 A
Frequency f_L	50 Hz/60 Hz

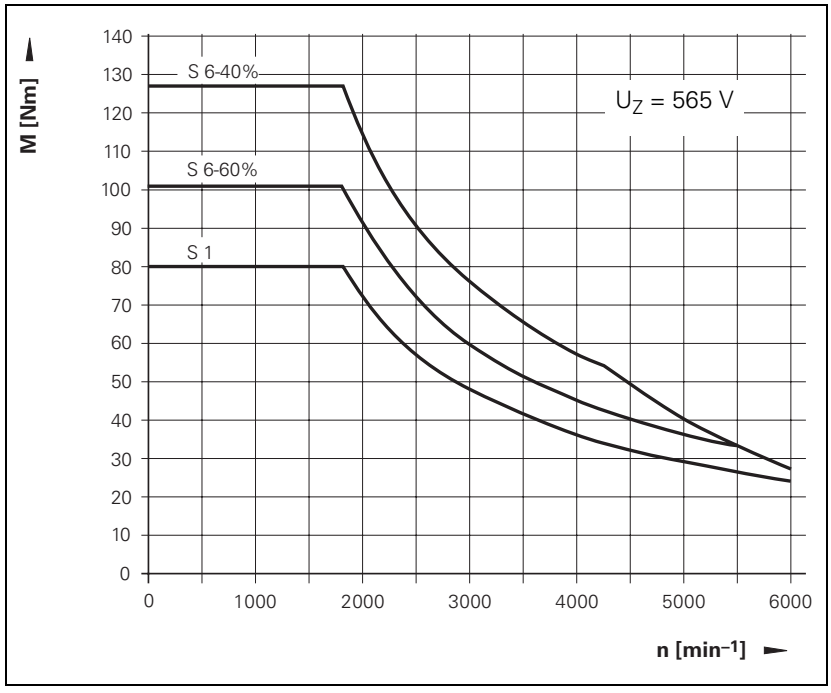
Power and torque characteristic QAN 4S

Operating mode	S1	S6-60%	S6-40 %
Speed n	1800 rpm 6000 rpm	1800 rpm 5500 rpm 6000 rpm	1800 rpm 4250 rpm 6000 rpm
Power P	15 kW 15 kW	19 kW 19 kW 17 kW	24 kW 24 kW 17 kW
Torque M	80 Nm 24 Nm	101 Nm 33 Nm 27 Nm	127 Nm 54 Nm 27 Nm
Current I (for 1800 rpm)	31 A	38 A	47 A

Power characteristic



Torque characteristic

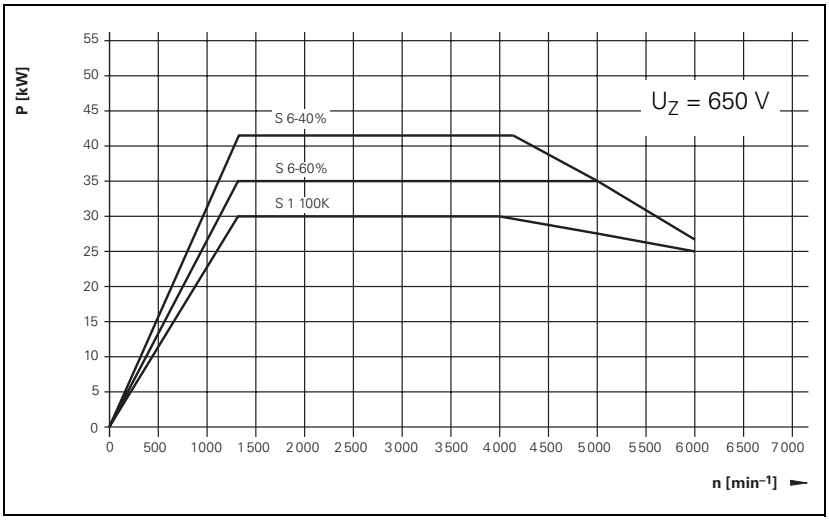


	QAN 164B
ID number	331 152-xx
Fan	+
Brake	–
Rated voltage U_N	423 V
Rated power output P_N	31.5 kW
Rated speed n_N	1350 rpm
Rated torque M_N	223 Nm
Rated current I_N	56.6 A
Operation ratio η	0.85
Maximum speed n_{max}	6000 rpm
Pole pairs PZ	2
Weight m	205 kg
Rotor inertia J	1740 $kgcm^2$
Rated voltage for fan U_L	3 x 400 V
Rated current for fan I_L	0.2 A
Frequency f_L	50 Hz/60 Hz

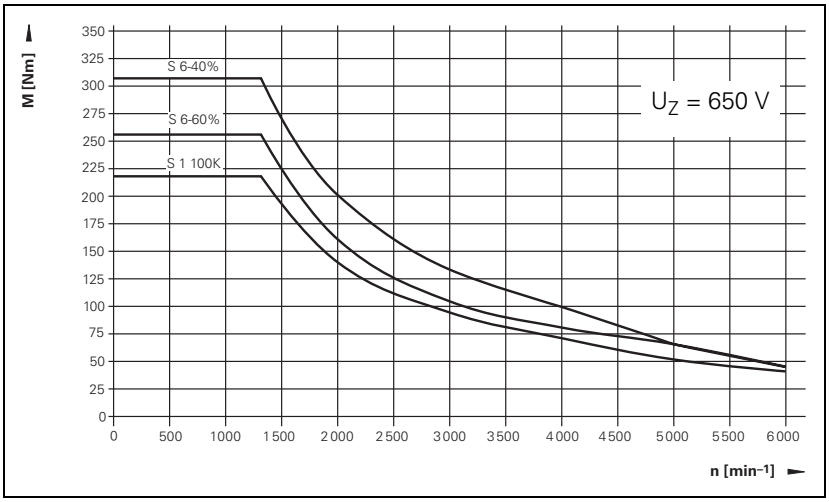
Power and torque characteristic for QAN 164B

Operating mode	S1	S6-60%	S6-40 %
Speed n	1300 rpm 4000 rpm 6000 rpm	1300 rpm 5000 rpm 6000 rpm	1300 rpm 4200 rpm 6000 rpm
Power P	30 kW 30 kW 25 kW	35 kW 35 kW 27 kW	42 kW 42 kW 27 kW
Torque M	221.0 Nm 71.6 Nm 39.8 Nm	257.00 Nm 66.84 Nm 43.00 Nm	308.5 Nm 95.5 Nm 43.0 Nm
Current I (for 1300 rpm)	57.0 A	62.5 A	77.0 A

