HEIDENHAIN

Technical Manual

Inverter Systems and Motors

for the Contouring Controls

TNC 410 M
TNC 426 M
TNC 430 M
iTNC 530
MANUALplusM
MANUALplus 4110
CNC PILOT 4290

July 2002

208 962-21 · 3 · 7/2002 · S · Printed in Germany · Subject to change without notice
(208 962-E3)

Foreword

This Technical Manual has been written for all machine tool manufacturers. It contains all of the information necessary for the mounting and electrical installation 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 can be perfect. To stay up to date, documentation must change constantly. It also thrives on your comments and suggestions for improvement. Please help us by sending us your ideas.

DR. JOHANNES HEIDENHAIN GmbH
E/P Department
Dr.-Johannes-Heidenhain-Str. 5
83301 Traunreut

1 Update Information No. 3

1.1 General Information

- New SM 110 voltage protection module for use with synchronous spindle motors
- Temperature sensor on the PW 1x0
- Double-row configuration of the HEIDENHAIN inverter system

1.2 Compact Inverters

- UE 241B no longer available
- New regenerative compact inverters
  - UR 230: Continuous load on axes: 2 x 7.5 A
    Continuous load on spindle: 25 A
  - UR 240: Continuous load on axes: 3 x 7.5 A
    Continuous load on spindle: 35 A
  - UR 242: Continuous load on axes: 3 x 7.5 A; 1 x 25 A
    Continuous load on spindle: 35 A
- New connections for controlling the motor brakes: X344, X392 and X393

1.3 Modular Inverter

- New UV 150 regenerative power supply unit with KDR 150 commutation reactor
  UV 150: DC-link full-load power: 50 kW
- New UM 115 power module
- New variants of the UV 1xx power units
- Current consumptions from the 15-V and 24-V power supply of the inverter system must be inspected
- New connections for controlling the motor brakes: X344 and X392

1.4 Motors

- QSY 96, QSY 116, QSY 155 with EQN 1325 absolute multiturn rotary encoder
- New QSY 155B synchronous motors with n_N = 2000 rpm and QSY 155C

Designation	Stall torque M_0	Rated speed n_N
QSY 155B	13 Nm	2000 rpm
QSY 155C	17.7 Nm	3000 rpm

- Input values for the digital current controller

1.5 Replacing Instructions

Page	Change	Remove Page	Insert Page
Title	New date of issue	February 99	July 2002
Chapter 1	Update Information	–	Update Info. 3
Chapter 2	■ Printing errors corrected ■ UE 241 B removed ■ UR 2xx, UV 150, KDR 150 and UM 115 added ■ Continuous load and short term rating for different PWM frequencies ■ Peak performances for 0.2 s ■ Current consumption of the 15-V and 24-V supply ■ Covers included in the items supplied with the compact inverters ■ Selection tables for ribbon cables and covers revised ■ SM 110 voltage protection module added ■ Double-row configuration of inverter systems	Entire chapter	Entire chapter
Chapter 3	■ Performance overview of a drive system added	Entire chapter	Entire chapter
Chapter 4	■ Note on radio interferences ■ Cross sections of the power cables ■ HEIDENHAIN recommends use of the three-phase current capacitor ■ Note on leakage current	Entire chapter	Entire chapter
Chapter 5	■ Printing errors corrected ■ UE 241B removed ■ UR 2xx added ■ New connections for controlling the motor brakes: X344, X392 and X393 ■ Line fuse for UE 2xx, UV 102, UE 2xxB ■ Temperature switch on the PW 110B ■ Additional voltage to X70, X71, X72 ■ Tightening torque of the electrical screw connections added ■ Dimensions only in mm	Entire chapter	Entire chapter
Chapter 6	■ New connections for controlling the motor brakes: X344 and X392 ■ Printing errors corrected ■ Line fuse for UV 1x0 ■ Temperature switch on the PW 110B ■ Additional voltage to X70, X71, X72 ■ Tightening torque of the electrical screw connections added ■ Dimensions only in mm	Entire chapter	Entire chapter

Page	Change	Remove Page	Insert Page
Chapter 7	■ Printing errors corrected ■ Bend radii of the power and encoder cables ■ Calculation of the maximum torque of a drive ■ Pin layout for speed encoders with EnDat interface ■ Note on differences between internal connections, ID label and motor tables of QAN 30 and QAN 4S ■ Power modules for QAN 3M: UM 111B, UM 121B ■ Turning radius for connectors changed ■ Incorrect assignment for the fan connection on QAN 104 and QSY 112D ■ QSY 96, QSY 116, QSY 155 with EQN 1325 absolute multiturn rotary encoder added ■ QSY 155B (n_N = 2000 rpm) and QSY 155C added ■ Specifications for QSY 155B revised ■ Characteristic curves revised ■ Bearing service life for QSY 041B, QSY 071B, QSY 090B, QSY 093B and QSY 112 series ■ Bearing service life for QAN 104, QAN 134 and QAN 164B ■ Dimensions only in mm ■ Input values for the digital current controller	Entire chapter	Entire chapter
Chapter 8	Keyword index	Entire chapter	Entire chapter

2 Introduction

2 Introduction

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 TNC 4xx M contouring controls, as well as the controls equipped with a CC 42x controller unit.

You will find the specifications for the controls in the corresponding Technical Manuals.

2.2 Designations of the Inverters and Motors

Designation	Device
UE 2xx	Non-regenerative compact inverter for up to 4 axes and spindle (internal PWM interfaces)
UE 2xxB	Non-regenerative compact inverter for up to 4 axes and spindle (external PWM interfaces), an additional UM 111 power module can be connected
UR 2xx	Regenerative compact inverter for up to 4 axes and spindle, an additional UM 111 power module can be connected
UV 102	Power supply unit for operating the LE 426M with the UE 2xx compact inverter (old)
PW 210	Braking resistor without fan
PW 110(B), PW 120	Braking resistor with fan
UV 130	Non-regenerative power module of the modular inverter system
UV 120, UV 140, UV 150	Energy-recovery power modules of the modular inverter system
KDR 120, KDR 140, KDR 150	Commutating reactors for the UV 120, UV 140 and UV 150 energy-recovery power modules
Line filters	Line filters for the UV 120, UV 140 and UV 150 energy-recovery power modules
UP 110	UP 110 braking resistor module for the modular inverter system with regenerative power supply.
UM 1xx (B)	Power module for the modular inverter system for up to 2 axes or spindle
SM 110	Voltage protection module for synchronous motors
QSY	Synchronous motor
QAN	Asynchronous motor

2.3 Compact Inverters

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

2.3.1 Components of the Compact Inverter

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

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

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

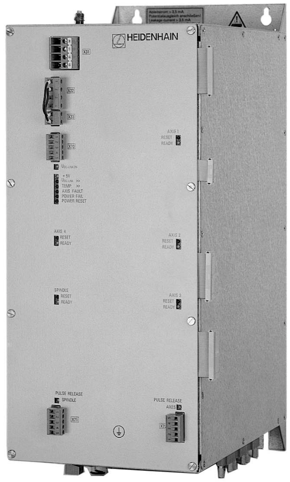
- UE 2xxB Compact inverter
- If required, PW 210 (or PW 110(B), PW 120) braking resistor
- Toroidal cores
- One UM 111 power module (optional)
- Ribbon cables for PWM signals and supply voltage (and optional unit bus)
- Covers for the ribbon cables

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

- UR 2xx compact inverter
- KDR 120 commutating reactor
- EPCOS 35 A line filter
- If required, UP 110 braking resistor module
- 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 control 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.



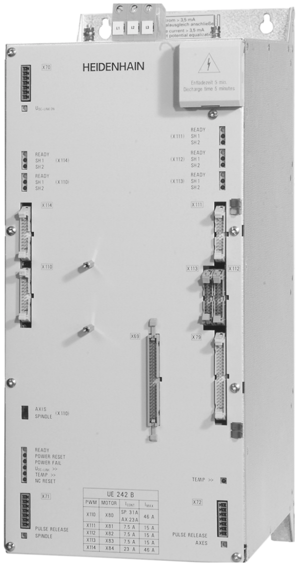
UE 212

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. 40 % cyclic duration factor for duration of 10 minutes (S6-40 %) or for 0.2 s at standstill
b. 0.4 % cyclic duration factor for duration of 120 s

2.3.3 UE 2xxB and UR 2xx Compact Inverters

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



UE 242 B

Specifications	UE 210B (non-regenerative)		UE 211B (non-regenerative)		
	3 axes	**Spindle/Axis**	**2 axes**	**1 axis**	**Spindle/Axis**
Power supply	400 Vac ±10 % (50 Hz to 60 Hz)				
dc-link voltage	565 Vdc (at 400 V power supply)				
DC-link power Rated power Peak power[a] Peak power[b]	 15 kW 23 kW 40 kW		 15 kW 23 kW 40 kW		
Power loss	Approx. 475 W		Approx. 525 W		
Continuous load at a PWM frequency of 3333 Hz 4000 Hz 5000 Hz 6666 Hz 8000 Hz 10000 Hz	9.0 A 8.3 A 7.5 A 6.4 A 5.3 A 4.5 A	24.5 A/18.4 A 22.5 A/16.9 A 20.0 A/15.0 A 17.0 A/12.8 A 14.5 A/10.9 A 12.0 A/9.0 A	9.0 A 8.3 A 7.5 A 6.4 A 5.3 A 4.5 A	18.4 A 16.9 A 15.0 A 12.8 A 10.9 A 9.0 A	24.5 A/18.4 A 22.5 A/16.9 A 20.0 A/15.0 A 17.0 A/12.8 A 14.5 A/10.9 A 12.0 A/9.0 A
Short-time load[c] at a PWM frequency of 3333 Hz 4000 Hz 5000 Hz 6666 Hz 8000 Hz 10000 Hz	 15.0 A 15.0 A 15.0 A 12.8 A 10.6 A 9.0 A	 30.0 A 30.0 A 30.0 A 25.5 A 21.8 A 18.0 A	 15.0 A 15.0 A 15.0 A 12.8 A 10.6 A 9.0 A	 30.0 A 30.0 A 30.0 A 25.6 A 21.8 A 18.0 A	 30.0 A 30.0 A 30.0 A 25.5 A 21.8 A 18.0 A
Continuous power of the integral braking resistor	1 kW		1 kW		
Peak power of the integral braking resistor[d]	23 kW		23 kW		
Degree of protection	IP 20		IP 20		
Weight	Approx. 20 kg		Approx. 20 kg		
ID number	337 042-xx		337 043-xx		

a. 40% cyclic duration factor for duration of 10 minutes (S6-40%)
b. 0.2 s cyclic duration factor for duration of 5 s
c. 40 % cyclic duration factor for duration of 10 minutes (S6-40 %) or for 0.2 s at standstill
d. 0.4 % cyclic duration factor for duration of 120 s

Specifications	UE 212B (non-regenerative)			UE 230B (non-regenerative)	
	3 axes	**1 axis**	**Spindle/Axis**	**2 axes**	**Spindle/Axis**
Power supply	400 Vac ±10 % (50 Hz to 60 Hz)				
dc-link voltage	565 Vdc (at 400 V power supply)				
DC-link power Rated power Peak power[a] Peak power[b]	 15 kW 23 kW 40 kW			 22 kW 30 kW 45 kW	
Power loss	Approx. 595 W			Approx. 520 W	
Continuous load at a PWM frequency of 3333 Hz 4000 Hz 5000 Hz 6666 Hz 8000 Hz 10000 Hz	9.0 A 8.3 A 7.5 A 6.4 A 5.3 A 4.5 A	18.4 A 16.9 A 15.0 A 12.8 A 10.9 A 9.0 A	24.5 A/18.4 A 22.5 A/16.9 A 20.0 A/15.0 A 17.0 A/12.8 A 14.5 A/10.9 A 12.0 A/9.0 A	9.0 A 8.3 A 7.5 A 6.4 A 5.3 A 4.5 A	38.0 A/28.2 A 35.0 A/26.0 A 31.0 A/23.0 A 26.0 A/19.3 A 22.5 A/16.7 A 19.0 A/14.1 A
Short-time load[c] at a PWM frequency of 3333 Hz 4000 Hz 5000 Hz 6666 Hz 8000 Hz 10000 Hz	 15.0 A 15.0 A 15.0 A 12.8 A 10.6 A 9.0 A	 30.0 A 30.0 A 30.0 A 25.6 A 21.8 A 18.0 A	 30.0 A 30.0 A 30.0 A 25.5 A 21.8 A 18.0 A	 15.0 A 15.0 A 15.0 A 12.8 A 10.6 A 9.0 A	 46.0 A 46.0 A 46.0 A 38.6 A 33.4 A 28.2 A
Degree of protection	IP 20			IP 20	
Weight	Approx. 23 kg			Approx. 23 kg	
ID number	337 044-xx			337 038-xx	

a. 40% cyclic duration factor for duration of 10 minutes (S6-40%)
b. 0.2 s cyclic duration factor for duration of 5 s
c. 40 % cyclic duration factor for duration of 10 minutes (S6-40 %) or for 0.2 s at standstill

Specifications	UE 240B (non-regenerative)		UE 242B (non-regenerative)		
	2 axes	Spindle/Axis	3 axes	1 axis	Spindle/Axis
Power supply	400 Vac ±10 % (50 Hz to 60 Hz)				
dc-link voltage	565 Vdc (at 400 V power supply)				
DC-link power					
Rated power	22 kW		22 kW		
Peak power[a]	30 kW		30 kW		
Peak power[b]	45 kW		45 kW		
Power loss	Approx. 520 W		Approx. 770 W		
Continuous load at a PWM frequency of					
3333 Hz	9.0 A	38.0 A/28.2 A	9.0 A	28.2 A	38.0 A/28.2 A
4000 Hz	8.3 A	35.0 A/26.0 A	8.3 A	26.0 A	35.0 A/26.0 A
5000 Hz	7.5 A	31.0 A/23.0 A	7.5 A	23.0 A	31.0 A/23.0 A
6666 Hz	6.4 A	26.0 A/19.3 A	6.4 A	19.3 A	26.0 A/19.3 A
8000 Hz	5.3 A	22.5 A/16.7 A	5.3 A	16.7 A	22.5 A/16.7 A
10000 Hz	4.5 A	19.0 A/14.1 A	4.5 A	14.1 A	19.0 A/14.1 A
Short-time load[c] at a PWM frequency of					
3333 Hz	15.0 A	46.0 A	15.0 A	46.0 A	46.0 A
4000 Hz	15.0 A	46.0 A	15.0 A	46.0 A	46.0 A
5000 Hz	15.0 A	46.0 A	15.0 A	46.0 A	46.0 A
6666 Hz	12.8 A	38.6 A	12.8 A	38.6 A	38.6 A
8000 Hz	10.6 A	33.4 A	10.6 A	33.4 A	33.4 A
10000 Hz	9.0 A	28.2 A	9.0 A	28.2 A	28.2 A
Degree of protection	IP 20		IP 20		
Weight	Approx. 23 kg		Approx. 23 kg		
ID number	337 039-xx		337 041-xx		

a. 40% cyclic duration factor for duration of 10 minutes (S6-40%)
b. 0.2 s cyclic duration factor for duration of 5 s
c. 40 % cyclic duration factor for duration of 10 minutes (S6-40 %) or for 0.2 s at standstill

Specifications	UR 230 (regenerative)	
	2 axes	Spindle/Axis
Power supply	400 Vac ±10 % (50 Hz to 60 Hz)	
dc-link voltage	650 Vdc	
DC-link power Rated power Peak power[a] Peak power[b]	 22 kW 30 kW 40 kW	
Power loss	Approx. 680 W	
Continuous load at a PWM frequency of 3333 Hz 4000 Hz 5000 Hz 6666 Hz 8000 Hz 10000 Hz	9.0 A 8.3 A 7.5 A 6.4 A 5.3 A 4.5 A	30.5 A 28.5 A 25.0 A 21.0 A 18.0 A 15.5 A
Short-time load[c] at a PWM frequency of 3333 Hz 4000 Hz 5000 Hz 6666 Hz 8000 Hz 10000 Hz	 15.0 A 15.0 A 15.0 A 12.8 A 10.6 A 9.0 A	 50.0 A 50.0 A 50.0 A 42.0 A 36.0 A 31.0 A
Degree of protection	IP 20	
Weight	Approx. 22.5 kg	
ID number	362 593-xx	

a. 40% cyclic duration factor for duration of 10 minutes (S6-40%)
b. 0.2 s cyclic duration factor for duration of 5 s
c. 40 % cyclic duration factor for duration of 10 minutes (S6-40 %) or for 0.2 s at standstill

Specifications	UR 240 (regenerative)		UR 242 (regenerative)		
	3 axes	**Spindle/Axis**	**3 axes**	**1 Axis/ Spindle**	**Spindle/Axis**
Power supply	400 Vac ±10 % (50 Hz to 60 Hz)				
dc-link voltage	650 Vdc				
DC-link power Rated power Peak power[a] Peak power[b]	 22 kW 30 kW 40 kW		 22 kW 30 kW 40 kW		
Power loss	Approx. 750 W		Approx. 930 W		
Continuous load at a PWM frequency of 3333 Hz 4000 Hz 5000 Hz 6666 Hz 8000 Hz 10000 Hz	 9.0 A 8.3 A 7.5 A 6.4 A 5.3 A 4.5 A	 42.5 A/30.4 A 39.5 A/28.3 A 35.0 A/25.0 A 29.5 A/21.1 A 25.0 A/17.9 A 21.5 A/15.4 A	 9.0 A 8.3 A 7.5 A 6.4 A 5.3 A 4.5 A	 30.5 A 28.5 A 25.0 A 21.0 A 18.0 A 15.5 A	 42.5 A/30.4 A 39.5 A/28.3 A 35.0 A/25.0 A 29.5 A/21.1 A 25.0 A/17.9 A 21.5 A/15.4 A
Short-time load[c] at a PWM frequency of 3333 Hz 4000 Hz 5000 Hz 6666 Hz 8000 Hz 10000 Hz	 15.0 A 15.0 A 15.0 A 12.8 A 10.6 A 9.0 A	 50.0 A 50.0 A 50.0 A 42.1 A 35.7 A 30.7 A	 15.0 A 15.0 A 15.0 A 12.8 A 10.6 A 9.0 A	 50.0 A 50.0 A 50.0 A 42.0 A 36.0 A 31.0 A	 50.0 A 50.0 A 50.0 A 42.1 A 35.7 A 30.7 A
Degree of protection	IP 20		IP 20		
Weight	Approx. 22.5 kg		Approx. 22.5 kg		
ID number	367 558-xx		367 559-xx		

a. 40% cyclic duration factor for duration of 10 minutes (S6-40%)
b. 0.2 s cyclic duration factor for duration of 5 s
c. 40 % cyclic duration factor for duration of 10 minutes (S6-40 %) or for 0.2 s at standstill

Changes to the UE 2xxB	
337 xxx-02	First issue UE 2xxB
337 xxx-03	Only UE 230B and UE 24xB: New connections for motor brakes and sliding switches

Changes to UR 230	
362 593-02	Initial version

Changes to UR 24x	
367 55x-02	First issue UR 24x

2.3.4 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

2.3.5 Toroidal Cores

To suppress occurrence of interference, toroidal cores must be mounted in the motor leads, in the voltage supply lead and in 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)
Axes 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 for UE 21x

2.3.6 Ribbon Cables and Covers (Only for UE 2xxB, UR 2xx)

50-line ribbon cable (power supply to the control)

The 50-line ribbon cable connects the UE 2xxB or UR 2xx to the control and is responsible for the power supply. It is available as an accessory with the compact inverter (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 control with the PWM connections on the compact inverter. One 20-line ribbon cable is required for each axis/spindle. The 20-line ribbon cables for the connections on the compact inverter 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 compact inverter.

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 them against interference.

The covers for the LE 4xx M and CC 42x are supplied with the LE 4xx M and CC 42x, respectively.
The cover for the compact inverter is included in the standard set (197.5 mm, Id. Nr. 325 808-07).
The plastic lateral termination cap has the Id. Nr. 325 810-01.

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 Inverter

2.4.1 Components of the Modular Inverter

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

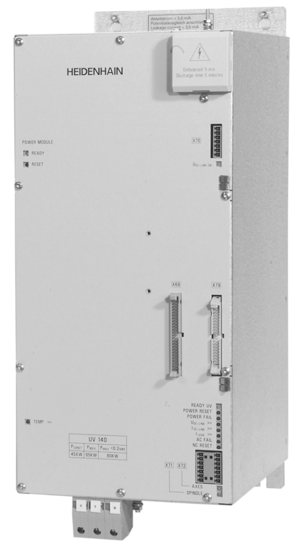
- UV 130 Power Supply Unit
- UM 1xx power modules, depending on version
- PW 210 (or PW 110(B), PW 120) braking resistor
- Ribbon cables for PWM signals, unit bus and power supply
- Covers for the ribbon cables

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

- UV 120, UV 140 or UV 150 power supply unit
- KDR 120, KDR 140 or KDR 150 commutating reactor
- Line filters
- If required, UP 110 braking resistor module
- UM 1xx (B) 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 control 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(B) 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 (regenerative)**	**UV 130 (non-regenerative)**	**UV 140 (regenerative)**	**UV 150 (regenerative)**
Power supply	400 Vac ±10 % (50 Hz to 60 Hz)			
DC-link power Rated power Peak power[a] Peak power[b]	 22 kW 30 kW 40 kW	 30 kW 40 kW 50 kW	 45 kW 65 kW 80 kW	 50 kW 75 kW 110 kW
Power loss	Approx. 300 W	Approx. 140 W	Approx. 570 W	Approx. 640 W
dc-link voltage	650 Vdc	565 Vdc (with 400 V power voltage)	650 Vdc	650 Vdc
Current consumption[c] 15 V 24 V	 270 mA/ 310 mA	 240 mA 410 mA	 380 mA 310 mA	 350 mA 540 mA
Degree of protection	IP 20			
Weight	Approx. 12.0 kg	Approx. 9.8 kg	Approx. 20.0 kg	Approx. 20.0 kg
ID number	344 504-xx	324 998-xx	335 009-xx	361 170-xx

a. 40% cyclic duration factor for duration of 10 minutes (S6-40%)
b. 0.2 s cyclic duration factor for duration of 5 s
c. After making your selection, check the current consumption of the 25-V and 24-V supply of the entire modular inverter system. See page 2 - 24.

Changes to UV 120	
344 504-01	Initial version
344 504-02	Power supply revised (grounding safety)

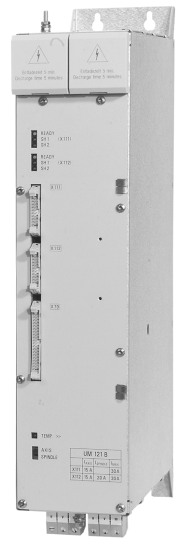
Changes to UV 130	
324 998-01	Initial version
324 998-02	Modification
324 998-03	Modification

Changes to UV 140	
335 009-01	Initial version
335 009-02	Modification
335 009-03	Power supply revised (grounding safety)

Changes to UV 150	
361 170-02	Initial version

2.4.3 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 control via external 20-line ribbon cables.



UM 121B

Specifications	UM 111	UM 111B		UM 112	
	Axis	**Axis**	**Spindle**	**Axis**	**Spindle**
Continuous load at a PWM frequency of 3333 Hz 4000 Hz 5000 Hz 6666 Hz 8000 Hz 10000 Hz	 9.0 A 8.3 A 7.5 A 6.4 A 5.3 A 4.5 A	 18.4 A 16.9 A 15.0 A 12.8 A 10.9 A 9.0 A	 24.5 A 22.5 A 20.0 A 17.0 A 14.5 A 12.0 A	 28.2 A 26.0 A 23.0 A 19.3 A 16.7 A 14.1 A	 38.0 A 35.0 A 31.0 A 26.0 A 22.5 A 19.0 A
Short-time load[a] at a PWM frequency of 3333 Hz 4000 Hz 5000 Hz 6666 Hz 8000 Hz 10000 Hz	 15.0 A 15.0 A 15.0 A 12.8 A 10.6 A 9.0 A	 30.0 A 30.0 A 30.0 A 25.6 A 21.8 A 18.0 A		 46.0 A 46.0 A 46.0 A 38.6 A 33.4 A 28.2 A	
Power loss	Approx. 70 W	Approx. 120 W	Approx. 160 W	Approx. 180 W	Approx. 270 W
Current consumption[b] 15 V 24 V	 120 mA 60 mA	 150 mA 170 mA		 170 mA 170 mA	
Degree of protection	IP 20	IP 20		IP 20	
Weight	Approx. 5.5 kg	Approx. 5.5 kg		Approx. 9 kg	
ID number	325 000-xx	336 948-xx		325 001-xx	

a. 40 % cyclic duration factor for duration of 10 minutes (S6-40 %) or for 0.2 s at standstill

b. After making your selection, check the current consumption of the 25-V and 24-V supply of the entire modular inverter system. See page 2 - 24.

Specifications	UM 113		UM 114		UM 115	
	Axis	**Spindle**	**Axis**	**Spindle**	**Axis**	**Spindle**
Continuous load at a PWM frequency of						
3333 Hz						
4000 Hz	39.0 A	61.0 A	58.6 A	91.5 A	85.4 A	122.0 A
5000 Hz	36.2 A	56.5 A	54.4 A	85.0 A	79.1 A	113.0 A
6666 Hz	32.0 A	50.0 A	48.0 A	75.0 A	70.0 A	100.0 A
8000 Hz	26.9 A	42.0 A	40.3 A	63.0 A	58.5 A	84.0 A
10000 Hz	23.0 A	36.0 A	34.6 A	54.0 A	50.4 A	72.0 A
	19.5 A	30.5 A	29.4 A	46.0 A	42.7 A	61.0 A
Short-time load[a] at a PWM frequency of						
3333 Hz						
4000 Hz	64.0 A		96.0 A		140.0 A	
5000 Hz	64.0 A		96.0 A		140.0 A	
6666 Hz	64.0 A		96.0 A		140.0 A	
8000 Hz	53.8 A		80.6 A		117.6 A	
10000 Hz	46.0 A		69.2 A		100.8 A	
	39.0 A		58.8 A		85.4 A	
Power loss	Approx. 280 W	Approx. 430 W	Approx. 420 W	Approx. 650 W	Approx. 610 W	Approx. 870 W
Current						
consumption[b]	170 mA		250 mA		270 mA	
15 V	250 mA		420 mA		420 mA	
24 V						
Degree of protection	IP 20		IP 20		IP 20	
Weight	Approx. 9.0 kg		Approx. 12.0 kg		Approx. 19.0 kg	
ID number	325 002-xx		325 005-xx		359 385-xx	

a. 40 % cyclic duration factor for duration of 10 minutes (S6-40 %) or for 0.2 s at standstill

b. After making your selection, check the current consumption of the 25-V and 24-V supply of the entire modular inverter system. See page 2 - 24.

Specifications	UM 121	UM 121B[a]		UM 122[a]	
	Axes	Axis	Spindle	Axis	Spindle
Continuous load at a PWM frequency of 3333 Hz 4000 Hz 5000 Hz 6666 Hz 8000 Hz 10000 Hz	 9.0 A 8.3 A 7.5 A 6.4 A 5.3 A 4.5 A	 18.4 A 16.9 A 15.0 A 12.8 A 10.9 A 9.0 A	 24.5 A 22.5 A 20.0 A 17.0 A 14.5 A 12.0 A	 28.2 A 26.0 A 23.0 A 19.3 A 16.7 A 14.1 A	 38.0 A 35.0 A 31.0 A 26.0 A 22.5 A 19.0 A
Short-time load[b] at a PWM frequency of 3333 Hz 4000 Hz 5000 Hz 6666 Hz 8000 Hz 10000 Hz	 15.0 A 15.0 A 15.0 A 12.8 A 10.6 A 9.0 A	 30.0 A 30.0 A 30.0 A 25.6 A 21.8 A 18.0 A		 46.0 A 46.0 A 46.0 A 38.6 A 33.4 A 28.2 A	
Power loss	Approx. 140 W	2 axes: Approx. 240 W 1 axis, 1 spindle: Approx. 280 W		2 axes: Approx. 360 W 1 axis, 1 spindle: Approx. 450 W	
Current consumption[c] 15 V 24 V	 120 mA 60 mA	 150 mA 170 mA		 170 mA 170 mA	
Degree of protection	IP 20	IP 20		IP 20	
Weight	Approx. 5.5 kg	Approx. 5.5 kg		Approx. 9.0 kg	
ID number	325 000-xx	336 948-xx		325 001-xx	

a. for this power module only the lower PWM connection can be used to control the spindle
b. 40 % cyclic duration factor for duration of 10 minutes (S6-40 %) or for 0.2 s at standstill
c. After making your selection, check the current consumption of the 25-V and 24-V supply of the entire modular inverter system. See page 2 - 24.

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

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

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

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

Changes to UM 115	
359 385-01	Initial version

2.4.4 Current Consumption of the Entire Inverter System

The current consumption by the power modules from the 15-V and 24-V supply unit strongly depends on their performance. If several high-performance power modules are used, the maximum permissible current for the supply unit can be exceeded. Therefore the current consumption must be controlled separately for the 15-V and 24-V supply units, especially when the UV 150 is used with a UM 115. The intrinsic needs of the supply unit must also be taken into account. The current consumption of the individual components is listed in the specifications table.

The following limit values apply:

- 15-V supply unit: Max. 1.5 A
- 24-V supply unit: Max. 2.0 A

If the total current consumption exceeds **one** limit value, please contact HEIDENHAIN.

Example:

Device	15 V power supply	24 V power supply
UV 140	0.38 A	0.31 A
UM 114	0.25 A	0.42 A
UM 121B	0.25 A	0.17 A
UM 121	0.20 A	0.21 A
UM 111	0.12 A	0.06 A
Total	1.20 A	1.17 A

2.4.5 Ribbon cables and covers

50-line ribbon cable (power supply to the control)

The 50-line ribbon cable connects the UV 1x0 with the control and serve as voltage supply. This cable is only required once.

Ribbon cable length	ID number
300 mm	325 816-01
400 mm	325 816-02
500 mm	325 816-03
600 mm[a]	325 816-04
700 mm[a]	325 816-05
800 mm[a]	325 816-06

a. With lengths of 600 mm and longer, the ribbon cable is led doubled to increase the line cross section.

How to select the cable length:

- Add the widths of all modules (including UP 110) between
  - UV 1x0 and LE 4xx M or CC 42x
  - UV 1x0 and UV 105
- Select the next-longer cable length, unless there is an exact match.

20-line ribbon cable (PWM signals)

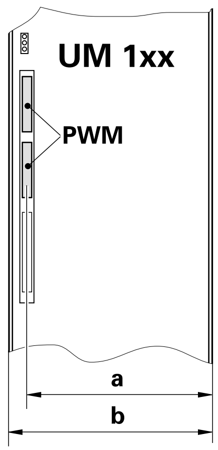
The 20-line ribbon cable connects the PWM outputs of the control with the corresponding UM 1xx power modules. One 20-line ribbon cable is required for each axis or spindle.

Ribbon cable length	ID number
100 mm	250 479-07
200 mm	250 479-08
300 mm	250 479-09
400 mm	250 479-10
500 mm	250 479-11
600 mm	250 479-12
700 mm	250 479-13

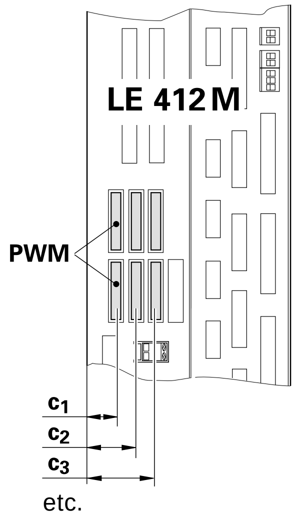
How to select the cable length:

- See the table for distance *a* of the PWM input on the power module.
- Add the widths *b* of all modules (including UP 110 and UV 105) between the corresponding power module and the LE 4xx M or CC 42x.
- Then add the distance c_n of the PWM output on the LE 4xx M or CC 42x.
- Select the next-longer cable length, unless there is an exact match.

Power module	Distance *a*	Module width *b*
UM 111, UM 121	Approx. 40 mm	50 mm
UM 111B, UM 121B	Approx. 85 mm	100 mm
UM 112, UM 113, UM 114, UM 122	Approx. 90 mm	100 mm
UM 115	Approx. 140 mm	150 mm



	c_1	c_2	c_3	c_4	c_5	c_6
LE 4xx M	22 mm	36 mm	50 mm	64 mm	–	–
LE 4xx M	27 mm	41 mm	55 mm	69 mm	83 mm	–
CC 422/6 control loops	22 mm	38 mm	55 mm	–	–	–
CC 422/10 control loops	28 mm	42 mm	56 mm	71 mm	82 mm	–
CC 422/12 control loops	28 mm	42 mm	56 mm	71 mm	82 mm	94 mm
CC 424/6 control loops	22 mm	38 mm	55 mm	72 mm	89 mm	–



40-line ribbon cable (unit bus)

The 40-line ribbon cable connects the UV 1x0 with all of the UM 1xx power modules (and the UP 110 braking resistor module, if present), making the unit bus. This cable is only required once.

Ribbon cable length	ID number
300 mm	325 817-01
400 mm	325 817-02
500 mm	325 817-03
600 mm	325 817-04
700 mm	325 817-05

How to select the cable length:

▶ Add the widths of all modules (including UP 110) between

- UV 1x0 and LE 4xx M or CC 42x
- UV 1x0 and UV 105

▶ Select the next-longer cable length, unless there is an exact match.

Ribbon cable covers

The ribbon cables must be covered to protect them 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 115 (width 150 mm) **or**
- One UM 1xx (width 100 mm) and one UM 1xx (width 50 mm)

The covers for the LE 4xx M and CC 42x are supplied with the LE 4xx M and CC 42x, respectively.

If further power modules and the UP 110 resistor module are used, the corresponding covers must be ordered separately:

Width of the cover	ID number
50 mm	329 031-05
100 mm	329 031-10
150 mm	329 031-15
200 mm	329 031-20

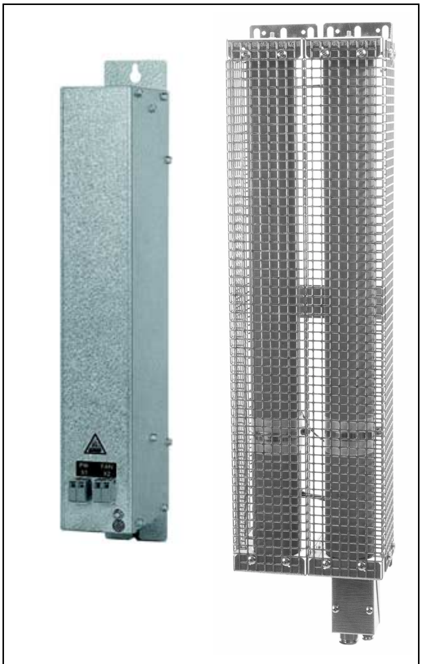
How to select the covers:

- Add the widths of all modules (including UP 110) between
  - UV 1x0 and LE 4xx M or CC 42x
  - UV 1x0 and UV 105
- Subtract 150 mm from this total width (cover included with the UV 1x0).
- Select the appropriate cover from the table in order to cover the remaining width.

2.5 Accessories for Compact Inverters and Modular Inverters

2.5.1 PW 210, PW 110(B), PW 120 Braking Resistor

The PW braking resistors convert the energy fed back into the dc-link during braking into heat.
The PW 110(B) and PW 120 have a cooling fan, the PW 210 cools only through heat radiation.
Either one PW x10(B) or two PW 120 switched in series can be connected to the UE 2xx compact inverters.
Either one PW 210, one PW 1x0(B) 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 110B	PW 120
Continuous power	2 kW	4 kW
Peak power[a]	27 kW	49 kW
Power consumption by the 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	348 945-01	333 000-01

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

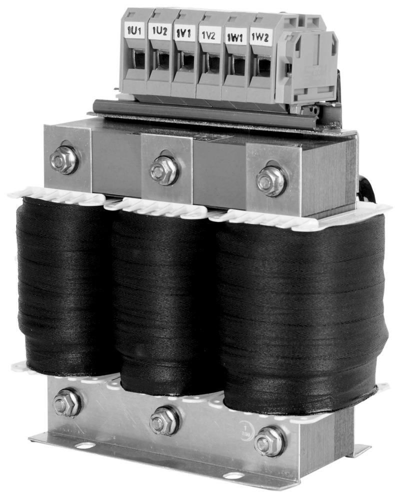
Changes to PW 110	
313 511-01	Initial version
348 945-01	Temperature switch added (PW 110B)

Danger

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

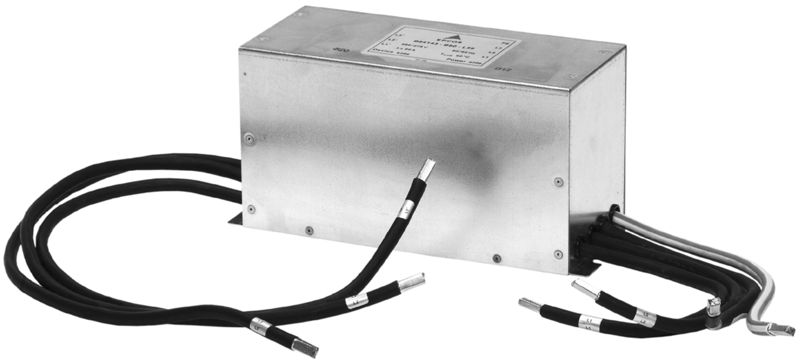
2.5.2 KDR 1x0 commutating reactor and line filter

The UV 120, UV 140 and UV 150 power recovery modules, as well as the UR 2xx compact inverters, must be connected to the main power line via the KDR 140 commutating reactor and the line filter. This is necessary for keeping the main line free of disruptive higher harmonics.



KDR 140

Specifications	**KDR 120**	**KDR 140**	**KDR 150**
Rated voltage	3 x 400 V	3 x 400 V	3 x 400 V
Rated frequency	50 Hz/60 Hz	50 Hz/60 Hz	50 Hz/60 Hz
Rated current	3 x 35 A	3 x 70 A	3 x 80 A
Power loss	Approx. 200 W	Approx. 340 W	Approx. 350 W
Degree of protection	IP 00	IP 00	IP 00
Weight	Approx. 11 kg	Approx. 22 kg	Approx. 23 kg
ID number	344 505-01	333 068-01	355 253-01

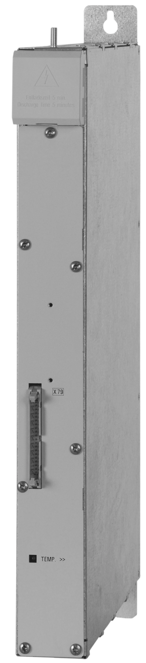


EPCOS 80 A line filter

Specifications	EPCOS 35 A line filter	EPCOS 80 A line filter
suitable for	UV 120	UV 140, UV 150
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

2.5.3 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

2.5.4 SM 110 Voltage Protection Module

When operating synchronous motors in a field weakening range (for example, as main spindle drives), the voltage can increase at the motor power connections if the power supply is interrupted. This increased voltage can damage the inverters. The voltage protection module is installed between the motor and die inverters, and in case of an error, it short-circuits the motor phases. The released braking energy is converted into heat.

The dimension of the SM 110 can be found on Page 6–49.

SM 110

Warning

The maximum cable length between the SM 110 and the inverter is 2 m.

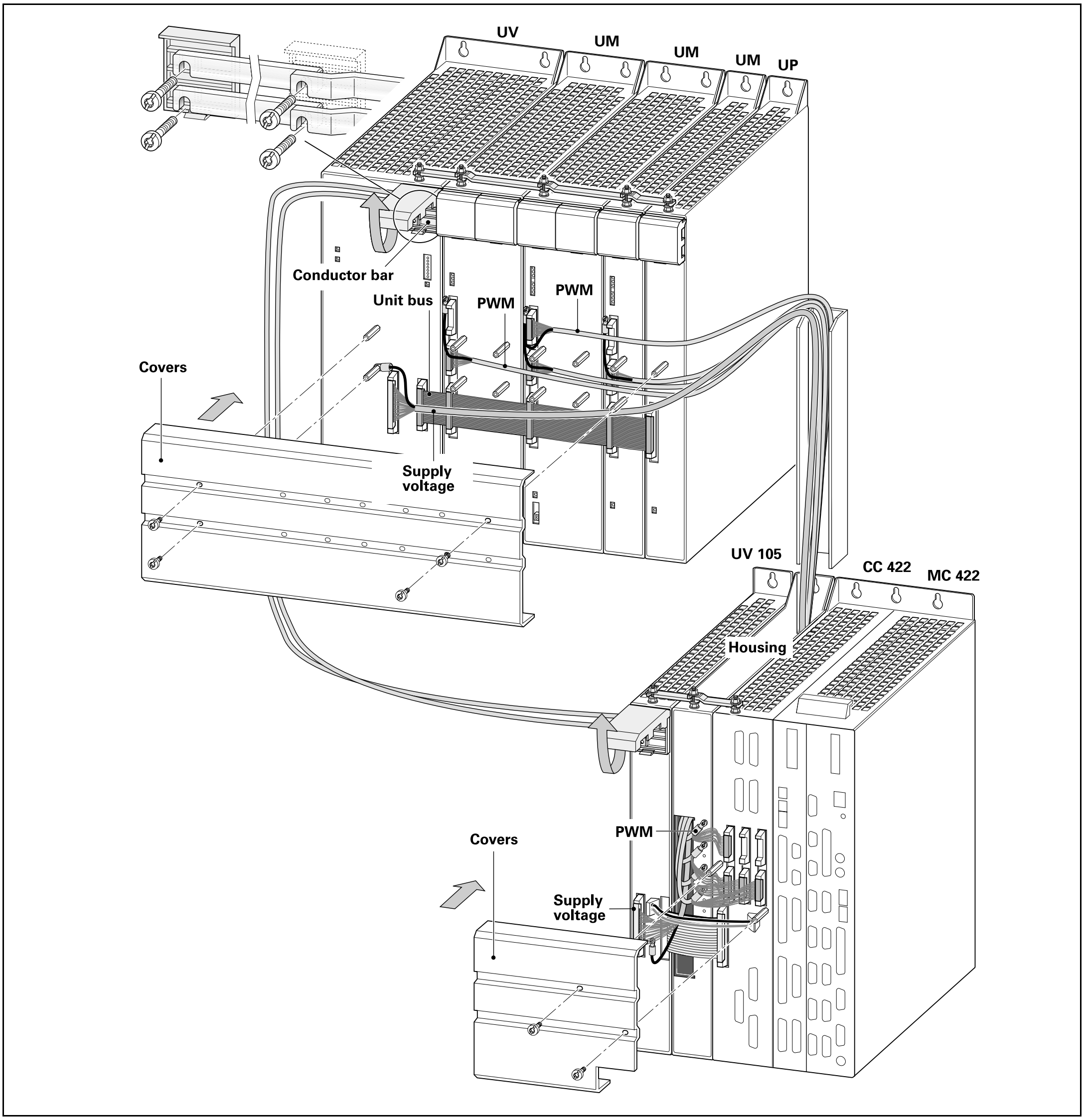
Specifications	**SM 110**
Maximum phase current	3 x 63 A
Maximum braking time at maximum phase current	10 s
Minimum duration between braking procedures	5 min
Degree of protection	IP 20
Weight	Approx. 2.1 kg
ID number	368 453-01

2.5.5 Double-Row Configuration of HEIDENHAIN Components

The inverter components connected to the LE 4xx M or CC 42x can be set up in a double-row configuration with the installation kit.
The installation kit includes the housing, covers for the cable, a grounding bar and the screws for the shielded connections of the round cables. The dc-link voltage can be led from one row to another with two leads.

Note

Due to the heat generated by the inverter components, the separation between the two rows should be at least 250 mm.

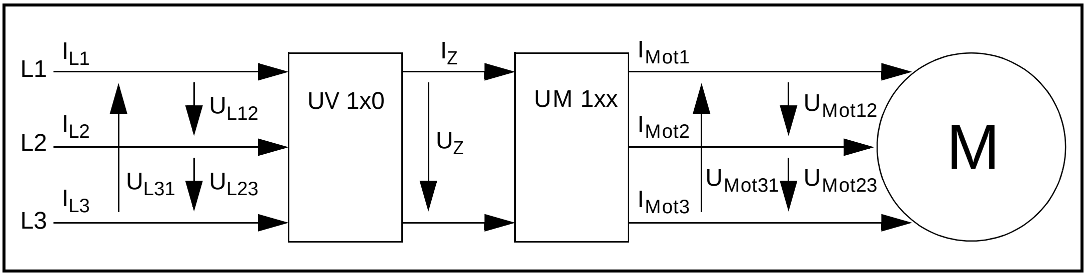


Components	ID number
Installation kit	361 452-01
PWM cable (round)	360 888-xx
Cable for supply voltage (round)	361 508-xx
Blue lead for dc-link voltage	365 691-xx
Red lead for dc-link voltage	365 692-xx

3 Selection of Motors and Inverters

3 Selection of Motors and Inverters

3.1 Performance Overview of a Complete Drive System



Power assumed by the power supply: $P_L = \sqrt{3} \cdot U_{L12} \cdot I_{L1}$

DC-link power: $P_Z = U_Z \cdot I_Z$

Power fed into the motor: $P_{Mot.\,el.} = \sqrt{3} \cdot U_{Mot12} \cdot I_{Mot1} \cdot \cos\varphi$

Power supplied by the motor: $P_{Mot} = P_{Mot.\,el.} \cdot \eta_{Mot}$

3.2 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
- Preselection of the motor according to
  - Stall torque of the motor ≥ static moment
  - Rated speed of the motor ≥ desired speed
- Preselection of the inverter according to
  - Rated current of the inverter ≥ continuous stall current 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}: Continuous 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]

3.3 Selection of the Spindle Motor

Procedure

- Selection of the spindle motor for required torque and speed

3.4 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]

3.5 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

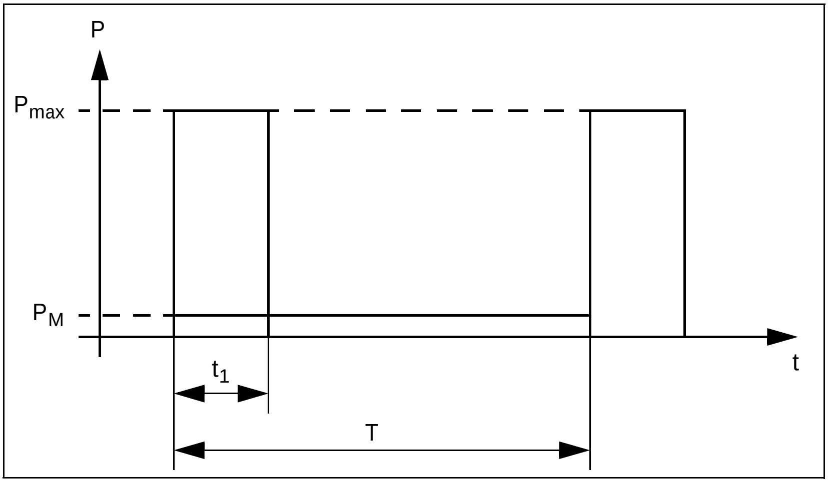
Mathematical formulas for calculation

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	$P_{Br} \le P_{max}$ $P_M \le P_{Mzul}$ $E_{Br} \le E_{max}$	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 – 12) 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:

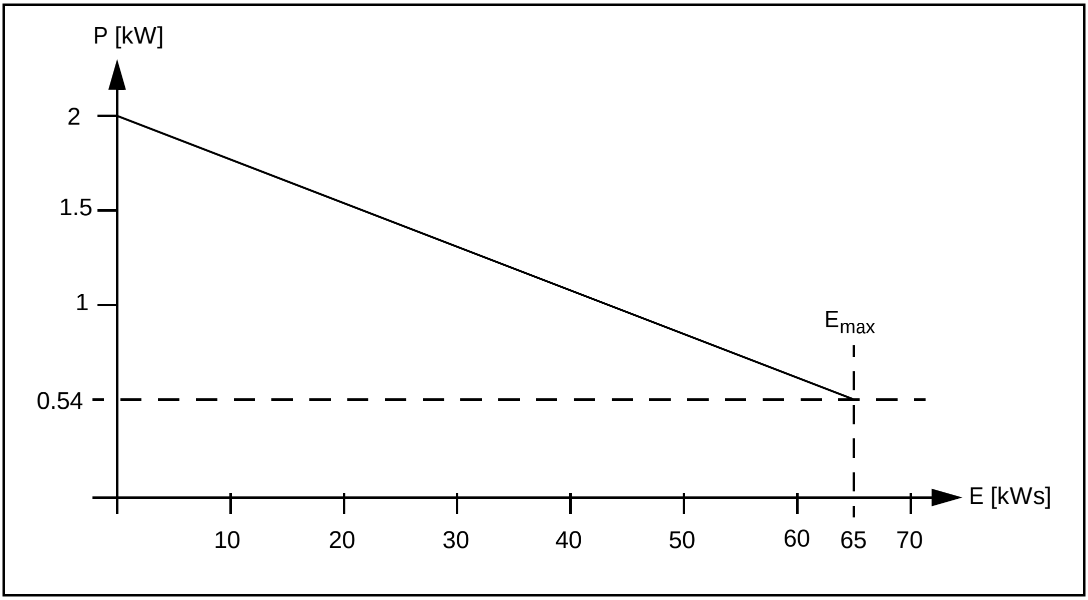
$$P_M = P_{max} \cdot \frac{t_1}{T}$$



PW 210

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

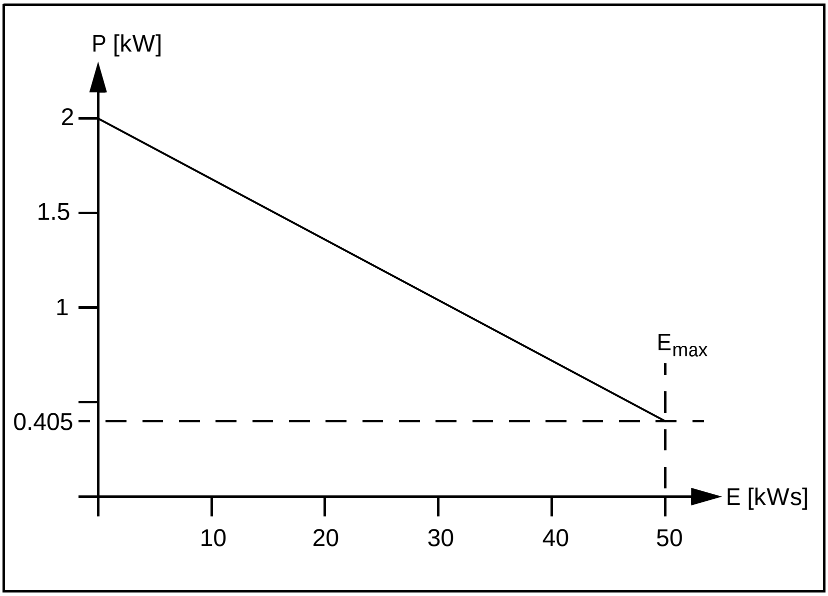
Permissible mean value of the braking performance P_{Mzul} as a function of the braking energy E:



PW 110(B)

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

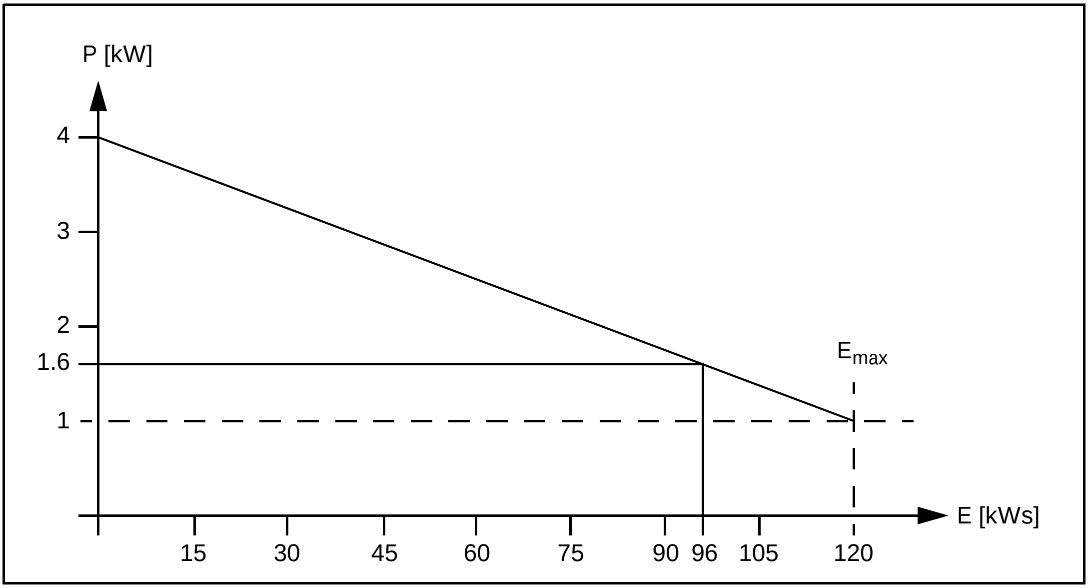
Permissible mean value of the braking performance P_{Mzul} as a function of the braking energy E:



PW 120

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 Intended area of application

Warning

Availability of this product is limited according to IEC 61800-3. This product can cause radio interferences in residential areas. This would require the operator to ensure that appropriate measures are taken.

4.1.2 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, UR 2xx	IP 20
PW 1x0(B), PW 210	IP 20
UV 102	IP 20
UV 120, 130, 140	IP 20
KDR 120, 140	IP 00
Line filters	IP 20
UP 110	IP 20
UM 1xx	IP 20
QAN asynchronous motors	IP 54
QSY synchronous motors	IP 65 (shaft bore: IP 64)

4.1.3 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 only genuine HEIDENHAIN cables, connectors and couplings
- The shield of the line 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.
- **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 braking resistor (only with UE 21x), to suppress interference (system perturbation in accordance with EN 55011 / 55022 class A).
- **Only with modular inverters, UE 2xxB and UR 2xx:** 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

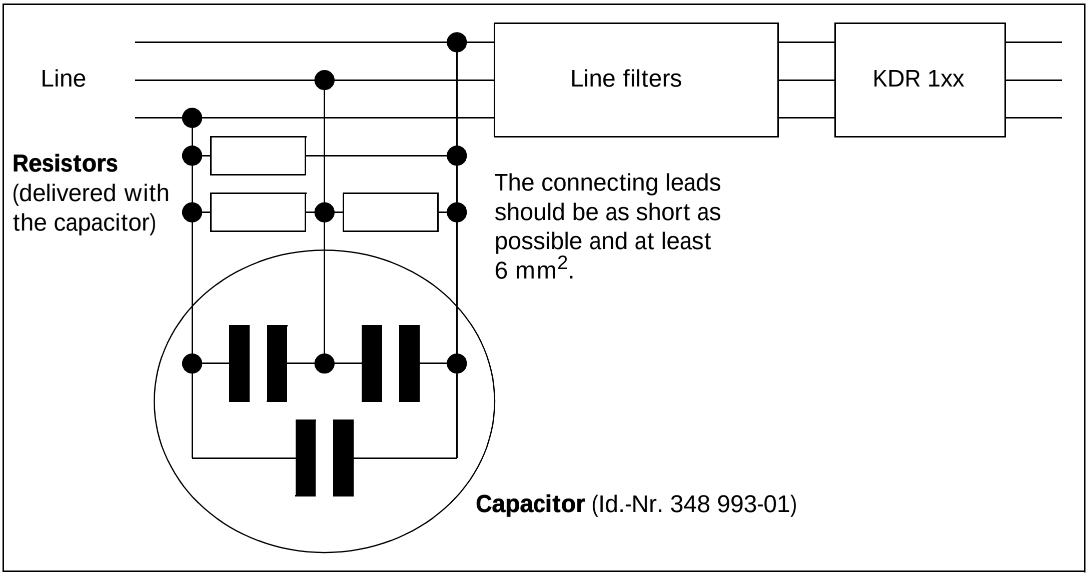
When using the UV 120, UV 140 and UV 150 regenerative power supply units as well as the UR 2xx regenerative compact inverters, you **must** use the HEIDENHAIN KDR 1x0 commutating reactors, as well as the EPCOS 35 A or 80 A line filters.
High-frequency disturbances in the line power may occur with other commutating reactors or line filters.

Using the three-phase current capacitor

In order to avoid disturbances in the line power even though HEIDENHAIN commutating reactors and line filters are being used, HEIDENHAIN recommends using the three-phase current capacitor 3 x 24.1 µF/525 V (Id. Nr. 348 993-01). You will find the overall dimensions on page 6 – 44.

Three-phase current capacitor

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, UR 2xx	$I_{SC} = 50 * I_N = 1600$ A	$S_K = 1.10$ MVA
UV 140	$I_{SC} = 50 * I_N = 3300$ A	$S_K = 2.15$ MVA
UV 150	$I_{SC} = 50 * I_N = 4000$ A	$S_K = 2.6$ 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 or UV 150 power supply units are 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	$U_K \leq 3$ %
UV 150	$S_N \geq 65$ kVA	$U_K \leq 3$ %

Note

Type A and type AC fault-current circuit breakers may not be used.

