

# ANILAM

## Inverter Systems and Motors for 6000i



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## Section 1 - Introduction

This manual was written for machine tool manufacturers. It contains information required to install and connect ANILAM SA Series inverter systems and motors on ANILAM 6000i-3X and 6000i-4X Computer Numerical Controls (CNCs).

The following topics are described in this section:

- ❑ **System Overview**
- ❑ **Product Designations**
- ❑ **Components**
- ❑ **Overview of Inverter Systems**
- ❑ **Modular Amplifiers**
- ❑ **Compact Inverters**
- ❑ **Motors**

### System Overview

The following sections describe components and motors required for a complete drive system. For more information on CNCs, refer to [6000i CNC Technical Manual](#), P/N 627787-21.

### Product Designations

Refer to **Table 1-1**.

**Table 1-1, Product Designations**

Model Number	Component
<b>AM</b>	Axis (synchronous) motor
<b>SM</b>	Spindle (asynchronous) motor
<b>Adapter Module</b>	Coupling the Power Supply Units
<b>BR 9</b>	BR 9 braking resistor module for the modular amplifier system with regenerative power supply
<b>BR 10F, BR 18F</b>	Braking resistor with fan
<b>BR 18</b>	Braking resistor without fan
<b>CR 135, CR 170, CR 180</b>	Commutating reactors for the PS 122R and PS 145R energy-recovery power supply modules
<b>DLF 1x0</b>	DC-Link Filter
<b>LF 135A, LF 180A</b>	Line filter for the PS 122R and PS 145R energy-recovery power modules

(Continued...)

**Table 1-1, Product Designations**

<b>Model Number</b>	<b>Component</b>
<b>PM 107</b>	Power module for the inverter system
<b>PM 1xx</b>	Power module for the modular amplifier system for one axis or spindle
<b>PMD 1xx</b>	Power module with additional features for diagnostics functions for the modular amplifier system for one axis or spindle
<b>PMD 2xx</b>	Power module with additional features for diagnostics functions for the modular amplifier system for two axes or spindle
<b>PS 120A</b>	Power supply for the main computer and controller unit.
<b>PS 130</b>	Non-regenerative power module of the modular amplifier system
<b>PS 122, PS 144</b>	Energy-recovery power modules of the modular amplifier system
<b>RA xxx</b>	Regenerative compact inverter
<b>SA 200 series</b> <b>SA 300 series</b> <b>SA 400 series</b>	Non-regenerative compact inverters for up to 4 axes and a spindle (external Pulse Width Modulation [PWM] interfaces). An additional PM 107 power module can be connected.
<b>VPM 163</b>	Voltage protection module

## Components

ANILAM SA Series inverter drive system includes the following components:

- BR 18 or BR 18F braking resistor (as necessary)
- P/N 34000250, 34000251, or 3400252 ferrite toroidal core
- PM 107 power module (optional)
- Ribbon cables for PWM signals and supply voltage (and optional unit bus)
- Covers for the ribbon cables

## Overview of Inverter Systems

The following topics are described:

- ❑ SA Series Non-Regenerative Compact Inverters
- ❑ RA Series Regenerative Compact Inverters
- ❑ Non-Regenerative Power Supply Unit
- ❑ Regenerative Power Supply Units

### SA Series Non-Regenerative Compact Inverters

The following ANILAM SA inverters have a sliding switch on the front of the unit. This feature enables you to use the spindle unit as an axis. Refer to **Table 1-2**.

**NOTE:** SA 301E and SA 411E do not have a sliding switch.

**Table 1-2, SA Series Non-Regenerative Compact Inverters**

Model Number	Number of Axes <sup>**1</sup>	Axis Current (in A) <sup>**2</sup>	Spindle (in A) <sup>**2</sup>	Rated Power
SA 301A (page 2-1)	3 / 1	7.5 / 15	20	15 kW
SA 311A (page 2-1)	2 / 1 / 1	7.5 / 15 / 15	20	15 kW
SA 411A (page 2-2)	3 / 1 / 1	7.5 / 15 / 15	20	15 kW
SA 201A (page 2-2)	2 / 1	7.5 / 23	31	22 kW
SA 301C (page 2-3)	3 / 1	7.5 / 23	31	22 kW
SA 411C (page 2-3)	3 / 1 / 1	7.5 / 23 / 23	31	22 kW
SA 301E (page 2-4)	3	6 <sup>**3</sup>	24 <sup>**3</sup>	10 kW
SA 411E (page 2-4)	3 / 1	6 / 9 <sup>**3</sup>	24 <sup>**3</sup>	10 kW

\*\*1 Depending on setting of operating mode switch (axis/spindle)

\*\*2 Data for a Pulse Width Modulation (PWM) of 5 kHz

\*\*3 Data for a PWM frequency of 3.33 kHz

**IMPORTANT:** Phoenix connectors X344, X392, and X393 on the bottom of the inverter are reserved for future applications. Do not use them.

### RA Series Regenerative Compact Inverters

The following ANILAM RA inverters have a sliding switch on the front of the unit. This feature enables you to use the spindle unit as an axis. Refer to **Table 1-3**.

**Table 1-3, RA Series Regenerative Compact Inverters**

Model Number	Number of Axes <sup>**1</sup>	Axis Current (in A) <sup>**2</sup>	Spindle 1 / 2 / 3 (in A) <sup>**2</sup>	Rated Power
<b>RA 201A</b> (page 2-5)	2 / 1	7.5 / 25	35 / – / –	22 kW
<b>RA 301C</b> (page 2-5)	3 / 1	7.5 / 25	10 / 35 / –	22 kW
<b>RA 411C</b> (page 2-6)	3 / 1 / 1	7.5 / 25 / 25	10 / 35 / 35	22 kW

<sup>\*\*1</sup> Depending on setting of operating mode switch (axis/spindle)

<sup>\*\*2</sup> Data for a Pulse Width Modulation (PWM) of 5 kHz

**IMPORTANT:** Phoenix connectors X344, X392, and X393 on the bottom of the inverter are reserved for future applications. Do not use them.

### Non-Regenerative Power Supply Unit

Refer to **Table 1-4**.

**Table 1-4, Non-Regenerative Power Supply**

Model Number	Load Capacity (in A)			Rated Power
	5 V	15 V	24 V	
<b>PS 130</b> (page 2-10)	8.5	1.5	2.0	30 kW

### Regenerative Power Supply Units

Refer to **Table 1-5**.

**Table 1-5, Regenerative Power Supply**

Model Number	Load Capacity (in A)			Rated Power
	5 V	15 V	24 V	
<b>PS 122R</b> (page 2-10)	8.5	1.5	2.0	22 kW
<b>PS 145R</b> (page 2-10)	8.5	1.5	2.0	45 kW

**Modular Amplifiers**

Refer to **Table 1-6**.

**Table 1-6, Modular amplifiers**

Modular Amplifiers	Maximum Current Load in A <sup>**1</sup>	
	Axis	Axis/Spindle <sup>**2</sup>
<b>1 axis</b>		
PM 107 (page 2-11)	7.5	
<b>1 axis/spindle</b>		
PM 115A (page 2-11)	–	15 / 20
PM 123A (page 2-11)	–	23 / 31
PM 132A (page 2-12)	–	32 / 50
PM 148A (page 2-12)	–	48 / 75
PM 170A (page 2-12)	–	70 / 100
<b>2 axes</b>		
PM 207 (page 2-13)	7.5	7.5 / –
<b>1 axis—1 axis/spindle</b>		
PM 215A (page 2-13)	15	15 / 20
PM 223A (page 2-13)	23	23 / 31

<sup>\*\*1</sup> Data for a PWM frequency of 5 kHz

<sup>\*\*2</sup> Depending on setting of operating mode switch (axis/spindle)

### Compact Inverters

Compact inverters are available for up to 4 axes plus spindle or up to five axes.

The following topics are described:

- **Components of the Compact Inverter**
- **SA 301A, SA 311A, SA 411A, SA 201A, SA 301A, SA 411C Compact Inverter**
- **SA 301E, SA 411E Compact Inverter**
- **RA 201A, RA 301C, RA 411C Compact Inverter**

#### Components of the Compact Inverter

For operation with the non-regenerative ANILAM **SA 301E, SA 411E** compact inverter, you need the following components:

- SA 301E, SA 411E compact inverter
- Toroidal cores for interference suppression

For operation with the non-regenerative ANILAM **SA 301A, SA 311A, SA 411A, SA 201A, SA 301A, SA 411C** compact inverter, you need the following components:

- SA 301A, SA 311A, SA 411A, SA 201A, SA 301A, SA 411C compact inverter
- BR 18 (or BR 10F, BR 18F) braking resistor (optional)
- Toroidal cores for interference suppression
- One PMD 107 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 ANILAM **RA 201A, RA 301C, RA 411C** compact inverter, you need the following components:

- RA 201A, RA 301C, & RA 411C compact inverter
- CR 135 commutating reactor
- BR 9 braking resistor module (optional)
- One PMD 107 power module (optional)
- In conjunction with direct drives (only via additional power module): One DLF 1x0 (DC-link filter)
- Ribbon cables for PWM signals and supply voltage (and optional unit bus)
- Covers for the ribbon cables



**SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C Compact Inverter**

With the non-regenerative SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C 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 external 20-line ribbon cable.

For specifications and power requirements, see **Table 2-1, Inverter Technical Specifications & Power Requirements**

**SA 301E, SA 411E Compact Inverter**

With SA 301E, SA 411E 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 SA 301E, SA 411E models are non-regenerative compact inverters with integral braking resistor.

The PWM signals are transferred via external 20-line ribbon cable.

For specifications and power requirements, see **Table 2-1, Inverter Technical Specifications & Power Requirements.**

<p><b>NOTE:</b> It is not possible to connect an external braking resistor to the SA 301E, SA 411E compact inverters.</p>
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**RA 201A, RA 301C, RA 411C Compact Inverter**

With the regenerative RA 201A, RA 301C, RA 411C 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 external 20-line ribbon cable.

For specifications and power requirements, see **Table 2-1, Inverter Technical Specifications & Power Requirements.**

**Motors**

For performance specifications, model numbers, and dimensional drawings, refer to “Section 7 - Available Motors and Accessories.”



## **Section 2 - Technical Specifications and Power Requirements**

The following topics are described in this section:

- ❑ **Inverter**
- ❑ **Toroidal Cores**
- ❑ **Ribbon Cables and Covers (Only for SA xxxx)**
- ❑ **Modular Amplifiers**
- ❑ **Axis Enabling Module**
- ❑ **Accessories for Inverters and Modular Amplifiers**

### Inverter

Refer to **Table 2-1**.

**Table 2-1, Inverter Technical Specifications & Power Requirements**

Parameter	SA 301A (non-regenerative)		SA 311A (non-regenerative)		
	3 axes	Spindle/Axis	2 axes	1 axis	Spindle/Axis
<b>ANILAM P/N</b>	34000300		34000301		
<b>Power Supply</b>	3 phase x 400 VAC ± 10 % (50 Hz to 60 Hz)				
<b>DC-link Voltage</b>	565 VDC (with power supply at 400 V)				
<b>DC-link Power</b>					
Rated power	15 kW		15 kW		
Peak power <sup>**1</sup>	23 kW		23 kW		
Peak power <sup>**2</sup>	40 kW		40 kW		
<b>Power Loss</b>	Approximately 475 W		Approximately 525 W		
<b>Rated current at a PWM frequency of:</b>					
3333 Hz	9.0 A	24.5 A/18.4 A	9.0 A	18.4 A	24.5 A/18.4 A
4000 Hz	8.3 A	22.5 A/16.9 A	8.3 A	16.9 A	22.5 A/16.9 A
5000 Hz	7.5 A	20.0 A/15.0 A	7.5 A	15.0 A	20.0 A/15.0 A
6666 Hz	6.4 A	17.0 A/12.8 A	6.4 A	12.8 A	17.0 A/12.8 A
8000 Hz	5.3 A	14.5 A/10.9 A	5.3 A	10.9 A	14.5 A/10.9 A
10000 Hz	4.5 A	12.0 A/9.0 A	4.5 A	9.0 A	12.0 A/9.0 A
<b>Current for S6-40% <sup>**3</sup> at a PWM frequency of:</b>					
3333 Hz		30.0 A			30.0 A
4000 Hz		30.0 A			30.0 A
5000 Hz		30.0 A			30.0 A
6666 Hz		25.5 A			25.5 A
8000 Hz		21.8 A			21.8 A
10000 Hz		18.0 A			18.0 A
<b>Maximum current <sup>**4</sup> at a PWM frequency of:</b>					
3333 Hz	15.0 A	30.0 A	15.0 A	30.0 A	30.0 A
4000 Hz	15.0 A	30.0 A	15.0 A	30.0 A	30.0 A
5000 Hz	15.0 A	30.0 A	15.0 A	30.0 A	30.0 A
6666 Hz	12.8 A	25.5 A	12.8 A	25.6 A	25.5 A
8000 Hz	10.6 A	21.8 A	10.6 A	21.8 A	21.8 A
10000 Hz	9.0 A	18.0 A	9.0 A	18.0 A	18.0 A
<b>Integral braking resistor <sup>**5</sup></b>	1 kW / 27 kW		1 kW / 27 kW		
<b>Load capacity +5 V</b>	8.5 A		8.5 A		
<b>Degree of protection</b>	IP 20		IP 20		
<b>Weight</b>	44 lb. (≅ 20 kg.)		44 lb. (≅ 20 kg.)		
<b>Connection overview</b>	Page 5-4		Page 5-5		
<b>Dimensions</b>	Page 5-44				

<sup>\*\*1</sup> 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*2</sup> 0.2 s cyclic duration factor for duration of 5 s

<sup>\*\*3</sup> For spindle motors: 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*4</sup> Axes: 0.2 s cyclic duration factor for duration of 5 s with rated current preload;  
0.2 s at standstill for synchronous motors

Spindle: 10 s cyclic duration factor for duration of 60 s with 70% rated current preload

<sup>\*\*5</sup> 1st value: Continuous power

2nd value: 1.5% cyclic duration factor for duration of 120 s

**Table 2-1, Inverter Technical Specifications & Power Requirements (Continued)**

Parameter	SA 411A (non-regenerative)			SA 201A (non-regenerative)	
	3 axes	1 axis	Spindle/Axis	2 axes	Spindle/Axis
<b>ANILAM P/N</b>	34000302			34000303	
<b>Power Supply</b>	3 phase x 400 VAC ± 10 % (50 Hz to 60 Hz)				
<b>DC-link Voltage</b>	565 VDC (with supply voltage of 400 V)				
<b>DC-link Power</b>					
Rated power	15 kW			22 kW	
Peak power <sup>**1</sup>	23 kW			30 kW	
Peak power <sup>**2</sup>	40 kW			45 kW	
<b>Power Loss</b>	Approximately 595 W			Approximately 520 W	
<b>Rated current at a PWM frequency of:</b>					
<b>3333 Hz</b>	9.0 A	18.4 A	24.5 A/18.4 A	9.0 A	38.0 A/28.2 A
<b>4000 Hz</b>	8.3 A	16.9 A	22.5 A/16.9 A	8.3 A	35.0 A/26.0 A
<b>5000 Hz</b>	7.5 A	15.0 A	20.0 A/15.0 A	7.5 A	31.0 A/23.0 A
<b>6666 Hz</b>	6.4 A	12.8 A	17.0 A/12.8 A	6.4 A	26.0 A/19.3 A
<b>8000 Hz</b>	5.3 A	10.9 A	14.5 A/10.9 A	5.3 A	22.5 A/16.7 A
<b>10000 Hz</b>	4.5 A	9.0 A	12.0 A/9.0 A	4.5 A	19.0 A/14.1 A
<b>Current for S6-40%<sup>**3</sup> at a PWM frequency of:</b>					
<b>3333 Hz</b>			30.0 A		46.0 A
<b>4000 Hz</b>			30.0 A		46.0 A
<b>5000 Hz</b>			30.0 A		46.0 A
<b>6666 Hz</b>			25.5 A		38.6 A
<b>8000 Hz</b>			21.8 A		33.4 A
<b>10000 Hz</b>			18.0 A		28.2 A
<b>Maximum current<sup>**4</sup> at a PWM frequency of:</b>					
<b>3333 Hz</b>	15.0 A	30.0 A	30.0 A	15.0 A	46.0 A
<b>4000 Hz</b>	15.0 A	30.0 A	30.0 A	15.0 A	46.0 A
<b>5000 Hz</b>	15.0 A	30.0 A	30.0 A	15.0 A	46.0 A
<b>6666 Hz</b>	12.8 A	25.6 A	25.5 A	12.8 A	38.6 A
<b>8000 Hz</b>	10.6 A	21.8 A	21.8 A	10.6 A	33.4 A
<b>10000 Hz</b>	9.0 A	18.0 A	18.0 A	9.0 A	28.2 A
<b>Integral braking resistor<sup>**5</sup></b>	1 kW / 27 kW			-	
<b>Load capacity +5 V</b>	8.5 A			8.5 A	
<b>Degree of protection</b>	IP 20			IP 20	
<b>Weight</b>	44.1 lb. (≅ 20 kg.)			50.6 lb. (≅ 23 kg.)	
<b>Connection overview</b>	Page 5-6			Page 5-7	
<b>Dimensions</b>	Page 5-44				

<sup>\*\*1</sup> 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*2</sup> 0.2 s cyclic duration factor for duration of 5 s

<sup>\*\*3</sup> For spindle motors: 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*4</sup> Axes: 0.2 s cyclic duration factor for duration of 5 s with rated current preload;  
0.2 s at standstill for synchronous motors

Spindle: 10 s cyclic duration factor for duration of 60 s with 70% rated current preload

<sup>\*\*5</sup> 1st value: Continuous power

2nd value: 1.5% cyclic duration factor for duration of 120 s

**Table 2-1, Inverter Technical Specifications & Power Requirements (Continued)**

Parameter	SA 301AD (non-regenerative)		SA 311AD (non-regenerative)		
	3 axes	Spindle/Axis	2 axes	1 axis	Spindle/Axis
<b>ANILAM P/N</b>	650999-01		651000-01		
<b>Power Supply</b>	3 phase x 400 VAC ± 10 % (50 Hz to 60 Hz)				
<b>DC-link Voltage</b>	565 VDC (with power supply at 400 V)				
<b>DC-link Power</b>					
Rated power	15 kW		15 kW		
Peak power <sup>**1</sup>	23 kW		23 kW		
Peak power <sup>**2</sup>	40 kW		40 kW		
<b>Power Loss</b>	Approximately 475 W		Approximately 525 W		
<b>Rated current at a PWM frequency of:</b>					
<b>3333 Hz</b>	9.0 A	24.0 A/18.0 A	9.0 A	18.4 A	24.0 A/18.0 A
<b>4000 Hz</b>	8.3 A	22.0 A/16.5 A	8.3 A	16.5 A	22.0 A/16.5 A
<b>5000 Hz</b>	7.5 A	20.0 A/15.0 A	7.5 A	15.0 A	20.0 A/15.0 A
<b>6666 Hz</b>	6.4 A	16.8 A/12.6 A	6.3 A	12.6 A	16.8 A/12.6 A
<b>8000 Hz</b>	5.5 A	14.6 A/11.0 A	5.5 A	11.0 A	14.6 A/11.0 A
<b>10000 Hz</b>	4.6 A	12.2 A/9.1 A	4.6 A	9.1 A	12.2 A/9.1 A
<b>Current for S6-40%<sup>**3</sup> at a PWM frequency of:</b>					
<b>3333 Hz</b>		36.0 A			36.0 A
<b>4000 Hz</b>		33.0 A			33.0 A
<b>5000 Hz</b>		30.0 A			30.0 A
<b>6666 Hz</b>		25.2 A			25.2 A
<b>8000 Hz</b>		21.9 A			21.9 A
<b>10000 Hz</b>		18.3 A			18.3 A
<b>Maximum current<sup>**4</sup> at a PWM frequency of:</b>					
<b>3333 Hz</b>	18.0 A	36.0 A	18.0 A	36.0 A	36.0 A
<b>4000 Hz</b>	16.5 A	33.0 A	16.5 A	33.0 A	33.0 A
<b>5000 Hz</b>	15.0 A	30.0 A	15.0 A	30.0 A	30.0 A
<b>6666 Hz</b>	12.6 A	25.2 A	12.6 A	25.2 A	25.2 A
<b>8000 Hz</b>	11.0 A	21.9 A	11.0 A	21.9 A	21.9 A
<b>10000 Hz</b>	9.1 A	18.3 A	9.1 A	18.3 A	18.3 A
<b>Integral braking resistor<sup>**5</sup></b>	1 kW / 27 kW		1 kW / 27 kW		
<b>Load capacity +5 V</b>	16 A		16 A		
<b>Degree of protection</b>	IP 20		IP 20		
<b>Weight</b>	44 lb. (≅ 20 kg.)		44 lb. (≅ 20 kg.)		
<b>Connection overview</b>	Page 5-9		Page 5-10		
<b>Dimensions</b>	Page 5-56				

<sup>\*\*1</sup> 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*2</sup> 4 s cyclic duration factor for duration of 20 s

<sup>\*\*3</sup> For spindle motors: 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*4</sup> Axes: 0.2 s cyclic duration factor for duration of 10 s with 70% rated current preload;  
Spindle: 10 s cyclic duration factor for duration of 60 s with 70% rated current preload

<sup>\*\*5</sup> 1st value: Continuous power  
2nd value: 1.5% cyclic duration factor for duration of 120 s

**Table 2-1, Inverter Technical Specifications & Power Requirements (Continued)**

Parameter	SA 411AD (non-regenerative)			SA 201AD (non-regenerative)	
	3 axes	1 axis	Spindle/Axis	2 axes	Spindle/Axis
<b>ANILAM P/N</b>	651001-01			668751-01	
<b>Power Supply</b>	3 phase x 400 VAC ± 10 % (50 Hz to 60 Hz)				
<b>DC-link Voltage</b>	565 VDC (with supply voltage of 400 V)				
<b>DC-link Power</b>					
Rated power	15 kW			22 kW	
Peak power <sup>**1</sup>	23 kW			30 kW	
Peak power <sup>**2</sup>	40 kW			45 kW	
<b>Power Loss</b>	Approximately 595 W			Approximately 520 W	
<b>Rated current at a PWM frequency of:</b>					
<b>3333 Hz</b>	9.0 A	18.0 A	24.0 A/18.0 A	9.0 A	37.2 A/27.6 A
<b>4000 Hz</b>	8.3 A	16.5 A	22.0 A/16.5 A	8.3 A	34.1 A/25.3 A
<b>5000 Hz</b>	7.5 A	15.0 A	20.0 A/15.0 A	7.5 A	31.0 A/23.0 A
<b>6666 Hz</b>	6.3 A	12.6 A	16.8 A/12.6 A	6.3 A	26.0 A/19.3 A
<b>8000 Hz</b>	5.5 A	11.0 A	14.6 A/11.0 A	5.5 A	22.6 A/16.8 A
<b>10000 Hz</b>	4.6 A	9.1 A	12.2 A/9.1 A	4.6 A	18.9 A/14.0 A
<b>Current for S6-40% <sup>**3</sup> at a PWM frequency of:</b>					
<b>3333 Hz</b>			36.0 A		55.2 A
<b>4000 Hz</b>			33.0 A		50.6 A
<b>5000 Hz</b>			30.0 A		46.0 A
<b>6666 Hz</b>			25.2 A		38.6 A
<b>8000 Hz</b>			21.9 A		33.6 A
<b>10000 Hz</b>			18.3 A		28.0 A
<b>Maximum current <sup>**4</sup> at a PWM frequency of:</b>					
<b>3333 Hz</b>	18.0 A	36.0 A	36.0 A	18.0 A	55.2 A
<b>4000 Hz</b>	16.5 A	33.0 A	33.0 A	16.5 A	50.6 A
<b>5000 Hz</b>	15.0 A	30.0 A	30.0 A	15.0 A	46.0 A
<b>6666 Hz</b>	12.6 A	25.2 A	25.2 A	12.6 A	38.6 A
<b>8000 Hz</b>	11.0 A	21.9 A	21.9 A	11.0 A	33.6 A
<b>10000 Hz</b>	9.1 A	18.3 A	18.3 A	9.1 A	28.0 A
<b>Integral braking resistor <sup>**5</sup></b>	1 kW / 27 kW			-	
<b>Load capacity +5 V</b>	16 A			16 A	
<b>Degree of protection</b>	IP 20			IP 20	
<b>Weight</b>	44.1 lb. (≅ 20 kg.)			50.6 lb. (≅ 23 kg.)	
<b>Connection overview</b>	Page 5-11			Page 5-12	
<b>Dimensions</b>	Page 5-56				

<sup>\*\*1</sup> 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*2</sup> 0.2 s cyclic duration factor for duration of 5 s

<sup>\*\*3</sup> For spindle motors: 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*4</sup> Axes: 0.2 s cyclic duration factor for duration of 5 s with rated current preload;  
0.2 s at standstill for synchronous motors

Spindle: 10 s cyclic duration factor for duration of 60 s with 70% rated current preload

<sup>\*\*5</sup> 1st value: Continuous power

2nd value: 1.5% cyclic duration factor for duration of 120 s

**Table 2-1, Inverter Technical Specifications & Power Requirements (Continued)**

Parameter	SA 301C (non-regenerative)		SA 411C (non-regenerative)		
	3 axes	Spindle/Axis	3 axes	1 axis	Spindle/Axis
<b>ANILAM P/N</b>	34000304		34000306		
<b>Power Supply</b>	3 phase x 400 VAC ± 10 % (50 Hz to 60 Hz)				
<b>DC-link Voltage</b>	565 VDC (with power supply at 400 V)				
<b>DC-link Power</b>					
Rated power	22 kW		22 kW		
Peak power <sup>**1</sup>	30 kW		30 kW		
Peak power <sup>**2</sup>	45 kW		45 kW		
<b>Power Loss</b>	Approximately 590 W		Approximately 770 W		
<b>Rated current at a PWM frequency of:</b>					
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
<b>Current for S6-40%<sup>**3</sup> at a PWM frequency of:</b>					
3333 Hz		46.0 A			46.0 A
4000 Hz		46.0 A			46.0 A
5000 Hz		46.0 A			46.0 A
6666 Hz		38.6 A			38.6 A
8000 Hz		33.4 A			33.4 A
10000 Hz		28.2 A			28.2 A
<b>Maximum current<sup>**4</sup> at a PWM frequency of:</b>					
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
<b>Load capacity +5 V</b>	8.5 A		8.5 A		
<b>Degree of protection</b>	IP 20		IP 20		
<b>Weight</b>	50.7 lb. (≅ 23 kg.)		50.7 lb. (≅ 23 kg.)		
<b>Connection overview</b>	Page 5-8		Page 5-9		
<b>Dimensions</b>	Page 5-44				

\*\*1 40% cyclic duration factor for duration of 10 minutes (S6-40%)

\*\*2 0.2 s cyclic duration factor for duration of 5 s

\*\*3 For spindle motors: 40% cyclic duration factor for duration of 10 minutes (S6-40%)

\*\*4 Axes: 0.2 s cyclic duration factor for duration of 5 s with rated current preload;  
0.2 s at standstill for synchronous motors

Spindle: 10 s cyclic duration factor for duration of 60 s with 70% rated current preload



**Table 2-1, Inverter Technical Specifications & Power Requirements (Continued)**

Parameter	SA 301E (non-regenerative)		SA 411E (non-regenerative)		
	3 axes	Spindle	3 axes	1 axis	Spindle
<b>ANILAM P/N</b>	34000307		34000308		
<b>Power Supply</b>	3 phase x 400 VAC ± 10 % (50 Hz to 60 Hz) 3 phase x 480 VAC ± 10 % (50 Hz to 60 Hz)				
<b>DC-link Voltage</b>	565 VDC (with supply voltage at 400 V) 678 VDC (with supply voltage at 480 V)				
<b>DC-link Power</b>					
Rated power	10 kW		10 kW		
Peak power <sup>**1</sup>	15 kW		15 kW		
Peak power <sup>**2</sup>	20 kW		20 kW		
<b>Power Loss</b>	Approximately 450 W		Approximately 450 W		
<b>Rated current at a PWM frequency of:</b>					
3333 Hz	6.0 A	24.0 A	6.0 A	9.0 A	24.0 A
4000 Hz	5.5 A	22.0 A	5.5 A	8.3 A	22.0 A
5000 Hz	5.0 A	20.0 A	5.0 A	7.5 A	20.0 A
6666 Hz	4.2 A	16.8 A	4.2 A	6.3 A	16.8 A
8000 Hz	3.65 A	14.6 A	3.65 A	5.5 A	14.6 A
10000 Hz	3.0 A	12.2 A	3.0 A	4.6 A	12.2 A
<b>Current for S6-40% <sup>**3</sup> at a PWM frequency of:</b>					
3333 Hz		36.0 A			36.0 A
4000 Hz		33.0 A			33.0 A
5000 Hz		30.0 A			20.0 A
6666 Hz		25.2 A			16.8 A
8000 Hz		21.9 A			14.6 A
10000 Hz		18.3 A			12.2 A
<b>Maximum current <sup>**4</sup> at a PWM frequency of:</b>					
3333 Hz	12.0 A	36.0 A	12.0 A	18.0 A	36.0 A
4000 Hz	11.0 A	33.0 A	11.0 A	16.5 A	33.0 A
5000 Hz	10.0 A	30.0 A	10.0 A	15.0 A	30.0 A
6666 Hz	8.4 A	25.2 A	8.4 A	12.6 A	25.2 A
8000 Hz	7.3 A	21.9 A	7.3 A	11 A	21.9 A
10000 Hz	6.0 A	18.3 A	6.0 A	9.2 A	18.3 A
<b>Integral braking resistor <sup>**5</sup></b>	1 kW / 27 kW		1 kW / 27 kW		
<b>Load capacity +5 V</b>	10 A		10 A		
<b>Degree of protection</b>	IP 20		IP 20		
<b>Weight</b>	44.1 lb. (≅ 20 kg.)		44.1 lb. (≅ 20 kg.)		
<b>Connection overview</b>	Page 5-2				
<b>Dimensions</b>	Page 5-43				

<sup>\*\*1</sup> 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*2</sup> 0.2 s cyclic duration factor for duration of 5 s

<sup>\*\*3</sup> For spindle motors: 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*4</sup> Axes: 0.2 s cyclic duration factor for duration of 5 s with rated current preload;  
0.2 s at standstill for synchronous motors

Spindle: 10 s cyclic duration factor for duration of 60 s with 70% rated current preload

<sup>\*\*5</sup> 1st value: Continuous power

2nd value: 1.5% cyclic duration factor for duration of 120 s

**Table 2-1, Inverter Technical Specifications & Power Requirements (Continued)**

Parameter	RA 201A (regenerative)		RA 301C (regenerative)	
	2 axes	Spindle/Axis	3 axes/spindle	Spindle/Axis
ANILAM P/N	34000310		34000311	
Power Supply	3 phase x 400 VAC ± 10 % (50 Hz to 60 Hz)			
DC-link Voltage	650 VDC			
DC-link Power				
Rated power			22 kW	
Peak power <sup>**1</sup>			30 kW	
Peak power <sup>**2</sup>			40 kW	
Power Loss	Approximately 680 W		Approximately 750 W	
Rated current at a PWM frequency of:				
3333 Hz	9.0 A	42.5 A/30.4 A	9.0 A/12.0 A	42.5 A/30.4 A
4000 Hz	8.3 A	39.5 A/28.3 A	8.3 A/11.1 A	39.5 A/28.3 A
5000 Hz	7.5 A	35.0 A/25.0 A	7.5 A/10.0 A	35.0 A/25.0 A
6666 Hz	6.4 A	29.5 A/21.1 A	6.4 A/8.5 A	29.5 A/21.1 A
8000 Hz	5.3 A	25.0 A/17.9 A	5.3 A/7.1 A	25.0 A/17.9 A
10000 Hz	4.5 A	21.5 A/15.4 A	4.5 A/6.0 A	21.5 A/15.4 A
Current for S6-40% <sup>**3</sup> at a PWM frequency of:				
3333 Hz		50.0 A		50.0 A
4000 Hz		50.0 A		50.0 A
5000 Hz		50.0 A		50.0 A
6666 Hz		42.0 A		42.1 A
8000 Hz		36.0 A		35.7 A
10000 Hz		31.0 A		30.7 A
Maximum current <sup>**4</sup> at a PWM frequency of:				
3333 Hz	15.0 A	50.0 A	15.0 A	50.0 A
4000 Hz	15.0 A	50.0 A	15.0 A	50.0 A
5000 Hz	15.0 A	50.0 A	15.0 A	50.0 A
6666 Hz	12.8 A	42.0 A	12.8 A	42.1 A
8000 Hz	10.6 A	36.0 A	10.6 A	35.7 A
10000 Hz	9.0 A	31.0 A	9.0 A	30.7 A
Load capacity +5 V	8.5 A		8.5 A	
Degree of protection	IP 20		IP 20	
Weight	49.6 lb. (≅ 22.5 kg.)		49.6 lb. (≅ 22.5 kg.)	
Connection overview	Page 5-11		Page 5-12	
Dimensions	Page 5-45			

<sup>\*\*1</sup> 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*2</sup> 0.2 s cyclic duration factor for duration of 5 s

<sup>\*\*3</sup> For spindle motors: 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*4</sup> Axes: 0.2 s cyclic duration factor for duration of 5 s with rated current preload;  
0.2 s at standstill for synchronous motors

Spindle: 10 s cyclic duration factor for duration of 60 s with 70% rated current preload

**Table 2-1, Inverter Technical Specifications & Power Requirements (Continued)**

Parameter	RA 411C (regenerative)		
	3 axes/spindle	1 axis/spindle	Spindle/Axis
ANILAM P/N	34000312		
Power Supply	3 phase x 400 VAC ± 10 % (50 Hz to 60 Hz)		
DC-link Voltage	650 VDC		
DC-link Power			
Rated power	22 kW		
Peak power <sup>**1</sup>	30 kW		
Peak power <sup>**2</sup>	40 kW		
Power Loss	Approximately 930 W		
Rated current at a PWM frequency of:			
3333 Hz	9.0 A/12.0 A	30.4 A/42.5 A	42.5 A/30.4 A
4000 Hz	8.3 A/11.1 A	28.3 A/29.5 A	39.5 A/28.3 A
5000 Hz	7.5 A/10.0 A	25.0 A/35.0 A	35.0 A/25.0 A
6666 Hz	6.4 A/8.5 A	21.1 A/29.5 A	29.5 A/21.1 A
8000 Hz	5.3 A/7.1 A	17.9 A/25.0 A	25.0A/17.9 A
10000 Hz	4.5 A/6.0 A	15.4 A/21.5 A	21.5 A/15.4 A
Current for S6-40% <sup>**3</sup> at a PWM frequency of:			
3333 Hz	15.0 A	50.0 A	50.0 A
4000 Hz	15.0 A	50.0 A	50.0 A
5000 Hz	15.0 A	50.0 A	50.0 A
6666 Hz	12.8 A	42.0 A	42.1 A
8000 Hz	10.6 A	36.0 A	35.7 A
10000 Hz	9.0 A	31.0 A	30.7 A
Maximum current <sup>**4</sup> at a PWM frequency of:			
3333 Hz	15.0 A	50.0 A	50.0 A
4000 Hz	15.0 A	50.0 A	50.0 A
5000 Hz	15.0 A	50.0 A	50.0 A
6666 Hz	12.8 A	42.0 A	42.1 A
8000 Hz	10.6 A	36.0 A	35.7 A
10000 Hz	9.0 A	31.0 A	30.7 A
Load capacity +5 V	8.5 A		
Degree of protection	IP 20		
Weight	49.6 lb. (≅ 22.5 kg.)		
Connection overview	Page 5-13		
Dimensions	Page 5-45		

<sup>\*\*1</sup> 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*2</sup> 0.2 s cyclic duration factor for duration of 5 s

<sup>\*\*3</sup> For spindle motors: 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*4</sup> Axes: 0.2 s cyclic duration factor for duration of 5 s with rated current preload;  
0.2 s at standstill for synchronous motors

Spindle: 10 s cyclic duration factor for duration of 60 s with 70% rated current preload

**PS 120A Power Supply Unit**

The power supply for the main computer and controller unit—and therefore for the connected encoders—is usually covered by the compact inverter or the power supply unit of the modular inverter systems. Refer to **Table 2-2**.

If several encoders with a high current consumption (e.g., encoders with EnDat interface) or a dual-processor control are connected, however, an additional power supply source might become necessary. The PS 120A power supply unit is used for this purpose.

The PS 120A is connected to the control via a ribbon cable and a 5 V terminal.

The cover for the cable is included in the items supplied.