Power characteristic

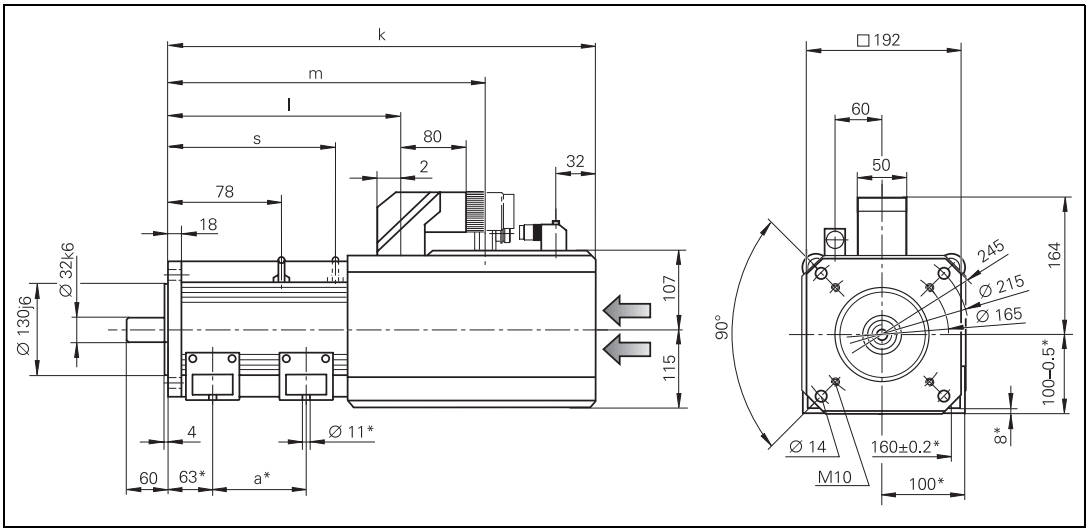


Torque characteristic



7.10.2 Dimensions of HEIDENHAIN Asynchronous motors, QAN Series

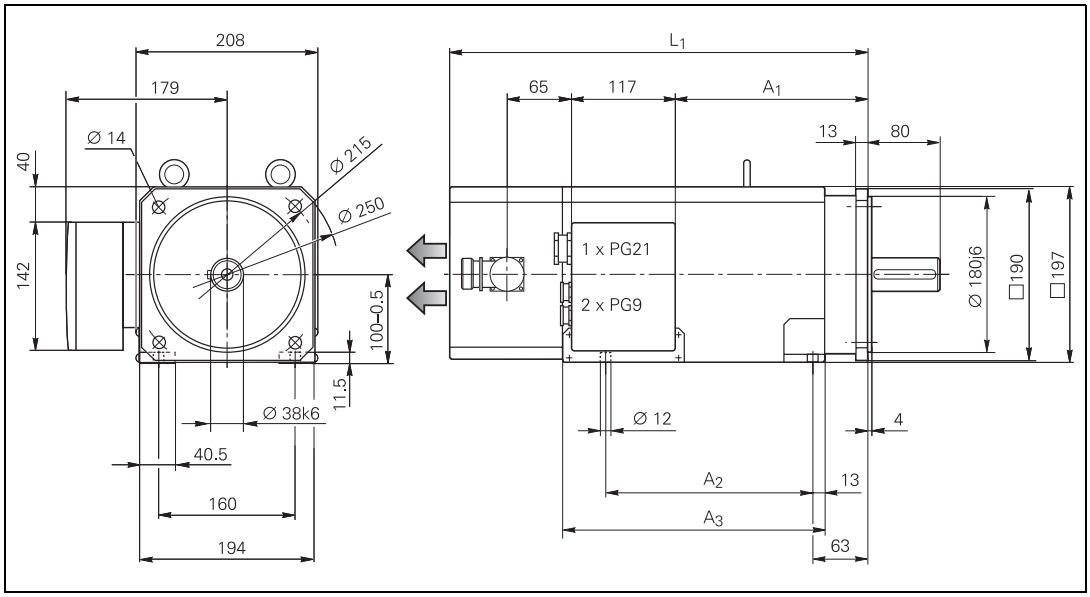
Series QSY 104



*) Mounting block (design IM B35) on request

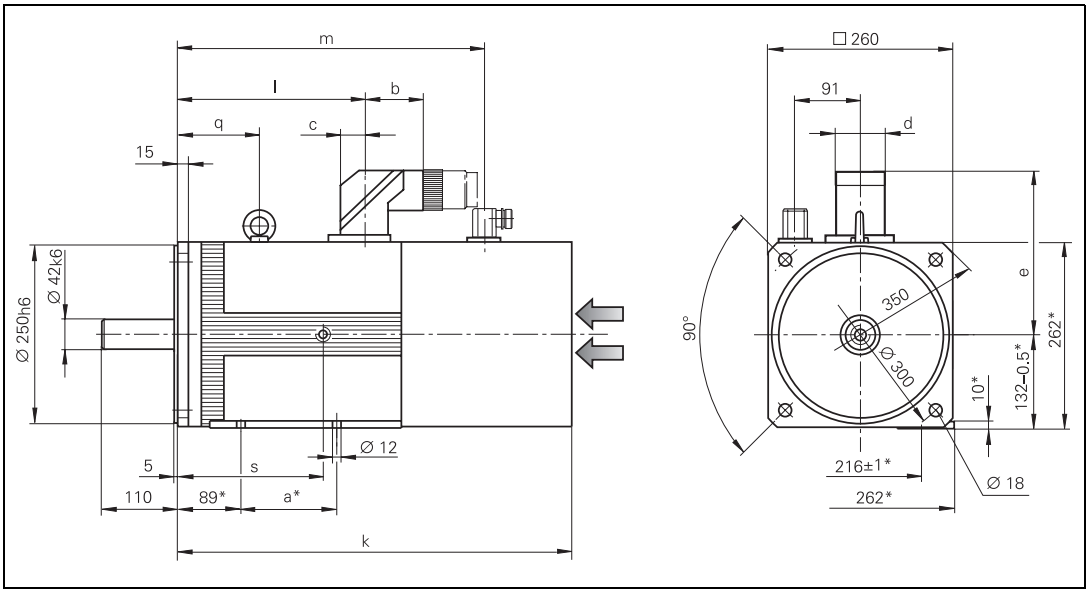
Motor	k	l	m	a	s
QAN 104B	507 mm	247 mm	339 mm	80 mm	166 mm
QAN 104C	582 mm	322 mm	414 mm	140 mm	241 mm
QAN 104D	657 mm	397 mm	489 mm	215 mm	316 mm

Air current of the fan



Motor	L_1	A_1	A_2	A_3
QAN 3M	530 mm	215 mm	230 mm	291 mm
QAN 3L	595 mm	280 mm	280 mm	335 mm
QAN 3U	660 mm	335 mm	350 mm	411 mm

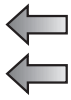
Air current of the fan



*) Mounting block (design IM B35) on request

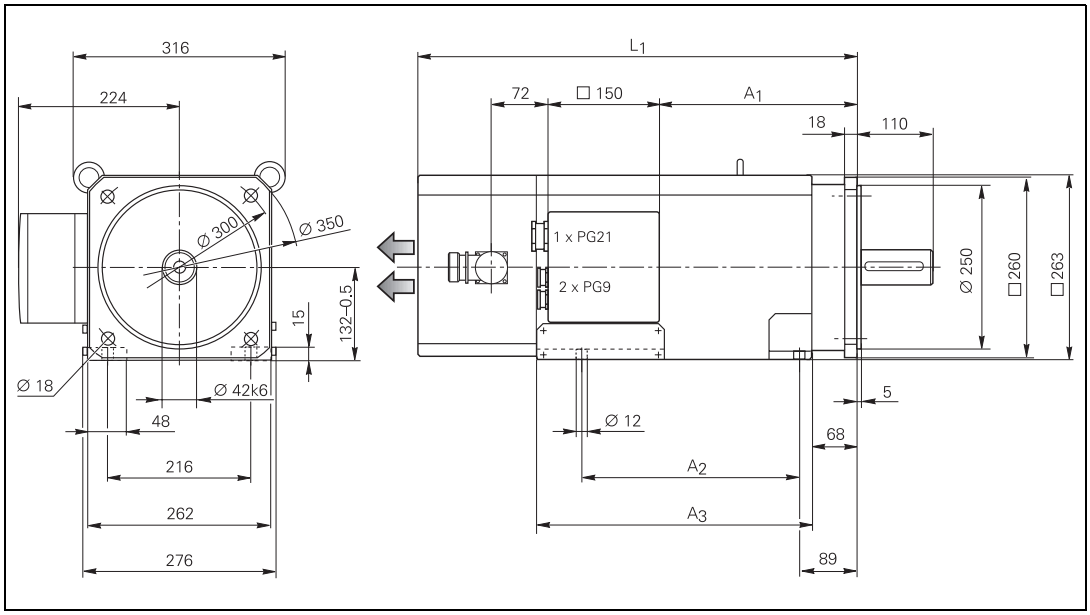
Motor	k	l	m	a	s
QAN 134B	550 mm	274 mm	402 mm	135 mm	205 mm
QAN 134C	620 mm	335 mm	472 mm	205 mm	230 mm
QAN 134D	50 mm	465 mm	602 mm	335 mm	275 mm

Motor	b	c	d	e	q
QAN 134B	80 mm	25 mm	50 mm	204 mm	115 mm
QAN 134C	84.5 mm	35.5 mm	71 mm	206 mm	185 mm
QAN 134D	84.5 mm	35.5 mm	71 mm	206 mm	275 mm



Air current of the fan

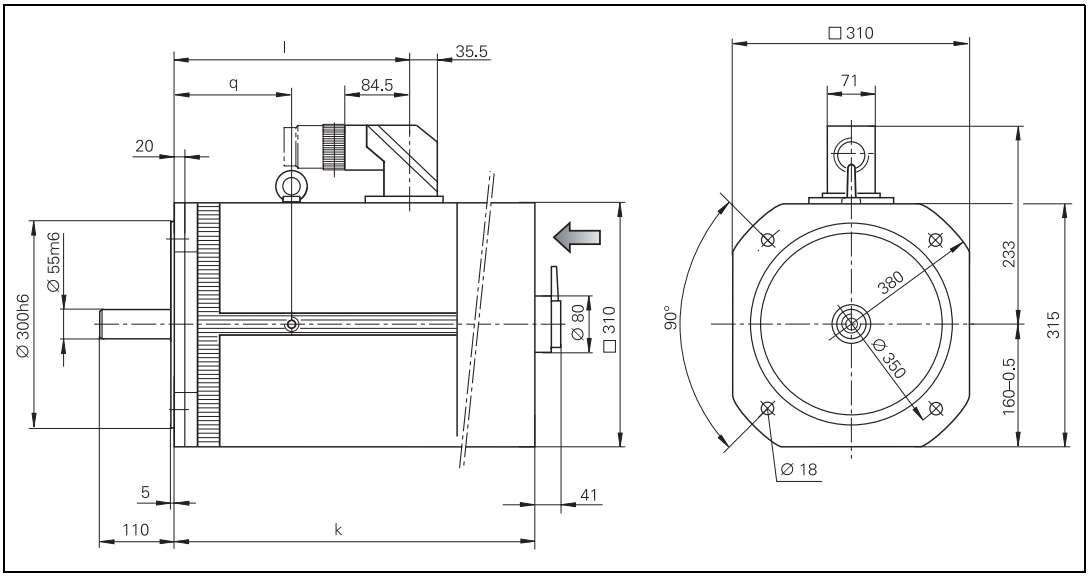
QAN 4S



Motor	**L_1**	**A_1**	**A_2**	**A_3**
QAN 4S	610 mm	245 mm	265 mm	338 mm

Air current of the fan

QAN 164B



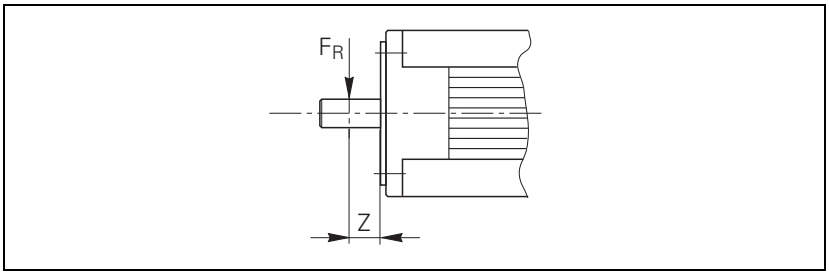
Motor	k	l	q
QAN 164B	751 mm	460.5 mm	280 mm