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, UR 2xx	$S_N \geq 28.5$ kVA
UV 130	$S_N \geq 44$ kVA
UV 140	$S_N \geq 58.3$ kVA
UV 150	$S_N \geq 65$ kVA

4.1.4 Cross Sections of the Power Cables

IEC 204-1 is valid for the dimensions of leads and 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
  - C_1 = 0.91 for +45 °C
  - C_1 = 0.82 for +50 °C
  - C_1 = 0.71 for +55 °C
- Correction factor C_2 = 1.13 for insulation material with increased operating temperature of +90 °C

The following tables are valid for

- an ambient temperature of +40 °C
- an operating temperature of +90 °C (only H07 V2-K and Lapp Ölflex-Servo-FD 795 P single conductors)
- Installation type B1
  Conductor in the installation armor and installation channels to be opened.
- Installation type B2
  Cables and leads in the installation armor and installation channels to be opened.
- Installation types C and E
  Cables and leads on walls and on open cable racks.

Cable cross section	**Permissible current load with installation type B1**		**Permissible current load with installation type B2**
	Single conductor Standard PVC	**Single conductor H07 V2-K**	**Cable Lapp Ölflex-Servo-FD 795 P**
1.0 mm^2	10.4 A	11.7 A	10.8 A
1.5 mm^2	13.5 A	15.2 A	13.8 A
2.5 mm^2	18.3 A	20.6 A	18.6 A
4.0 mm^2	25.0 A	28.2 A	26.0 A
6.0 mm^2	32.0 A	36.1 A	32.8 A
10.0 mm^2	44.0 A	49.7 A	45.2 A
16.0 mm^2	60.0 A	67.8 A	59.9 A
25.0 mm^2	77.0 A	87.0 A	75.7 A
35.0 mm^2	97.0 A	109.6 A	93.8 A

Cable cross section	Permissible current load with installation types C and E		
	Single conductor Standard PVC	**Single conductor H07 V2-K**	**Cable Lapp Ölflex-Servo-FD 795 P**
35.0 mm^2	104.0 A	117.5 A	117.5 A
50.0 mm^2	123.0 A	139.0 A	139.0 A
70.0 mm^2	155.0 A	175.1 A	175.1 A
95.0 mm^2	192.0 A	217.0 A	217.0 A
120.0 mm^2	221.0 A	249.7 A	249.7 A

Cable bundling is not taken into account in the tables. Please consult IEC 204-1.

Example

H07 V2-K single conductor with a cross section of 16 mm^2 and installation type B2 at an ambient temperature of +50 °C:

Permissible current load at +40 °C (according to table): 67.8 A
Correction factor for ambient temperature of +50 °C: 0.82

Permissible current load (+50 °C) = C1 · permissible current load (+40 °C)
Permissible current load (+50 °C) = 0.82 · 67.8 A = 55.6 A

4.2 Leakage Current from the Inverter Housing to the Grounding Connection

HEIDENHAIN inverters are electronic equipment with a leakage current greater than 3.5 mA (from the housing to ground). Therefore a sticker with the following warning is on the inverter components:

Ableitstrom > 3,5 mA
Potentialausgleich anschließen!

Leakage current > 3.5 mA
Connect potential equalization!

Since humans must not be subjected to leakage currents greater than 3.5 mA, the following must be ensured according to EN 50 178 (protective low voltage):

- Power connection with clamping:
  The cable for the grounding connection must have a line cross section greater than half that of a line conductor, but at least ∅ 10 mm^2.
- Power connection with connector:
  A second grounding conductor with a line cross section greater than half that of a line conductor, but at least ∅ 10 mm^2, along with the grounding conductor of the connector, must be firmly grounded.

In both cases a clamped grounding connection must also be installed.

If more than one piece of equipment is connected to the same grounding connection, the leakage currents add up. Therefore the commissioner must ensure that the grounding connection is of sufficient low-impedance.

Note

HEIDENHAIN recommends placing a sign on the outside of the electrical cabinet with a warning and a connection recommendation for the grounding conductor.

4.3 Environmental Conditions

4.3.1 Heat Generation and Cooling

The permissible ambient temperature in operation is between 0 °C and 40 °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.

4.3.2 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 devices not be switched off, so that condensation is avoided on the circuit boards.

4.3.3 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

4.3.4 Contamination

EN 50 178 permits contamination level 2.

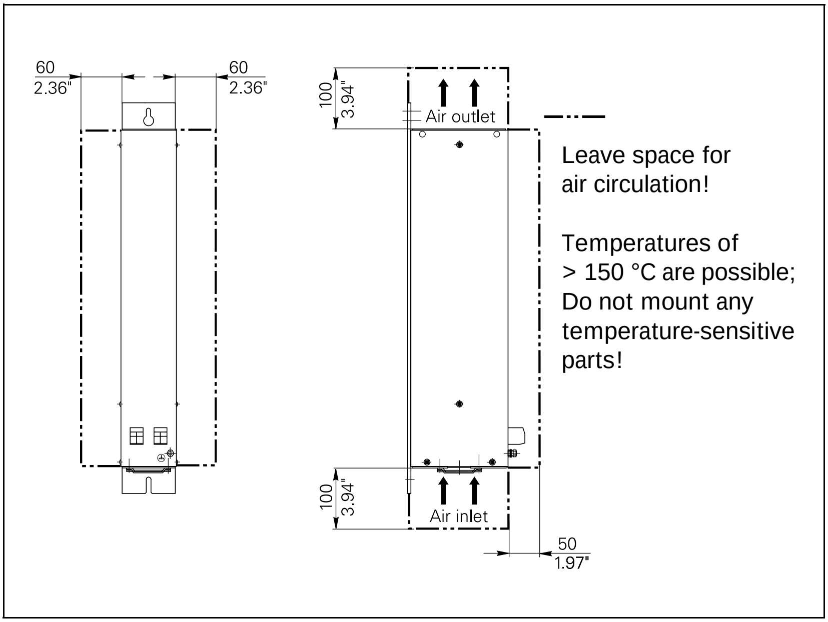
4.4 Mounting Conditions

Warning

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

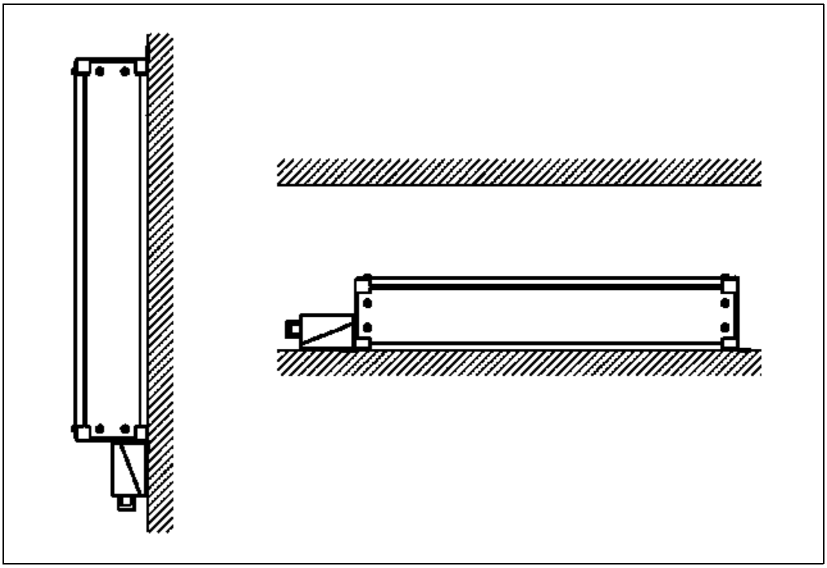
Mounting attitude of the PW 1x0(B) braking resistor

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

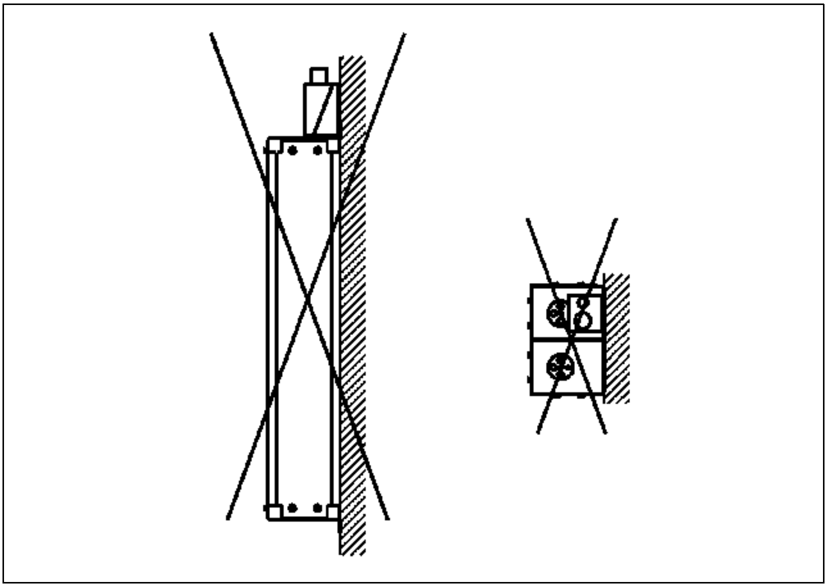


Mounting attitude of the PW 210 braking resistor

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).

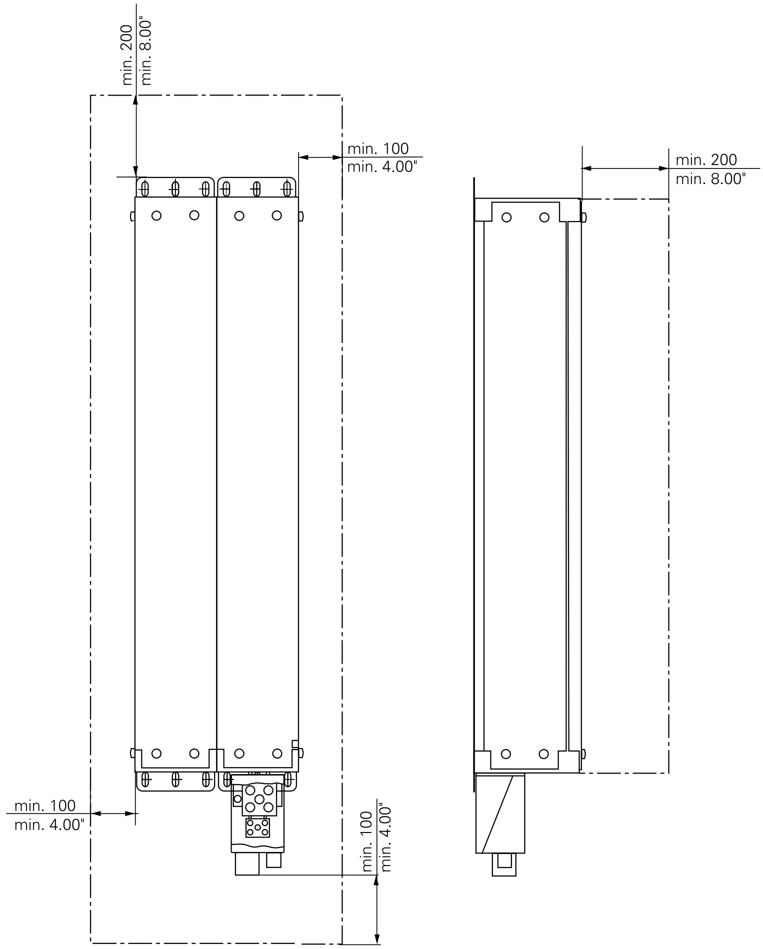


The braking resistor may not be positioned so that the connections face upwards, since the heat produced rises.



Warning

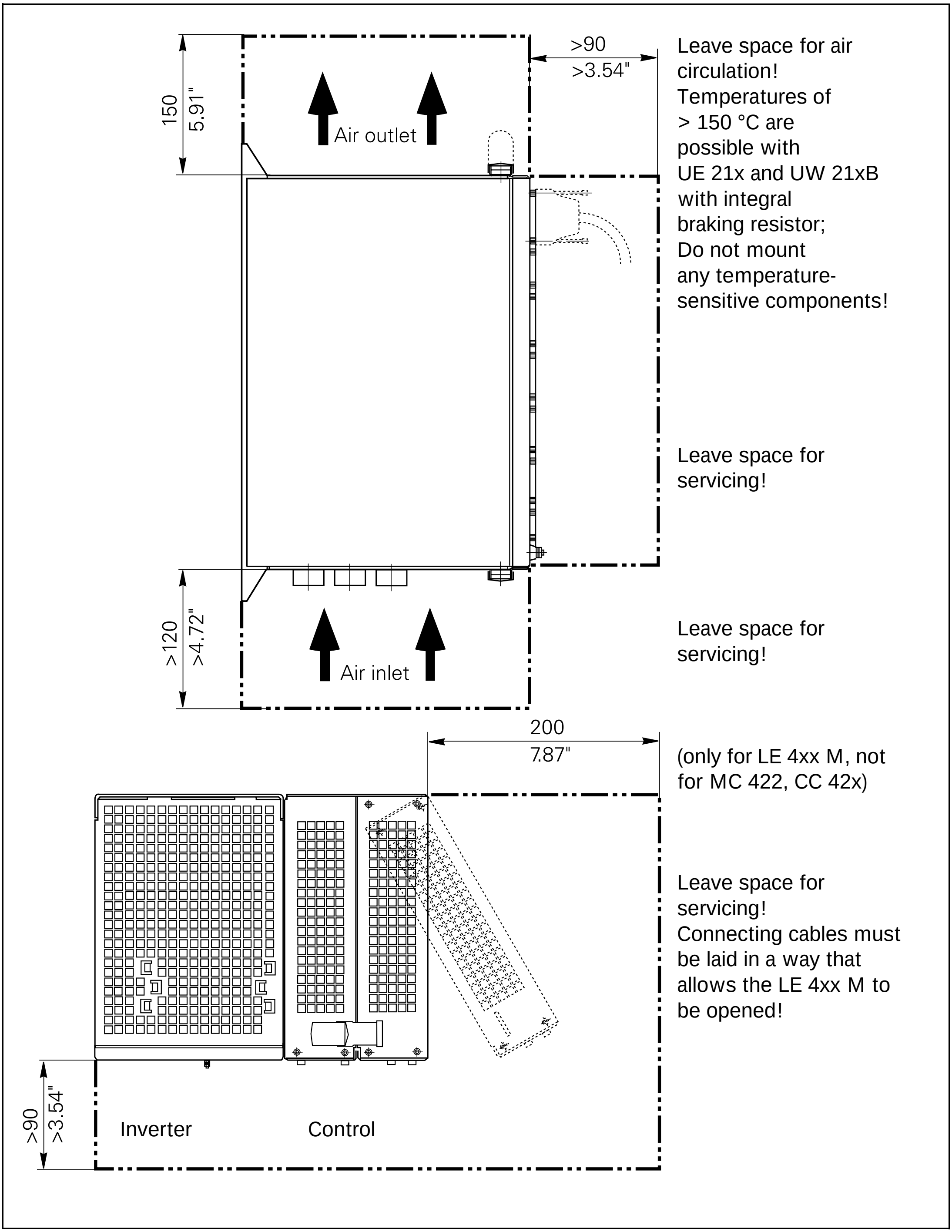
Mount the braking resistor in a way that prevents the ingress of splashing water (coolant). At the same time, a cover must be mounted to make personal contact with the braking resistor impossible.



Leave space for air circulation!

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

Mounting attitude of the HEIDENHAIN inverter



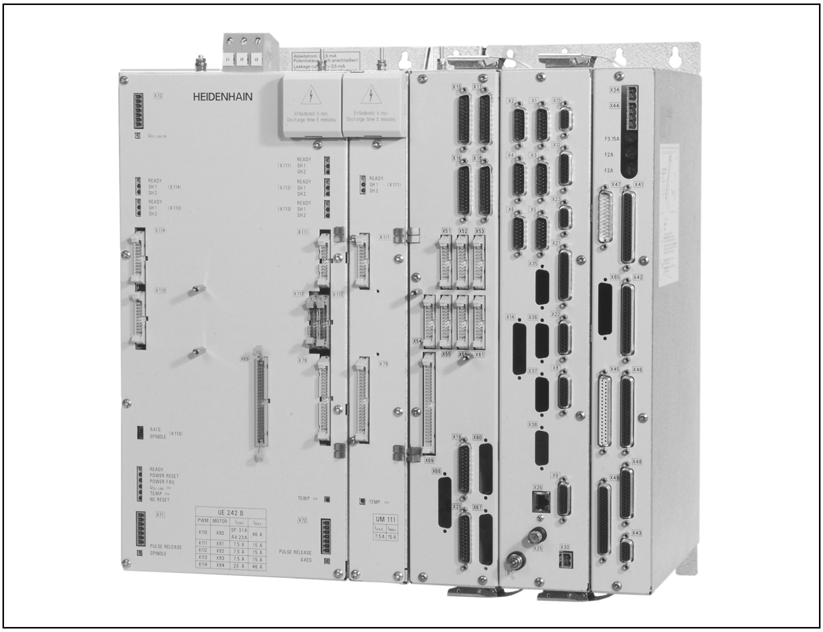
5 UE 2xx, UE 2xxB and UR 2xx Compact Inverters

5 UE 2xx, UE 2xxB and UR 2xx Compact Inverters

5.1 Connection Overview

LE 410 M “compact” with UE 212

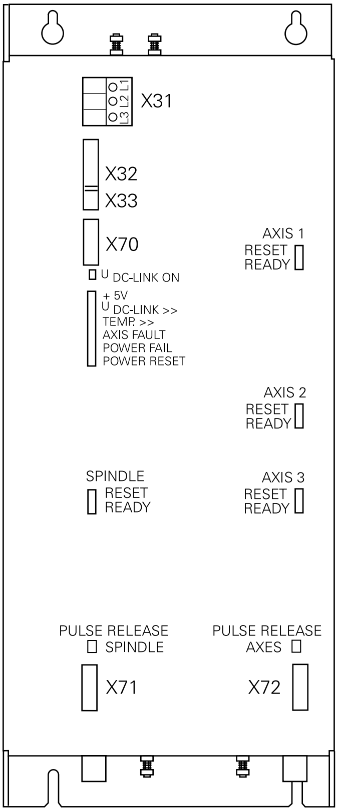
LE 426 M with UE 2xxB compact inverter and UM 111 power module



5.1.1 Compact inverter UE 210

Danger

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

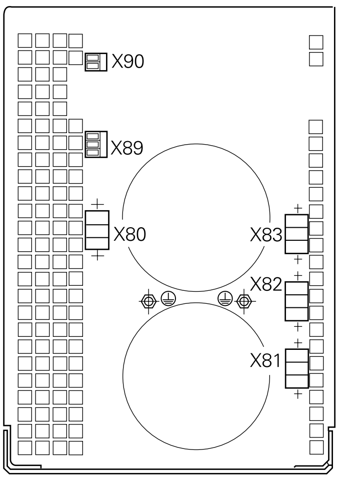


X31 Power supply for inverter

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)

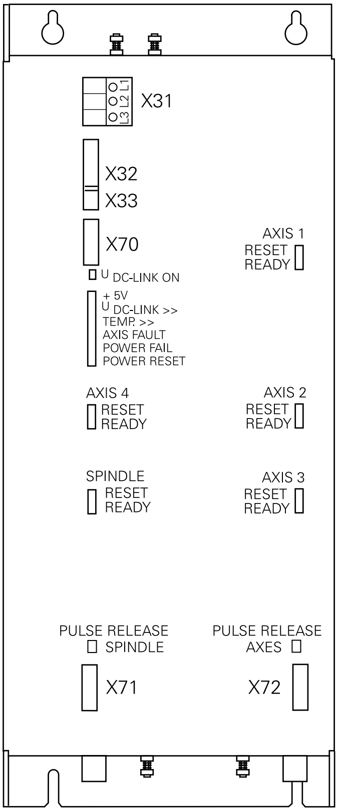
X82 Motor connection for axis 2 (7.5 A)

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!

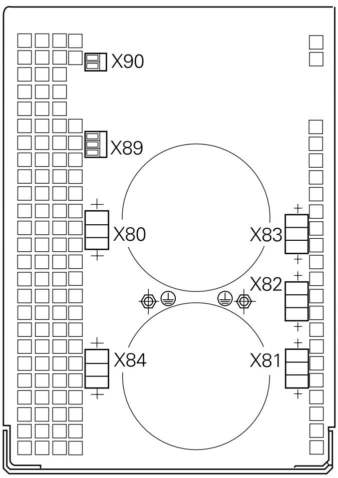


X31 Power supply for inverter

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)

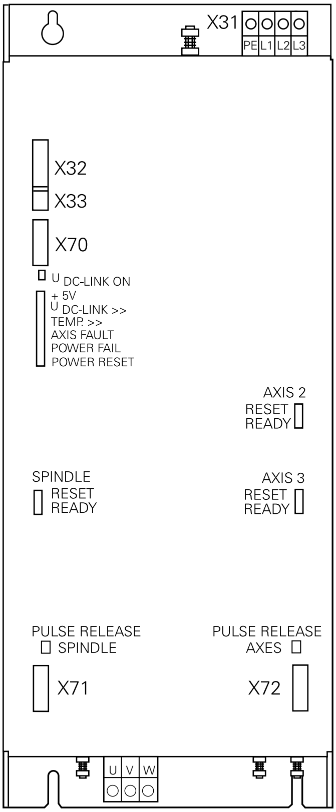
X84 Motor connection for axis 4 (14 A)
X81 Motor connection for axis 1 (7.5 A)

⏚ Equipment ground

5.1.3 Compact inverter UE 230

Danger

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



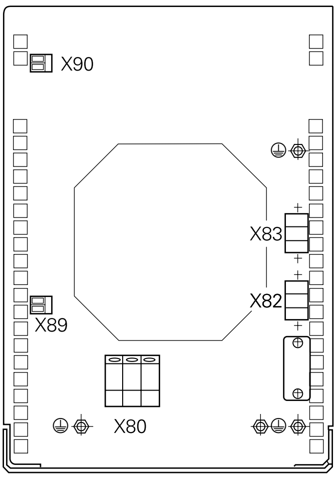
X31 Power supply for inverter

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

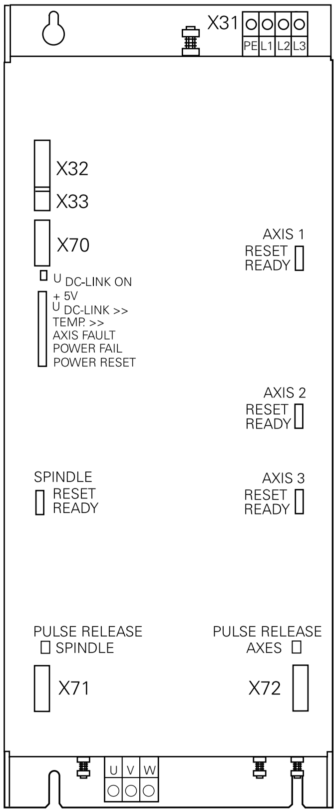
X80 Motor connection for spindle (31 A)

Equipment ground

5.1.4 Compact inverter UE 240

Danger

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



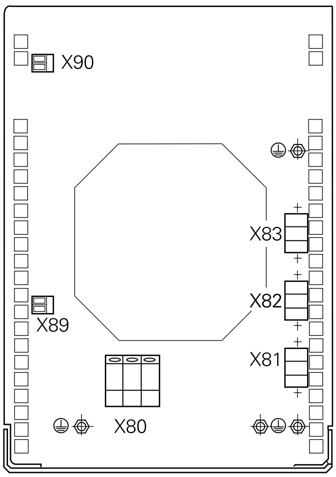
X31 Power supply for inverter

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)

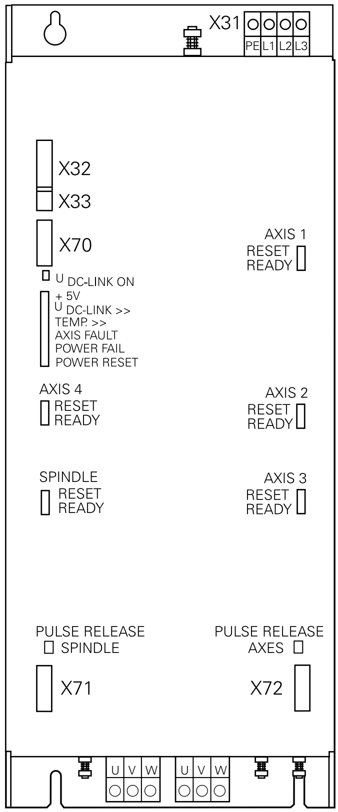
X82 Motor connection for axis 2 (7.5 A)
X89 Braking resistor

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!



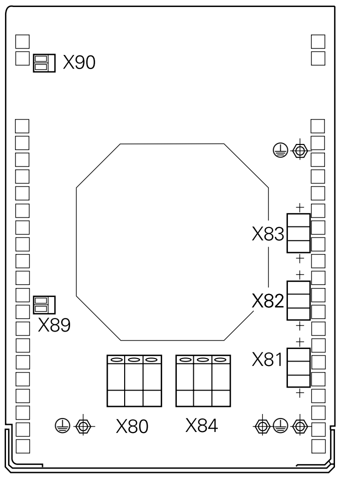
X31 Power supply for inverter

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

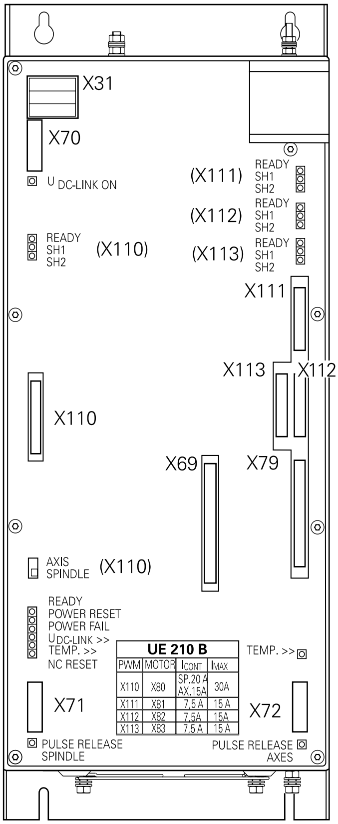
X83 Motor connection for axis 3 (7.5 A)
X82 Motor connection for axis 2 (7.5 A)
X89 Braking resistor

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

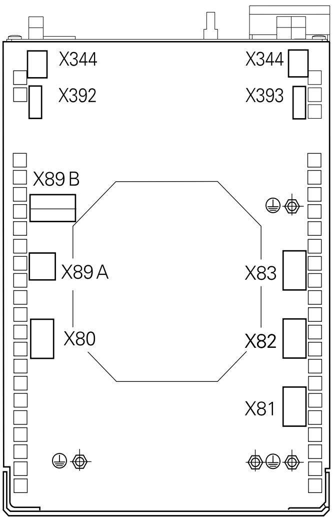
X70 Main contactor

X110 to
X113 PWM connection for axes/spindle

X69 Power supply for control
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 24-V supply for motor holding brake
X392 Motor holding brake (X110)
X393 Motor holding brake (X111 to X113)

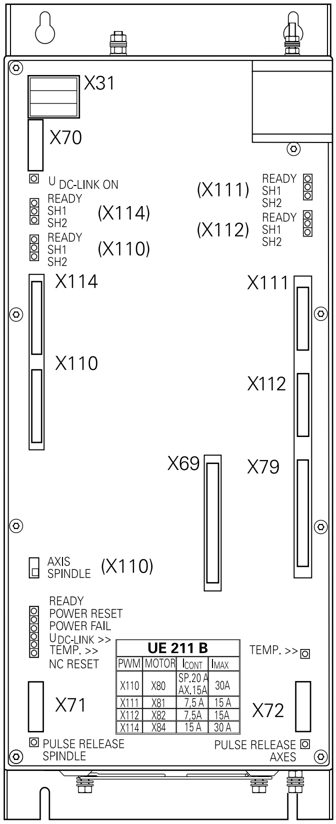
X89B Internal braking resistor
X89A PW 210 or PW 1x0(B) external braking resistor

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

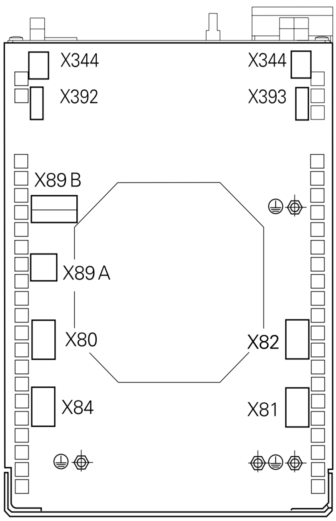
X70 Main contactor

X110 to
X114 PWM connection for axes/spindle

X69 Power supply for control
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 24-V supply for motor holding brake
X392 Motor holding brake (X110, X114)
X393 Motor holding brake (X111, X113)

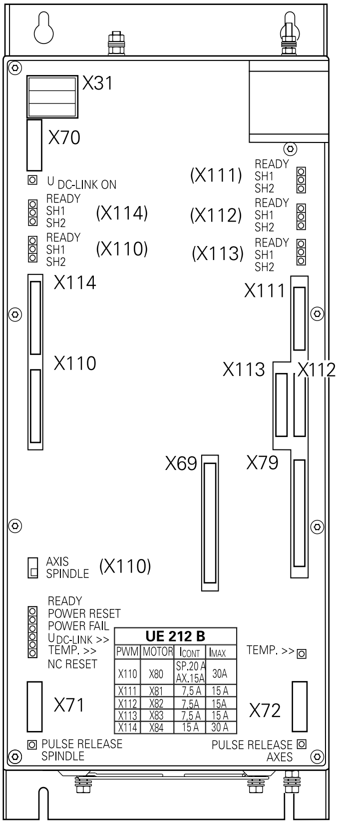
X89B Internal braking resistor
X89A PW 210 or PW 1x0(B) external braking resistor

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

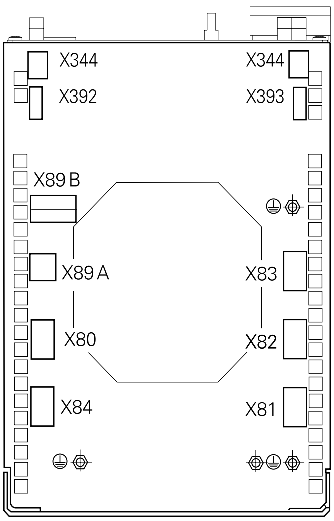
X70 Main contactor

X110 to
X114 PWM connection for axes/spindle

X69 Power supply for control
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 24-V supply for motor holding brake
X392 Motor holding brake (X110, X114)
X393 Motor holding brake (X111 to X113)

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

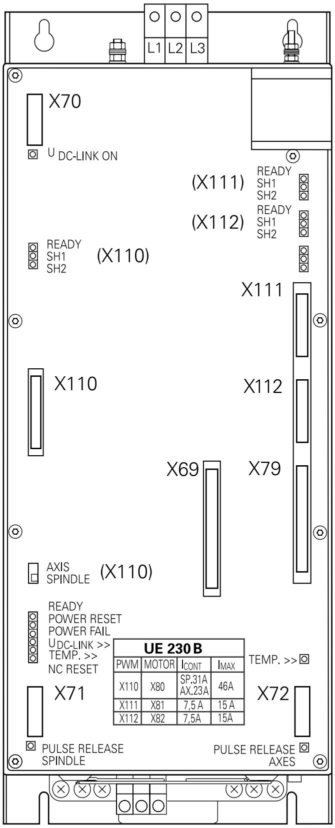
X83 Motor connection for axis 3 (7.5 A)
X80 Motor connection for spindle (20 A)
X82 Motor connection for axis 2 (7.5 A)
X84 Motor connection for axis 4 (15 A)
X81 Motor connection for axis 1 (7.5 A)

⏚ 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

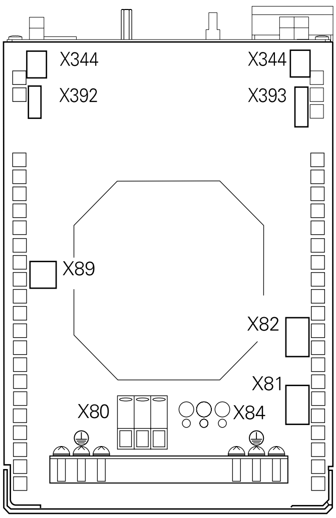
X70 Main contactor

X110 to
X112 PWM connection for axes/spindle

X69 Power supply for control
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 24-V supply for motor holding brake
X392 Motor holding brake (X110)
X393 Motor holding brake (X111, X112)

X89 Braking resistor

X82 Motor connection for axis 2 (7.5 A)

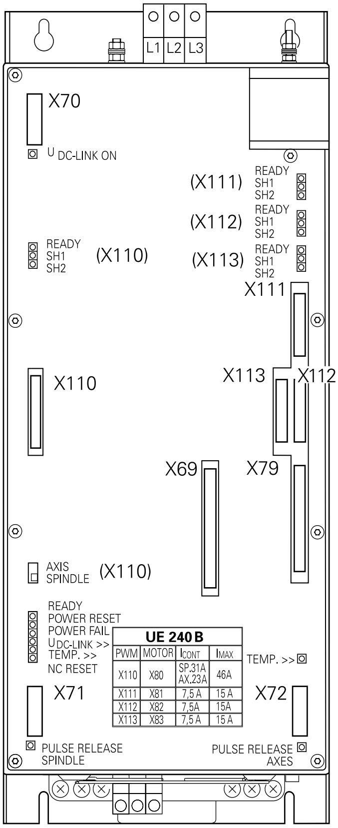
X81 Motor connection for axis 1 (7.5 A)
X80 Motor connection for spindle (31 A)

⏚ 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 control

X79 Unit bus

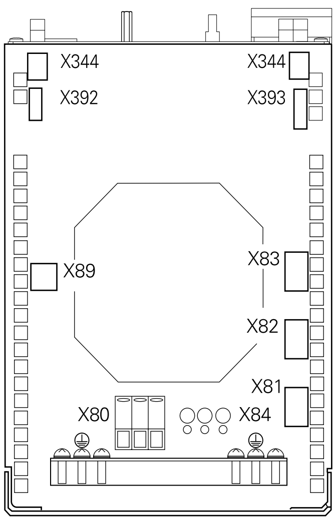
Sliding switch:

AXIS: X110 is used as axis

SPINDLE: X110 is used as spindle

X71 Safety relay for spindle

X72 Safety relay for axes



X344 24-V supply for motor holding brake

X392 Motor holding brake (X110)

X393 Motor holding brake (X111 to X113)

X89 Braking resistor

X83 Motor connection for axis 3 (7.5 A)

X82 Motor connection for axis 2 (7.5 A)

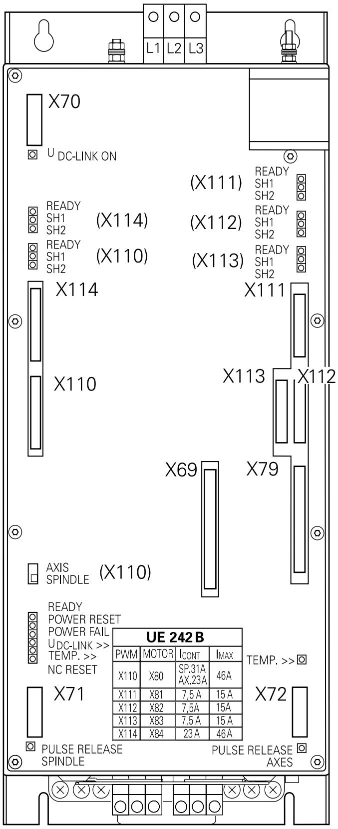
X81 Motor connection for axis 1 (7.5 A)

X80 Motor connection for spindle (31 A)

⏚ Equipment ground

5.1.11 Compact inverter UE 242B

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



X31 Power supply for inverter

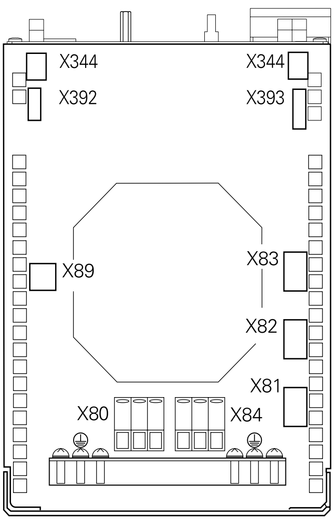
X70 Main contactor

X110 to
X114 PWM connection for axes/spindle

X69 Power supply for control
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 24-V supply for motor holding brake
X392 Motor holding brake (X110, X114)
X393 Motor holding brake (X111 to X113)

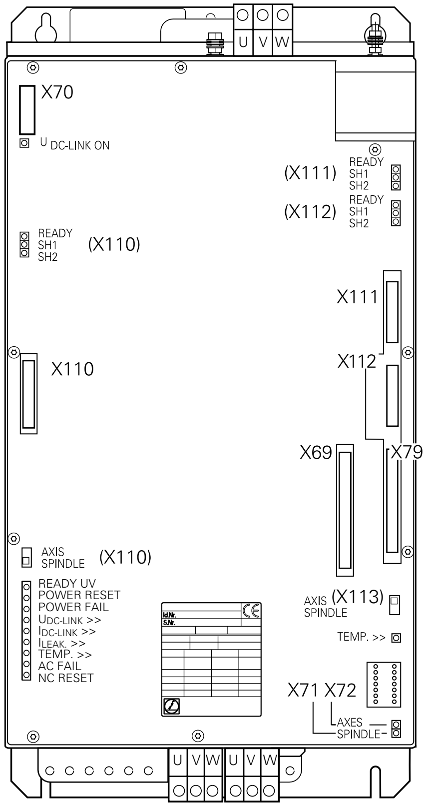
X89 Braking resistor
X83 Motor connection for axis 3 (7.5 A)
X82 Motor connection for axis 2 (7.5 A)
X81 Motor connection for axis 1 (7.5 A)
X80 Motor connection for spindle (31 A)
X84 Motor connection for axis 4 (23 A)

⏚ Equipment ground

5.1.12 Compact inverter UR 230

Danger

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



X31 Power supply for inverter

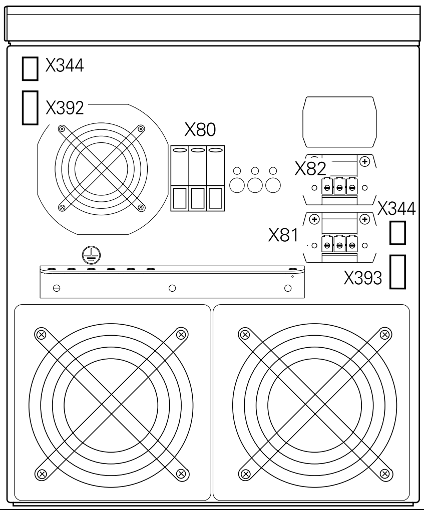
X70 Main contactor

X110 to
X112 PWM connection for axes/spindle

X69 Power supply for control
X79 Unit bus

Sliding switch:
AXIS: X110 or X113 is used as axis
SPINDLE: X110 or X113 is used as spindle

X71 Safety relay for spindle
X72 Safety relay for axes

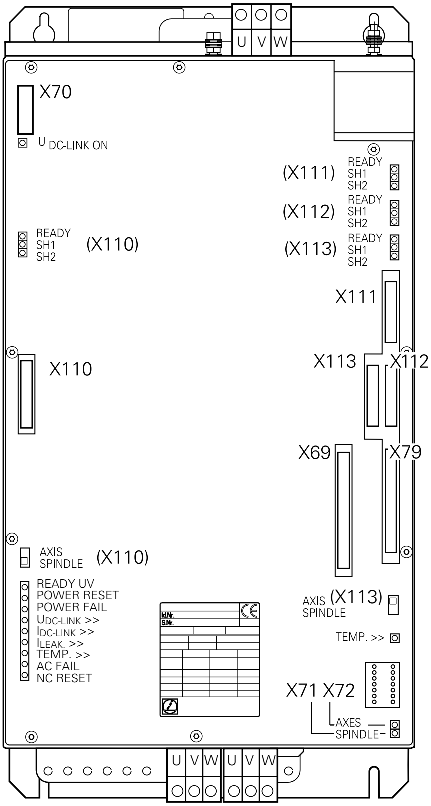


X344 24-V supply for motor holding brake
X392 Motor holding brake (X110)

X80 Motor connection for spindle (35 A)
X82 Motor connection for axis 2 (7.5 A)
X81 Motor connection for axis 1 (7.5 A)
⏚ Equipment ground
X393 Motor holding brake (X111, X112)

5.1.13 Compact inverter UR 240

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



X31 Power supply for inverter

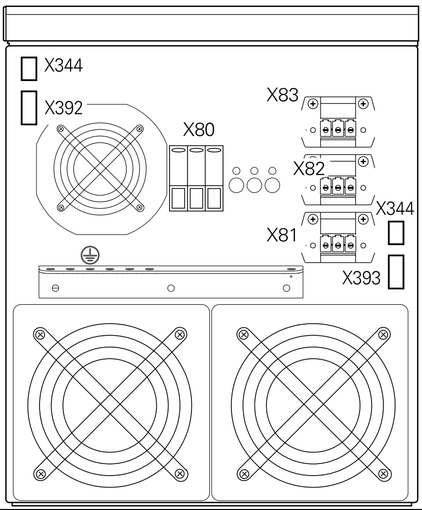
X70 Main contactor

X110 to
X113 PWM connection for axes/spindle

X69 Power supply for control
X79 Unit bus

Sliding switch:
AXIS: X110 or X113 is used as axis
SPINDLE: X110 or X113 is used as spindle

X71 Safety relay for spindle
X72 Safety relay for axes

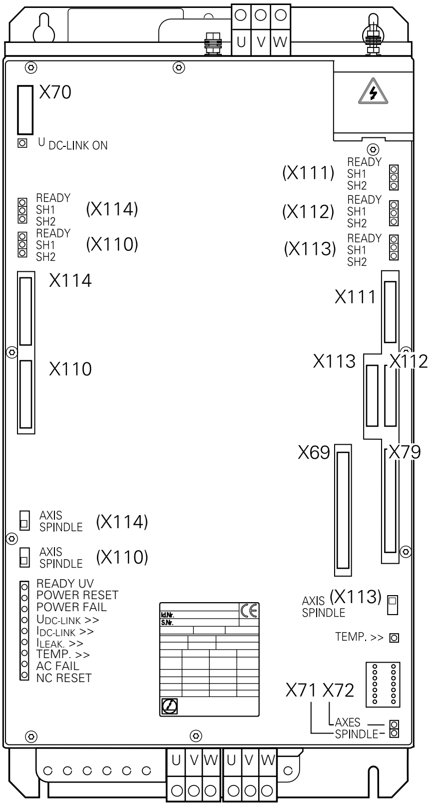


X344 24-V supply for motor holding brake
X392 Motor holding brake (X110)
X83 Motor connection for axis 3 (7.5 A)
X80 Motor connection for spindle (35 A)
X82 Motor connection for axis 2 (7.5 A)
X81 Motor connection for axis 1 (7.5 A)
⏚ Equipment ground
X393 Motor holding brake (X111 to X113)

5.1.14 Compact inverter UR 242

Danger

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



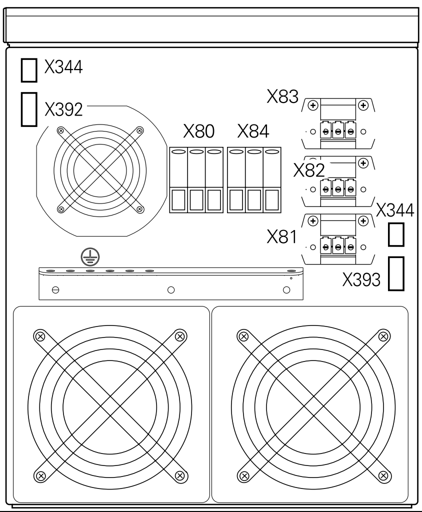
X31 Power supply for inverter

X70 Main contactor

X110 to
X114 PWM connection for axes/spindle

X69 Power supply for control
X79 Unit bus

Sliding switch:
AXIS: X110, X113 or X114 is used as axis
SPINDLE: X110, X113 or X114 is used as spindle
X71 Safety relay for spindle
X72 Safety relay for axes



X344 24-V supply for motor holding brake
X392 Motor holding brake (X110, X114)

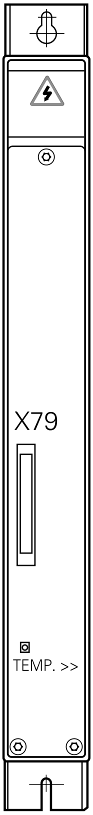
X83 Motor connection for axis 3 (7.5 A)
X80 Motor connection for spindle (35 A)
X84 Motor connection for axis 4 (25 A)
X82 Motor connection for axis 2 (7.5 A)
X81 Motor connection for axis 1 (7.5 A)

Equipment ground
X393 Motor holding brake (X111 to X113)

5.1.15 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

5.1.16 Meaning of the LEDs

On the front of the compact inverters 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, CC	$\overline{\text{ERR.UZ.GR}}$
TEMP >>	Temperature of heat sink too high (> 100 °C)	UE → LE, CC	$\overline{\text{ERR.TEMP}}$
AXIS FAULT	Short circuit between a phase of the motor output and U_Z (axes only)	UE → LE, CC	$\overline{\text{AXISFAULT}}$
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, CC	$\overline{\text{PF.PS}}$
POWER RESET	Reset signal from UE to LE	UE → LE, CC	$\overline{\text{RES.PS}}$
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, CC → UE	$\overline{\text{SH2}}$
AXIS/SPINDLE READY	Inverter ready	UE → LE, CC	$\overline{\text{RDY}}$

UE 2xxB

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

UR 2xx

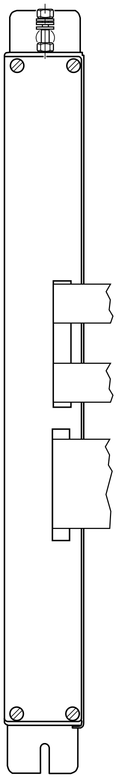
LED	Meaning	Signal direction	Signal
$U_{DC\ LINK\ ON}$	Main contactor on	–	–
X11x READY	Inverter ready	LE, CC $\rightarrow$ UR	RDY
X11x SH1	Flashing DSP error, PLC error with Emergency Stop, LE hardware or software error	LE, CC $\rightarrow$ UR	$\overline{\text{SH1B}}$
X11x SH2	No drive enable (e.g. by the PLC, active via external signal or SH1)	LE, CC $\rightarrow$ UR	$\overline{\text{SH2}}$
READY UV	Inverter ready	UR $\rightarrow$ LE, CC	RDY
POWER RESET	Reset signal from UR to LE	UR $\rightarrow$ LE, CC	$\overline{\text{RES.PS}}$
POWER FAIL	U_Z too low, U_Z < 410 V (e.g. caused by the failure of a phase under load, power < 290 V)	UR $\rightarrow$ LE, CC	$\overline{\text{PF.PS}}$
$U_{DC\ LINK}$ >>	U_Z too high (> approx. 800 V); Power modules are switched off	UR $\rightarrow$ LE, CC	$\overline{\text{ERR.UZ.GR}}$
$I_{DC\ LINK}$ >>	I_Z > 52 A, Warning signal to control at 58 A	UR $\rightarrow$ LE, CC	$\overline{\text{ERR.IZ.GR}}$
I_{LEAK} >>	Error current, e.g. through short to earth; warning signal to control	UR $\rightarrow$ LE, CC	$\overline{\text{ERR.ILEAK}}$
TEMP >> (left)	Heat sink temperature too high for axis 4 and spindle (> 100 °C)	UR $\rightarrow$ LE, CC	$\overline{\text{ERR}}$
TEMP >> (right)	Heat sink temperature too high for axis 1 to axis 3 (> 100 °C)	UR $\rightarrow$ LE, CC	$\overline{\text{ERR}}$
AC FAIL	Phase missing	UR $\rightarrow$ LE, CC	$\overline{\text{PF.PS.AC}}$
NC RESET	Reset signal from the LE to the UR 2xx	LE, CC $\rightarrow$ UR	$\overline{\text{RES.LE}}$
SPINDLE	Safety relay for spindle on	–	–
AXES	Safety relay for axes on	–	–

5.1.17 UV 102 power supply unit

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

Danger

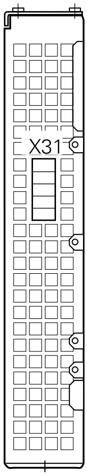
Do not engage or disengage any connecting elements while the unit is under power!



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)

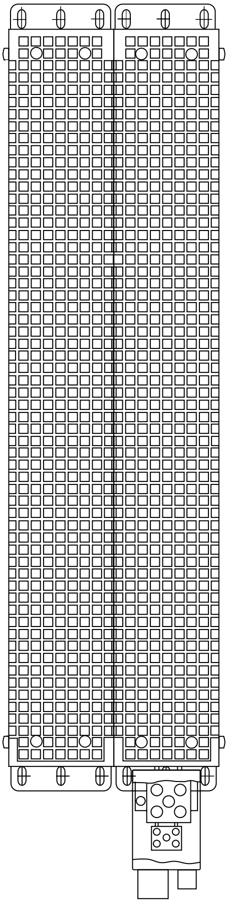


X31 Supply voltage for UV 102

5.1.18 PW 210 braking resistor

Danger

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



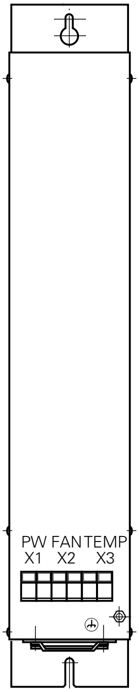
RB1, RB2
: Compact inverter UE 2xx or UE 2xxB

T1, T2
: Temperature switch

5.1.19 PW 1x0(B) Braking Resistor

Danger

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



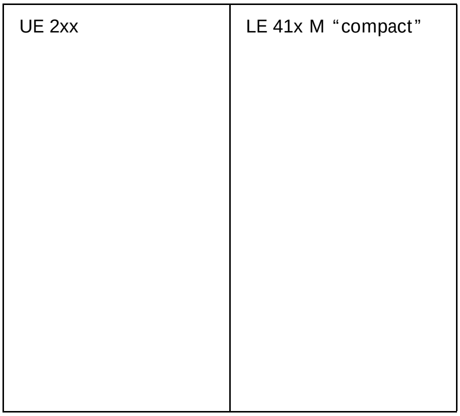
X1 Compact inverter UE 2xx or UE 2xxB
X2 Supply voltage for the fan of the braking resistor
X3 Temperature switch

5.2 Mounting and Connecting the Compact Inverter

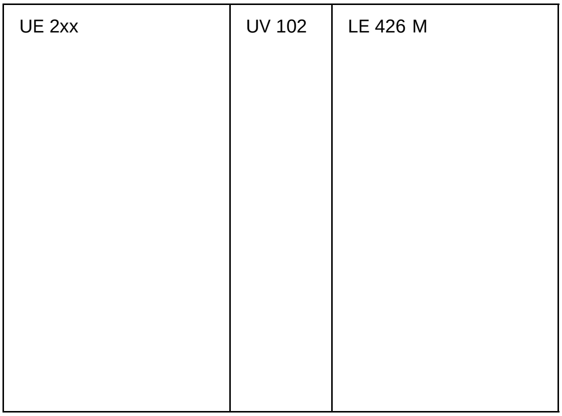
5.2.1 UE 2xx compact inverter

Arranging the modules

If an 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 an 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 of the UV 102 are connected to the LE. Once these connections have been made, the front panel is replaced on the UV 102 housing.

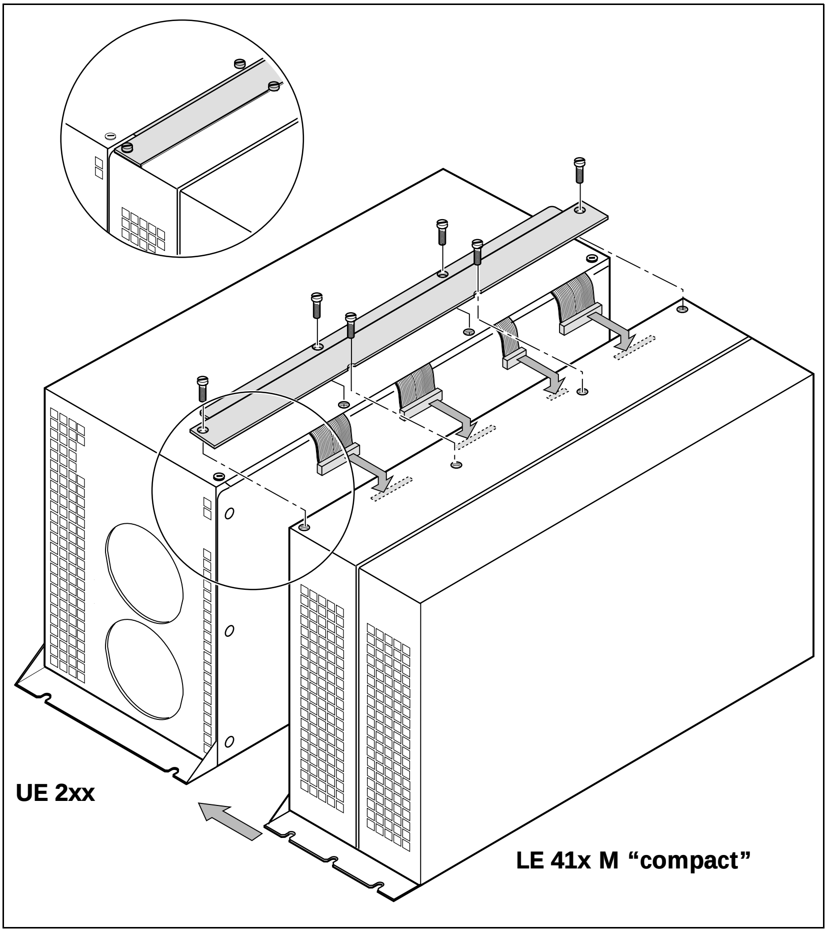
Covering the modules

LE 41x M “compact”: No covers are required.

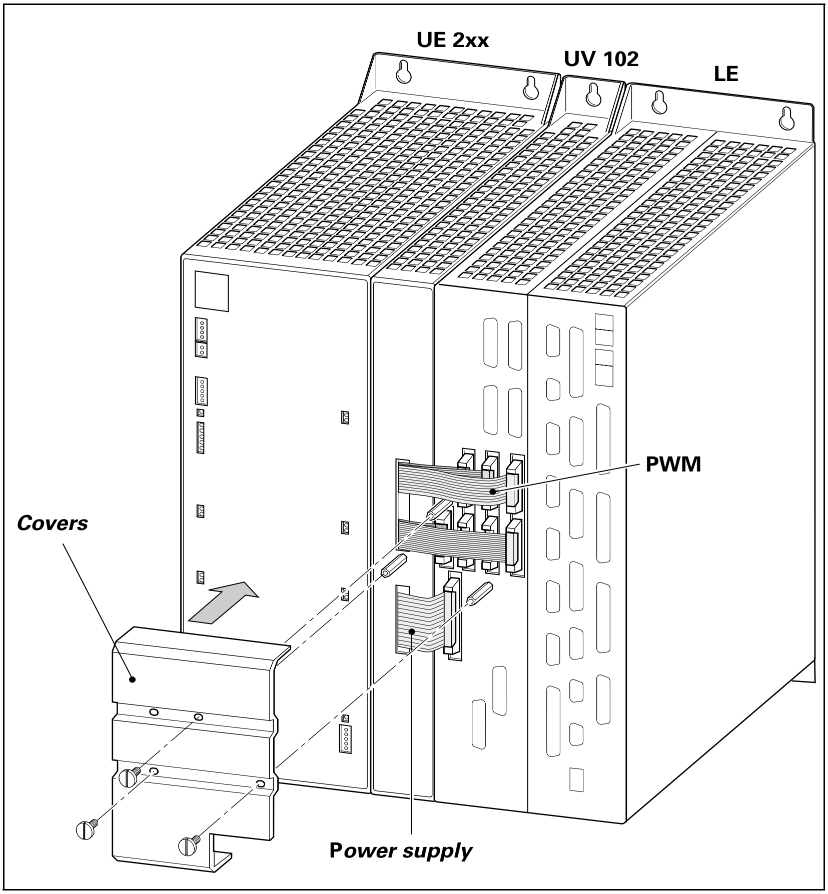
LE 426 M: The ribbon cables must be covered to protect against interference. The protective cover for the LE is supplied as an accessory with the LE, and that for the UV 102 as an accessory with the UV 102.