**Table 2-2, PS 120A Specifications**

<b>Specifications</b>	<b>PS 120A</b>
<b>ANILAM P/N</b>	34000347
<b>Power supply</b>	400 VAC $\pm$ 10 % (50 Hz to 60 Hz)
<b>Load capacity (5 V)</b>	20A
<b>Degree of protection</b>	IP 20
<b>Module width</b>	1.97 inch (50 mm)
<b>Weight</b>	8.8 lb (4 kg)

**Toroidal Cores**

To suppress occurrence of line interference, toroidal cores must be mounted in the motor leads, in the voltage supply lead, and in the lead to the braking resistor (only SA 301A, SA 311A, and SA 411A). Refer to **Table 2-3**, to determine the proper core.

**Table 2-3, Connections for Toroidal Cores**

<b>Terminal on Inverter</b>	<b>Toroidal Core</b>
<b>Power Supply (X31)</b>	∅ 87 mm (≅3.43 inch) (34000250)
<b>Braking Resistor (X89)**1</b>	∅ 42 mm (≅1.65 inch) (34000251)
<b>Axis 1 to 3 (X81 to X83)</b>	∅ 42 mm (≅1.65 inch) (34000251)
<b>Axis 4 (X84)</b>	∅ 59 mm (≅2.32 inch) (34000252)
<b>Spindle (X80)</b>	∅ 59 mm (≅2.32 inch) (34000252)

\*\*1 Only for SA 301A, SA 311A, and SA 411A

### Ribbon Cables and Covers (Only for SA xxxx)

#### 50-Line Ribbon Cable (Power Supply to CNC Chassis)

The 50-line ribbon cable connects the SA series inverter to the CNC Chassis and supplies voltage to the CNC Chassis. It is supplied with SA xxxx (length 300 mm ( $\cong$ 11.8 inch), P/N 325 816-01).

#### 20-Line Ribbon Cable (PWM Signals)

The 20-line ribbon cable connects the power module outputs of the CNC chassis to the power module connections on the inverter. One 20-line ribbon cable is required for each axis/ spindle. The 20-line ribbon cables for the connections on the inverter are supplied with the SA xxxx (length 200 mm ( $\cong$ 7.9 inch), P/N 250 479-08; length 400 mm ( $\cong$ 15.8 inch), P/N 250 479-10). If you are using an additional PM 107 power module, an additional 20-line ribbon cable is required. Refer to **Table 2-4**.

**Table 2-4, 20-Line Ribbon Cable Specifications**

PWM Connection on the PM 107 Power Module	Length of 20-Line Ribbon Cable	P/N
X111, X112	100 mm ( $\cong$ 4 inch)	34000263

#### 40-Line Ribbon Cable (Unit Bus)

The 40-line ribbon cable serves as the unit bus. It is required if an additional PM 107 power module is being operated with the inverter. Refer to **Table 2-5**.

**Table 2-5, 40-Line Ribbon Cable Specifications**

Unit Bus Connection	Length of 40-Line Ribbon Cable	P/N
X79	50 mm ( $\cong$ 2 inch)	34000264

#### Ribbon Cable Covers

The ribbon cables must be covered to protect them from electrical interference. One cover is supplied with the OEM CNC; one cover is supplied with the inverter (197.5 mm, P/N 34000274).

The plastic lateral termination cap is P/N 34000278.

If you are using an additional PM 107 power supply, the cover for this module must be ordered separately. Refer to **Table 2-6**.

**Table 2-6, Ribbon Cable Cover - Specifications**

Additional Power Module	Length of Cover	P/N
PM 107	50 mm ( $\cong$ 2 inch)	34000265

## Modular Amplifiers

The following topics are described:

- ❑ **Components of the Modular Amplifier**
- ❑ **PS 122R, PS 130, PS 145R Power Supply Unit**
- ❑ **PM 1xx, PM 2xx, PMD 1xx, PMD 2xx Power Modules**
- ❑ **Current Consumption of the Entire Inverter System**
- ❑ **Ribbon Cables and Covers**
- ❑ **Ribbon Cable Covers**

### Components of the Modular Amplifier

For operation of the modular ANILAM **non-regenerative** amplifiers, the following components are required:

- PS 130 power supply unit
- PM 1xx power modules, depending on version
- Toroidal cores for interference suppression
- PW 210 (or PW 110, PW 120) braking resistor
- One PMD 107 power module (optional)
- Ribbon cables for Pulse Width Modulation (PWM) signals, unit bus, and power supply
- Covers for the ribbon cables

For operation of the modular ANILAM **regenerative** amplifiers, the following components are required:

- PS 122R or PS 145R power supply unit
- CR 135 or CR 170 commutating reactor
- Line filter
- If required, BR 9 braking resistor module
- One PMD 107 power module (optional)
- Ribbon cables for PWM signals, unit bus, and power supply
- Covers for the ribbon cables

### PS 122R, PS 130, PS 145R Power Supply Unit

The PS 1xx power supply units supply the DC-link voltage as well as the power for the electronics to the CNC Chassis and power modules.

During braking, the motors feed energy into the DC-link. This energy is converted into heat by the PS 130 through the BR 18 (or BR 10F or BR 18F) braking resistor, or returned to the power line through the PS 122R or PS 145R. The PS 122R and PS 145R can be driven only with commutating reactor and line filter.

Refer to **Table 2-7**.

**Table 2-7, Power Supply Technical Specifications and Power Requirements**

Parameter	PS 122R (regenerative)	PS 130 (non-regenerative)	PS 145R (regenerative)
<b>ANILAM P/N</b>	34000340	34000343	34000346
<b>Description</b>	Amplifier, Power Supply, 22/30kW	Amplifier, Power Supply, 30/40kW	Amplifier, Power Supply, 45/65kW
<b>Power Supply</b>	3 phase x 400 VAC $\pm$ 10 % (50 Hz to 60 Hz)		
<b>DC-link Power</b>			
<b>Rated Power</b>	22 kW	30 kW	45 kW
<b>Peak Power <sup>**1</sup></b>	30 kW	40 kW	65 kW
<b>Peak Power <sup>**2</sup></b>	40 kW	50 kW	80 kW
<b>Power Loss</b>	$\cong$ 300 W	$\cong$ 140 W	$\cong$ 570 W
<b>DC-link Voltage</b>	650 VDC	565 VDC (with supply voltage of 400 V)	650 VDC
<b>Current Consumption:</b>			
<b>15 V</b>	270 mA	240 mA	380 mA
<b>24 V</b>	310 mA	410 mA	310 mA
<b>Current Load <sup>**3</sup></b>			
<b>15 V</b>	1.5 A	1.5 A	1.5 A
<b>24 V</b>	2.0 A	2.0 A	2.0 A
<b>Load Capacity +5 V</b>	8.5 A		
<b>Degree of protection</b>	IP 20		
<b>Weight</b>	27 lb. ( $\cong$ 12.0 kg.)	22 ( $\cong$ 9.8 kg.)	44 lb. ( $\cong$ 20.0 kg.)

<sup>\*\*1</sup> 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*2</sup> 0.2 s cyclic duration factor for duration of 5 s

<sup>\*\*3</sup> After making your selection, check the current consumption of the 15 V and 24 V supply of the entire modular amplifier system.



**PM 1xx, PM 2xx, PMD 1xx, PMD 2xx 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 CNC Chassis via external 20-line ribbon cables. Refer to **Table 2-8**.

**Table 2-8, Power Module Technical Specifications**

Specifications	PM 107	PMD 107	PM 115A	
	Axis	Axis	Axis	Spindle
<b>ANILAM P/N</b>	34000320	638663-01	34000321	
<b>Rated current at a PWM frequency of:</b>				
<b>3333 Hz</b>	9.0 A	9.0 A	18.4 A	24.5 A
<b>4000 Hz</b>	8.3 A	8.3 A	16.9 A	22.5 A
<b>5000 Hz</b>	7.5 A	7.5 A	15.0 A	20.0 A
<b>6666 Hz</b>	6.4 A	6.4 A	12.8 A	17.0 A
<b>8000 Hz</b>	5.3 A	5.3 A	10.9 A	14.5 A
<b>10000 Hz</b>	4.5 A	4.5 A	9.0 A	12.0 A
<b>Current at S6-40%<sup>**1</sup> at a PWM frequency of:</b>				
<b>3333 Hz</b>				30.0 A
<b>4000 Hz</b>				30.0 A
<b>5000 Hz</b>				30.0 A
<b>6666 Hz</b>				25.6 A
<b>8000 Hz</b>				21.8 A
<b>10000 Hz</b>				18.0 A
<b>Maximum current<sup>**2</sup> at a PWM frequency of:</b>				
<b>3333 Hz</b>	15.0 A	18.0 A <sup>**3</sup>	30.0 A	
<b>4000 Hz</b>	15.0 A	16.6 A <sup>**3</sup>	30.0 A	
<b>5000 Hz</b>	15.0 A	15.0 A	30.0 A	
<b>6666 Hz</b>	12.8 A	12.8 A	25.6 A	
<b>8000 Hz</b>	10.6 A	10.6 A	21.8 A	
<b>10000 Hz</b>	9.0 A	9.0 A	18.0 A	
<b>Power loss</b>	≅ 70 W		≅ 120 W	≅ 160 W
<b>Current consumption<sup>**4</sup></b>				
<b>15 V</b>	120 mA		150 mA	
<b>24 V</b>	60 mA		170 mA	
<b>Degree of protection</b>	IP 20			
<b>Weight</b>	12 lb. (≅ 5.5 kg.)			

**\*\*1** For spindle motors: 40% cyclic duration factor for duration of 10 minutes (S6-40%)

**\*\*2** Axes: 0.2s cyclic duration factor for duration of 5 s with rated current preload;  
0.2 s at standstill for synchronous motors

Spindle: 10 s cyclic duration factor for duration of 60 s with 70% rated current preload

**\*\*3** As of mid-2005 (depending on software. Information available from ANILAM.

**\*\*4** After making your selection, check the current consumption of the 15 V and 24 V supply of the entire modular amplifier system.

**Table 2-8, Power Module Technical Specifications (Continued)**

Specifications	PMD 115		PM 123A		PMD 125	
	Axis	Spindle	Axis	Spindle	Axis	Spindle
<b>ANILAM P/N</b>	638664-01		34000322		638665-01	
<b>Rated current at a PWM frequency of:</b>						
<b>3333 Hz</b>	18.4 A	24.5 A	28.2 A	38.0 A	29.5 A	40.0 A
<b>4000 Hz</b>	16.9 A	22.5 A	26.0 A	35.0 A	27.7 A	37.0 A
<b>5000 Hz</b>	15.0 A	20.0 A	23.0 A	31.0 A	25.0 A	34.0 A
<b>6666 Hz</b>	12.8 A	17.0 A	19.3 A	26.0 A	21.0 A	28.5 A
<b>8000 Hz</b>	10.9 A	14.5 A	16.7 A	22.5 A	18.5 A	25.0 A
<b>10000 Hz</b>	9.0 A	12.0 A	14.1 A	19.0 A	15.5 A	21.0 A
<b>Current at S6-40%<sup>**1</sup> at a PWM frequency of:</b>						
<b>3333 Hz</b>		35.0 A <sup>**2</sup>		46.0 A		59.0 A <sup>**2</sup>
<b>4000 Hz</b>		33.0 A <sup>**2</sup>		46.0 A		55.0 A <sup>**2</sup>
<b>5000 Hz</b>		30.0 A		46.0 A		42.6 A
<b>6666 Hz</b>		25.6 A		38.6 A		37.0 A
<b>8000 Hz</b>		21.8 A		33.4 A		31.0 A
<b>10000 Hz</b>		18.0 A		28.2 A		
<b>Maximum current<sup>**3</sup> at a PWM frequency of:</b>						
<b>3333 Hz</b>	35.0 A <sup>**2</sup>		46.0 A		59.0 A <sup>**2</sup>	
<b>4000 Hz</b>	33.0 A <sup>**2</sup>		46.0 A		55.0 A <sup>**2</sup>	
<b>5000 Hz</b>	30.0 A		46.0 A		50.0 A	
<b>6666 Hz</b>	25.6 A		38.6 A		42.6 A	
<b>8000 Hz</b>	21.8 A		33.4 A		37.0 A	
<b>10000 Hz</b>	18.0 A		28.2 A		31.0 A	
<b>Power loss</b>	≅ 120 W	≅ 160 W	≅ 180 W	≅ 270 W	≅ 70 W	≅ 110 W
<b>Current consumption<sup>**4</sup></b>						
<b>15 V</b>	150 mA		170 mA		120 mA	
<b>24 V</b>	170 mA		170 mA		60 mA	
<b>Degree of protection</b>	IP 20					
<b>Weight</b>	12 lb. (≅ 5.5 kg.)		20 lb. (≅ 9 kg.)		12 lb. (≅ 5.5 kg.)	

<sup>\*\*1</sup> For spindle motors: 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*2</sup> As of mid-2005 (depending on software. Information available from ANILAM.

<sup>\*\*3</sup> Axes: 0.2s cyclic duration factor for duration of 5 s with rated current preload;  
0.2 s at standstill for synchronous motors

Spindle: 10 s cyclic duration factor for duration of 60 s with 70% rated current preload

<sup>\*\*4</sup> After making your selection, check the current consumption of the 15 V and 24 V supply of the entire modular amplifier system.

**Table 2-8, Power Module Technical Specifications (Continued)**

Specifications	PM 132A		PMD 140		PM 148A	
	Axis	Spindle	Axis	Spindle	Axis	Spindle
<b>ANILAM P/N</b>	34000323		638666-01		34000324	
<b>Rated current at a PWM frequency of:</b>						
<b>3333 Hz</b>	39.0 A	61.0 A	47.0 A	67.0 A	58.6 A	91.5 A
<b>4000 Hz</b>	36.2 A	56.5 A	44.0 A	62.0 A	54.4 A	85.0 A
<b>5000 Hz</b>	32.0 A	50.0 A	40.0 A	56.0 A	48.0 A	75.0 A
<b>6666 Hz</b>	26.9 A	42.0 A	33.5 A	47.0 A	40.3 A	63.0 A
<b>8000 Hz</b>	23.0 A	36.0 A	29.5 A	41.0 A	34.6 A	54.0 A
<b>10000 Hz</b>	19.5 A	30.5 A	24.5 A	34.0 A	29.4 A	46.0 A
<b>Current at S6-40%<sup>**1</sup> at a PWM frequency of:</b>						
<b>3333 Hz</b>		64.0 A		88.0 A <sup>**2</sup>		140.0 A
<b>4000 Hz</b>		64.0 A		82.0 A <sup>**2</sup>		140.0 A
<b>5000 Hz</b>		64.0 A		75.0 A		140.0 A
<b>6666 Hz</b>		53.8 A		63.0 A		117.6 A
<b>8000 Hz</b>		46.0 A		55.0 A		100.8 A
<b>10000 Hz</b>		39.0 A		46.0 A		85.4 A
<b>Maximum current<sup>**3</sup> at a PWM frequency of:</b>						
<b>3333 Hz</b>	64.0 A		94.0 A <sup>**2</sup>		140.0 A	
<b>4000 Hz</b>	64.0 A		88.0 A <sup>**2</sup>		140.0 A	
<b>5000 Hz</b>	64.0 A		80.0 A		140.0 A	
<b>6666 Hz</b>	53.8 A		67.0 A		117.6 A	
<b>8000 Hz</b>	46.0 A		59.0 A		100.8 A	
<b>10000 Hz</b>	39.0 A		49.0 A		85.4 A	
<b>Power loss</b>	≅ 280 W	≅ 420 W	≅ 180 W	≅ 270 W	≅ 420 W	≅ 650 W
<b>Current consumption<sup>**4</sup></b>						
<b>15 V</b>	170 mA		170 mA		250 mA	
<b>24 V</b>	250 mA		170 mA		420 mA	
<b>Degree of protection</b>	IP 20					
<b>Weight</b>	20 lb. (≅ 9 kg.)				26.5 lb. (≅ 12.0 kg.)	

**\*\*1** For spindle motors: 40% cyclic duration factor for duration of 10 minutes (S6-40%)

**\*\*2** As of mid-2005 (depending on software. Information available from ANILAM.

**\*\*3** Axes: 0.2s cyclic duration factor for duration of 5 s with rated current preload;  
0.2 s at standstill for synchronous motors

Spindle: 10 s cyclic duration factor for duration of 60 s with 70% rated current preload

**\*\*4** After making your selection, check the current consumption of the 15 V and 24 V supply of the entire modular amplifier system.

**Table 2-8, Power Module Technical Specifications (Continued)**

Specifications	PMD 160		PM 170A		PMD 196	
	Axis	Spindle	Axis	Spindle	Axis	Spindle
<b>ANILAM P/N</b>	638667-01		34000325		34000325	
<b>Rated current at a PWM frequency of:</b>						
<b>3333 Hz</b>	70.0 A	108.0 A	85.4 A	122.0 A	115.0 A	150.0 A
<b>4000 Hz</b>	66.0 A	99.0 A	79.1 A	113.0 A	106.0 A	138.0 A
<b>5000 Hz</b>	60.0 A	90.0 A	70.0 A	100.0 A	96.0 A	125.0 A
<b>6666 Hz</b>	55.0 A	76.5 A	58.5 A	84.0 A	80.0 A	105.0 A
<b>8000 Hz</b>	44.0 A	66.0 A	50.4 A	72.0 A	70.0 A	92.0 A
<b>10000 Hz</b>	37.0 A	55.0 A	42.7 A	61.0 A	59.0 A	76.0 A
<b>Current at S6-40%<sup>**1</sup> at a PWM frequency of:</b>						
<b>3333 Hz</b>		125.0 A <sup>**2</sup>		140.0 A		180.0 A <sup>**2</sup>
<b>4000 Hz</b>		116.0 A <sup>**2</sup>		140.0 A		165.0 A <sup>**2</sup>
<b>5000 Hz</b>		105.0 A		140.0 A		150.0 A
<b>6666 Hz</b>		88.0 A		117.6 A		126.0 A
<b>8000 Hz</b>		77.0 A		100.8 A		110.0 A
<b>10000 Hz</b>		64.0 A		85.4 A		92.0 A
<b>Maximum current<sup>**3</sup> at a PWM frequency of:</b>						
<b>3333 Hz</b>	140.0 A <sup>**2</sup>		140.0 A		230.0 A <sup>**2</sup>	
<b>4000 Hz</b>	132.0 A <sup>**2</sup>		140.0 A		211.0 A <sup>**2</sup>	
<b>5000 Hz</b>	120.0 A		140.0 A		192.0 A	
<b>6666 Hz</b>	101.6 A		117.6 A		161.0 A	
<b>8000 Hz</b>	88.0 A		100.8 A		141.0 A	
<b>10000 Hz</b>	73.0 A		85.4 A		117.0 A	
<b>Power loss</b>	≅ 420 W	≅ 650 W	≅ 610 W	≅ 870 W	≅ 610 W	≅ 870 W
<b>Current consumption<sup>**4</sup></b>						
<b>15 V</b>	250 mA			270 mA		
<b>24 V</b>	420 mA			460 mA		
<b>Degree of protection</b>	IP 20					
<b>Weight</b>	26.5 lb. (≅ 12.0 kg.)		41.9 lb. (≅ 19.0 kg.)			

**\*\*1** For spindle motors: 40% cyclic duration factor for duration of 10 minutes (S6-40%)

**\*\*2** As of mid-2005 (depending on software. Information available from ANILAM.

**\*\*3** Axes: 0.2s cyclic duration factor for duration of 5 s with rated current preload;  
0.2 s at standstill for synchronous motors

Spindle: 10 s cyclic duration factor for duration of 60 s with 70% rated current preload

**\*\*4** After making your selection, check the current consumption of the 15 V and 24 V supply of the entire modular amplifier system.

**Table 2-8, Power Module Technical Specifications (Continued)**

Specifications	PM 207	PMD 207	PM 215A**1	
	Axis	Axes	Axis	Axis
<b>ANILAM P/N</b>	34000327	638670-01	34000328	
<b>Rated current at a PWM frequency of:</b>				
<b>3333 Hz</b>	9.0 A	9.0 A	18.40 A	24.5 A
<b>4000 Hz</b>	8.3 A	8.3 A	16.9 A	22.5 A
<b>5000 Hz</b>	7.5 A	7.5 A	15.0 A	20.0 A
<b>6666 Hz</b>	6.4 A	6.4 A	12.8 A	17.0 A
<b>8000 Hz</b>	5.3 A	5.3 A	10.9 A	14.5 A
<b>10000 Hz</b>	4.5 A	4.5 A	9.0 A	12.0 A
<b>Current at S6-40%**2 at a PWM frequency of:</b>				
<b>3333 Hz</b>				30.0 A
<b>4000 Hz</b>				30.0 A
<b>5000 Hz</b>				30.0 A
<b>6666 Hz</b>				25.6 A
<b>8000 Hz</b>				21.8 A
<b>10000 Hz</b>				18.0 A
<b>Maximum current**4 at a PWM frequency of:</b>				
<b>3333 Hz</b>	15.0 A	18.0 A**3	30.0 A	
<b>4000 Hz</b>	15.0 A	16.6 A**3	30.0 A	
<b>5000 Hz</b>	15.0 A	15.0 A	30.0 A	
<b>6666 Hz</b>	12.8 A	12.8 A	25.6 A	
<b>8000 Hz</b>	10.6 A	10.6 A	21.8 A	
<b>10000 Hz</b>	9.0 A	9.0 A	18.0 A	
<b>Power loss</b>	≅ 140 W		2 axes: ≅ 240 W 1 axis, 1 spindle: ≅ 280 W	
<b>Current consumption**5</b>				
<b>15 V</b>	200 mA		250 mA	
<b>24 V</b>	110 mA		170 mA	
<b>Degree of protection</b>	IP 20			
<b>Weight</b>	12 lb. (≅ 5.5 kg.)			

\*\*1 For this power module only, the lower PWM connection can be used to control the spindle

\*\*2 For spindle motors: 40% cyclic duration factor for duration of 10 minutes (S6-40%)

\*\*3 As of mid-2005 (depending on software. Information available from ANILAM.

\*\*4 Axes: 0.2 s cyclic duration factor for duration of 5 s with rated current preload;  
0.2 s at standstill for synchronous motors

Spindle: 10 s cyclic duration factor for duration of 60 s with 70% rated current preload

\*\*5 After making your selection, check the current consumption of the 15 V and 24 V supply of the entire modular amplifier system.

**Table 2-8, Power Module Technical Specifications (Continued)**

Specifications	PMD 215 <sup>**1</sup>		PM 223A <sup>**1</sup>		PMD 225 <sup>**1</sup>	
	Axis	Spindle	Axis	Spindle	Axis	Spindle
<b>ANILAM P/N</b>	628671-10		34000329		638672-01	
<b>Rated current at a PWM frequency of:</b>						
<b>3333 Hz</b>	17.5 A	24.5 A	28.2 A	38.0 A	29.5 A	40.0 A
<b>4000 Hz</b>	16.5 A	22.5 A	26.0 A	35.0 A	27.7 A	37.0 A
<b>5000 Hz</b>	15.0 A	20.0 A	23.0 A	31.0 A	25.0 A	34.0 A
<b>6666 Hz</b>	12.8 A	17.0 A	19.3 A	26.0 A	21.0 A	28.5 A
<b>8000 Hz</b>	10.9 A	14.5 A	16.7 A	22.5 A	18.5 A	25.0 A
<b>10000 Hz</b>	9.0 A	12.0 A	14.1 A	19.0 A	15.5 A	21.0 A
<b>Current at S6-40%<sup>**2</sup> at a PWM frequency of:</b>						
<b>3333 Hz</b>		35.0 A <sup>**3</sup>		46.0 A		59.0 A <sup>**3</sup>
<b>4000 Hz</b>		33.0 A <sup>**3</sup>		46.0 A		55.0 A <sup>**3</sup>
<b>5000 Hz</b>		30.0 A		46.0 A		50.0 A
<b>6666 Hz</b>		25.6 A		38.6 A		42.0 A
<b>8000 Hz</b>		21.8 A		33.4 A		37.0 A
<b>10000 Hz</b>		18.0 A		28.2 A		31.0 A
<b>Maximum current<sup>**4</sup> at a PWM frequency of:</b>						
<b>3333 Hz</b>	35.0 A <sup>**3</sup>		46.0 A		59.0 A <sup>**3</sup>	
<b>4000 Hz</b>	33.0 A <sup>**3</sup>		46.0 A		55.0 A <sup>**3</sup>	
<b>5000 Hz</b>	30.0 A		46.0 A		50.0 A	
<b>6666 Hz</b>	25.6 A		38.6 A		42.0 A	
<b>8000 Hz</b>	21.8 A		33.4 A		37.0 A	
<b>10000 Hz</b>	18.0 A		28.2 A		31.0 A	
<b>Power loss</b>	2 axes: $\cong$ 240 W 1 axis, 1 spindle: $\cong$ 280 W		2 axes: $\cong$ 360 W 1 axis, 1 spindle: $\cong$ 450 W		2 axes: $\cong$ 460 W 1 axis, 1 spindle: $\cong$ 490 W	
<b>Current consumption<sup>**5</sup></b>						
<b>15 V</b>	250 mA		290 mA		150 mA	
<b>24 V</b>	170 mA		220 mA		170 mA	
<b>Degree of protection</b>	IP 20					
<b>Weight</b>	12 lb. ( $\cong$ 5.5 kg.)		20 lb. ( $\cong$ 9 kg.)		12 lb. ( $\cong$ 5.5 kg.)	

<sup>\*\*1</sup> For this power module only, the lower PWM connection can be used to control the spindle

<sup>\*\*2</sup> For spindle motors: 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*3</sup> As of mid-2005 (depending on software. Information available from ANILAM.

<sup>\*\*4</sup> Axes: 0.2 s cyclic duration factor for duration of 5 s with rated current preload;  
0.2 s at standstill for synchronous motors

Spindle: 10 s cyclic duration factor for duration of 60 s with 70% rated current preload

<sup>\*\*5</sup> After making your selection, check the current consumption of the 15 V and 24 V supply of the entire modular amplifier system.

### 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. 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 (refer to **Table 2-9**):

**Table 2-9, Current Limit Values**

Power Supply Units	15 V Power Supply	24 V Power Supply
PS 130	Maximum: 1.5 A	Maximum: 2.0 A
PS 122R, PS 145R	Maximum: 3.5 A	Maximum: 4.0 A

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

**Example:**

Device	15 V Power Supply	24 V Power Supply
PS 145R	0.38 A	0.31 A
PMD 160	0.25 A	0.42 A
PMD 215	0.25 A	0.17 A
PMD 207	0.20 A	0.11 A
PMD 107	0.12 A	0.06 A
Total	1.20 A	1.07 A

### Ribbon Cables and Covers

#### 50-Line Ribbon Cable (Power Supply to CNC Chassis)

The 50-line ribbon cable connects the PS 1xx with the CNC Chassis and serves as voltage supply. This cable is only required once. Refer the **Table 2-10**.

**Table 2-10, 50-Line Ribbon Cable P/N List**

Ribbon Cable Length	P/N
300 mm (≅18.81 inches)	34000260
400 mm (≅15.74 inches)	34000280
500 mm (≅19.69 inches)	34000281
600 mm <sup>**1</sup> (≅23.62 inches)	34000282

**\*\*1** With lengths of 600 mm (23.62 inches) and longer, the ribbon cable is led doubled to the CNC Chassis to increase the line cross section.

To select the 50-line ribbon cable length:

- Add the widths of all modules (including BR 9) between PS 1xx and CNC Chassis.
- PS 130: Add 130 mm to the width and select the next-longer cable length from **Table 2-10**.

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 CNC Chassis with the corresponding PM 1xx power modules. One 20-line ribbon cable is required for each axis or spindle. If you are using an additional PMD 107 power module, you will need an additional 20-line ribbon cable: PWM connection on the PMD 107 power module: X111, X112, length of 20-line ribbon cable: 100 mm, P/N 34000263. Refer the **Table 2-11**.

**Table 2-11, 20-Line Ribbon Cable P/N List**

Ribbon Cable Length	P/N
100 mm (≅3.94 inches)	34000263
200 mm (≅7.87 inches)	34000261
300 mm (≅18.81 inches)	34000262
400 mm (≅15.74 inches)	34000270
500 mm (≅19.69 inches)	34000271
600 mm (≅23.62 inches)	34000272

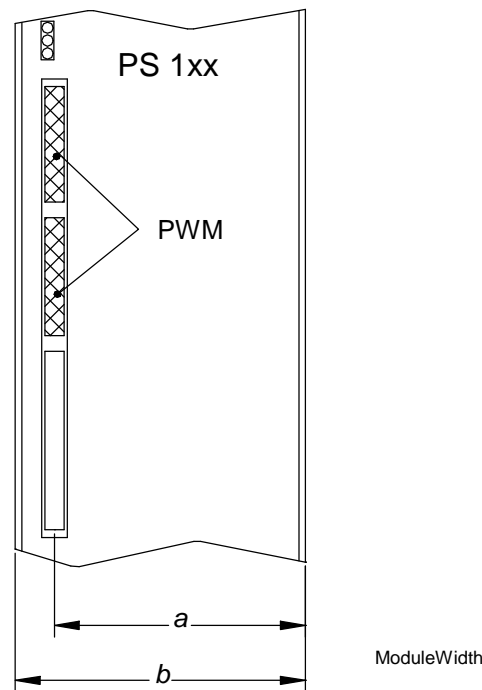


To select the 20-line ribbon cable length:

1. See **Table 2-12** for distance *a* (See **Figure 2-1**) of the PWM input on the power module.
2. Add the widths *b* of all modules (including BR 9 and PS 120A) between the corresponding power module and the CNC Chassis.
3. Select the next-length cable length, unless there is an exact match.

**Table 2-12, 20-Line Ribbon Cable Distance Guide**

Power Module	Distance <i>a</i>	Module Width <i>b</i>
<b>PM 107, PM 207</b>	Approximately 40 mm	50 mm
<b>PM 115A, PM 215A</b>	Approximately 85 mm	100 mm
<b>PM 123A, PM 132A, PM 148A, PM 223A</b>	Approximately 90 mm	100 mm
<b>PM 170A</b>	Approximately 140 mm	150 mm



**Figure 2-1, Module Width Measures**

**40-Line Ribbon Cable (Unit Bus)**

The 40-line ribbon cable connects the PS 1xx power supplies with all of the PM 1xx, PM 2xx, PMD 1xx, and PMD 2xx power modules (and the PR 9 braking resistor module, if present), making the unit bus. This cable is only required once. The 40-line ribbon cable serves as the unit bus. It is required if an additional PMD 107 power module is being operated with the compact inverter. Unit bus connection: X79, length of the 40-line ribbon cable: 50 mm ( $\cong$ 1.97 inches), P/N 34000264. Refer to **Table 2-13**.

**Table 2-13, 40-Line Ribbon Cable (Unit Bus) P/N List**

Ribbon Cable Length	P/N
300 mm ( $\cong$ 18.81 inches)	34000275
400 mm ( $\cong$ 15.74 inches)	34000276
500 mm ( $\cong$ 19.69 inches)	34000277

To select the 40-line ribbon cable length:

- Add the widths of all modules (including BR 9) between:
  - PS 1xx and CNC Chassis
  - PS 1xx and PS 120A
- PS 130: Add 80 mm to the width and select the next-longer cable length from **Table 2-13**.

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

**Ribbon Cable Covers**

The ribbon cables must be covered to protect against interference.

The cover for the CNC Chassis is supplied with the CNC Chassis.

If further power modules and the BR 9 braking resistor module are used, the corresponding covers must be ordered separately. Refer to **Table 2-14**.

**Table 2-14, Ribbon Cable Covers P/N List**

Width of the Cover	P/N
<b>50 mm (≈1.97 inches)</b>	34000265
<b>100 mm (≈3.84 inches)</b>	34000266
<b>150 mm (≈5.90inches)</b>	34000267
<b>200 mm (≈7.87 inches)</b>	34000268

To select the ribbon cable covers:

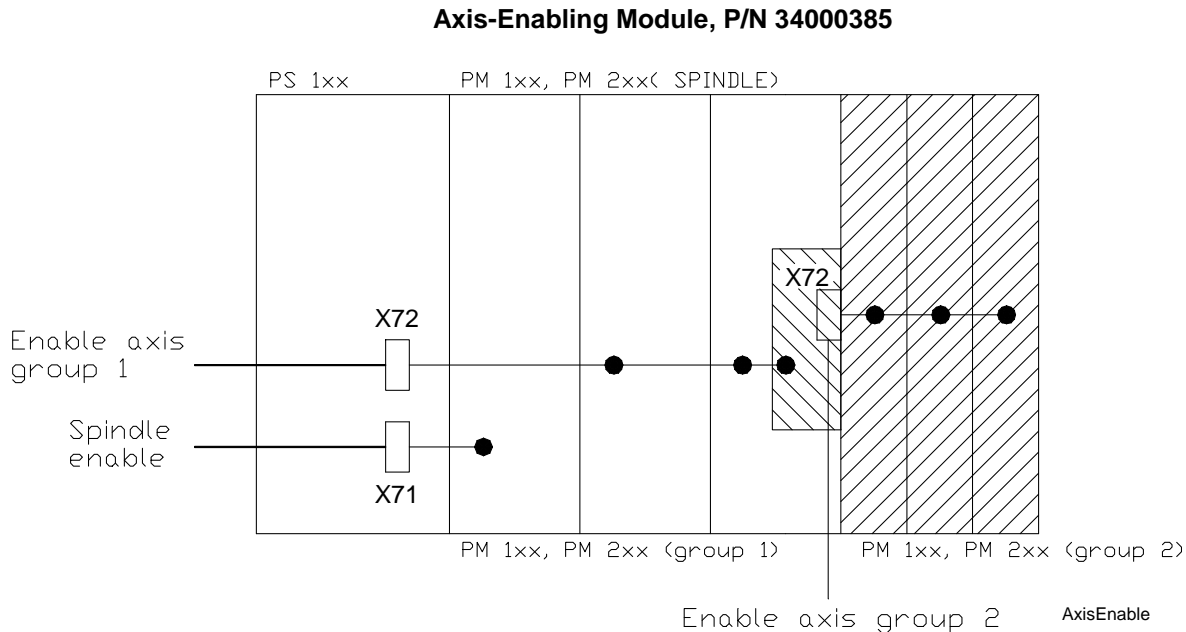
1. Add the widths of all modules (including BR 9) between:
  - PS 1xx and CNC Chassis.
  - PS 130 and PS 120A
2. Subtract 150 mm from this total (cover included with the PS 1xx)
3. Select the appropriate cover from the table in order to cover the remaining width.

### Axis-Enabling Module

If no axis-enabling module is used, all axis power modules are switched off simultaneously via X72 of the PS 1xx power supply. The axis-enabling module makes it possible to switch off power modules group by group. Refer to **Figure 2-2**.

The module—instead of mounting pins for the covers—is screwed into the front panel of a power module.

The axis-enabling signal is transmitted via a line in the unit bus from power module to power module. This line is interrupted through the axis-enabling module so that all the power modules connected to the axis-enabling module are switched off. All other power modules are switched off via X72 of the PS 1xx.



**Figure 2-2, Axis-Enabling Module**

The unit bus requires a 40-line ribbon cable with connects the PS 1xx power supply unit, the axis-enabling module, and the power module to switch off via PS 1xx.

A further 40-line ribbon cable connects the axis-enabling module with the power modules, which are to be switched off the axis-enabling module.

The width of the covers required for the ribbon cables for the modular amplifier system is reduced by the width of the axis-enabling module (50 mm). Suitable covers are included with the modular amplifier system.

## Accessories for Inverters and Modular Amplifiers

The following topics are described:

- ❑ **Braking Resistors**
- ❑ **Line Filters**
- ❑ **CC 3P – Three-Phase Capacitor**
- ❑ **CR 1xx – Commutating Reactor**
- ❑ **DLF 1x0 – DC-Link Filter**
- ❑ **VPM 163 – Voltage Protection Module**
- ❑ **Adapter Module**

### Braking Resistors

During braking, the braking resistors convert the energy fed back to the DC-link into heat. The BR 10F and BR 18F have a cooling fan; the BR 18 cools through heat radiation only.

Either one BR 18, BR 10F or BR 18F, or two BR 18s in parallel can be connected to a SA series compact inverter and a PM 107 power module.

For PS 122R and PS 145R 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 BR 9 braking resistor module.

For PS 130, the BR 10F braking resistor is used.

### BR 18 Braking Resistor

For BR 18, refer to **Table 2-15**.

**Table 2-15, BR 18 Braking Resistor Technical Specifications**

Specifications	BR 18
<b>ANILAM P/N</b>	34000450
<b>Continuous Power</b>	2 kW (4 kW) <sup>**1</sup>
<b>Peak Power<sup>**2</sup></b>	27 kW (54 kW) <sup>**1</sup>
<b>Resistance</b>	18 Ω (9 Ω)
<b>Degree of protection</b>	IP 20
<b>Weight</b>	12.1 lb. (5.5 kg.)