Air current of the fan

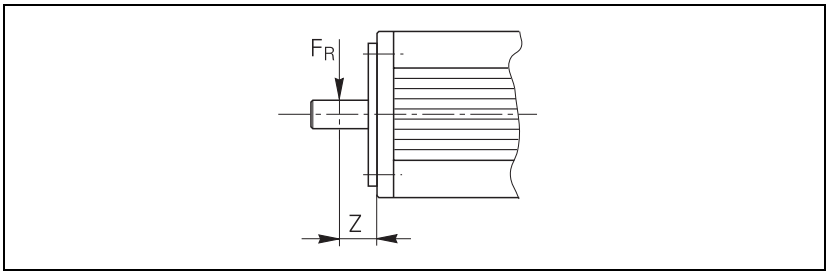
7.11 Permissible forces on the motor shaft

7.11.1 Point of the radial force

**QSY 10, QSY 96,
QSY 116, QSY 20,
QSY 155, QAN 30,
QAN 4S**



**QSY 041B,
QSY 071B,
QSY 090B,
QSY 093B,
Series QSY 112,
QAN 104, QAN 134
and QAN 164B**

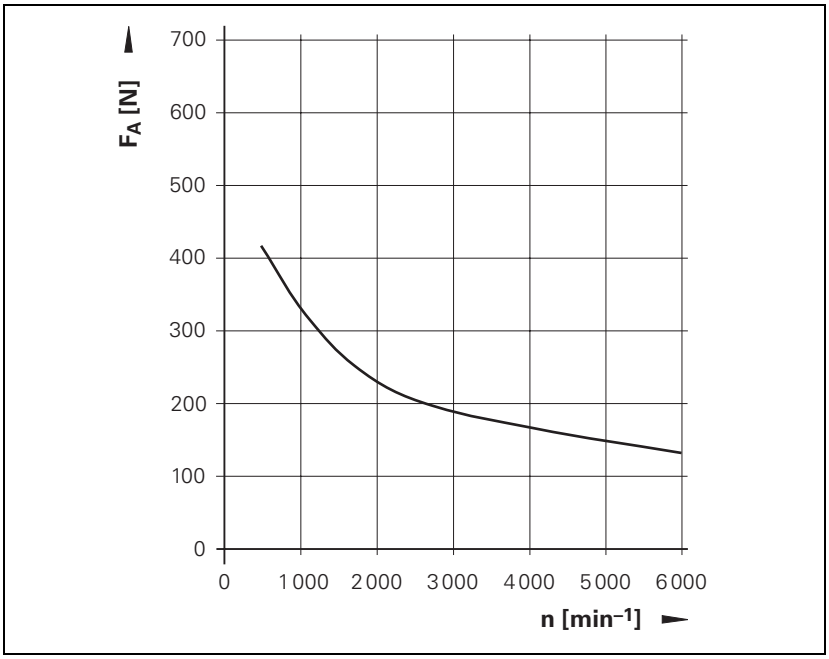


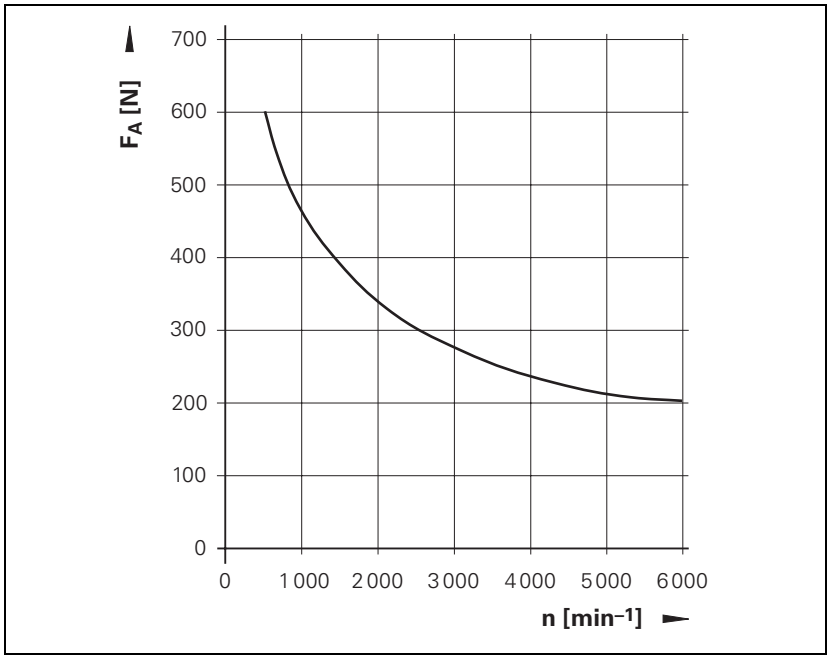
7.11.2 Permissible forces on the HEIDENHAIN synchronous motors QSY 10, QSY 20

Axial force F_A

The following diagrams show the max. permissible axial forces F_A for a bearing service life of 30 000 h.

Series QSY 10

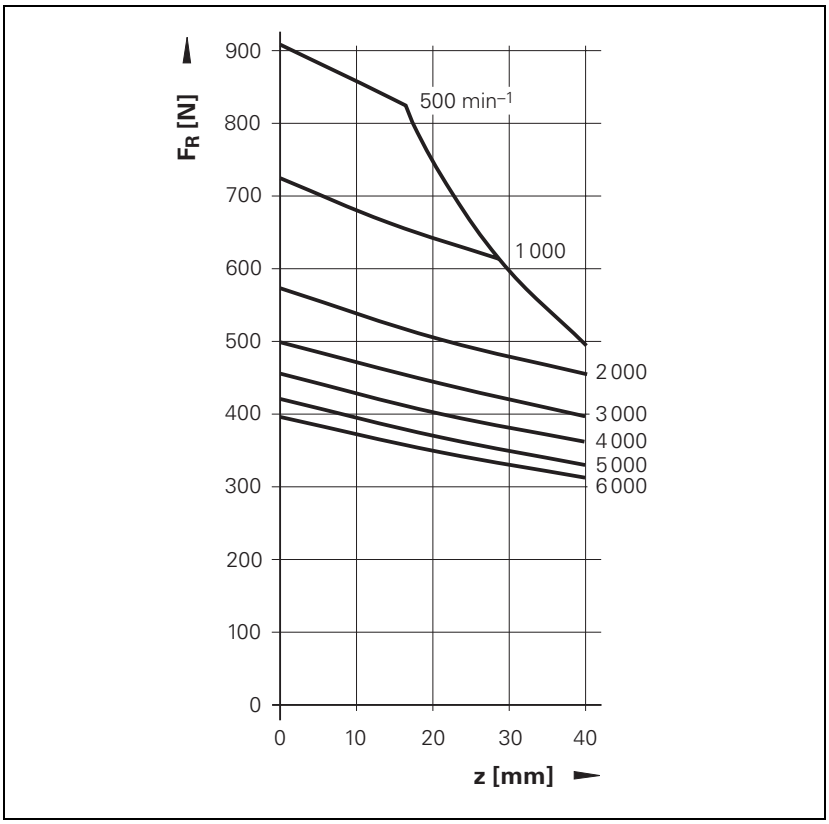


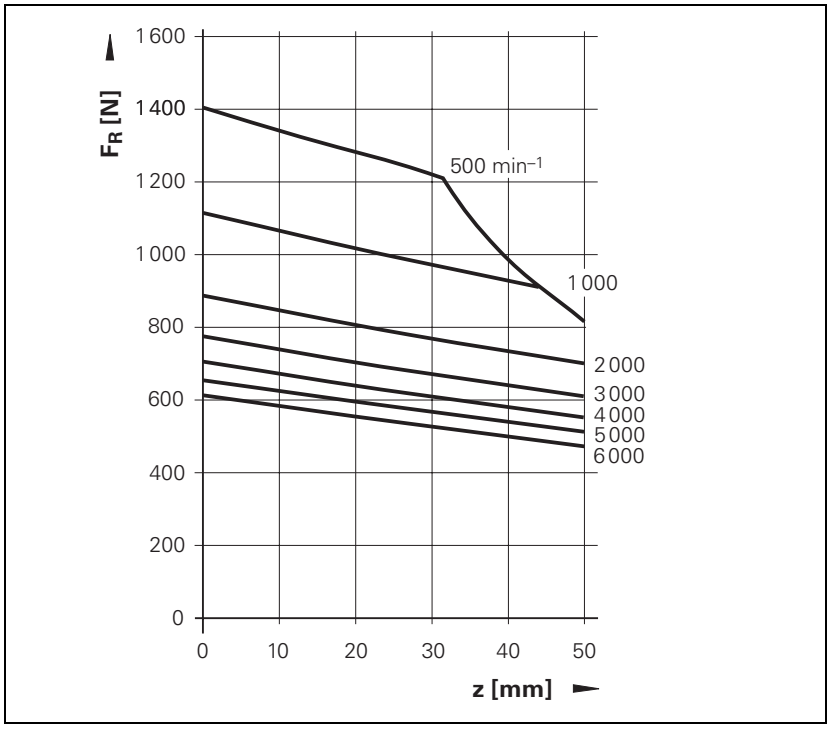

700
600
500
400
300
200
100
0
F_A [N]
0
1000
2000
3000
4000
5000
6000
n [min^{-1}]

Radial force F_R

The following diagrams show the max. permissible radial forces F_R for a bearing service life of 30 000 h.