Mounting the HEIDENHAIN UE 2xx compact inverter

LE 41x M “compact”:



LE 426 M:

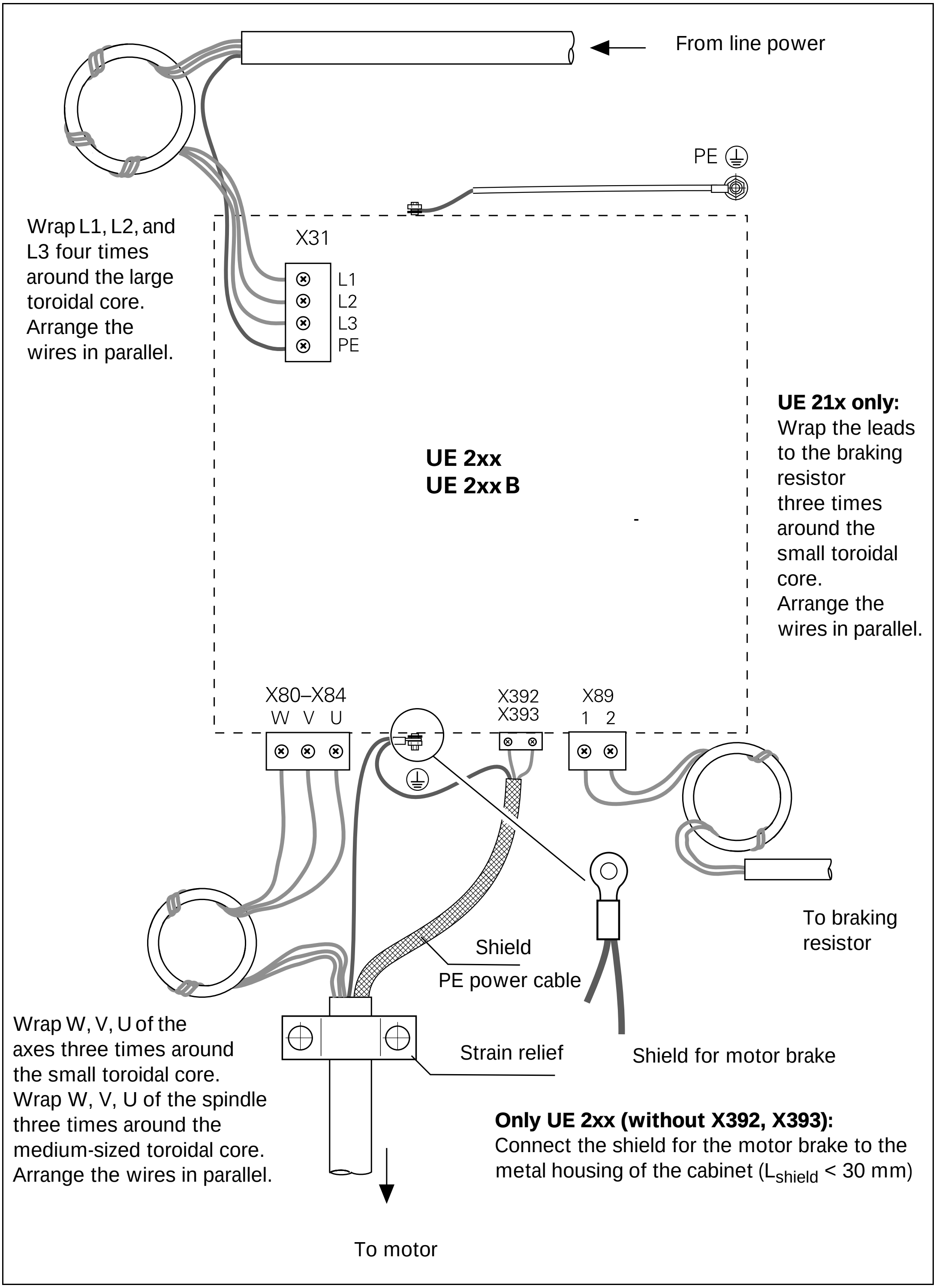


Warning

All electrical screw connections must be tightened after installation is complete (tightening torque 3.5 Nm).

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 and UR 2xx Compact Inverters

Arranging the modules

The UE 2xxB and UR 2xx compact inverters can only be operated with the LE 426 M/LE 430 M, the LE 41x M “modular” (with external PWM interfaces) or the MC 422/CC 42x. The compact inverter is arranged to the left of the control.

If the UP 110 braking resistor module is used together with the UR 2xx regenerative compact inverter, the braking resistor is arranged between the weakest power module and the control.

UE 2xxB UR 2xx	possible UP 110 (only for UR 2xx)	LE 41x M “modular” LE 426 M/LE 430 M MC 422/CC 42x

An additional UM 111 power module **can** be connected to the UE 2xxB and UR 2xx compact inverters. It must be placed between the control or UP 110 and the compact inverter.

UE 2xxB UR 2xx	UM 111	possible UP 110 (only for UR 2xx)	LE 41x M “modular” LE 426 M/LE 430 M MC 422/CC 42x

Connecting the modules

A 50-line ribbon cable connects the control to the UE 2xxB or UR 2xx and supplies the power to the control.

The 20-line ribbon cables connect the control to the UE 2xxB or UR 2xx and supply the PWM signals to the axes and spindle(s).

U_Z dc-link power is supplied to the additional UM 111 power module from the UE 2xxB or UR 2xx 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 or UR 2xx and the UM 111.
The power bars are supplied as accessories with the power modules.

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

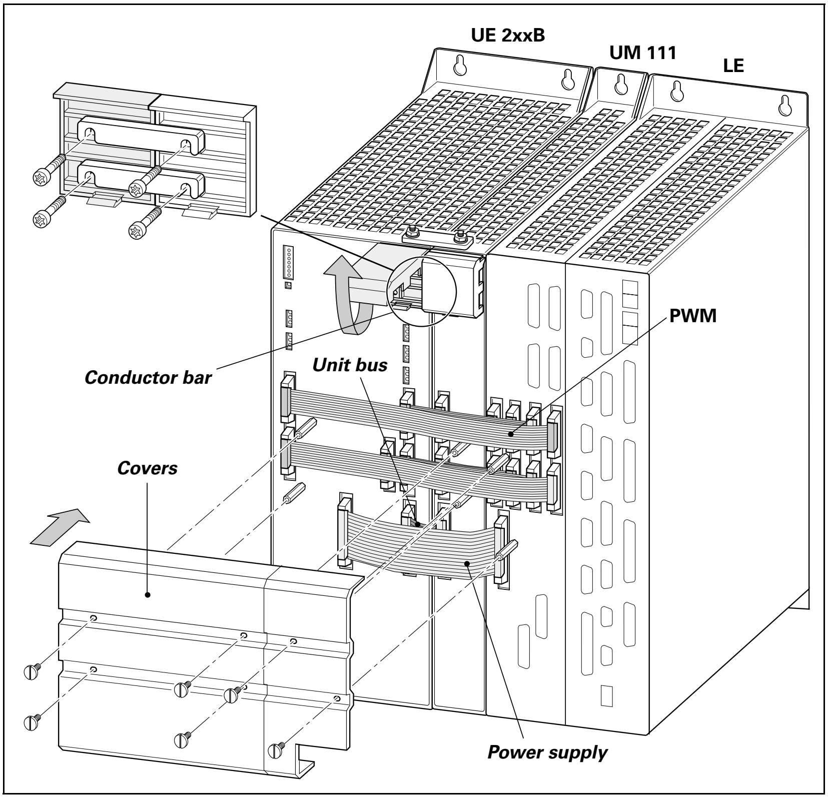
Covering the modules

The ribbon cables must be covered to protect them against interference.

The covers for the control and the UE 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 and UR 2xx compact inverters



Warning

All electrical screw connections must be tightened after installation is complete (tightening torque 3.5 Nm).

Mounting the toroidal cores

Mounting the toroidal cores for the UE 2xxB is the same as for the UE 2xx. See “Mounting the toroidal cores” on page 5 – 28.

No toroidal cores are necessary for the UR 2xx.

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:

$$U_{SetupPower} = \left(\frac{U_{N,\,motor} \cdot n_{setup}}{n_{N,\,motor} \cdot \sqrt{3}}\right) \cdot 2$$

Pin layout:

Terminals	UE 210, UE 212	UE 230, UE 240, UE 242
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: 35 A (gRL) Grounding terminal: ≥ 10 mm^2	Cable: Wire cross section: 10 mm^2 Line fuse: 50 A (gRL) 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 4A)
2	Jumper to X33/pin 2 (short-circuit protection with 4A)
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 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[a]	Normally closed contact 1
5[a]	Normally closed contact 2

a. Max. 125 V

Warning

A recovery diode is required in the proximity of inductive loads, e.g. relay or contactor coils.

5.3.4 PW 210 or PW 1x0(B) 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(B) 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(B)	1.5 mm^2
2 x PW 120 in parallel	4 mm^2

X89 Braking resistor

Pin layout on UE 21x:

Connecting terminal X89 UE 21x	Assignment	Internal braking resistor	PW 210	PW 1x0(B); 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(B); connecting terminal X1
1	$+U_Z$	RB1	1
2	Switch against $-U_Z$	RB2	2

Temperature switch

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

Connecting terminal on the PW 210	Assignment
T1	1
T2	2

Connecting terminal X3 on the PW 110B	Assignment
1	1
2	2

X2 Fan for the PW 1x0(B) external braking resistor

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 five 20-line 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: 6.3 A (gRL) Grounding terminal: $\geq$ 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 and UR 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.

5.5.1 Power supplies

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.

UE 2xxB: 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 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: 35 A (gRL) Grounding terminal: ≥ 10 mm^2	Cable: Wire cross section: 10 mm^2 Line fuse: 50 A (gRL) Grounding terminal: ≥ 10 mm^2

UR 2xx: X31 Supply voltage for U_Z

The inverter voltage U_Z is 650 Vdc.

The UR 2xx regenerative compact inverters must be connected to the main power line via the KDR 120 commutating reactor and the line filter. This is necessary for keeping the main line free of disruptive higher harmonics.

Pin layout:

Power supply		**Line filter (EPCOS)** **Power**	 **Device**		**KDR 120**			**UR 2xx** **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	**UR 2xx:** Cable: Wire cross section: 16 mm^2 Line fuse: 35 A (gRL) Grounding terminal: $\geq$ 10 mm^2							

Note

The cables between the UR 2xx compact inverter and line filter as well as between the commutating reactor and line filter must be as short as possible (< 0.4 m)!

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 Connection of the Motor Holding Brakes

X344 24-V supply for motor holding brake

Pin layout:

Connecting terminals X34	Assignment
1	+24 V
2	0 V

X392 Motor holding brake

Pin layout:

Connecting terminals X392	Assignment
1	Holding brake (X110)
2	0 V (X110)
3	Holding brake (X114)
4	0 V (X114)

X393 Motor holding brake

Pin layout:

Connecting terminals X393	Assignment
1	Holding brake (X111)
2	0 V (X111)
3	Holding brake (X112)
4	0 V (X112)
5	Holding brake (X113)
6	0 V

5.5.4 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[a]	Normally closed contact (OE1, OE1A or OE1S)
7[a]	Normally closed contact (OE2, OE2A or OE2S)

a. Max. 125 V

Warning

A recovery diode is required in the proximity of inductive loads, e.g. relay or contactor coils.

5.5.5 PWM Connection to the Control

X110 to X114 PWM connection to control

Pin layout:

Ribbon cable 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	$\overline{\text{SH2}}$
4b	0 V ($\overline{\text{SH2}}$)
5a	$\overline{\text{SH1}}$
5b	0 V ($\overline{\text{SH1}}$)
6a	$+I_{\text{Actl 1}}$
6b	$-I_{\text{Actl 1}}$
7a	0 V (analog)
7b	$+I_{\text{Actl 2}}$
8a	$-I_{\text{Actl 2}}$
8b	0 V (analog)
9a	Do not assign
9b	$\overline{\text{BRK}}$
10a	$\overline{\text{ERR}}$
10b	RDY

Note

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

5.5.6 NC supply voltage and control signals

X69: NC supply voltage and control signals

Pin layout:

Ribbon connector, 50-line	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	$\overline{\text{PF.PS}}$
13b	GND
14a	$\overline{\text{ERR.UZ.GR}}$
14b	GND
15a	$\overline{\text{ERR.IZ.GR}}$
15b	GND
16a	$\overline{\text{ERR.TEMP}}$

Ribbon connector, 50-line	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 (UE 2xxB: 0V)
21b	GND
22a	Do not assign (UE 2xxB: 0V)
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.”

5.5.7 Unit Bus

The unit bus connects the compact inverter with a UM 111 power module. If you are not using a UM 111, you do not need to connect the unit bus.

X79 Unit bus

Pin layout:

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

Note

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

5.5.8 PW 210 and PW 1x0(B) Braking Resistor 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 x10(B), one PW 210 or two PW 210 switched in series can be connected to all 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 mm^2
1 x PW 110(B)	1.5 mm^2
1 x PW 120	4 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	

Pin layout on UE 21xB for external braking resistor:

Connecting terminal X89B UE 21xB	Assignment	Connecting terminal X89A UE 21xB	Assignment	PW 210	PW 1x0(B); 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(B), connecting terminal X1
1	$+U_Z$	RB 1	1
2	Switch against $–U_Z$	RB 2	2

Temperature switch

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

Pin layout:

Connecting terminal on the PW 210	Assignment
T1	1
T2	2

Connecting terminal X3 on the PW 110B	Assignment
1	1
2	2

X2 Fan for the PW 1x0(B) external braking resistor

Pin layout:

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

5.6 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:

Ribbon connector, 40-line	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

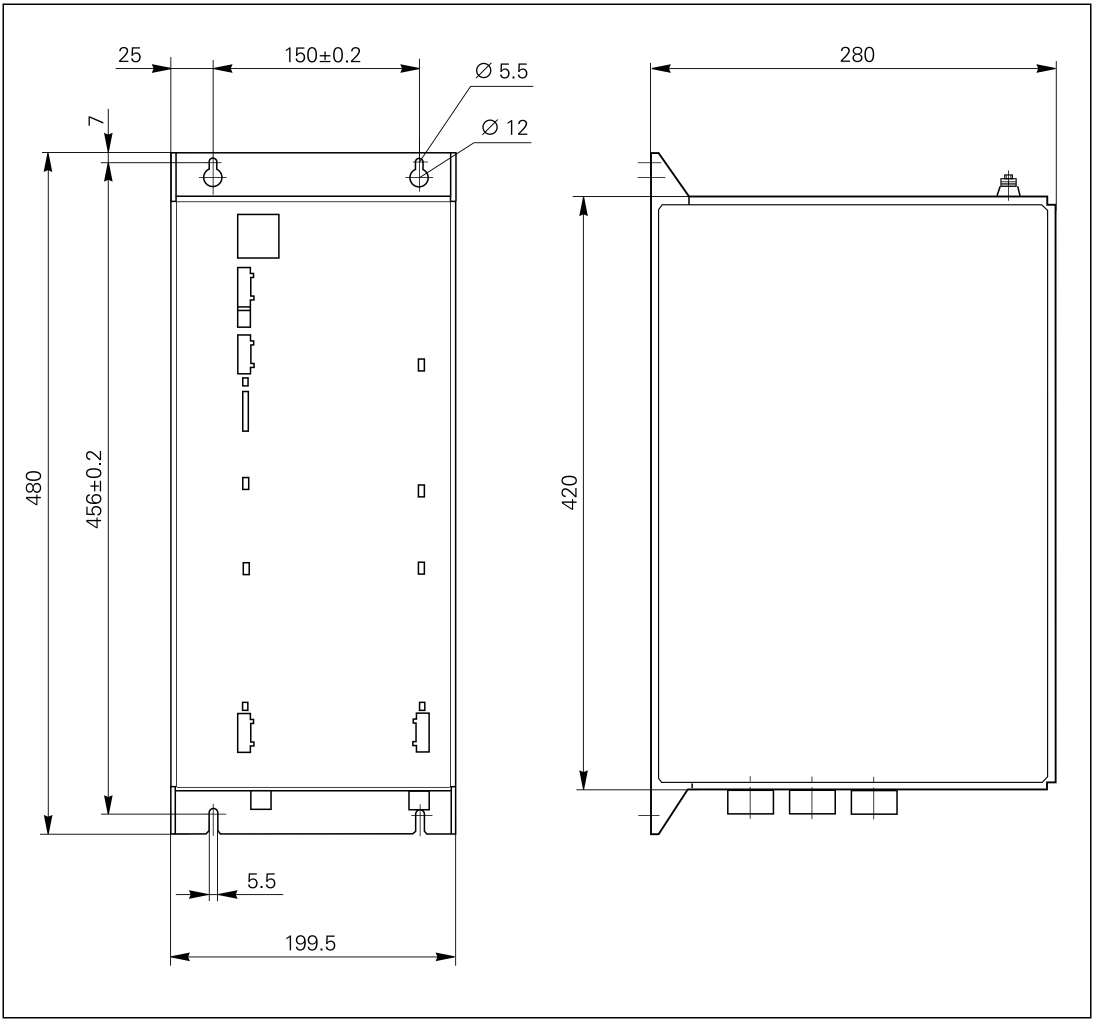
The interface complies with the requirements of EN 50 178 for low voltage electrical separation (except for 1a to 6b).

5.7 Dimensions

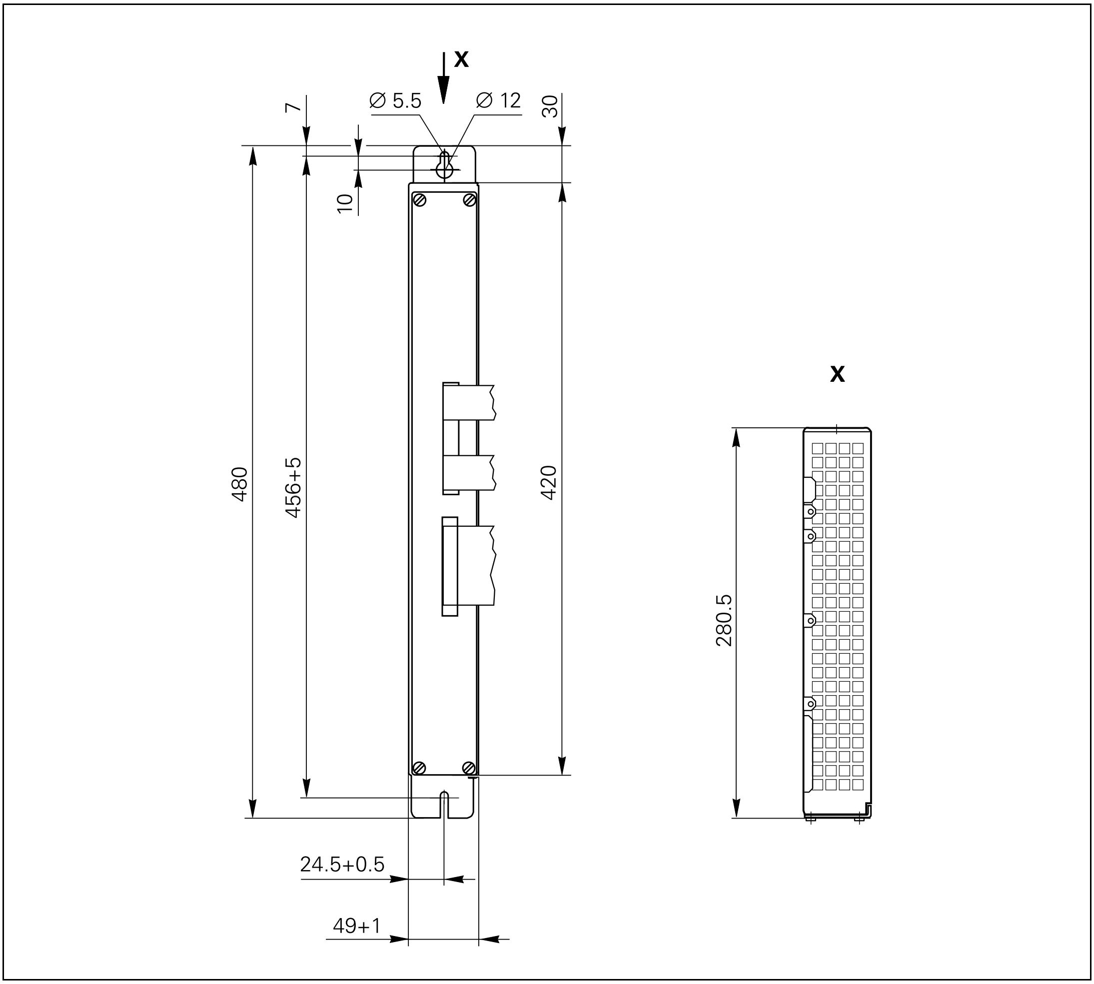
Note

All dimensions in [mm].

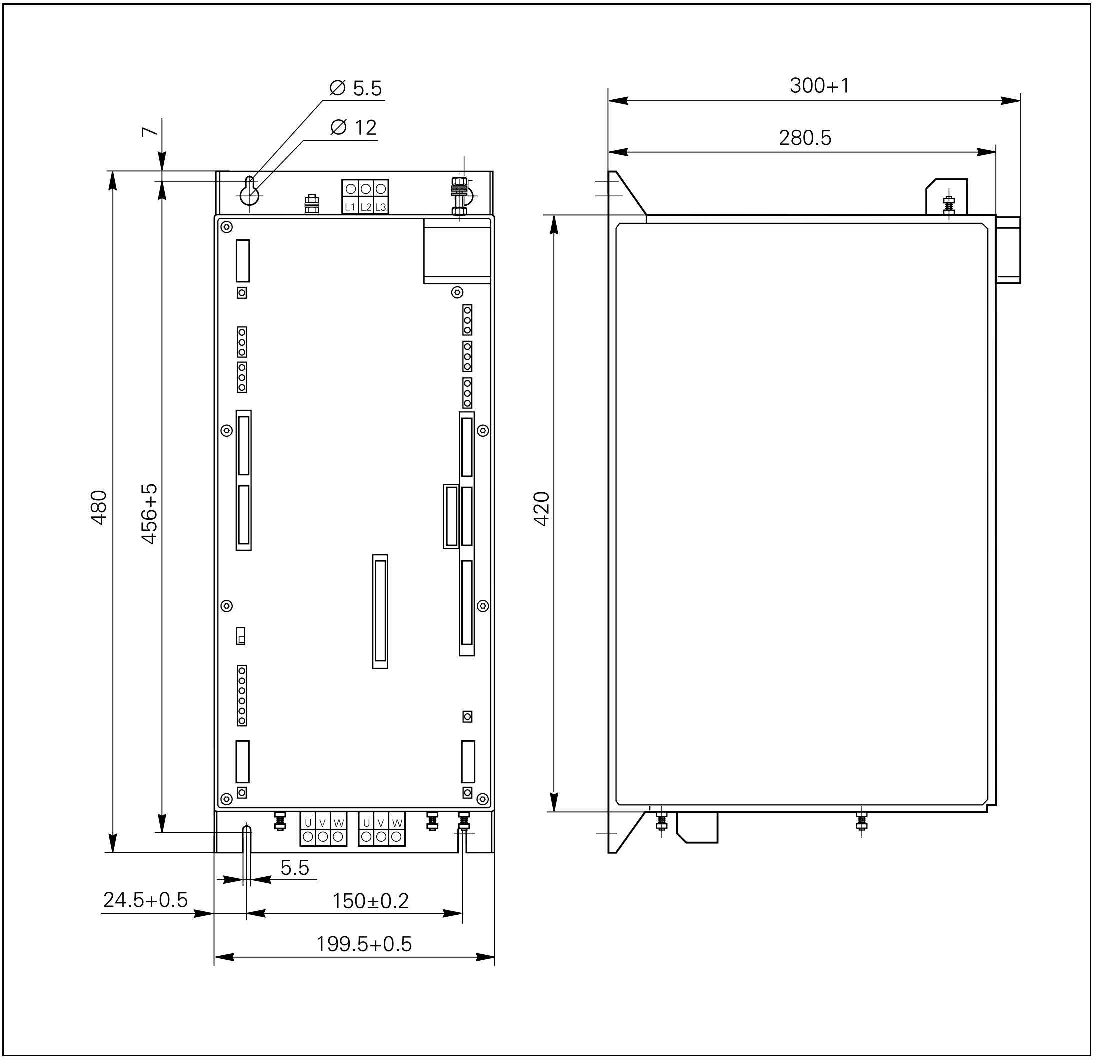
5.7.1 UE 2xx



5.7.2 UV 102

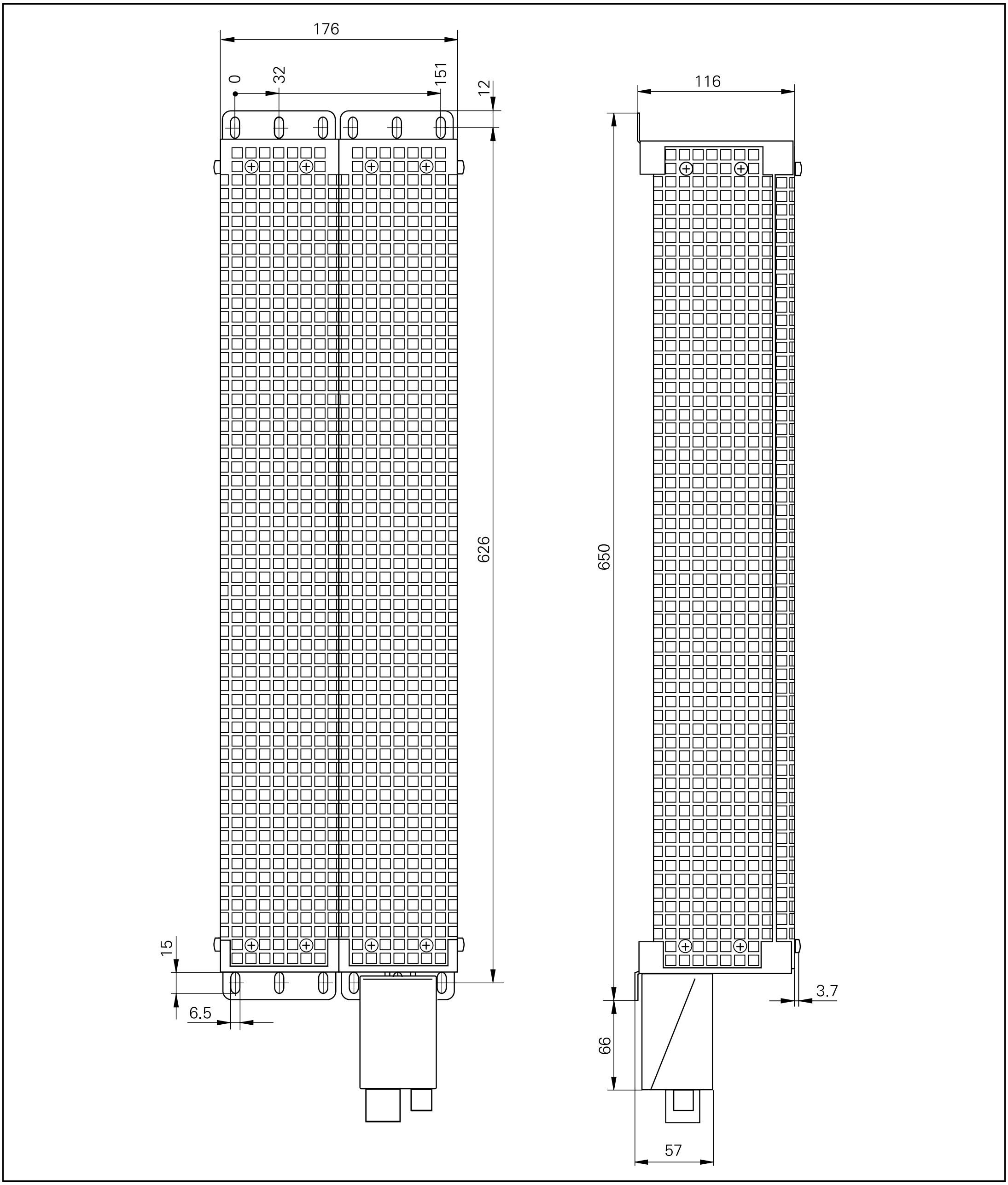


5.7.3 UE 2xxB

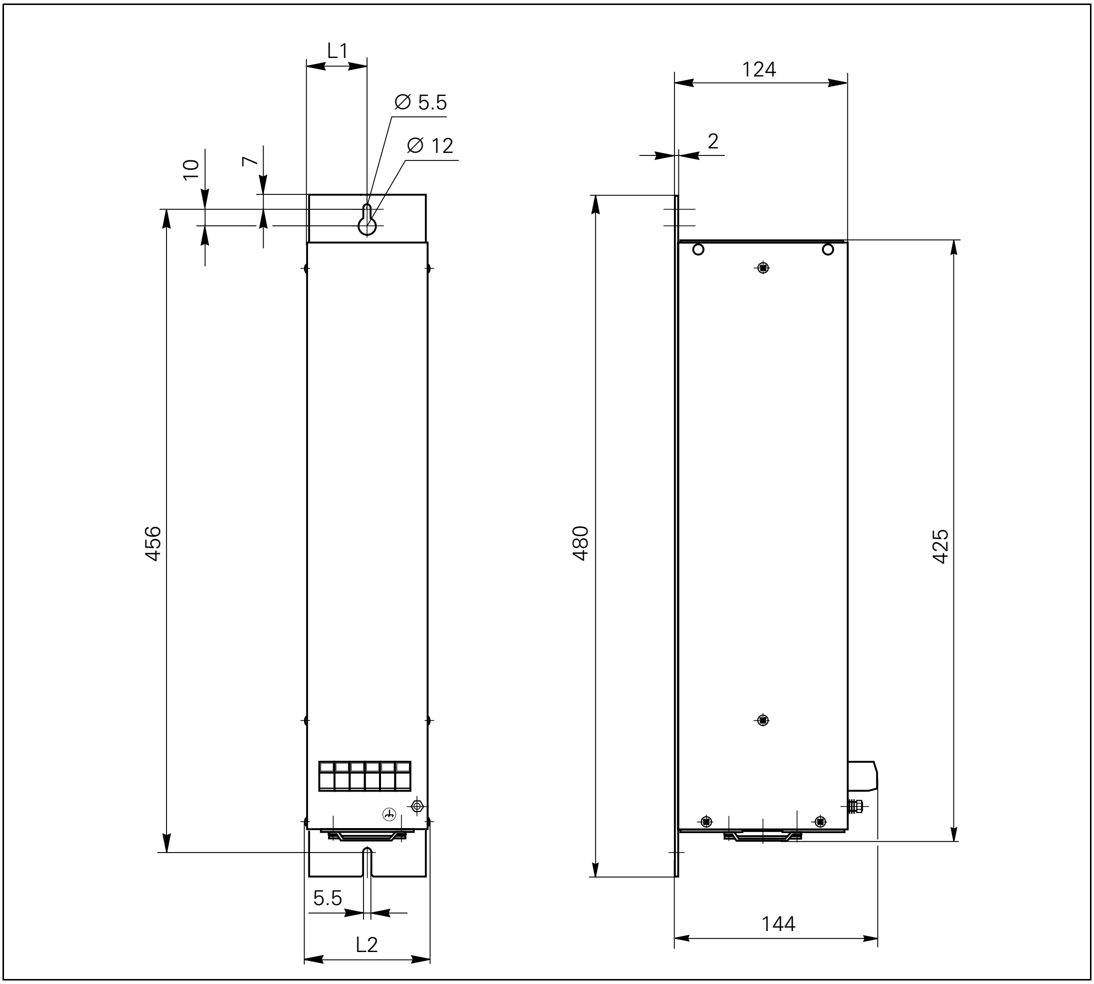


Ø 5.5
Ø 12
7
480
456+5
L1 L2 L3
U V W
U V W
5.5
24.5+0.5
150±0.2
199.5+0.5
300+1
280.5
420

5.7.4 PW 210

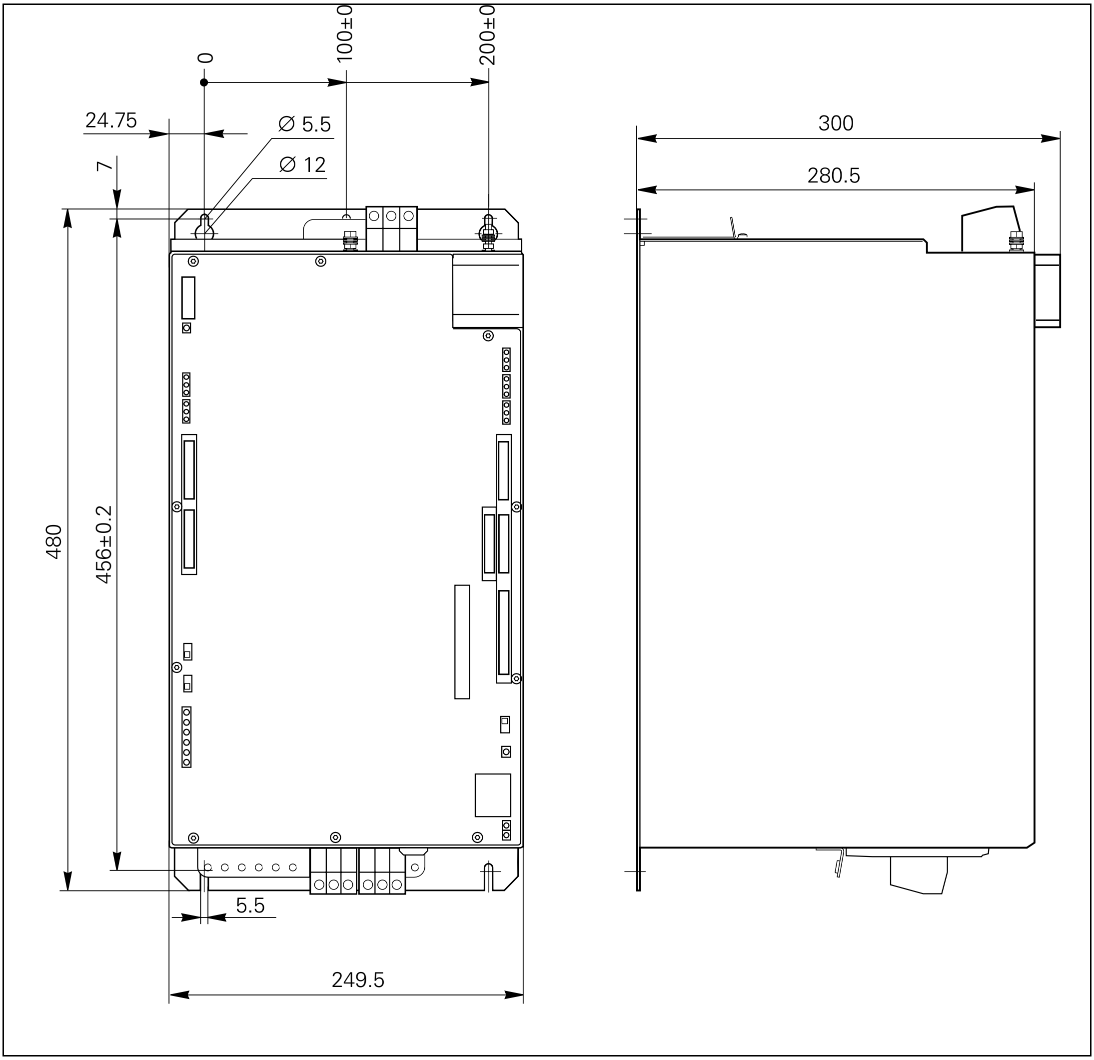


5.7.5 PW 1x0(B)

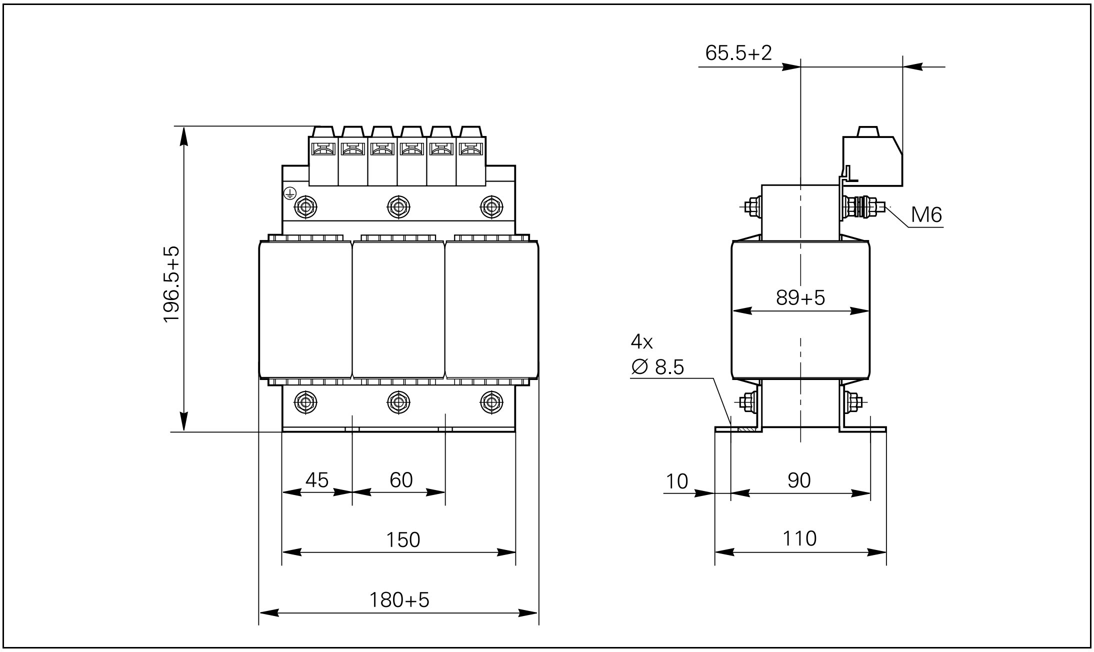


Value	PW 110(B)	PW 120
L1	38.5	62.5
L2	77	125

5.7.6 UR 2xx

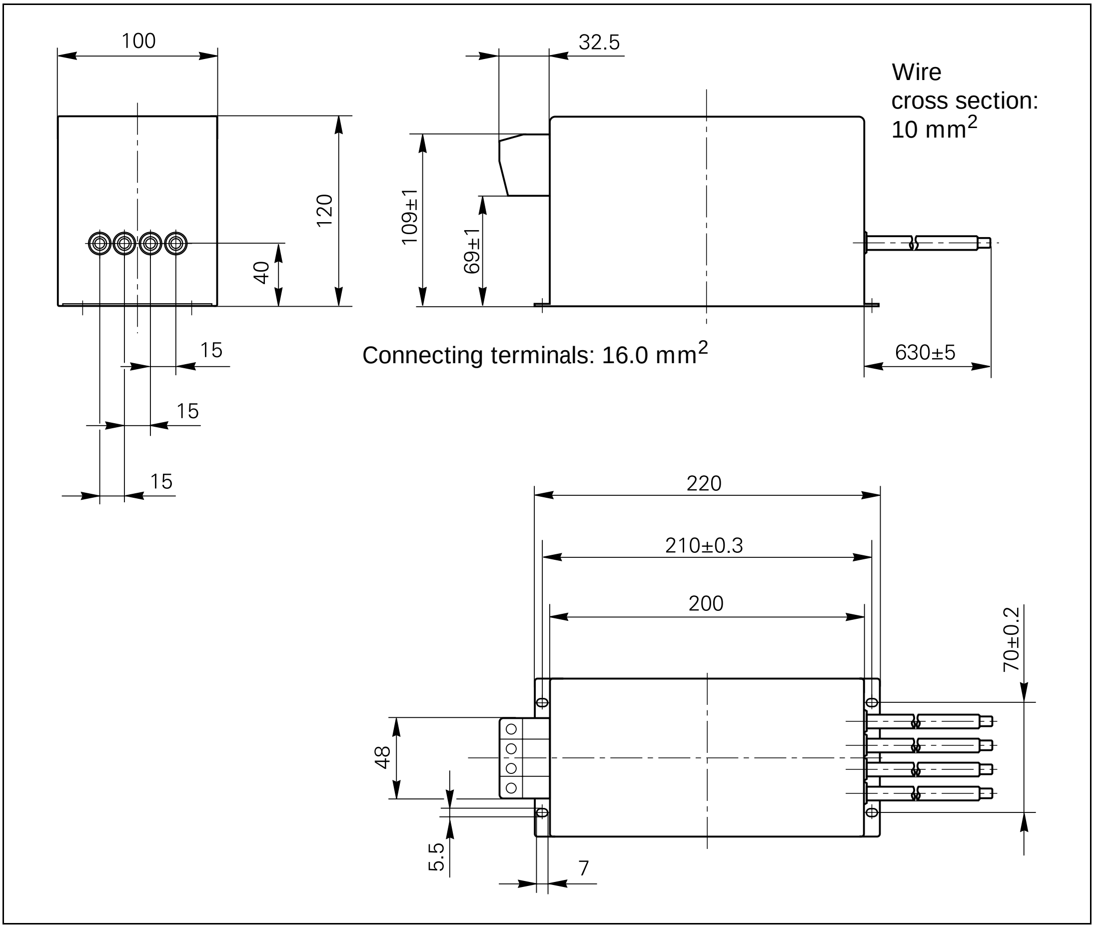


5.7.7 KDR 120

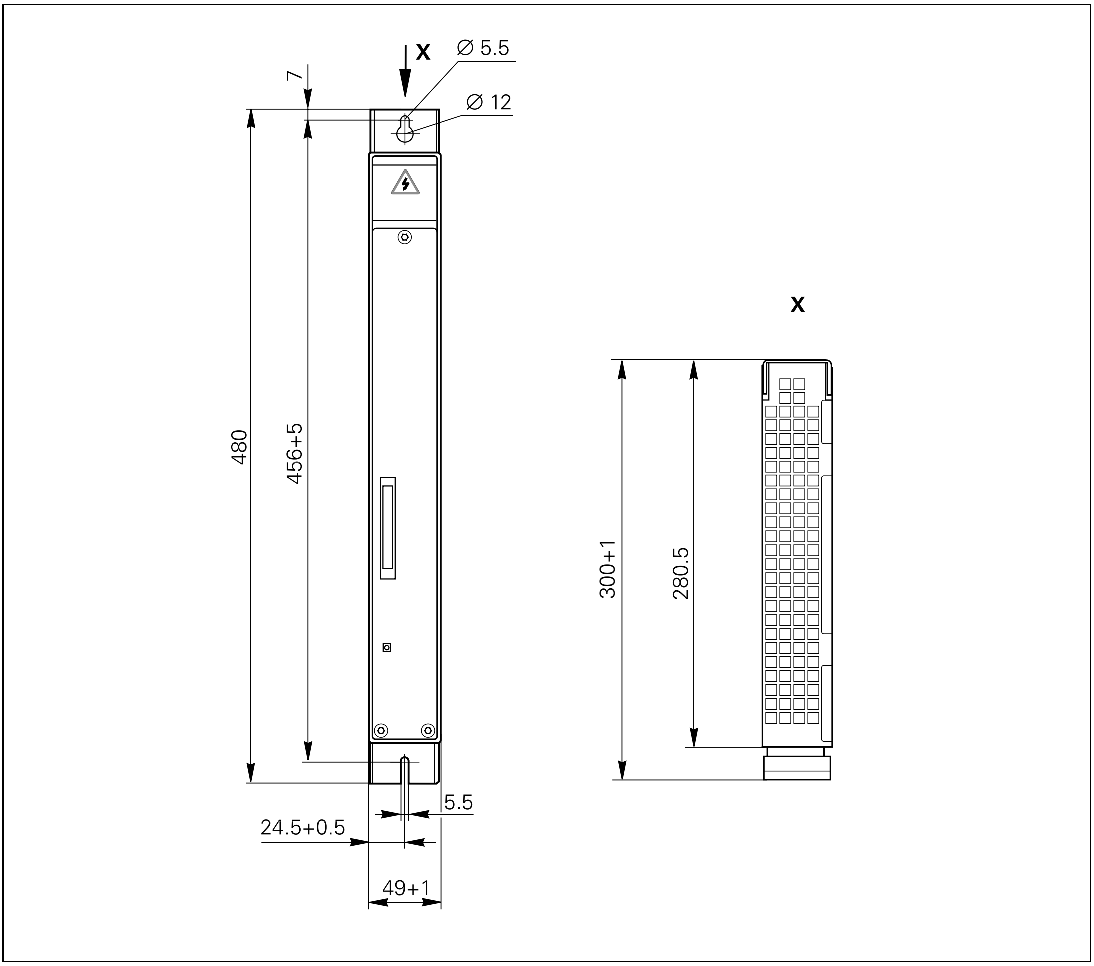


5.7.8 Line filters

EPCOS 35 A line filter



5.7.9 UP 110 braking resistor module

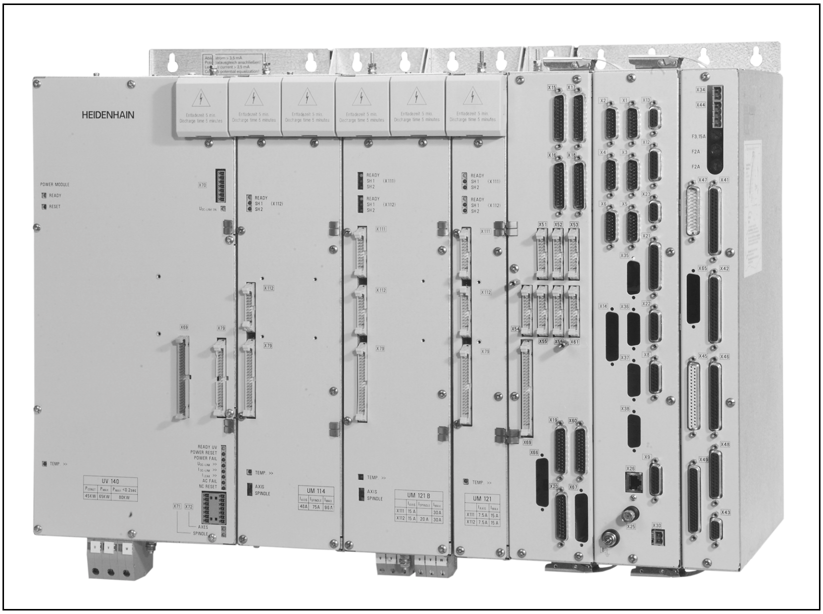


6 Modular Inverter

6 Modular Inverter

6.1 Connection Overview

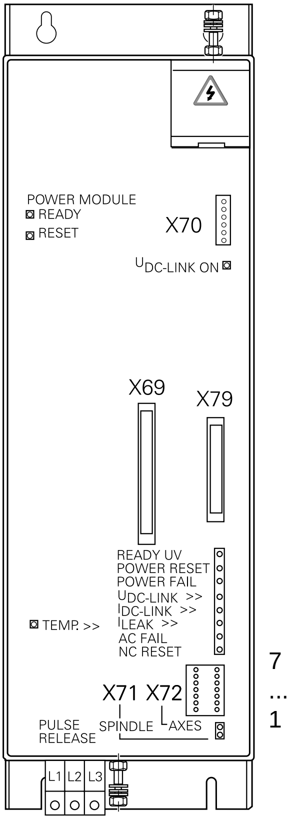
LE 430 M with modular inverter



6.1.1 UV 120 power supply unit

Danger

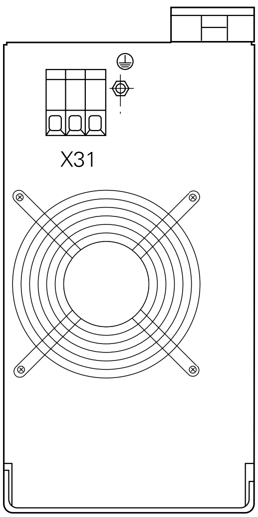
Do not engage or disengage any connecting elements while the unit is under power!



X70 Main contactor

X69 Power supply for the control
(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)



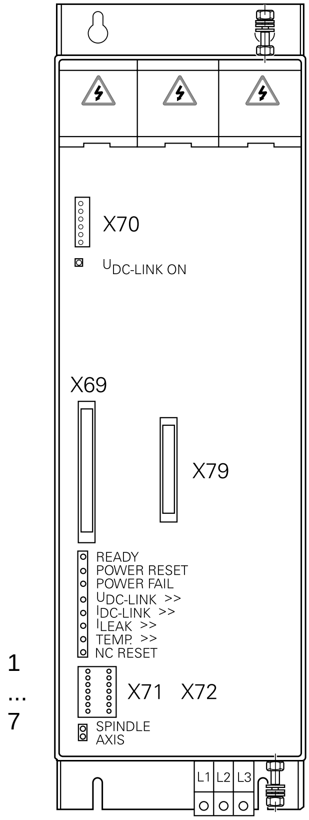
X31 Supply voltage for inverter (3 x 400 V ±10 %)

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!



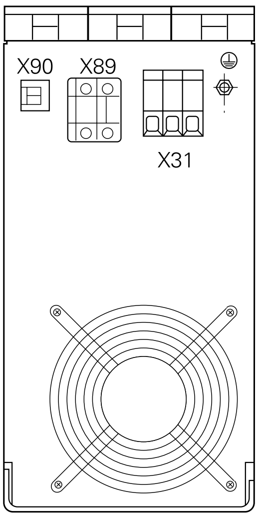
X70 Main contactor

X69 Power supply for the control
(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 %) X89Braking resistor

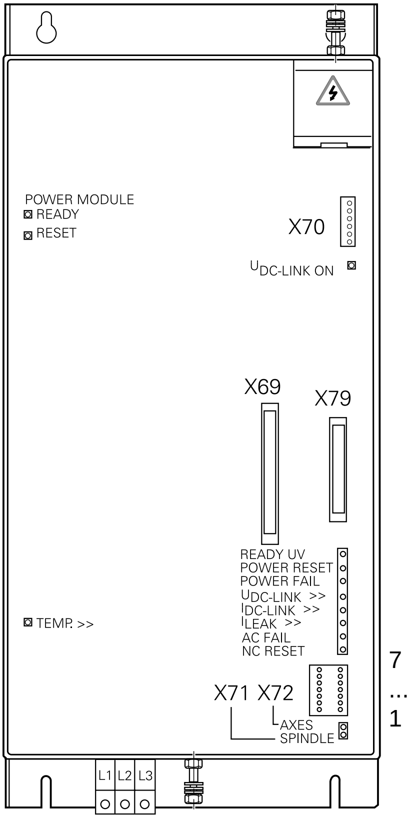
X90 24-V output

⏚ Equipment ground

6.1.3 UV 140, UV 150 Power Supply Unit

Danger

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



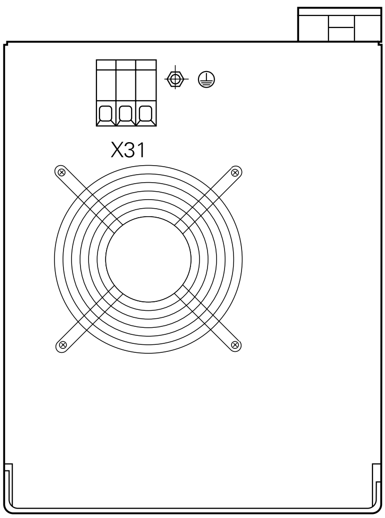
X70 Main contactor

X69 Power supply for the control (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

6.1.4 Meaning of LEDs on the UV 1x0

UV 120

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

UV 130

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

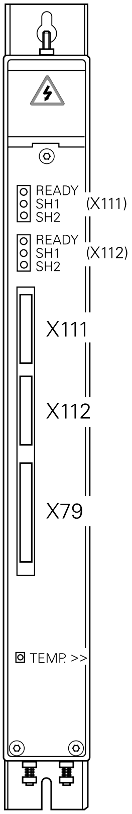
UV 140, UV 150

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

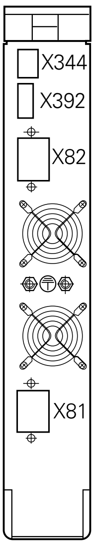
6.1.5 UM 1x1 power module

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

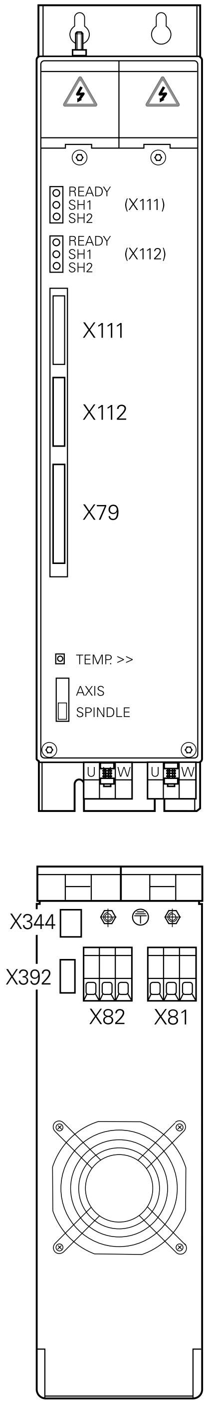


X344	24-V supply for motor holding brake
X392	Motor holding brake
X82	Motor connection for axis 2 (X112); not on the UM 111
⏚	Equipment ground
X81	Motor connection for axis 1 (X111)

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 24-V supply for motor holding brake
X392 Motor holding brake

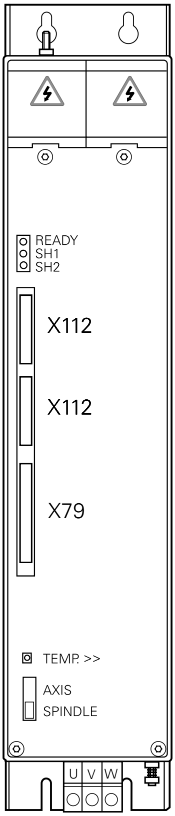
X82 Motor connection for axis 2 / spindle (X112)
X81 Motor connection for axis 1 (X111);
not on the UM 112 and UM 111B

⏚ Equipment ground

6.1.7 UM 113 and UM 114 Power Modules

Danger

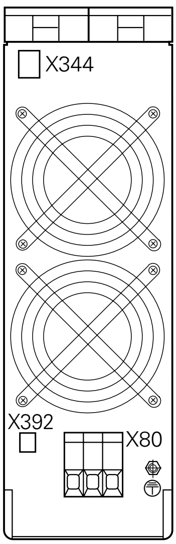
Do not engage or disengage any connecting elements while the unit is under power!



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



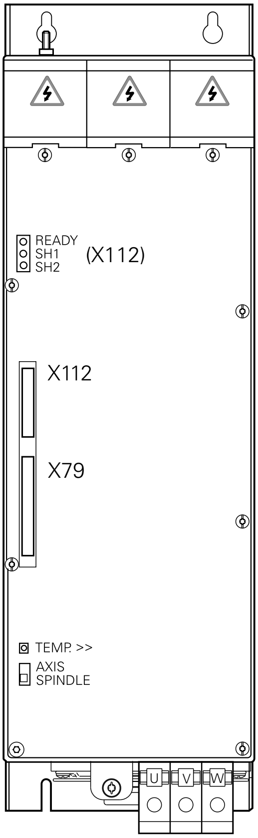
X344	24-V supply for motor holding brake
X392	Motor holding brake
X80	Motor connection for axis / spindle (X112)

Equipment ground

6.1.8 UM 115 Power Module

Danger

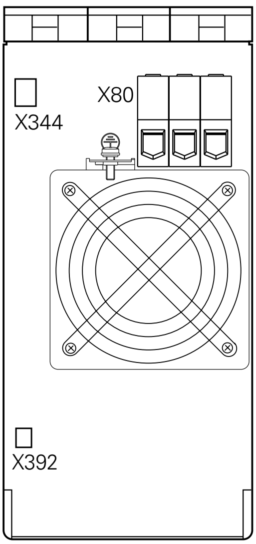
Do not engage or disengage any connecting elements while the unit is under power!



X112 PWM, axis / spindle

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 24-V supply for motor holding brake
X80 Motor connection for axis / spindle

Equipment ground

X392 Motor holding brake

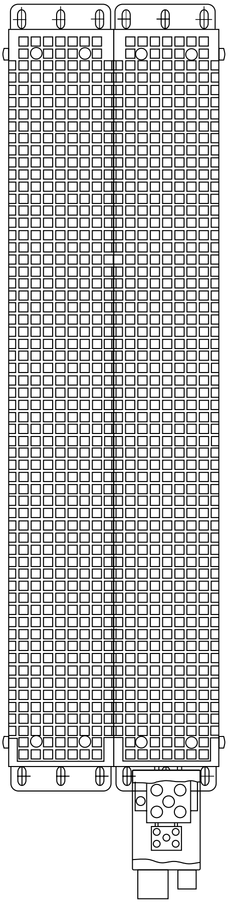
6.1.9 Meaning of LEDs on the UM 1xx

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

6.1.10 PW 210 braking resistor

Danger

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

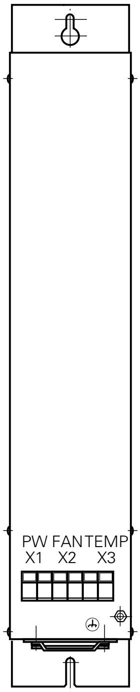


RB1, RB2
UV 130 power supply unit
T1, T2
Temperature switch

6.1.11 PW 1x0(B) Braking Resistor

Danger

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

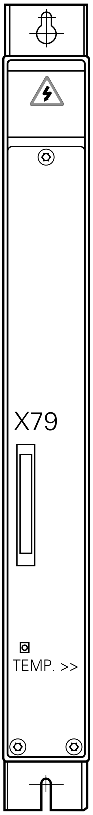


X1 UV 130 power supply module
X2 Supply voltage for the fan of the braking resistor
X3 Temperature switch

6.1.12 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 control. 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, UV 140 and UV 150 energy-recovery power modules, the braking resistor is arranged between the weakest power module and the control.
The power module for a second spindle (not on all controls) 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 second spindle (not all controls)	UM 1xx	UM 1xx	If reqd. UP 110 (only UV 120, UV 140 or UV 150)	LE 41x M "modular" LE 426 M LE 430 M MC 422/ CC 42x

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 control with the UV 1x0 and supplies the power to the control.