<sup>\*\*1</sup> When two BR 18 units are connected in parallel

<sup>\*\*2</sup> 1.5 % cyclic duration factor for duration of 120 s

### BR 10F and BR 18F Braking Resistor

For BR 10F and BR 18F, refer to **Table 2-16**.

**Table 2-16, BR 10F and BR 18F Braking Resistor Technical Specifications**

Specifications	BR 18F	BR 10F
ANILAM P/N	34000451	34000452
Continuous Power	2 kW	4 kW
Peak Power <sup>**1</sup>	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	13.2 lb. (6 kg.)	50.6 lb. (11 kg.)

<sup>\*\*1</sup> BR 18F: 1.5 % cyclic duration factor for duration of 120 s  
 BR 10F: 2 % cyclic duration factor for duration of 120 s

**WARNING:** The surface of the braking resistor can exceed temperatures of up to greater than 150 °C (302 °F).

**NOTE:** The lines between the compact inverter/power supply unit and the braking resistor may have a length of 49.2 ft. (15 m.)

### BR 9 Braking Resistor

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 energy must be dissipated with the BR 9 braking resistor module.

In specific cases, it may be sufficient that the motor is equipped with a brake or it may be considered uncritical that the axes or spindle coast to a stop (for example, spindle coasting to a stop when the protective doors are closed). However, it must be considered for each individual application whether this is sufficient. Refer to **Table 2-17**.

**Table 2-17, BR 9 Braking Resistor Technical Specifications**

Specifications	BR 9
ANILAM P/N	34000453
Power	60 kW (for 2 s)
Resistance	9 Ω
Degree of protection	IP 20
Weight	15.5 lb (7 kg.)

**Line Filters**

If you are using regenerative inverter systems, you must use a line filter in addition to the commutating reactor. Line filters suppress interference and ensure EMC-compatible energy recovery. The line filter must be connected between the power line and the commutating reactor.

The size of the line filter depends on the power module used. Refer to **Table 2-18**.

**Table 2-18, Line Filter Technical Specifications**

Parameter	LF 135A	LF 180A
<b>ANILAM P/N</b>	34000359	34000358
<b>Suitable for:</b>	PS 122R	PS 145R
<b>Rated Voltage</b>	3 phase x 400 V	
<b>Rated Frequency</b>	50 Hz/60 Hz	
<b>Rated Current</b>	3 phase x 35 A	3 phase x 80 A
<b>Power Loss</b>	Approximately 50 W	Approximately 75 W
<b>Degree of protection</b>	IP 20	
<b>Weight</b>	11 lb. (5 kg.)	24.25 lb. (11 kg.)

**CC 3P – Three-Phase Capacitor**

If you are using regenerative inverter systems, we basically recommend that you use a three-phase capacitor. The three-phase capacitor suppresses low-frequency interference during energy recovery to the power line. It must be connected between the line filter and commutating reactor.

Refer to **Table 2-19**.

**Table 2-19, CC 3P, Three-phase Capacitor, Specifications**

Specifications	CC 3P
<b>ANILAM P/N</b>	34000386
<b>Phase-to-phase voltage</b>	525
<b>Capacity</b>	3 phase x 24.1 $\mu$ F
<b>Charging and discharging resistors)**1</b>	3 phase x 630 k $\Omega$
<b>Discharge period (5 time constant)</b>	75 s
<b>Degree of protection</b>	IP 00
<b>Weight</b>	2.86 lb. (Approximately 1.3 kg)

\*\*1 Included in items supplied

**CR 1xx – Commutating Reactor**

The PS 122R and PS 145R power recovery modules must be connected to the main power line via the CR 1xx commutating reactor and the line filter. The commutating reactor serves as a power storage device for the step-up converter.

The size of the commutating reactor depends on the power module used. Refer to **Table 2-20**.

**Table 2-20, CR 1xx – Commutating Reactor Technical Specifications**

<b>Specifications</b>	<b>CR 135</b>	<b>CR 170</b>	<b>CR 180</b>
<b>ANILAM P/N</b>	34000355	34000356	34000357
<b>Rated voltage</b>	3 phase x 400 V		
<b>Rated frequency</b>	50 Hz/60 Hz		
<b>Thermally permissible continuous current</b>	3 phase x 35 A	3 phase x 70 A	3 phase x 80 A
<b>Rated current</b>	3 phase x 31.5 A	3 phase x 63 A	3 phase x 72 A
<b>Power loss</b>	≅ 200 W	≅ 340 W	≅ 350 W
<b>Degree of protection</b>	IP 00		
<b>Weight</b>	24.25 lb. (≅11 kg.)	48.5 lb (≅ 22 kg.)	51 lb (≅ 23 kg.)



**DLF 1x0 – DC-Link Filter**

Direct drives (linear motors, torque motors) used with regenerative inverter systems result in voltage peaks, which might destroy the drive. If you are using direct drives in conjunction with the regenerative PS 122R, PS 145R power supply and RA 201A, RA 301C, RA 411C compact inverters (amplifiers), you must therefore use DLF 1x0 DC-link filter.

Refer to **Table 2-21**.

**Table 2-21, DLF 1x0 – DC-Link Filter Technical Specifications**

Specifications	DLF 110	DLF 120	DLF 130
<b>ANILAM P/N</b>	647528-01	647530-01	647531-01
<b>Rated power</b>	30 kW	30 kW	55 kW
<b>Peak power</b>	47 kW <sup>**1</sup>	47 kW <sup>**1</sup>	80 kW <sup>**1</sup>
	67 kW <sup>**2</sup>	67 kW <sup>**2</sup>	100 kW <sup>**2</sup>
	110 kW <sup>**3</sup>	110 kW <sup>**3</sup>	110 kW <sup>**3</sup>
<b>Maximum leakage current</b>	<1.3 A	<6.0 A	<6.0 A
<b>Current consumption<sup>**4</sup></b> 24 V	–	–	440 mA
<b>Degree of protection</b>	IP 20	IP 20	IP 20
<b>Weight</b>	22.04 lb. (≅10 kg.)	26.45 lb (≅ 12 kg.)	28.66 lb (≅ 13 kg.)

<sup>\*\*1</sup> 40% cyclic duration factor for duration of 10 minutes (S6-40%)

<sup>\*\*2</sup> 20% cyclic duration factor for duration of 10 minutes (S6-20%)

<sup>\*\*3</sup> Pmax absolute

<sup>\*\*4</sup> After making your selection, check the current consumption of the 15 V and 24 V supply of the entire modular inverter system. See “**Current Consumption of the Entire Inverter System.**”

**WARNING:** The DLF 110 differs from the DLF 120 only in its maximum leakage current. If you are using the DLF 110, an ANILAM technician must check on site whether the leakage current is less than 1.3 A. If you are using the DLF 120, this verification is not required because a leakage current of 6 A is sufficient in any case.

**WARNING:** The total power of the direct drives must not exceed the power of the filter.

### VPM 163 – Voltage Protection Module

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

The present phase of a motor  $I_{mot}$  can be determined using the following formula and must be less than the maximum phase current of the VPM 163, Voltage Protection Module:

$$I_{Mot} = \frac{U_0}{\sqrt{3} \cdot XH} < 63 \text{ A}$$

U0: No-load voltage [V], see motor table of the control

XH: Magnetizing reactance ( $\Omega$ ), see motor table of the control

**WARNING: The maximum cable length between the VPM 163 and the inverter is 2 m. (6.56 ft.)**

Refer to **Table 2-22**.

**Table 2-22, VPM 163 – Voltage Protection Module Specifications**

Specifications	VPM 363
<b>ANILAM P/N</b>	34000387
<b>Switching voltage</b>	850 V
<b>Maximum phase current</b>	3 phase x 63 A
<b>Maximum braking time at maximum phase current</b>	10 s
<b>Minimum duration between braking procedures</b>	5 min
<b>Degree of protection</b>	IP 20
<b>Weight</b>	4.6 lb ( $\cong$ 2.1 kg.)

**Adapter Module**

In modular regenerative inverter systems an additional power supply unit may be come necessary if you are using inverter or motors with a high power demand. The adapter module gives you the possibility of connecting this power supply unit to the present inverter system. In this way one power supply unit can, for example, supply the power to a high-performance spindle and the pother power supply unit can used for the axes.

The two power supply units are coupled via the supply bus (X69a/X69b – X69) and in this way integrated in the system monitoring.

This results in two separate supply systems whose power modules operate independently of each other, but are also monitored by the control.

Refer to **Table 2-23**.

**Table 2-23, Adapter Module Specifications**

<b>Specifications</b>	<b>Adapter Module</b>
<b>ANILAM P/N</b>	647528-01
<b>Weight</b>	≅ 6.6 lb (3 kg.)



## Section 3 - Selecting Motors and Inverters

The following topics are described in this section:

- ❑ **Selecting an Axis Motor**
- ❑ **Selecting a Spindle Motor**
- ❑ **Selecting an Inverter**
- ❑ **Selection of the Braking Resistor**

### Selecting an Axis Motor

To select the appropriate axis motor and inverter for your needs, you will need to do some calculations. Refer to **Table 3-1, Calculation Data for Selecting Axis Motors and Inverters**.

- ❑ **Calculate the static moment from the sum of:**
  - Frictional moment (with horizontal axes)
  - Moment for overcoming the force of gravity (for vertical axis)
  - Machining moment
- ❑ **Calculate the desired speed of the motor:**
- ❑ **Select the motor that meets the following requirements:**
  - Stall torque of the motor  $\geq$  static moment
  - Rated speed of the motor  $\geq$  desired speed
- ❑ **Select the inverter that meets the following requirement:**
  - Rated current of the inverter  $\geq$  continuous stall current of the motor
- ❑ **Calculate 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
- ❑ **Calculate the total moment of inertia from the following variables:**
  - External moment of inertia
  - Moment of inertia of the motor
- ❑ **Check the ratio of external moment of inertia to the moment of inertia of the motor.**
- ❑ **Calculate the acceleration moment.**
- ❑ **Compare the acceleration moment with the following variables:**
  - Maximum moment of the inverter
  - Maximum moment of the motor

- Calculate the effective moment at a given load cycle.
- Compare the effective moment at a given load cycle with the rated torque of the motor.

**Table 3-1, Calculation Data for Selecting Axis Motors and Inverters**

Parameter	Formula	Variables
<b>Frictional moment</b> $M_{frict}$	$M_{frict} = \frac{m \cdot g \cdot \mu \cdot h \cdot \cos \alpha}{2 \cdot \pi \cdot i \cdot \eta}$	<b>m:</b> Mass [kg] <b>g:</b> Acceleration of gravity [m/s <sup>2</sup> ] <b>μ:</b> Coefficient of friction [-] <b>h:</b> Ballscrew pitch [m] <b>α:</b> Axis angle [°] (0°=horizontal axis) <b>i:</b> Gear ratio [-] ( $n_{motor} / n_{ballscrew}$ ) <b>η:</b> Efficiency [-]
<b>Moment of overcoming the force of gravity</b> $M_{wz}$	$M_{wz} = \frac{m \cdot g \cdot h \cdot \sin \alpha}{2 \cdot \pi \cdot i \cdot \eta}$	<b>m:</b> Mass [kg] <b>g:</b> Acceleration of gravity [m/s <sup>2</sup> ] <b>h:</b> Ballscrew pitch [m] <b>α:</b> Axis angle [°] (90°=vertical axis) <b>i:</b> Gear ratio [-] ( $n_{motor} / n_{ballscrew}$ ) <b>η:</b> Efficiency [-]
<b>Machining moment</b> $M_{mach}$	$M_{mach} = \frac{F_{mach} \cdot h}{2 \cdot \pi \cdot i \cdot \eta}$	<b>F<sub>mach</sub>:</b> Machining force [N] <b>h:</b> Ballscrew pitch [m] <b>i:</b> Gear ratio [-] ( $n_{motor} / n_{ballscrew}$ ) <b>η:</b> Efficiency [-]
<b>Static moment</b> $M_{Stat}$	$M_{Stat} = M_{frict} + M_{wz} + M_{mach}$	<b>M<sub>frict</sub>:</b> Frictional moment [Nm] <b>M<sub>wz</sub>:</b> Moment for overcoming the force of gravity [Nm] <b>M<sub>mach</sub>:</b> Machining moment [Nm]
<b>Rated motor speed</b> $n_{Noml}$	$n_{Noml} = \frac{v_{max} \cdot i}{h}$	<b>v<sub>max</sub>:</b> Rapid traverse [m/min] <b>i:</b> Gear ratio [-] ( $n_{motor} / n_{ballscrew}$ ) <b>h:</b> Ballscrew pitch [m]
<b>Motor selection</b>	$M_{0Motor} \geq M_{Stat}$ $n_{NMotor} \geq n_{Noml}$	<b>M<sub>0Motor</sub>:</b> Stall torque of the motor <b>M<sub>Stat</sub>:</b> Static moment <b>n<sub>NMotor</sub>:</b> Rated speed of the motor <b>n<sub>Noml</sub>:</b> Desired speed of the motor
<b>Modular Amplifier: Selection of the power module Compact Inverter: Selection of the axis unit</b>	$I_{NInverter} \geq I_{0Motor}$	<b>I<sub>NInverter</sub>:</b> Rated current of the inverter <b>I<sub>0Motor</sub>:</b> Continuous stall current of the motor

(Continued...)

**Table 3-1, Calculation Data for Selecting Axis Motors and Inverters (Continued)**

Parameter	Formula	Variables
<b>Moment of inertia of the table</b> <b>J<sub>T</sub></b>	$J_T = m \cdot \left( \frac{h}{2 \cdot \pi} \right)^2$	<b>m:</b> Table mass [kg] <b>h:</b> Ballscrew pitch [m]
<b>Moment of inertia of the ballscrew</b> <b>J<sub>S</sub></b>	$J_S = \frac{d_s^4 \cdot \pi \cdot l \cdot \rho}{32}$	<b>d<sub>s</sub>:</b> Diameter of the ballscrew [m] <b>l:</b> Length of the ballscrew [m] <b>ρ:</b> Density of the ballscrew material [kg/m <sup>3</sup> ]
<b>Moment of inertia of the gearwheel on the ballscrew</b> <b>J<sub>GS</sub></b>	$J_{GS} = \frac{d_{GS}^4 \cdot \pi \cdot l \cdot \rho}{32}$	<b>d<sub>GS</sub>:</b> Diameter of the gearwheel on the ballscrew [m] <b>l:</b> Length of the gearwheel on the spindle [m] <b>ρ:</b> Density of the gearwheel material [kg/m <sup>3</sup> ]
<b>Moment of inertia of the gearwheel on the motor</b> <b>J<sub>GM</sub></b>	$J_{GM} = \frac{d_{GM}^4 \cdot \pi \cdot l \cdot \rho}{32}$	<b>d<sub>GM</sub>:</b> Diameter of the gearwheel on the ballscrew [m] <b>l:</b> Length of the gearwheel on the spindle [m] <b>ρ:</b> Density of the gearwheel material [kg/m <sup>3</sup> ]
<b>External moment of inertia</b> <b>J<sub>ext</sub></b>	$J_{ext} = \frac{J_T + J_S + J_{GS}}{i^2} + J_{GM}$	<b>J<sub>T</sub>:</b> Moment of inertia of the table [kgm <sup>2</sup> ] <b>J<sub>S</sub>:</b> Moment of inertia of the ballscrew [kgm <sup>2</sup> ] <b>J<sub>GS</sub>:</b> Moment of inertia of the gearwheel on the ballscrew [kgm <sup>2</sup> ] <b>i:</b> Gear ratio (n <sub>motor</sub> / n <sub>ballscrew</sub> ) <b>J<sub>GM</sub>:</b> Moment of inertia of the gearwheel on the motor [kgm <sup>2</sup> ]
<b>Total moment of inertia of the machine slide with motor</b> <b>J<sub>total</sub></b>	$J_{total} = \frac{J_T + J_S + J_{GS}}{i^2} + J_{GM} + J_M$	<b>J<sub>T</sub>:</b> Moment of inertia of the table [kgm <sup>2</sup> ] <b>J<sub>S</sub>:</b> Moment of inertia of the ballscrew [kgm <sup>2</sup> ] <b>J<sub>GS</sub>:</b> Moment of inertia of the gearwheel on the ballscrew [kgm <sup>2</sup> ] <b>i:</b> Gear ratio (n <sub>motor</sub> / n <sub>ballscrew</sub> ) <b>J<sub>GM</sub>:</b> Moment of inertia of the gearwheel on the motor [kgm <sup>2</sup> ] <b>J<sub>M</sub>:</b> Moment of inertia of the motor [kgm <sup>2</sup> ]

(Continued...)

**Table 3-1, Calculation Data for Selecting Axis Motors and Inverters (Continued)**

Parameter	Formula	Variables
Ratio of external moment of inertia to the moment of inertia of the motor	$0.5 \leq \frac{J_F}{J_M} \leq 2$	<p><b>J<sub>F</sub></b>: External moment of inertia [kgm<sup>2</sup>]  <b>J<sub>M</sub></b>: Moment of inertia of the motor [kgm<sup>2</sup>]  <b>This ratio ensures a stable control response.</b></p>
Acceleration moment <b>M<sub>acc</sub></b>	$M_{acc} = \frac{J_{total} \cdot 2 \cdot \pi \cdot n_M}{60 \cdot \eta \cdot t_{acc}}$	<p><b>J<sub>total</sub></b>: Total moment of inertia [kgm<sup>2</sup>]  <b>n<sub>M</sub></b>: Desired speed of the motor [min<sup>-1</sup>]  <b>η</b>: Efficiency of the motor [-]  <b>t<sub>acc</sub></b>: Desired acceleration time [s]</p>
Maximum moment of the motor <b>M<sub>Mmax</sub></b>	<p><b>M<sub>Mmax</sub></b> from data sheet, or:  <b>M<sub>Mmax</sub></b> = 3 · M<sub>0</sub></p>	<p><b>M<sub>0</sub></b>: Stall torque of the motor [Nm]</p>
Maximum moment of the inverter <b>M<sub>Umax</sub></b>	<p><math display="block">M_{Umax} = \frac{M_{Mmax}}{I_{Mmax}} \cdot I_{Umax}</math></p> <p>– or –</p> <p><math display="block">M_{Umax} = 0.8 \cdot \frac{M_{MN}}{I_{MN}} \cdot I_{Umax}</math></p>	<p><b>M<sub>Mmax</sub></b>: Maximum moment of the motors [Nm]  <b>I<sub>Mmax</sub></b>: Maximum current of the motor [A]  <b>I<sub>Umax</sub></b>: Maximum current of the inverter [A]  <b>M<sub>MN</sub></b>: Rated torque of the motor [Nm]  <b>I<sub>MN</sub></b>: Rated current of the motor [A]</p>
Comparison of the acceleration moment with the maximum moment of the motor and inverter	<p><b>M<sub>Mmax</sub></b> &gt; <b>M<sub>acc</sub></b>  <b>M<sub>Umax</sub></b> &gt; <b>M<sub>acc</sub></b></p>	<p><b>M<sub>Mmax</sub></b>: Maximum moment of the motors [Nm]  <b>M<sub>acc</sub></b>: Acceleration moment [Nm]  <b>M<sub>Umax</sub></b>: Maximum moment of the inverter [Nm]</p>
Weighting factors	<p><math display="block">K_{mach} = \frac{t_{mach}}{t_{total}}</math></p> <p><math display="block">K_{pos} = \frac{t_{pos}}{t_{total}}</math></p> <p><math display="block">K_{acc} = \frac{t_{acc}}{t_{total}}</math></p> <p><b>NOTE:</b>  <b>K<sub>mach</sub></b> + <b>K<sub>pos</sub></b> + <b>K<sub>acc</sub></b> = 1</p>	<p><b>t<sub>mach</sub></b>: Machining time  <b>t<sub>total</sub></b>: Total running time  <b>t<sub>pos</sub></b>: Time for positioning operations  <b>t<sub>acc</sub></b>: Time for acceleration  <b>All times must be given in the same unit of measure.</b></p>

(Continued...)



**Table 3-1, Calculation Data for Selecting Axis Motors and Inverters (Continued)**

Parameter	Formula	Variables
<b>Effective moment at a given load cycle</b>	<b>M<sub>Stat</sub>:</b> Static moment [Nm] <b>K<sub>mach</sub>:</b> Weighting factor for machining operations [-] <b>M<sub>frict</sub>:</b> Frictional moment [Nm] <b>M<sub>wz</sub>:</b> Moment for overcoming the force of gravity [Nm] <b>K<sub>Pos</sub>:</b> Weighting factor for positioning operations [-] <b>M<sub>acc</sub>:</b> Acceleration moment [Nm] <b>K<sub>acc</sub>:</b> Weighting factor for acceleration operations [-]	
$M_{eff} = \sqrt{(M_{Stat})^2 \cdot K_{mach} + (M_{frict} + M_{wz})^2 \cdot K_{pos} + (M_{frict} + M_{wz} + M_{acc})^2 \cdot K_{acc}}$		
<b>Comparison of the effective moment at a given load cycle with the rated motor torque.</b>	$M_{MN} \geq M_{eff}$	<b>M<sub>MN</sub>:</b> Rated torque of the motor (Nm) <b>M<sub>eff</sub>:</b> Effective moment at a given load cycle (Nm)

### Selecting a Spindle Motor

Select a spindle motor based on torque and speed requirements.

### Selecting an Inverter

#### Modular Amplifier

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 required and the current requirements determine which inverter is appropriate. It has not yet been determined whether the DC-link power of the compact inverter is sufficient. Refer to **Table 3-2**.

**Table 3-2, Calculation Data for Selecting Inverters**

Parameter	Formula	Variable
<b>DC-link power</b> $P_{DC}$	$P_{DC} = \frac{P_{NScr}}{\eta_{Scr}} + \frac{\sum P_{NAx}}{\eta_{Ax}} \cdot F_{Mratio}$	<b><math>P_{NScr}</math>:</b> Power rating of the spindle motor [W] <b><math>\eta_{Scr}</math>:</b> Efficiency of the spindle motor [-] $\sum P_{NAx}$ Sum of the power ratings of the feed motors [W] <b><math>\eta_{Ax}</math>:</b> Efficiency of the feed motors [-], unless indicated otherwise $\eta_{Ax}=1$ <b><math>F_{Mratio}</math>:</b> Ratio of mean power to rated power of the feed motors.
<b>Selection of power supply unit or examination of the compact inverter</b>	$P_{DC} \leq P_{NU}$	<b><math>P_{DC}</math>:</b> DC-link power [W] <b><math>P_{NU}</math>:</b> Rated power of the power supply unit or the compact inverter [W]

## Selection of the Braking Resistor

The following topics are described:

- ❑ Introduction
- ❑ Mean Value of Braking Performance Example
- ❑ BR 18 Braking Resistor Example
- ❑ BR 10F Braking Resistor Example
- ❑ BR 18 F Braking Resistor Example

### Introduction

To select the appropriate braking resistor for your system, you will need to do some calculations. Refer to **Table 3-3, Calculation Data for Selecting Braking Resistor**.

- 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

**Table 3-3, Calculation Data for Selecting Braking Resistor**

Parameter	Formula	Variable
<b>Braking power</b> $P_{Br}$	$P_{Br} = \frac{2 * \pi * M_{Br} * n_{max}}{60}$	<b>M<sub>Br</sub></b> : Braking moment [N <sub>M</sub> ] <b>n<sub>max</sub></b> : Maximum speed at which braking occurs [rpm]
<b>Braking energy</b> $E_{Br}$	$E_{Br} = 2 * J * \pi^2 * \left[ \left( \frac{n_2}{60} \right)^2 - \left( \frac{n_1}{60} \right)^2 \right]$	<b>J</b> : Moment of inertia, including the motor [kgm <sup>2</sup> ] <b>n<sub>2</sub></b> : Desired speed of the brakes [rpm] <b>n<sub>1</sub></b> : Desired speed after braking [rpm]
<b>Mean value of the braking power with a specified alternation of load</b> $P_M$	$P_M = P_{Br} * \frac{t_1}{T}$	<b>P<sub>Br</sub></b> : Braking power [W] <b>t<sub>1</sub></b> : Load time [s] <b>T</b> : Cycle duration [s]
<b>Selection of braking resistor</b>	$P_{BR} \leq P_{max}$ $P_M \leq P_{Mzul}$ $E_{Br} \leq E_{max}$	<b>P<sub>BR</sub></b> : Braking power [W] <b>P<sub>max</sub></b> : Peak performance of the braking resistor [W] <b>P<sub>Mzul</sub></b> : Permissible mean value of the braking performance according to the diagram as a function of E <sub>Br</sub> [W] (see example on page 3-11) <b>E<sub>max</sub></b> : Maximum braking energy of the braking resistor [W <sub>s</sub> ]

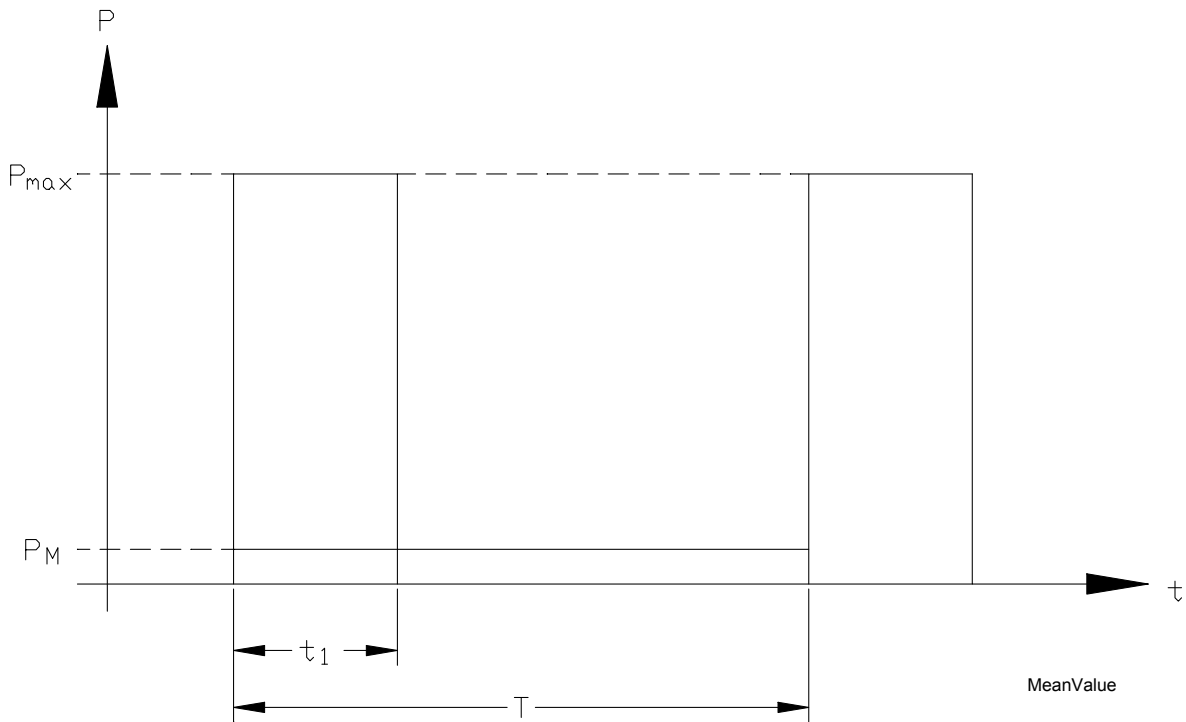
**Mean Value of Braking Performance Example**

See **Figure 3-1**, for an illustration of a braking system with load time  $t_1$  and cycle duration  $T$ .

$P_M$  is the mean value of the braking performance in this load alternation.

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

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



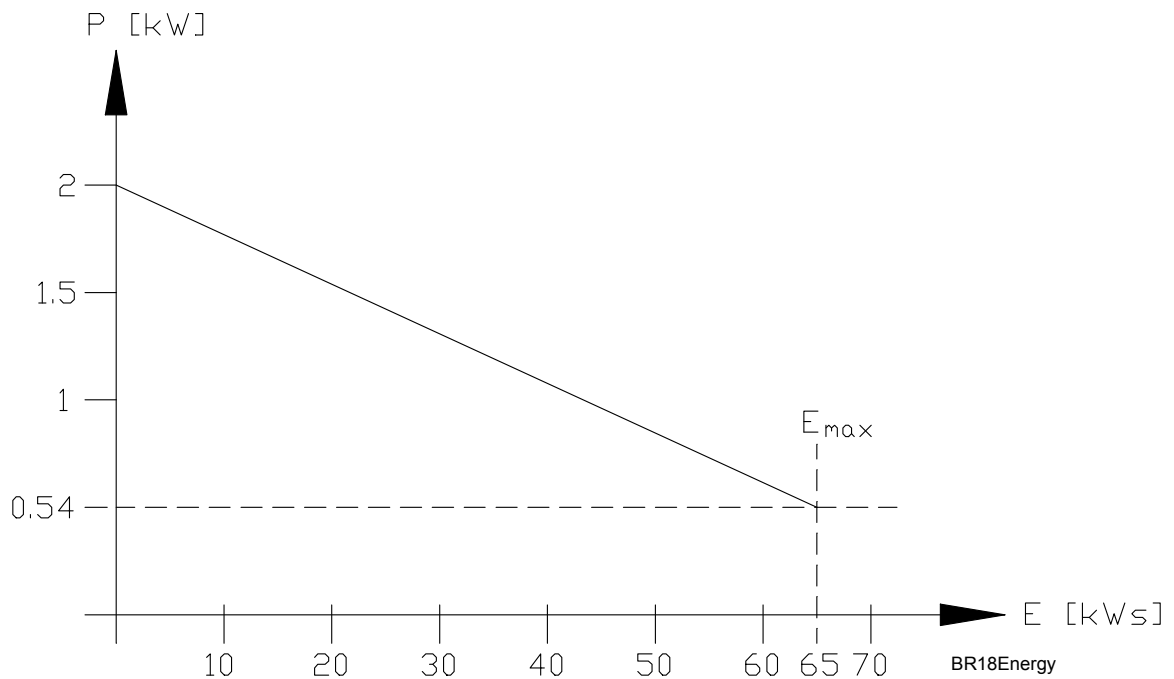
**Figure 3-1, Mean Value of Braking Performance Example**

### BR 18 Braking Resistor Example

Permissible mean value of the braking performance  $P_{Mzul}$  as a function of the braking energy  $E$ . Refer to **Table 3-4** and **Figure 3-2**.

**Table 3-4, BR 18 - Data for Mean Value Braking Performance**

$t_1$	T	Pmax	E <sub>max</sub>
<b>0.37 s</b>	5 s	27 kW	10 kW <sub>s</sub>
<b>0.7 s</b>	10 s	27 kW	18.9 kW <sub>s</sub>
<b>1.1 s</b>	20 s	27 kW	29.7 kW <sub>s</sub>
<b>1.5 s</b>	50 s	27 kW	40.5 kW <sub>s</sub>
<b>2.4 s</b>	120 s	27 kW	65 kW <sub>s</sub>



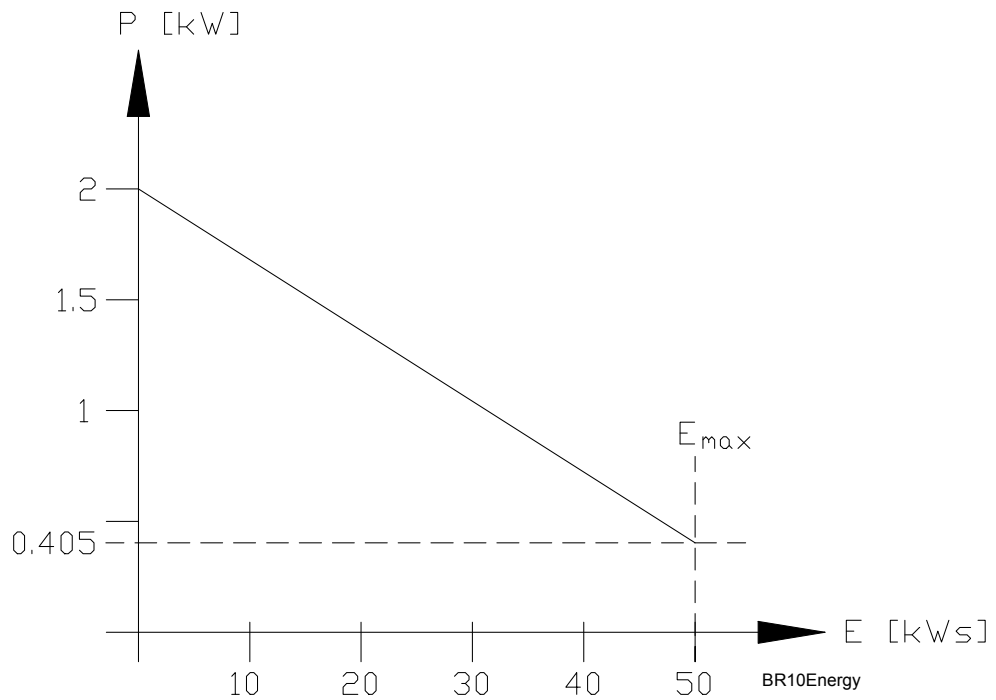
**Figure 3-2, BR 18 - Braking Performance Function of Braking Energy**

**BR 10F Braking Resistor Example**

Permissible mean value of the braking performance  $P_{Mzul}$  as a function of the braking energy  $E$ . Refer to **Table 3-5** and **Figure 3-3**.

**Table 3-5, BR 10F - Data for Mean Value Braking Performance**

$t_1$	T	$P_{max}$	$E_{max}$
<b>0.37 s</b>	5 s	27 kW	10 kW <sub>s</sub>
<b>0.6 s</b>	10 s	27 kW	16.2 kW <sub>s</sub>
<b>0.9 s</b>	20 s	27 kW	24.3 kW <sub>s</sub>
<b>1.3 s</b>	50 s	27 kW	35.1 kW <sub>s</sub>
<b>1.8 s</b>	120 s	27 kW	50 kW <sub>s</sub>



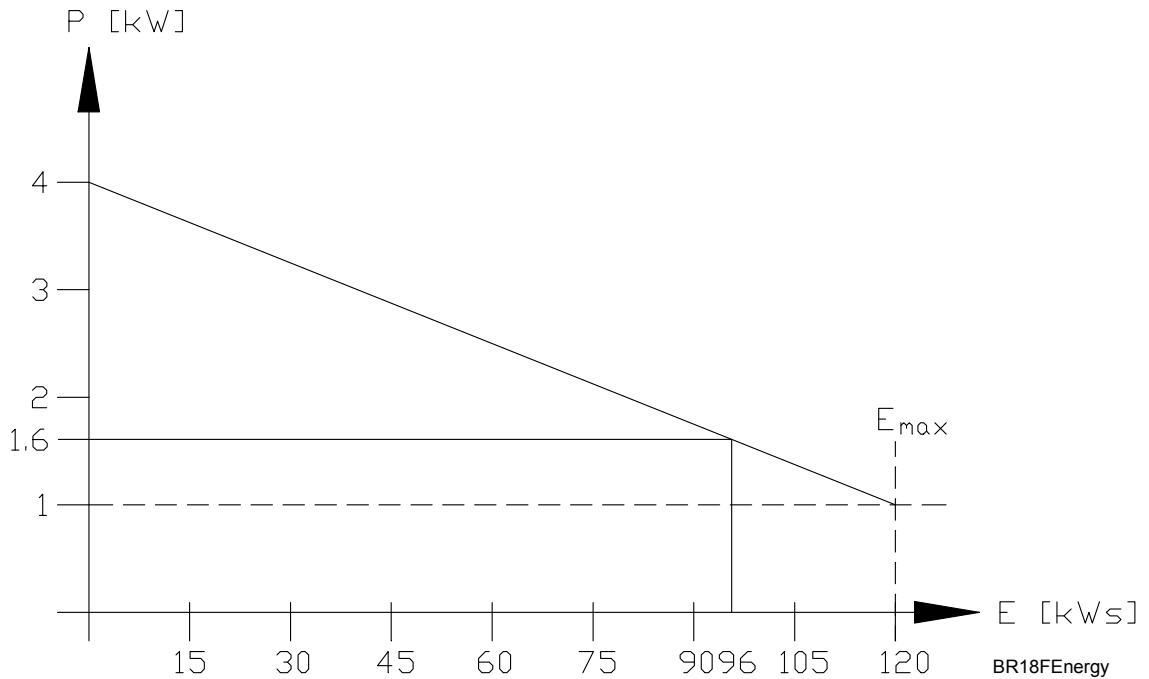
**Figure 3-3, BR 10F - Braking Performance Function of Braking Energy**

### BR 18F Braking Resistor Example

Permissible mean value of the braking performance  $P_{Mzul}$  as a function of the braking energy  $E$ . Refer to **Table 3-6** and **Figure 3-4**.