Series QSY 10



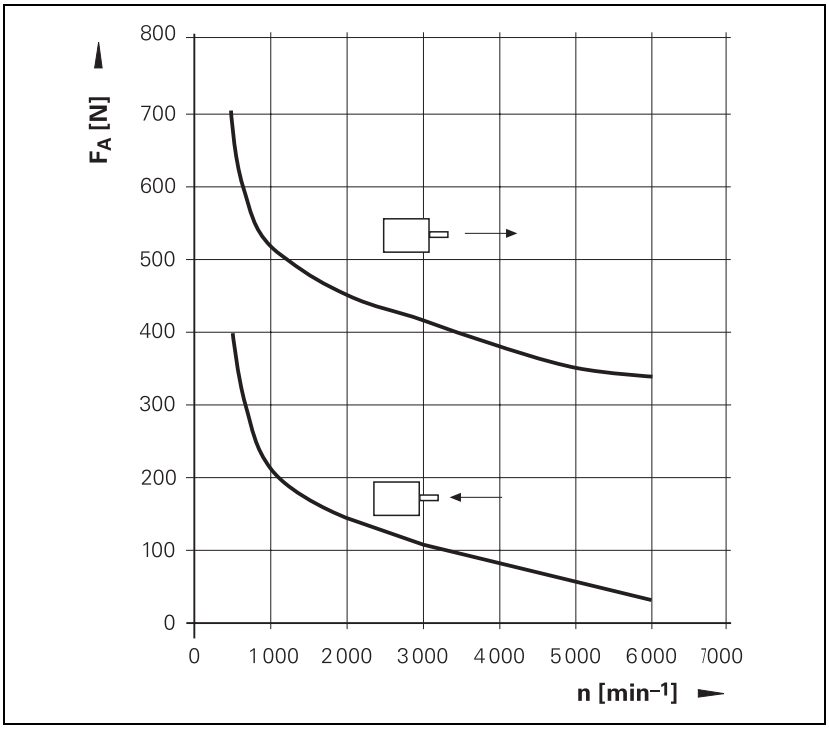

1 600
1 400
1 200
1 000
800
600
400
200
0
F_R [N]
500 min⁻¹
1 000
2 000
3 000
4 000
5 000
6 000
0
10
20
30
40
50
z [mm]

7.11.3 Permissible forces on the HEIDENHAIN synchronous motors QSY 96G, QSY 116 and QSY 155

Axial force F_A on QSY 96

The following diagrams show the max. permissible axial forces F_A for a bearing service life of 30 000 h.

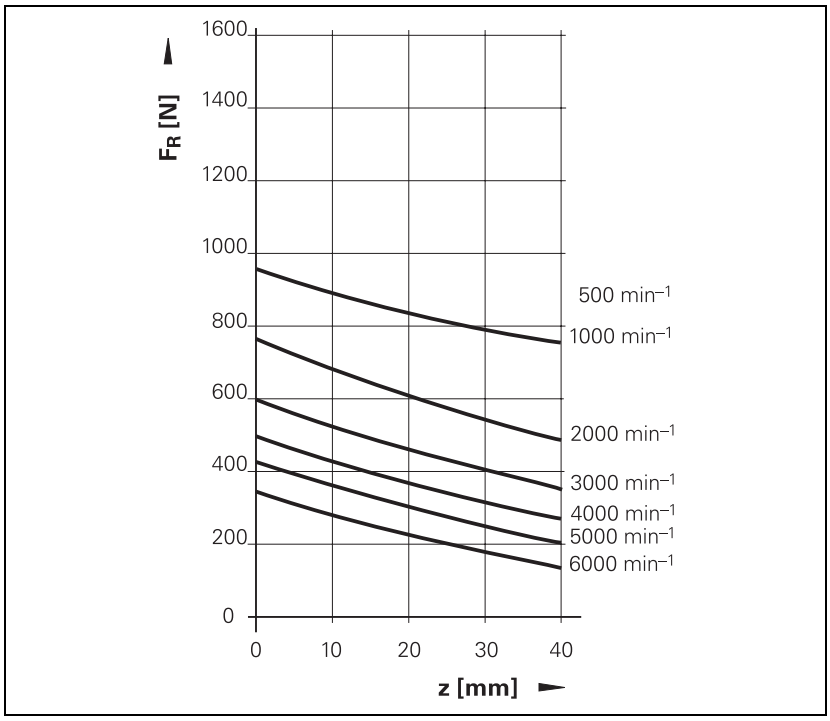
Series QSY 96



Radial force F_R on QSY 96

The following diagrams show the max. permissible radial forces F_R for a bearing service life of 30 000 h.

Series QSY 96



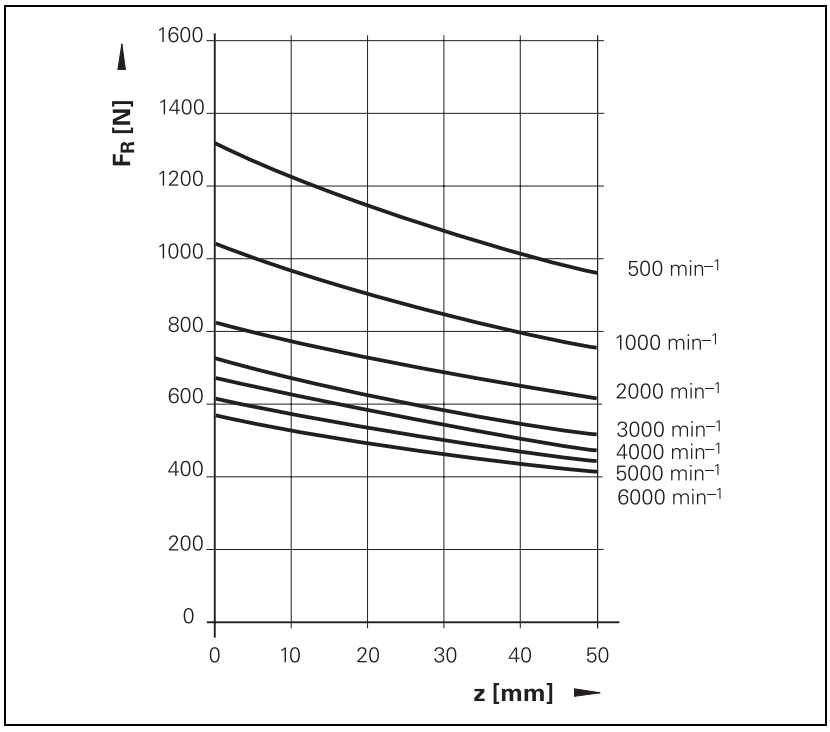
Combined load on QSY 116 and QSY 155

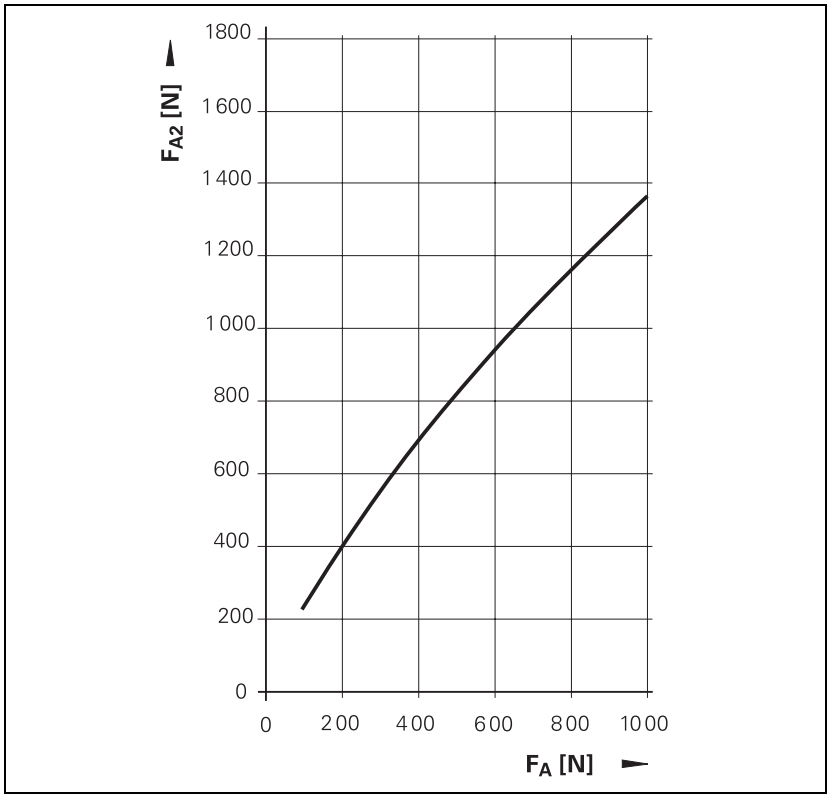
It is necessary to determine the combined load resulting from axial and radial forces for the HEIDENHAIN synchronous motors QSY 116 and QSY 155.