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 control and the power modules, and supply the PWM signals to the axes and the spindle(s).

Covering the modules

The ribbon cables must be covered to protect them against interference.

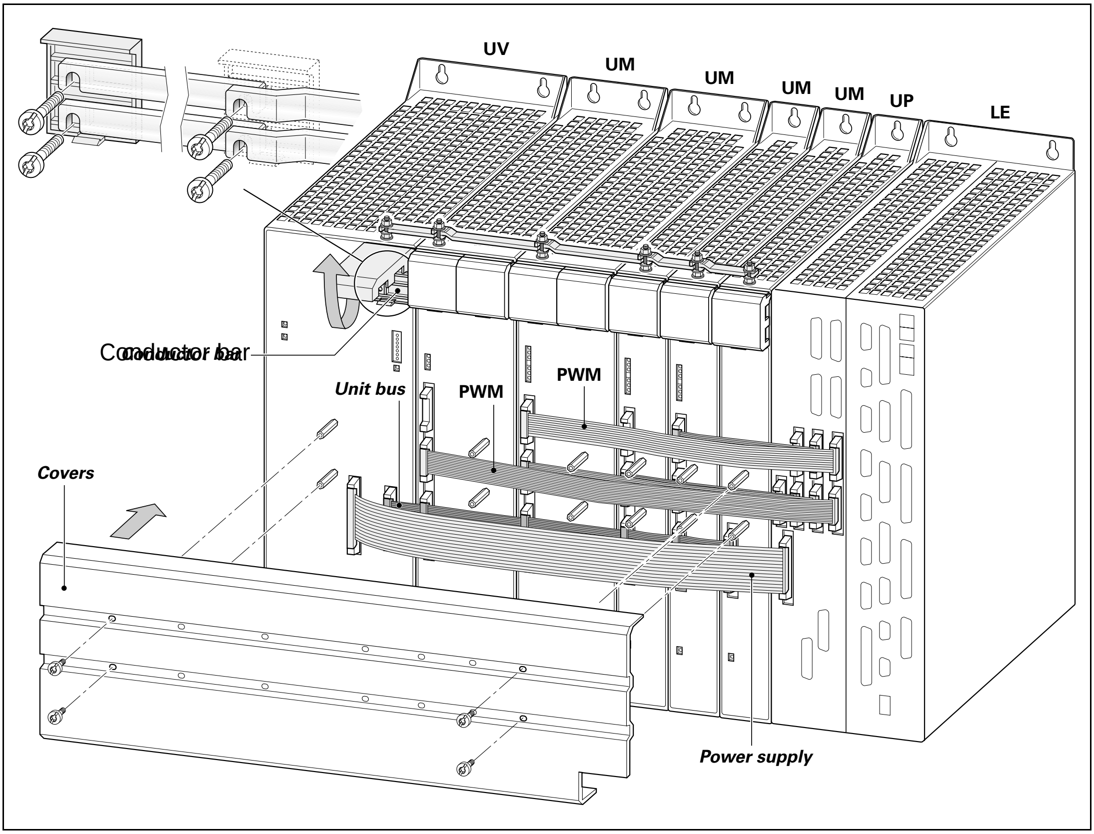
A cover is supplied as an accessory with the UV 1x0 (Id. Nr. 329 031-03), which protects the following modules

- UV 1x0
- UM 115 or
- One UM 1xx (width 100 mm) and one UM 1xx (width 50 mm)

The cover for the control is supplied with it.

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

Mounting the modular HEIDENHAIN inverter system

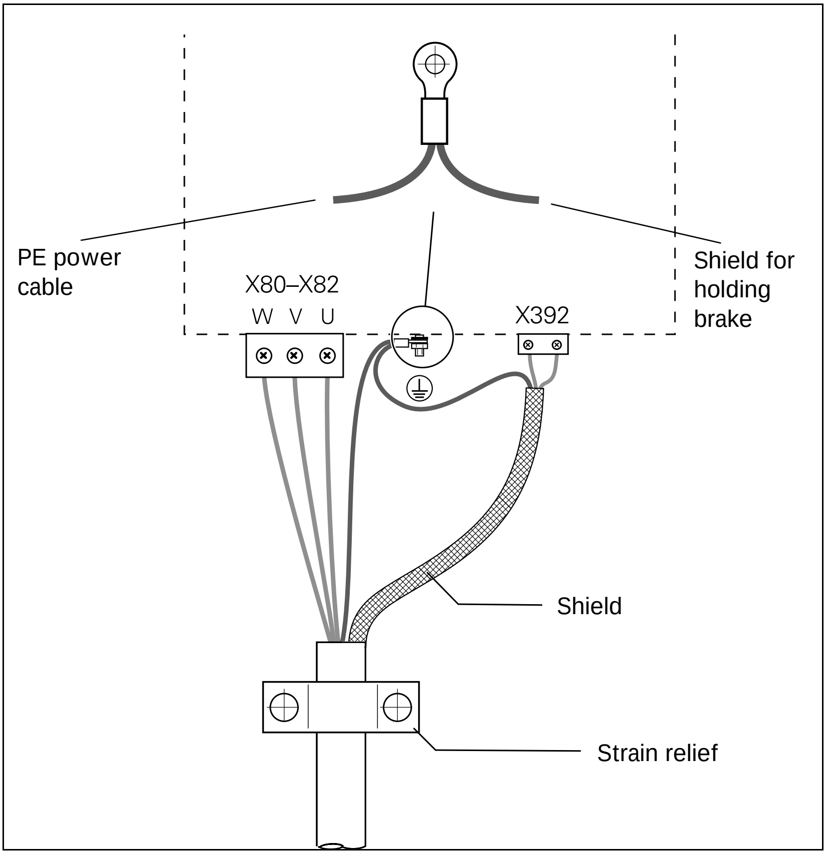


Warning

All electrical screw connections must be tightened after installation is complete (tightening torque 3.5 Nm).

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 % 50 Hz to 60 Hz
L2	
L3	
	Cable: Wire cross section 16 mm^2 Line fuse: 63 A (gRL) 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[a]	Normally closed contact (OE1)
7[a]	Normally closed contact (OE2)

a. Max. 125 V

Warning

A recovery diode is required in the proximity of inductive loads, e.g. relay or contactor coils.

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[a]	Normally closed contact (OE1A or OE1S)
7[a]	Normally closed contact (OE2A or OE2S)

a. Max. 125 V

Warning

A recovery diode is required in the proximity of inductive loads, e.g. relay or contactor coils.

6.3.3 NC supply voltage and control signals

X69: NC supply voltage and control signals

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

Ribbon connector, 50-pin	Assignment	Ribbon connector, 50-pin	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	0 V
12a	$\overline{\text{RES.PS}}$	21b	GND
12b	0 V	22a	0 V
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.”

6.3.4 Unit Bus

X79 Unit bus

Pin layout:

Ribbon connector, 40-line	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 210 or PW 1x0(B) Braking Resistors on the UV 130 Power Supply Unit

A PW 210, PW 1x0(B) 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 mm^2
PW 110(B)	1.5 mm^2
PW 120	4 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(B):

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

Temperature switch

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

Pin layout:

Connecting terminal on the PW 210	Assignment
T1	1
T2	2

Connecting terminal X3 on the PW 110B	Assignment
1	1
2	2

X2 Fan for the PW 1x0(B) external braking resistor

Pin layout:

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

6.4 Connections to the UV 1x0 Energy-Recovery Power Supply Units

Danger

Danger of electrical shock!
The UV 120, UV 140 and UV 150 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

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.

X31 Supply voltage for U_Z

The inverter voltage U_Z is 650 Vdc.

The UV 120, UV 140 and UV 150 energy-recovery modules must be connected to the main power line via the KDR 120, KDR 140 and KDR 150 commutating reactor and the line filter. This is necessary for keeping the main line free of disruptive higher harmonics.

Pin layout:

Power supply		**Line filter (EPCOS)** **Power**	**Device**		**KDR 120** **KDR 140** **KDR 150**			**UV 1x0** **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:** Cables or single wires: Wire cross section 16 mm^2 Line fuse: 35 A (gRL) Grounding terminal: $\geq$ 10 mm^2 **UV 140:** Cables or single wires: Wire cross section 25 mm^2 Line fuse: 80 A (gRL) Grounding terminal: $\geq$ 16 mm^2 **UV 150:** Single wires: Wire cross section 25 mm^2 Line fuse: 80 A (gRL) Grounding terminal: $\geq$ 16 mm^2							

Note

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

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[a]	Normally closed contact (OE1)
7[a]	Normally closed contact (OE2)

a. Max. 125 V

Warning

A recovery diode is required in the proximity of inductive loads, e.g. relay or contactor coils.

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[a]	Normally closed contact (OE1A or OE1S)
7[a]	Normally closed contact (OE2A or OE2S)

a. Max. 125 V

Warning

A recovery diode is required in the proximity of inductive loads, e.g. relay or contactor coils.

6.4.3 X90 24 V output

Pin layout:

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

6.4.4 NC supply voltage and control signals

X69: NC supply voltage and control signals

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

Ribbon connector, 50-pin	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	$\overline{\text{ERR.TEMP}}$

Ribbon connector, 50-pin	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:

Ribbon connector, 40-line	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).

6.5 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:

Ribbon connector, 40-line	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 Control

X111, X112 PWM connection to the control

Pin layout:

Ribbon cable 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	$\overline{\text{SH2}}$
4b	0 V ($\overline{\text{SH2}}$)
5a	$\overline{\text{SH1}}$
5b	0 V ($\overline{\text{SH1}}$)
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	$\overline{\text{BRK}}$
10a	$\overline{\text{ERR}}$
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:

Ribbon connector, 40-line	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 X81, X82	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.

6.6.4 Connection of the Motor Holding Brakes

X344 24-V supply for motor holding brake

Pin layout:

Connecting terminals X34	Assignment
1	+24 V
2	0 V

X392 Motor holding brake

Pin layout:

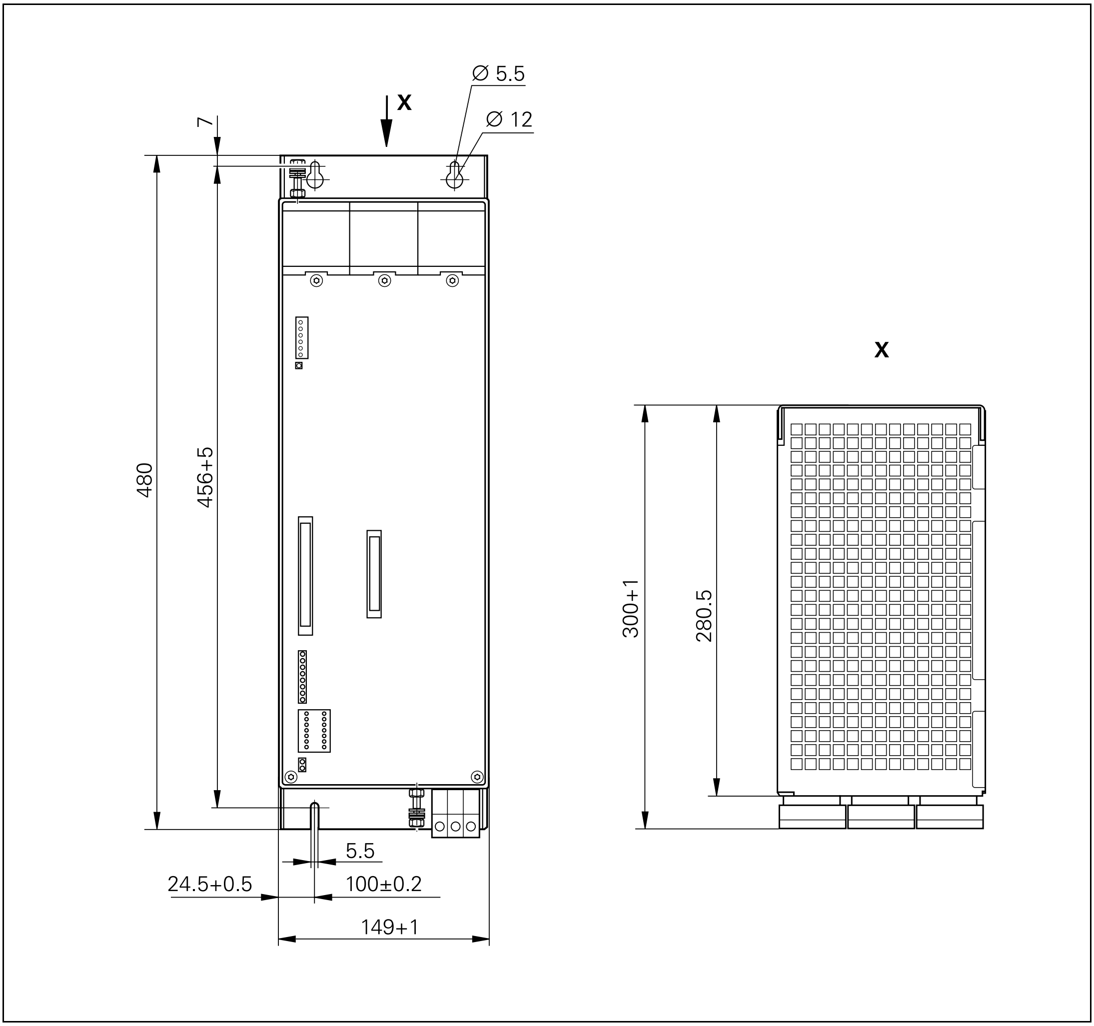
Connecting terminals X392	Assignment
1	Holding brake (X111)
2	0 V (X111)
3	Holding brake (X112)
4	0 V (X112)

6.7 Dimensions

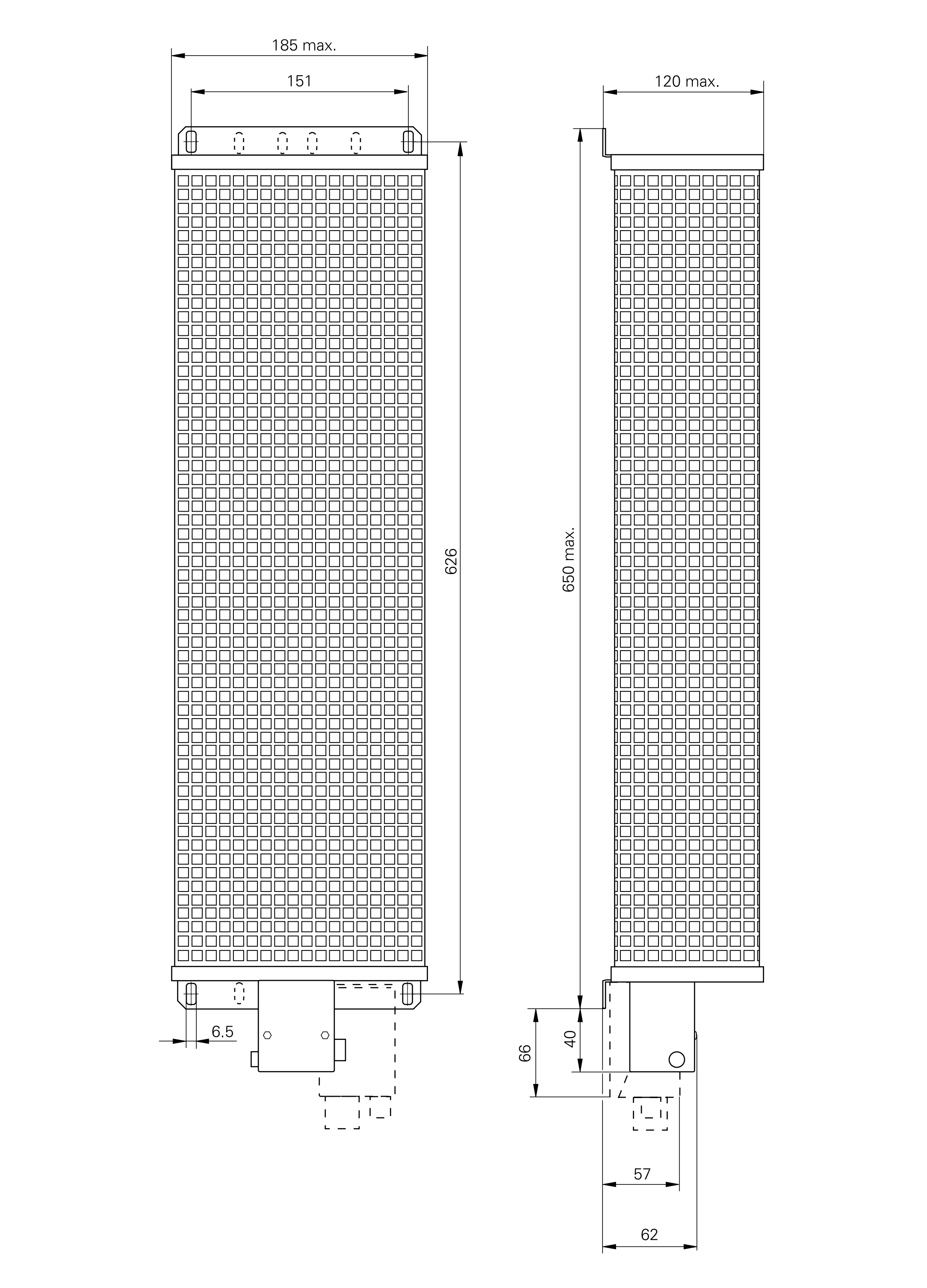
Note

All dimensions in [mm].

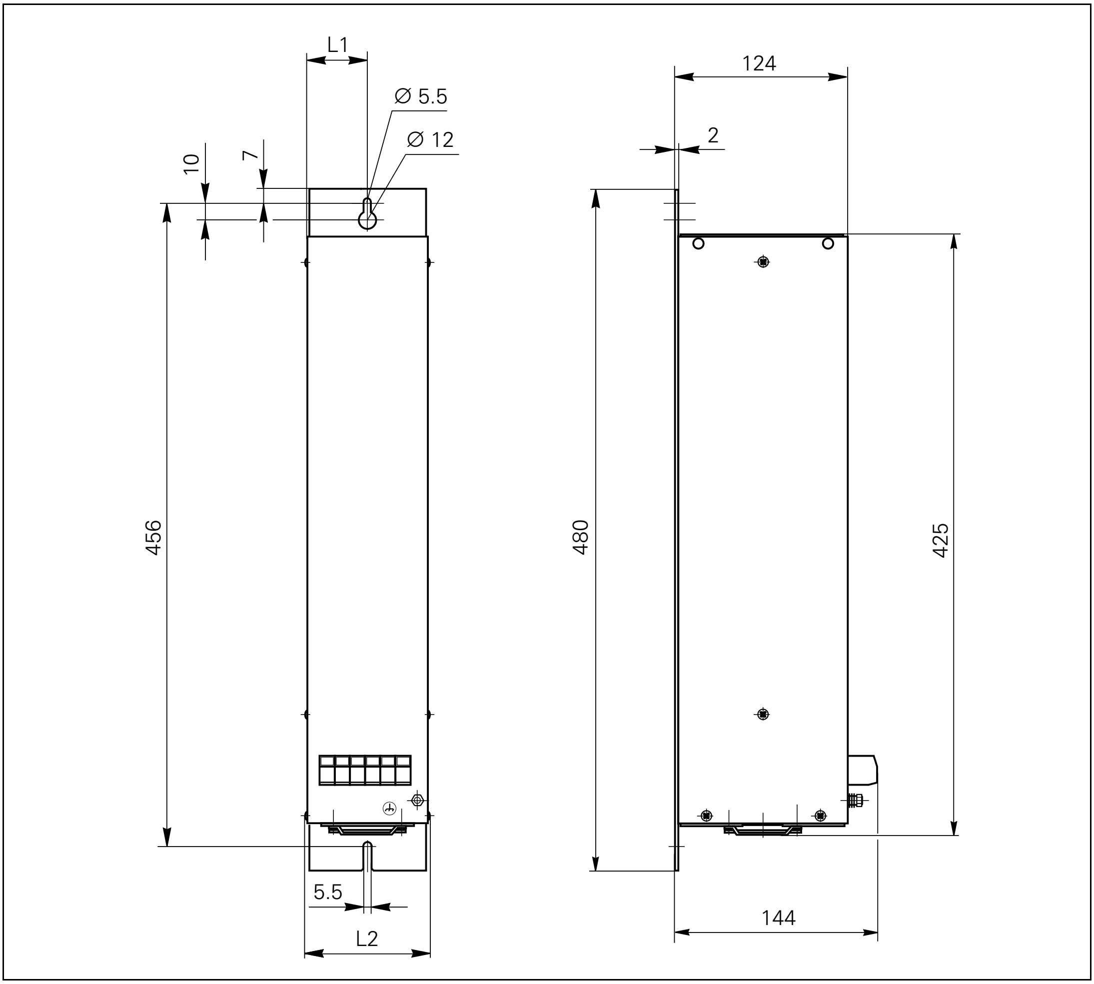
6.7.1 UV 130 Power Supply Unit



6.7.2 PW 210 braking resistor

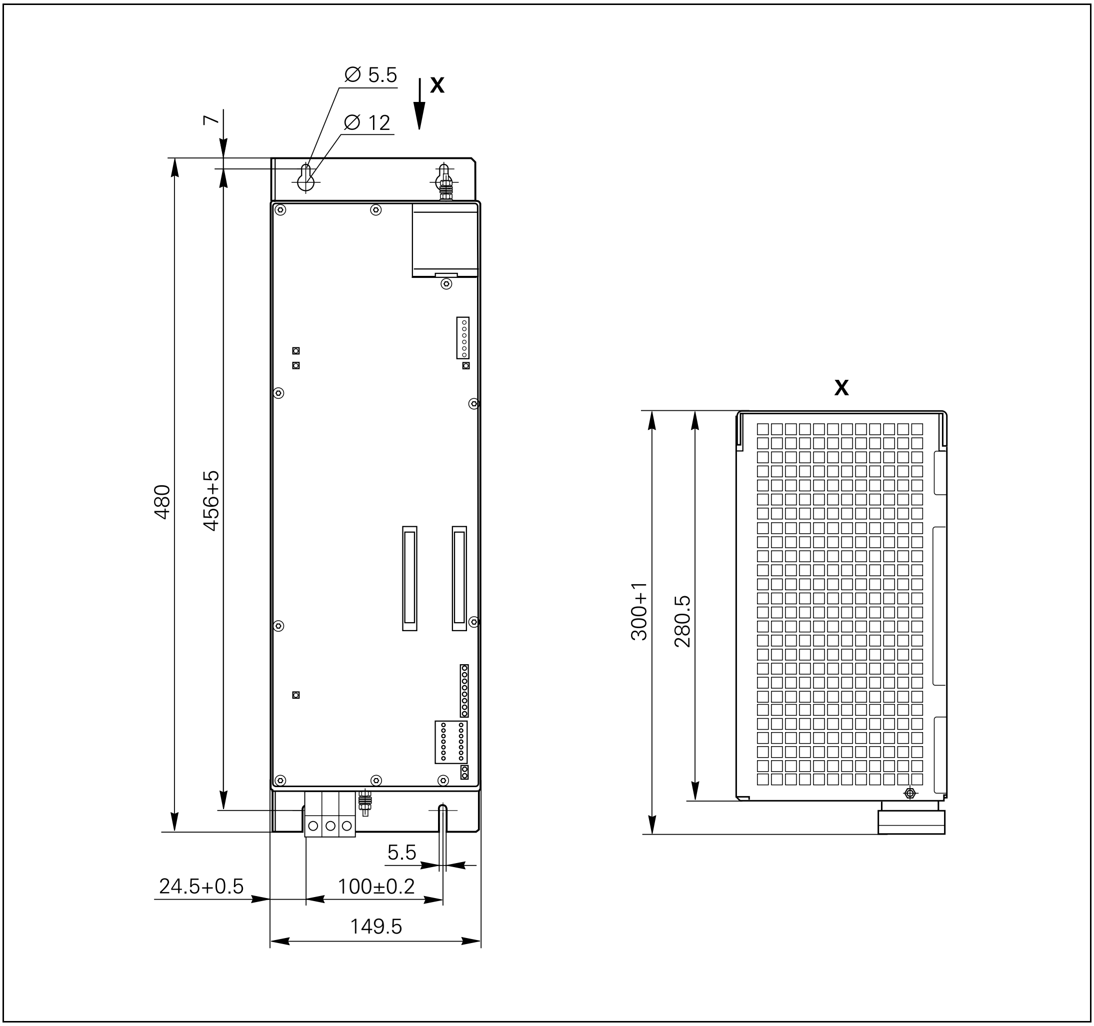


6.7.3 PW 1x0(B) Braking Resistor

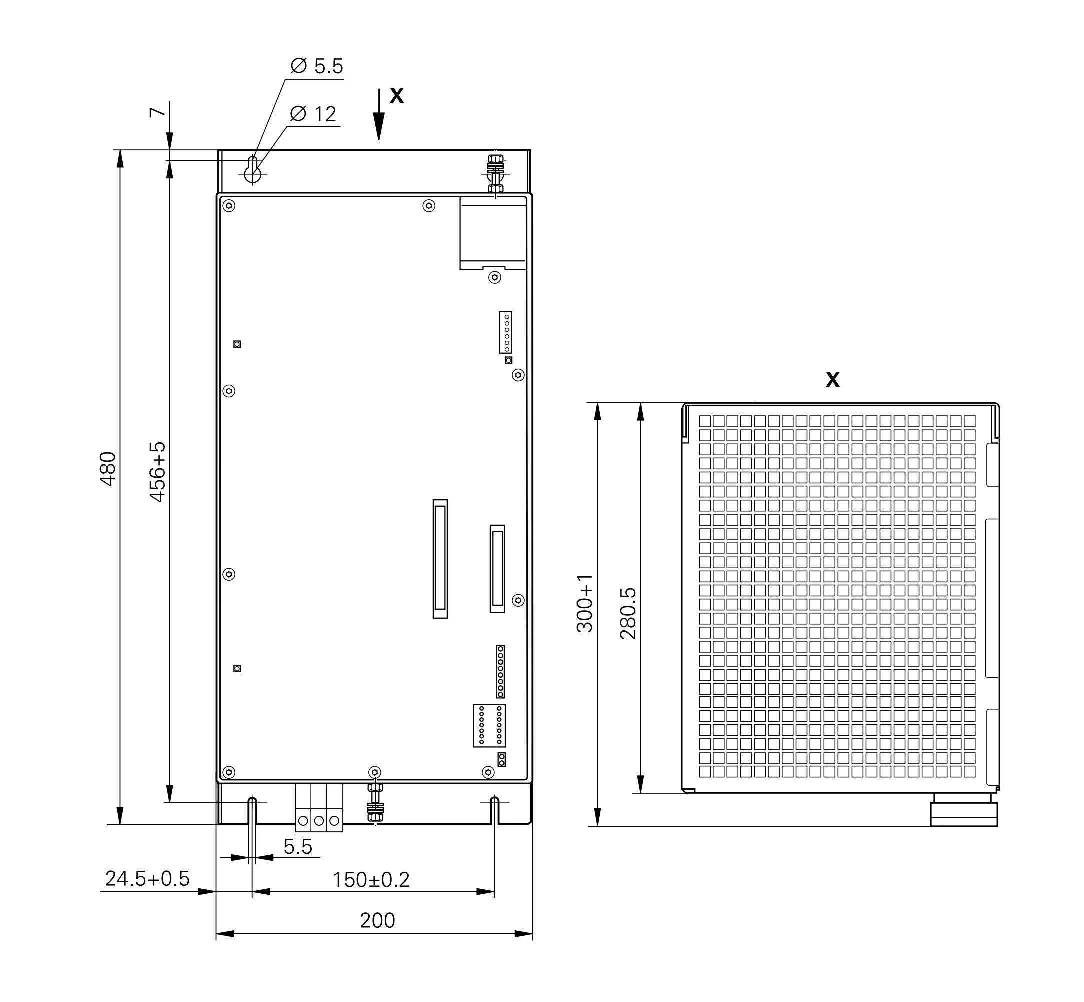


Value	PW 110(B)	PW 120
L1	38.5	62.5
L2	77	125

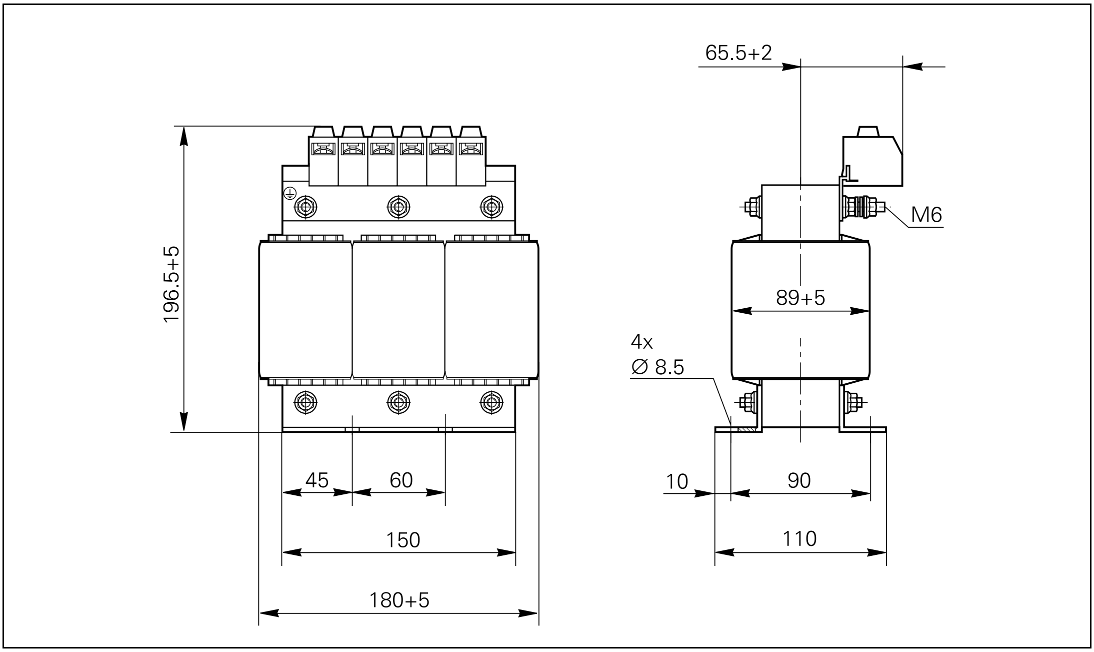
6.7.4 UV 120 Power Supply Unit



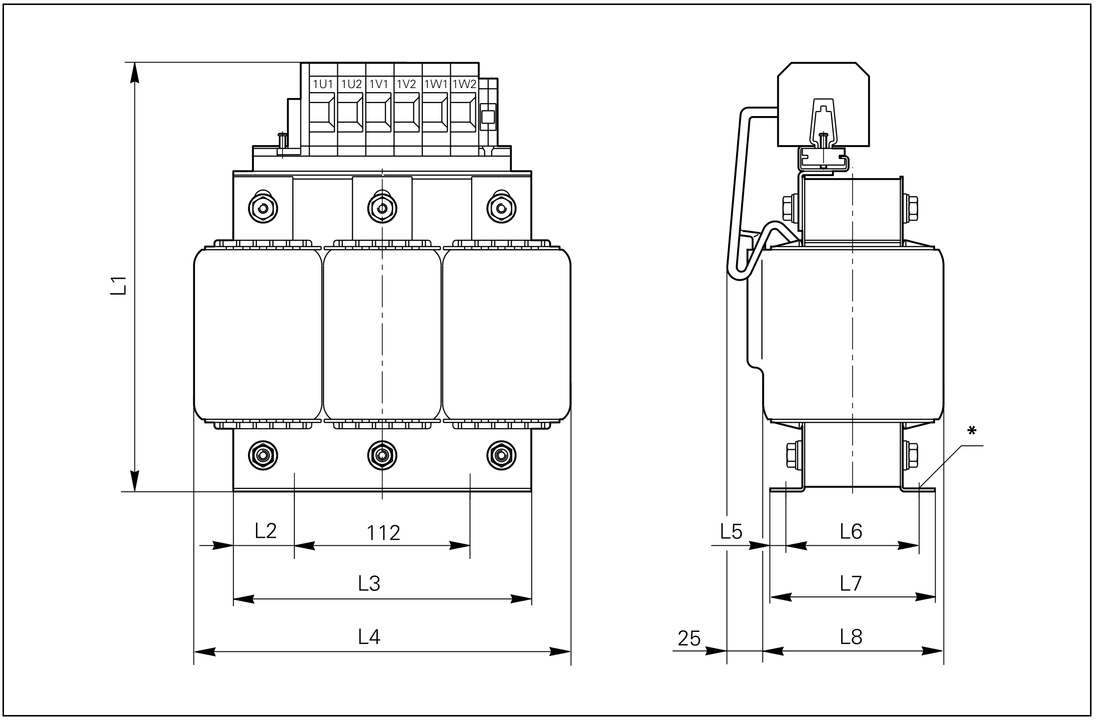
6.7.5 UV 140, UV 150 Power Supply Unit



6.7.6 KDR 120



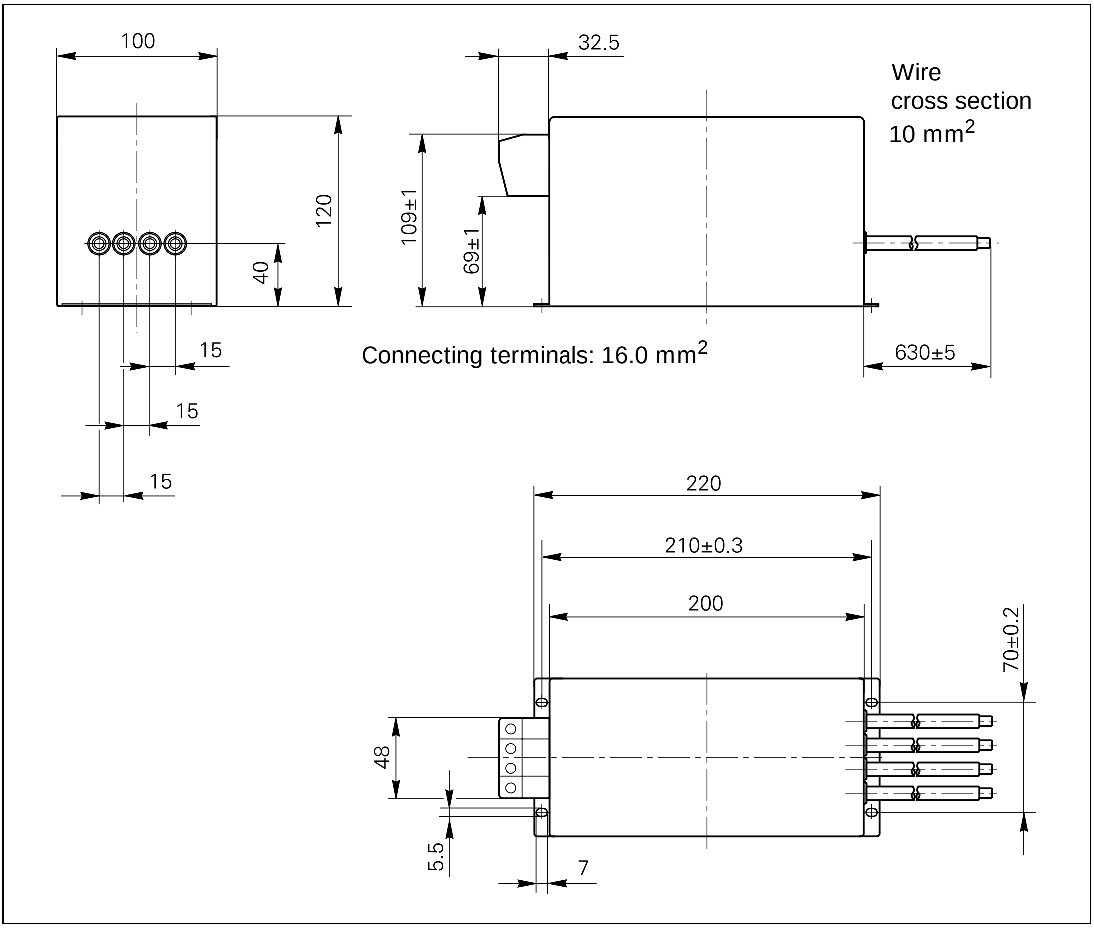
6.7.7 KDR 140, KDR 150



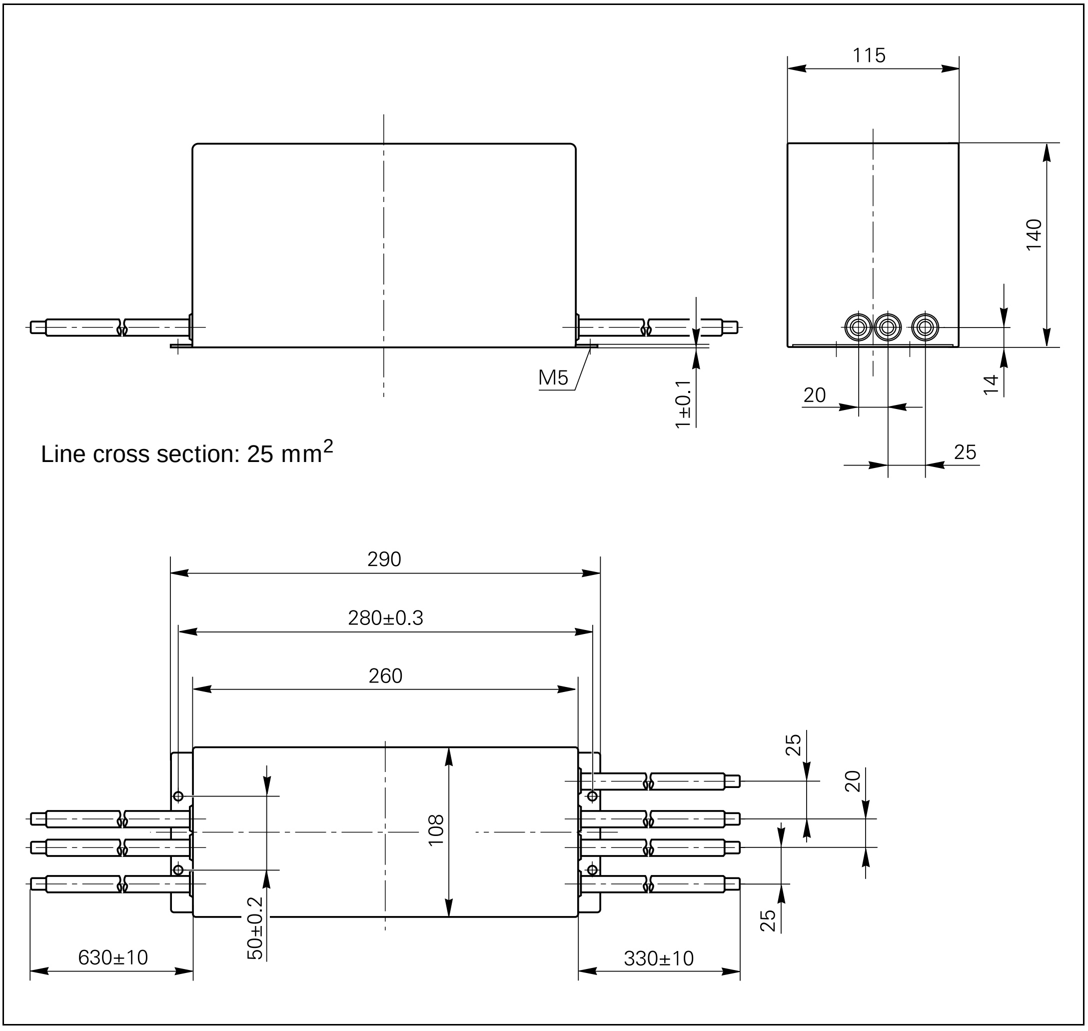
Value	KDR 140	KDR 150
L1	273	287
L2	39	44
L3	190	200
L4	240	250
L5	10	11
L6	95	103
L7	115	125
L8	115	130

6.7.8 Line filters

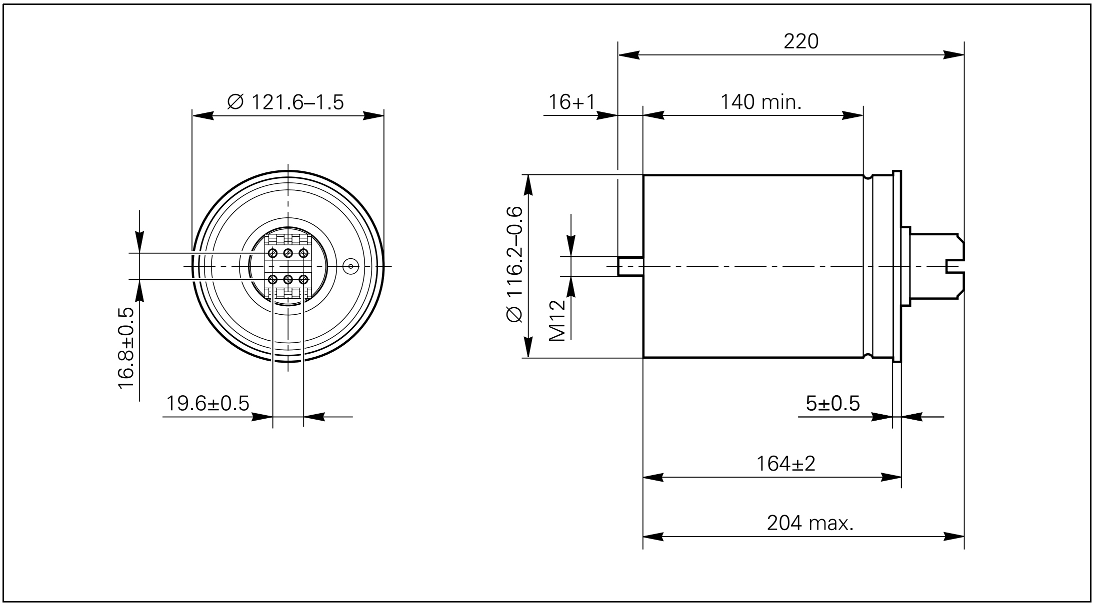
EPCOS 35 A line filter



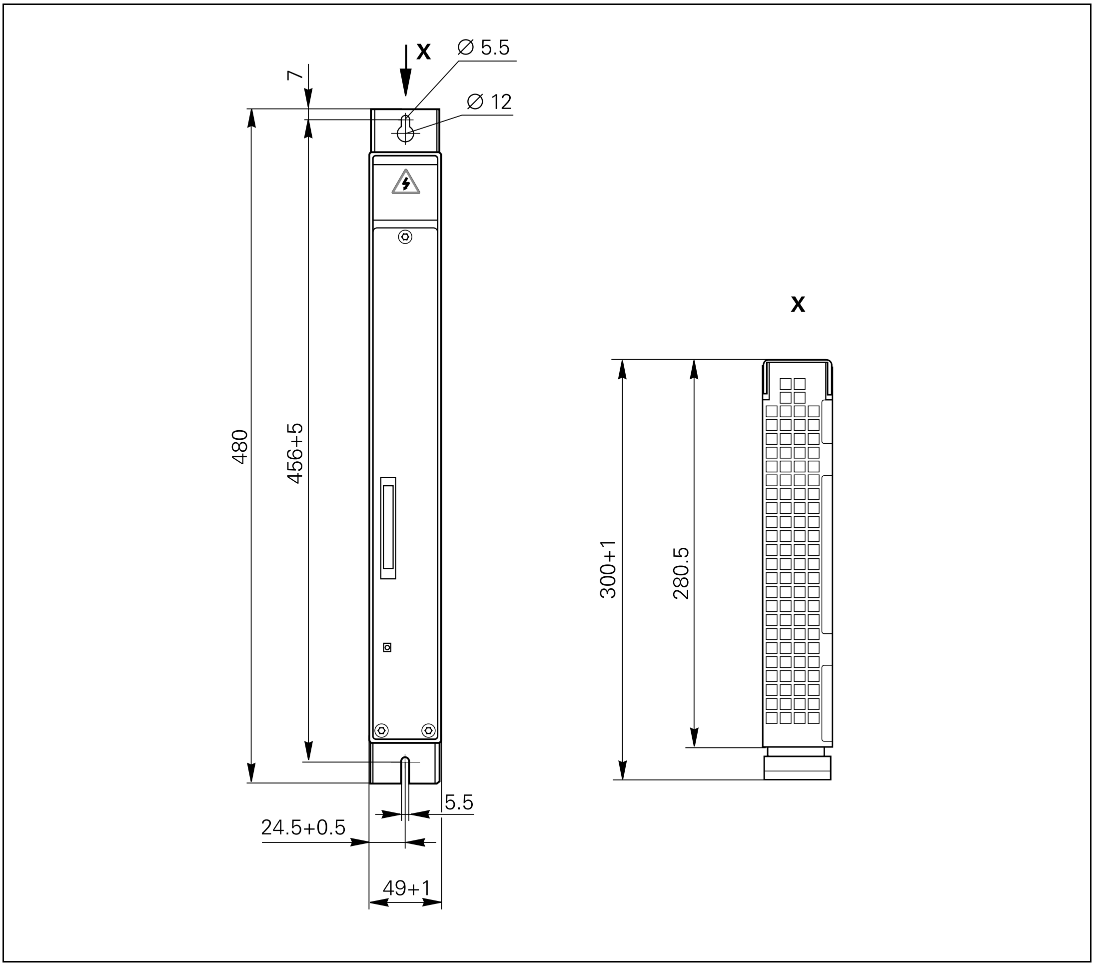
EPCOS 80 A line filter



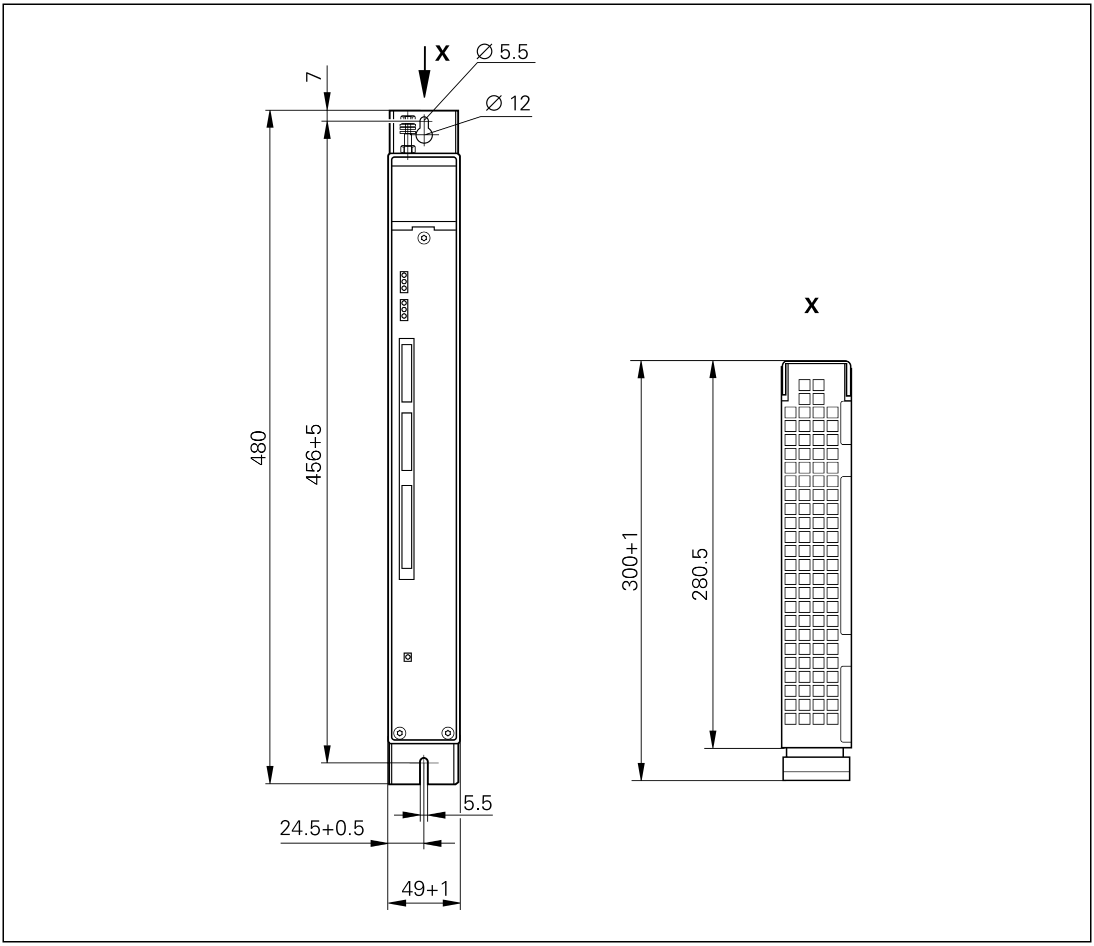
6.7.9 Three-Phase Current Capacitor



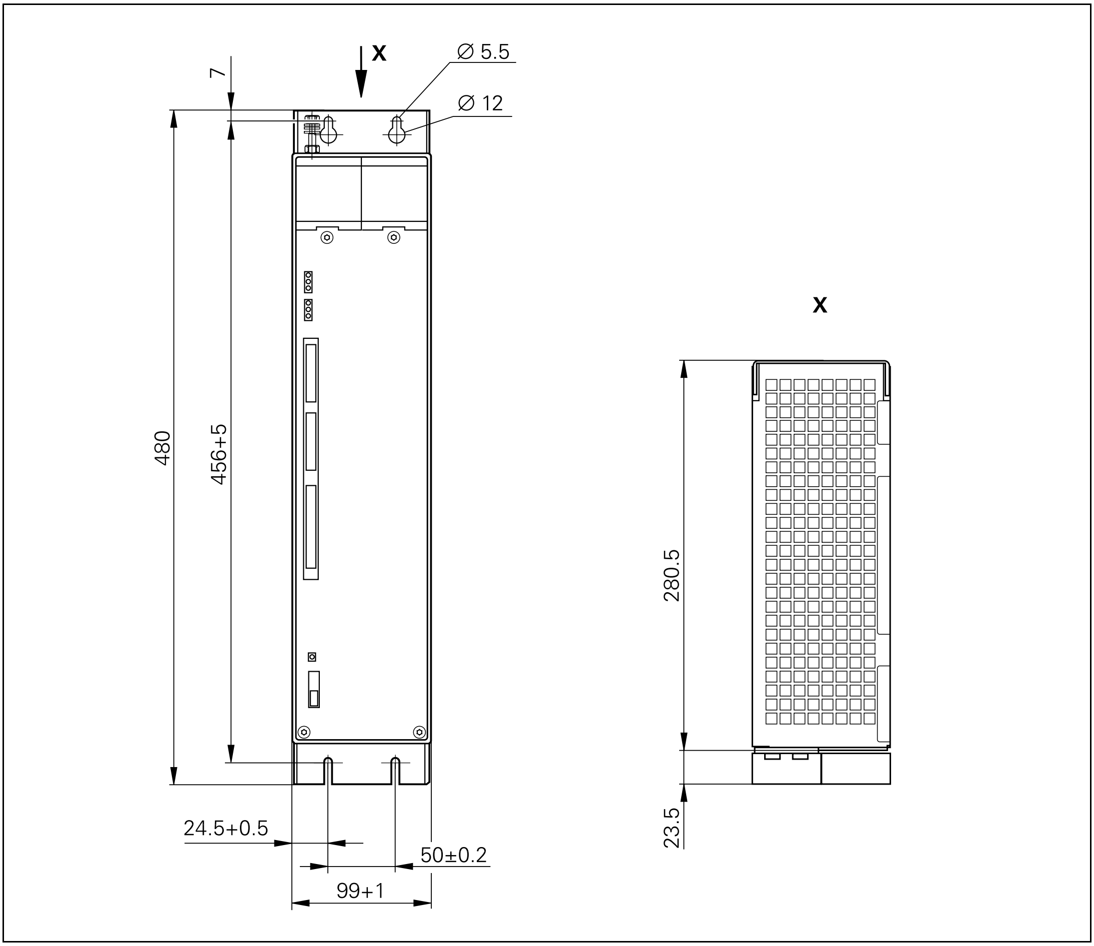
6.7.10 UP 110 braking resistor module



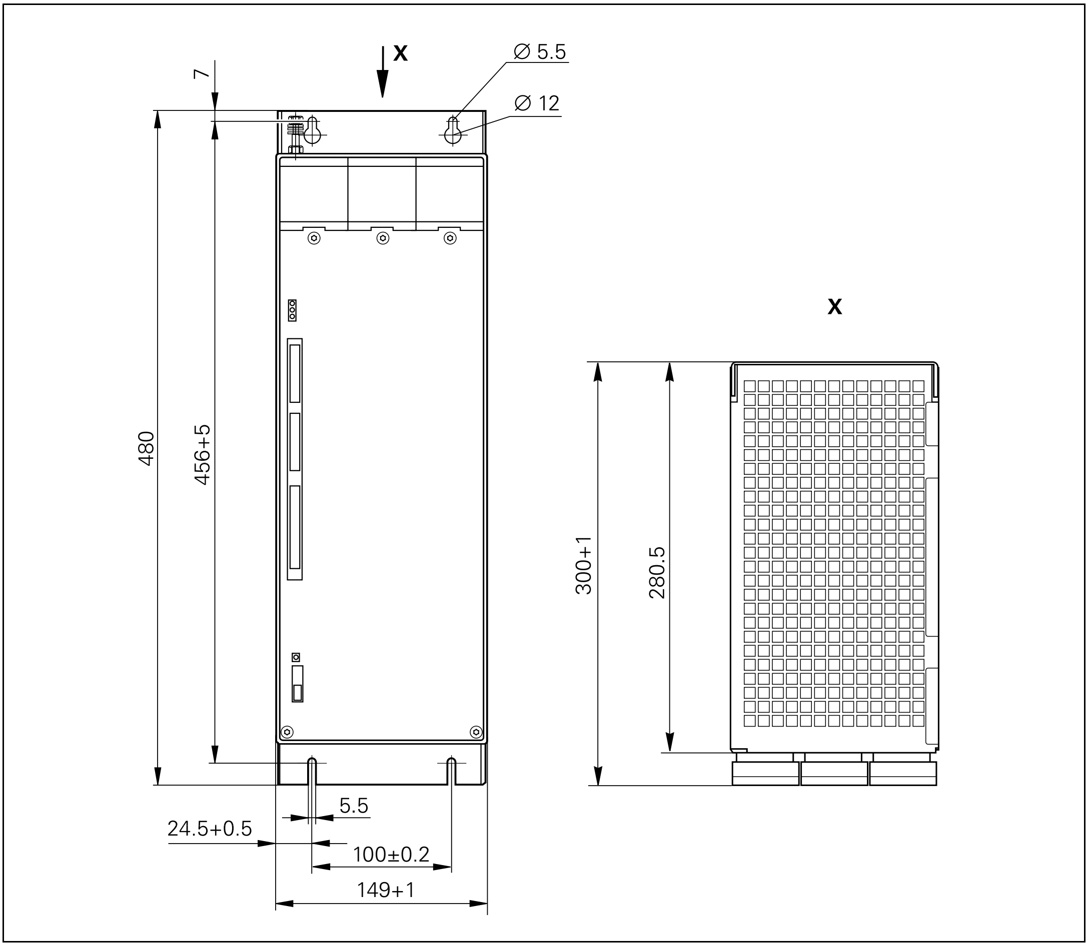
6.7.11 UM 1x1 Power Module



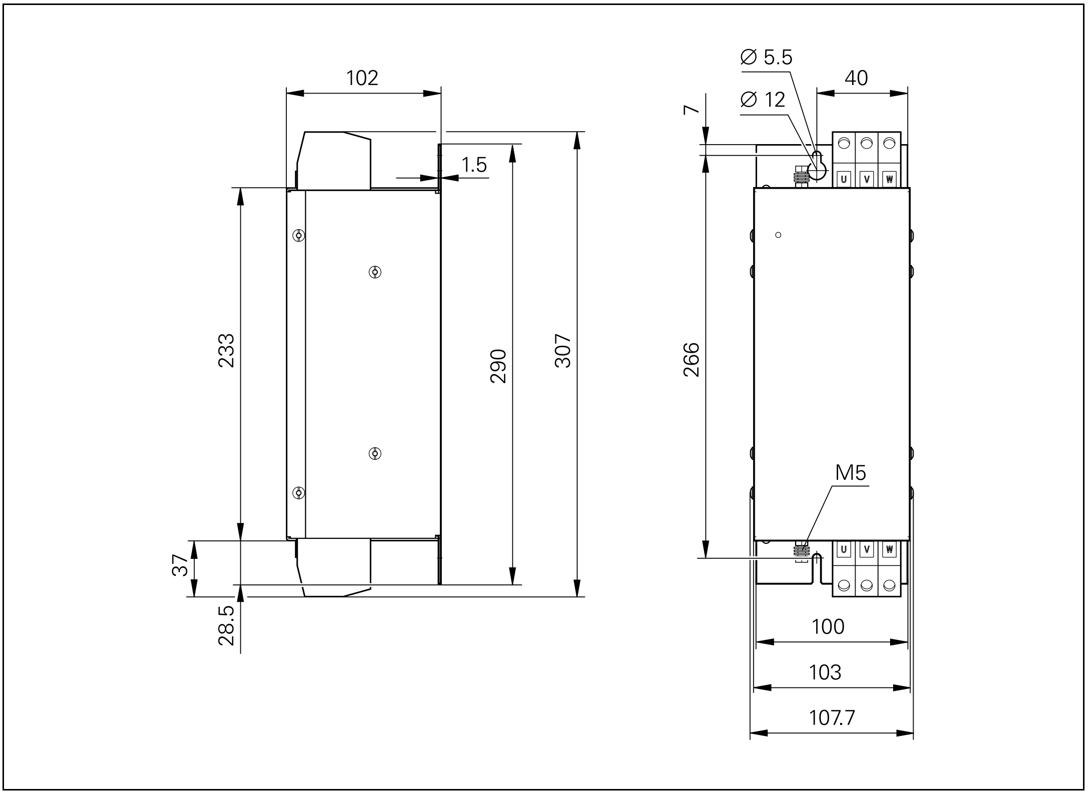
6.7.12 UM 111B, UM 1x2, UM 121B, UM 113, UM 114 Power Modules



6.7.13 UM 115 Power Module



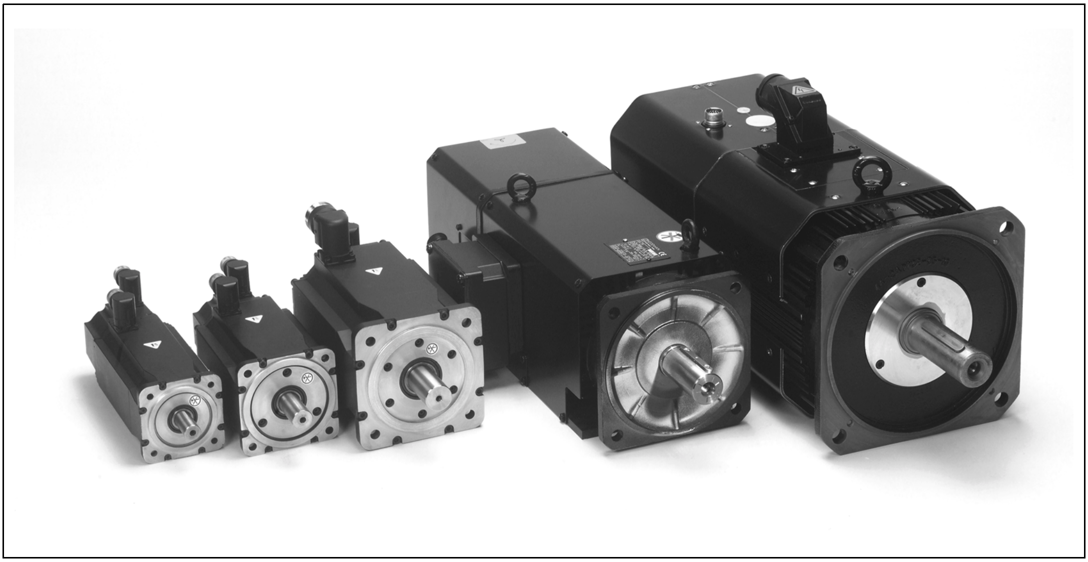
6.7.14 SM 110 Voltage Protection Module



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	331 146-11
QAN 104C	7.5 kW	1500 rpm	331 147-11
QAN 104D	10.0 kW	1500 rpm	331 148-11
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	331 149-11
QAN 134C	18.0 kW	1500 rpm	331 150-11
QAN 134D	22.0 kW	1250 rpm	331 151-11
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	
			with brake	without brake
QSY 041B	3.0 Nm	3000 rpm	331 140-04	331 140-03
QSY 1A	3.5 Nm	3000 rpm	317 122-44	317 122-43
QSY 1C	6.5 Nm	3000 rpm	317 123-44	317 123-43
QSY 1E	9.3 Nm	3000 rpm	317 124-44	317 124-43
QSY 96A with ERN 1387 with EQN 1325	1.5 Nm	4500 rpm	 344 512-04 344 512-54	 344 512-03 344 512-53
QSY 96G with ERN 1387 with EQN 1325	5.2 Nm	4500 rpm	 339 875-04 339 875-54	 339 875-03 339 875-53
QSY 071B	9.0 Nm	3000 rpm	331 141-04	331 141-03
QSY 116C with ERN 1387 with EQN 1325	5.2 Nm	3000 rpm	 339 876-04 339 876-54	 339 876-03 339 876-53
QSY 116E with ERN 1387 with EQN 1325	7.2 Nm	3000 rpm	 339 877-04 339 877-54	 339 877-03 339 877-53
QSY 116J with ERN 1387 with EQN 1325	10.0 Nm	3000 rpm	 339 878-04 339 878-54	 339 878-03 339 878-53
QSY 2C	10.8 Nm	3000 rpm	317 125-44	317 125-43
QSY 2E	15.3 Nm	**2000 rpm**	317 126-44	317 126-43
QSY 2E	15.3 Nm	**3000 rpm**	317 126-54	317 126-53
QSY 2G	20.0 Nm	2000 rpm	317 127-44	317 127-43

Designation	Stall torque (100 K)	Rated speed	ID number	
			with brake	**without brake**
QSY 155B with ERN 1387 with EQN 1325	13 Nm	**2000 rpm**	 339 880-14 339 880-64	 339 880-13 339 880-63
QSY 155B with ERN 1387 with EQN 1325	13 Nm	**3000 rpm**	 339 880-04 339 880-54	 339 880-03 339 880-53
QSY 155C with ERN 1387 with EQN 1325	17.7 Nm	3000 rpm	 365 308-04 365 308-54	 365 308-03 365 308-53
QSY 155D with ERN 1387 with EQN 1325	21.6 Nm	3000 rpm	 339 881-04 339 881-54	 339 881-03 339 881-53
QSY 155F with ERN 1387 with EQN 1325	26.1 Nm	3000 rpm	 339 882-04 339 882-54	 339 882-03 339 882-54
QSY 090B	13.0 Nm	**2000 rpm**	331 142-14	331 142-13
QSY 090B	13.0 Nm	**3000 rpm**	331 142-04	331 142-03
QSY 093B	20.0 Nm	3000 rpm	331 143-04	331 143-03
QSY 112B	32.0 Nm	3000 rpm	331 144-04	331 144-03
QSY 112C	44.0 Nm	3000 rpm	331 145-04	331 145-03
QSY 112D	72.0 Nm	2000 rpm	344 736-14	344 736-13

7.1.3 Cables and Connectors

Danger

Ensure appropriate strain relief of the connecting lines!