**Table 3-6, BR 18F - Data for Mean Value Braking Performance**

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



**Figure 3-4, BR 18F - Braking Performance Function of Braking Energy**

**Example:**

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



## Section 4 - Mounting and Operating Conditions

The following topics are described in this section:

- ❑ **General Information**
- ❑ **Electromagnetic Compatibility**
- ❑ **Leakage Current from the Inverter Housing to the Grounding Connection**
- ❑ **Environmental Conditions**
- ❑ **Installation Guidelines**
- ❑ **Connection Overviews**

### General Information

The following topics are described:

- ❑ **Trained Personnel**
- ❑ **Meaning of the Note Descriptions**
- ❑ **General Safety Precautions**
- ❑ **General Electrical Protective Measures**
- ❑ **Intended Area of Application**
- ❑ **Degree of Protection (IP Code)**
- ❑ **Fault-Current Circuit Breaker**
- ❑ **Overvoltage Protector**
- ❑ **Cross Sections of the Power Cables**

<p><b>WARNING:</b> Before mounting the inverter and making electrical connections, consider: local regulations concerning power installation, interference and noise immunity, environmental conditions, and mounting orientation of the unit (thermal considerations, accessibility, safety, and so forth).</p>
--

### Trained Personnel

In this document, “trained personnel” means persons who are familiar with the installation, mounting, commissioning, and operation of ANILAM inverter systems and motors. Furthermore, electrical engineering work on the system may be carried out only by trained electrical engineering technicians or persons trained specifically for the respective application.

Basically, persons who perform work on ANILAM inverter systems and motors must meet the following requirements:

- They must have been trained or instructed regarding the standards for safety engineering.
- They must be familiar with the use of appropriate safety equipment (gear, measuring systems).
- They should be skilled in first aid practice.

### Meaning of the Note Descriptions

The Note boxes have the following descriptions:

- |                |   |
|----------------|---|
| <b>Danger</b>  | Failure to comply with this information could result in serious up to fatal injuries or in substantial material damage. |
| <b>Warning</b> | Failure to comply with this information could result in injuries and interruptions of operation up to material damage.  |
| <b>Note</b>    | Tips and important information about standards and regulations as well as for better understanding of the document.     |

### General Safety Precautions

The inverter systems from ANILAM comply with the safety regulations for the electrical equipment of machines in accordance with EN 60204.

#### **Danger:**

- **During the operation of electrical equipment certain parts can inevitably be under power.**
- **Work on ANILAM inverter systems and motors may be performed only by trained personnel or personnel familiar with the equipment.**
- **The personnel must be familiar with the *Inverter Systems and Motors for 6000i* and must keep the document well visible and easily accessible.**
- **The personnel must be familiar with the safety precautions and warning in the *Inverter Systems and Motors for 6000i*.**
- **The reliable and safe operation for ANILAM inverter systems requires proper transport as well as professional mounting, installation, and commissioning. Furthermore, careful maintenance and professional servicing of the ANILAM components must be ensured.**
- **ANILAM warns that the motors operated by inverter systems may cause hazardous movements of the machine axes.**

## General Electrical Protective Measures

**Danger:**

- With ANILAM inverter systems, the leakage current (current at the equipment grounding conductor) is sometimes higher than 3.5 mA.
- The equipment grounding conductor must therefore have a cross section of at least 10 mm<sup>2</sup> according to EN 50178.

**Warning:** ANILAM performs a voltage test according to EN 60204 on the inverters. If you want to perform this test on the entire system, you must disconnect the power connection of the ANILAM inverter system in order to prevent damage.

## 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 appropriate measures are taken.

### Degree of Protection (IP Code)

The IP Code number indicates the amount of protection afforded by the housing against penetration of solid foreign bodies and/or water. The first digit of this two-digit number indicates the degree of protection afforded by the housing against penetration of solid foreign bodies. The second number indicates the degree of protection against water. For example, an IP code of 20 refers to a chassis that protects against (2) particles  $\geq 12.5$  mm (0.48 in), and provides no protection (0) from water intrusion. Refer to **Table 4-1** and **Table 4-2**.

**Table 4-1, IP Code Explanation**

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	$\geq 50.0$ mm (2 in)	1	Perpendicular droplets
2	$\geq 12.5$ mm (0.48 in)	2	Droplets at 15° angle
3	$\geq 2.5$ mm (0.09 in)	3	Spraying water
4	$\geq 1$ mm (0.04 in)	4	Splashing water
5	Dust protected	5	Flowing water
6	Dustproof	6	Heavily flowing water
		7	Temporary submersion
		8	Continuous submersion

**Table 4-2, Inverter Component IP Ratings**

Component	IP Rating
SA Series inverter	IP 20
PS amplifier power supply	IP 20
PM amplifier power modules	IP 20
BR Series braking resistors	IP 20
CR commutating reactors	IP 20
LF line filter	IP 20
SM Series spindle motors	IP 54
AM Series axis motors	IP 65 (shaft bore: IP 64)

### Fault-Current Circuit Breaker

For TT and IT networks, power supply companies require that the inverters be connected via fault-current circuit breakers or isolating transformers. 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  $I_N = 63A$ . This is enough for the compact inverters and modular amplifiers with PS 130 power supply units. If the PS 145R power supply unit is used at full capacity, the 63 A of the fault-current circuit breaker is exceeded (65A); in this case, an isolation transformer must be used. Refer to **Figure 4-1**.

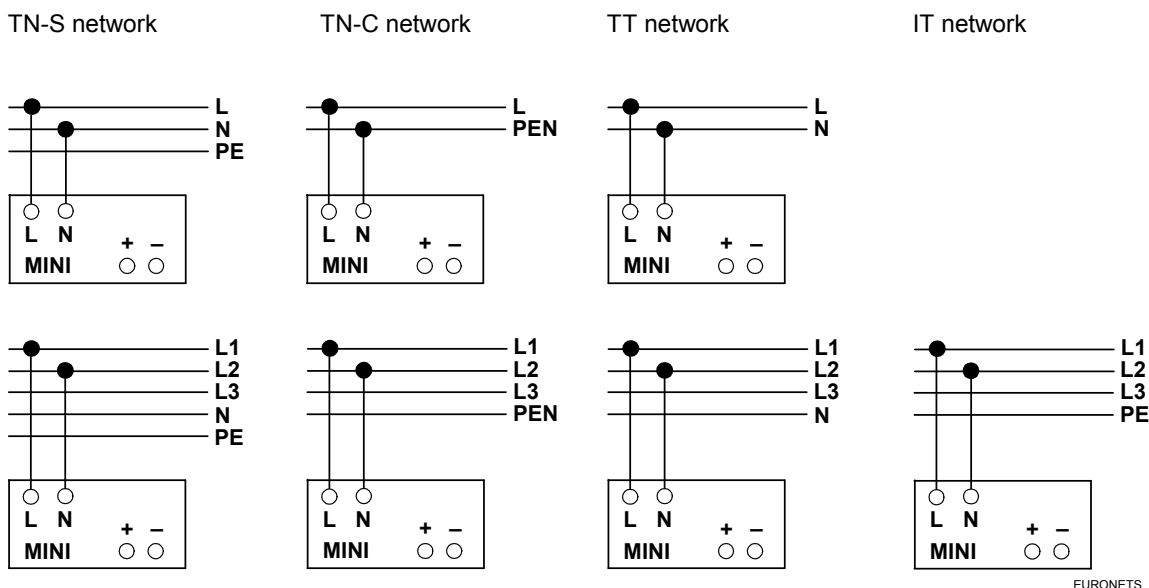
For TN networks, ANILAM recommends connecting the inverter/amplifier without the fault-current circuit breaker. Ensure that the grounding conductor has a large enough cross section. Refer to **Table 4-3**. Refer to **Figure 4-1**.

**Table 4-3, Power Supply Isolation Transformer**

Power Supply Unit	Rated Power Output of the Isolation Transformer	Short-Circuit Voltage
PS 145R	$S_N \geq 58.3 \text{ kVA}$	$U_K \leq 3 \%$

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

### Connection of Various Types of European Networks: 100 - 240 V AC networks



**Figure 4-1, European Network Connections**

### Adjusting the Line Voltage by Means of a Transformer

In case no line power with 400 VAC  $\pm$  10 % is available, an autotransformer may be used for adjusting the line voltage. See **Table 4-4**.

**Table 4-4, Autotransformer Power Output**

Device	Rated Power Output of the Autotransformer
SA 301E <sup>**1</sup> , SA 411E <sup>**1</sup>	$S_N \geq 15.0 \text{ Kva}$
SA 301A, SA 311A, SA 411A	$S_N \geq 22.5 \text{ Kva}$
SA 201A, SA 301C, SA 411C	$S_N \geq 33.0 \text{ Kva}$
RA 201A, RA 301C, SA 411C, PS 122R	$S_N \geq 28.6 \text{ kVA}$
PS 130	$S_N \geq 45.0 \text{ kVA}$
PS 145R	$S_N \geq 58.5 \text{ kVA}$

<sup>\*\*1</sup> The inverters can be operated up to a line voltage of 480 VAC  $\pm$  10 %.

### Overvoltage Protector

It may become necessary to insert an overvoltage protector in the supply voltage path (preferable in front of the line filter) in order to protect the inverters against overvoltage from the power line and against the resulting overvoltage. For information about the connection, see "Connection Overviews."

ANILAM recommends using an overvoltage protector which limits the voltage peaks from the power line to 2500 V.

Modules such as FLT-CP-3C-350 from the company Phoenix Contact, are available for this purpose.

**NOTE:** If a machine is required to comply with UL requirements, an overvoltage protector (such as mentioned above) **must** be inserted.

**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 value must be corrected with two factors:

- Correction factor  $C_1$  for increased ambient air temperature
  - $C_1 = 0.91$  for +45 °C (113 °F)
  - $C_1 = 0.81$  for +50 °C (122 °F)
  - $C_1 = 0.71$  for +55 °C (133 °F)
- Correction factor  $C_2 = 1.13$  for insulation material with increased operating temperature.

The following tables are valid for:

- An ambient air temperature of +40° C (104 °F)
- An operational temperature of +90 °C (194 °F) (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 type C and E  
Cables and leads on walls and on open cable racks.

Refer to **Table 4-5** and **Table 4-6**.

**Table 4-5, Cable Cross Section Current Load Specifications Installation Type B1**

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 Ölfex-Servo-FD 795 P
1.0 mm <sup>2</sup>	10.4 A	11.7 A	10.8 A
1.5 mm <sup>2</sup>	13.5 A	15.2 A	13.8 A
2.5 mm <sup>2</sup>	18.3 A	20.6 A	18.6 A
4.0 mm <sup>2</sup>	25.0 A	28.2 A	26.0 A
6.0 mm <sup>2</sup>	32.0 A	36.1 A	32.8 A
10.0 mm <sup>2</sup>	44.0 A	49.7 A	45.2 A
16.0 mm <sup>2</sup>	60.0 A	67.8 A	59.9 A
25.0 mm <sup>2</sup>	77.0 A	87.0 A	75.7 A
35.0 mm <sup>2</sup>	97.0 A	109.6 A	93.8 A

**Table 4-6, Cable Cross Section Current Load Specifications Installation Type C and E**

Cable Cross Section	Permissible Current Load with Installation Type C and E		
	Single Conductor Standard PVC	Single Conductor H07 V2-K	Cable Lapp Ölfex-Servo-FD 795 P
35.0 mm <sup>2</sup>	104.0 A	117.5 A	117.5 A
50.0 mm <sup>2</sup>	123.0 A	139.0 A	139.0 A
70.0 mm <sup>2</sup>	155.0 A	175.1 A	175.1 A
95.0 mm <sup>2</sup>	192.0 A	217.0 A	217.0 A
120.0 mm <sup>2</sup>	221.0 A	249.7 A	249.7 A

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

**Example:**

H07 V2-K single conductor with a cross section of 16 mm<sup>2</sup> and installation type B2 at an ambient temperature of + 50 °C (122 °F):

Permissible current load at 40 °C (according to table): 67.8 A  
 Correction factor for ambient temperature of + 50 °C (122 °F): 0.82

Permissible current load (+ 50 °C) = (C1) x (permissible current load [+40 °C (104 °F)])

Permissible current load (+ 50 °C) = (0.82) x (67.8 A) = 55.6 A



## **Electromagnetic Compatibility**

The following topics are described:

- ❑ **Valid Regulations**
- ❑ **Likely Sources of Interference**
- ❑ **Power Supply Stability Requirements**
- ❑ **CE Marking**
- ❑ **Interference and Noise Immunity**
- ❑ **Noise Immunity**
- ❑ **Protective Measures**

### **Valid Regulations**

The inverter systems and motors comply with the following standards based on European Community Electromagnetic Compatibility (EMC) directive No. 89/336/EWG:

- Power line disturbance and radio interference suppression Class A according to EN 55022
- Power line disturbance and radio interference suppression Class A according to EN 55011
- Radio interference and immunity to interference according to EN 61800-3

The inverter systems and motors are intended for operation in industrially zoned areas.

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

### **Likely Sources of Interference**

Interference 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

### Power Supply Stability Requirements

Since the regenerative power supply units from ANILAM use sine commutation, there is no interference in the frequency range up to 2.5 kHz. This results in the following recommended values for the required power supply stability. Refer to **Table 4-7**.

**Table 4-7, Power Supply Stability Requirement**

Regenerative Power Supply Unit	Minimum Short-Circuit Current <sup>**1</sup>	Minimum Short-Circuit Power
PS 122R	$I_{SC} = 50 * I_N = 1600 \text{ A}$	$S_K = 1.10 \text{ MVA}$
PS 145R	$I_{SC} = 50 * I_N = 3300 \text{ A}$	$S_K = 2.15 \text{ MVA}$

<sup>\*\*1</sup> This value applies only in conjunction with ANILAM three-phase capacitors.

### CE Marking

Machine tool builders, system, and plant constructors are responsible for EMC compliance. Systems, machines, and complete drives with frequency inverters must therefore bear the CE mark. The ANILAM components all bear the CE mark.

### Interference and Noise Immunity

The fast switching processes and high coupling capacitance of variable-speed three-phase motors with frequency inverters result in substantial interference to ground. This interference is not only spread along the lines, but is also radiated and must therefore be suppressed by taking adequate measures.

The following topics are described:

- Conducted Interference**
- Radiated Interference**

#### Conducted Interference

Conducted interference includes both high-frequency interference from the PWM (pulse width modulation) operation of the inverter system and power line disturbance due to non-sinusoidal current drain (not with ANILAM inverter systems) from the power line (for example, through commutation notches in the power rectifier). This type of interference is spread mainly through the power line. Appropriate protective measures must therefore be taken. See "Protective Measures."

### **Radiated Interference**

Radiated interference is high-frequency interference spreading in the form of electromagnetic waves. They are primarily radiated from the motor cable, but also from the inverter housing as well as from the motor itself. These waves are taken up by electric leads and their connecting leads and then fed back into the power line as interference current. Appropriate protective measures must therefore be taken. See “Protective Measures.”

### **Noise Immunity**

External electromagnetic influences must not affect the functioning and operational reliability of the inverter systems. These also include conducted interference that affects the power input and radiated interference that may be caused by the inverter itself (self-induced interference). Appropriate protective measures must therefore be taken. See “Protective Measures.”

### **Protective Measures**

The following topics are described:

- ❑ **General**
- ❑ **Compact Inverters (Modular Amplifiers): SA 301E, SA 411E, SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C**
- ❑ **Regenerative Inverter Systems: RA 201A, RA 301C, RA 411C**
- ❑ **Motors**

#### **General**

- Keep a minimum distance of 20 cm (8 in) from the CNC chassis and its leads to interfering equipment.
- A minimum distance of 10 cm (4 in) from the CNC chassis and its leads to cables that carry interfering signals. For cables in metallic ducting, adequate decoupling can be achieved by using a grounded separation shield.
- Shielding according to IEC 742 and EN 50 178.
- Use potential compensating lines with a minimum cross section of 10 mm<sup>2</sup>.
- Use genuine ANILAM cables, connectors, and couplings.
- Use ANILAM covers for the ribbon cables between the inverter units in modular inverter systems.

**Compact Inverters (Modular Amplifiers): SA 301E, SA 411E, SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C**

- Integration of toroidal cores in the motor leads (X80 to X84).
- Integration of one toroidal core in the voltage supply lead (X31).

These measures serve to suppress conducted interference (power line disturbance according the EN 55011 / 55022 Class A). The toroidal cores are included in the items supplied with the compact inverters.

**Regenerative Inverter Systems: RA 201A, RA 301C, RA 411C**

- A suitable ANILAM commutating reactor must be used.
- A LF line filter from ANILAM must be used.
- We recommend that you use an ANILAM three-phase capacitor to ensure additional interference suppression if you are using a line filter.

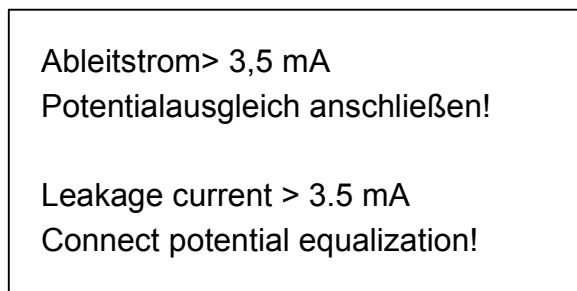
<p><b>NOTE:</b> High-frequency disturbances in the power line may occur with other commutating reactors or line filters.</p>
--

**Motors**

- If the described EMC protective measures are taken, the ANILAM motors can be operated with cable lengths up to 15 m. (49.2 ft.) If greater cable lengths are required, additional measures for interference suppression must be taken.
- The shield of the line for the holding brake is to be kept as close as possible (< 30 mm [1.18 in.]) to ground. The best solution is to fasten the shield with a metal clamp directly onto the sheet metal housing of the electrical cabinet.

## Leakage Current from the Inverter Housing to the Grounding Connection

ANILAM inverters are electronic equipment with a leakage current greater than 3.5 mA (from the housing to the ground). Therefore, a sticker with the following warning is on all inverter components. See **Figure 4-2**.



**Figure 4-2, Leakage Current Warning Label**

**Danger:** 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  $(\geq) \varnothing 10 \text{ mm}^2$ .
- **Power connection with connector:**  
A second grounding conductor with a line cross section greater than half that of a line conductor, but at least  $(\geq) \varnothing 10 \text{ mm}^2$ , along with the grounding conductor of the connector, must be firmly grounded.

This means that, in both cases, a clamped grounding connection must be installed.

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

**NOTE:** ANILAM recommends placing a sign on the outside of the electrical cabinet with a warning and a connection recommendation for the grounding conductor.

### Environmental Conditions

The following topics are described:

- ❑ **Heat Generation and Cooling**
- ❑ **Air Humidity**
- ❑ **Mechanical Vibration**
- ❑ **Contamination**

#### Heat Generation and Cooling

**WARNING:** The permissible ambient operating temperature for the SA Series inverter is between 0 °C and 40 °C (32 °F to 104 °F). Operation at temperatures outside these parameters will impair the operating safety.

The following measures can ensure adequate heat removal:

- Provide sufficient space for air circulation.
- An integrated ventilation system must remove the warm air and introduce cooling air, while ensuring that the permissible degree of contamination of the cooling air is not exceeded. See “Contamination.” If this is not possible, a heat exchanger must be provided to avoid failures. ANILAM recommends that these units (with separate internal and external cooling circuit) always be installed for reasons of operational safety.
- Exit air from cooling systems of other devices must not be introduced into the unit. Install a fan to extract warm air. Do not allow pre-warmed air to be blown into the unit.
- The warm air should flow over surfaces that have good thermal conductivity to the external surroundings (for example, sheet metal, which enables heat dissipation).
- Where the chassis is a closed steel housing without assisted cooling, the formula for heat conduction is 3 W/m<sup>2</sup> of surface per °C air temperature difference between inside and outside.
- Use of a cooler.

#### Air Humidity

Permissible air humidity:

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

**NOTE:** To avoid condensation on the circuit boards, leave units powered on in humid environments.

## Mechanical Vibration

Permissible vibration:  $\pm 0.075$  mm, 10 to 41 Hz  
5 m/s<sup>2</sup>, 41 Hz to 500 Hz

Permissible shock: 50 m/c<sup>2</sup>, 11 ms

## Contamination

ENJ 50 178 permits contamination level 2. If this standard cannot be adhered to, be sure to use a heat exchanger in order to avoid failures. For reasons of operating safety, ANILAM in principle recommends installing the modules with a separate internal and external cooling circuit.

### **WARNING:**

**ANILAM cannot assume responsibility for inverter failures caused by impermissible contamination.**

**A conducting layer might form on the live components of the inverter from the following:**

- **Deposition of dust from the ambient air**
- **Precipitation of chemical particles contained in the air**
- **Natural formation of dew after the machine has been switched off**

**This conducting layer may cause flashovers of DC-link voltage that might damage the unit.**

**The so-called “protection by electrical separation” of:**

- **Line voltage**
- **DC-link voltages**
- **“Exposed” voltages,**

**which are required for safety reasons, are not guaranteed any longer.**

### Installation Guidelines

The following topics are described:

- ❑ **Minimum Clearances for BR 10F and BR 18F Braking Resistors**
- ❑ **Installation Guidelines for BR 18 Braking Resistor**
- ❑ **Minimum Clearances for BR 18 Braking Resistor**
- ❑ **Minimum Clearances for SA Series Inverter**

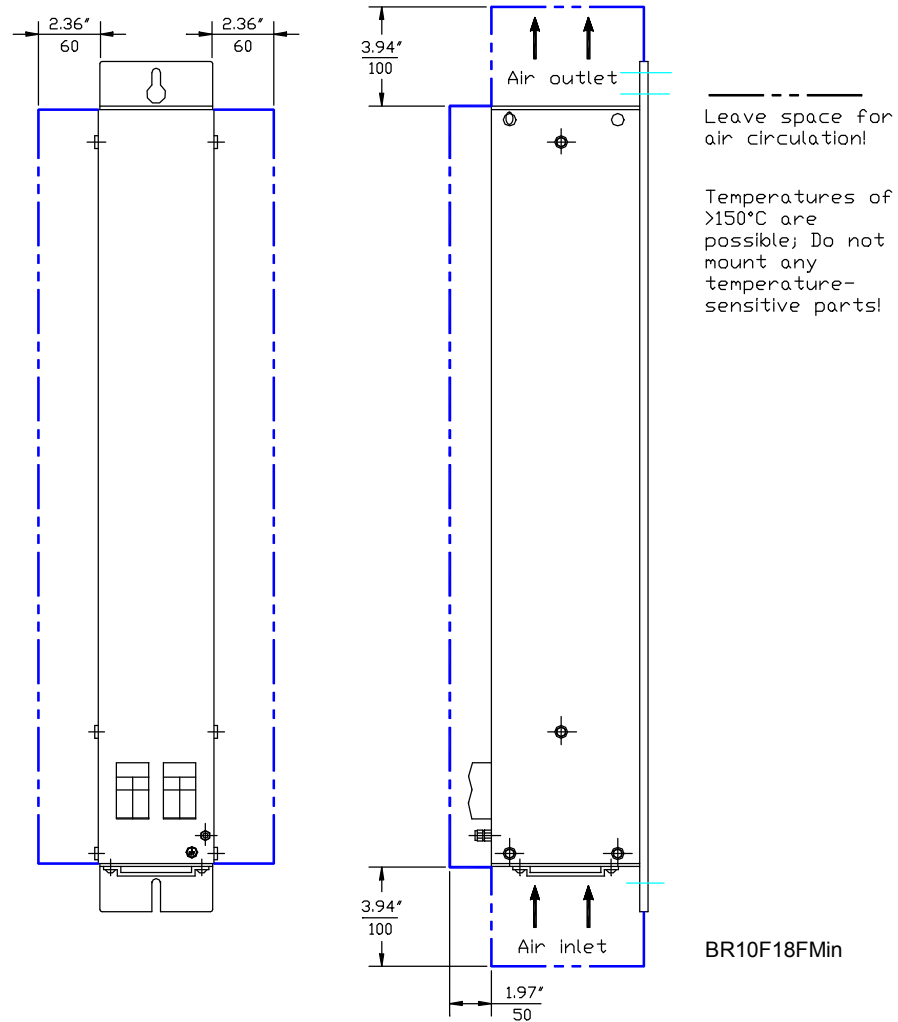
<p><b>WARNING:</b> When mounting the braking resistors and inverter, observe proper minimum clearance, space requirements, and length of connecting cable.</p>
--



**Minimum Clearances for BR 10F and BR 18F Braking Resistors**

**WARNING:** Because of their high heat generation, these braking resistors must be mounted outside the CNC cabinet in a vertical position (with the fan at the bottom). Position braking resistors in a way that prevents mechanical damage from splashing water (coolant) and injury due to accidental human contact with hot surfaces.

Refer to **Figure 4-3**.

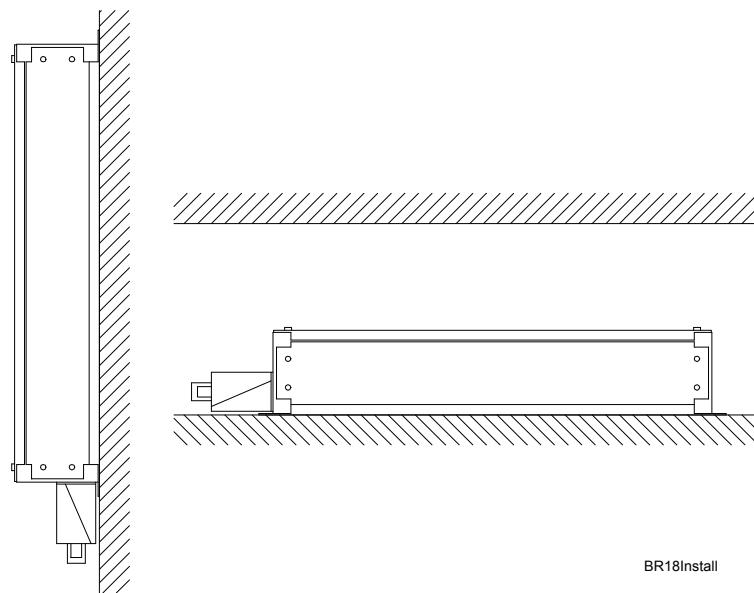


**Figure 4-3, BR 10F and BR 18F - Minimum Clearance**

### Installation Guidelines for BR 18 Braking Resistor

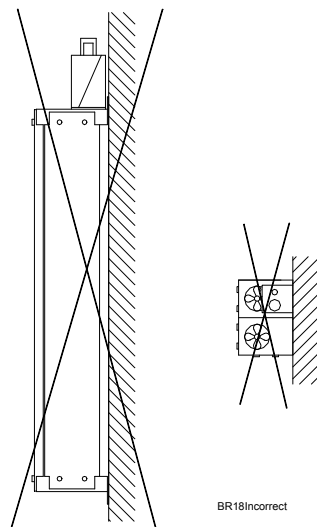
**WARNING:** Because of their high heat generation, the BR 18 braking resistor must be mounted outside the CNC cabinet, either vertically (connections at bottom) or horizontally (connections at rear).

Refer to **Figure 4-4**.



**Figure 4-4, BR 18 – Correct Installation**

The braking resistor may not be positioned so that the connections face upwards, since the heat produced rises. Refer to **Figure 4-5**.

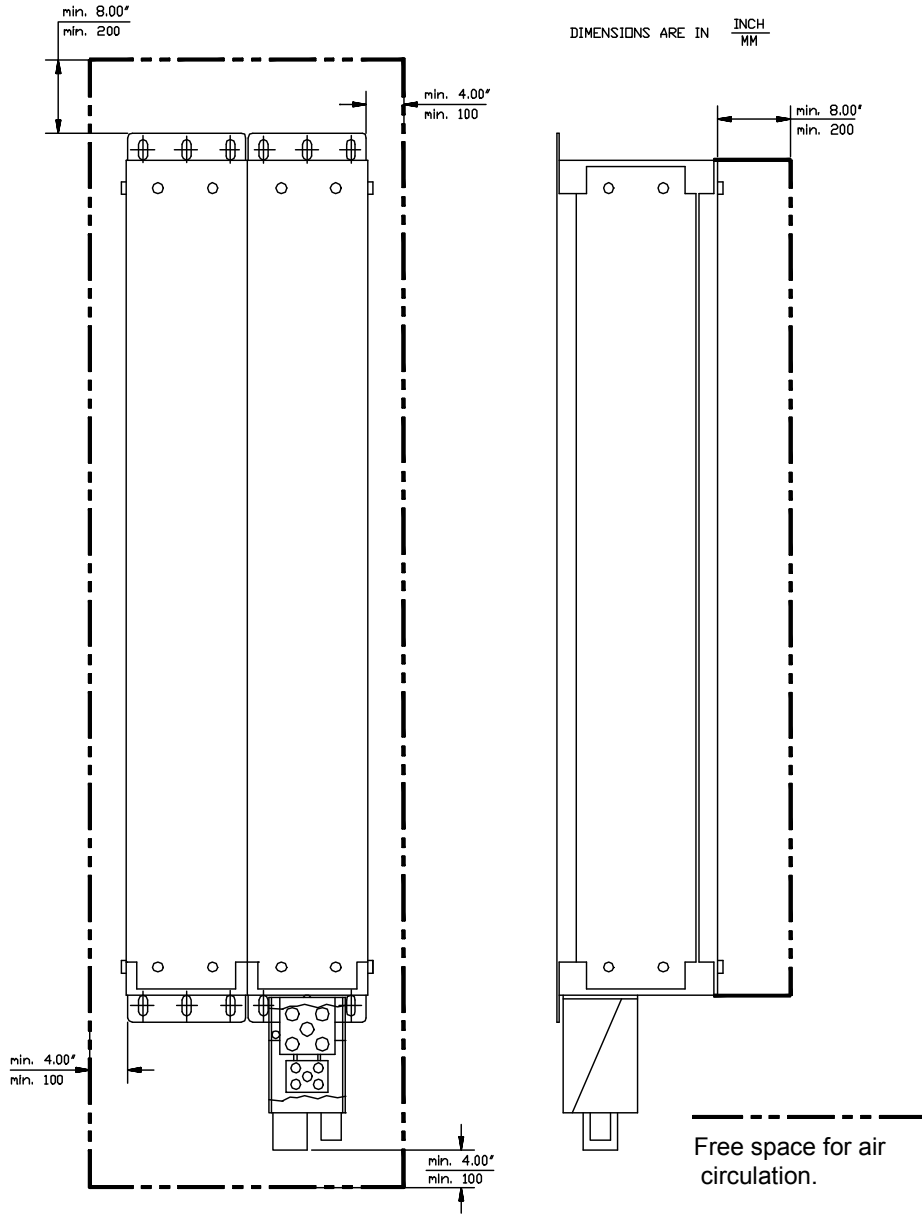


**Figure 4-5, BR 18 - Incorrect Installation**

**Minimum Clearances for BR 18 Braking Resistor**

**WARNING:** Because of their high heat generation, the BR 18 braking resistor must be mounted outside the CNC cabinet, either vertically (connections at bottom) or horizontally (connections at rear).

Refer to Figure 4-6.



BR18Min

Free space for air circulation.

Temperatures of greater than 150° C (302° F) are possible. Do not mount near any temperature sensitive components.

**Figure 4-6, BR 18 - Minimum Clearances**

### Minimum Clearances for the SA Series Inverter

Refer to Figure 4-7.

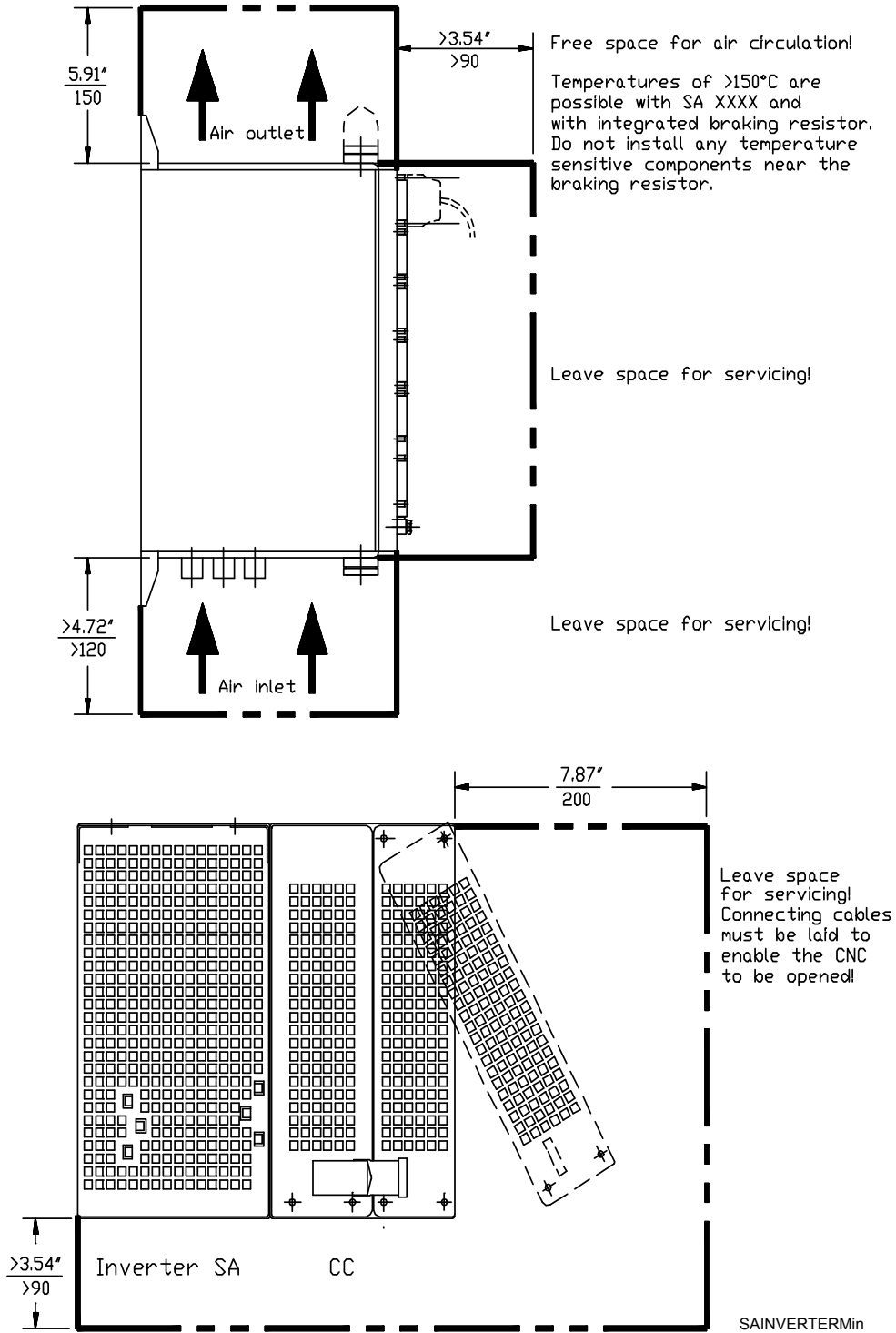


Figure 4-7, SA Series Inverter - Minimum Clearances

## Connection Overviews

The following topics are described:

- ❑ **Power Connection of Regenerative Inverter Systems**
- ❑ **Power Connection of Non-Regenerative Inverter Systems**
- ❑ **Arranging the Inverter Modules**
- ❑ **Arranging Additional Modules**

### Power Connection of Regenerative Inverter Systems

See **Figure 4-8**.



**Figure 4-8, Power Connection of Regenerative Inverter Systems**

#### Standard

A line filter and commutating reactor are required for connecting regenerative inverter systems. The use of ht three-phase capacitor for additional mains interference suppression is recommended.

If you are using a PS 120A as an additional 5 V power supply, you must connect it through an isolating transformer via separate fuses. For connecting the PS 120A, see “Section 6, Connecting the PS 120A Power Supply Unit.”

#### UL Certification

In addition to the above mentioned components, an overvoltage protector is required for compliance with UL requirements. See “Overvoltage Protector.”

**Power Connection of Non-Regenerative Inverter Systems**

See **Figure 4-9**.



**Figure 4-9, Power Connection of Non-Regenerative Inverter Systems**

**Standard**

A toroidal cores included in the items supplied must be mounted when connecting non-regenerative inverter systems. The procedure for mounting the toroidal cores is described in “Section 5, Mounting the Toroidal Cores.”

If you are using a PS 120A as an additional 5 V power supply, you must connect it through an isolating transformer via separate fuses. For connecting the PS 120A, see “Section 6, Connecting the PS 120A Power Supply Unit.”

**UL Certification**

In addition to the above mentioned components, an overvoltage protector is required for compliance with UL requirements. See “Overvoltage Protector.”

### Arranging the Inverter Modules

The following topics are described:

- ❑ **Arrangement with the DLF 120**
- ❑ **Arrangement with the DLF 130**
- ❑ **Additional Inductance**
- ❑ **Voltage Protection Module**

The following connection overview illustrates the combination of different types of drives in an inverter system. The arrangement of the inverter modules also depends on the combination used.