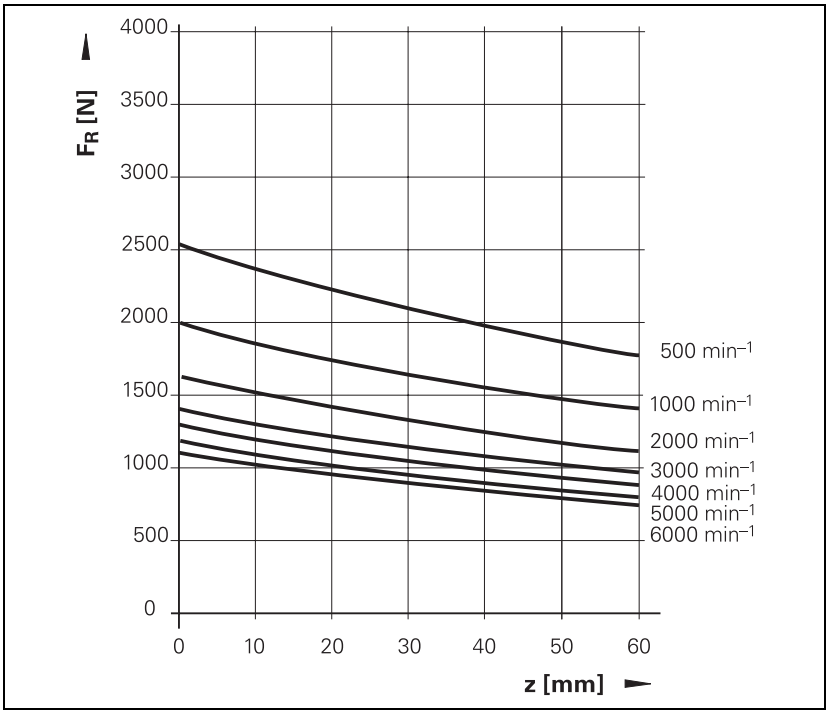
- Use the first diagram for determining the permissible radial force F_R in dependence on the distance z.
- Use the second diagram for determining the equivalent axial force F_{A2} in dependence on the applied axial force F_A, where the applied axial force F_A must not exceed 1000 N.
- Calculate the combined load F_{com} from the permissible radial force F_R and the equivalent axial force F_{A2}:

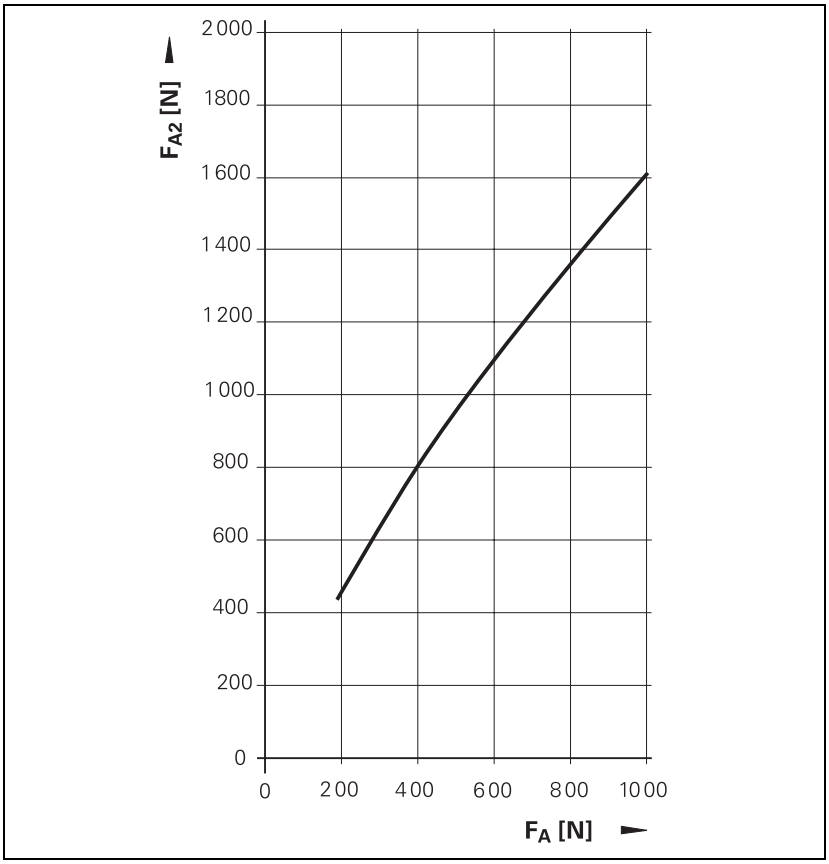
  $$F_{com} = (0{,}56 \cdot F_R) + F_{A2}$$

- The following conditions must be fulfilled:
  - The applied axial force F_A must not exceed 1000 N.
  - The applied radial force F_{Ra} must not exceed the permissible radial force F_R from the first diagram.
  - The combined load F_{com} must not exceed the permissible radial force F_R from the first diagram.


1600
1400
1200
1000
800
600
400
200
0
F_R [N]
0
10
20
30
40
50
z [mm]
500 min–1
1000 min–1
2000 min–1
3000 min–1
4000 min–1
5000 min–1
6000 min–1


1800
1 600
1 400
1 200
1 000
800
600
400
200
0
F_{A2} [N]
0
200
400
600
800
1000
F_A [N]


4000
3500
3000
2500
2000
1500
1000
500
0
F_R [N]
0
10
20
30
40
50
60
z [mm]
500 min^{-1}
1000 min^{-1}
2000 min^{-1}
3000 min^{-1}
4000 min^{-1}
5000 min^{-1}
6000 min^{-1}

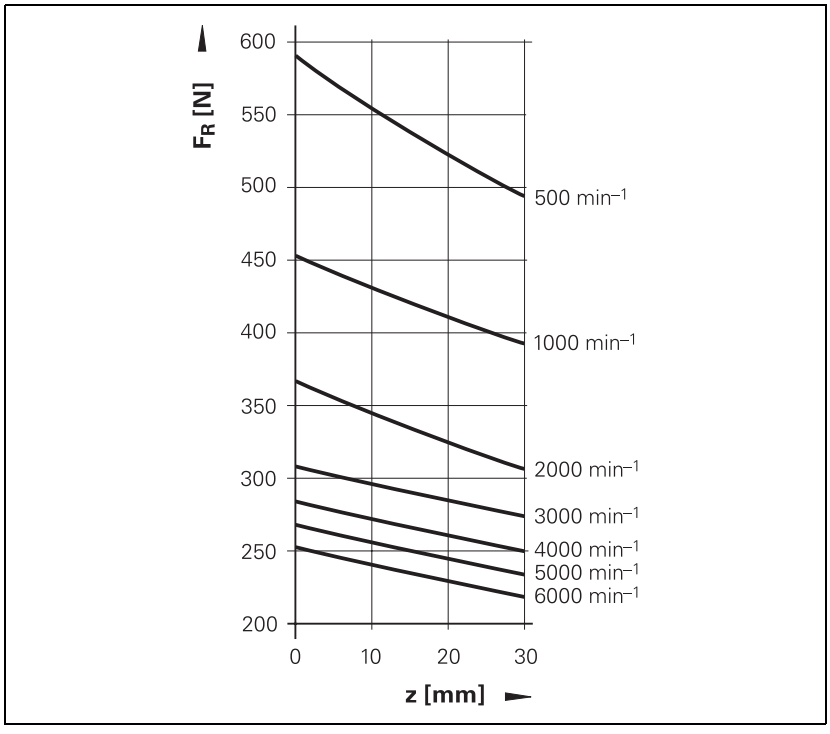

2 000
1800
1 600
1 400
1 200
1 000
800
600
400
200
0
F_{A2} [N]
0
200
400
600
800
1000
F_A [N]