Never perform any work on the unit when 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, 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	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, 2G QSY 116, QSY 155B (n_N = 2000 rpm)	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 155B (n_N = 3000 rpm) QSY 155C	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	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	309 687-02 (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 ($4 \times 1\ mm^2$, in meters, diameter 9.7 mm)	309 683-01
Fan cable for QAN 104, QSY 112D ($3 \times 1\ mm^2$, in meters)	309 683-02
Fan cable for QAN 104, 30, 4S, 134, 164B with UL certification ($4 \times 0.75\ mm^2$, in meters, diameter 7.7 mm)	348 949-01
Connectors for QSY 10, 96G, 116, 20 and QSY 155B (n_N = 2000 rpm)	325 165-02
Connectors for QSY 041B, 071B, 090B	325 165-04
Connectors for QSY 155B (n_N = 3000 rpm) and QSY 155C, 155D, 155F	333 090-02

Maximum bend radii of power cables with UL certification

Cross section	Maximum bend radius[a]
$4 \times 1.5\ mm^2 + (2 \times 1\ mm^2)$	≥ 65 mm
$4 \times 2.5\ mm^2 + (2 \times 1\ mm^2)$	≥ 65 mm
$4 \times 4\ mm^2 + (2 \times 1\ mm^2)$	≥ 75 mm
$4 \times 6\ mm^2 + (2 \times 1\ mm^2)$	≥ 85 mm
$4 \times 10\ mm^2 + (2 \times 1\ mm^2)$	≥ 105 mm
$4 \times 2.5\ mm^2$	≥ 60 mm
$4 \times 4\ mm^2$	≥ 70 mm
$4 \times 6\ mm^2$	≥ 75 mm
$4 \times 10\ mm^2$	≥ 100 mm
$4 \times 16\ mm^2$	≥ 135 mm
$4 \times 25\ mm^2$	≥ 150 mm
$4 \times 35\ mm^2$	≥ 175 mm

a. Frequent flexing

Maximum bend radii of encoder cables

Cable	Maximum bend radius[a]
289 440-xx	≥ 100 mm
336 376-xx	≥ 100 mm
340 302-xx	≥ 100 mm

a. Frequent flexing

7.1.4 Required Power Modules or Compact Inverters

Synchronous motors

Motor	Power module		Compact Inverters
	1-axis	2-axis	
QSY 10, 96, QSY 2C, 2E (n_N = 2000 rpm), QSY 116, QSY 155B (n_N = 2000 rpm)	UM 111	UM 121	Axes 1 to 4
QSY 2E (n_N = 3000 rpm), QSY 2G	UM 111B	UM 121B	Axis 4
QSY 155B (n_N = 3000 rpm) QSY 155C, 155D	UM 111B	UM 121B	Axis 4
QSY 155F	UM 112	UM 122	Axis 4 (only UE 242, UE 242B, UR 242)
QSY 041B, 071B, QSY 090B (n_N = 2000 rpm)	UM 111	UM 121	Axes 1 to 4
QSY 090B (n_N = 3000 rpm)	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 Inverters
	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 111B	UM 121B	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	–	–

Maximum torque of a drive

If the power module is not powerful enough, the maximum torque of the motor cannot be reached because the required current is being limited by the power module. The maximum torque M_{max} achievable by the drive can be calculated.

Synchronous motors:

$$M_{max} = \frac{M_{Nmot}}{I_{Nmot}} \cdot I_{Ndrv}$$

Asynchronous motors:

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

$$P_{max} = P_{Nmot} \cdot \frac{I_{qmax}}{I_{qN}}$$

$$I_{qmax} = \sqrt{I_{max}^2 - I_{0mot}^2}$$

$$I_{qN} = \sqrt{I_{Ndrv}^2 - I_{0mot}^2}$$

M_{Nmot}:	Rated torque of the motor in Nm
I_{Nmot}:	Rated current of the motor in A
I_{Ndrv}:	Rated current of the power module in A
n:	Motor speed in rpm
P_{Nmot}:	Power rating of the motor in W
I_{max}:	Lesser value between the maximum current of the motor and the maximum current of the power module in A
I_{0mot}:	No-load current of the motor

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 especially sure that 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 very 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 – 23.

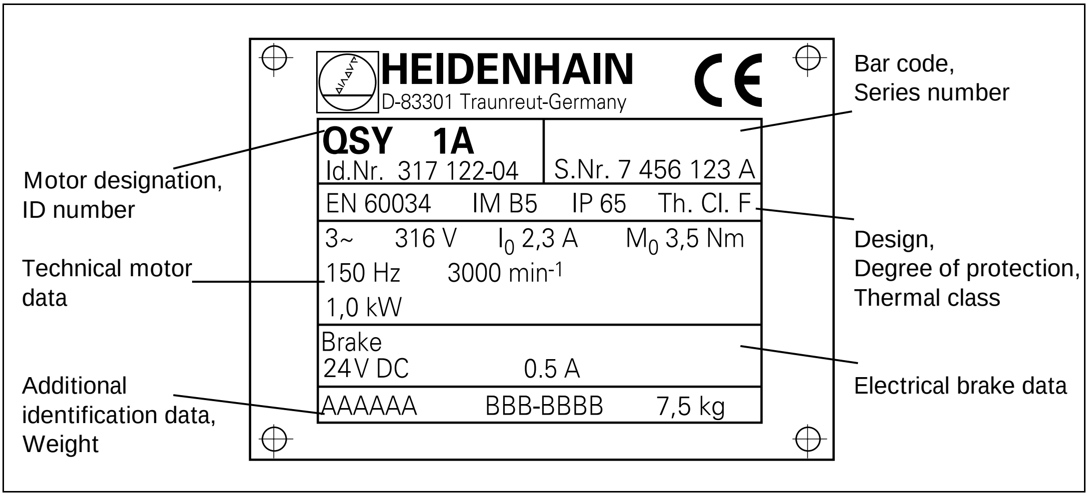
Danger

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

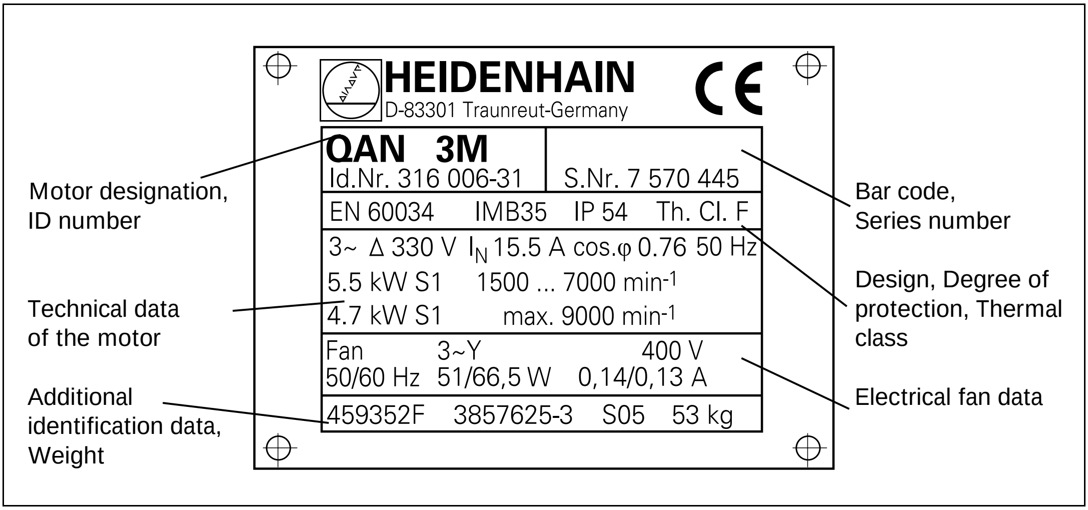
You will find further information on the safe and trouble-free functioning of your motor in the operating instructions that accompany each unit.

7.2.2 Data on the name plate

QSY synchronous motors



QAN asynchronous motors



Note

The motors of the QAN 30 series and of the QAN 4S are wired for delta connection. This data is included on the name plate.
The control’s motor table includes the data for the wye equivalent circuit.

7.3 Different dc-link Voltages for HEIDENHAIN Motors

The HEIDENHAIN inverter systems supply different dc-link voltages:

- UE 2xx, UE 2xxB non-regenerative compact inverters: 565 V
- UR 2xx regenerative compact inverters: 650 V
- Modular inverters with UV 130: 565 V
- Modular inverters with UV 120, UV 140, UV 150: 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.

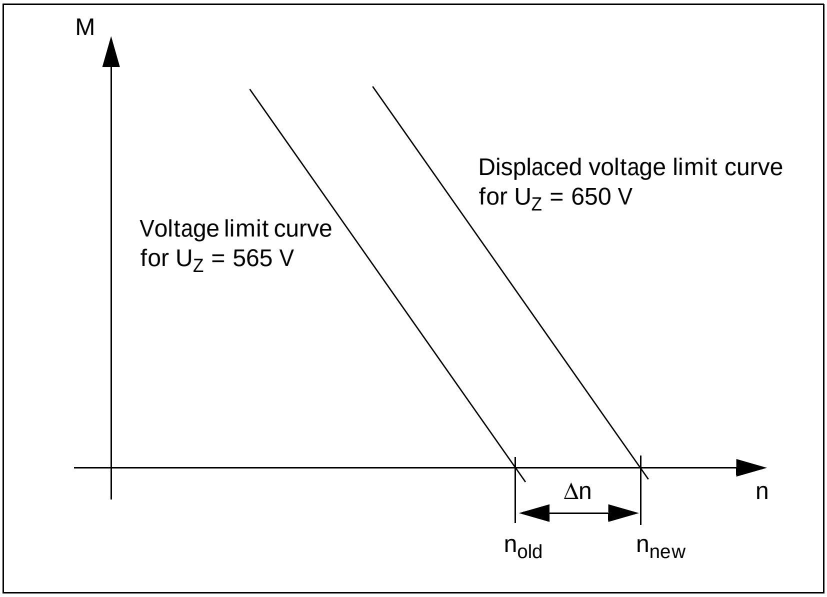
If a synchronous motor is operated at a different dc-link voltage, the voltage limit curve must be displaced in parallel.
The displacement is calculated as follows:

$$\Delta n = n_{old} \cdot \frac{U_{Znew}}{U_{Zold}} - n_{old}$$

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

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

$$n_{new} = n_{old} + \Delta n = 3300 \text{ rpm} + 497 \text{ rpm} = 3797 \text{ rpm}$$



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.

$$P_{new} = P_{old} \cdot k$$

and

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

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

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

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?

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

$$P_{new} = 10.5\ \mathrm{kW} \cdot 1.32 = 13.9\ \mathrm{kW}$$

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

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.

1-V_{PP} speed encoder

Pin layout:

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.”

Speed encoder with EnDat interface (EQN 1325)

Pin layout:

Motor flange socket (male) 17-pin	Assignment	Cable for speed encoder (Id.-Nr. 336 376-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	Data	3	Red	15
4		4		
5	Clock	5	Green	10
6		6		
7	0 V (U_N)	7	White/Green	2
8	Temperature +	8	Yellow	13
9	Temperature–	9	Violet	25
10	+5 V (U_P)	10	Brown/Green	1
11	B+	11	Blue/Black	6
12	B–	12	Red/Black	7
13	$\overline{\text{Data}}$	13	Black	23
14	$\overline{\text{Clock}}$	14	Brown	12
15	0 V (sensor line)	15	White	16
16	+5 V (sensor line)	16	Blue	14
17	Internal shield	17	Internal shield	8
Housing	External shield	Housing	External shield	Housing
			Free	5, 9, 11, 17, 18, 19, 20, 21, 22, 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	Connector (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	Connector (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	Connector (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

QAN 30 and QAN 4S series

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 – 26.

Terminal strip 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**	**Connector (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 (optional).
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 – 19.

Note

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

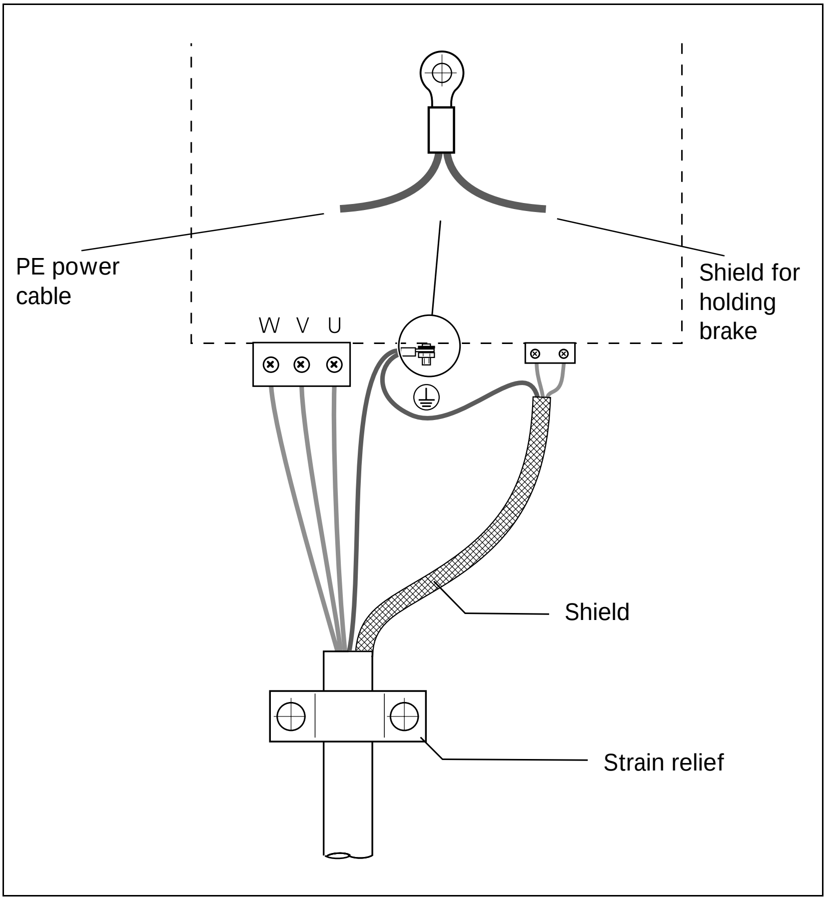
When connecting the brake, particular attention should be paid to electrical noise immunity!

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

Warning

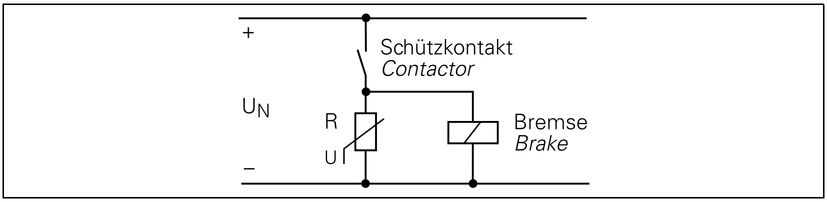
The holding brakes are permanent-magnet brakes! Observe the correct polarity of the dc voltage. Otherwise the brake will not be released.

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 brakes, 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 – 19.

Terminal strip 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. The connector is supplied 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	N	Black 2
3	Do not assign	
⏚	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. The connector is supplied 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

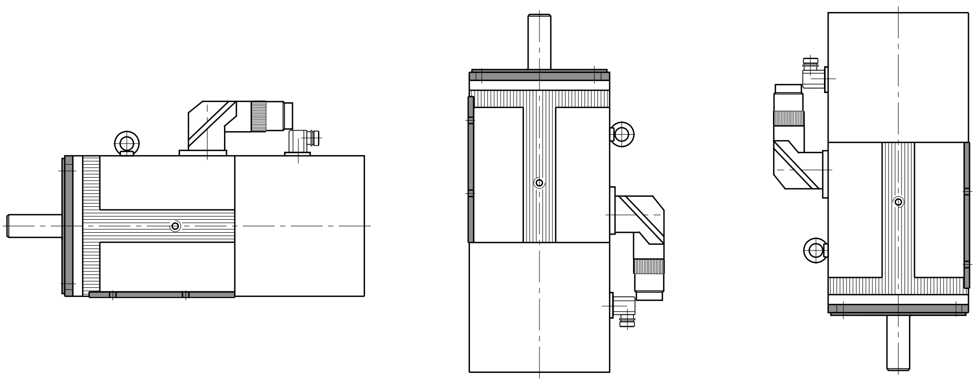
All HEIDENHAIN motors except the QSY 041B, QSY 071B and the QAN 104 series are equipped with a mounting flange according to DIN 42948 and IEC 72.

By mounting the motor via an attachment flange part of the power loss is dissipated via this flange. If the motor is mounted so that it is thermally insulated, which means that 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.

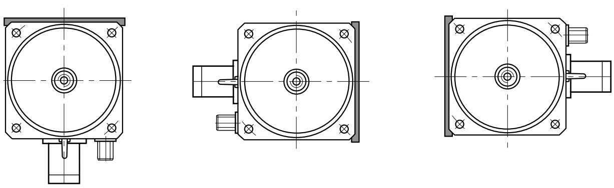
All indicated motor operating data refer to a maximum ambient temperature of +40 °C.
If you are using a motor with natural cooling, you must therefore ensure adequate heat dissipation. If the space in which the motor is mounted is too narrow (from a narrow frame or shaft), the dissipation of heat may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

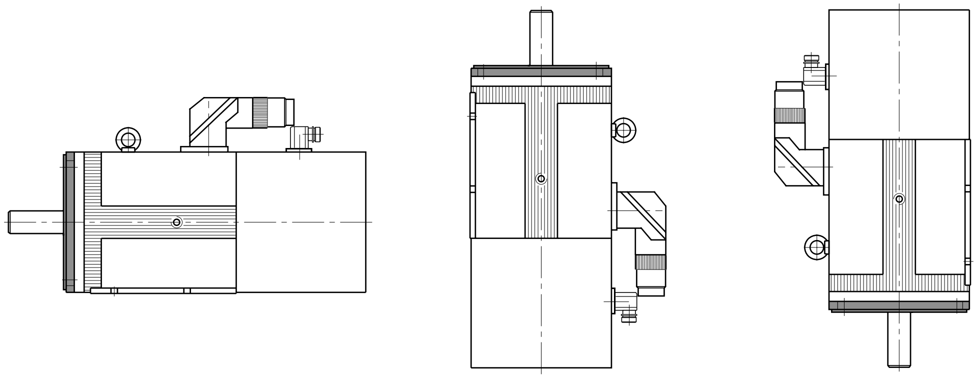


IM B35 IM V36 IM V15



IM B8 IM B7 IM B6

Design B5



7.8.2 Mounting the Motor

We recommend using the following screws according to EN 24017 or DIN 912 to mount the motors:

Motor	To secure the flange	To secure the block
QSY 041B	M10	–
QSY 10	ISO 4017 – M8 x 30 EN 24017 – M8 x 25	–
QSY 96	M6	–
QSY 116	M8	–
QSY 071B	M10	–
QSY 20	ISO 4017 – 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	ISO 4017 – M12 x 30	ISO 4017 – 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

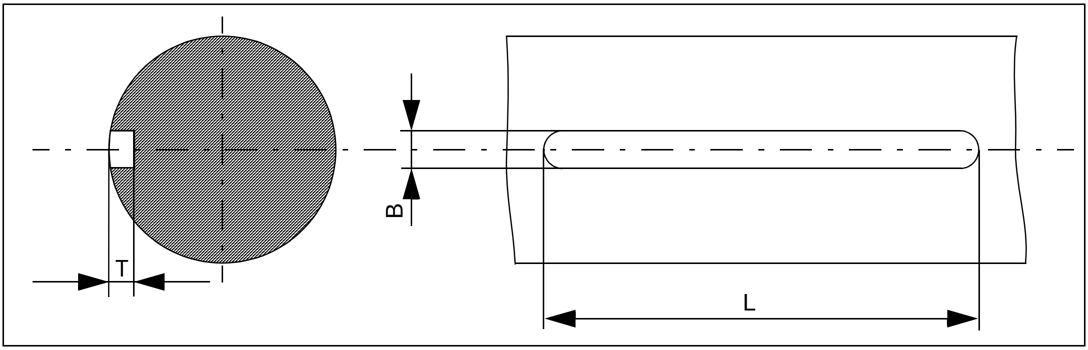
HEIDENHAIN motors have one center hole in the drive shaft.

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 QAN 104	DIN 332 - DR M8 x 19
Series QAN 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 QAN 30	DIN 6885 – E 10 x 8 x 70	70	10	5
Series QAN 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

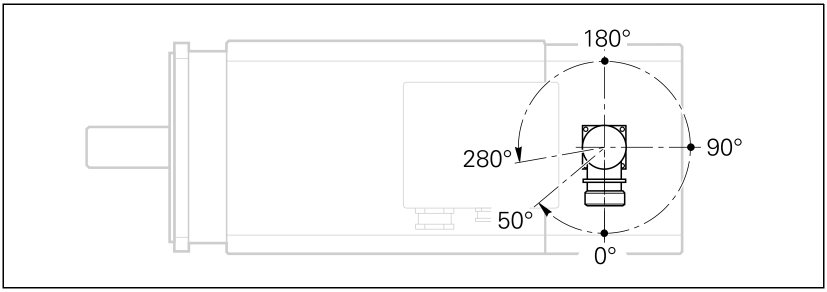


7.8.4 Rotatable Flange Sockets

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

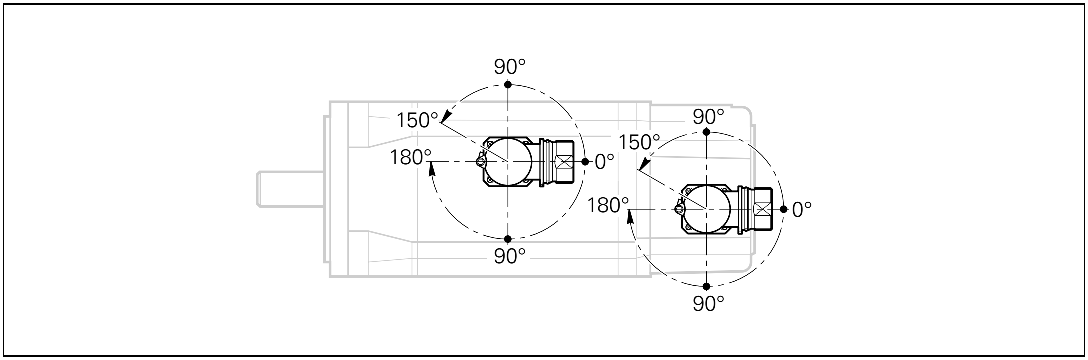
Asynchronous motors

QAN 30 series and QAN 4S

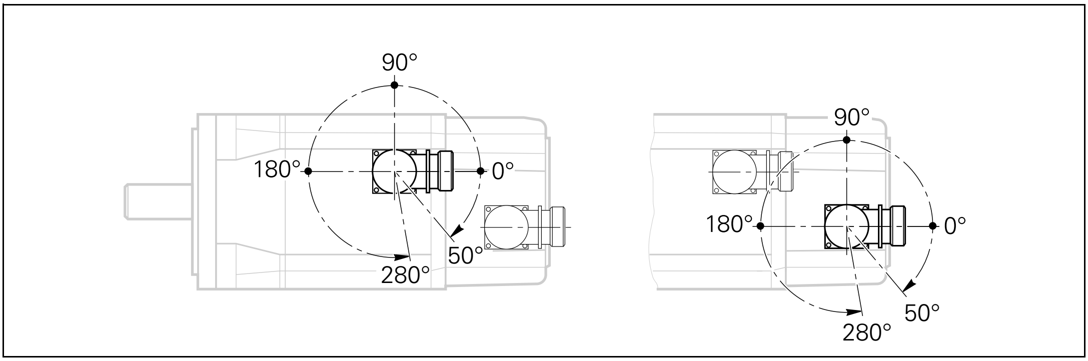


Synchronous motors series

Series QSY 96, 116 (starting in mid-2002)

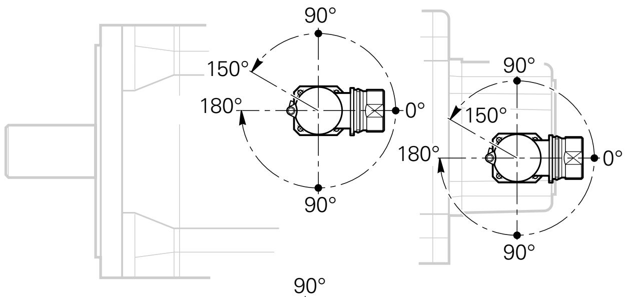


Series QSY 96, 116 (until mid-2002)

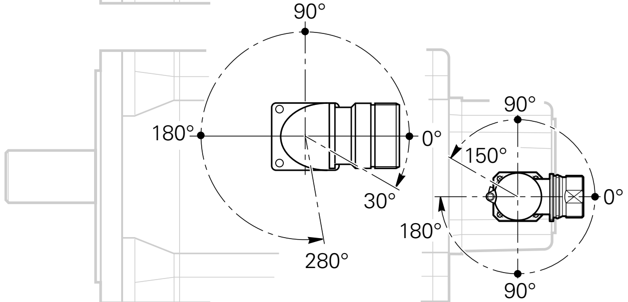


Series QSY 155 (starting in mid-2002)

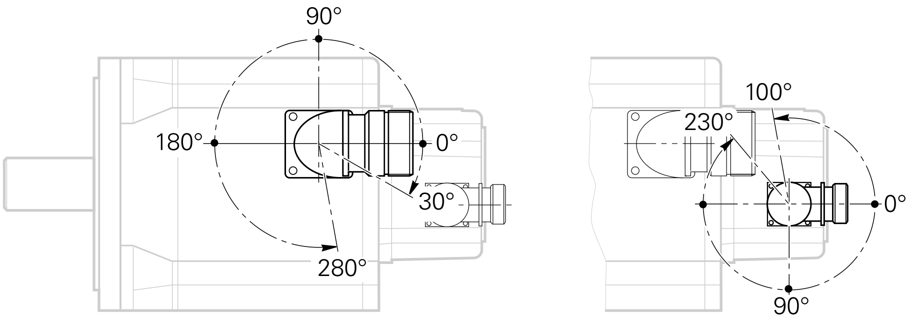
QSY 155B (n_N = 3000 rpm)
QSY 155C, QSY 155D,
QSY 155F



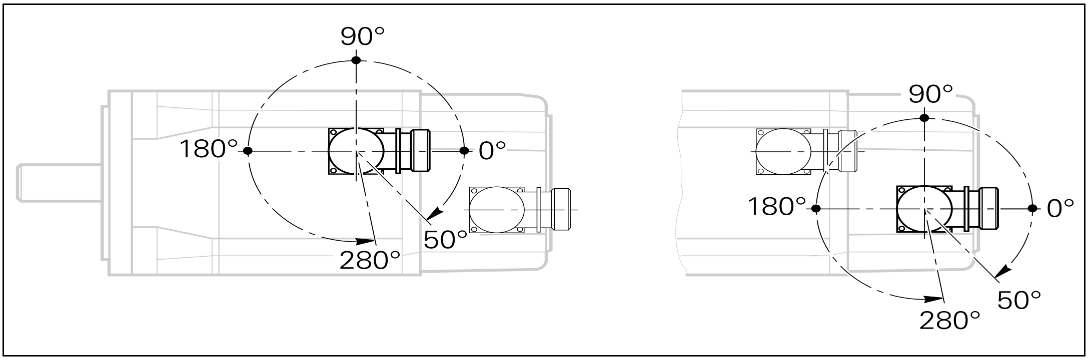
QSY 155B (n_N = 2000 rpm)



Series QSY 155 (until mid-2002)



Series QSY 10, QSY 20



7.9 HEIDENHAIN Synchronous Motors, QSY Series

The HEIDENHAIN synchronous motors have the following features:

- Sine commutation
- Incremental HEIDENHAIN ERN 1387 encoder or EQN 1325 absolute multiturn encoder (only QSY 96, QSY 116, QSY 155) 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 HEIDENHAIN Synchronous Motors, QSY Series

QSY 041B

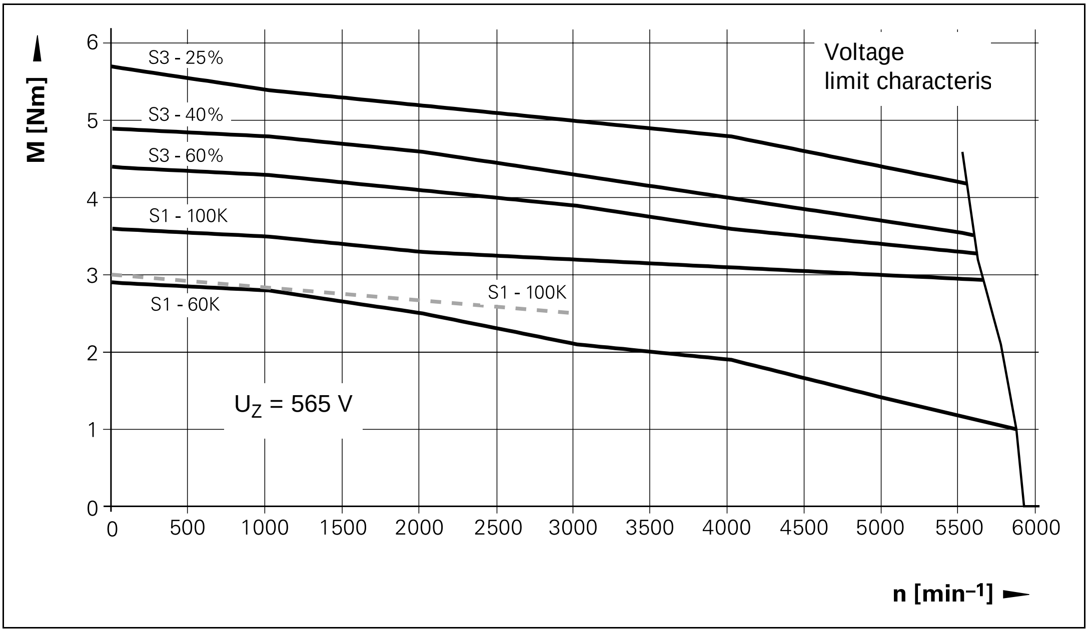
	QSY 041B with brake	**QSY 041B without brake**
Rated voltage U_N	244 V	
Rated power output P_N	0.8 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	2.5 Nm	
Rated current (100 K) I_N	2.8 A	
Stall torque (100 K) M_0	3.0 Nm	
Stall current (100 K) I_0	3.3 A	
Maximum current (for ≤ 200 ms) I_{max}	13.5 A	
Maximum torque (for ≤ 200 ms) M_{max}	11.3 Nm	
Pole pairs PZ	3	
Mass *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

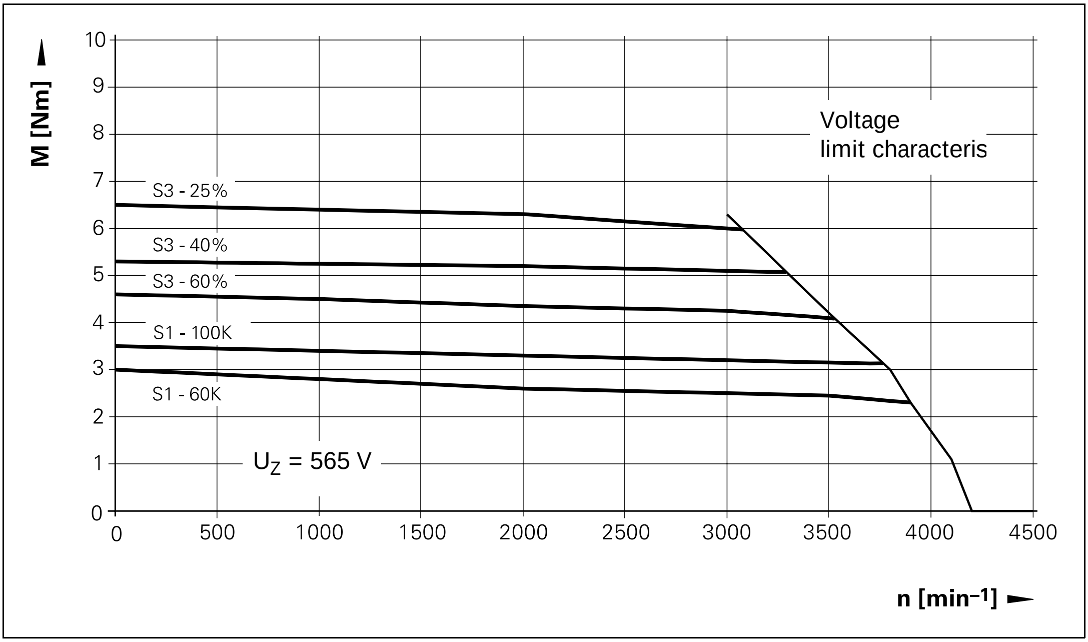
	QSY 1A with brake	**QSY 1A without brake**
Rated voltage U_N	316 V	
Rated power output P_N	1.0 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	3.2 Nm	
Rated current (100 K) I_N	2.1 A	
Stall torque (100 K) M_0	3.5 Nm	
Stall current (100 K) I_0	2.3 A	
Maximum current (for ≤ 200 ms) I_{max}	8.6 A	
Maximum torque (for ≤ 200 ms) M_{max}	11.0 Nm	
Pole pairs PZ	3	
Mass *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

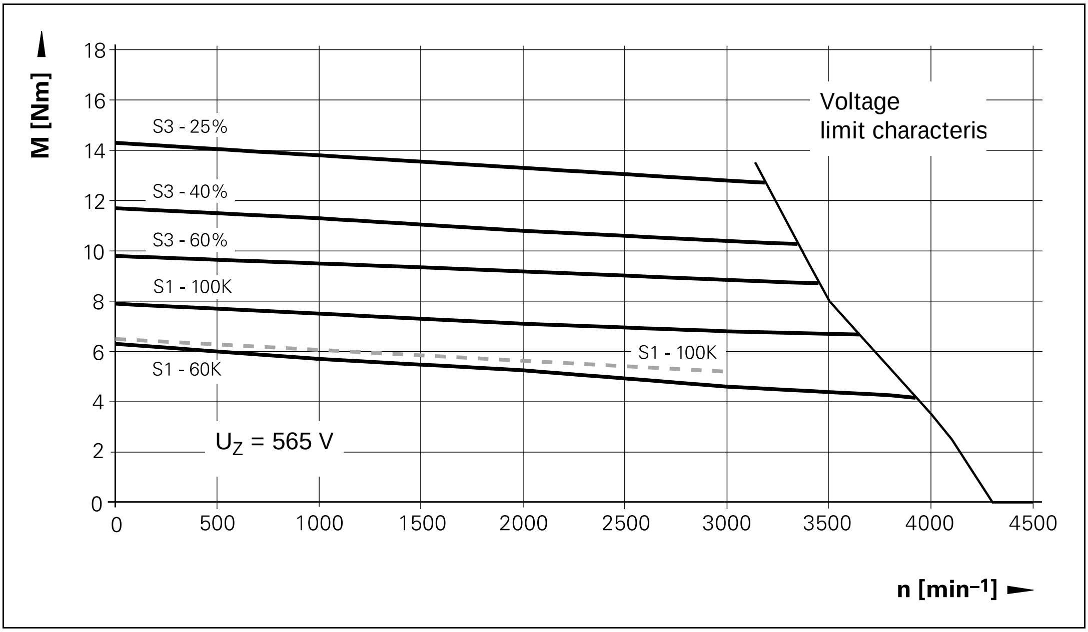
	QSY 1C with brake	**QSY 1C without brake**
Rated voltage U_N	299 V	
Rated power output P_N	1.6 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	5.2 Nm	
Rated current (100 K) I_N	3.4 A	
Stall torque (100 K) M_0	6.5 Nm	
Stall current (100 K) I_0	4.2 A	
Maximum current (for ≤ 200 ms) I_{max}	17.0 A	
Maximum torque (for ≤ 200 ms) M_{max}	22.0 Nm	
Pole pairs PZ	3	
Mass *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

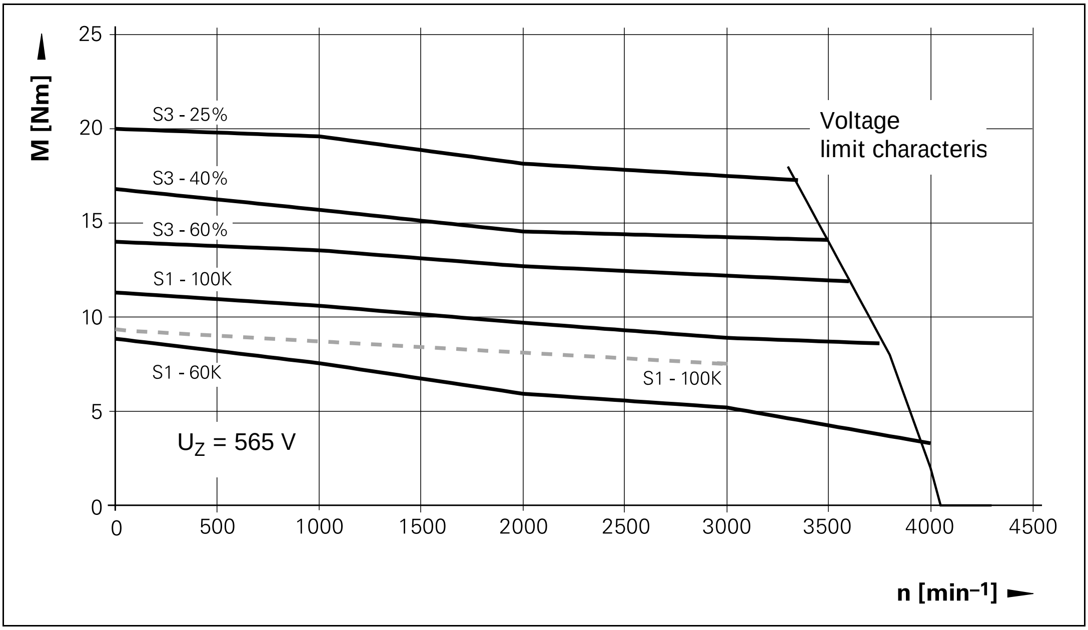
	QSY 1E with brake	QSY 1E without brake
Rated voltage U_N	295 V	
Rated power output P_N	2.4 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	7.6 Nm	
Rated current (100 K) I_N	4.9 A	
Stall torque (100 K) M_0	9.3 Nm	
Stall current (100 K) I_0	6.1 A	
Maximum current (for ≤ 200 ms) I_{max}	25.4 A	
Maximum torque (for ≤ 200 ms) M_{max}	33.0 Nm	
Pole pairs PZ	3	
Mass *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

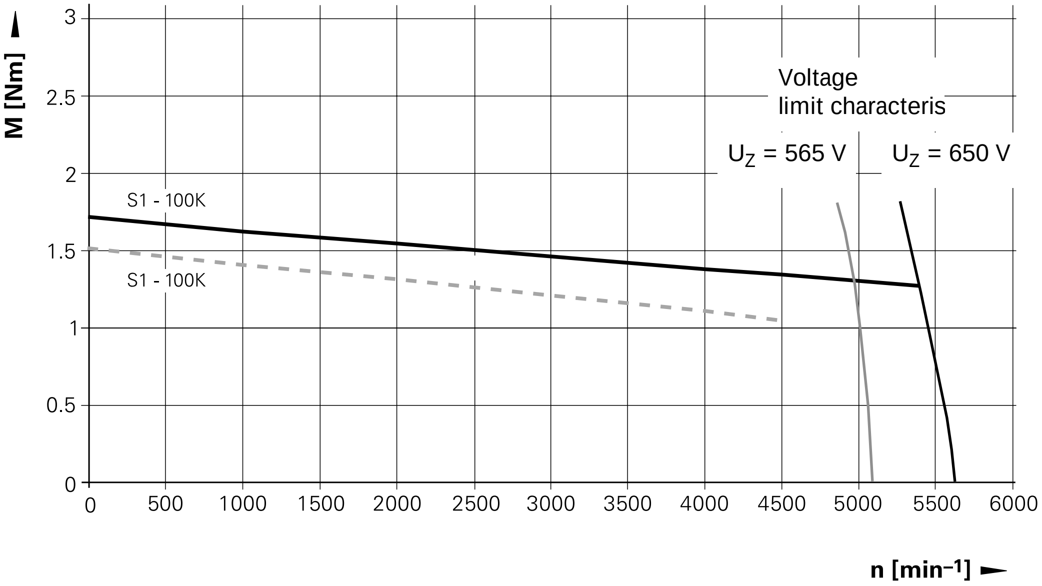
	QSY 96A with brake	**QSY 96A without brake**
Rated voltage U_N	329 V	
Rated power output P_N	0.5 kW	
Rated speed n_N	4500 rpm	
Rated torque (100 K) M_N	1.05 Nm	
Rated current (100 K) I_N	1.1 A	
Stall torque (100 K) M_0	1.5 Nm	
Stall current (100 K) I_0	1.5 A	
Maximum current (for ≤ 200 ms) I_{max}	6.3 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	
Mass *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

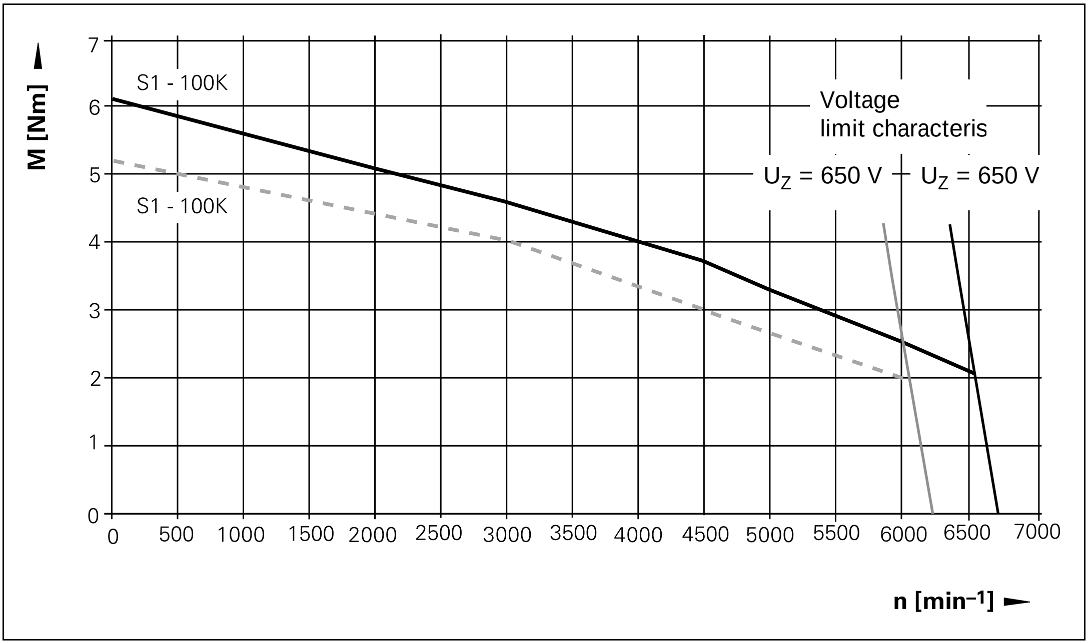
	QSY 96G with brake	QSY 96G without brake
Rated voltage U_N	305 V	
Rated power output P_N	1.4 kW	
Rated speed n_N	4500 rpm	
Rated torque (100 K) M_N	3.0 Nm (4.1 Nm with 3000 rpm)	
Rated current (100 K) I_N	3.3 A	
Stall torque (100 K) M_0	5.2 Nm	
Stall current (100 K) I_0	5.2 A	
Maximum current (for ≤ 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	
Mass *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

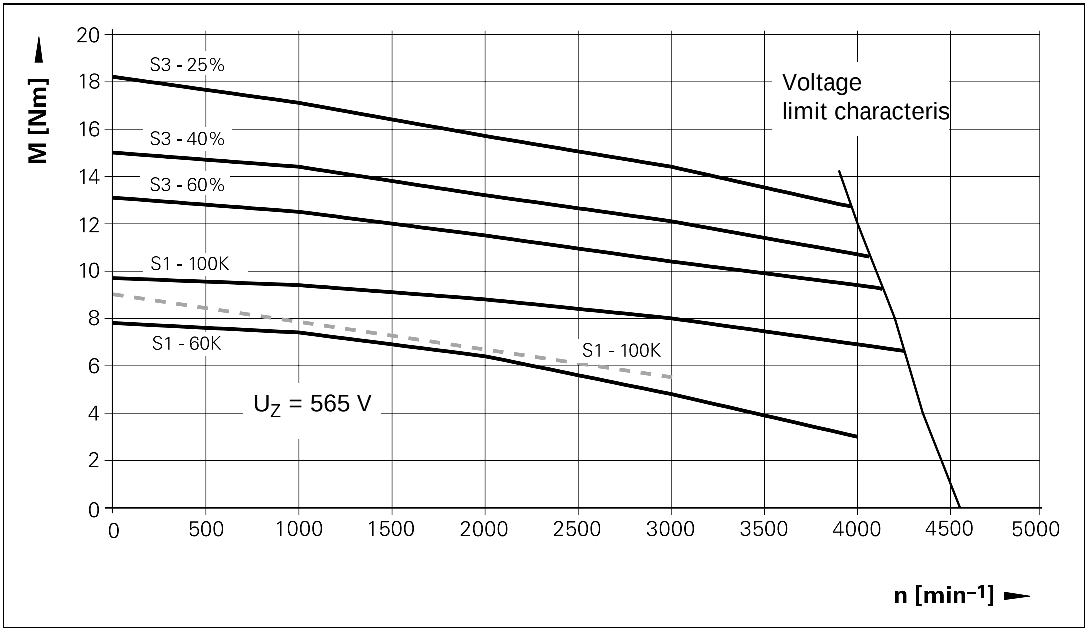
	QSY 071B with brake	QSY 071B without brake
Rated voltage U_N	323 V	
Rated power output P_N	1.7 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	5.5 Nm	
Rated current (100 K) I_N	4.4 A	
Stall torque (100 K) M_0	9.0 Nm	
Stall current (100 K) I_0	7.2 A	
Maximum current (for ≤ 200 ms) I_{max}	29.0 A	
Maximum torque (for ≤ 200 ms) M_{max}	32.0 Nm	
Pole pairs PZ	4	
Mass *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

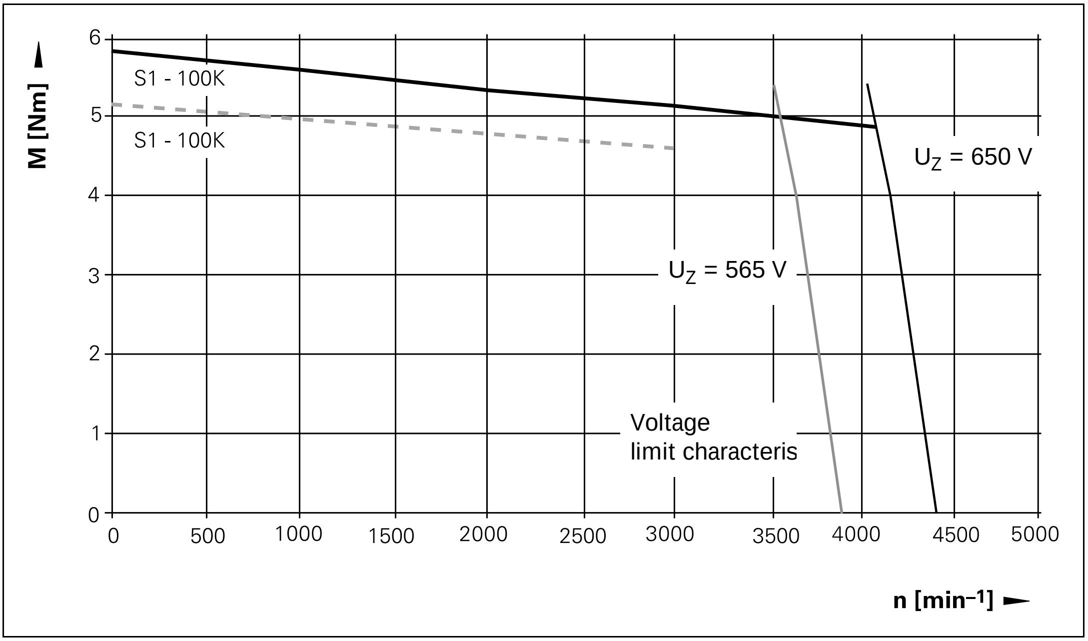
	QSY 116C with brake	**QSY 116C without brake**
Rated voltage U_N	315 V	
Rated power output P_N	1.45 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	4.6 Nm	
Rated current (100 K) I_N	3.3 A	
Stall torque (100 K) M_0	5.2 Nm	
Stall current (100 K) I_0	3.4 A	
Maximum current (for ≤ 200 ms) I_{max}	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	
Mass *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