The following guidelines should be observed:

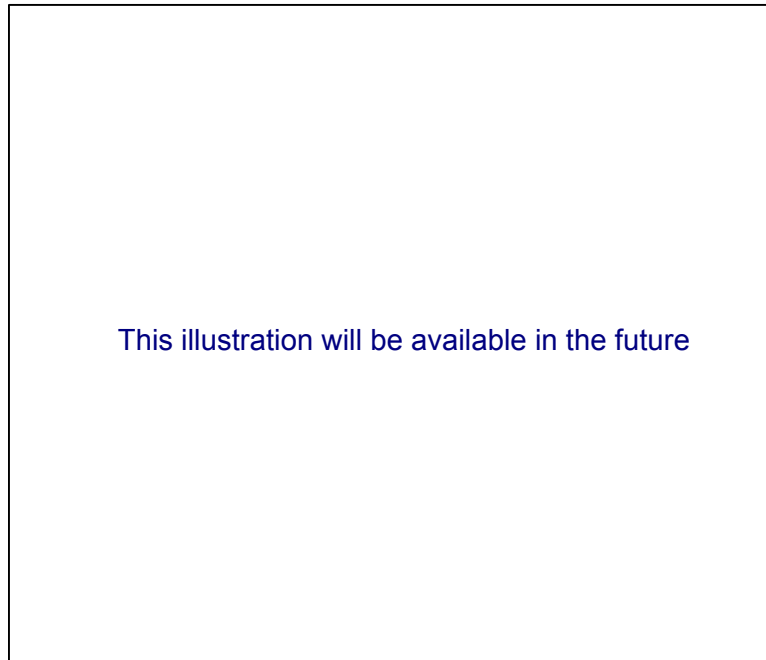
- The inverter modules for the most powerful motors (e.g., spindle, axis 1, axis 2, etc.) must be placed next to the right of the power supply module.
- If you want to connect motors requiring a DC-link filter (linear motors, torque motors, special synchronous spindle motors), primarily ensure that the PLF DC-link filter's maximum permissible load is not exceeded. The DC-link filter is inserted next to the left of the inverters in the DC-link and connected.

Depending on the application, there are the following possibilities:

- ❑ **Arrangement with the DLF 120**
- ❑ **Arrangement with the DLF 130**

**Arrangement with the DLF 120**

In this application, a PLF 120 was inserted after the high-performance modules for the spindles in order to connect two direct drives. See **Figure 4-10**.



**Figure 4-10, Arrangement with the DLF 120**



**Arrangement with the DLF 130**

In this application, a PLF 130 was placed next to the power supply module, because a high-performance synchronous spindle motor requiring a DC-link filter was used. In this application, the total system power must not exceed the maximum permissible power the PLF 130. See **Figure 4-11**.



**Figure 4-11, Arrangement with the DLF 130**

**Additional Inductance****Motors**

- Whose self-inductance is insufficient for operation require additional inductance (e.g., series reactors) to ensure proper servo control. The formulas and values required for calculating the additional inductance can be found in the *6000i CNC Technical Manual*, P/N 627787-21.
- With cable lengths over 49.2 ft. (15 m.) may require additional inductance for noise suppression.

**Voltage Protection Module**

For information on the VPM 163 voltage protection module, see “Section 2, VPM 163 – Voltage Protection Module.”

### Arranging Additional Modules

Increased power demand in modular regenerative inverter systems may make it necessary to use two power supply modules. In this case, an Adapter Module, P/N 647705-01 is required for connecting the supply bus of the power supply modules to the control. See **Figure 4-12**.

Details for connecting the adapter module and two power supply units are in “Section 6, Connecting the Adapter Module.”



**Figure 4-12, Arranging Additional Modules**

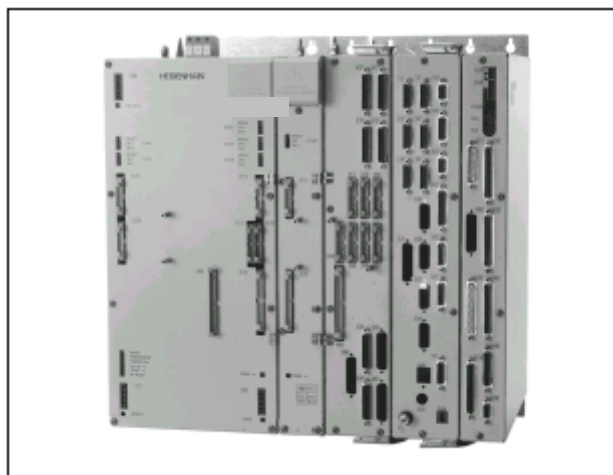
## Section 5 - Installing Amplifier Systems

The following topics are described in this section:

- ❑ **Connection Overview**
- ❑ **Mounting and Connecting the Amplifier**
- ❑ **Connecting the SA 301E, SA 411E Amplifier**
- ❑ **Connecting the SA 301A, SA 311A, Sa 411A, SA 201A, SA 301C, SA 411C, or RA 201A, RA 301C, RA 411C Amplifiers**
- ❑ **Connecting the PS 120A Power Supply Unit**
- ❑ **Connecting the BR 9 Braking Resistor Module**
- ❑ **Physical Dimensions**

### Connection Overview

Refer to **Figure 5-1**.



**Figure 5-1, Series 6000 CNC, SA Series Amplifier and PM 107 Power Module**

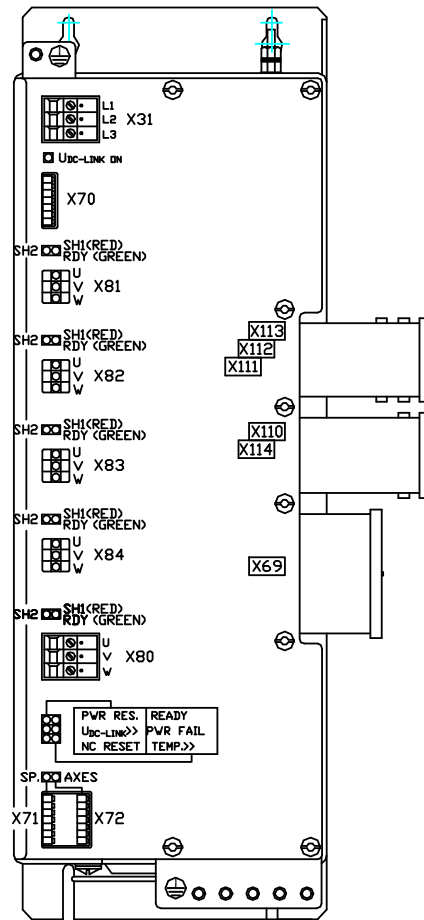
<b>DANGER:</b> Do not connect or disconnect any elements while the unit is powered up.
--

The following components and connections are illustrated:

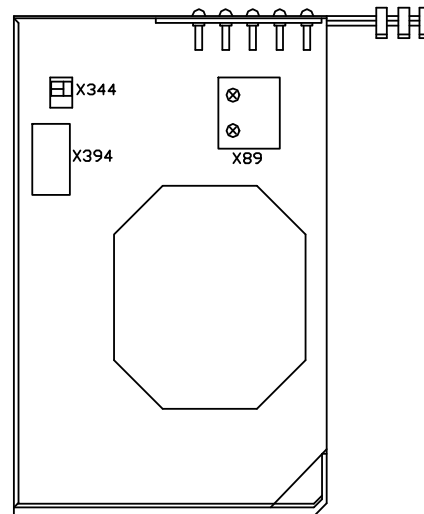
- SA 311E/SA 411E
- Description of LEDs on the SA 311E/SA 411E Amplifiers
- SA 301A
- SA 311A
- SA 411A
- SA 201A
- SA 301AD
- SA 311AD
- SA 411AD
- SA 201AD
- SA 301C
- SA 411C
- Description of LEDs on the Amplifiers: SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C
- RA 201A
- RA 301C
- RA 411C
- Description of LEDs on the Amplifiers: RA 201A, RA 301C, RA 411C
- PS 120A Power Supply Unit
- BR 9 Braking Resistor Module
- BR 18 Braking Resistor
- BR 10F and BR 18F Braking Resistors

**SA 301E/SA 411E**

Refer to Figure 5-2.



- X31 Power supply for amplifier (L1, L2, L3)
- X70 Main contactor
- X81 Motor connection for axis 1 (to X111) (6 A with 3.3 kHz PWM frequency)
- X82 Motor connection for axis 2 (to X112) (6 A with 3.3 kHz PWM frequency)
- X83 Motor connection for axis 3 (to X113) (6 A with 3.3 kHz PWM frequency)
- X84 Motor connection for axis 4 (to X114) (9 A with 3.3 kHz PWM frequency) (only SA 411E)
- X69 Supply bus
- X80 Motor connection for spindle (to X110) (24 A with 3.3 kHz PWM frequency)
- X71 Safety relay for spindle
- X72 Safety relay for axes



- X344 24 V input for motor brake output
- X394 24 V brake output
- Equipment ground

SAEConnect

**Figure 5-2, SA 301E/SA 411E**

### Description of LEDs on the SA 301E/SA 411E Amplifiers

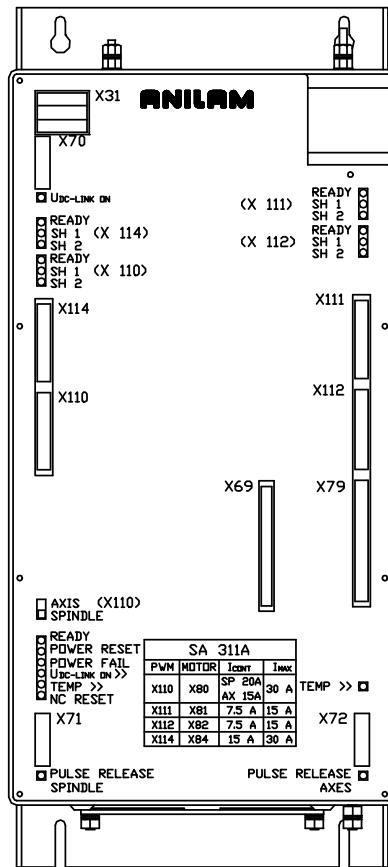
LEDs on the front panel of the amplifier (a.k.a. compact inverter) indicate functional control, with the following meaning. Refer to **Table 5-1**.

**Table 5-1, LED Designations for SA 301E/SA 401E Amplifiers**

LED	Indicator	Signal Direction	Signal
<b>NC RESET</b>	Reset signal from CNC to SA	CNC → SA	$\overline{\text{RES.LE}}$
<b>PWR FAIL</b> (Power Fail)	$U_z$ too low, $U_z < 410$ V (for example, caused by the failure of a phase under load, power < 290 V)	SA → CNC	$\overline{\text{PF.PS}}$
<b>PWR RES</b> (Power Reset)	Reset signal from SA to CNC	SA → CNC	$\overline{\text{RES.PS}}$
<b>READY</b>	Amplifier ready	SA → CNC	RDY
<b>TEMP &gt;&gt;</b>	Temperature of heat sink too high (>100 °C (212 °F))	SA → CNC	$\overline{\text{ERR.TEMP}}$
<b>U<sub>DC</sub> LINK &gt;&gt;</b>	$U_z$ too high. (> approximately 800 V); power modules are switched off.	SA → CNC	$\overline{\text{ERR.UZ.GR}}$
<b>U<sub>DC</sub> LINK ON</b>	Main contactor on	–	–
<b>X71 SP.</b> (Spindle)	Safety relay for spindle on	–	–
<b>X72 AXES</b>	Safety relay for axes on	–	–
<b>X 8x SH1 (Red)</b>	Safe stop 1; no enable from control (main contactor not active, DSP error, PLC error with Emergency Stop, hardware or software error of CNC)	CNC → SA	$\overline{\text{SH1B}}$
<b>RDY (Green)</b>	Axis/Spindle enabled	SA → CNC	RDY
<b>X 8x SH2</b>	Safe stop 2; no drive enable from control (for example, by the PLC, active via external signal or SH1)	CNC → SA	$\overline{\text{SH2}}$

**SA 301A**

Refer to Figure 5-3.



X31 Power supply for amplifier

X70 Main contactor

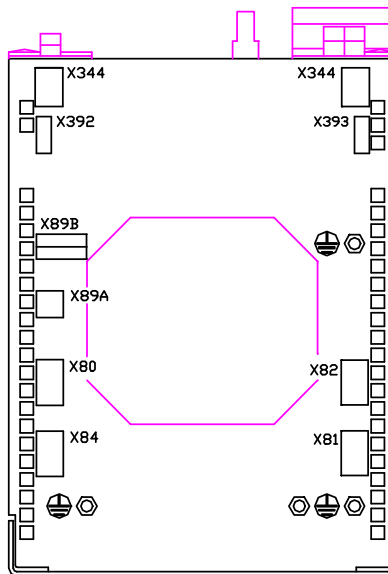
X110 to X114 PWM connection for axes/spindle

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

X89B Internal braking resistor  
X89A BR 18 or BR 1x $\Phi$  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)

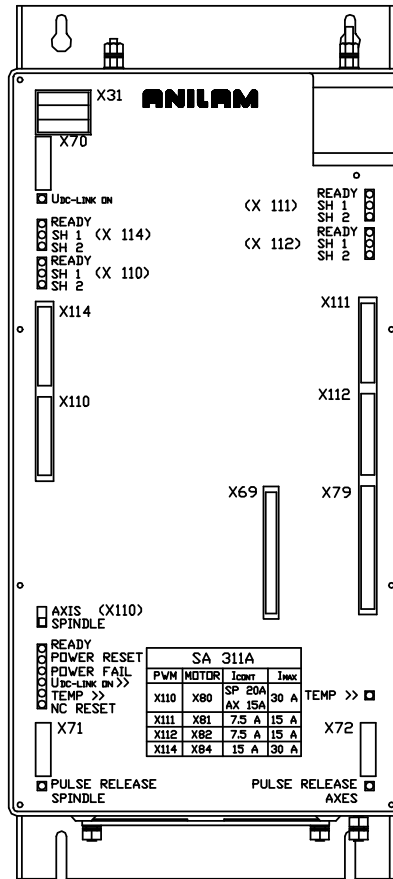
Equipment ground

SA311AConnect

**Figure 5-3, SA 301A**

## SA 311A

Refer to Figure 5-4.



X31 Power supply for amplifier

X70 Main contactor

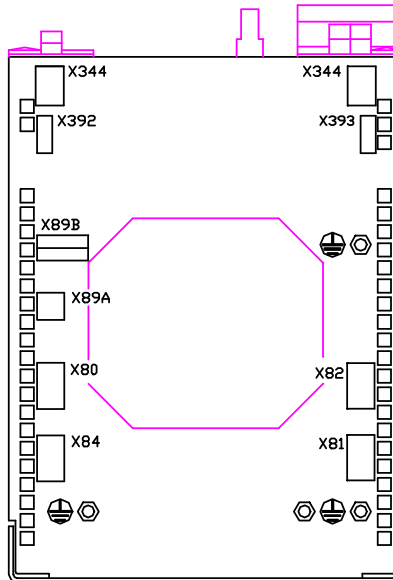
X110 to  
X114 PWM connection for axes/spindle

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

X89B Internal braking resistor  
X89A BR 18 or BR 1xF 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

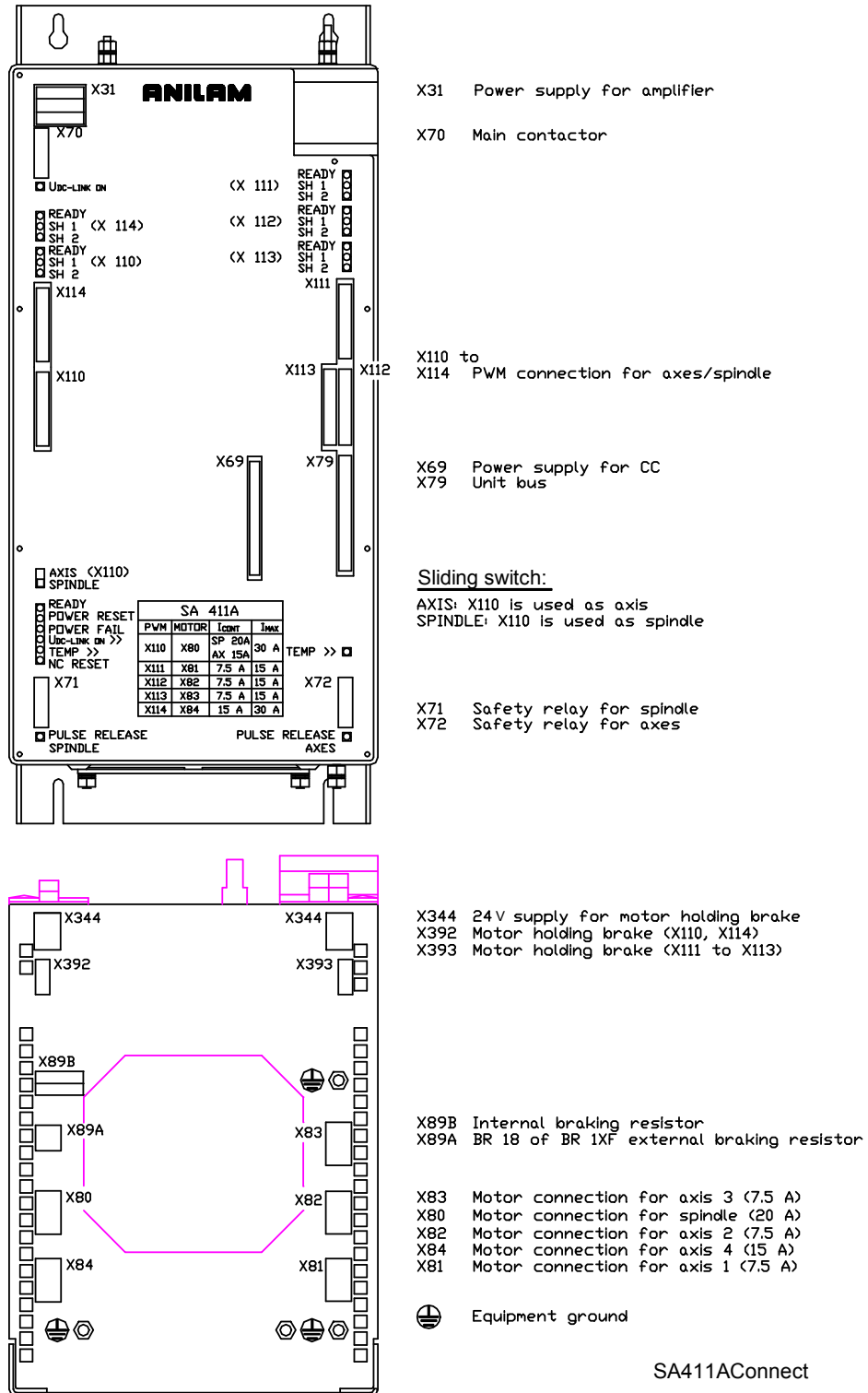
SA311AConnect

Figure 5-4, SA 311A



**SA 411A**

Refer to Figure 5-5.



**Figure 5-5, SA 411A**

SA411AConnect

## SA 201A

Refer to Figure 5-6.

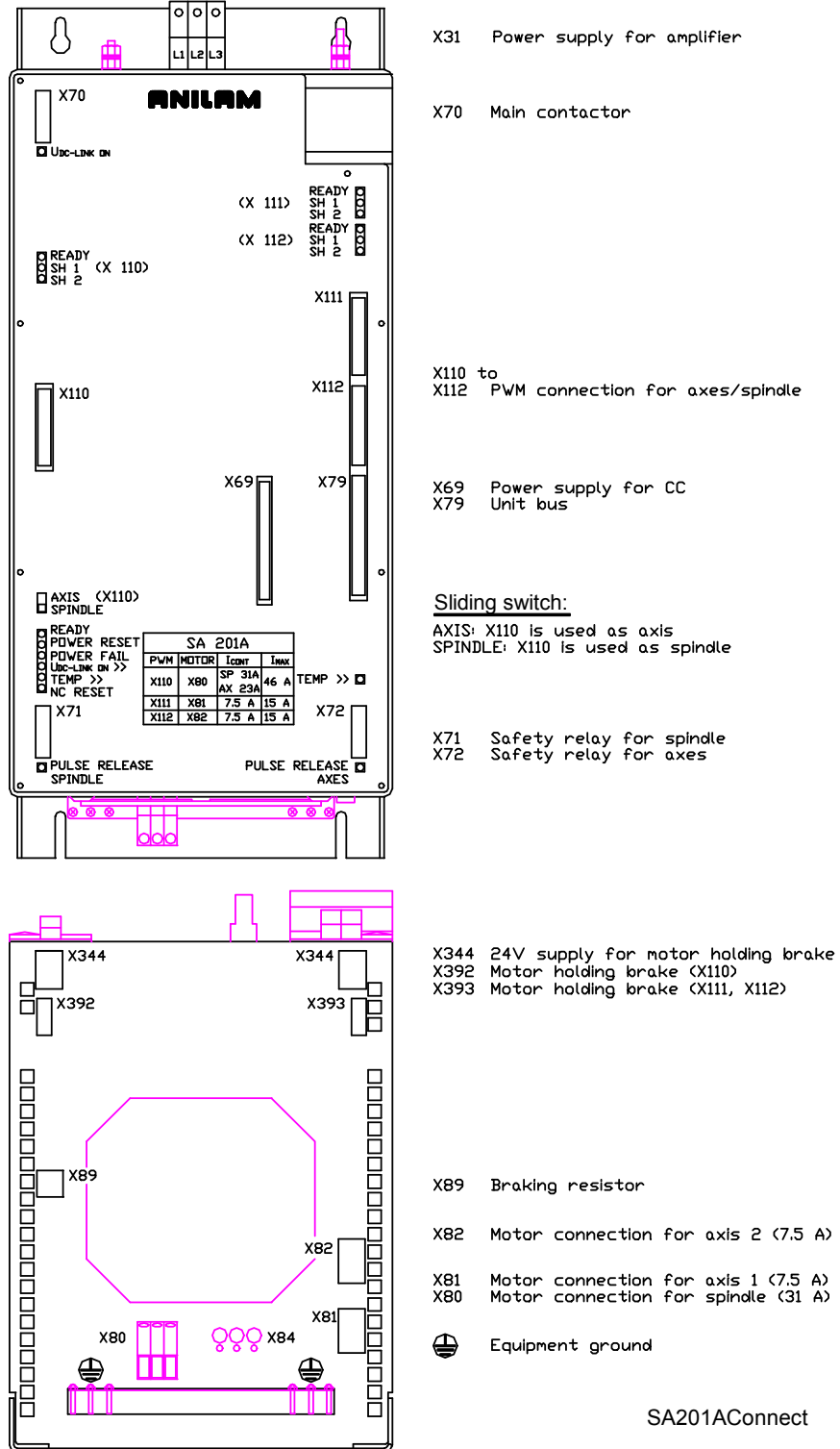
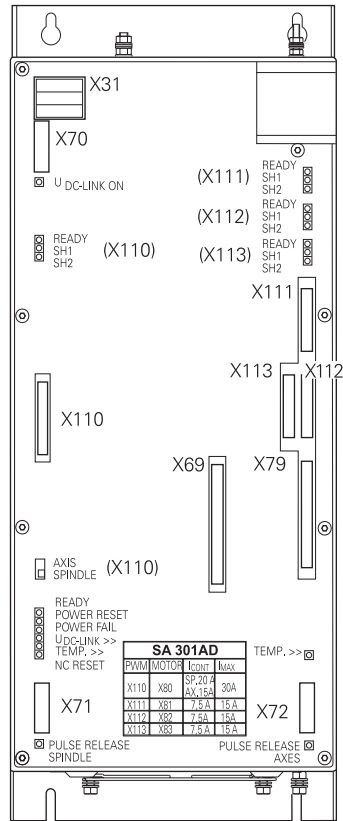


Figure 5-6, SA 201A

SA201AConnect

**SA 301AD**

Refer to **Figure 5-7**.



- X31 Power supply for inverter
- X70 Main contactor

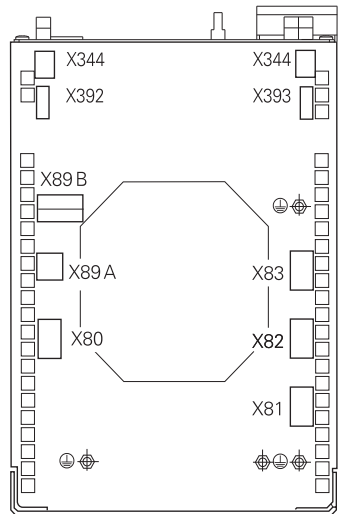
X110 to X113 PWM connection for axes/spindle

- 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 21x 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)

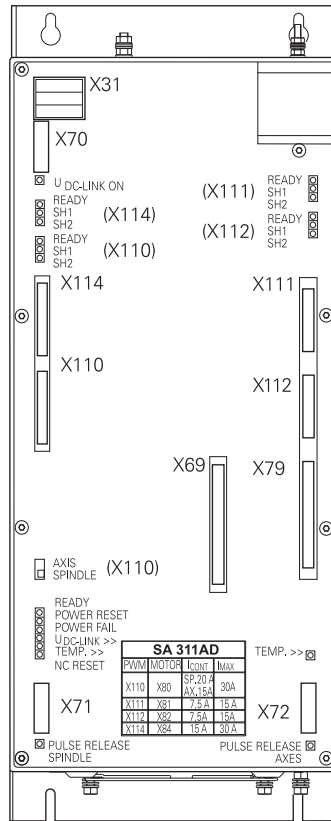
Equipment ground

SA301ADConnect

**Figure 5-7, SA 301AD**

### SA 311AD

Refer to Figure 5-8.



X31 Power supply for inverter

X70 Main contactor

X110 to X114 PWM connection for axes/spindle

X69 Power supply for control

X79 Unit bus

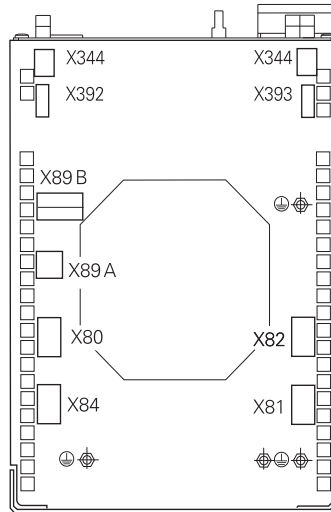
**Sliding switch:**

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 21x 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)

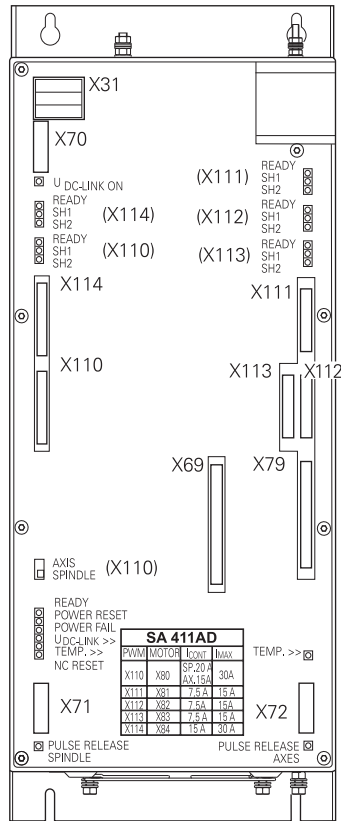
Equipment ground

SA311ADConnect

Figure 5-8, SA 311AD

**SA 411AD**

Refer to **Figure 5-9**.



X31 Power supply for inverter

X70 Main contactor

X110 to X114 PWM connection for axes/spindle

X69 Power supply for control

X79 Unit bus

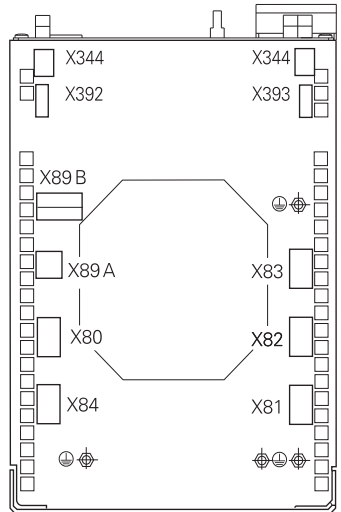
**Sliding switch:**

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 21x 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)

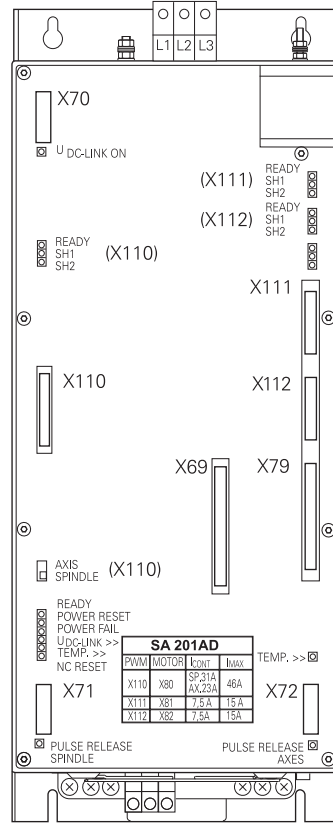
Equipment ground

SA411ADConnect

**Figure 5-9, SA 411AD**

## SA 201AD

Refer to Figure 5-10.



X31 Power supply for inverter

X70 Main contactor

X110 to  
X112 PWM connection for axes/spindle

X69 Power supply for control

X79 Unit bus

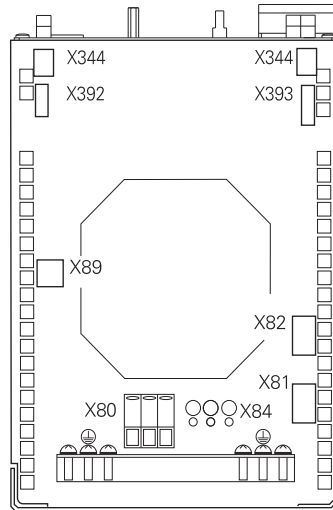
**Sliding switch:**

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)



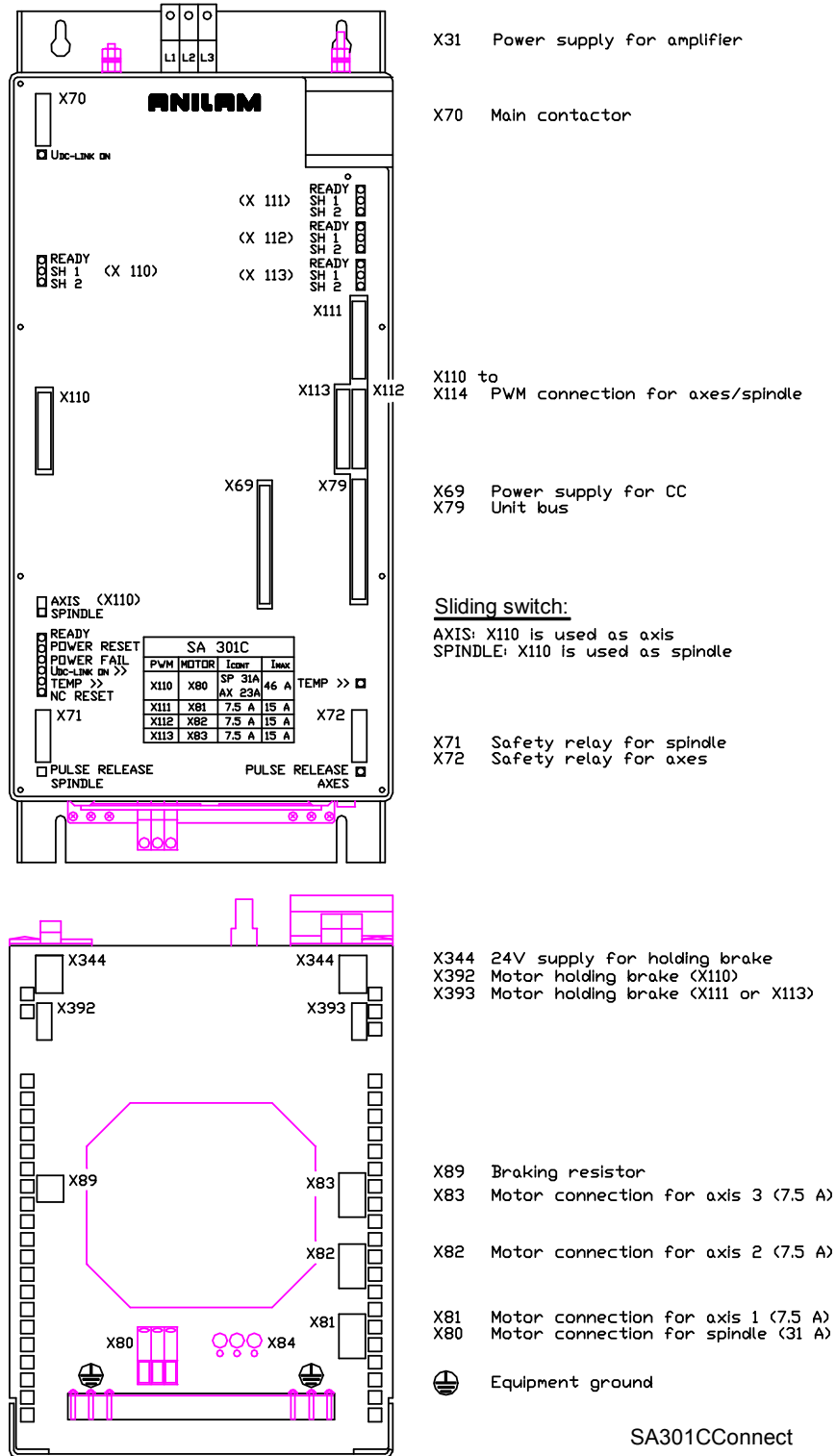
Equipment ground

SA201ADConnect

Figure 5-10, SA 201AD

**SA 301C**

Refer to Figure 5-11.



X31 Power supply for amplifier

X70 Main contactor

X110 to X114 PWM connection for axes/spindle

X69 Power supply for CC  
 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 24V supply for holding brake  
 X392 Motor holding brake (X110)  
 X393 Motor holding brake (X111 or 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

**Figure 5-11, SA 301C**

### SA 411C

Refer to Figure 5-12.

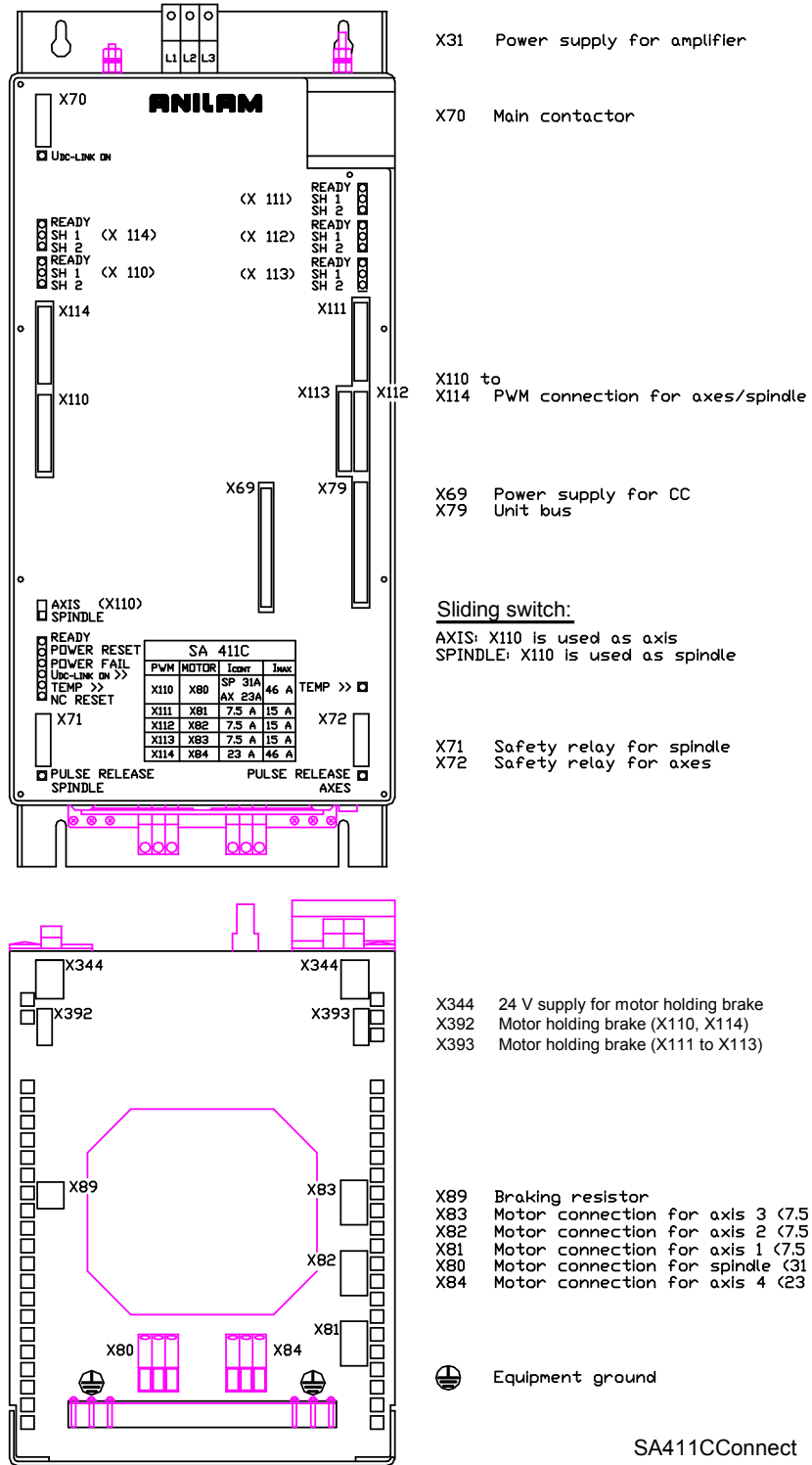


Figure 5-12, SA 411C



**Description of LEDs on the Amplifiers: SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C**

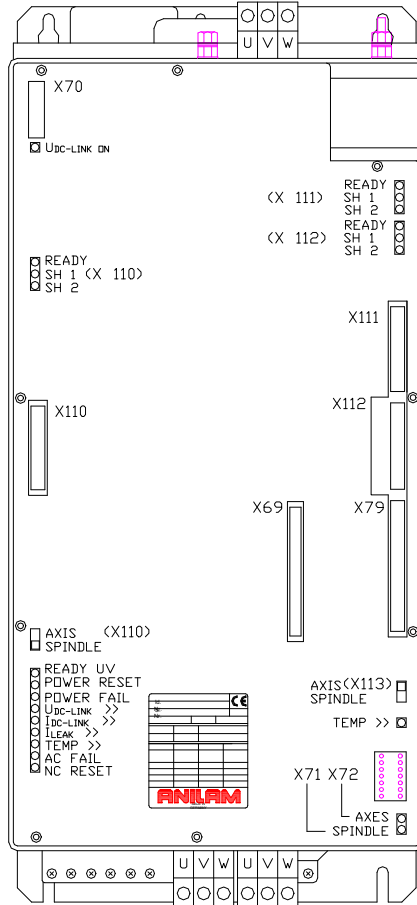
Light Emitting Diodes (LEDs) on the front panel of the amplifier indicate functional control, with the following meaning. Refer to **Table 5-2**.