7.11.4 Permissible forces on the HEIDENHAIN synchronous motors QSY 041B, QSY 071B, QSY 090B, QSY 093B and series QSY 112

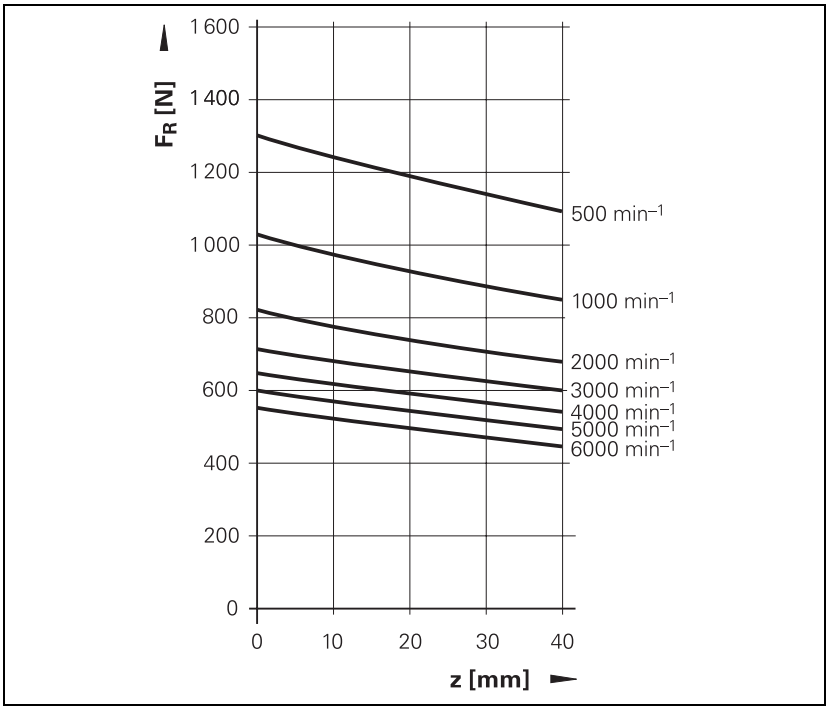
Axial force F_A $F_A = x \cdot F_R$

Motor	Factor x
QSY 041B	0.45
QSY 071B	0.55
QSY 090B	0.34
QSY 093B	0.24
QSY 112B	0.36
QSY 112C	0.35
QSY 112D	0.35