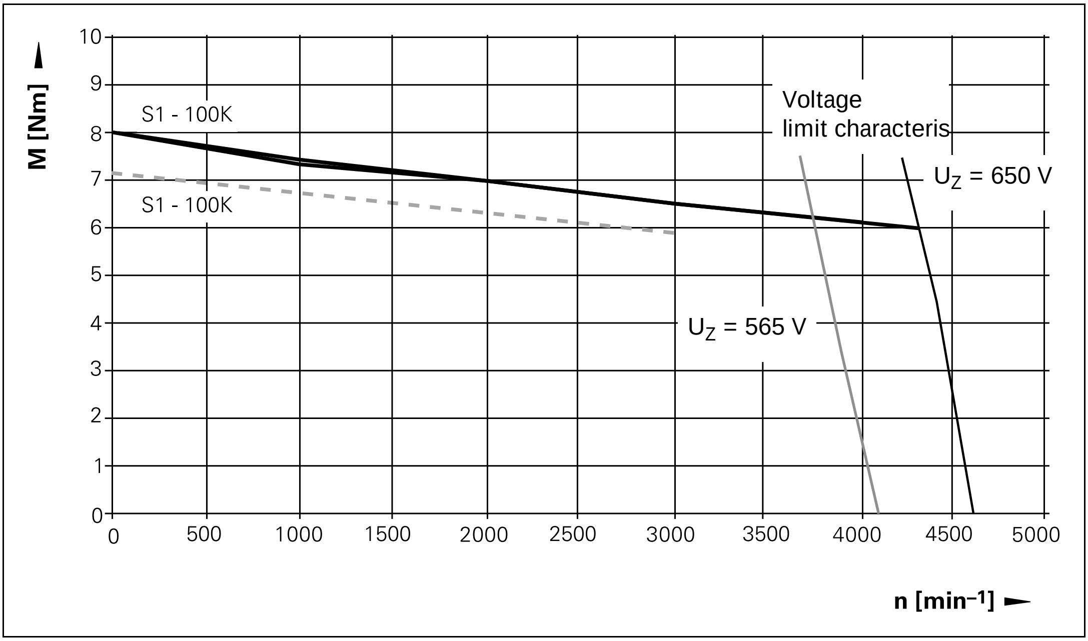
	QSY 116E with brake	**QSY 116E without brake**
Rated voltage U_N	294 V	
Rated power output P_N	1.85 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	5.9 Nm	
Rated current (100 K) I_N	4.1 A	
Stall torque (100 K) M_0	7.2 Nm	
Stall current (100 K) I_0	4.8 A	
Maximum current (for ≤ 200 ms) I_{max}	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	
Mass *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

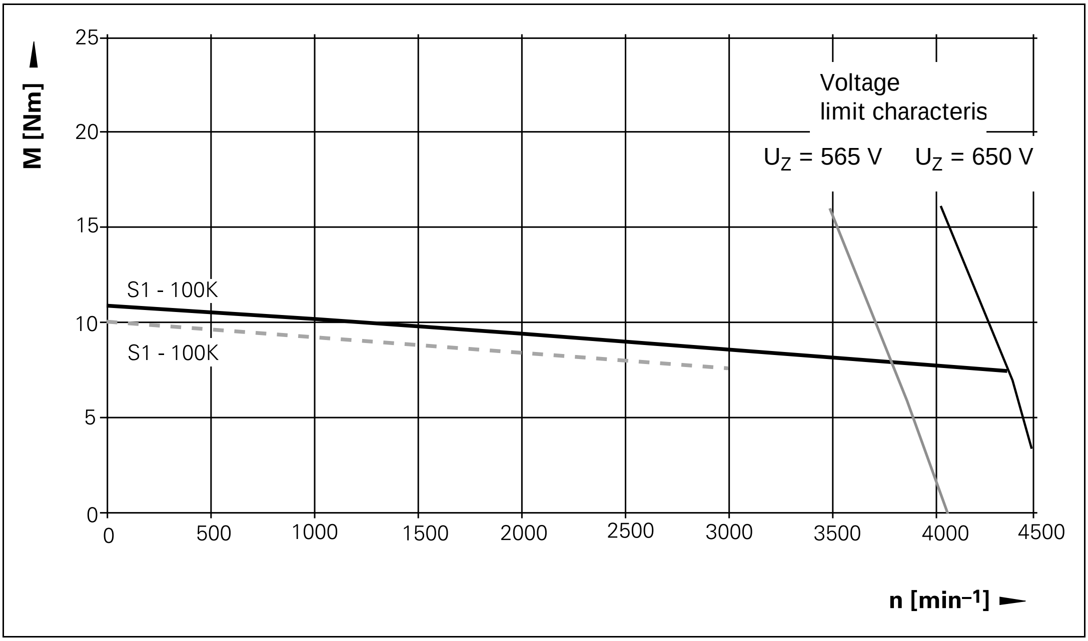
	QSY 116J with brake	**QSY 116J without brake**
Rated voltage U_N	303 V	
Rated power output P_N	2.42 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	7.7 Nm	
Rated current (100 K) I_N	5.35 A	
Stall torque (100 K) M_0	10.0 Nm	
Stall current (100 K) I_0	6.8 A	
Maximum current (for ≤ 200 ms) I_{max}	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	
Mass *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

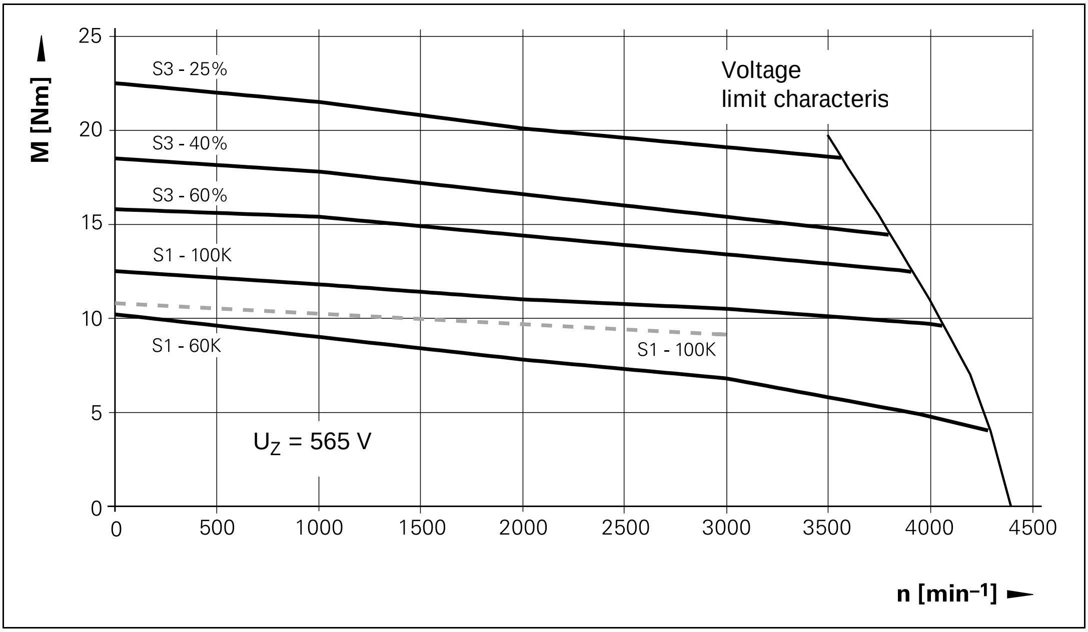
	QSY 2C with brake	QSY 2C without brake
Rated voltage U_N	299 V	
Rated power output P_N	2.7 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	8.6 Nm	
Rated current (100 K) I_N	5.9 A	
Stall torque (100 K) M_0	10.8 Nm	
Stall current (100 K) I_0	7.0 A	
Maximum current (for ≤ 200 ms) I_{max}	24.7 A	
Maximum torque (for ≤ 200 ms) M_{max}	30.0 Nm	
Pole pairs PZ	3	
Mass *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
(n_N = 2000 rpm)

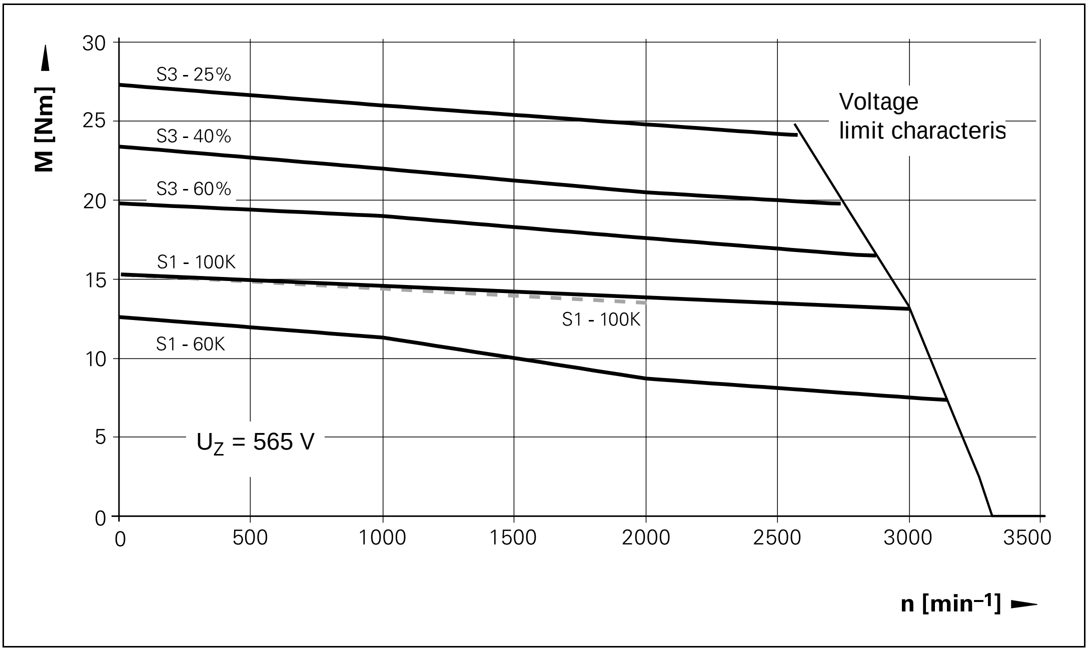
	QSY 2E (n_N = 2000 rpm) with brake	**QSY 2E (n_N = 2000 rpm) without brake**
Rated voltage U_N	275 V	
Rated power output P_N	2.8 kW	
Rated speed n_N	2000 rpm	
Rated torque (100 K) M_N	13.5 Nm	
Rated current (100 K) I_N	6.5 A	
Stall torque (100 K) M_0	15.3 Nm	
Stall current (100 K) I_0	7.3 A	
Maximum current (for ≤ 200 ms) I_{max}	28.3 A	
Maximum torque (for ≤ 200 ms) M_{max}	45.0 Nm	
Pole pairs PZ	3	
Mass *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 (n_N = 2000 rpm)



QSY 2E
(n_N = 3000 rpm)

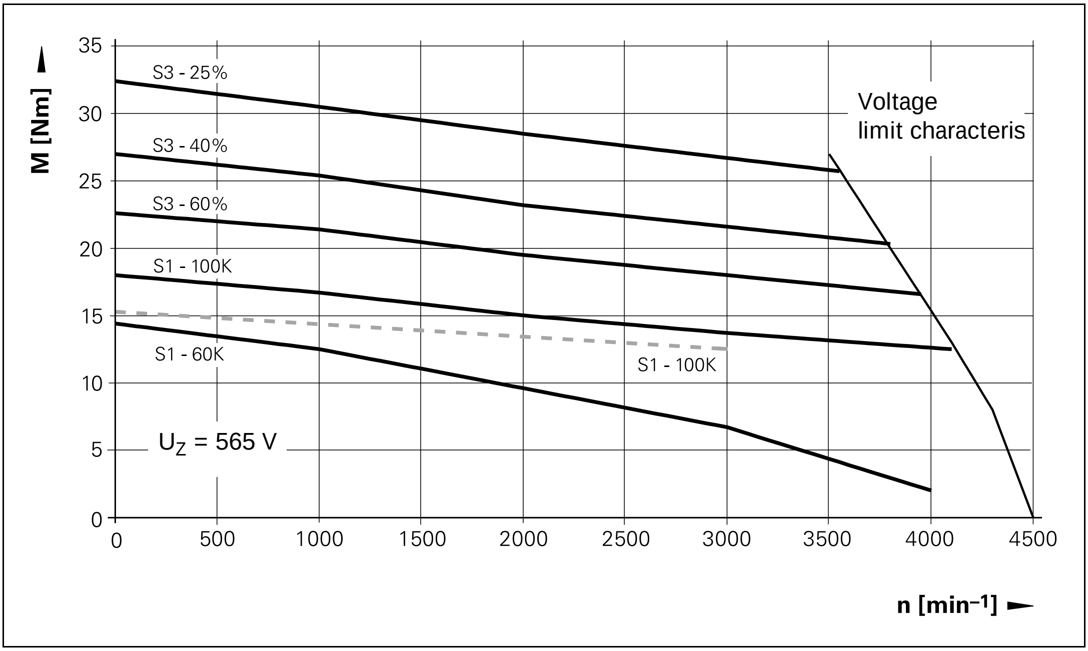
	QSY 2E (n_N = 3000 rpm) with brake	**QSY 2E-3000 (n_N = 3000 rpm) without brake**
Rated voltage U_N	295 V	
Rated power output P_N	4.0 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	12.7 Nm	
Rated current (100 K) I_N	8.3 A	
Stall torque (100 K) M_0	15.3 Nm	
Stall current (100 K) I_0	10.0 A	
Maximum current (for ≤ 200 ms) I_{max}	37.5 A	
Maximum torque (for ≤ 200 ms) M_{max}	45.0 Nm	
Pole pairs PZ	3	
Mass *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 (n_N = 3000 rpm)



QSY 2G

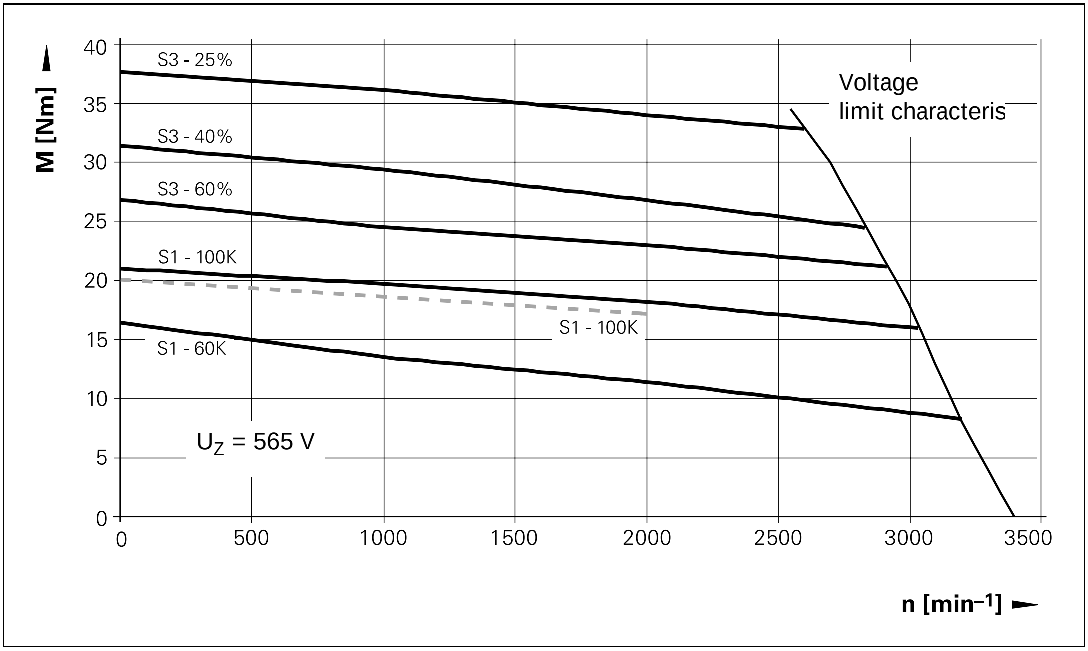
	QSY 2G with brake	QSY 2G without brake
Rated voltage U_N	272 V	
Rated power output P_N	3.6 kW	
Rated speed n_N	2000 rpm	
Rated torque (100 K) M_N	17.2 Nm	
Rated current (100 K) I_N	8.2 A	
Stall torque (100 K) M_0	20.0 Nm	
Stall current (100 K) I_0	9.5 A	
Maximum current (for ≤ 200 ms) I_{max}	35.4 A	
Maximum torque (for ≤ 200 ms) M_{max}	60.0 Nm	
Pole pairs PZ	3	
Mass *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 155B
(n_N = 2000 rpm)

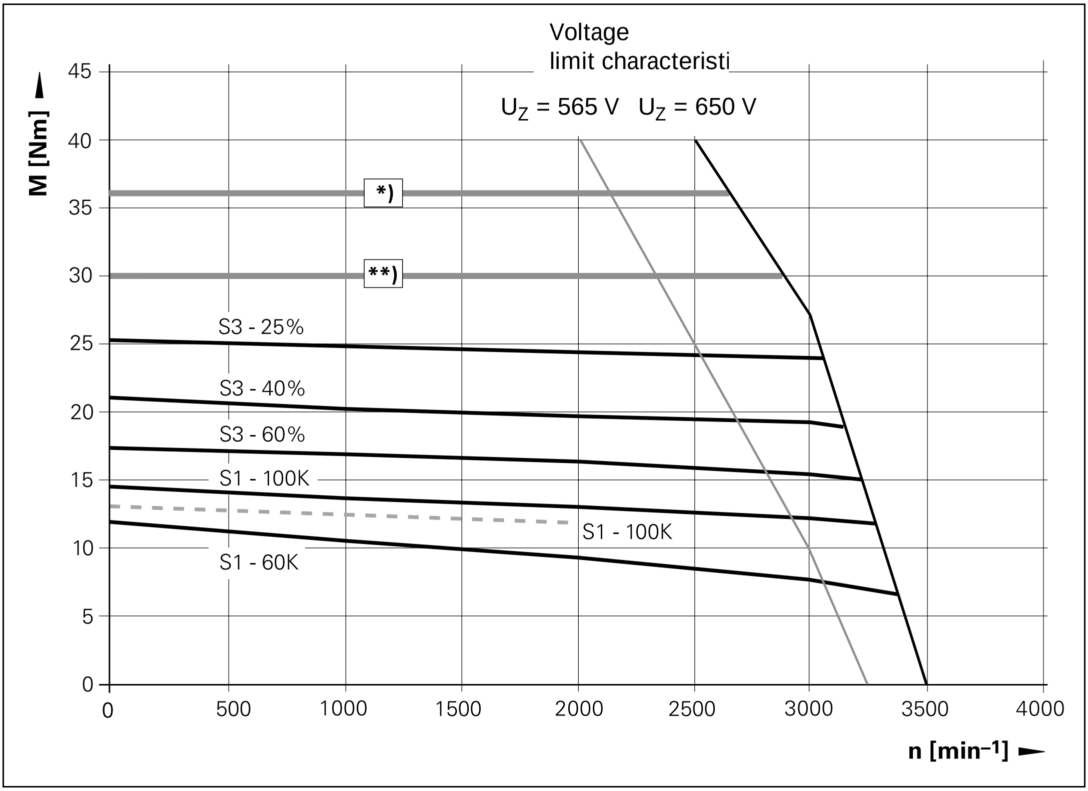
	QSY 155B (n_N = 2000 rpm) with brake	**QSY 155B (n_N = 2000 rpm) without brake**
Rated voltage U_N	287 V	
Rated power output P_N	2.47 kW	
Rated speed n_N	2000 rpm	
Rated torque (100 K) M_N	11.8 Nm	
Rated current (100 K) I_N	6.3 A	
Stall torque (100 K) M_0	13 Nm	
Stall current (100 K) I_0	6.5 A	
Maximum current (for ≤ 200 ms) I_{max}	21.2 A	
Maximum torque (for ≤ 200 ms) M_{max}	36.3 Nm	
Pole pairs PZ	4	
Winding resistance (in one phase)	1.3 Ω	
Winding inductance (in one phase)	9.8 mH	
Mass *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 (n_N = 2000 rpm)



*) M_{max} = 36 Nm when I_{max} = 21.2 A

**) M_{max} = 30 Nm when I_{max} = 15 A

QSY 155B
(n_N = 3000 rpm)

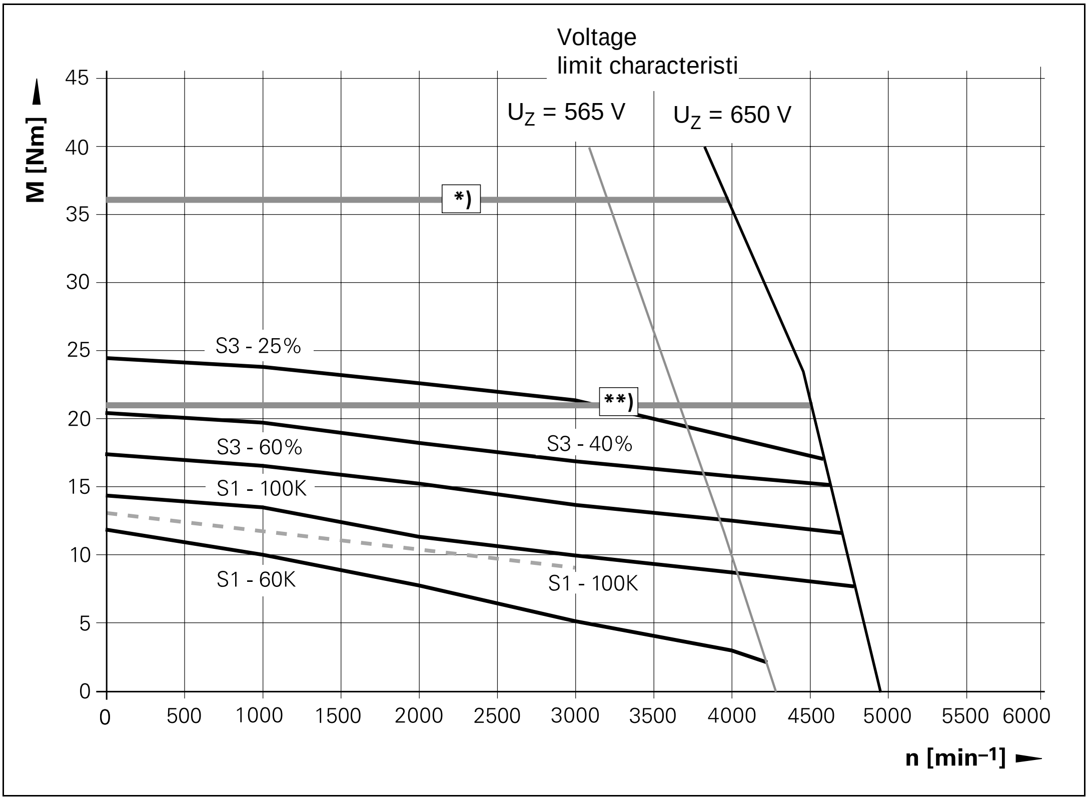
	QSY 155B (n_N = 3000 rpm) with brake	**QSY 155B (n_N = 3000 rpm) without brake**
Rated voltage U_N	295 V	
Rated power output P_N	2.9 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	9.2 Nm	
Rated current (100 K) I_N	6.9 A	
Stall torque (100 K) M_0	13 Nm	
Stall current (100 K) I_0	9.1 A	
Maximum 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	
Mass *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 (n_N = 3000 rpm)



*) M_{max} = 36 Nm when I_{max} = 26.9 A

**) M_{max} = 21 Nm when I_{max} = 15 A

QSY 155C

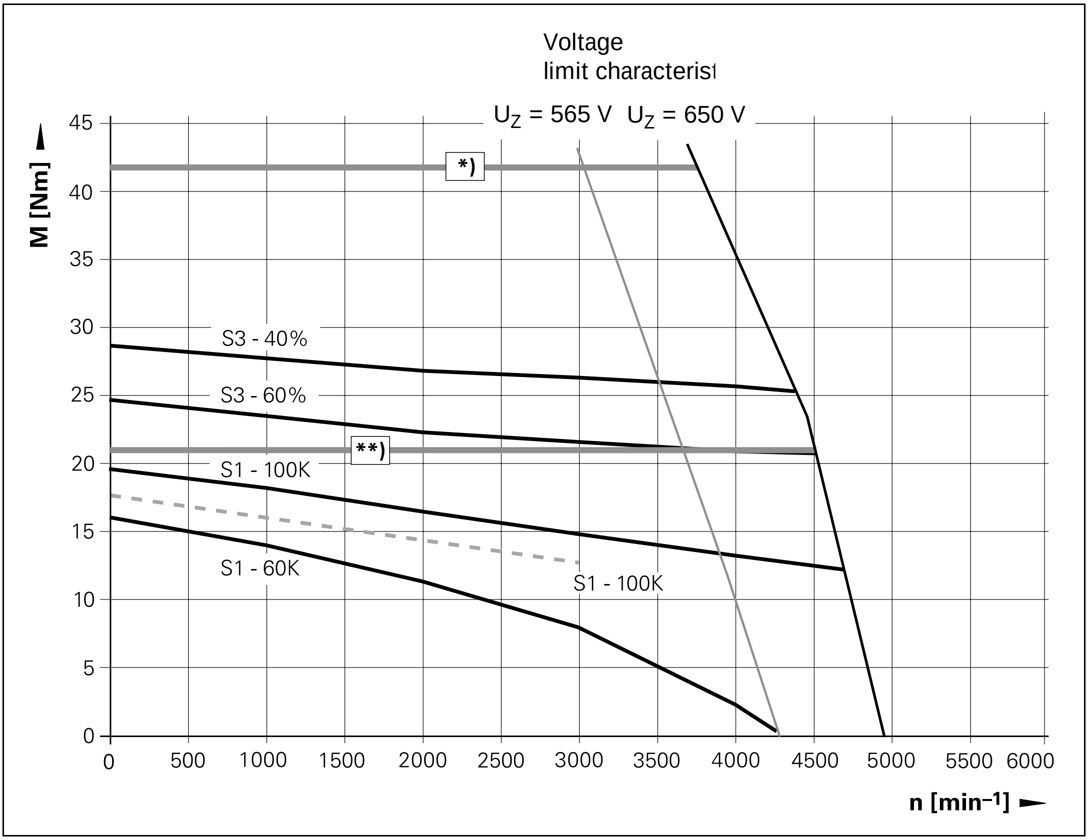
	QSY 155C with brake	**QSY 155C without brake**
Rated voltage U_N	295 V	
Rated power output P_N	3.93 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	12.5 Nm	
Rated current (100 K) I_N	8.7 A	
Stall torque (100 K) M_0	17.7 Nm	
Stall current (100 K) I_0	11.8 A	
Maximum current (for ≤ 200 ms) I_{max}	39.0 A	
Maximum torque (for ≤ 200 ms) M_{max}	52.0 Nm	
Pole pairs PZ	4	
Winding resistance (in one phase)	0.45 Ω	
Winding inductance (in one phase)	3.72 mH	
Mass *m*	19.90 kg	17.50 kg
Rotor inertia J	54.00 kgcm^2	43.00 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 155C



*) M_{max} = 42 Nm when I_{max} = 30 A

**) M_{max} = 21 Nm when I_{max} = 15 A

QSY 155D

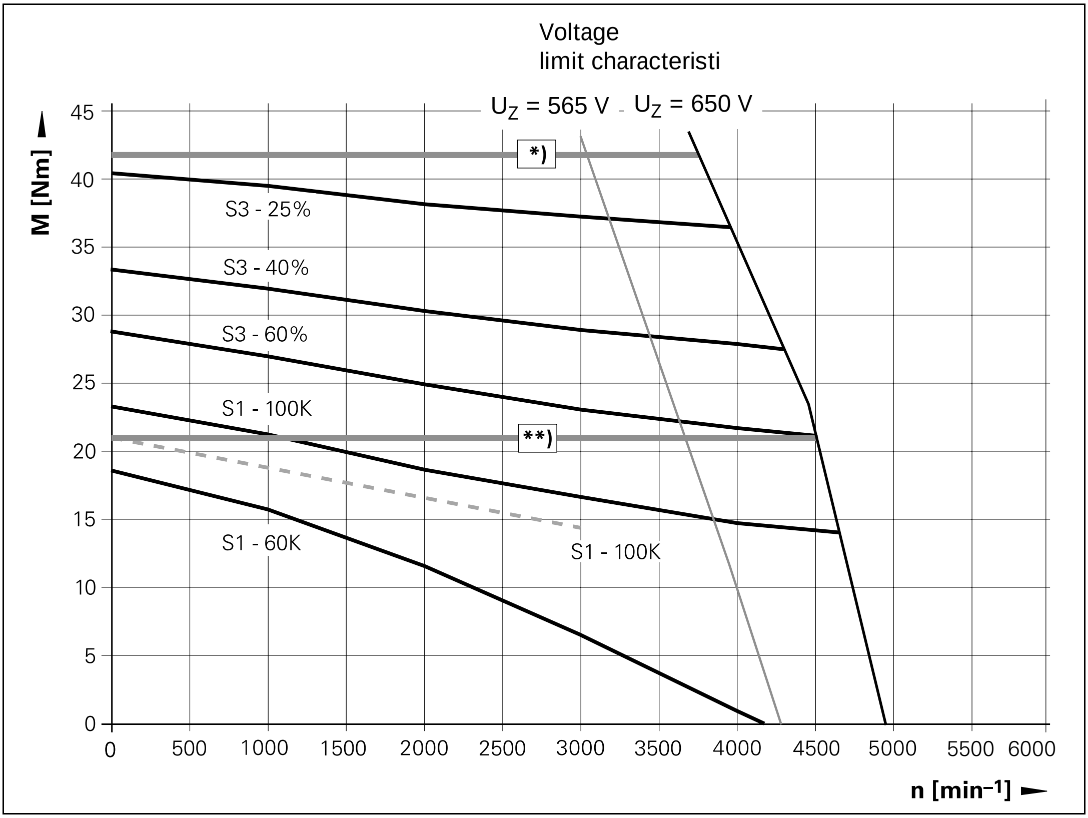
	QSY 155D with brake	QSY 155D without brake
Rated voltage U_N	298 V	
Rated power output P_N	4.6 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	14.8 Nm	
Rated current (100 K) I_N	10.6 A	
Stall torque (100 K) M_0	21.6 Nm	
Stall current (100 K) I_0	14.6 A	
Maximum current (for ≤ 200 ms) I_{max}	44.6 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	
Mass *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



*) M_{max} = 42 Nm when I_{max} = 30 A

**) M_{max} = 21 Nm when I_{max} = 15 A

QSY 155F

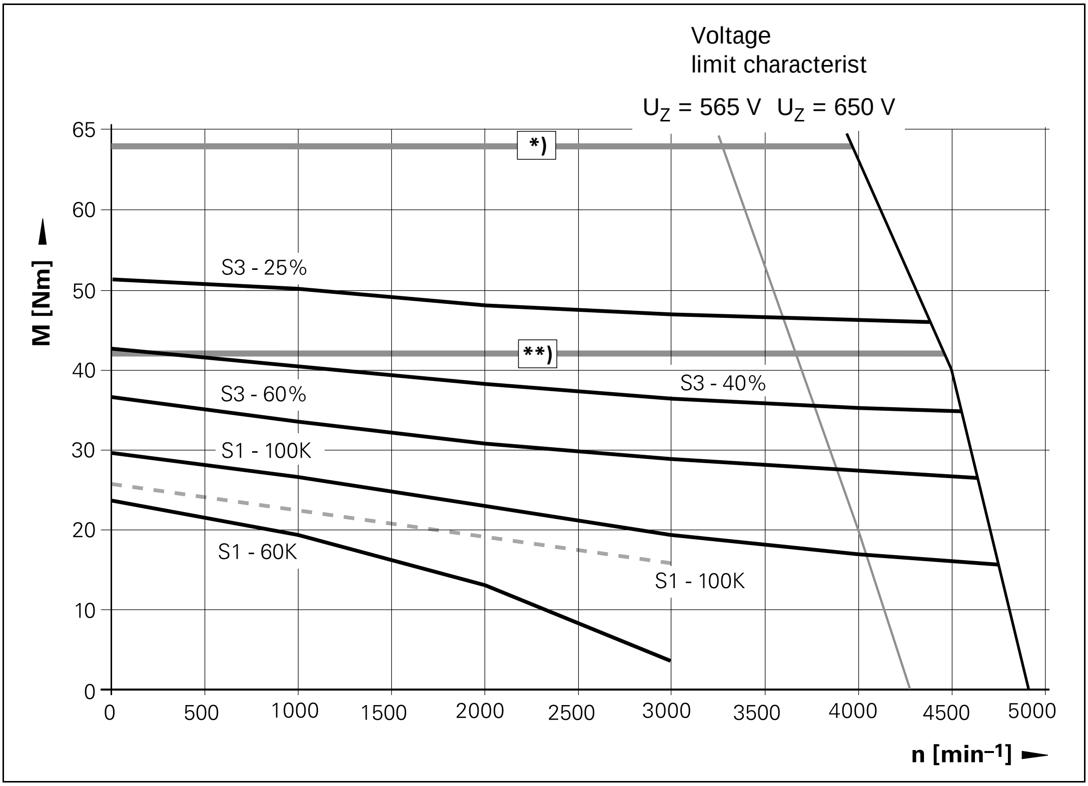
	QSY 155F with brake	**QSY 155F without brake**
Rated voltage U_N	289 V	
Rated power output P_N	5.2 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	16.7 Nm	
Rated current (100 K) I_N	12.0 A	
Stall torque (100 K) M_0	26.1 Nm	
Stall current (100 K) I_0	18.0 A	
Maximum current (for ≤ 200 ms) I_{max}	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	
Mass *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



*) M_{max} = 64 Nm when I_{max} = 46 A

**) M_{max} = 42 Nm when I_{max} = 30 A

QSY 090B
(n_N = 2000 rpm)

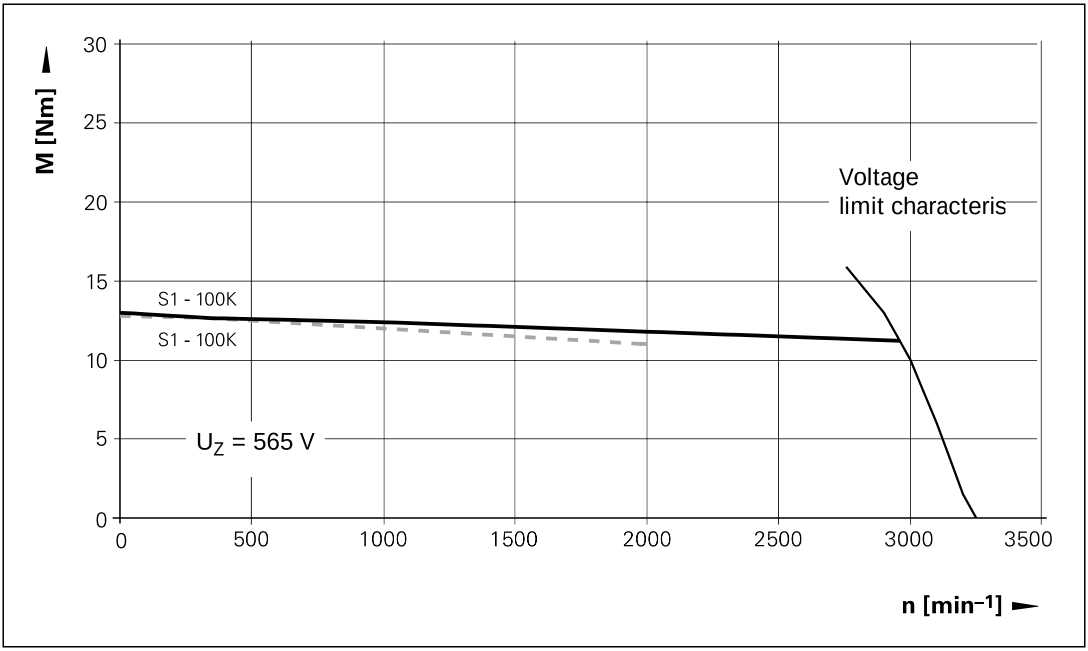
	QSY 090B (n_N = 2000 rpm) with brake	**QSY 090B (n_N = 2000 rpm) without brake**
Rated voltage U_N	305 V	
Rated power output P_N	2.3 kW	
Rated speed n_N	2000 rpm	
Rated torque (100 K) M_N	11.0 Nm	
Rated current (100 K) I_N	6.0 A	
Stall torque (100 K) M_0	13.0 Nm	
Stall current (100 K) I_0	7.2 A	
Maximum current (for ≤ 200 ms) I_{max}	30.0 A	
Maximum torque (for ≤ 200 ms) M_{max}	43.5 Nm	
Pole pairs PZ	4	
Mass *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 (n_N = 2000 rpm)



QSY 090B
(n_N = 3000 rpm)

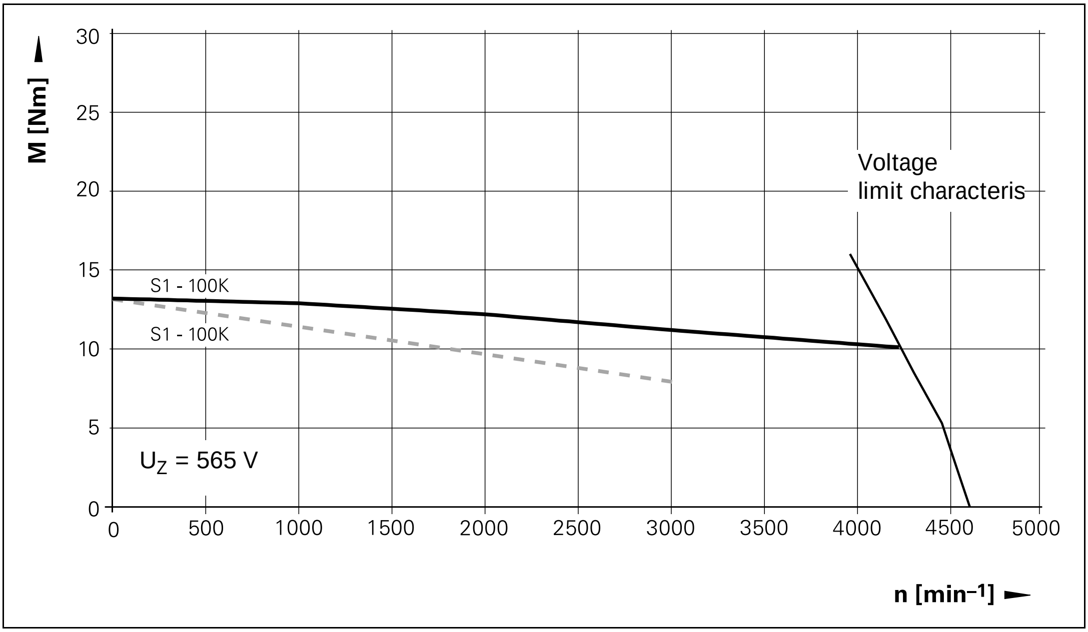
	QSY 090B (n_N = 3000 rpm) with brake	**QSY 090B (n_N = 3000 rpm) without brake**
Rated voltage U_N	330 V	
Rated power output P_N	2.7 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	8.5 Nm	
Rated current (100 K) I_N	6.6 A	
Stall torque (100 K) M_0	13.0 Nm	
Stall current (100 K) I_0	10.1 A	
Maximum current (for ≤ 200 ms) I_{max}	42.0 A	
Maximum torque (for ≤ 200 ms) M_{max}	43.5 Nm	
Pole pairs PZ	4	
Mass *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 (n_N = 3000 rpm)



QSY 093B

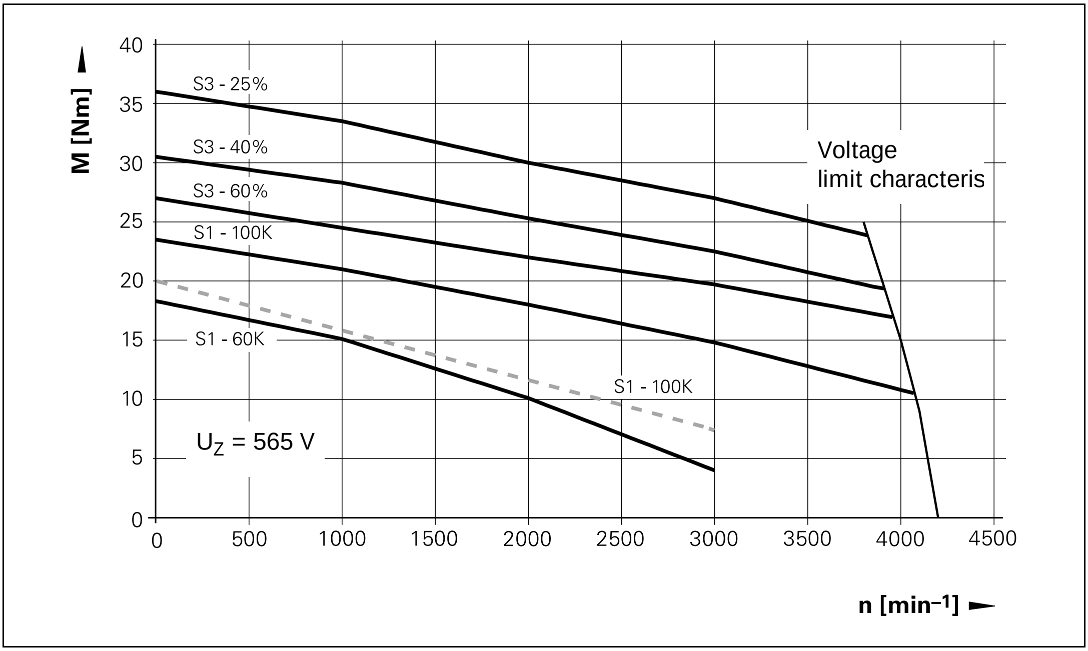
	QSY 093B with brake	QSY 093B without brake
Rated voltage U_N	356 V	
Rated power output P_N	2.3 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	7.2 Nm	
Rated current (100 K) I_N	4.7 A	
Stall torque (100 K) M_0	20.0 Nm	
Stall current (100 K) I_0	13.0 A	
Maximum current (for ≤ 200 ms) I_{max}	51.0 A	
Maximum torque (for ≤ 200 ms) M_{max}	66.0 Nm	
Pole pairs PZ	4	
Mass *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

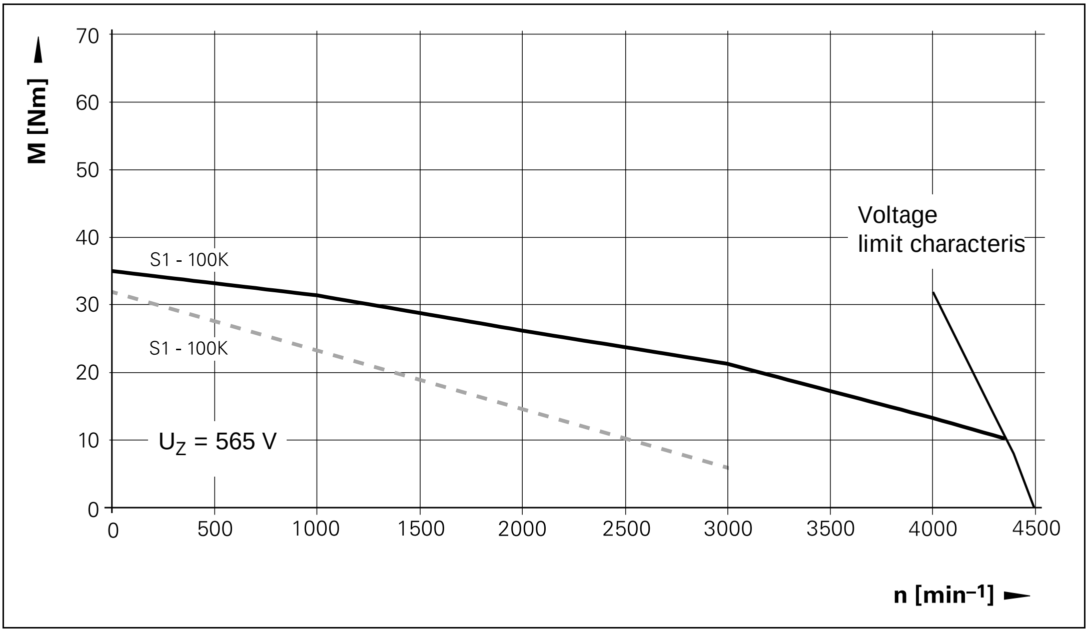
	QSY 112B with brake	QSY 112B without brake
Rated voltage U_N	278 V	
Rated power output P_N	1.9 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	6.0 Nm	
Rated current (100 K) I_N	5.4 A	
Stall torque (100 K) M_0	32.0 Nm	
Stall current (100 K) I_0	28.8 A	
Maximum current (for ≤ 200 ms) I_{max}	113.5 A	
Maximum torque (for ≤ 200 ms) M_{max}	102.0 Nm	
Pole pairs PZ	4	
Mass *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

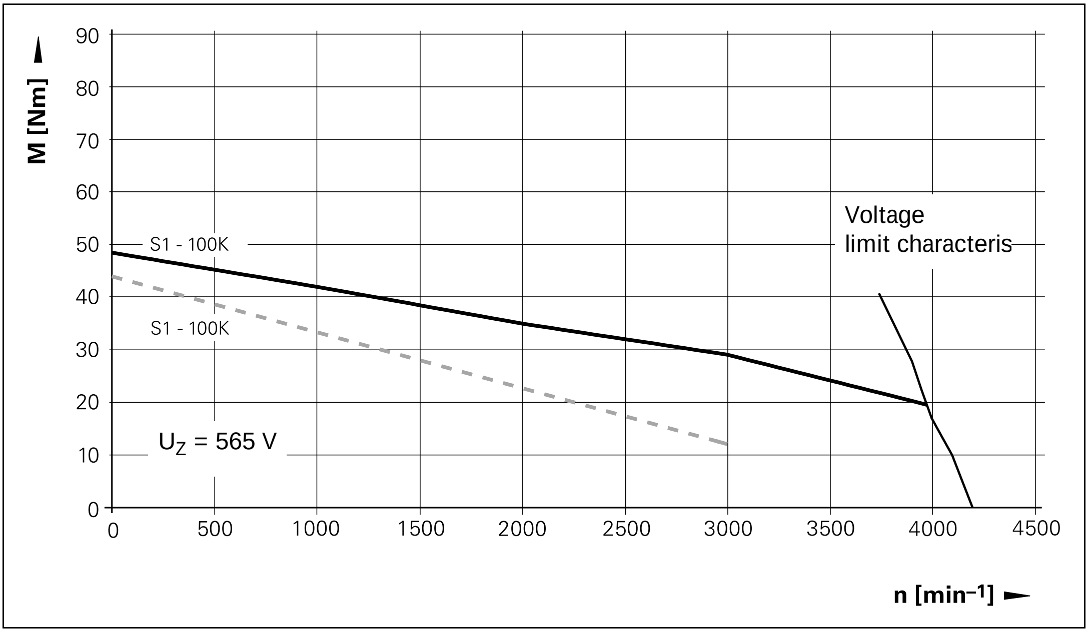
	QSY 112C with brake	QSY 112C without brake
Rated voltage U_N	336 V	
Rated power output P_N	3.8 kW	
Rated speed n_N	3000 rpm	
Rated torque (100 K) M_N	12.0 Nm	
Rated current (100 K) I_N	8.5 A	
Stall torque (100 K) M_0	44.0 Nm	
Stall current (100 K) I_0	31.3 A	
Maximum current (for ≤ 200 ms) I_{max}	121.5 A	
Maximum torque (for ≤ 200 ms) M_{max}	148.0 Nm	
Pole pairs PZ	4	
Mass *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

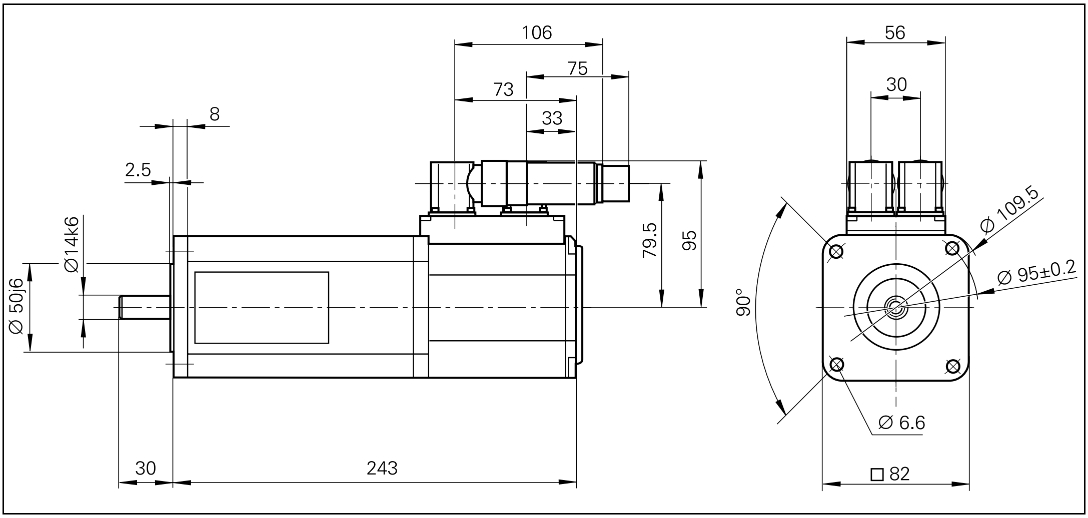
	QSY 112D with fan with brake	QSY 112D with fan without brake
Rated voltage U_N	328 V	
Rated power output P_N	12.0 kW	
Rated speed n_N	2000 rpm	
Rated torque (100 K) M_N	57.1 Nm	
Rated current (100 K) I_N	23.4 A	
Stall torque (100 K) M_0	72.0 Nm	
Stall current (100 K) I_0	33.3 A	
Maximum current (for ≤ 200 ms) I_{max}	100.0 A	
Maximum torque (for ≤ 200 ms) M_{max}	185.0 Nm	
Pole pairs PZ	4	
Mass *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

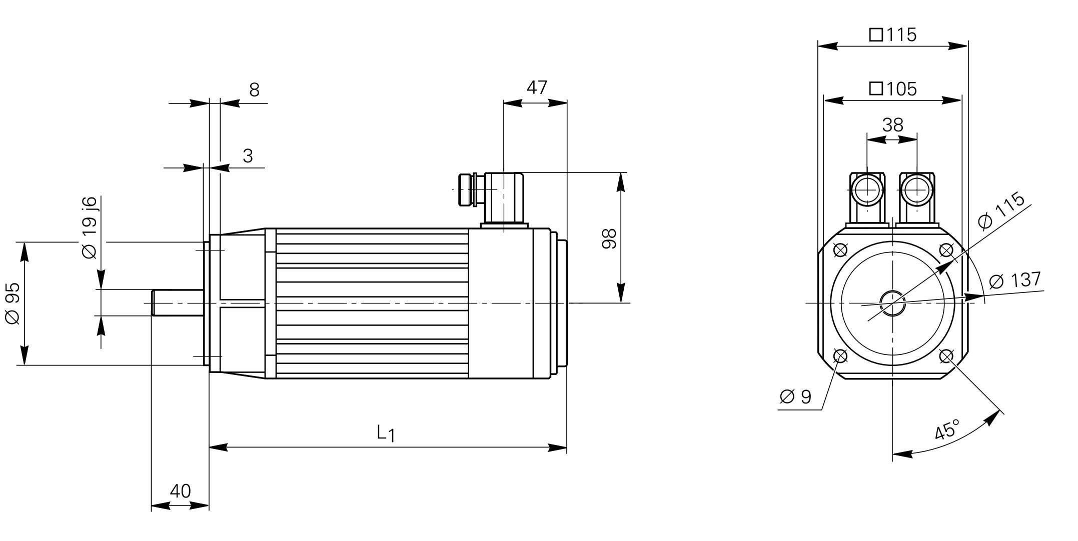
Note

All dimensions in [mm].