**Table 5-2, LED Designations for Amplifiers: SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C**

LED	Indicator	Signal Direction	Signal
<b>NC RESET</b>	Reset signal from the CNC to the SA	CNC → SA	$\overline{\text{RES.LE}}$
<b>POWER FAIL</b>	$U_z$ too low, $U_z < 410$ V (for example, caused by the failure of a phase under load, power < 290 V)	SA → CNC	$\overline{\text{PF.PS}}$
<b>POWER RESET</b>	Reset signal from SA to CNC	SA → CNC	$\overline{\text{RES.PS}}$
<b>PULSE RELEASE AXES</b>	Safety relay for axes on	–	–
<b>PULSE RELEASE SPINDLE</b>	Safety relay for spindle on	–	–
<b>READY</b>	Amplifier ready	SA → CNC	RDY
<b>TEMP &gt;&gt; (left)</b>	Heat sink temperature too high for axis 4 and spindle (>100 °C (212 °F))	SA → CNC	$\overline{\text{ERR}}$
<b>TEMP &gt;&gt; (right)</b>	Heat sink temperature too high for axis 1 to axis 3 (>100 °C (212 °F))	SA → CNC	$\overline{\text{ERR}}$
<b>U<sub>DC LINK</sub> &gt;&gt;</b>	$U_z$ too high. (> approximately 800 V); power modules are switched off.	SA → CNC	$\overline{\text{ERR.UZ.GR}}$
<b>U<sub>DC LINK ON</sub></b>	Main contactor on	–	–
<b>X11× READY</b>	Amplifier ready	SA → CNC	RDY
<b>X11× SH1</b>	DSP error, PLC error with Emergency Stop, CNC hardware or software error	CNC → SA	$\overline{\text{SH1B}}$
<b>X11× SH2</b>	No drive enabled (for example, by the PLC, active via external signal or SH1)	CNC → SA	$\overline{\text{SH2}}$

## RA 201A

Refer to Figure 5-13.



X31 Power supply for amplifier

X70 Main contactor

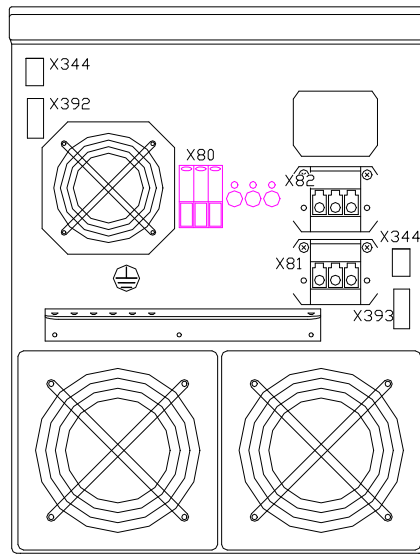
X110 to  
X112 PWM connection for axes/spindle

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 (35A)  
X82 Motor connection for axis 2 (7.5A)  
X81 Motor connection for axis 1 (7.5A)

Equipment ground

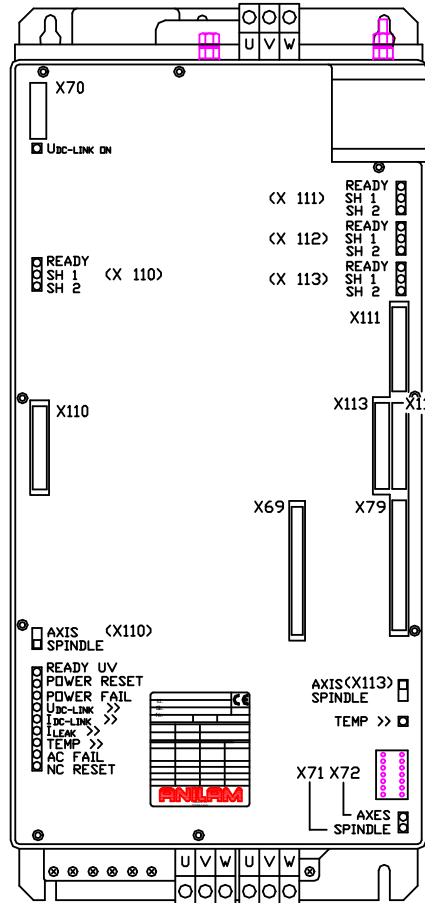
X393 Motor holding brake (X111, X112)

RA201AConnect

Figure 5-13, RA 201A

**RA 301C**

Refer to **Figure 5-14**.



X31 Power supply for amplifier

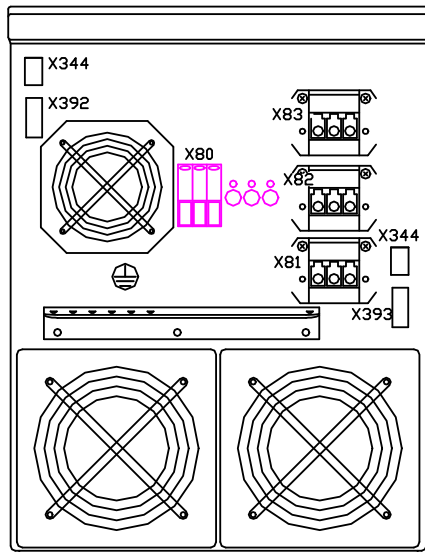
X70 Main contactor

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 (7.5A)  
 X80 Motor connection for spindle (35A)  
 X82 Motor connection for axis 2 (7.5A)  
 X81 Motor connection for axis 1 (7.5A)

⊕ Equipment ground

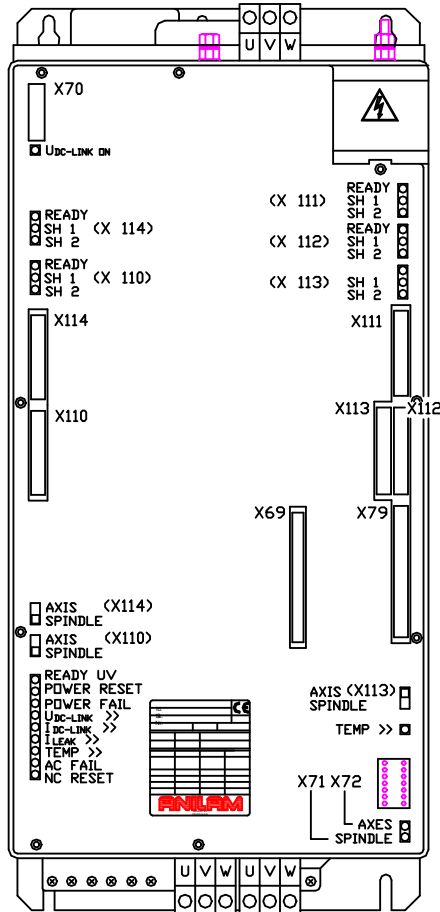
X393 Motor holding brake (X111 to X113)

RA301CConnect

**Figure 5-14, RA 301C**

### RA 411C

Refer to Figure 5-15.



X31 Power supply for amplifier

X70 Main contactor

X110 to X114 PWM connection for axes/spindle

X69 Power supply for control

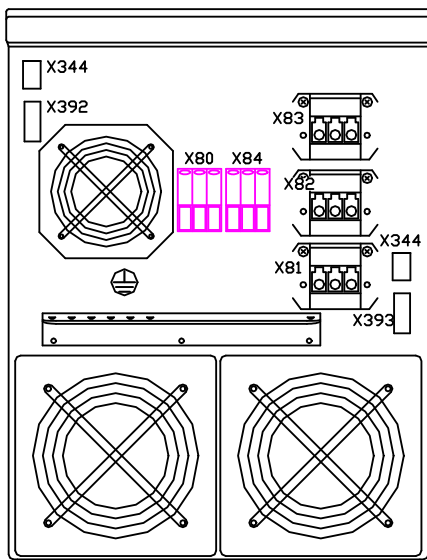
X79 Unit bus

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)

X83 Motor connection for axis 3 (7.5A)

X80 Motor connection for spindle (35A)

X84 Motor connection for axis 4 (25A)

X82 Motor connection for axis 2 (7.5A)

X81 Motor connection for axis 1 (7.5A)

Equipment ground

X393 Motor holding brake (X111 to X113)

RA411CConnect

Figure 5-15, RA 411C

**Description of LEDs on the Amplifiers: RA 201A, RA 301C, RA 411C**

Light Emitting Diodes (LEDs) on the front panel of the amplifier indicate functional control, with the following meaning. Refer to **Table 5-3**.

**Table 5-3, LED Designations for Amplifiers: RA 201A, RA 301C, RA 411C**

LED	Indicator	Signal Direction	Signal
<b>AC FAIL</b>	Phase missing	RA → CNC	$\overline{\text{PF.PS.AC}}$
<b>AXES</b>	Safety relay for axes on	–	–
<b>I<sub>DC LINK</sub> &gt;&gt;</b>	I <sub>z</sub> > 52 A, warning signal to control at 58 A	RA → CNC	$\overline{\text{ERR.IZ.GR}}$
<b>I<sub>LEAK</sub> &gt;&gt;</b>			
<b>NC RESET</b>	Reset signal from the CNC to the RA	CNC → RA	$\overline{\text{RES.LE}}$
<b>POWER FAIL</b>	U <sub>z</sub> too low, U <sub>z</sub> < 410 V (for example, caused by the failure of a phase under load, power < 290 V)	RA → CNC	$\overline{\text{PF.PS}}$
<b>POWER RESET</b>	Reset signal from RA to CNC	RA → CNC	$\overline{\text{RES.PS}}$
<b>READY UV</b>	Amplifier ready	RA → CNC	RDY
<b>SPINDLE</b>	Safety relay for spindle on	–	–
<b>TEMP &gt;&gt;</b> (left)	Heat sink temperature too high for axis 4 and spindle (>100 °C (212 °F))	RA → CNC	$\overline{\text{ERR}}$
<b>TEMP &gt;&gt;</b> (right)	Heat sink temperature too high for axis 1 to axis 3 (>100 °C (212 °F))	RA → CNC	$\overline{\text{ERR}}$
<b>U<sub>DC LINK</sub> &gt;&gt;</b>	U <sub>z</sub> too high. (> approximately 800 V); power modules are switched off.	RA → CNC	$\overline{\text{ERR.UZ.GR}}$
<b>U<sub>DC LINK ON</sub></b>	Main contactor on	–	–
<b>X11× READY</b>	Amplifier ready	RA → CNC	RDY
<b>X11× SH1</b>	DSP error, PLC error with Emergency Stop, CNC hardware or software error	CNC → RA	$\overline{\text{SH1B}}$
<b>X11× SH2</b>	No drive enabled (for example, by the PLC, active via external signal or SH1)	CNC → RA	$\overline{\text{SH2}}$

### PS 120A Power Supply Unit

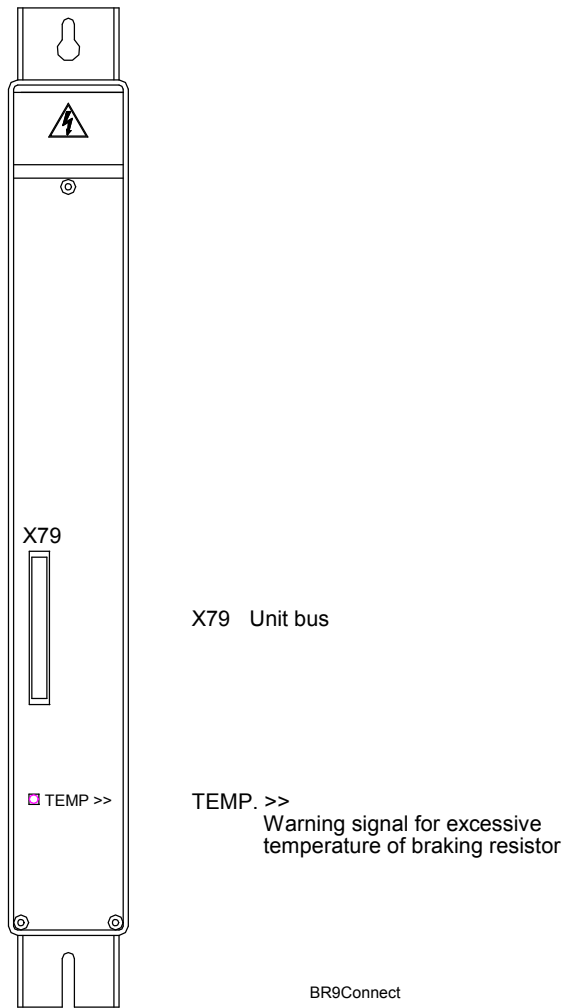
Refer to **Figure 5-16**.



**Figure 5-16, PS 120A Power Supply Unit**

**BR 9 Braking Resistor Module**

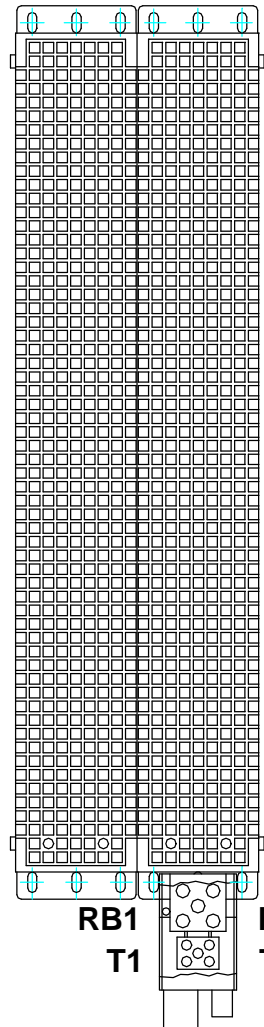
Refer to **Figure 5-17**.



**Figure 5-17, BR 9 Braking Resistor**

### BR 18 Braking Resistor

Refer to **Figure 5-18**.



**RB1, RB2** - Compact Inverter SA XXXX

**T1, T2** - Temperature switch

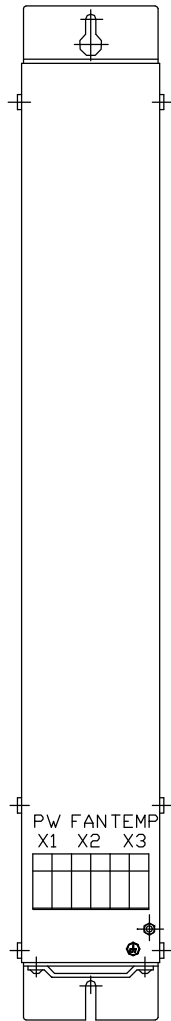
BR18Connect

**Figure 5-18, BR 18 Connections**



**BR 10F and BR 18F Braking Resistors**

Refer to **Figure 5-19**.



- X1 Compact inverter SA XXXX
- X2 Supply voltage for the fan of the braking resistor
- X3 Temperature switch

BR10F18FConnect

**Figure 5-19, BR 10F and BR 18F Braking Resistors**

### Mounting and Connecting the Amplifier

The following products are illustrated:

- Arranging the Components
- Connecting the Components
- Direct Drives
- Module Covers
- Additional Power Supply
- Mounting the Amplifier
- Conducted Interference
- Mounting the Toroidal Cores

#### Arranging the Components

The amplifier is arranged next to the CNC at its left. Refer to **Figure 5-20**.

If the BR 9 braking resistor module is used together with the SA Series regenerative amplifier, the braking resistor is arranged between the weakest power module and the control.

<p>SA Series Amplifiers (all) (SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C, and SA 301E, SA 411E)</p> <p>RA Series Amplifiers (RA 201A, RA 301C, RA 411C)</p>	<p>Optional BR 9</p>	<p>Optional PS 120A</p>	<p>CNC</p>
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**Figure 5-20, Configuration of Amplifier, Braking Resistor, Power Supply, and CNC**

Additional PMD 107 power module can be connected to SA Series Amplifier (SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C) and RA Series Amplifier (RA 201A, RA 301C, RA 411C). It must be placed between the CNC or BR 9 and the amplifier. Refer to **Figure 5-21**.

SA Series Amplifiers (SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C)  RA Series Amplifiers (RA 201A, RA 301C, RA 411C)	Optional With linear drive, DLF 1x0 DC-Link Filter to RA Series Amplifiers (RA 201A, RA 301C, RA 411C)	Optional PMD 107	Optional BR 9	Optional PS 120A	CNC
--	--	---------------------	------------------	---------------------	-----

**Figure 5-21, Configuration of Amplifier, Power Module, Braking Resistor, Power Supply, and CNC**

**Connecting the Components**

The SA Series or RA Series amplifiers supply power to the control via the 50-line ribbon cable.

The control transmits the PWM signals for the axes and spindle(s) to the SA Series or RA Series amplifiers via 20-line ribbon cables.

U<sub>z</sub> DC-link power is supplied to the additional PMD 107 power module from the SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 311C, SA 411C, or RA Series amplifier via a conductor bar, which is screwed to the power module and the amplifier. A second power conductor establishes the ground connection between the SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 311C, SA 411C, or RA Series amplifier and the PMD 107. The power bars are supplied as accessories with the power module.

A 40-line ribbon cable connects the SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 311C, SA 411C, or RA Series amplifier with the PMD 107 power module, forming the unit bus.

**Direct Drives**

Direct drives (linear motors, torque motors) used in conjunction with regenerative inverter systems require a DLF 1x0 DC-link filter, which is mounted to the left of the direct drives' power modules. The DC-link current is then led through this filter.

**Module Covers**

With the SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 311C, SA 411C, and RA Series amplifier, the ribbon cables must be covered to protect them against interference.

The covers for the CNC and the SA Series amplifier are included with each as accessories.

The cover for an optional PMD 107 power module must be ordered separately.

**Additional Power Supply**

If several encoders with a high current consumption (e.g., encoders with EnDat interface) are connected, an additional power supply source used in conjunction with the amplifier or a power supply unit might become necessary. The additional PS 120A power supply unit can be used for this purpose. It is mounted next to the CNC at its left.

The power supply unit is connected to the DC-link voltage via the conductor bar of the previous left module. The upper conductor bar also establishes the ground connection of the DE-link.

The 50-line ribbon cable of the amplifier / power supply unit for transmitting the status signals is connected to X69 of the PS 120A. The free ribbon cable of the PS 120A is connected to X69 of the CNC.

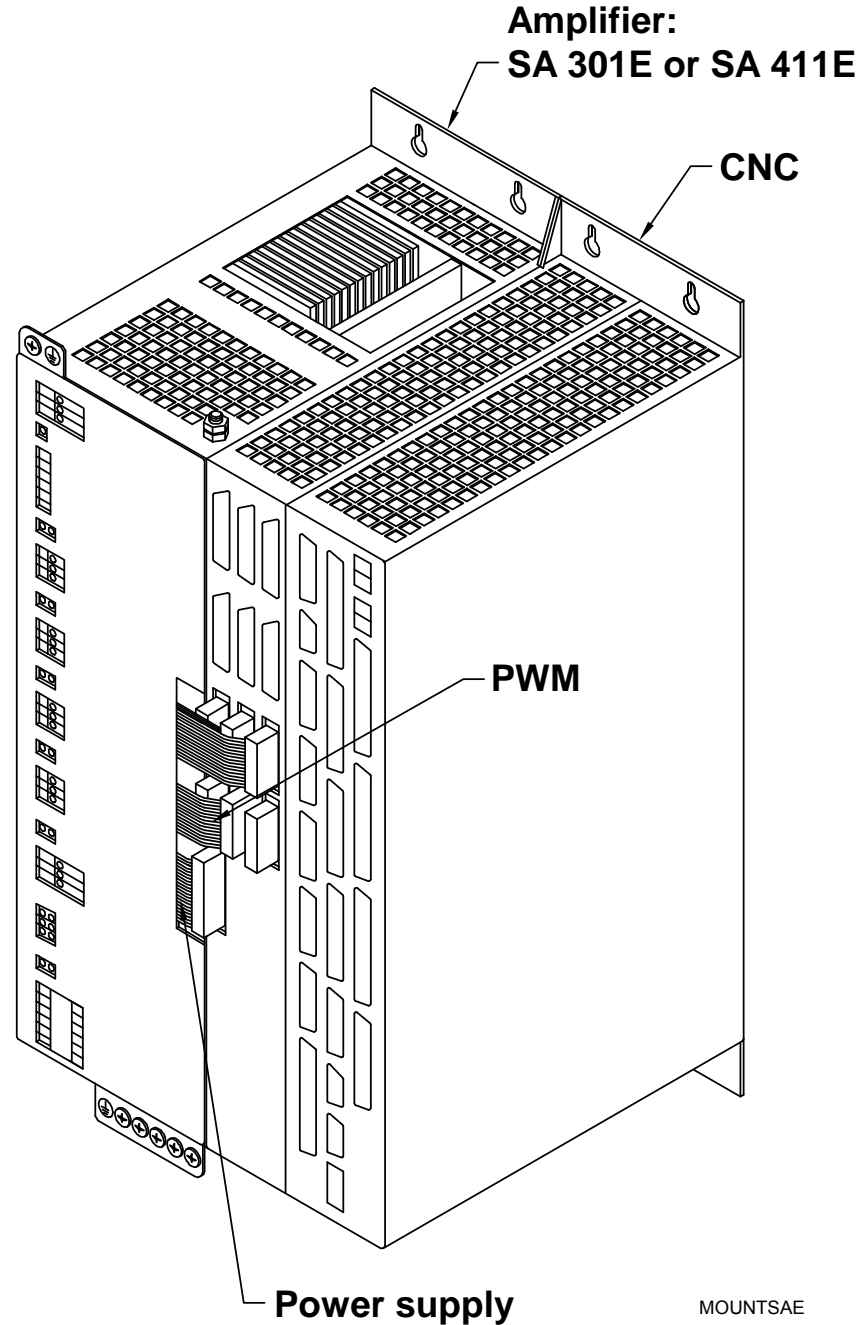
The 5 V power supply (X74) of the PS 120A is connected to the terminals on the CNC (X74) by means of the wires included in the PS 120A items supplied.

**SA 301AD, SA 311AD, SA 411AD and SA 201AD diagnosable compact inverters**

These compact inverters are equipped with a 5-V power pack for supplying the MC/CC. The power pack provides up to 16 A. The X74 connecting terminal for an additional supply of 5 V to the MC/CC is new. The PS 120A power supply unit for MC/CC is no longer necessary in combination with these compact inverters!

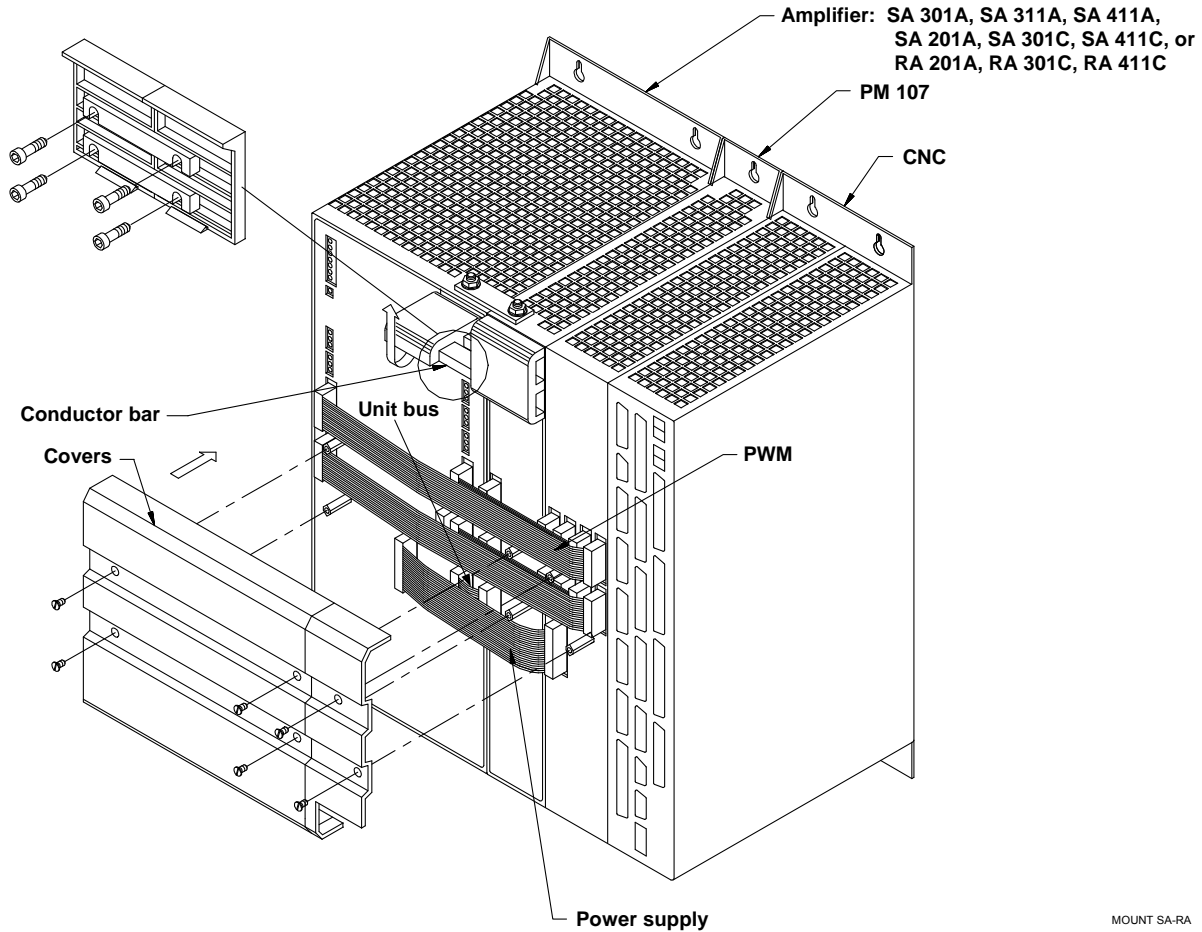
Mounting the Amplifier

Refer to **Figure 5-22** and **Figure 5-23**, Mounting the SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 311C, SA 411C, or RA 201A, RA 301C, RA 411C Amplifier.



**Figure 5-22, Mounting the SA 301E, SA 411E Amplifier**

**Warning:** All electrical screw connections must be tightened after installation is complete (tightening torque 3.5 Nm [30.8 in-lb]).



**Figure 5-23, Mounting the SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 311C, SA 411C, or RA 201A, RA 301C, RA 411C Amplifier**

**Warning: All electrical screw connections must be tightened after installation is complete (tightening torque 3.5 Nm [30.8 in-lb]).**

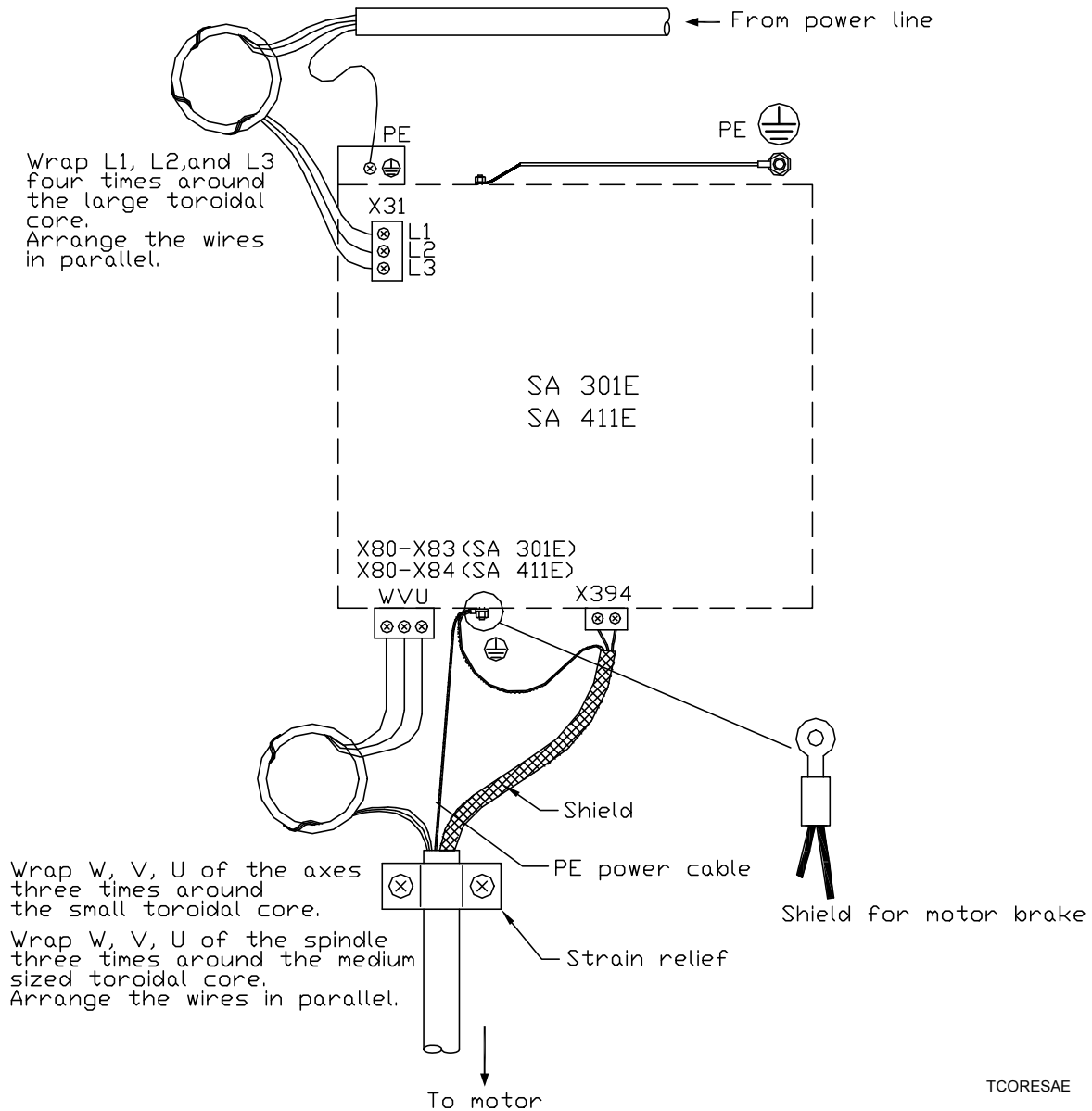
### Conducted Interference

To suppress occurrence of conducted 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 for SA 301A, SA 311A, and SA 411A. See "Mounting the Toroidal Cores."

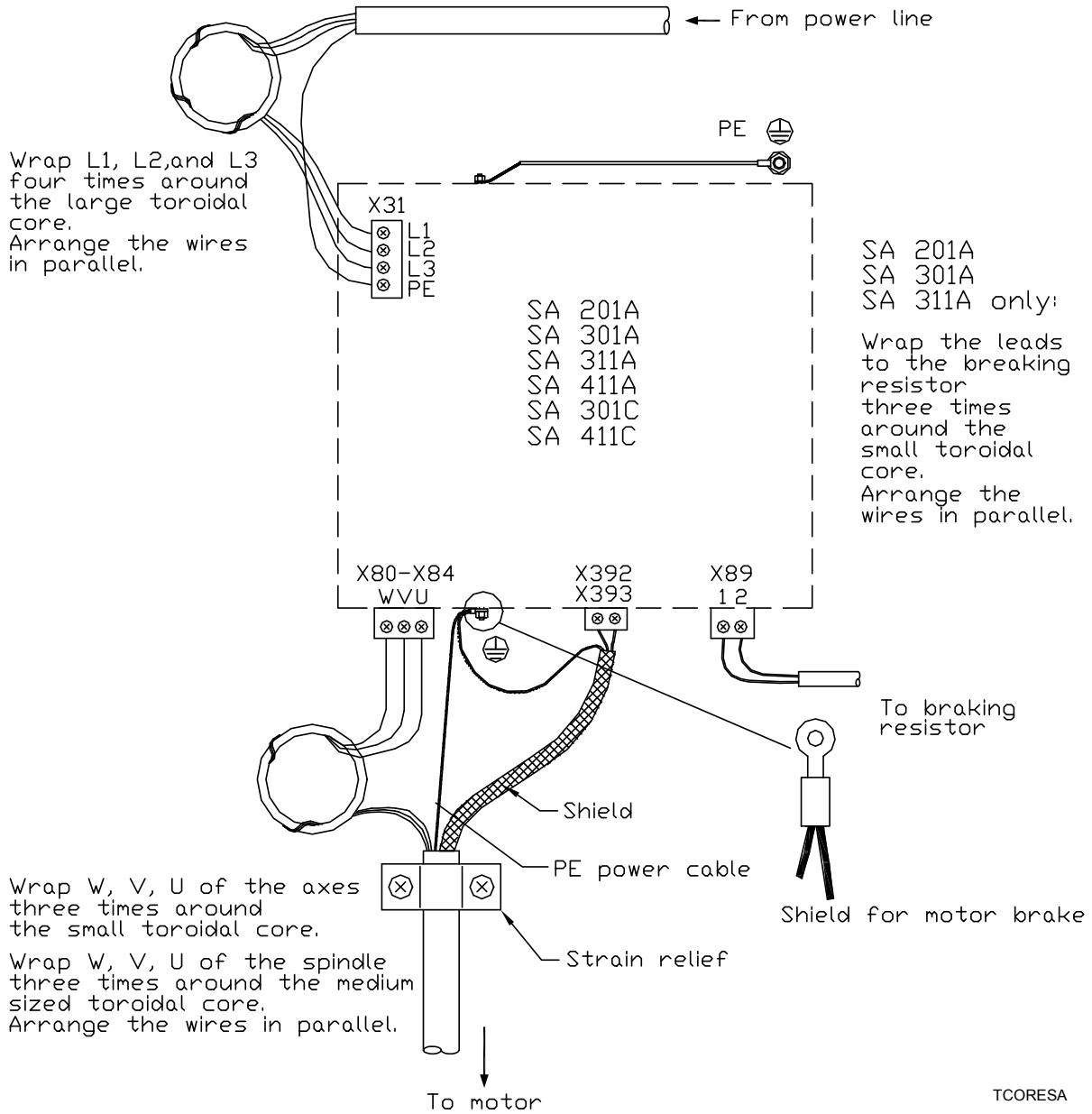
No toroidal cores are necessary for the RA 201A, RA 301C, RA 411C.

**Mounting the Toroidal Cores**

To suppress occurrence of conductive interference, toroidal cores must be mounted in the motor leads in the motor leads (X80 to X84) and in the voltage supply lead (X31). Refer to **Figure 5-24** and **Figure 5-25**, **SA 301A**, **SA 311A**, **SA 411A**, **SA 201A**, **SA 301C**, **SA 411C Toroidal Core Configuration**.