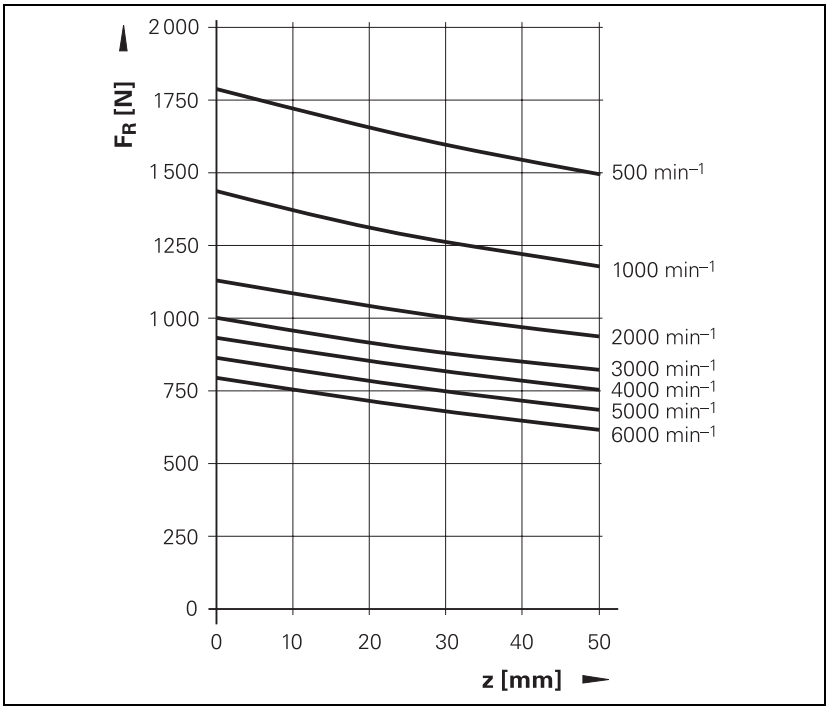
Radial force F_R **QSY 041B**



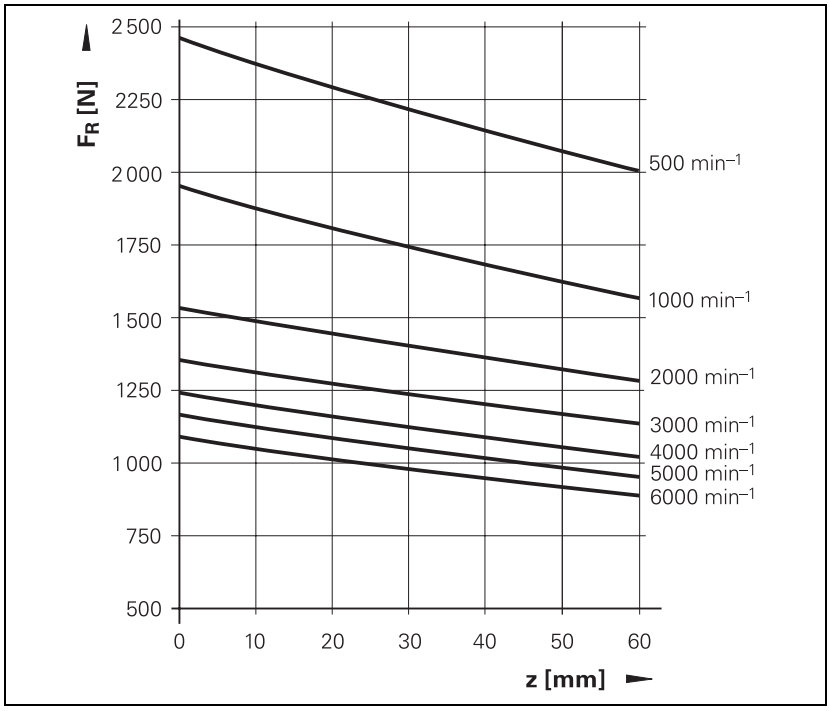
QSY 071B



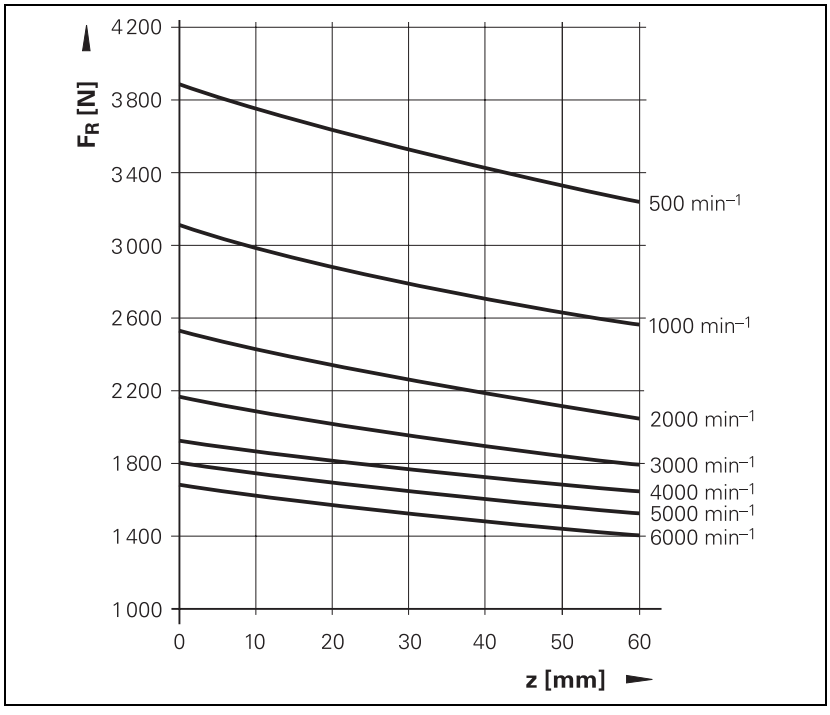
QSY 090B



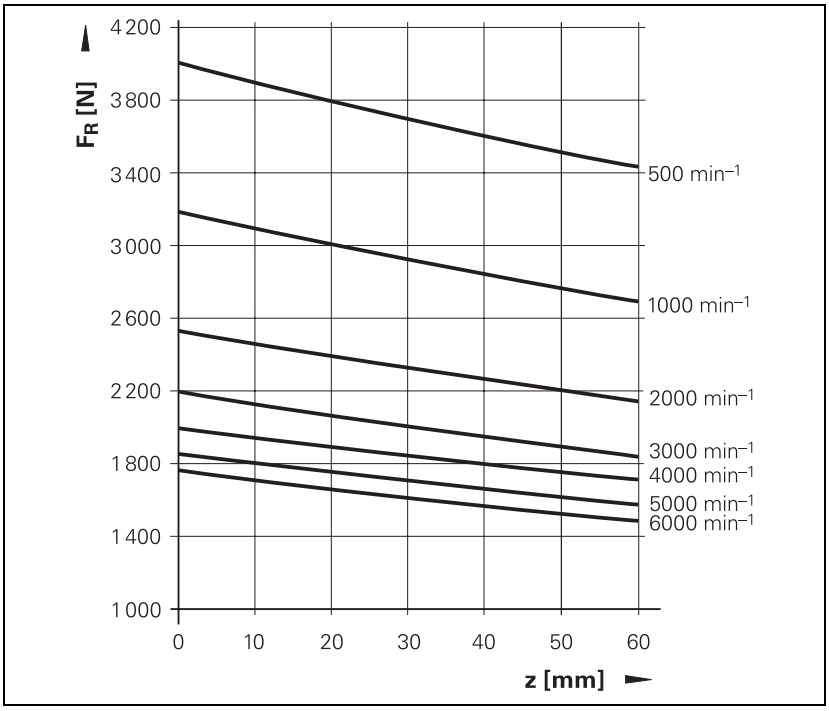
QSY 093B



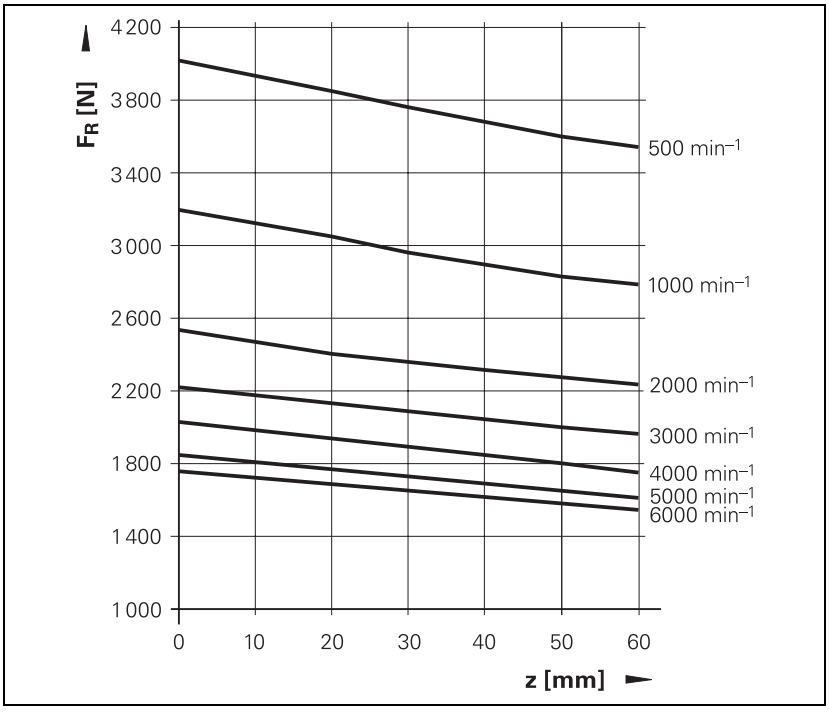
QSY 112B



QSY 112C



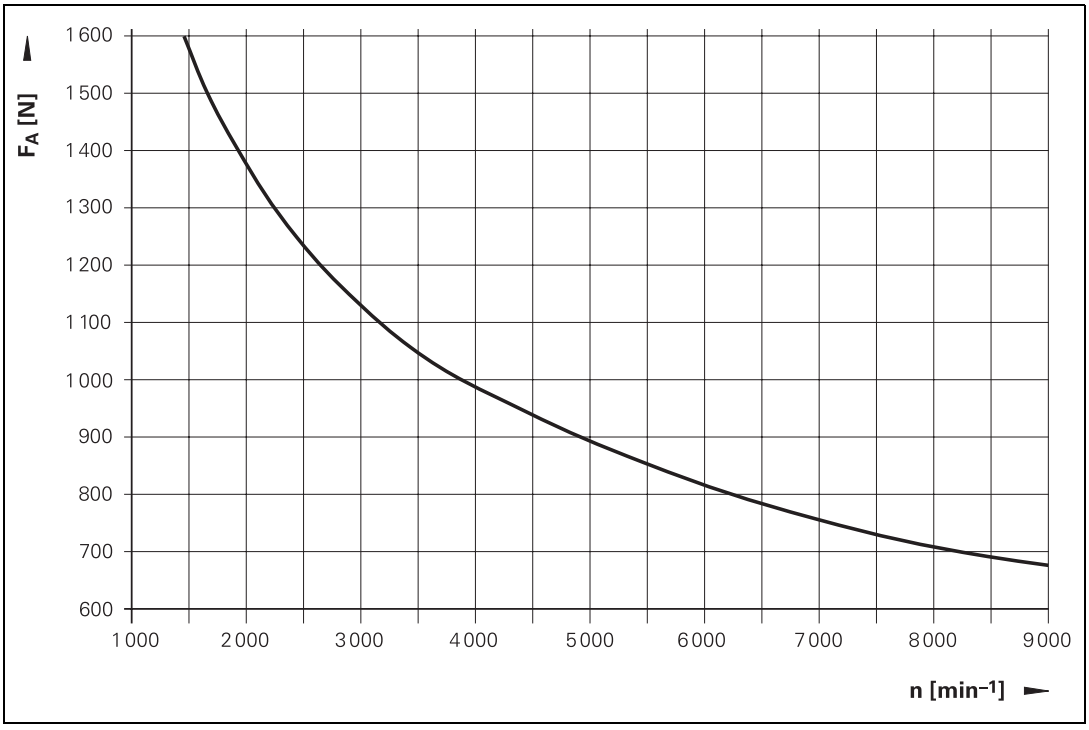
QSY 112D



7.11.5 Permissible forces on the HEIDENHAIN asynchronous motors QSY 30, QSY 4S

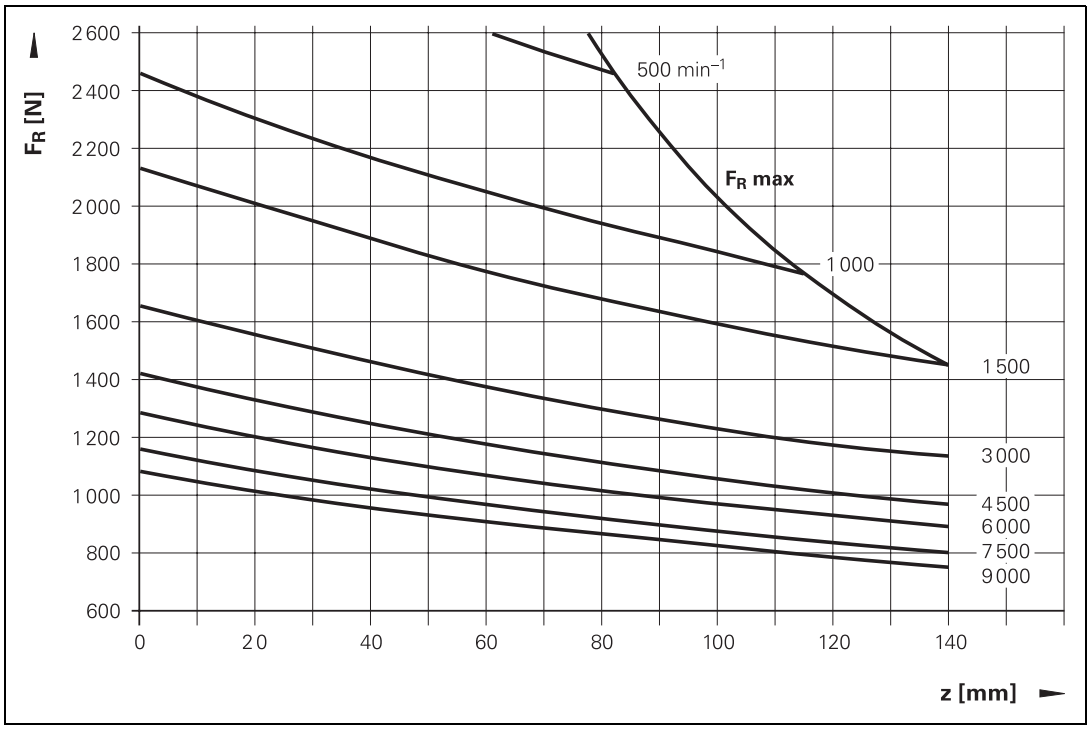
Axial force F_A

The following diagram shows the max. permissible axial force F_A with horizontal mounting and a bearing service life of 20 000 h. Axial load with vertical mounting upon request.



Radial force F_R

The following diagram shows the max. permissible radial force F_R at z = 30 mm for a bearing service life of 20 000 h.