QSY 041B

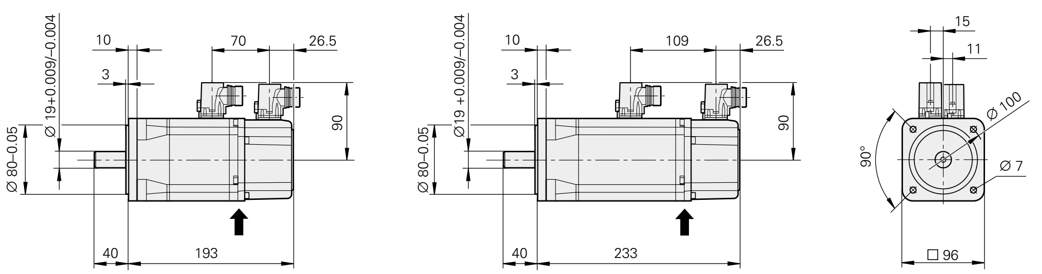


Series QSY 10

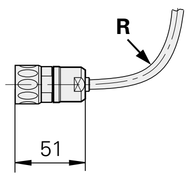
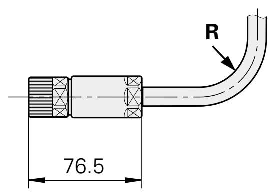


Motor	L_1
QSY 1A	235 mm
QSY 1C	275 mm
QSY 1E	315 mm

QSY 96A

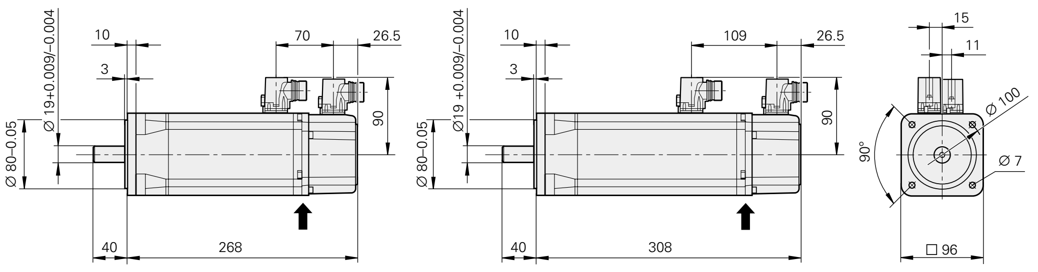


⬆ Fixed bearing

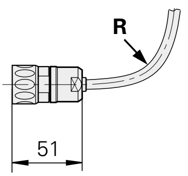
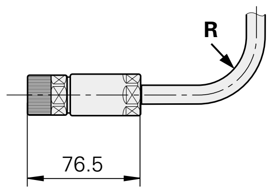
Connector for speed encoder	Connector for power connection
	

QSY 96G

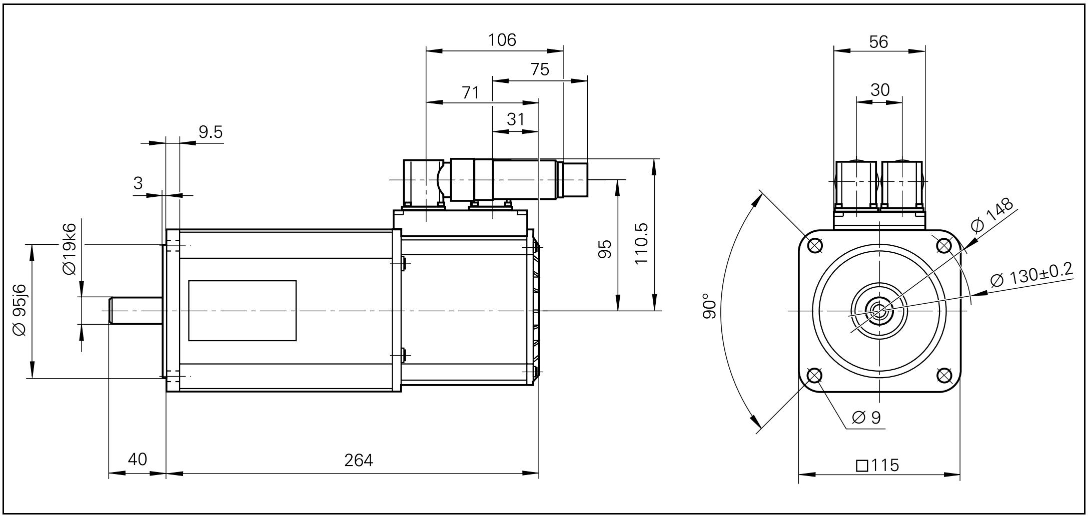
Without brake   With brake



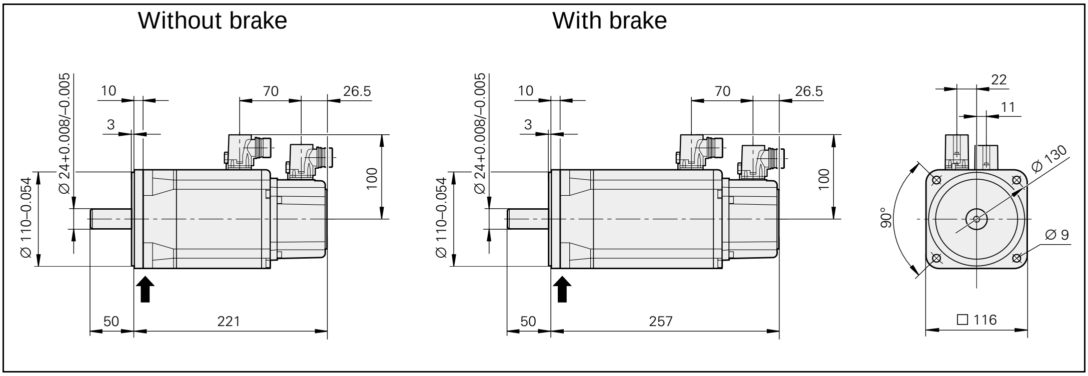
Fixed bearing

Connector for speed encoder	Connector for power connection
	

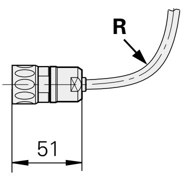
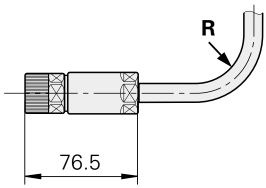
QSY 071B


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

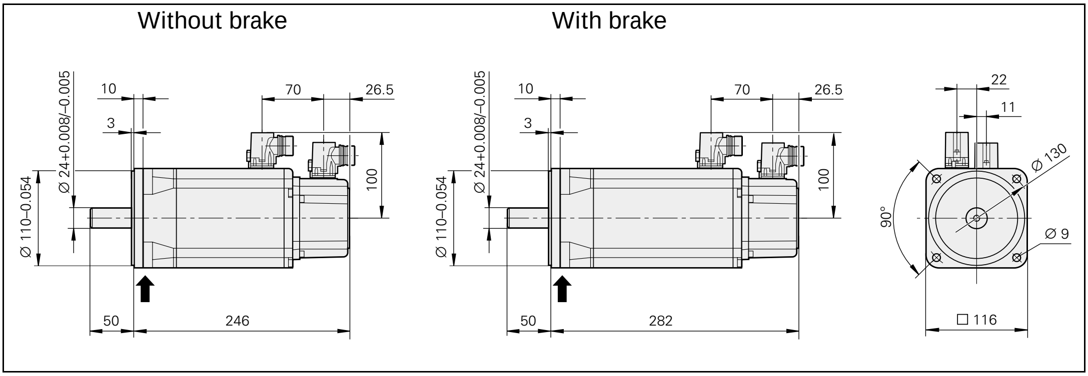
QSY 116C



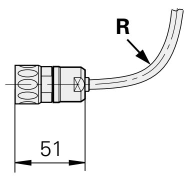
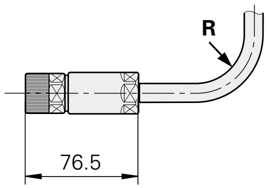
Fixed bearing

Connector for speed encoder	Connector for power connection
	

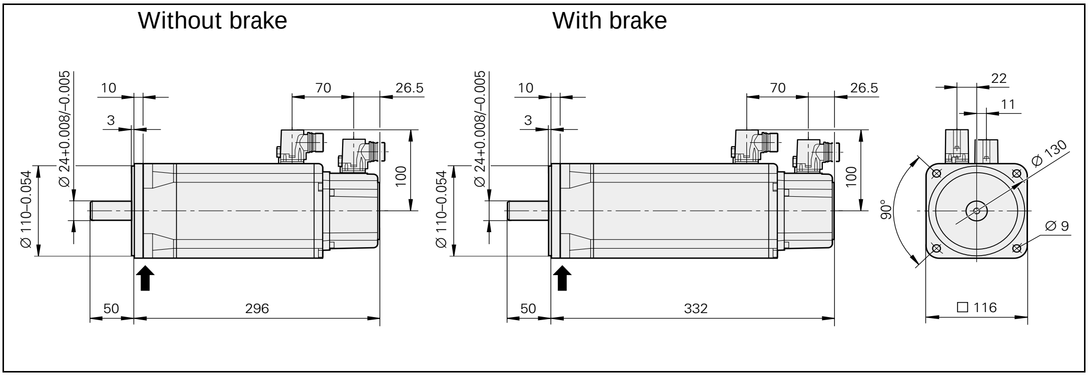
QSY 116E



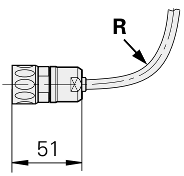
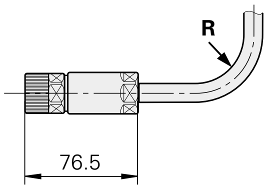
 Fixed bearing

Connector for speed encoder	Connector for power connection
 R 51	 R 76.5

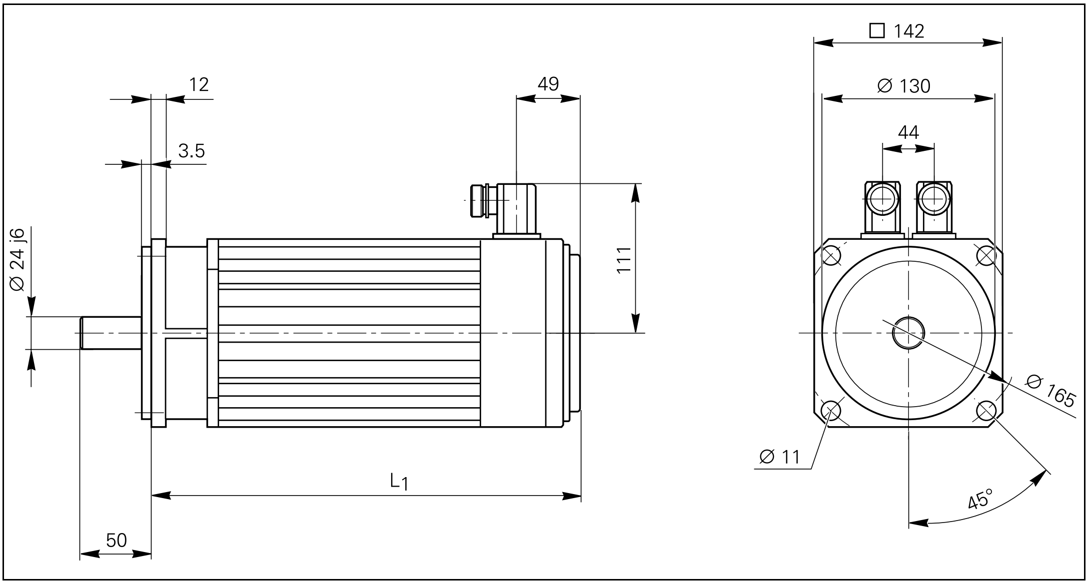
QSY 116J



⬆ Fixed bearing

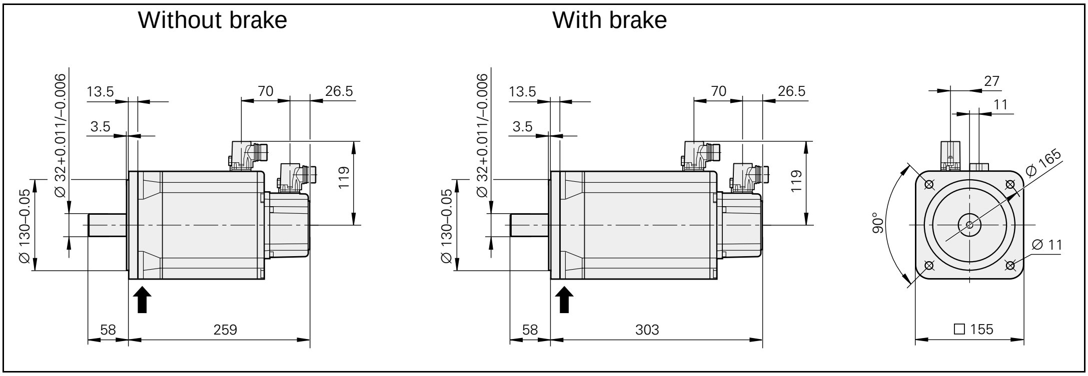
Connector for speed encoder	Connector for power connection
	

Series QSY 20

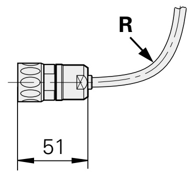
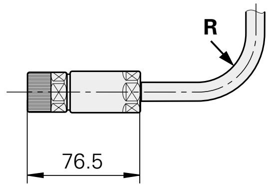


Motor	L_1
QSY 2C	312 mm
QSY 2E	352 mm
QSY 2G	392 mm

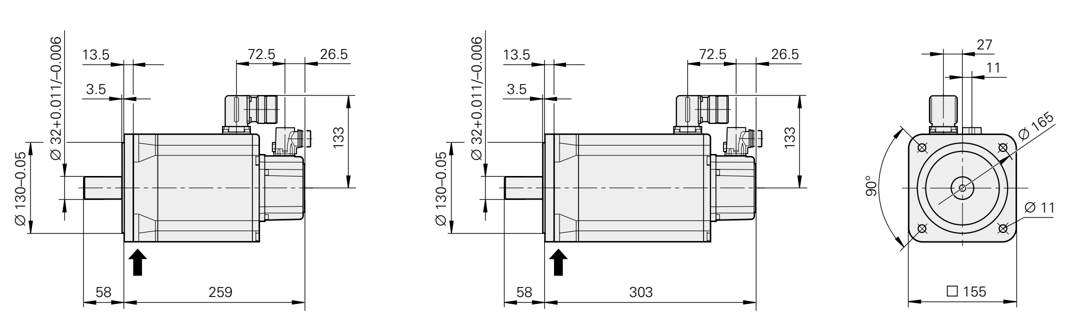
QSY 155B
(n_N = 2000 rpm)



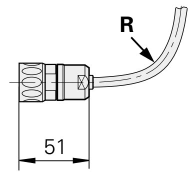
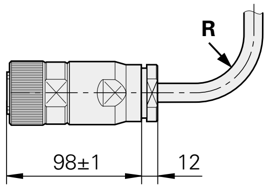
Fixed bearing

Connector for speed encoder	Connector for power connection
	

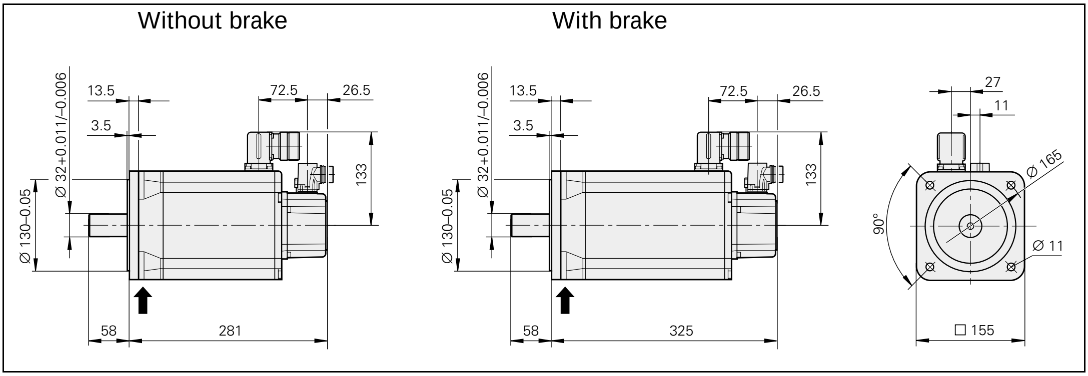
QSY 155B
(n_N = 3000 rpm)



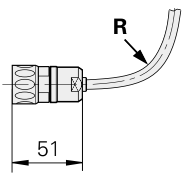
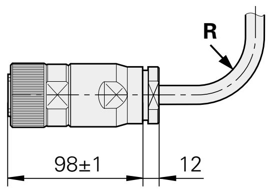
 Fixed bearing

Connector for speed encoder	Connector for power connection
	

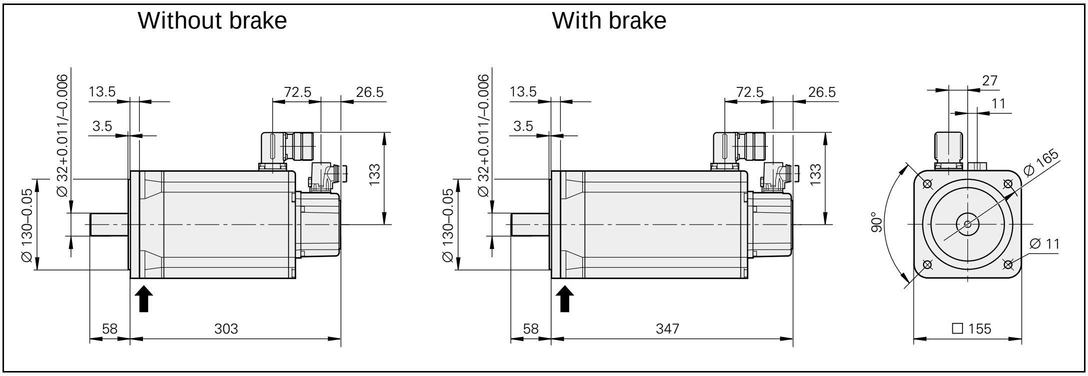
QSY 155C



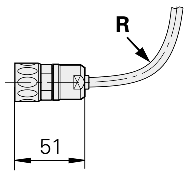
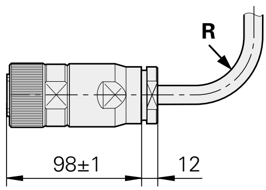
⬆ Fixed bearing

Connector for speed encoder	Connector for power connection
	

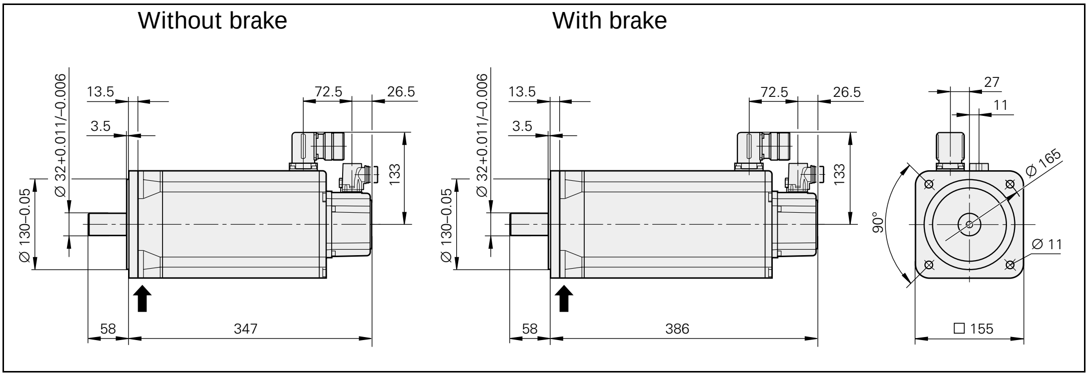
QSY 155D



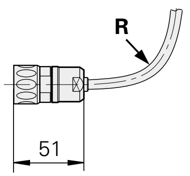
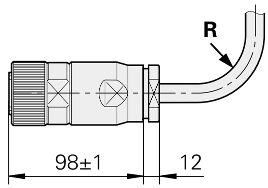
⬆ Fixed bearing

Connector for speed encoder	Connector for power connection
	

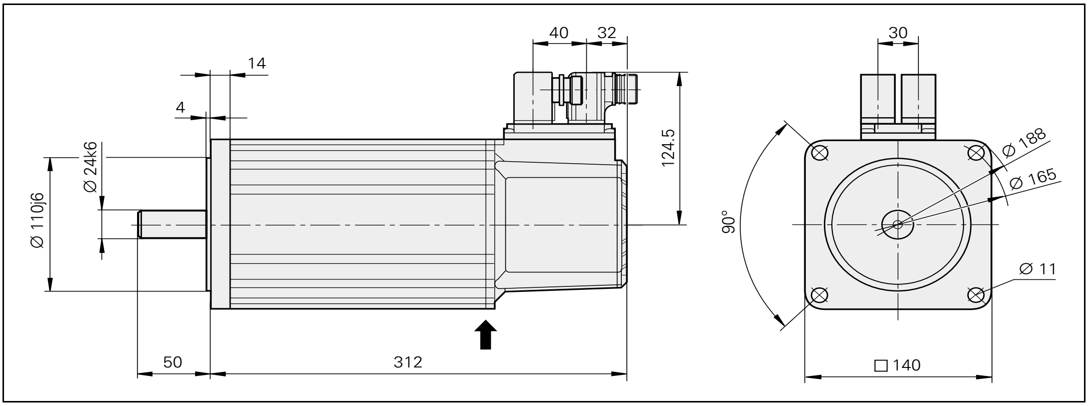
QSY 155F



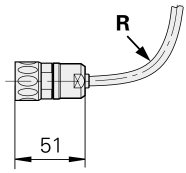
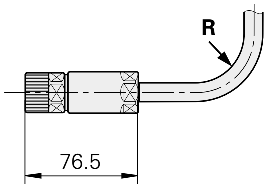
Fixed bearing

Connector for speed encoder	Connector for power connection
	

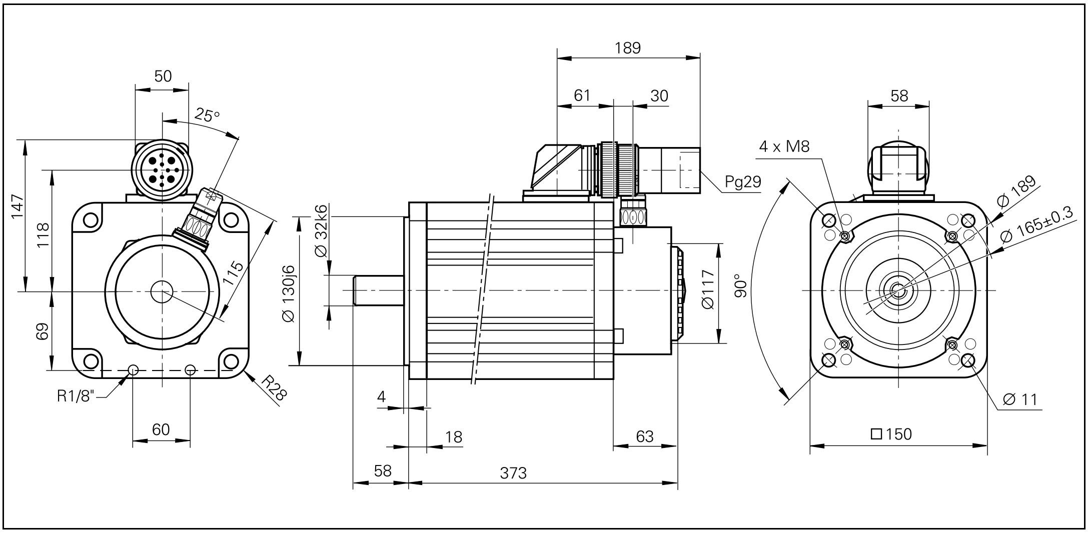
QSY 090B



Fixed bearing

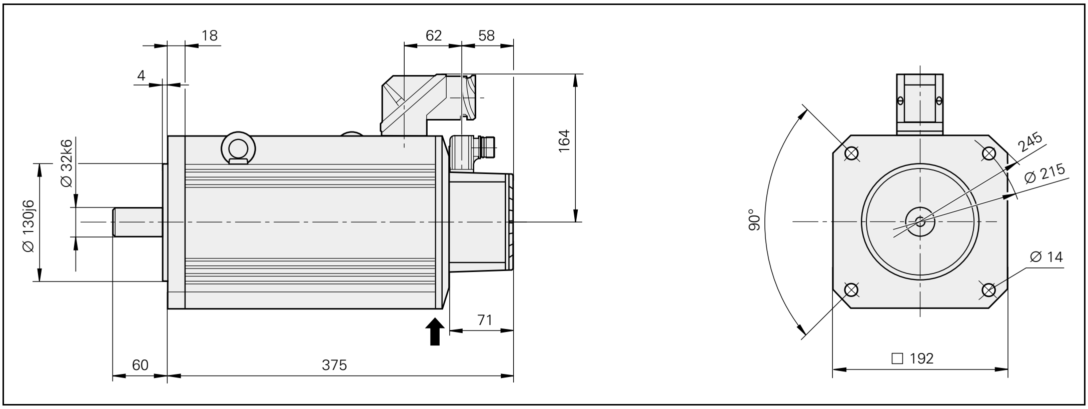
Connector for speed encoder	Connector for power connection
	

QSY 093B

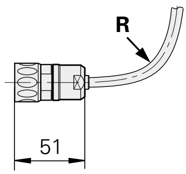
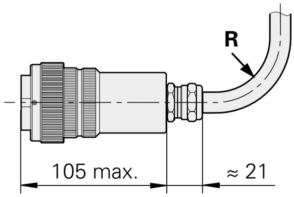


50
25°
147
118
69
115
R1/8"
R28
60
189
61
30
Pg29
Ø 32k6
Ø 130j6
Ø117
4
18
63
58
373
58
4 x M8
Ø 189
Ø 165±0.3
90°
Ø 11
□150

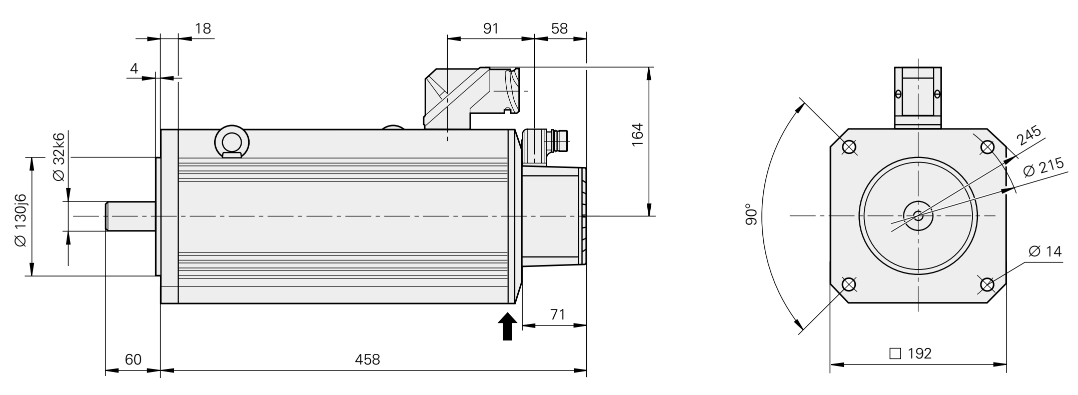
QSY 112B



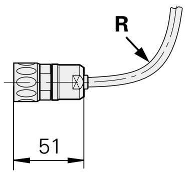
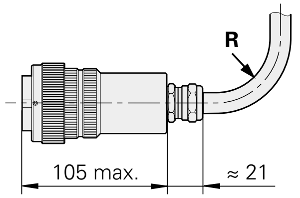
⬆ Fixed bearing

Connector for speed encoder	Connector for power connection
	

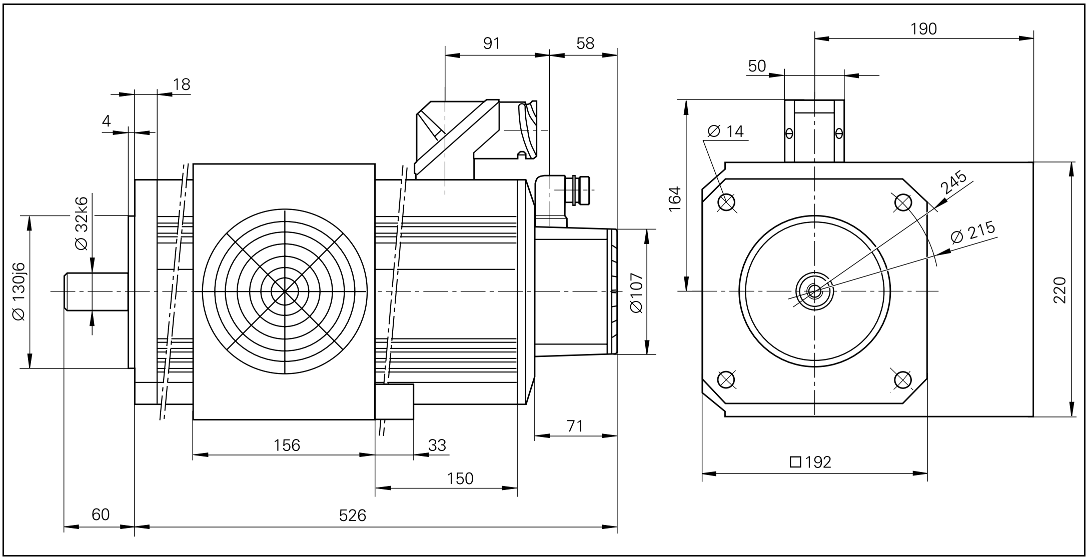
QSY 112C



⬆ Fixed bearing

Connector for speed encoder	Connector for power connection
	

QSY 112D



91
58
18
4
Ø 32k6
Ø 130j6
Ø107
156
33
150
71
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 HEIDENHAIN Asynchronous Motors, QAN Series

Series QAN 104

	QAN 104B	**QAN 104C**	**QAN 104D**
ID number	331 146-11	331 147-11	331 148-11
Fan	+	+	+
Holding 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
Efficiencyη	0.85		
Maximum speed n_{max}	9000 rpm		
Pole pairs PZ	2		
Mass *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		

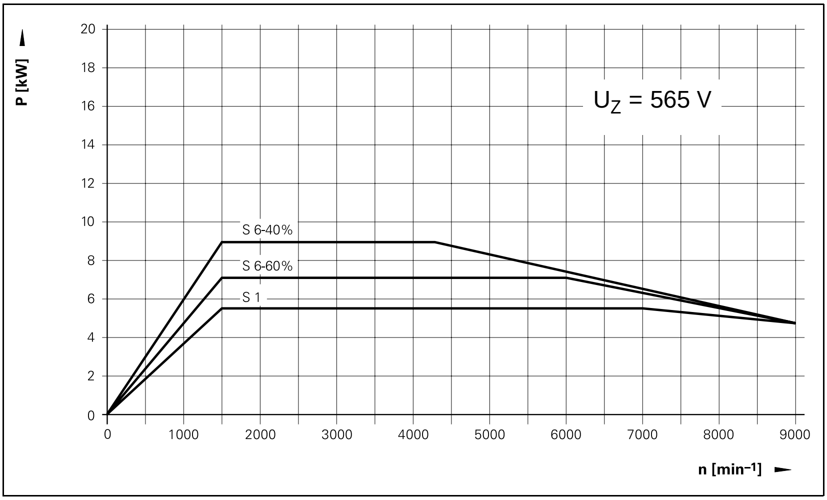
Series QAN 30

	QAN 3M	QAN 3L	QAN 3U
ID number	316 006-31	316 007-31	316 008-31
Fan	+	+	+
Holding 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
Efficiency η	0.83		0.82
Maximum speed n_{max}	9000 rpm		
Pole pairs PZ	2		
Mass *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		

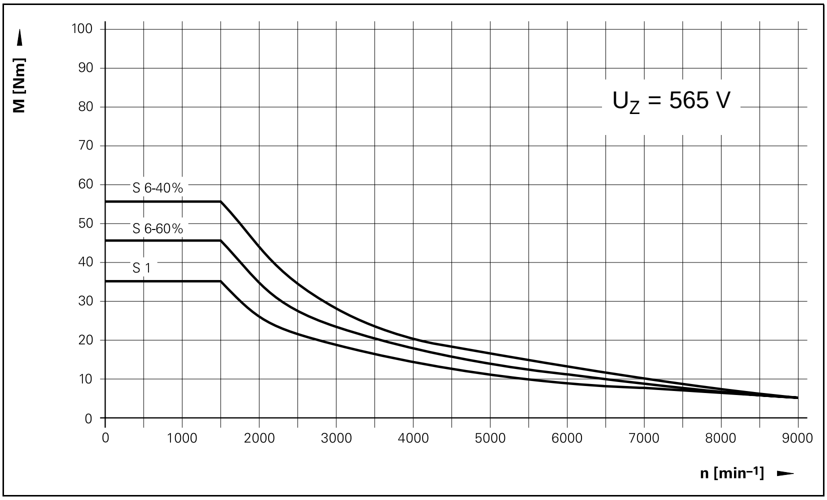
Power and torque characteristics for QAN 3M

Mode of operation	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



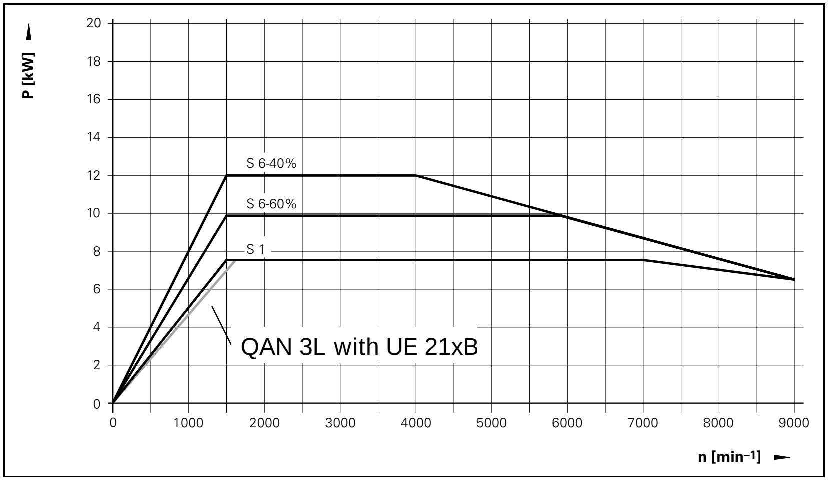
Torque characteristic



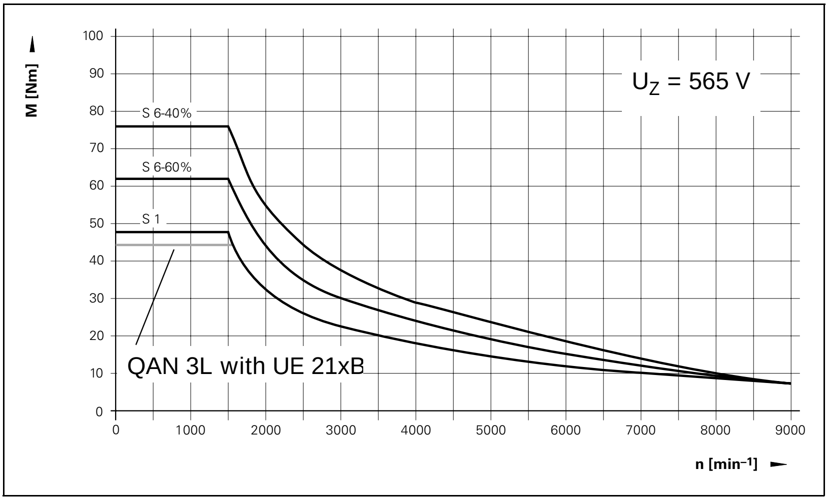
Power and torque characteristic for QAN 3L

Mode of operation	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



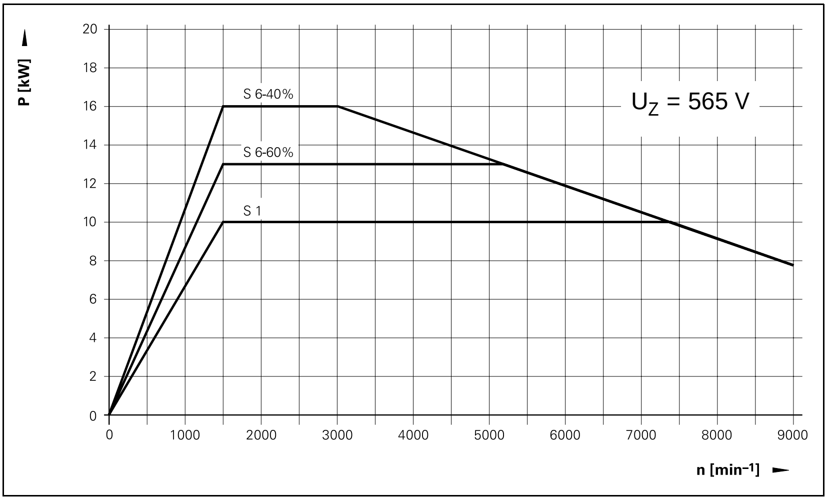
Torque characteristic



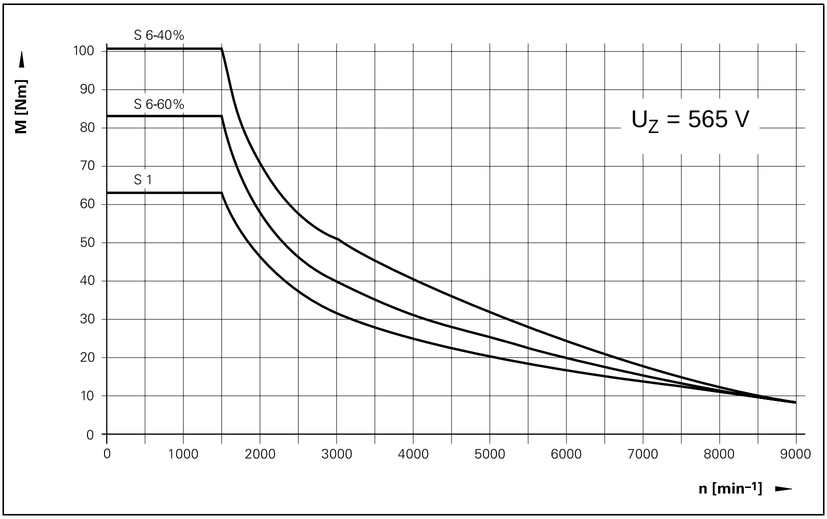
Power and torque characteristic for QAN 3U

Mode of operation	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



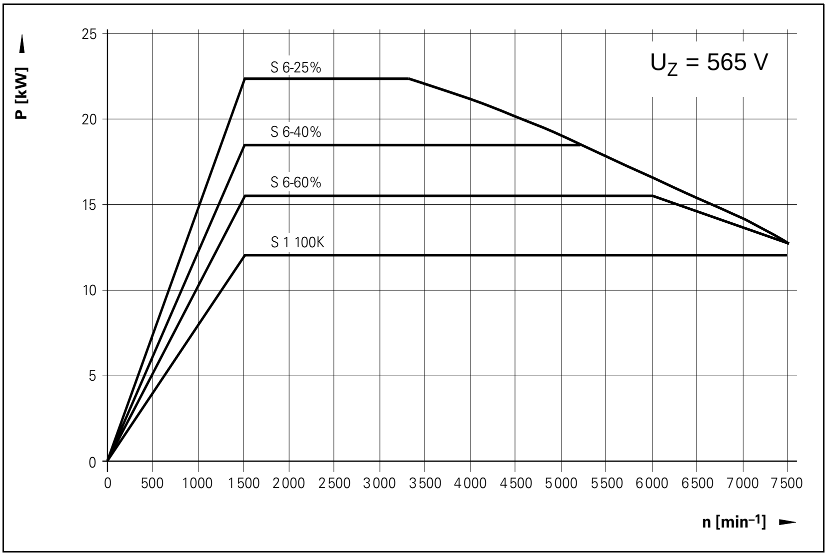
Series QAN 134

	QAN 134B	QAN 134C	QAN 134D
ID number	331 149-11	331 150-11	331 151-11
Fan	+	+	+
Holding 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
Efficiency η	0.85		
Maximum speed n_{max}	7500 rpm		
Pole pairs PZ	2		
Mass 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		

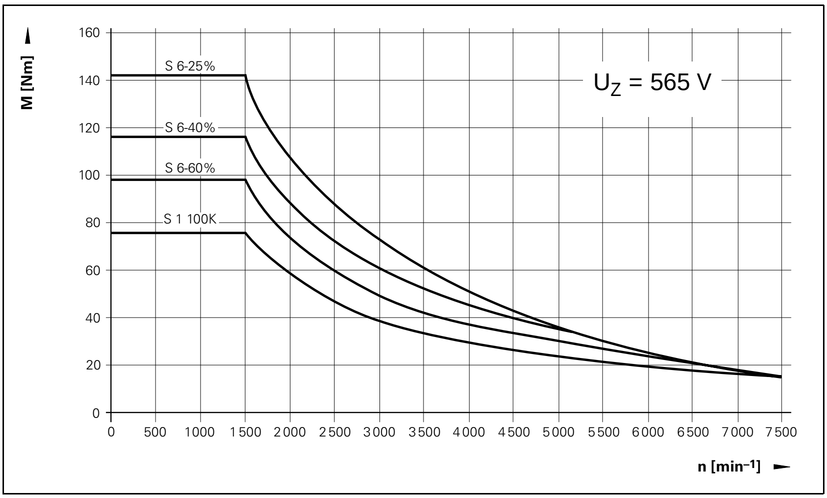
Power and torque characteristic for QAN 134B

Mode of operation	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



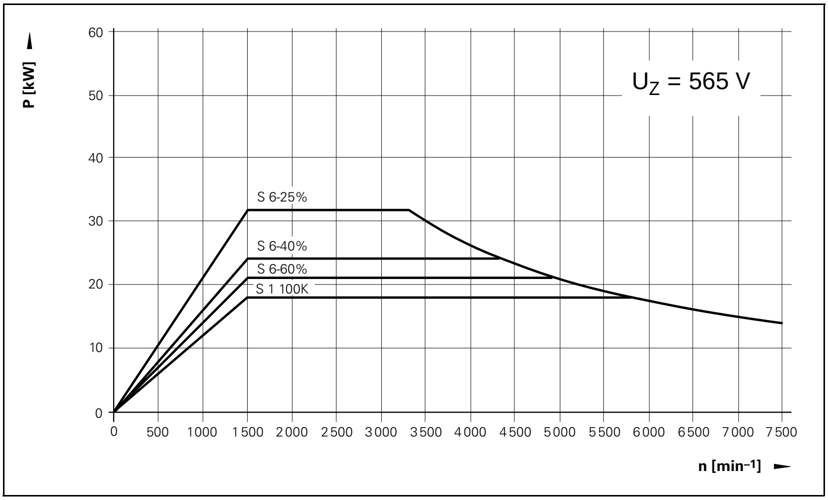
Torque characteristic



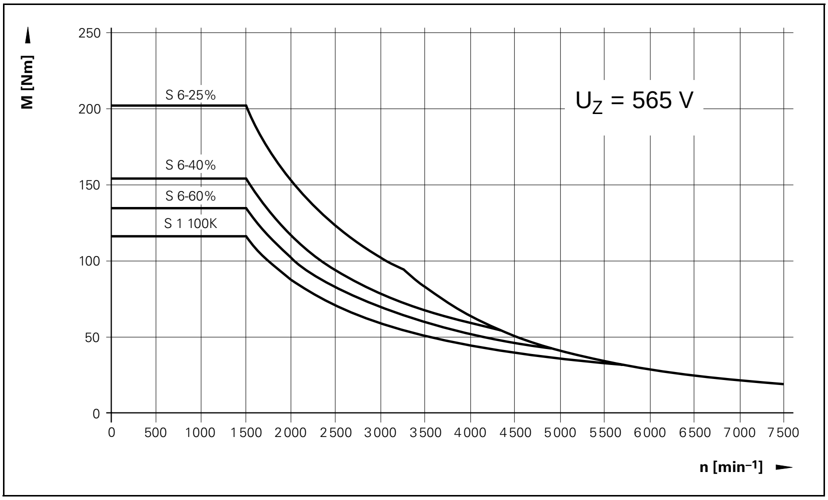
Power and torque characteristic for QAN 134C

Mode of operation	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



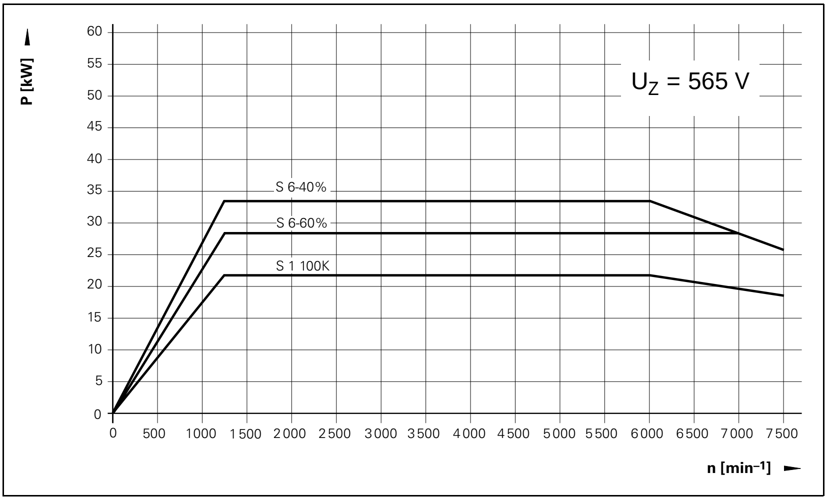
Torque characteristic



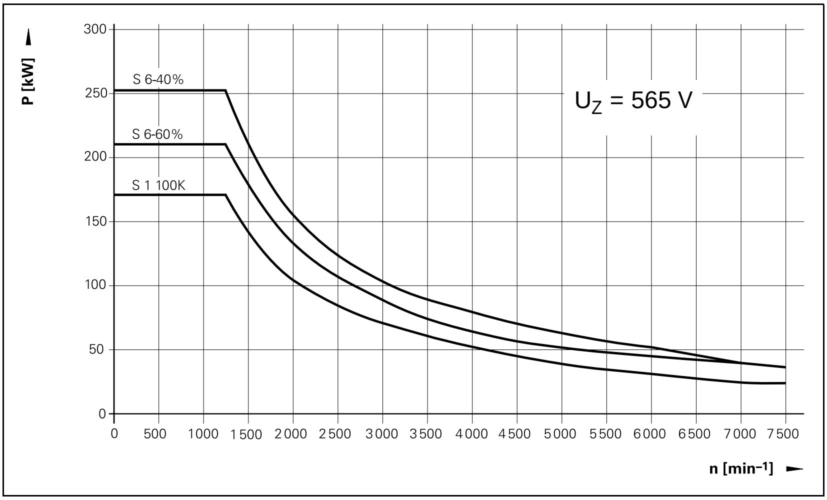
Power and torque characteristic for QAN 134D

Mode of operation	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



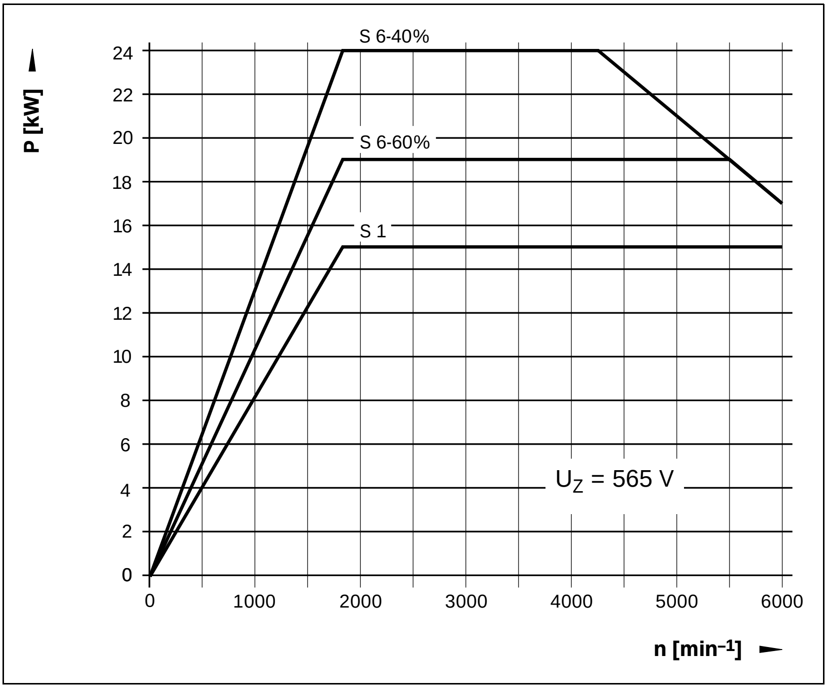
QAN 4S

	QAN 4S
ID number	317 449-31
Fan	+
Holding 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
Efficiency η	0.85
Maximum speed n_{max}	6000 rpm
Pole pairs PZ	2
Mass *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

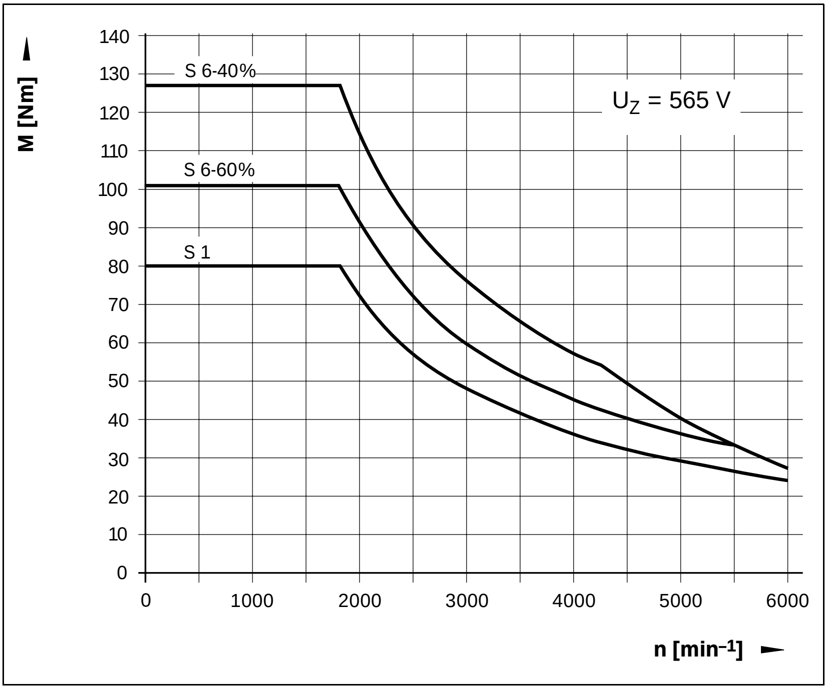
Power and torque characteristic for QAN 4S

Mode of operation	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



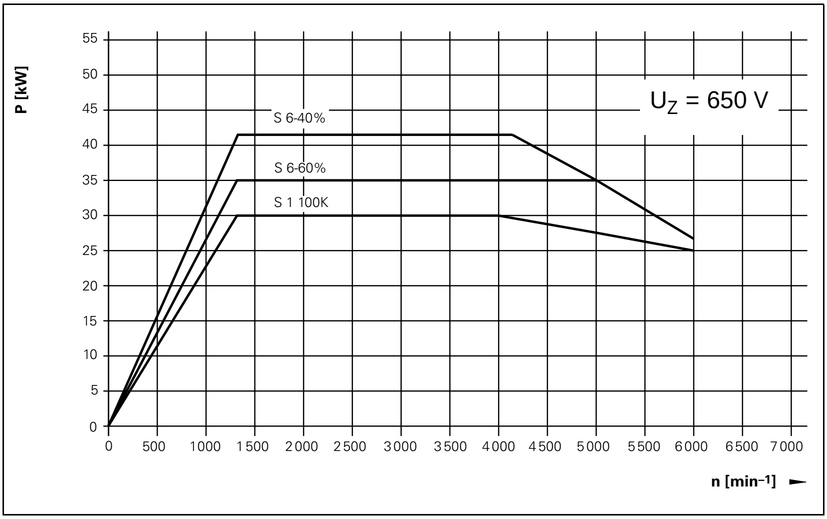
QAN 164B

	QAN 164B
ID number	331 152-xx
Fan	+
Holding 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
Efficiency η	0.85
Maximum speed n_{max}	6000 rpm
Pole pairs PZ	2
Mass *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

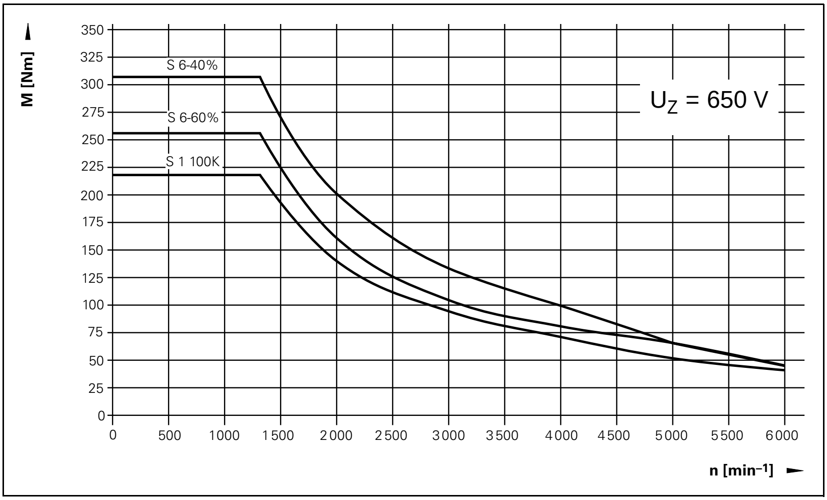
Power and torque characteristic for QAN 164B

Mode of operation	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

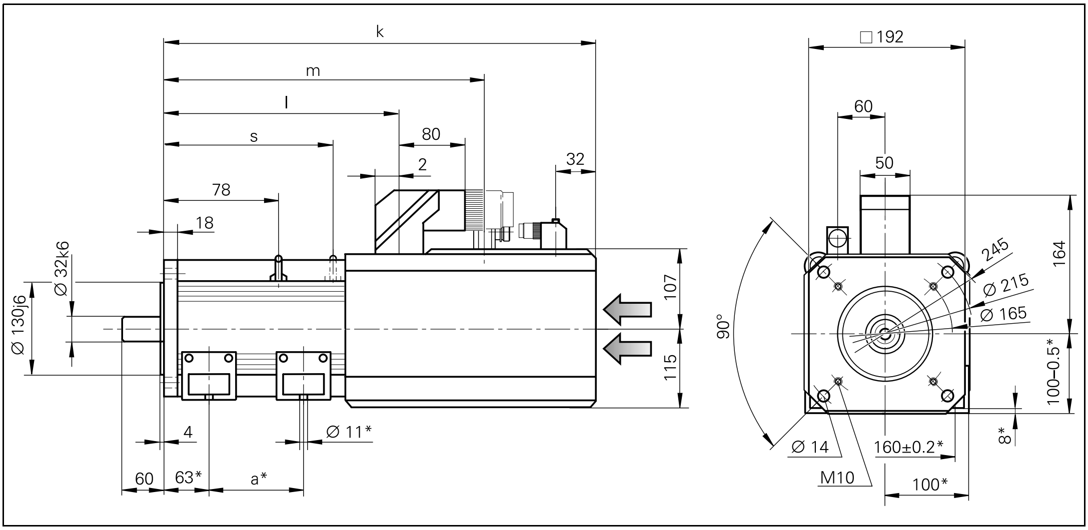


7.10.2 Dimensions of HEIDENHAIN Asynchronous motors, QAN Series

Note

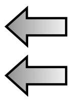
All dimensions in [mm].