**Figure 5-24, SA 301E, SA 411E Toroidal Core Configuration**



**Figure 5-25, SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C Toroidal Core Configuration**



## Connecting the SA 301E, SA 411E Amplifier

**DANGER:** Danger of electrical shock.  
Only ANILAM service engineers may open the amplifiers.  
Do not engage or disengage any terminals while they are under power.

The following topics are described:

- ❑ SA 301E, SA 411E Power Supplies
- ❑ SA 301E, SA 411E Motor Connections
- ❑ SA 301E, SA 411E Motor Holding Brakes
- ❑ SA 301E, SA 411E Main Contactor and Safety Relay
- ❑ SA 301E, SA 411E PWM Connection to CNC
- ❑ SA 301E, SA 411E CNC Supply Voltage and Control Signals

### SA 301E, SA 411E Power Supplies

**NOTE:** EN 50 178 requires a non-detachable connection to the line power supply.  
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 amplifier.

**SA 301E, SA 411E:  
X31: Power Supply**

With a power supply of 400 V, the amplifier voltage  $U_z$  is 565 VDC, and with a power supply of 480 V it is 678 VDC. Refer to **Table 5-4**.

**Table 5-4, SA 301E, SA 411E: X31: Power Supply Connections**

Terminals	SA 301E, SA 411E
<b>Operation with 400 VAC</b>	
L1	400 VAC $\pm$ 10 % 50 Hz to 60 Hz
L2	
L3	
	<u>Cable / single conductor (HT wire):</u> 6 mm <sup>2</sup> <u>Single conductor H07 V2-K:</u> 4 mm <sup>2</sup> <u>Line fuse:</u> 25 A (gRL) Siemens Sitor type <u>Grounding terminal:</u> $\geq$ 10 mm <sup>2</sup>
<b>Operation with 480 VAC</b>	
L1	480 VAC $\pm$ 10 % 50 Hz to 60 Hz
L2	
L3	
	<u>Cable / single conductor (HT wire):</u> 6 mm <sup>2</sup> <u>Single conductor H07 V2-K:</u> 4 mm <sup>2</sup> <u>Line fuse:</u> 25 A (gRL) Siemens Sitor type <u>Grounding terminal:</u> $\geq$ 10 mm <sup>2</sup>
	Tightening torque for connecting terminals: 0.7 Nm (6.5–7 lb/in)

**SA 301E, SA 411E Motor Connections**

**SA 301E, SA 411E:**

- X80: Spindle Motor,**
- X81: Axis Motor 1,**
- X82: Axis Motor 2,**
- X83: Axis Motor 3,**
- (X84: Axis Motor 4)**

Refer to **Table 5-5** and **Table 5-6**.

**Table 5-5, SA 301E, SA 411E: Terminal Connections**

<b>Terminals</b>	<b>Assignment</b>
<b>U</b>	Motor connection U
<b>V</b>	Motor connection V
<b>W</b>	Motor connection W

For information on synchronous motors, asynchronous motors, and power cables, refer to “Section 7, Cables and Connectors.”

**Table 5-6, SA 301E, SA 411E: X80, X81, X82, X83, X84: Connections**

<b>Terminals</b>	<b>Assignment</b>
X80	X110
X81	X111
X82	X112
X83	X113
X84 (SA 411E)	X114 (SA 411E)

### SA 301E, SA 411E Motor Holding Brakes

#### SA 301E, SA 411E:

##### X344: 24 V Supply for Motor Holding Brake

Refer to Table 5-7. :

**Table 5-7, SA 301E, SA 411E: X344: 24 V Supply for Motor Holding Brake**

X344 Connecting Terminals	Assignment
1	+ 24 V
2	0 V

#### SA 301E, SA 411E:

##### X394: Motor Holding Brake

Refer to Table 5-8.

**Table 5-8, SA 301E, SA 411E: X394: Motor Holding Brake Pinout**

X394 Connecting Terminals	Assignment
1	Holding brake (X111)
2	0 V (X111)
3	Holding brake (X112)
4	0 V (X112)
5	Holding brake (X113)
6	0 V (X113)
7	Holding brake (X114)
8	0 V (X114)

#### SA 301E, SA 411E:

##### Maximum Current for X394

Refer to Table 5-9.

**Table 5-9, SA 301E, SA 411E: X394: Maximum Current**

Amplifier	$I_{max}$ (X394)
SA 301E	1.5 A
SA 411E	1.5 A

**SA 301E, SA 411E Main Contactor and Safety Relay**

**SA 301E, SA 411E:**

- X70: Main Contactor,**
- X71: Safety Relay for Spindle,**
- X72: Safety Relay for Axes**

For information on the wiring and function, see the Basic Circuit Diagram for your CNC. Refer to **Table 5-10**.

**Table 5-10, SA 301E, SA 411E: X70–X72: Terminal Assignments Pinout**

<b>X70–X72 Terminals</b>	<b>Assignment</b>
<b>1</b>	+ 24 V output (maximum 250 mA)
<b>2</b>	0 V
<b>3</b>	+ 24 V input for U <sub>Z</sub> ON, Axis ON, Spindle ON
<b>4</b>	Do not assign
<b>5</b>	Do not assign
<b>6<sup>**1</sup></b>	Normally closed contact (OE1, OE1A, or OE1S)
<b>7<sup>**1</sup></b>	Normally closed contact (OE2, OE2A, or OE2S)

**\*\*1** Maximum 125 V

**Warning: A recovery diode is required in the proximity of inductive loads (for example, relay or contactor coils).**

### SA 301E, SA 411E PWM Connection to the CNC

SA 301E, SA 411E:

X110 to X114: PWM Connection to the CNC

Refer to Table 5-11.

**Table 5-11, SA 301E, SA 411E: X110–X114: PWM Connection to the CNC**

20-line Ribbon Cable	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 <sub>Act1</sub>
6b	-I <sub>Act1</sub>
7a	0 V (analog)
7b	+I <sub>Act2</sub>
8a	-I <sub>Act2</sub>
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.”

**SA 301E, SA 411E CNC Supply Voltage and Control Signals**

**SA 301E, SA 411E:**

**X69: CNC Supply Voltage and Control Signals**

For X69, CNC supply voltage and control signals refer to **Table 5-12**.

**Table 5-12, SA 301E, SA 411E: X69: CNC Supply Voltage and Control Signals**

50-line Ribbon Cable	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	RES.PS
12b	0V
13a	PF.PS
13b	GND
14a	ERR.UZ.GR
14b	GND
15a	ERR.UZ.GR
15b	GND
16a	ERR.TEMP

50-line Ribbon Cable	Assignment
16a	GND
17a	RDY PS
17b	GND
18a	ERR.ILEAK
18b	GND
19a	Do not assign
19b	GND
20a	Do not assign
20b	GND
21a	Do not assign (SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C: 0V)
21b	GND
22a	Do not assign (SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C: 0V)
22b	GND
23a	Reserved (SDA)
23b	GND
24a	Reserved (SCL)
24b	GND
25a	RES.LE
25b	GND

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

### Connecting the SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C, or RA 201A, RA 301C, RA 411C Amplifiers

**DANGER:** Danger of electrical shock.  
Only ANILAM service engineers may open the amplifiers.  
Do not engage or disengage any terminals while they are under power.

The following topics are described:

- ❑ **Power Supplies**
- ❑ **RA 201A, RA 301C, RA 411C: Motor Connections**
- ❑ **RA 201A, RA 301C, RA 411C: Connection of the Motor Holding Brakes**
- ❑ **RA 201A, RA 301C, RA 411C: Main Contactor and Safety Relay**
- ❑ **RA 201A, RA 301C, RA 411C: PWM Connection to the CNC**
- ❑ **RA 201A, RA 301C, RA 411C: Unit Bus**
- ❑ **Unit Bus – Amplifier to PMD 107 Power Module**
- ❑ **BR 18, BR 10F, BR 18F Braking Resistors for SA 301A, SA 311C, SA 411A, SA 201A, SA 301C, SA 411C Amplifiers**



**Power Supplies**

**NOTE:** EN 50 178 requires a non-detachable connection to the line power supply.  
 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 amplifier.

**SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 311C, SA 411C:  
 X31: Power Supply**

Given a power supply of 400 V, the amplifier voltage  $U_z$  is 565 VDC.  
 Refer to **Table 5-13** and **Table 5-14**, RA 201A, RA 301C, RA 411C:  
**X31: Power Supply.**

**Table 5-13, SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 311C, SA 411C:  
 X31: Supply Voltage Connections**

Connecting Terminals X31	SA 301A, SA 311A, SA 411A	SA 201A, SA 301C, SA 311C, SA 411C
L1	400 Vac $\pm$ 10%	400 Vac $\pm$ 10%
L2	50 Hz to 60 Hz	50 Hz to 60 Hz
L3		
	<u>Cable / single conductor (HT wire):</u> 6 mm <sup>2</sup> <u>Single conductor H07 V2-K:</u> 4 mm <sup>2</sup> <u>Line fuse:</u> 35A (gRL) Siemens Sitor type <u>Grounding connection:</u> $\geq 10$ mm <sup>2</sup>	<u>Cable / single conductor (HT wire):</u> 10 mm <sup>2</sup> <u>Single conductor H07 V2-K:</u> 6 mm <sup>2</sup> <u>Line fuse:</u> 50 A (gRL) Siemens Sitor type <u>Grounding connection:</u> $\geq 10$ mm <sup>2</sup>
<b>Tightening torque for connecting terminals</b>	0.7 Nm (6.5–7 lb/in)	2.0–2.7 Nm (18–20.5 lb/in)

**RA 201A, RA 301C, RA 411C:  
X31: Power Supply**

The amplifier voltage is  $U_z$  is 650 VDC. Refer to **Table 5-14**.

The RA 201A, RA 301C, RA 411C regenerative amplifiers must be connected to the main power line via the CR 135 commutating reactor and the line filter. This is necessary for keeping the main line free of disruptive higher harmonics.

**Table 5-14, RA 201A, RA 301C, RA 411C: X31: Power Supply**

Connecting Terminals X31	RA 201A, RA 301C, RA 411C
L1	400 VAC $\pm$ 10%
L2	50 Hz
L3	
	<u>Cable / single conductor (HT wire):</u> 10 mm <sup>2</sup> <u>Single conductor H07 VS-K:</u> 6 mm <sup>2</sup> <u>Line fuse:</u> 35 A (gRL) Siemens Sitor type <u>Grounding connection:</u> $\geq$ 10 mm <sup>2</sup>
<b>Tightening torque for connecting terminals</b>	0.7 Nm (6.5–7 lb/in)

**NOTE:** The cables between the RA 201A, RA 301C, RA 411C amplifier and commutating reactor as well as between the commutating reactor and line filter must be as short as possible (< 0.4 m. (1.3 ft.)).

**RA 201A, RA 301C, RA 411C: Motor Connections**

**RA 201A, RA 301C, RA 411C:**

**X80: Spindle Motor,**

**X81: Axis Motor 1,**

**X82: Axis Motor 2,**

**X83: Axis Motor 3,**

**X84: Axis Motor 4**

Refer to **Table 5-15** and **Table 5-16**.

**Table 5-15, RA 201A, RA 301C, RA 411C Motor Connection Pinout**

<b>Terminals</b>	<b>Assignment</b>
<b>U</b>	Motor connection U
<b>V</b>	Motor connection V
<b>W</b>	Motor connection W

For information on synchronous motors, asynchronous motors, and power cables, refer to “Section 7, Cables and Connectors.”

**Table 5-16, RA 201A, RA 301C, RA 411C PWM Inputs**

<b>Motor Connection</b>	<b>PWM Input</b>
<b>X80</b>	X110
<b>X81</b>	X111
<b>X82</b>	X112
<b>X83</b>	X113
<b>X84</b>	X114

**RA 201A, RA 301C, RA 411C:  
Connection of the Motor Holding Brakes**

**RA 201A, RA 301C, RA 411C:  
X344: 24 V Supply for Motor Holding Brake**

Refer to Table 5-17. holding brake:

**Table 5-17, RA 201A, RA 301C, RA 411C:  
X344: 24 V Supply for Motor Holding Brake Pinout**

Connecting Terminals X344	Assignment
1	+ 24 V
2	0 V

**RA 201A, RA 301C, RA 411C:  
X392: Motor Holding Brake**

Refer to Table 5-18.

**Table 5-18, RA 201A, RA 301C, RA 411C:  
X392 - Motor Holding Brake Pinout**

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

**RA 201A, RA 301C, RA 411C:  
X393: Motor Holding Brake**

Refer to Table 5-19.

**Table 5-19, RA 201A, RA 301C, RA 411C:  
X393: Motor Holding Brake Pinout**

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 (X113)

**SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C, RA 201A, RA 301C, RA 411C:  
X392/X393 Maximum Current**

Maximum current  $I_{max}$  for controlling the holding brake via X392 and X393. Refer to **Table 5-20**.

**Table 5-20, SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C RA 201A, RA 301C, RA 411C:  
X392/X393: Maximum Current**

Amplifiers	$I_{max}$ (X392)	$I_{max}$ (X393)
SA 301A, SA 301C, RA 301C	3.0 A	1.5 A
SA 311A	2.0 A	2.0 A
SA 411A, SA 411C, RA 411C	2.0 A	1.5 A
SA 201A, RA 201A	3.0 A	2.0 A

**RA 201A, RA 301C, RA 411C:  
Main Contactor and Safety Relay**

For information on wiring and function, refer to the Basic Circuit diagram for your CNC.

**RA 201A, RA 301C, RA 411C:  
X70: Main Contactor,  
X71: Safety Relay for Spindle,  
X 72: Safety Relay for Axes**

Refer to **Table 5-21**. for axes: for spindle

**Table 5-21, RA 201A, RA 301C, RA 411C:  
X70 Main Contactor, X71 Safety Relay Spindle, and X72 Safety Relay for Axes**

Terminals X70 to X72	Assignment
1	+24 V output (maximum 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 <sup>**1</sup>	Normally closed contact (OE1, OE1A, or OE1S)
7 <sup>**1</sup>	Normally closed contact (OE2, OE2A, or OE2S)

\*\*1 Maximum 125 V

**Warning: A recovery diode is required in the proximity of inductive loads (for example, relay or contactor coils).**

**RA 201A, RA 301C, RA 411C:  
PWM Connection to the CNC**

**RA 201A, RA 301C, RA 411C:  
X110–X114: PWM Connection to the CNC**

Refer to Table 5-22.

**Table 5-22, RA 201A, RA 301C, RA 411C:  
X110–X114 PWM Connection to the CNC**

20-Pin Ribbon Connector	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 <sub>Act1</sub> 1
6b	-I <sub>Act1</sub> 1
7a	0 V (analog)
7b	+I <sub>Act1</sub> 2
8a	-I <sub>Act1</sub> 2
8b	0 V (analog)
9a	Do not assign
9b	$\overline{\text{BRK}}$
10a	$\overline{\text{ERR}}$
10b	RDY

**NOTE:** The interface conforms with the requirements of EN 50 178 for “low voltage electrical separation.”

**RA 201A, RA 301C, RA 411C:  
Unit Bus**

The unit bus connects the amplifier with a PM 107 power module. If you are not using a PM 107, you do not need to connect the unit bus.

**RA 201A, RA 301C, RA 411C:  
X79: Unit Bus**

Refer to **Table 5-23**.

**Table 5-23, RA 201A, RA 301C, RA 411C: X79 – Unit Bus Pinout**

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

**NOTE:** This interface complies with the requirements of EN 50 178 for “low voltage electrical separation” except for 1a to 6a.

### Unit Bus – Amplifier to PM 107 Power Module

The unit bus connects the amplifier and the PM 107 power module. If you are not using a PM 107, you do not need to connect the unit bus. Refer to **Table 5-24**.

**Table 5-24, Unit Bus Connection Pinout**

40-Conductor Ribbon Connector	Assignment	
1a to 3b	0 V <sup>**1</sup>	**1 These voltages must not be linked with other voltages (insulation limitation).
4a	+ 24 V <sup>**1</sup>	
4b	+ 24 V <sup>**1</sup>	
5a	+ 15 V <sup>**1</sup>	
5b	+ 24 V <sup>**1</sup>	
6a	+ 15 V <sup>**1</sup>	
6b	+ 15 V <sup>**1</sup>	
7a to 8b	Do not assign	
9a	Reserved (SDA)	
9b	Do not assign	
10a	Reserved (SCL)	
10b	ERR.TEMP	
11a	PF.PS	
11b	0 V	
12a	RES.PS	
12b	0 V	
13a	PWR.OFF	
13b	0 V	
14a	5 V FS (spindle enable)	
14b	0 V	
15a	5 V FA (axis 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).



**BR 18, BR 10F, BR 18F Braking Resistors for SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C Amplifiers**

An external braking resistor must be connected to the SA 201A, SA 301C, and SA 411C amplifiers, as these amplifiers are not equipped with an internal braking resistor.

An external braking resistor can also be connected to the SA 301A, SA 311A, and SA 411A amplifiers to be used instead of the internal braking resistor. This may be necessary if the internal resistor fails to fully absorb the excessive braking energy, or if the braking resistor needs to be mounted outside the CNC cabinet.

Either one BR 10F or BR 18F, one BR 18F, one BR 18, or two BR 18 in parallel can be connected to the SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C amplifiers.

The braking resistor is switched on when the amplifier voltage  $U_z$  exceeds 700 V and is switched off as soon as the voltage falls below 670 V.

**NOTE:** If no braking resistor is connected, the amplifier voltage  $U_z$  can increase and at  $U_z > 760$  V, all power stages are switched off (LED for  $U_{DC-LINK} >>$  lights up)!

The following topics are described:

- ❑ **Cross Section**
- ❑ **X89 - Braking Resistor Connection**
- ❑ **Temperature Switch on BR 18, BR 10F, and BR 18F Braking Resistor**
- ❑ **X2 Fan for the BR 10F and BR 18F External Braking Resistors**

**Cross Section**

The following cross section is required for connecting the braking resistor. Refer to **Table 5-25**.

**Table 5-25, SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C: Cross-Sections for Connection to Braking Resistors**

Braking Resistor	Cross Section for Connection
1 x BR 18	1.5 mm <sup>2</sup>
2 x BR 18F in parallel	4 mm <sup>2</sup>
1 x BR 10F	1.5 mm <sup>2</sup>
1 x BR 18F	4 mm <sup>2</sup>

### X89 - Braking Resistor Connection

Refer to Table 5-26, Table 5-27, and Table 5-28.

**Table 5-26, SA 301A, SA 301C, SA 411C:  
X89: Internal Braking Resistor Connections**

Connecting Terminal X89A on SA 301A, SA 311A, and SA 411A	Assignment	Connecting Terminal X89B on SA 301A, SA 311A, and SA 411A	Assignment
1	Do not assign	1	Jumper
2	Do not assign	2	

**Table 5-27, SA 301A, SA 311A, SA 411A:  
X89: External Braking Resistor Connections**

Connecting Terminal X89B on SA 301A, SA 311A, and SA 411A	Assignment	Connecting Terminal X89A on SA 301A, SA 311A, and SA 411A	Assignment	BR 18	BR 10F, BR 18F Connecting Terminal X1
1	Do not assign	1	+U <sub>z</sub>	RB 1	1
2	Do not assign	2	Switch against -U <sub>z</sub>	RB 2	2

**WARNING: Do not operate an internal and external braking resistor in parallel.**

**Table 5-28, SA 201 A, SA 301C, SA 411C:  
X89: Braking Resistor Connections**

Connecting Terminal X89 on SA 201A, SA 301C, and SA 411C	Assignment	BR 18	BR 10F, BR 18F Connecting Terminal X1
1	+U <sub>z</sub>	RB 1	1
2	Switch against -U <sub>z</sub>	RB 2	2

**Temperature Switch on BR 18, BR 10F, and BR 18F Braking Resistor**

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 CNC, and can be evaluated via the PLC. Refer to **Table 5-29** and **Table 5-30**.

**Table 5-29, BR 18 Temperature Switch Pinout**

Connecting Terminal on the BR 18	Assignment
T1	1
T2	2

**Table 5-30, BR 10F, BR 18F Temperature Switch Pinout**

Connecting Terminal X3 on the BR 10F, BR 18F	Assignment
1	1
2	2

**X2 Fan for the BR 10F and BR 18F External Braking Resistors**

Refer to **Table 5-31**.

**Table 5-31, BR 10 and BR 18F – X2 Fan Connections Pinout**

Connecting Terminal X2	Assignment
+	+ 24 V (PLC)
-	0 V

### Connecting the PS 120A Power Supply Unit

#### X69, X169: CNC Supply Voltage and Control Signals

**NOTE:** For the control to be able to evaluate the status signals of the power supply units, connector X69 of the CNC must be connected by ribbon cable with X69 of the PS 120A.

Since non-ANILAM amplifiers do not send any status signals, an adapter connector (P/N 349 211-01) must be connected to X69 on the PS 120A. This connector is delivered with the PS 120A.

**Table 5-32, PS 120A: X69, X169: CNC Supply Voltage and Control Signals**

50-line Ribbon Cable	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	RES.PS
12b	0V
13a	PF.PS
13b	GND
14a	ERR.UZ.GR
14b	GND
15a	ERR.UZ.GR
15b	GND
16a	ERR.TEMP


50-line Ribbon Cable	Assignment
16a	GND
17a	RDY PS
17b	GND
18a	ERR.ILEAK
18b	GND
19a	Do not assign
19b	GND
20a	Do not assign
20b	GND
21a	PF.PS.AC (only RA 201A, RA 301C, RA 411C)
21b	GND
22a	Do not assign
22b	GND
23a	Reserved (SDA)
23b	GND
24a	Reserved (SCL)
24b	GND
25a	RES.LE
25b	GND

**X31: Supply Voltage for PS 120A**

Supply voltage: 400 V

Refer to **Table 5-33**.

**Table 5-33, PX 120A: X31: Power Supply**

Connecting Terminals X31	Assignment
<b>Tightening torque for connecting terminals</b>	0.7 Nm (6.5–7 lb/in)
<b>U</b>	Phase 1 / 400 VAC ± 10% / 50 Hz to 60 Hz
<b>V</b>	Phase 2 / 400 VAC ± 10% / 50 Hz to 60 Hz
	Equipment ground (YL/GY) ≥ 10 mm <sup>2</sup>
	<p><u>Cable:</u> Wire cross section: 1.5 mm<sup>2</sup> (AWG 16)</p> <p><u>Line fuse:</u> 6.5 A (gRL) Siemens Sitor type The screw terminal between X31 and the grounding terminal must be used for fixing the cable and for ensuring appropriate strain relief of the cable.</p> <p><u>Grounding connection:</u> ≥ 10 mm<sup>2</sup> (AWG 6)</p>
<b>Tightening torque for connecting terminals</b>	0.7 Nm (6.5–7 lb/in)

**NOTE:**

- If you are using non-ANILAM inverter systems or regenerative ANILAM inverter systems, you must connect the supply voltage to the terminals U and V via an isolating transformer (300 VA, basic insulation as per EN 50 178 and VDE 0550).
- There is no need for an isolating transformer if non-regenerative ANILAM inverter systems are used.

**Warning: When using an isolating transformer, do not ground this isolating transformer on the secondary side!**

**The isolating transformer decouples the DE-link voltage from ground. Grounding the isolating transformer on the secondary side leads to an addition of the DC-link voltage and the supply voltage. This overloads the PS 120A, thereby destroying it!**

**Please keep this in mind in your circuit diagrams.**

**X74: 5 V Connection of the PS 120A**Refer to **Table 5-34**.**Table 5-34, PS 120A: X74: 5 V Connections**

Wire Color of 5 V Connection	5 V Terminal on CC 422
Black	0 V
Red	+5 V

**U<sub>z</sub>: Supply of the PS 120A with U<sub>z</sub>**

Since the power to PS 120A is supplied through the DC-link, the voltage fed into the DC-link by the motors that are still running can be used during the voltage failures. The PS 120A uses this voltage to maintain the power supply to the control until the system has been shut down properly by the control. Refer to **Table 5-35**.

**Table 5-35, PS 120A: U<sub>z</sub>: Supply of the with U<sub>z</sub> Connection**

Terminals	Assignment
-U <sub>z</sub>	DC-link voltage -
+U <sub>z</sub>	DC-link voltage +

The PS 120A is powered with DC-link voltage U<sub>z</sub> through:

- The conductor bars (for ANILAM inverter systems)
- A cable which is connected instead of the conductor bar (for non-ANILAM inverter systems).

### Connecting the BR 9 Braking Resistor Module

The BR 9 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 BR 9 is switched on when the amplifier voltage  $U_z$  exceeds 740 V and is switched off again as soon as it falls below 720V. The X79 cable provides the data communication to the BR 9.

**DANGER: Danger of electrical shock.**  
**Only ANILAM service engineers must open the BR 9 braking resistor module.**  
**Do not engage or disengage any terminals while they are under power.**

#### X79 Unit Bus

Table 5-36, BR 9 - X79 Unit Bus Connection Pinout

40-line Ribbon Connector	Assignment	
1a to 3b	0 V <sup>**1</sup>	**1 These voltages must not be linked with other voltages (only basic insulation).
4a	+ 24 V <sup>**1</sup>	
4b	+ 24 V <sup>**1</sup>	
5a	+ 15 V <sup>**1</sup>	
5b	+ 24 V <sup>**1</sup>	
6a	+ 15 V <sup>**1</sup>	
6b	+ 15 V <sup>**1</sup>	
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 (axis 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).

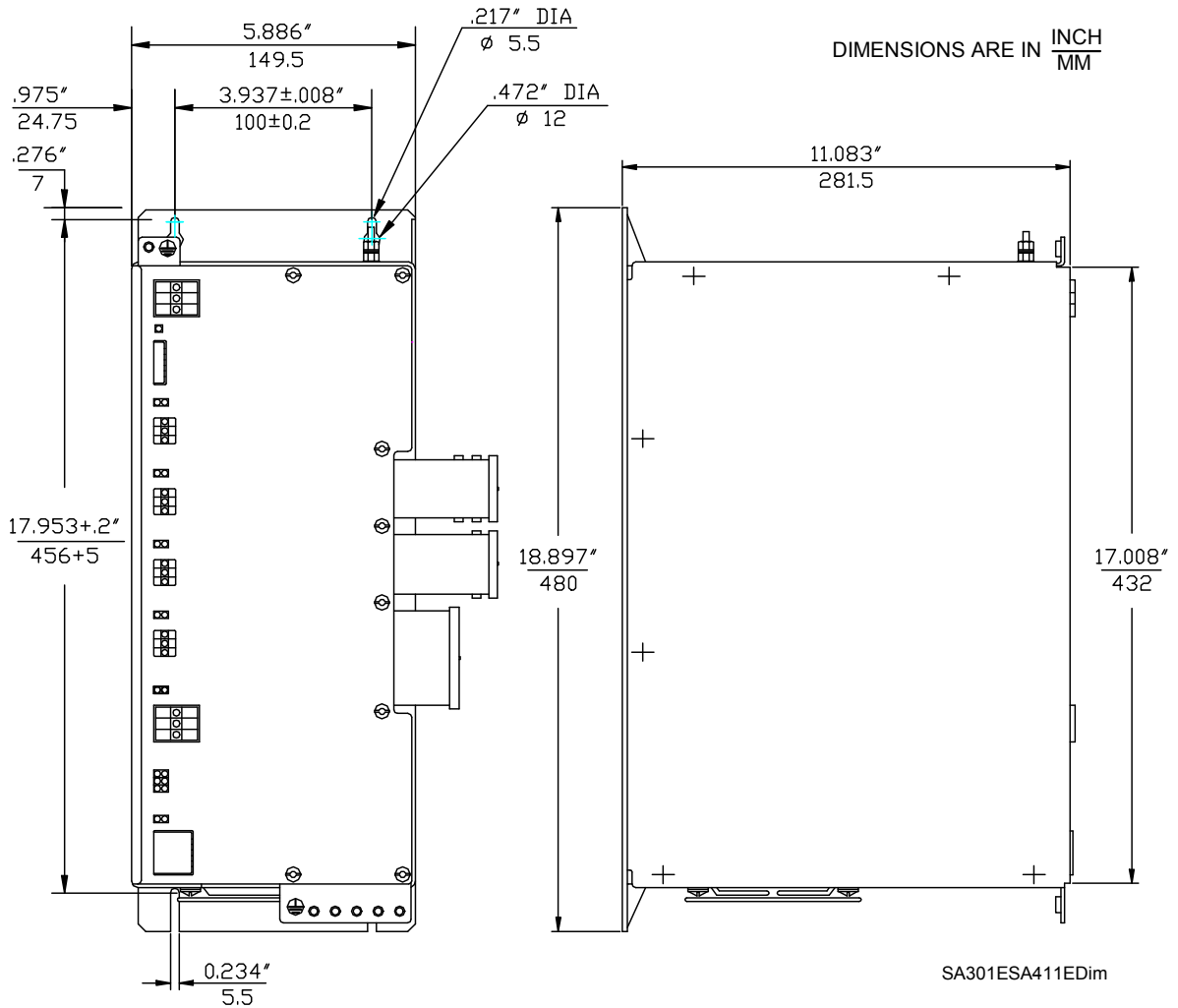
### Physical Dimensions

The following products are illustrated:

- ❑ SA 301E, SA 411E Amplifiers
- ❑ SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C Amplifiers
- ❑ SA 301AD, SA 311AD, SA 411AD, SA 201AD Amplifiers
- ❑ RA 201A, RA 301C, RA 411C Amplifiers
- ❑ PS 120A Power Supply Unit
- ❑ Braking Resistors
- ❑ CR 135 Commutating Reactor

#### SA 301E, SA 411E Amplifiers

For SA 301E/SA 411E amplifiers, refer to **Figure 5-26**.

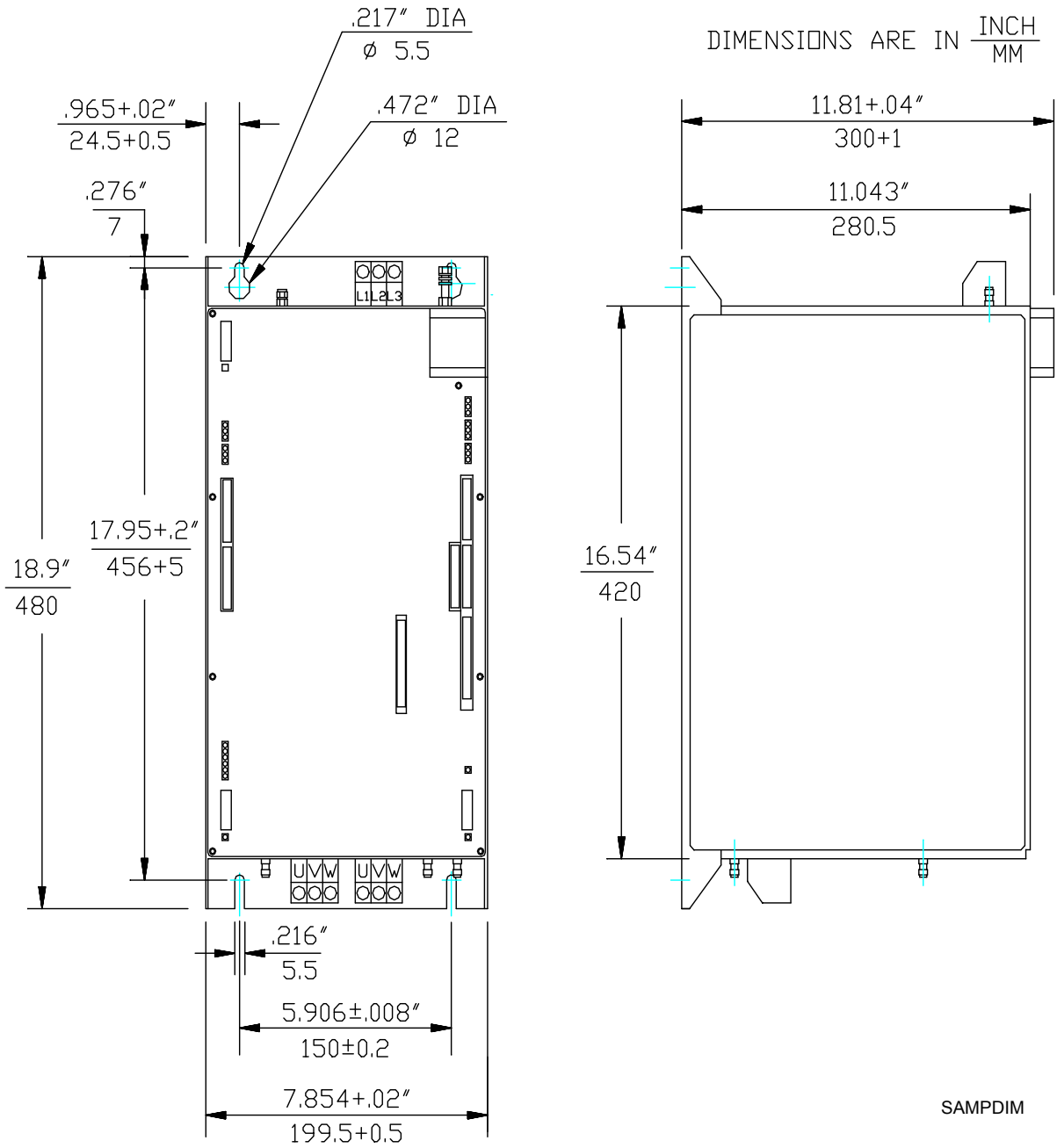


**Figure 5-26, SA 301E/SA 411E Amplifiers Dimensions**



**SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C Amplifiers**

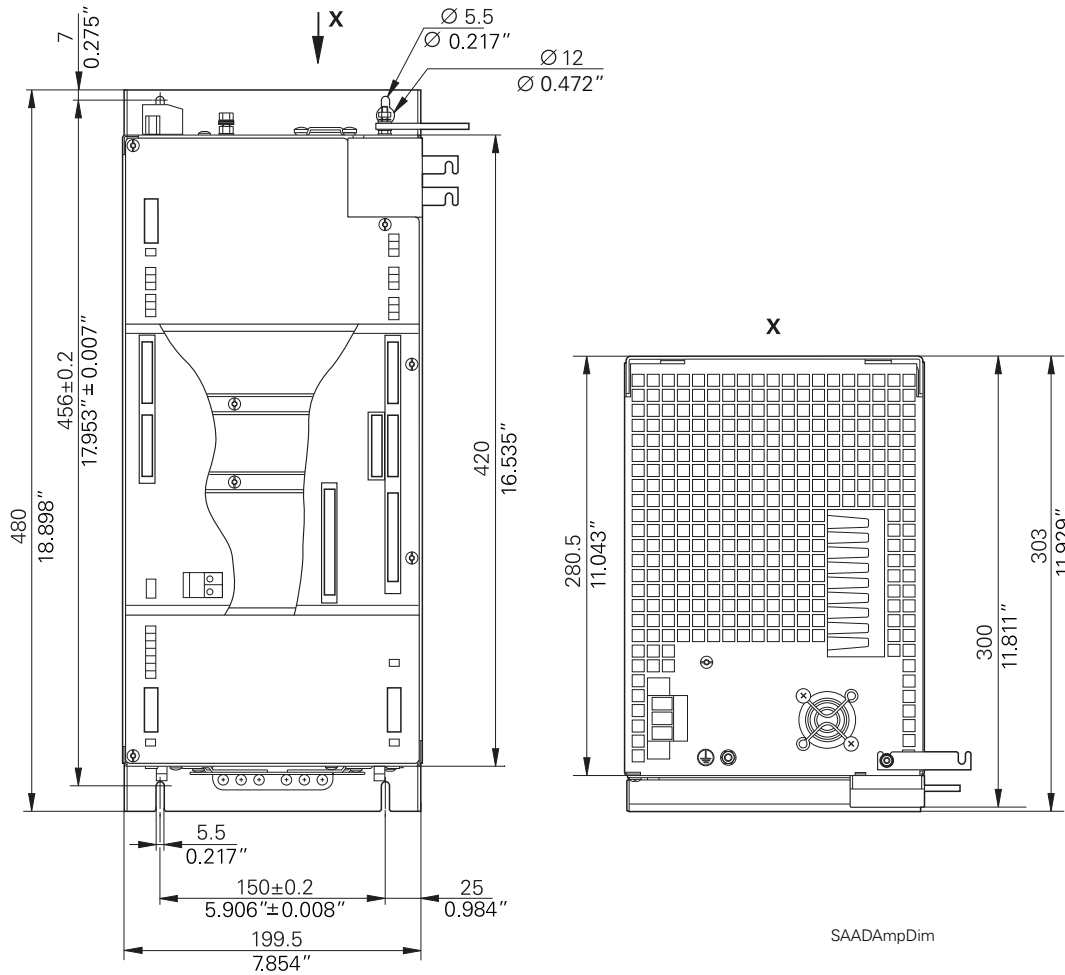
Refer to **Figure 5-27**.