7.11.6 Permissible forces on the HEIDENHAIN asynchronous motors QAN 104, QAN 134, QAN 164B

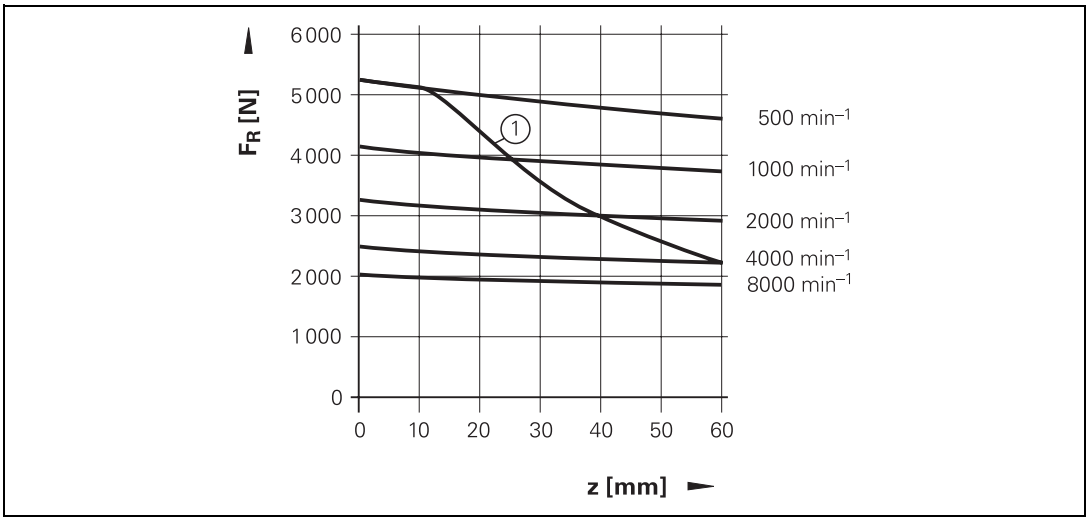
Axial force F_A

Series QAN 104, maximum permissible axial force: F_A = 30 N
Series QAN 134, QAN 164B, maximum permissible axial force: F_A = 50 N

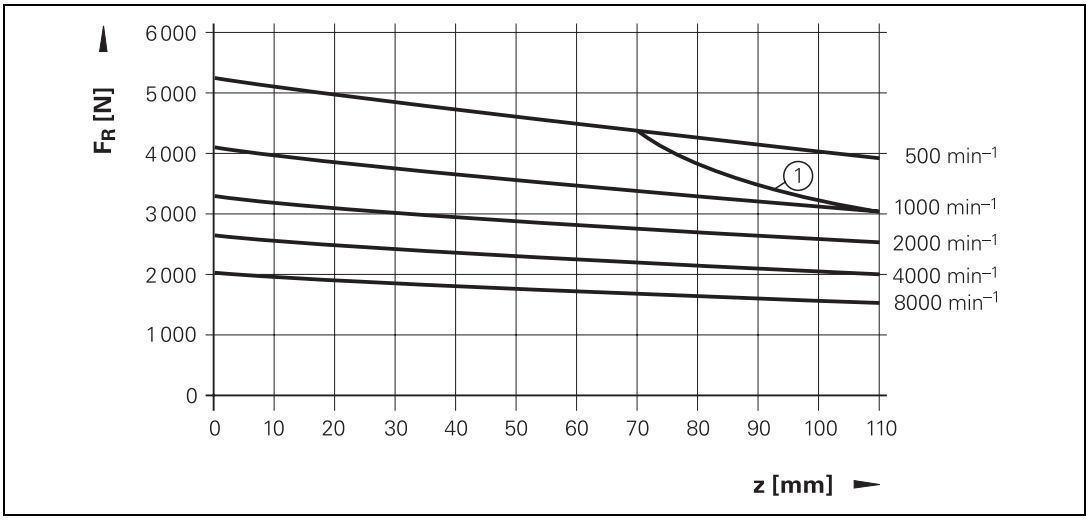
Radial force F_R

1 = load limit for drive shaft with feather key

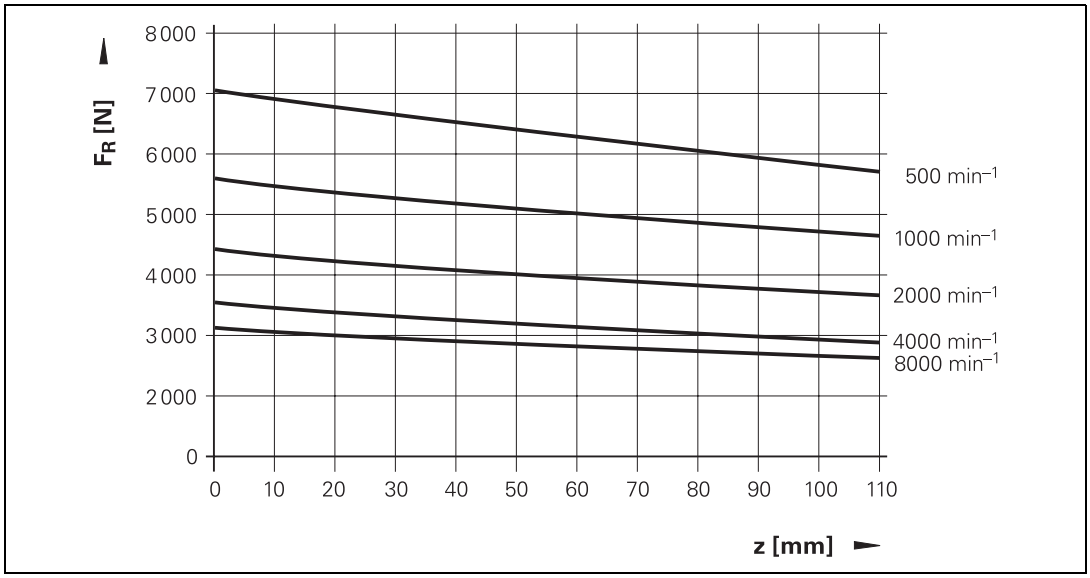
Series QSY 104



Series QSY 134



QAN 164B


8000
7000
6000
5000
4000
3000
2000
0
F_R [N]
0
10
20
30
40
50
60
70
80
90
100
110
z [mm]
500 min–1
1000 min–1
2000 min–1
4000 min–1
8000 min–1

7.12 Input values for the current controller

The following input values for the current controller of the TNC and MANUALplusM are start values and must be adjusted from case to case.

7.12.1 Synchronous motors

Motor	TNC MP2400.x	TNC MP2402.x	MANUALplusM MC_4x16	MANUALplusM MC_4x17
QSY 041B	45	0	45	0
QSY 1A	100	0	100	0
QSY 1C	100	0	100	0
QSY 1E	120	0	120	0
QSY 96A	150	0	150	0
QSY 96G	50	0	50	0
QSY 071B	45	0	45	0
QSY 116C	150	0	150	0
QSY 116E	100	0	100	0
QSY 116J	50	0	50	0
QSY 2C	80	0	80	0
QSY 2E-2000	80	0	80	0
QSY 2E-3000	80	0	80	0
QSY 2G-2000	100	0	100	0
QSY 2G-3000	45 to 60	0	45 to 60	0
QSY 155A	100	0	100	0
QSY 155B	50	0	50	0
QSY 155D	30	0	30	0
QSY 155F	30	0	30	0
QSY 090B-2000	70	0	70	0
QSY 090B-3000	55	0	55	0
QSY 093B	30	0	30	0
QSY 112B	10	0	10	0
QSY 112C	22	0	22	0
QSY 112D	35	0	35	0

7.12.2 Asynchronous motors

Motor	TNC 410 M, TNC 426 M (12 000 rpm) MP2401	MANUALplusM MC_4416	TNC 410 M, TNC 426 M (12 000 rpm) MP2403	MANUALplusM MC_4417
QAN 104B	30		70	
QAN 104C	25		60	
QAN 3M	15 to 20		45 to 60	
QAN 3L	10		50 to 70	
QAN 3U	10		30 to 45	
QAN 134B	25		50	
QAN 134C	15		50	
QAN 134D	10		50	
QAN 4S	8		25 to 40	
QAN 164B	10		30	

8 Subject Index

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1 Update Information No. 2

1.1 Compact inverter

- Length of ribbon cable delivered with the UE 2xxB changed

1.2 Modular Inverters

- New EPCOS 35 A line filter added for the regenerative UV 120 power supply unit
- New connections on the bottom of the UM 1xx power module. These connections are reserved for future applications and must not be wired.
- If disturbances in the line power supply net occur with the regenerative power supply units even though HEIDENHAIN commutating reactors and line filters are being used, the new three-phase current capacitor must be used.

1.3 Motors

- QSY 96A has been added
- Power and torque characteristic for QAN 134D has been added
- Machine parameters for the current controller for QAN 134D have been added
- New power cable with UL certification

1.4 Replacing Instructions

Page	Change	Remove Page	Insert Page
Title	New date of issue	August 99	February 2001
Chapter 1	Update Information	–	Update Info. 2
Chapter 2	■ Printing errors corrected ■ New Id. Nr. for the UE 2xxB ribbon cable ■ UE 2xxB power consumption corrected ■ EPCOS 35 A line filter added, FINMOTOR removed ■ Selection tables for ribbon cables and covers revised	Entire chapter	Entire chapter
Chapter 3	■ Printing errors corrected ■ Selection of the braking resistor	Entire chapter	Entire chapter
Chapter 4	■ Printing errors corrected ■ Demands of the line power supply ■ New three-phase current capacitor ■ PW 210 mounting instructions modified	Entire chapter	Entire chapter
Chapter 5	■ Printing errors corrected	Entire chapter	Entire chapter
Chapter 6	■ Printing errors corrected ■ EPCOS 35 A line filter added, FINMOTOR removed ■ Notes for connecting the motor brake ■ New connections for the power modules	Entire chapter	Entire chapter
Chapter 7	■ Printing errors corrected ■ Notes for connecting the motor brake ■ New power cable with UL certification ■ QSY 96A has been added ■ Terminal box illustration corrected ■ Rotatable flange sockets modified ■ Power and torque characteristic for QAN 134D has been added ■ Input values for the current controller on the QAN 134D have been added	Entire chapter	Entire chapter
Chapter 8	Subject Index	Entire chapter	Entire chapter