Series QAN 104



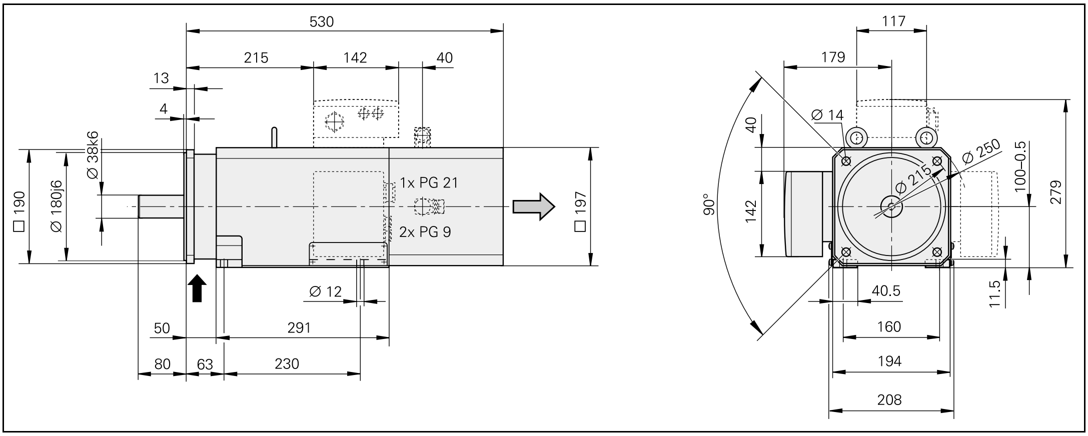
*) Mounting block (design IM B35) on request

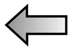
Motor	k	l	m	a	s
QAN 104B	507 mm	247 mm	339 mm	80 mm	166 mm
QAN 104C	582 mm	322 mm	414 mm	140 mm	241 mm
QAN 104D	657 mm	397 mm	489 mm	215 mm	316 mm



Air current of the fan

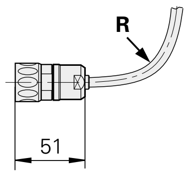
QAN 3M



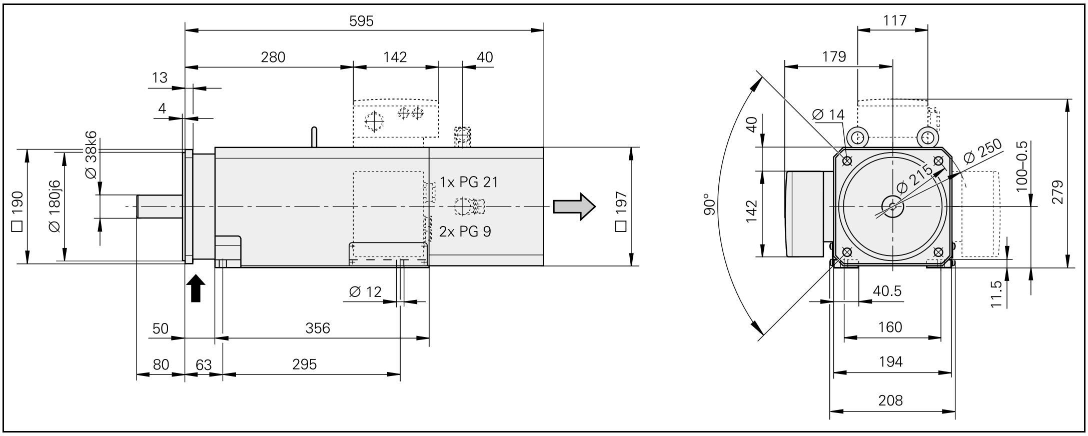


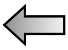
Air current of the fan

Fixed bearing

Connector for speed encoder


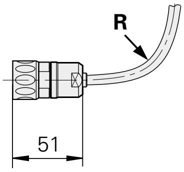
QAN 3L



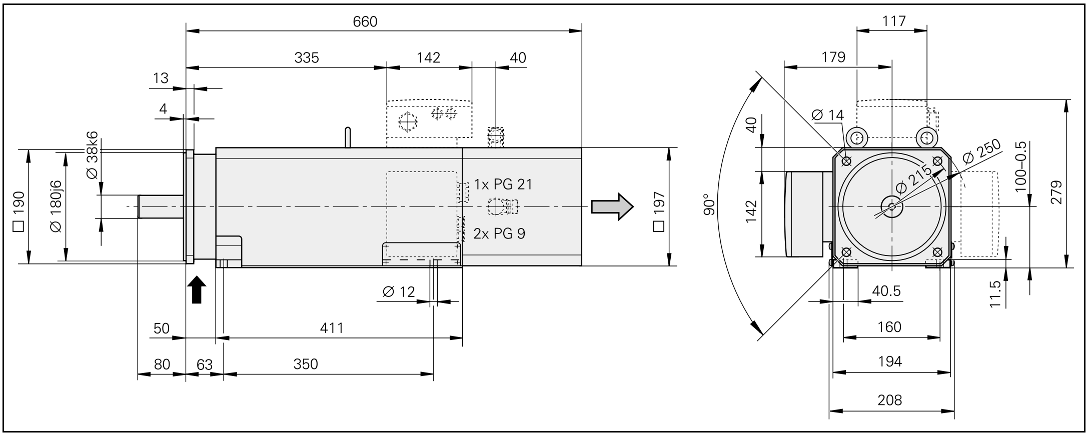


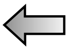
Air current of the fan

Fixed bearing

Connector for speed encoder


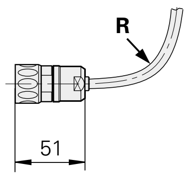
QAN 3U



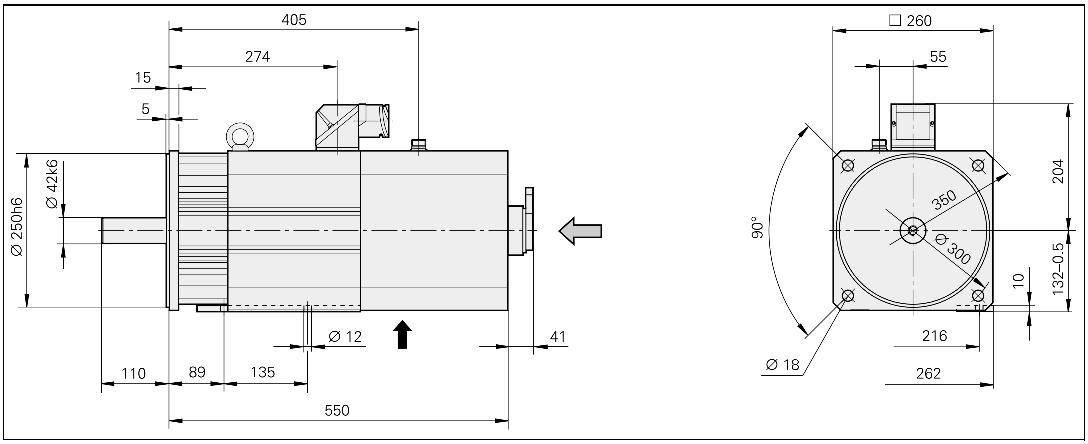


Air current of the fan

Fixed bearing

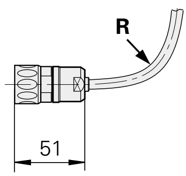
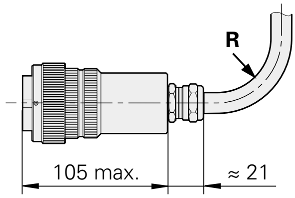
Connector for speed encoder


QAN 134B

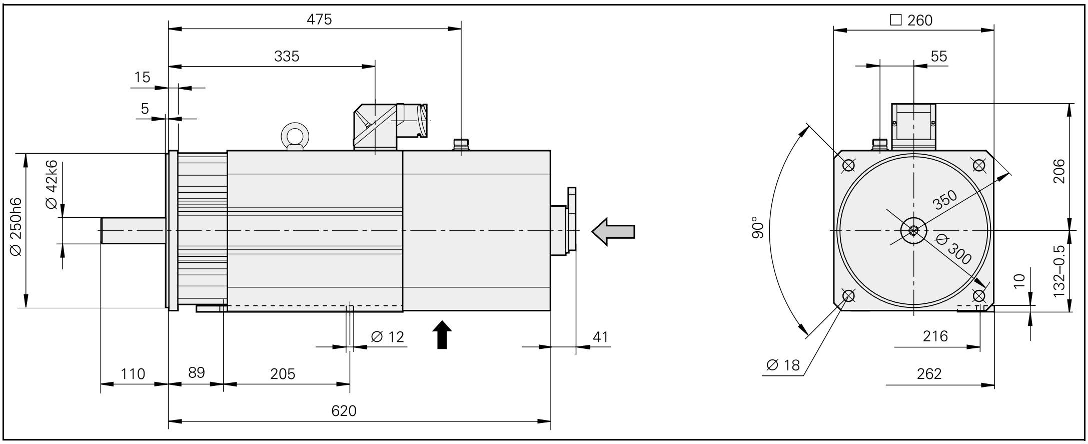


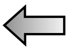
Air current of the fan

Fixed bearing

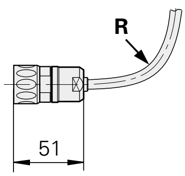
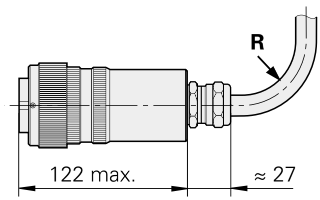
Connector for speed encoder	Connector for power connection
	

QAN 134C

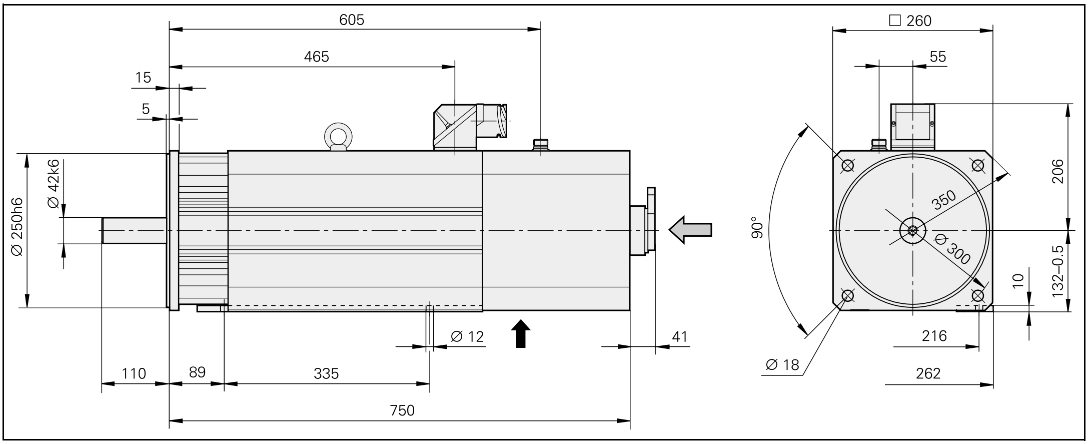


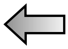
 Air current of the fan

 Fixed bearing

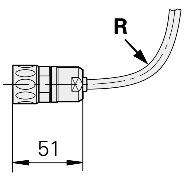
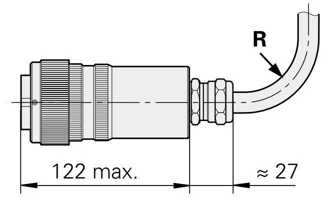
Connector for speed encoder	Connector for power connection
	

QAN 134D

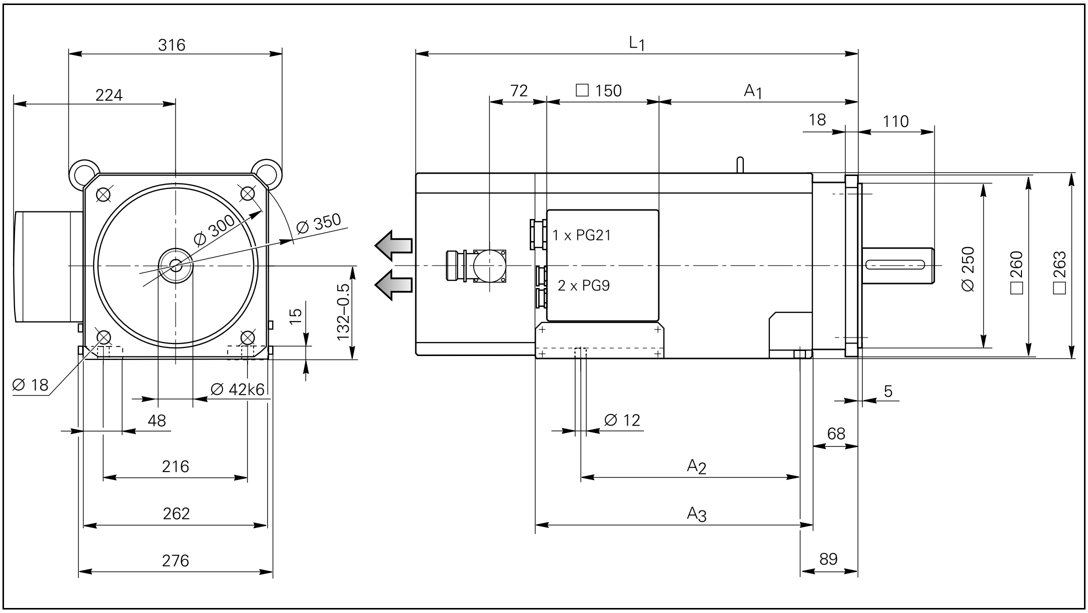


 Air current of the fan

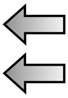
 Fixed bearing

Connector for speed encoder	Connector for power connection
	

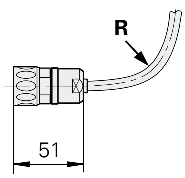
QAN 4S



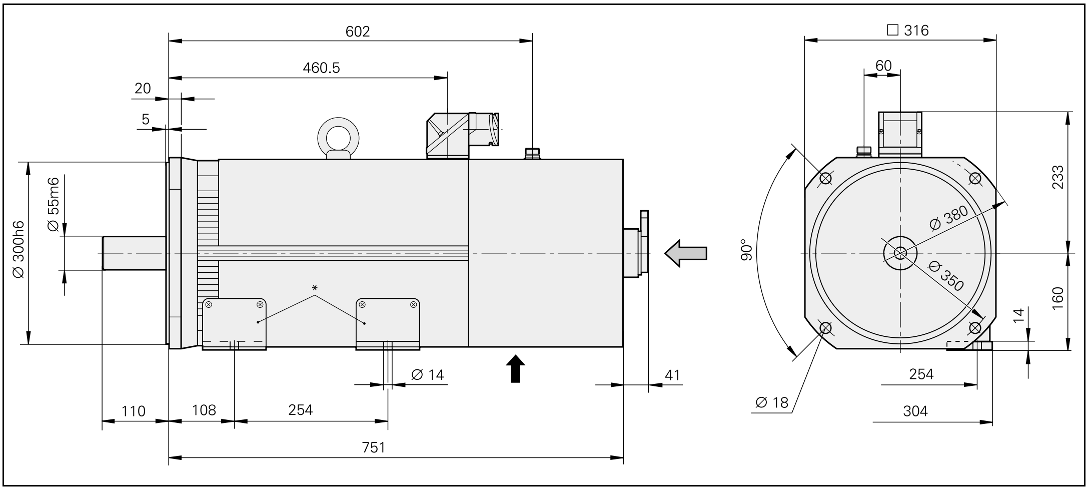
Motor	**L_1**	**A_1**	**A_2**	**A_3**
QAN 4S	610 mm	245 mm	265 mm	338 mm

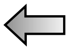


Air current of the fan

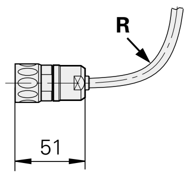
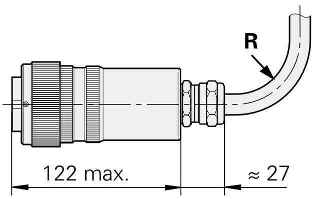
Connector for speed encoder


QAN 164B



 Air current of the fan

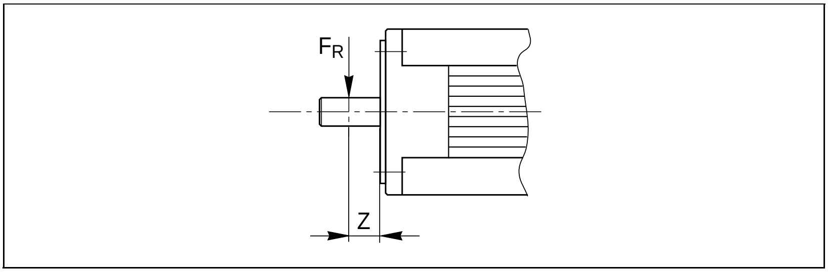
 Fixed bearing

Connector for speed encoder	Connector for power connection
	

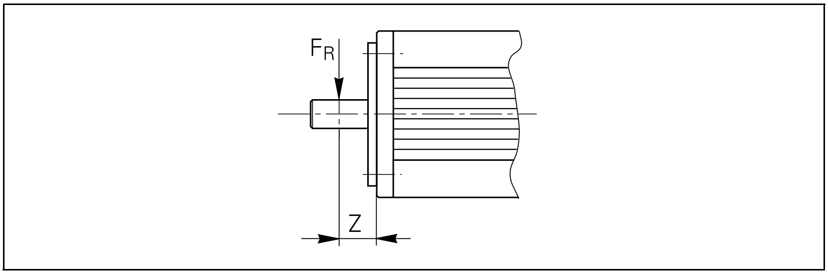
7.11 Permissible forces on the motor shaft

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**

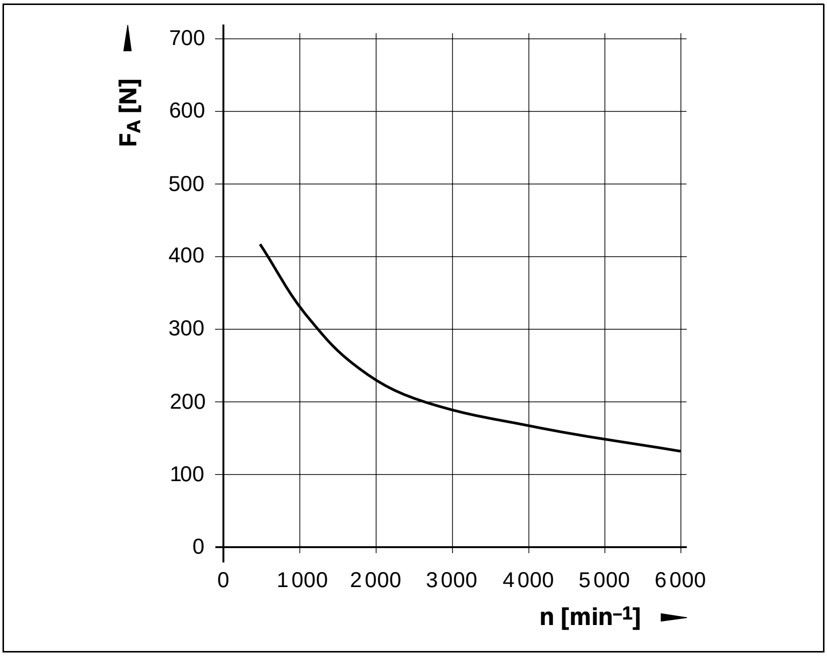


7.11.2 Permissible Forces on the HEIDENHAIN Synchronous Motors QSY 10, QSY 20

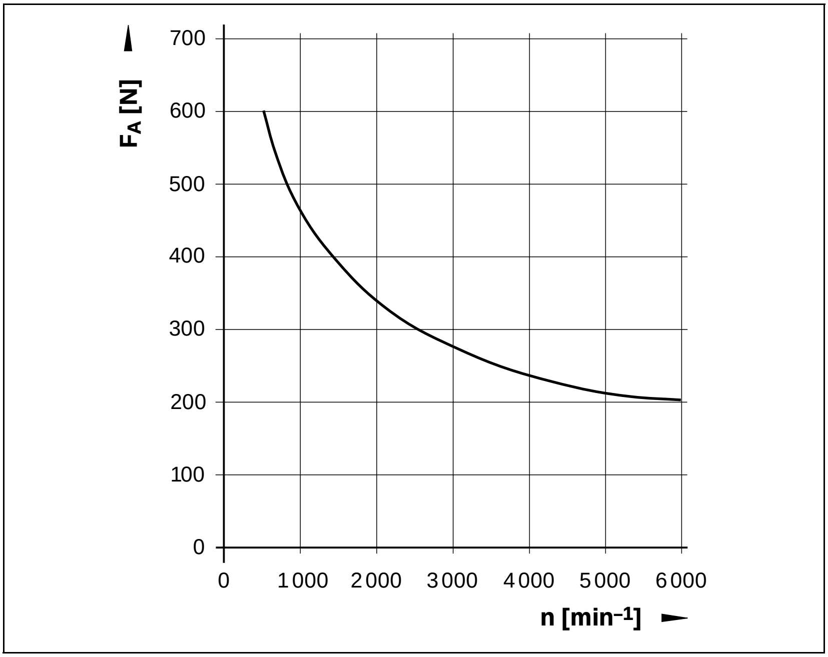
Axial force F_A

The following diagrams show the maximum permissible axial forces F_{Amax} for a bearing service life of 30 000 h.

Series QSY 10



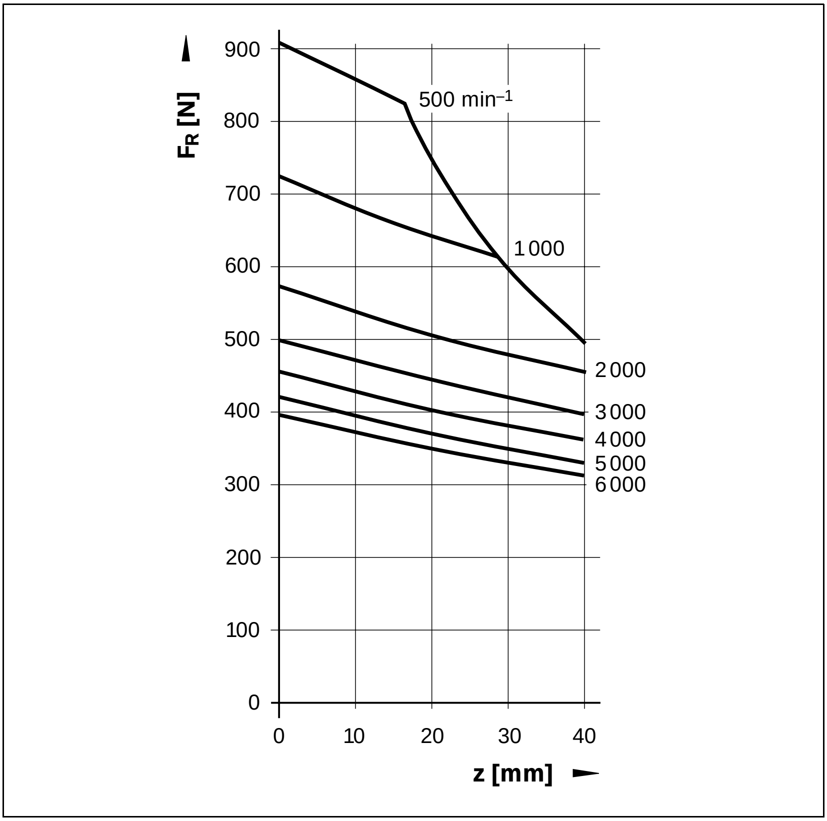
Series QSY 20



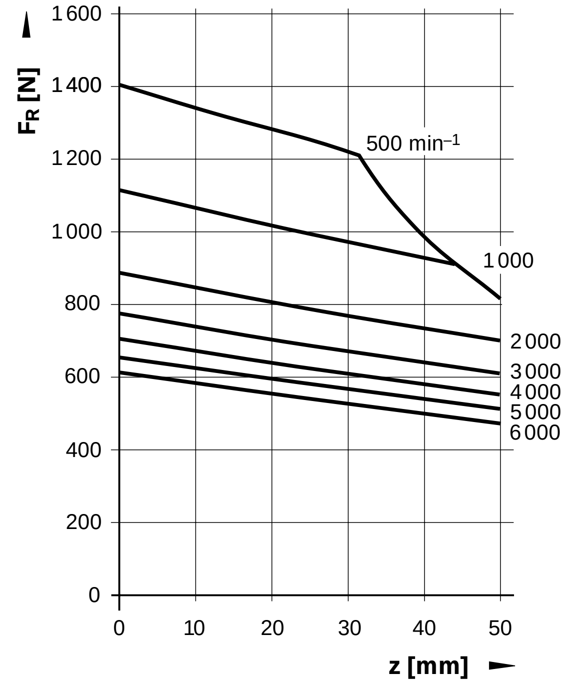
Radial force F_R

The following diagrams show the maximum permissible radial forces F_{Rmax} for a bearing service life of 30 000 h, depending on the point of the radial force and the average speed.

Series QSY 10



Series QSY 20

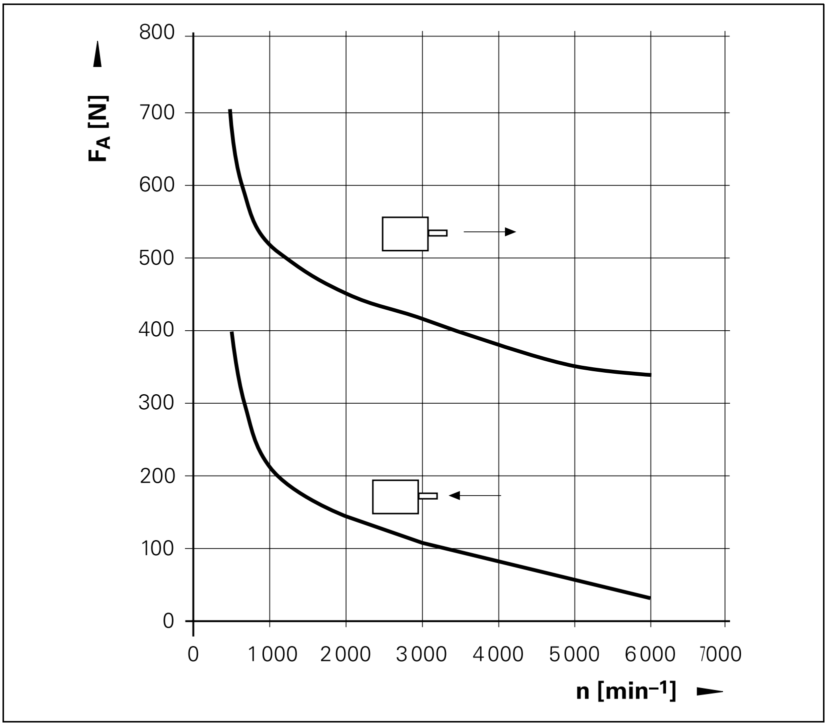


7.11.3 Permissible forces on the HEIDENHAIN synchronous motors QSY 96G, QSY 116 and QSY 155

Axial force F_A on QSY 96

The following diagram shows the maximum permissible axial force F_{Amax} for a bearing service life of 30 000 h.

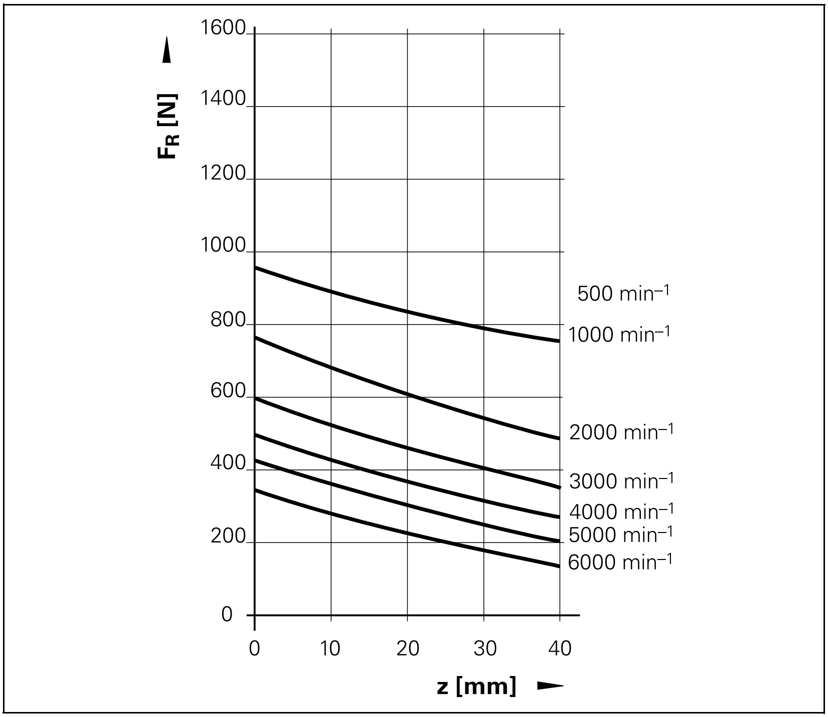
Series QSY 96



Radial force F_R on QSY 96

The following diagram shows the maximum permissible radial force F_{Rmax} for a bearing service life of 30 000 h, depending on the point of the radial force and the average speed.

Series QSY 96



Combined load on QSY 116 and QSY 155

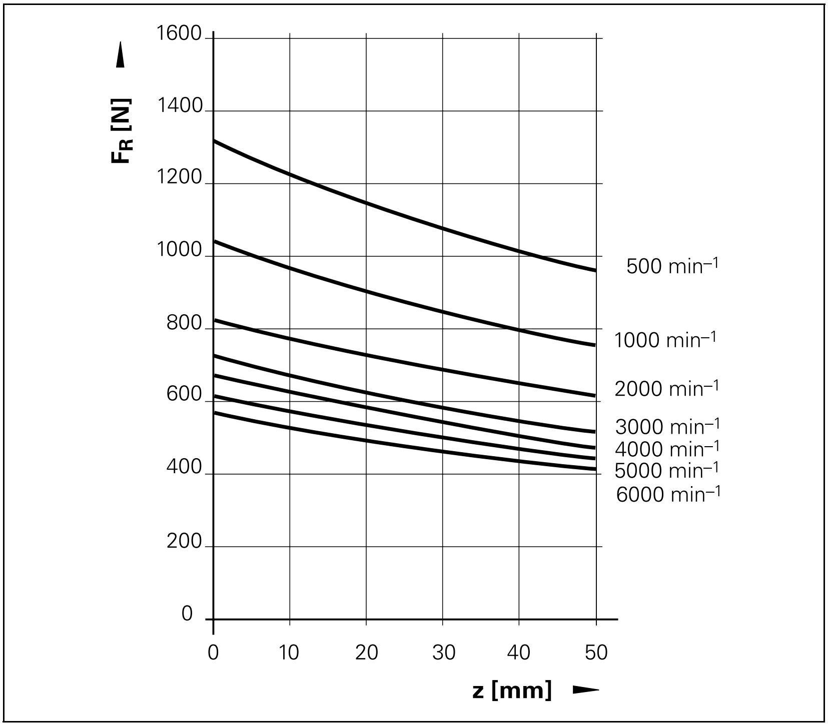
It is necessary to determine the combined load resulting from axial and radial forces for the HEIDENHAIN synchronous motors QSY 116 and QSY 155.

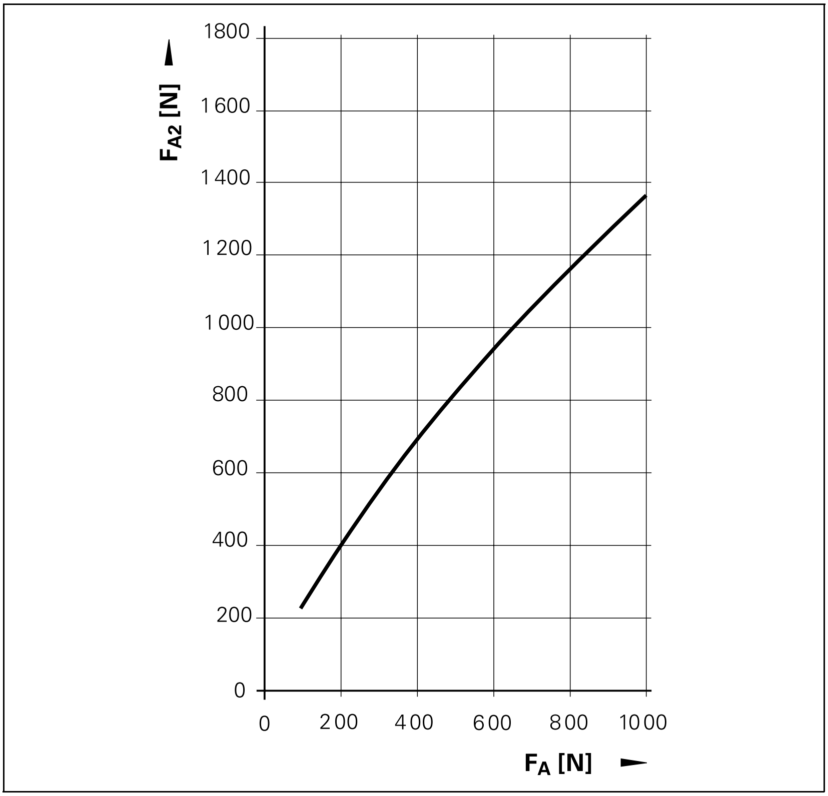
- Use the first diagram for determining the permissible radial force F_R depending on the distance *z* and the average speed.
- Use the second diagram for determining the equivalent axial force F_{A2} depending on the applied axial force F_A, where the applied axial force F_A must not exceed 1000 N.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

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

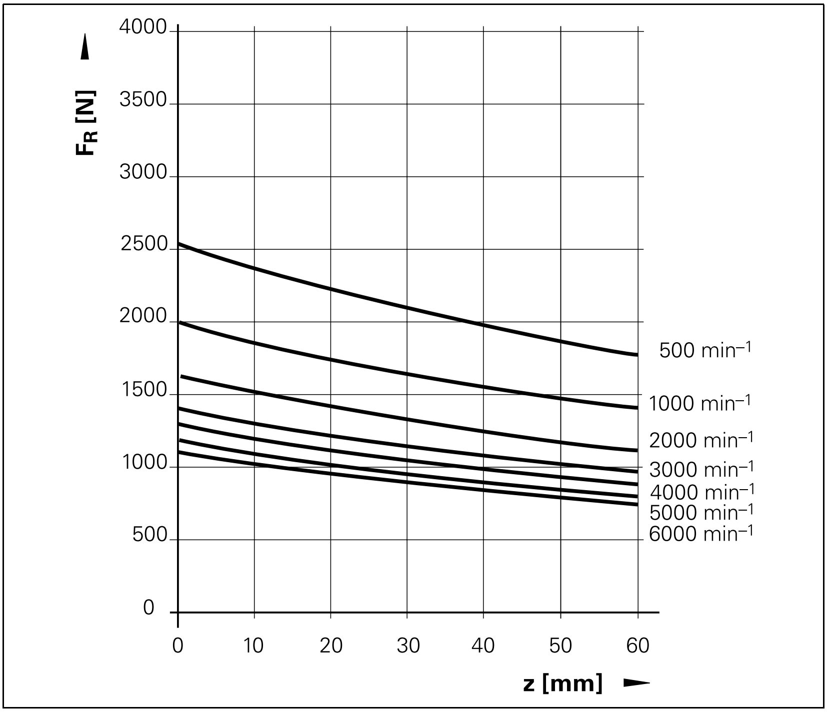
- The following conditions must be fulfilled in order to achieve a bearing service life of 30 000 h:
  - The applied axial force F_A must not exceed 1000 N.
  - The applied radial force F_{Ra} must not exceed the permissible radial force F_R from the first diagram.
  - The combined load F_{com} must not exceed the permissible radial force F_R from the first diagram.

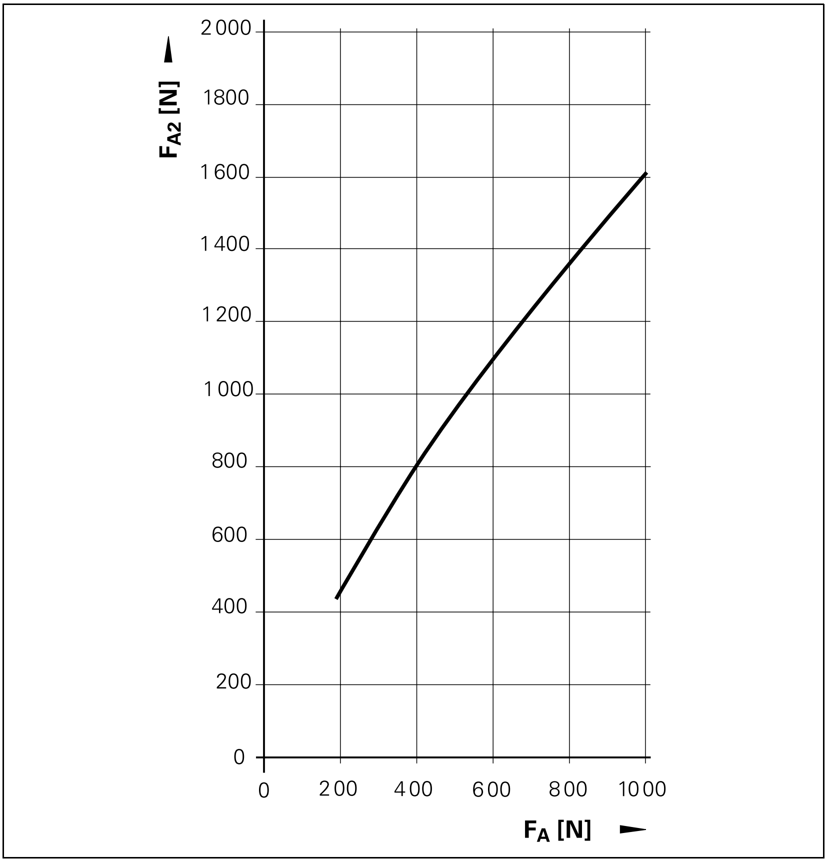
Series QSY 116





Series QSY 155





7.11.4 Permissible Forces on the HEIDENHAIN Synchronous Motors QSY 041B, QSY 071B, QSY 090B, QSY 093B and series QSY 112

The values given for permissible axial and radial forces are valid for a bearing life of 30 000 h.

Axial force F_A

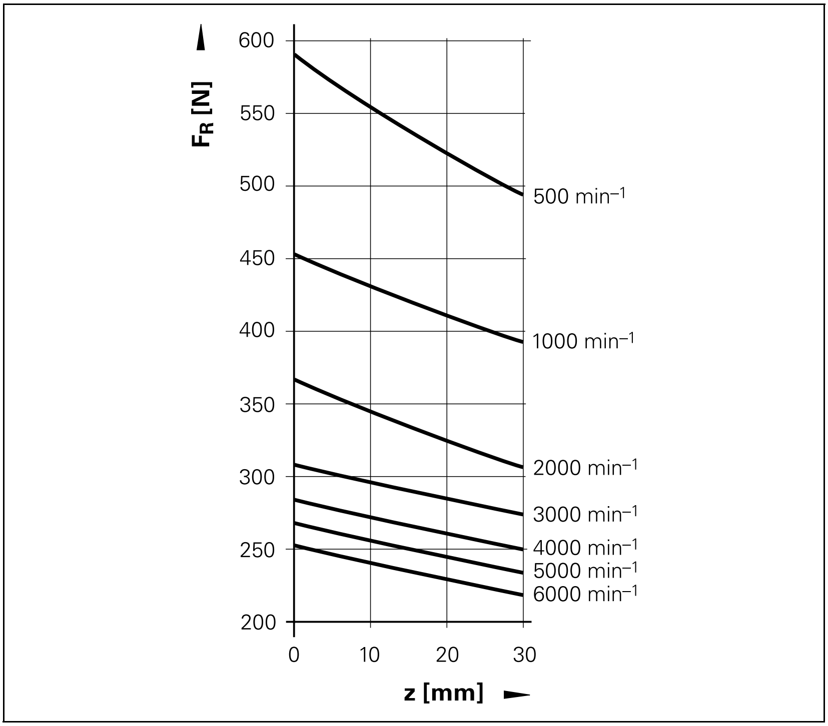
$F_{Amax} = x \cdot F_{Rmax}$

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

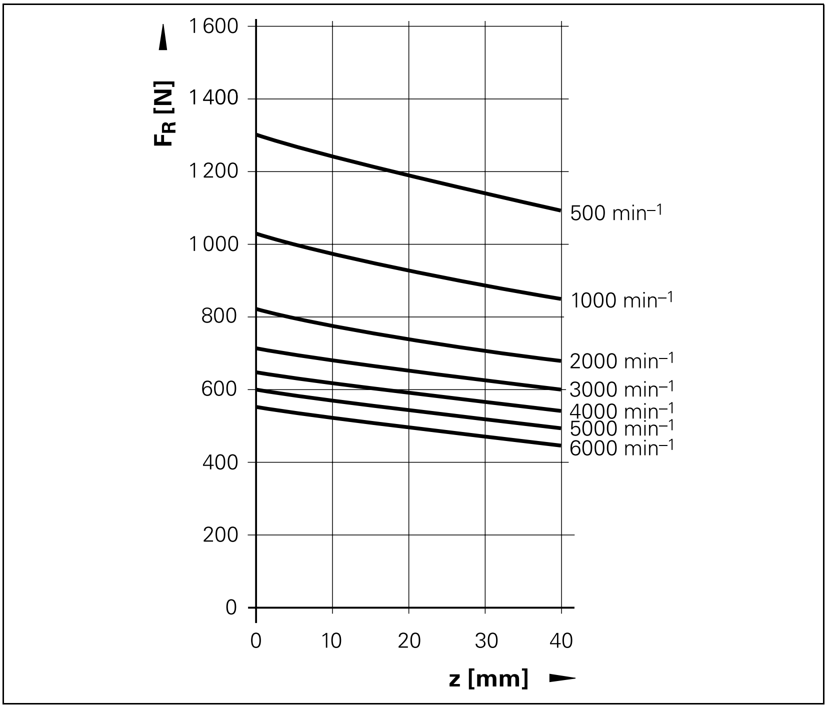
Radial force F_R

The following diagrams show the maximum permissible radial forces F_{Rmax}, depending on the point of the radial force and the average speed.

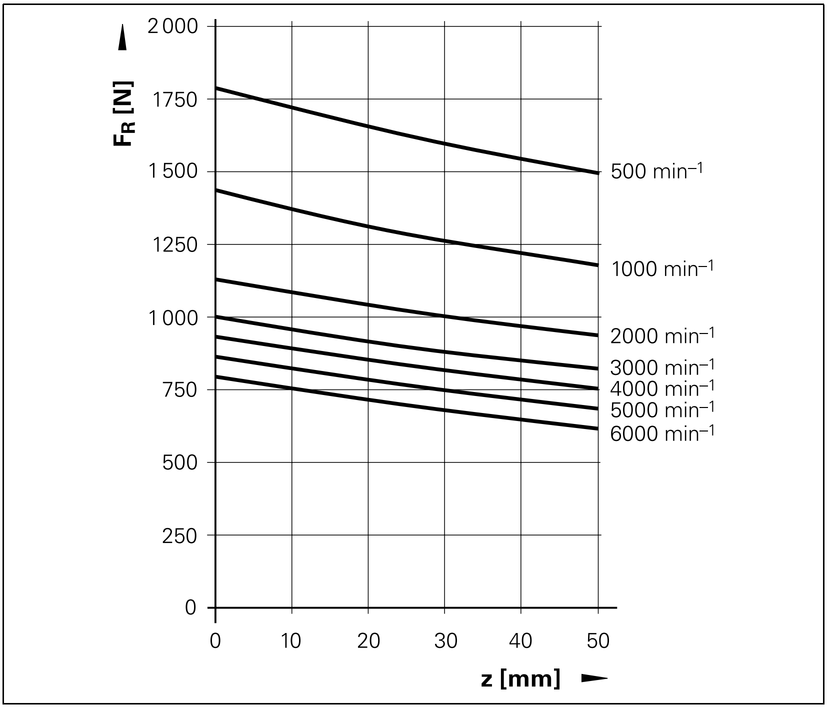
QSY 041B



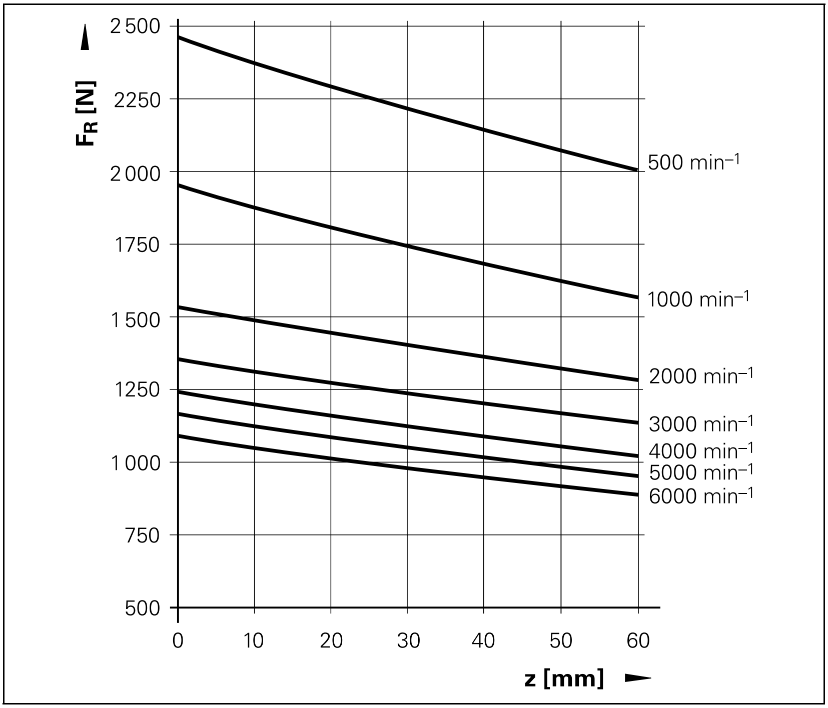
QSY 071B



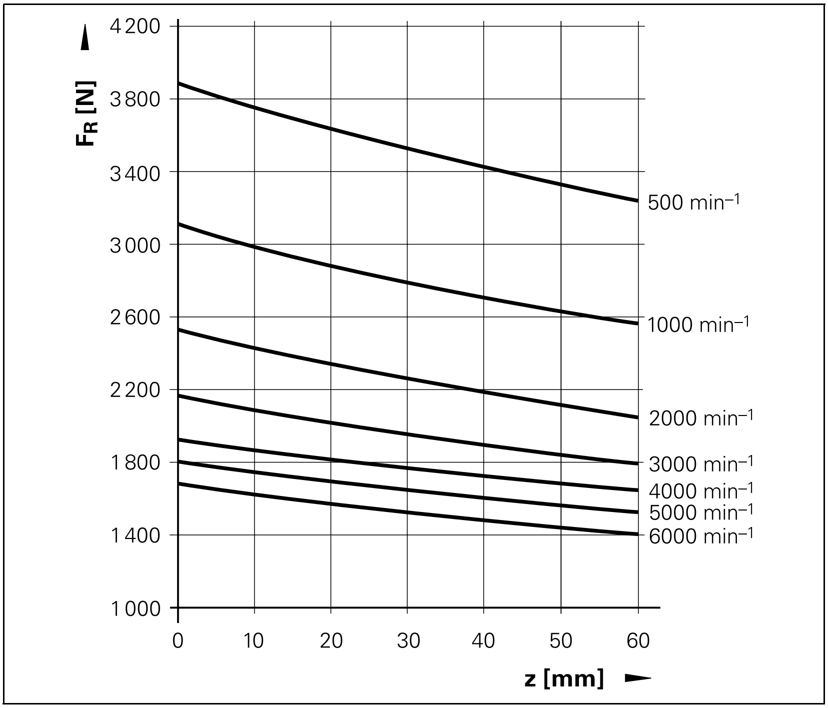
QSY 090B



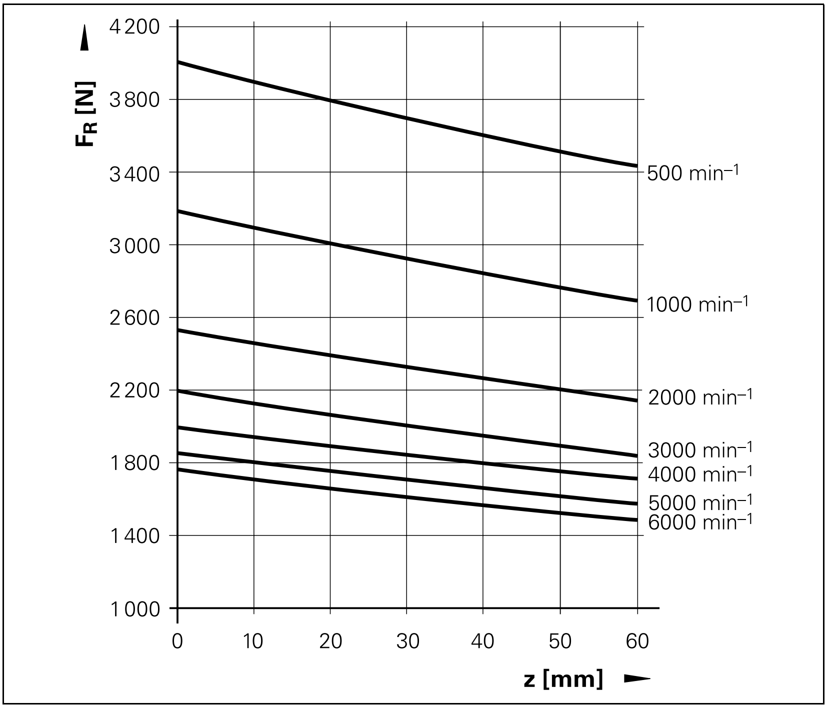
QSY 093B



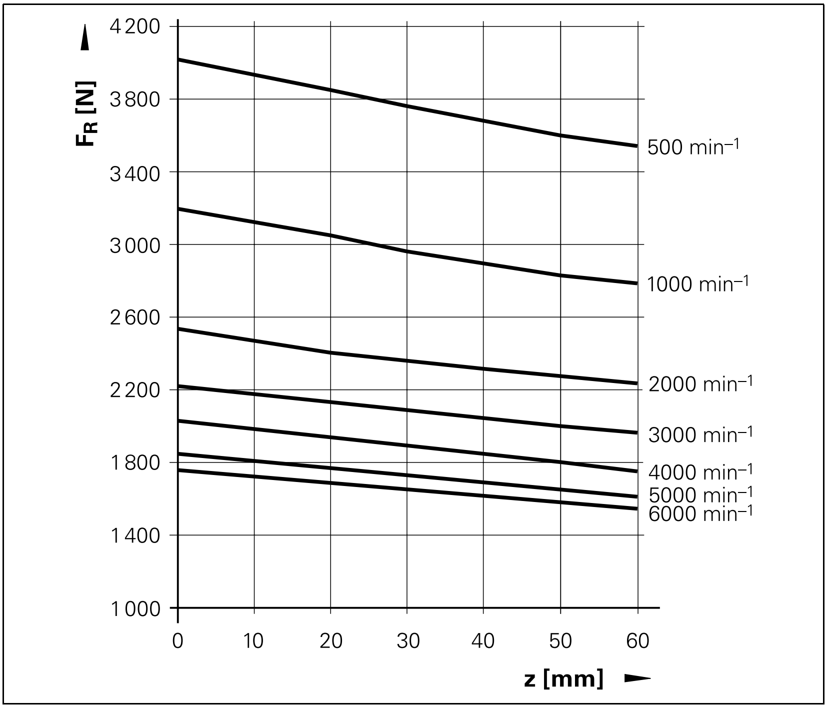
QSY 112B



QSY 112C



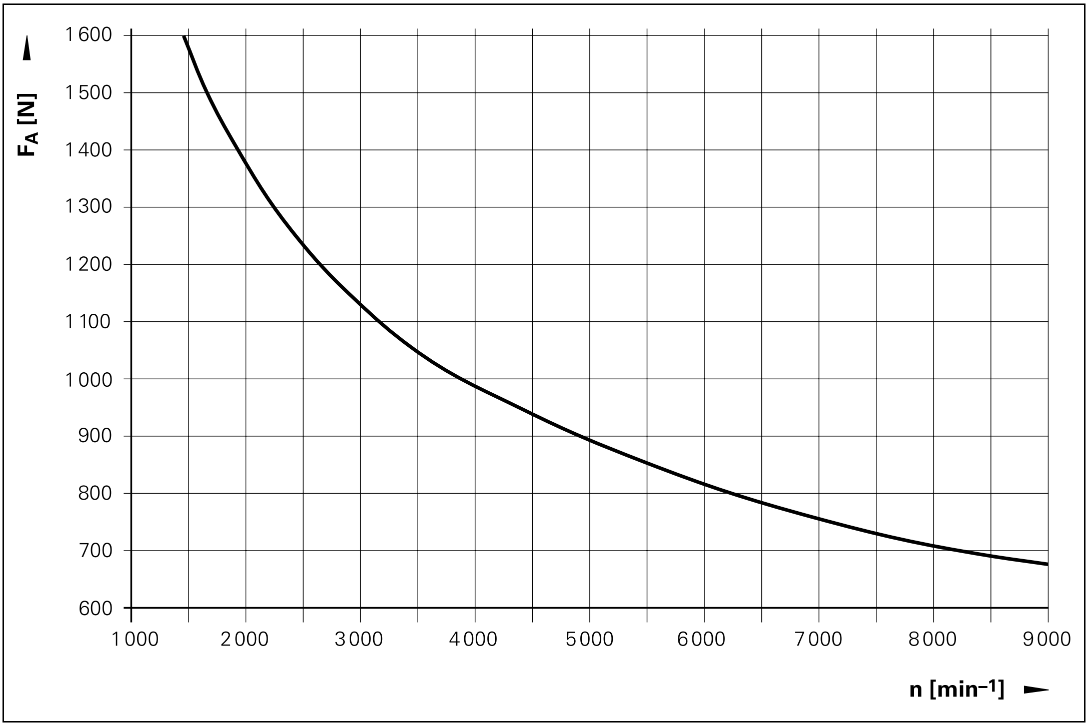
QSY 112D



7.11.5 Permissible Forces on the HEIDENHAIN Asynchronous Motors QAN 30, QAN 4S

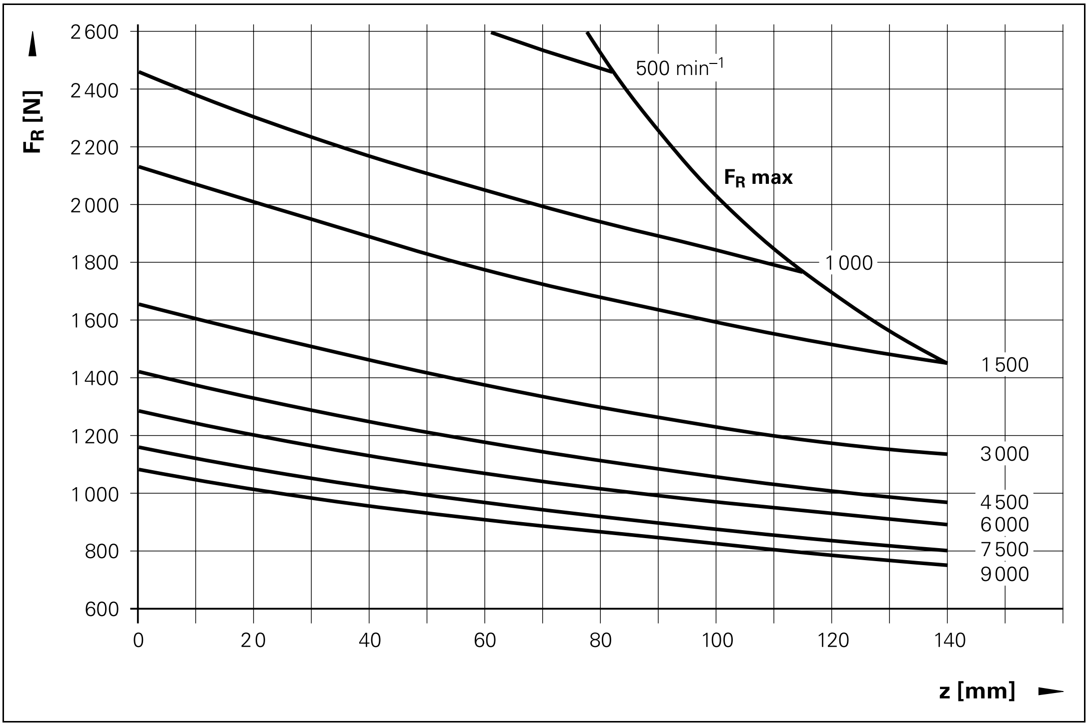
Axial force F_A

The following diagram shows the maximum permissible axial force F_A with horizontal mounting for a bearing service life of 20 000 h. The permissible axial force for HEIDENHAIN asynchronous motors with vertical mounting is available upon request.



Radial force F_R

The following diagram shows the maximum permissible radial force F_{Rmax} for z = 30 mm for a bearing service life of 20 000 h, depending on the average speed.



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

The values given for permissible axial and radial forces are valid for a bearing life of 20 000 h.

Axial force F_A

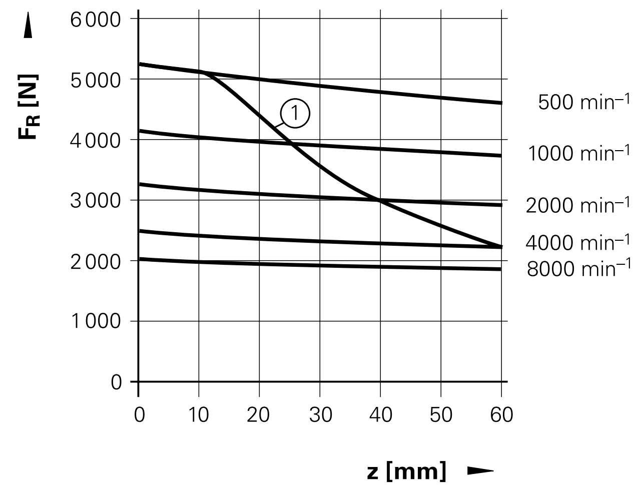
Series QAN 104, maximum permissible axial force: F_A = 30 N
Series QAN 134, QAN 164B, maximum permissible axial force: F_A = 50 N

Radial force F_R

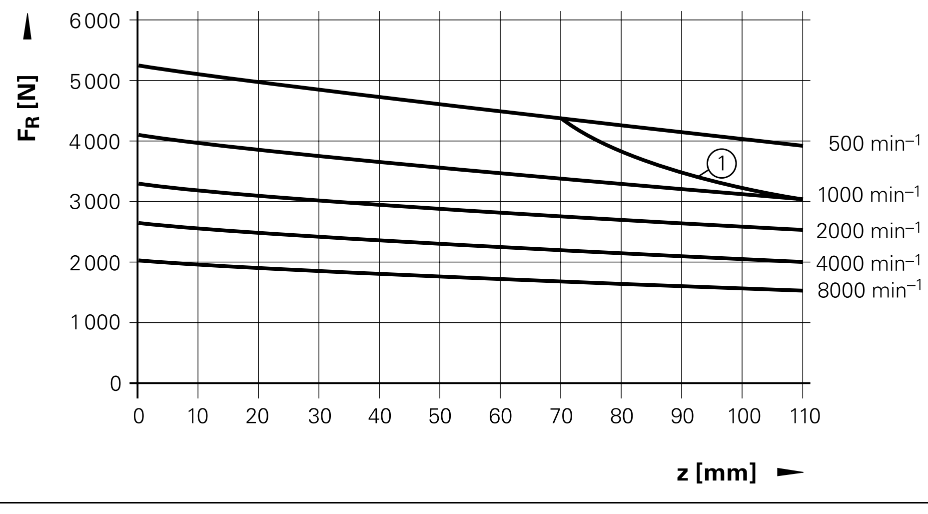
The following diagrams show the maximum permissible radial forces F_{Rmax}, depending on the point of the radial force and the average speed.

1 = load limit for drive shaft with feather key

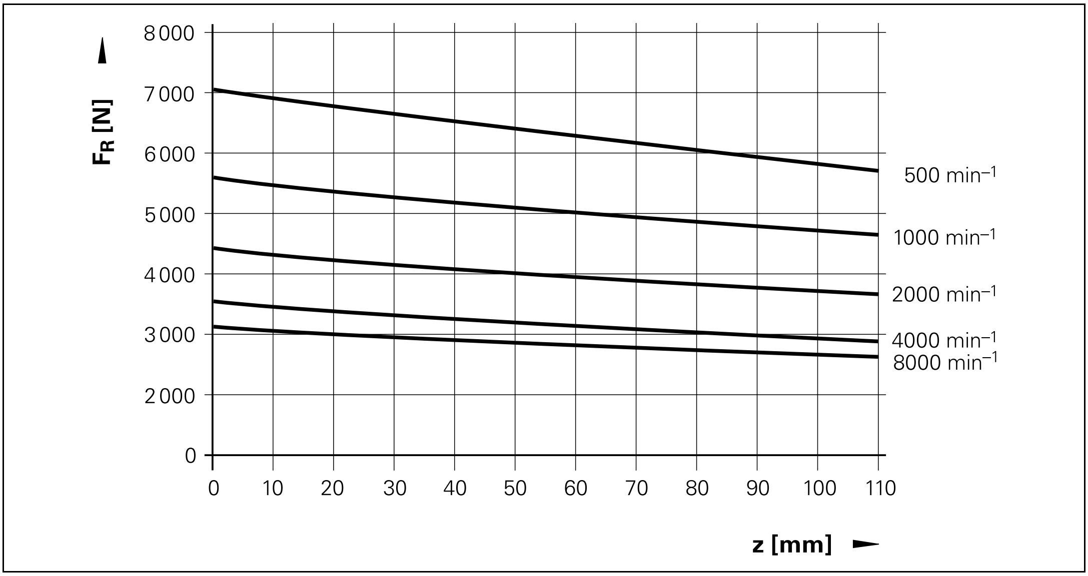
Series QAN 104



Series QAN 134



QAN 164B



F_R [N]
8000
7000
6000
5000
4000
3000
2000
0
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 are initial values, and must be adjusted from case to case.

7.12.1 Synchronous motors

Motor	Analog current controller: Amplification	Analog current controller: Amplification at maximum speed	Digital current controller: P factor	Digital current controller: I factor
QSY 041B	45	0		
QSY 1A	100	0		
QSY 1C	100	0		
QSY 1E	120	0		
QSY 96A	150	0		
QSY 96G	50	0		
QSY 071B	45	0		
QSY 116C	150	0		
QSY 116E	100	0		
QSY 116J	50	0		
QSY 2C	80	0		
QSY 2E (n_N = 2000 rpm)	80	0		
QSY 2E (n_N = 3000 rpm)	80	0		
QSY 2G (n_N = 2000 rpm)	100	0		
QSY 2G (n_N = 3000 rpm)	45 to 60	0	12	20000
QSY 155B (n_N = 2000 rpm)			25	15000
QSY 155B (n_N = 3000 rpm)	50	0	15	25000
QSY 155C	50	0	10	6000
QSY 155D	30	0	8	5000
QSY 155F	30	0		
QSY 090B (n_N = 2000 rpm)	70	0		
QSY 090B (n_N = 3000 rpm)	55	0		
QSY 093B	30	0		
QSY 112B	10	0		
QSY 112C	22	0		
QSY 112D	35	0		

7.12.2 Asynchronous motors

Motor	Analog current controller: Amplification	Analog current controller: Amplification at maximum speed	Digital current controller: P factor	Digital current controller: I factor
QAN 104B	30	70		
QAN 104C	25	60		
QAN 104D				
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

D

E

F

H

I

L

T

U

V

X