**Figure 5-27, SA 301A, SA 311A, SA 411A, SA 201A, SA 301C, SA 411C Amplifier Dimensions**

### SA 301AD, SA 311AD, SA 411AD, SA 201AD Amplifiers

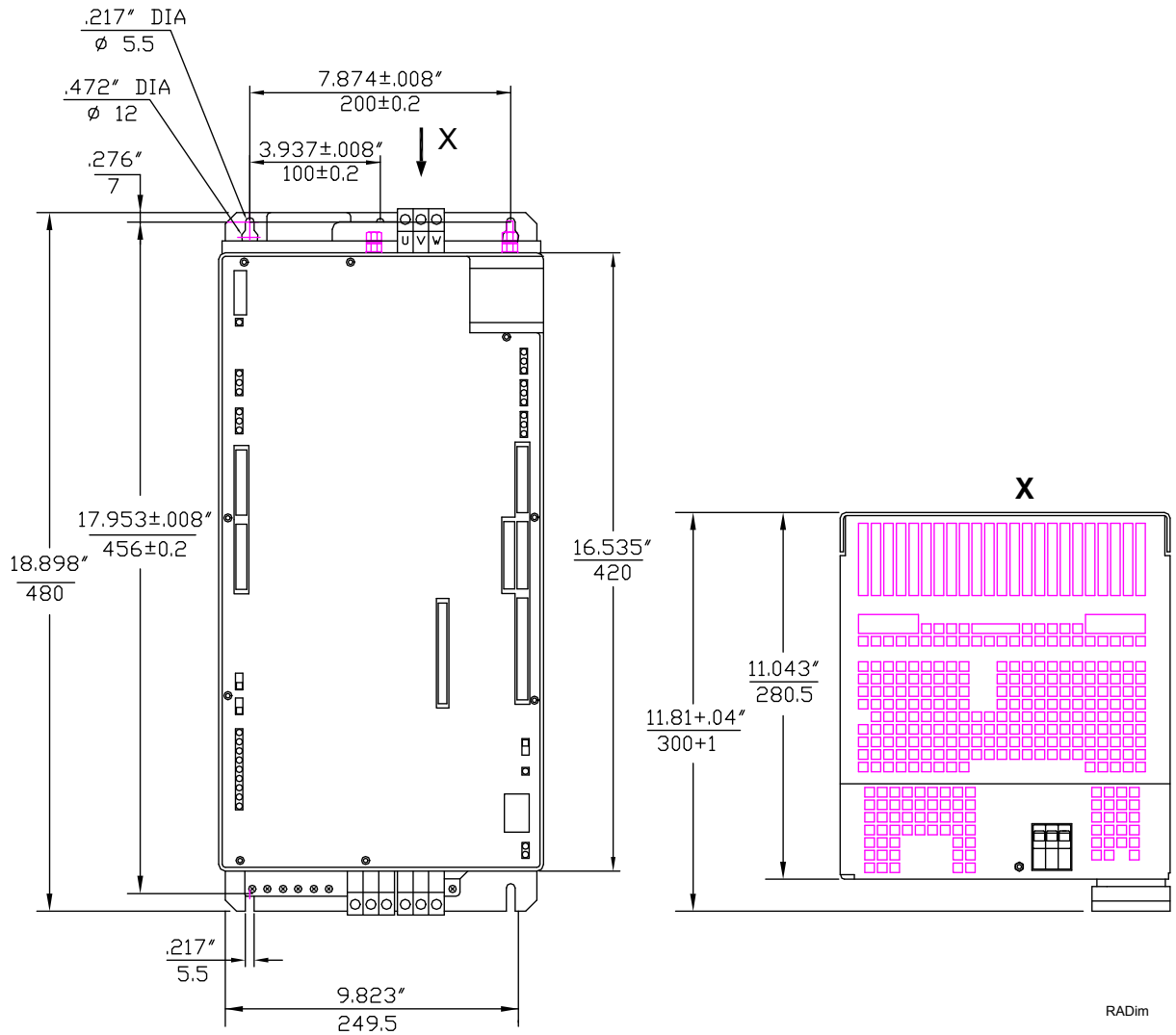
Refer to Figure 5-28.



**Figure 5-28, SA 301AD, SA 311AD, SA 411AD, SA 201AD Amplifier Dimensions**

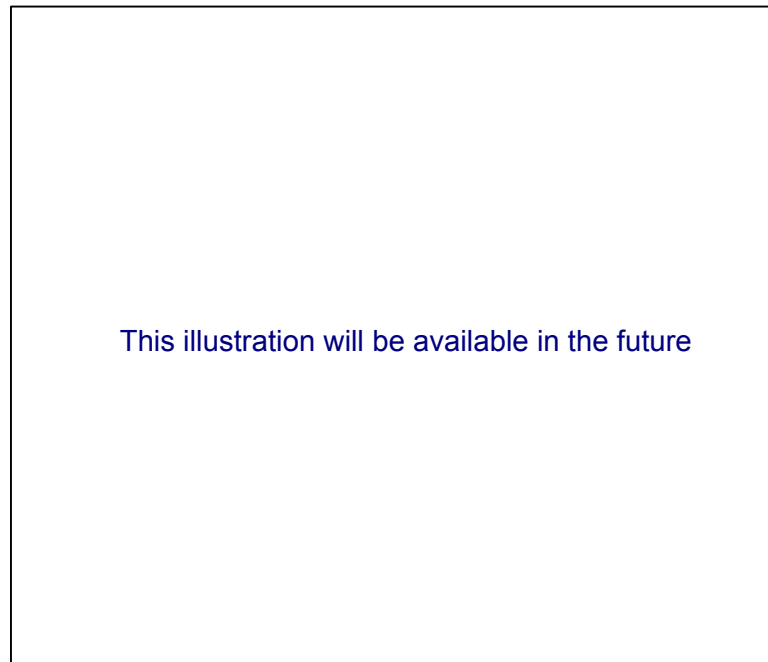
**RA 201A, RA 301C, RA 411C Amplifiers**

Refer to Figure 5-29.



### PS 120A Power Supply Unit

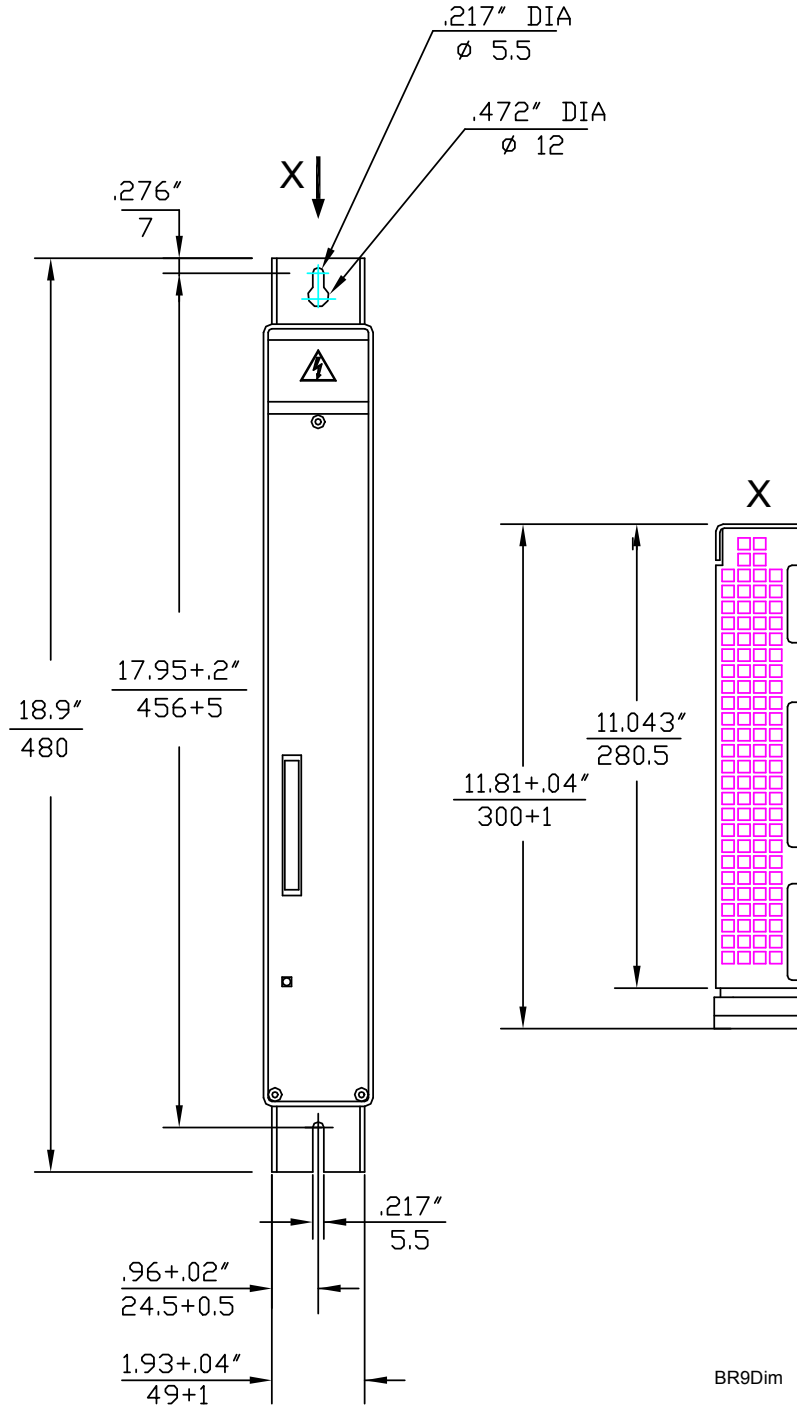
Refer to **Figure 5-30**.



**Figure 5-30, PS 120A Power Supply Unit Dimensions**

**Braking Resistors**

Refer to **Figure 5-31, Figure 5-32, BR 18 Braking Resistor Dimensions, Figure 5-33, BR 10F and BR 18F Braking Resistor Dimensions, and Table 5-37, Braking Resistors with Fans.**



**Figure 5-31, BR 9 Braking Resistor Dimensions**

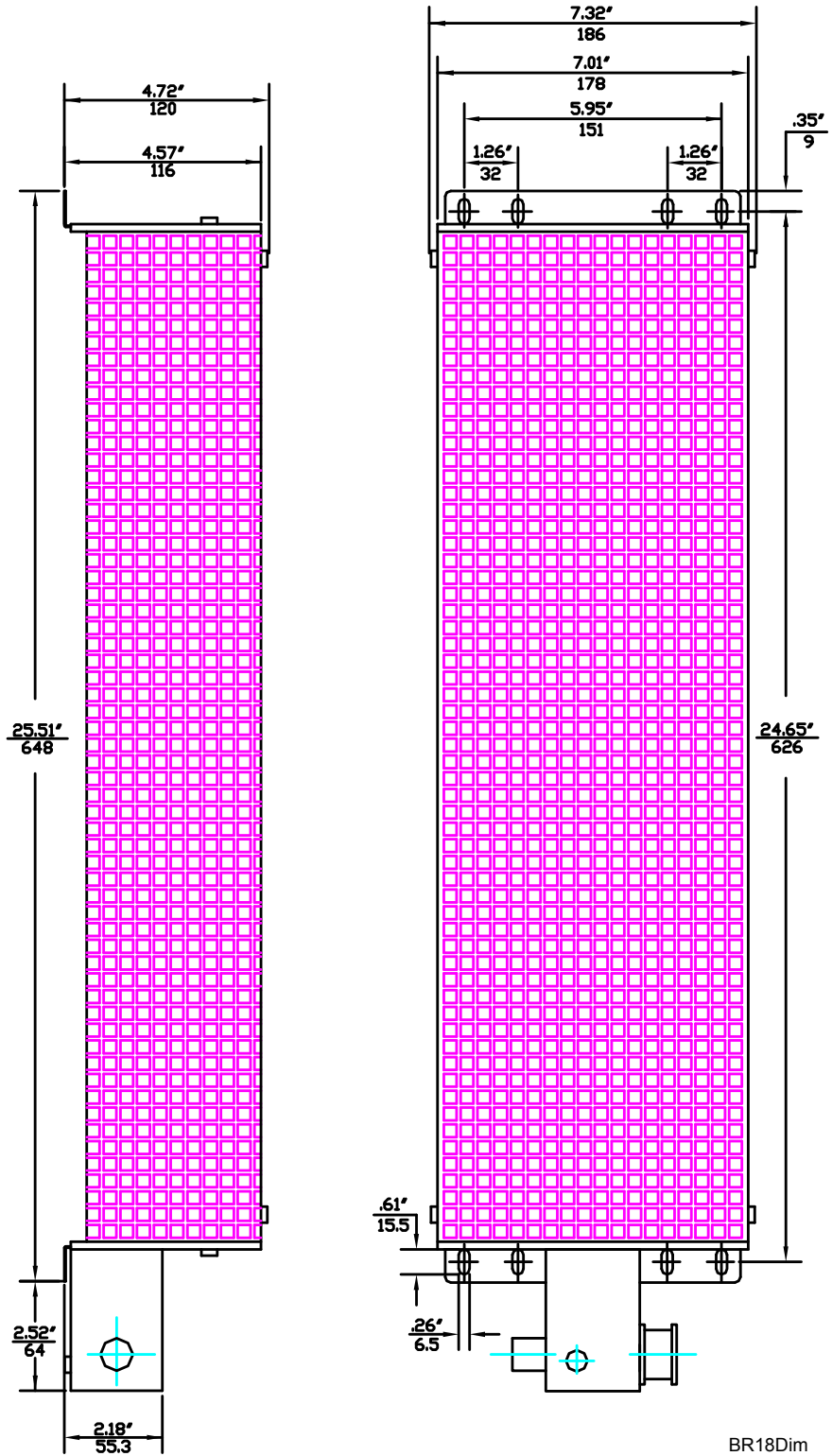
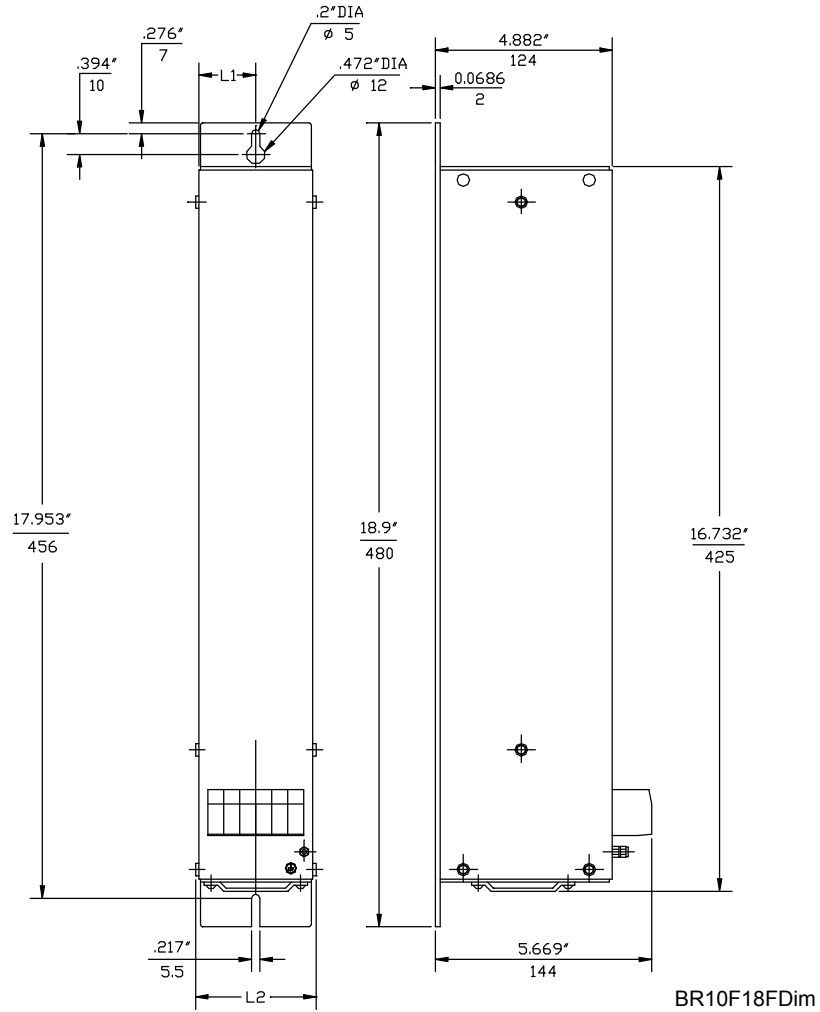


Figure 5-32, BR 18 Braking Resistor Dimensions



**Figure 5-33, BR 10F and BR 18F Braking Resistor Dimensions**

**Table 5-37, Braking Resistors with Fans**

Value	BR 18F	BR 10F
<b>L1</b>	38.5 mm (1.516 in)	62.5 mm (2.461 in)
<b>L2</b>	77 mm (3.031 in)	125 mm (4.921 in)

## CR 135 Commutating Reactor

Refer to Figure 5-34.

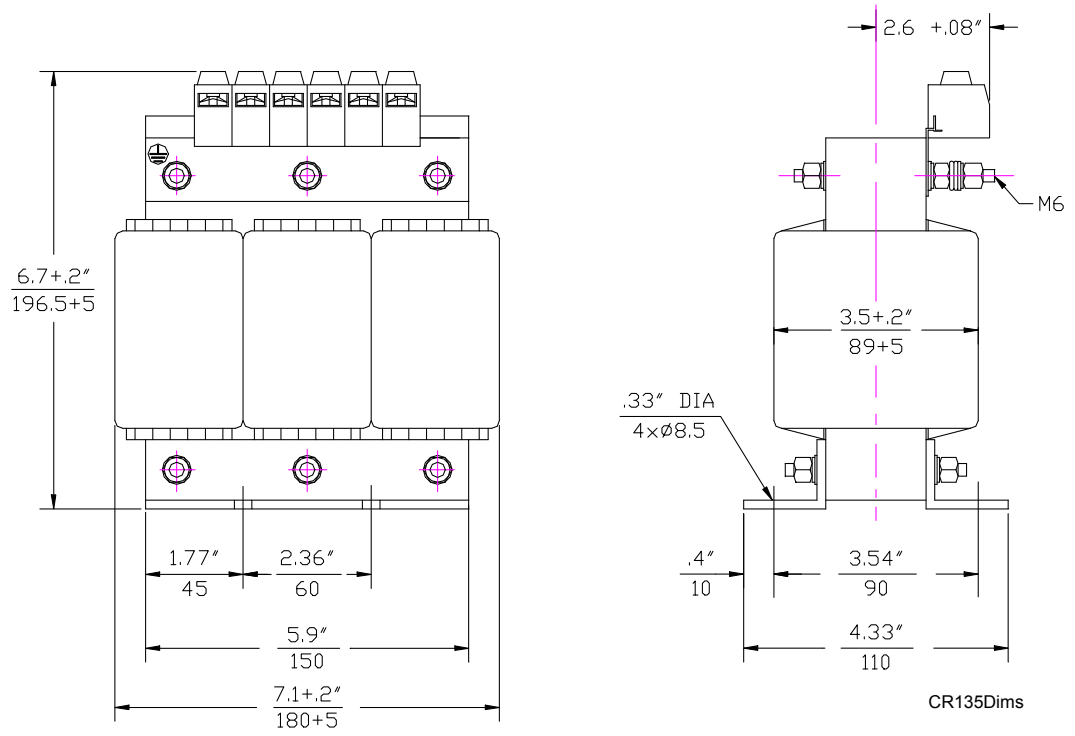


Figure 5-34, CR 135 Dimensions



## Section 6 - Installing Modular Amplifiers

The following topics are described in this section:

- ❑ **Connection Overview**
- ❑ **Mounting and Connection of the Modular Amplifier System**
- ❑ **Connection with BR 9 Braking Resistor Module**
- ❑ **Connections on the PM 1xz(A), PM 2xx(A), PMD 1xx, PMD 2xx Power Modules**
- ❑ **Connecting the PS 120A Power Module Unit**
- ❑ **Connecting the DLF 1x0 DC-Link Filter**
- ❑ **Connecting the Adapter Module**
- ❑ **Physical Dimensions**

### Connection Overview

The following components and connections are illustrated:

- ❑ **PS 122R Power Supply Unit**
- ❑ **Description of the LEDs on PS 122R**
- ❑ **PS 130 Power Supply Unit**
- ❑ **Description of the LEDs on PS 130**
- ❑ **PS 145 Power Supply Unit**
- ❑ **Description of the LEDs on PS 145R**
- ❑ **PM 107 Power Module**
- ❑ **PMD 107 Power Module**
- ❑ **PM 115A Power Module**
- ❑ **PMD 115 Power Module**
- ❑ **PM 123A Power Module**
- ❑ **PMD 125 and PMD 140 Power Module**
- ❑ **PM 132A and PM 148A Power Module**
- ❑ **PMD 160 Power Module**
- ❑ **PM 170A Power Module**
- ❑ **PMD 196 Power Module**
- ❑ **PM 207 Power Module**
- ❑ **PMD 207 Power Module**
- ❑ **PM 215A and PM 223A Power Module**
- ❑ **PMD 215 and PMD 225 Power Module**
- ❑ **Description of the LEDs on PM and PMD Power Modules**
- ❑ **PS 120A Power Supply Unit**
- ❑ **BR 9 Braking Resistor**
- ❑ **BR 10F and BR 18F Braking Resistor**
- ❑ **BR 18 Braking Resistor Module**
- ❑ **DLF 130 DC-Link Filter**
- ❑ **Adapter Module**

### PS 122R Power Supply Unit

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

See Figure 6-1.

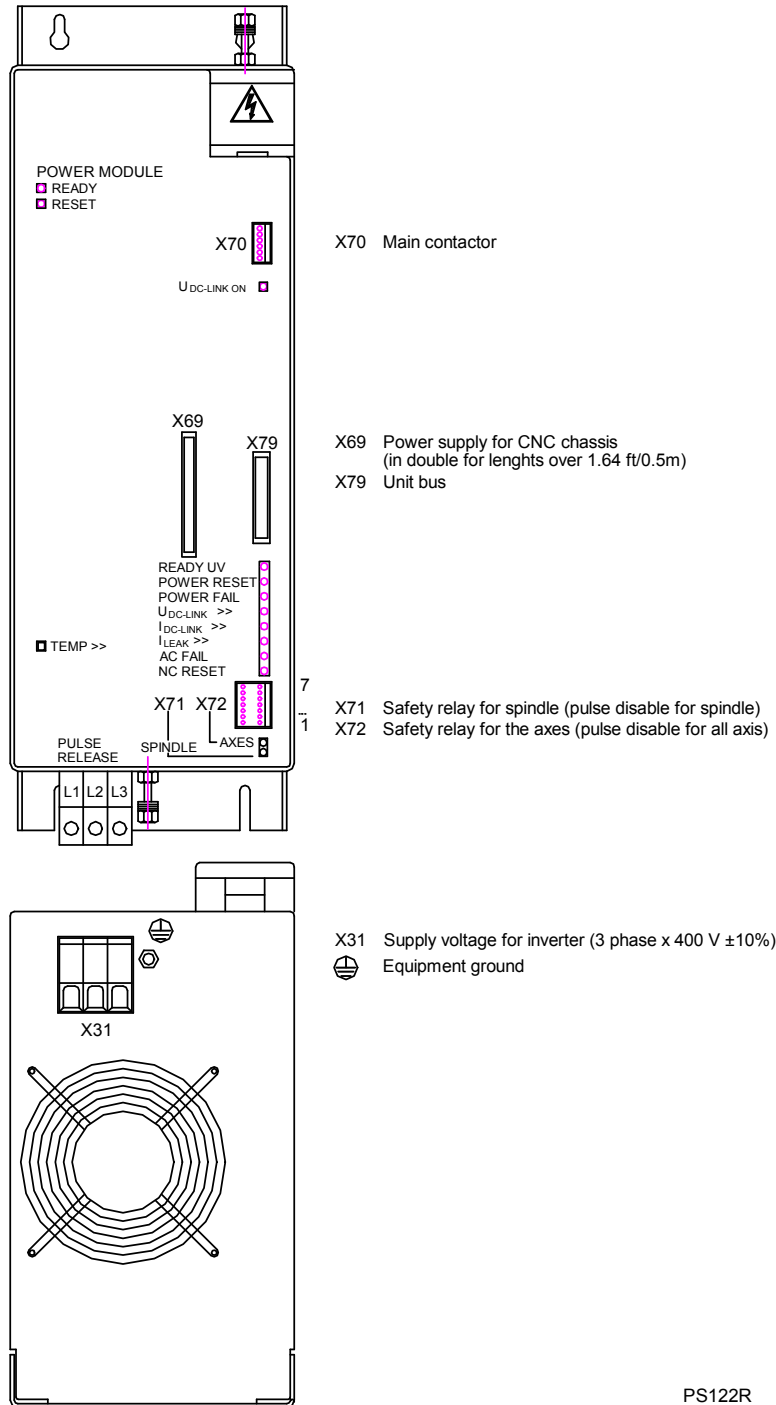


Figure 6-1, PS 122R Power Supply Unit, Connections

**Description of LEDs on PS 122R**

Refer to **Table 6-1**.

**Table 6-1, PS 122R - LEDs Description**

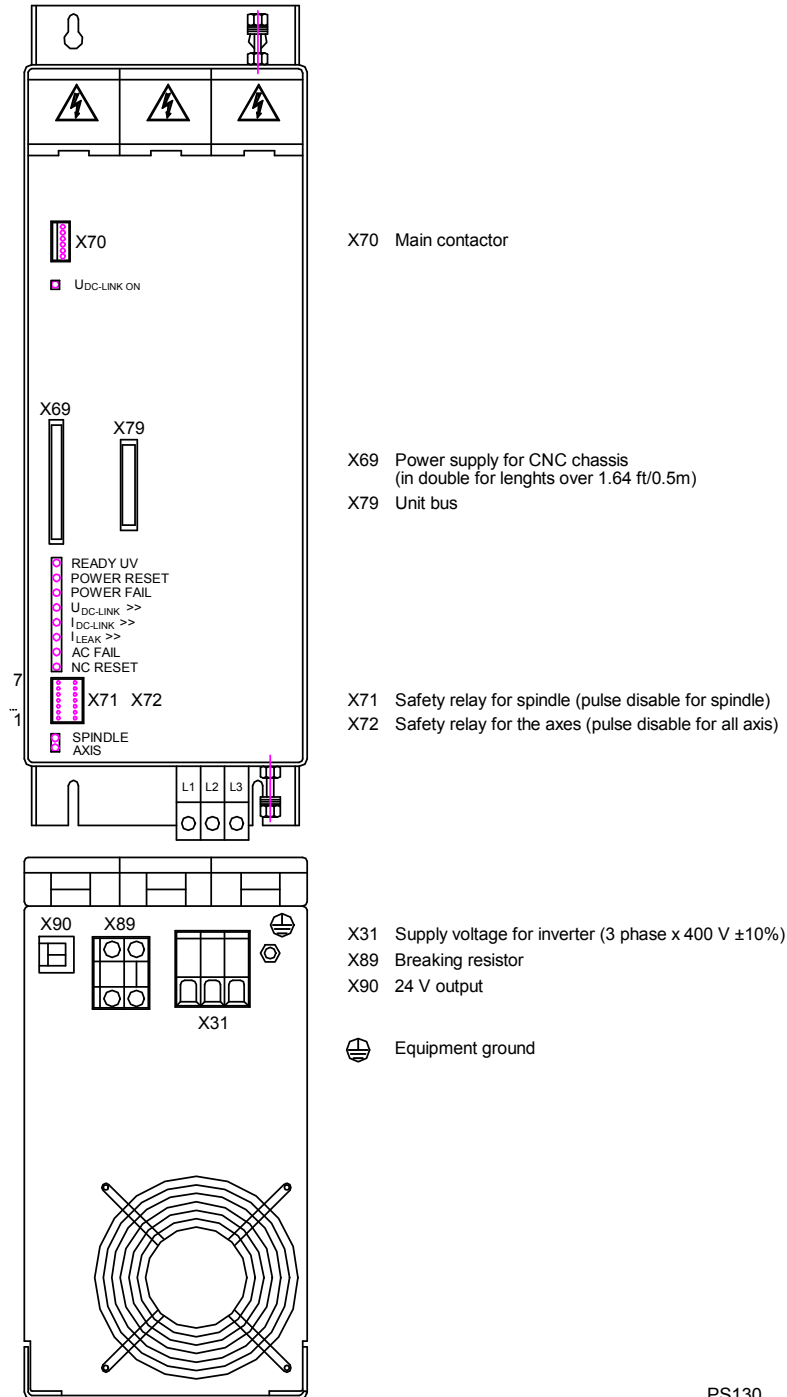
<b>LED</b>	<b>Meaning</b>	<b>Signal Direction</b>	<b>Signal</b>
<b>U<sub>DC LINK ON</sub></b>	Main contactor on	–	–
<b>READY</b>	End stage ready (only for service purposes)	–	–
<b>RESET</b>	Reset for end stage (only for service purposes)	–	–
<b>READY UV</b>	Supply unit ready	PS > CNC Chassis	RDY.PS
<b>POWER RESET</b>	Reset signal from PS 122R to CNC Chassis	PS > CNC Chassis	$\overline{\text{RES.PS}}$
<b>POWER FAIL</b>	U <sub>Z</sub> too low, U <sub>Z</sub> < 410 A (e.g. line power < 290 V)	PS > CNC Chassis	$\overline{\text{PF.PS}}$
<b>U<sub>DC LINK &gt;&gt;</sub></b>	U <sub>Z</sub> too high (>approx. 800 V); power modules are switched off	PS > CNC Chassis	$\overline{\text{ERR.UZ.GR}}$
<b>I<sub>DC LINK &gt;&gt;</sub></b>	Warning signal to control at I <sub>Z</sub> > 52 A <sup>**1</sup>	PS > CNC Chassis	$\overline{\text{ERR.IZ.GR}}$
<b>I<sub>LEAK</sub></b>	Error current (e.g. through short to earth; warning signal to control)	PS > CNC Chassis	$\overline{\text{ERR.ILEAK}}$
<b>TEMP &gt;&gt;</b>	Temperature of heat sink too high (>95 °C [203 °F])	PS > CNC Chassis	$\overline{\text{ERR.TEMP}}$
<b>AC FAIL</b>	Phase missing	PS > CNC Chassis	$\overline{\text{PF.PS.AC}}$
<b>NC RESET</b>	Reset signal from the CNC Chassis to the PS 122R	CNC Chassis > PS	$\overline{\text{RES.LE}}$
<b>AXES</b>	Safety relay for axes on	–	–
<b>SPINDLE</b>	Safety relay for spindle on	–	–

<sup>\*\*1</sup> A further increase of approximately 10 % results in the drives being switched off.

### PS 130 Power Supply Unit

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

See Figure 6-2.



**Figure 6-2, PS 130 Power Supply Unit, Connections**

**Description of LEDs on PS 130**

Refer to **Table 6-2**.

**Table 6-2, PS 130 - LEDs Description**

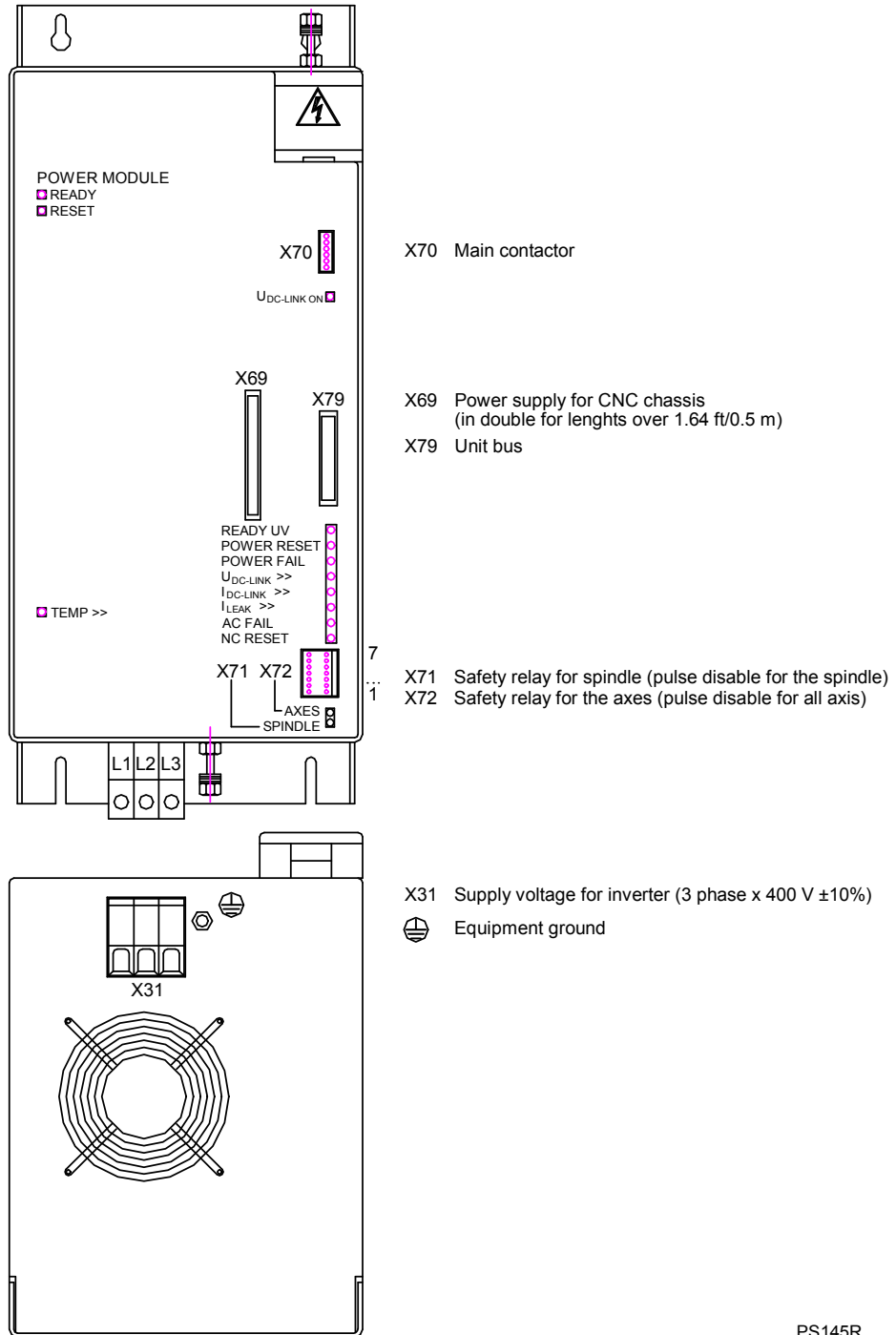
LED	Meaning	Signal Direction	Signal
<b>U<sub>DC LINK ON</sub></b>	Main contactor on	–	–
<b>READY UV</b>	Supply unit ready	–	RDY.PS
<b>POWER RESET</b>	Reset signal from the PS 130 to CNC Chassis	PS > CNC Chassis	$\overline{\text{RES.PS}}$
<b>POWER FAIL</b>	U <sub>Z</sub> too low, U <sub>Z</sub> < 410 A (e.g. line power < 290V)	PS > CNC Chassis	$\overline{\text{PF.PS}}$
<b>U<sub>DC LINK &gt;&gt;</sub></b>	U <sub>Z</sub> too high (>approximately 760 V); power modules are switched off	PS > CNC Chassis	$\overline{\overline{\text{ERR.UZ.GR}}}$
<b>I<sub>DC LINK &gt;&gt;</sub></b>	Warning signal to control at I <sub>Z</sub> > 75 A <sup>**1</sup>	PS > CNC Chassis	$\overline{\overline{\text{ERR.IZ.GR}}}$
<b>I<sub>LEAK</sub></b>	Error current (e.g. through short to earth; warning signal to control)	PS > CNC Chassis	$\overline{\overline{\text{ERR.ILEAK}}}$
<b>TEMP &gt;&gt;</b>	Temperature of heat sink too high (>95 °C [203 °F])	PS > CNC Chassis	$\overline{\overline{\text{ERR.TEMP}}}$
<b>NC RESET</b>	Reset signal from the CNC Chassis to the PS 130	CNC Chassis > PS	$\overline{\text{RES.LE}}$
<b>AXES</b>	Safety relay for axes on	–	–
<b>SPINDLE</b>	Safety relay for spindle on	–	–

\*\*1 A further increase of approximately 10 % results in the drives being switched off.

### PS 145R Power Supply Unit

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

See Figure 6-3.



**Figure 6-3, PS 145R Power Supply Unit, Connections**

**Description of LEDs on PS 145R**

Refer to **Table 6-3**.

**Table 6-3, PS 145R - LEDs Description**

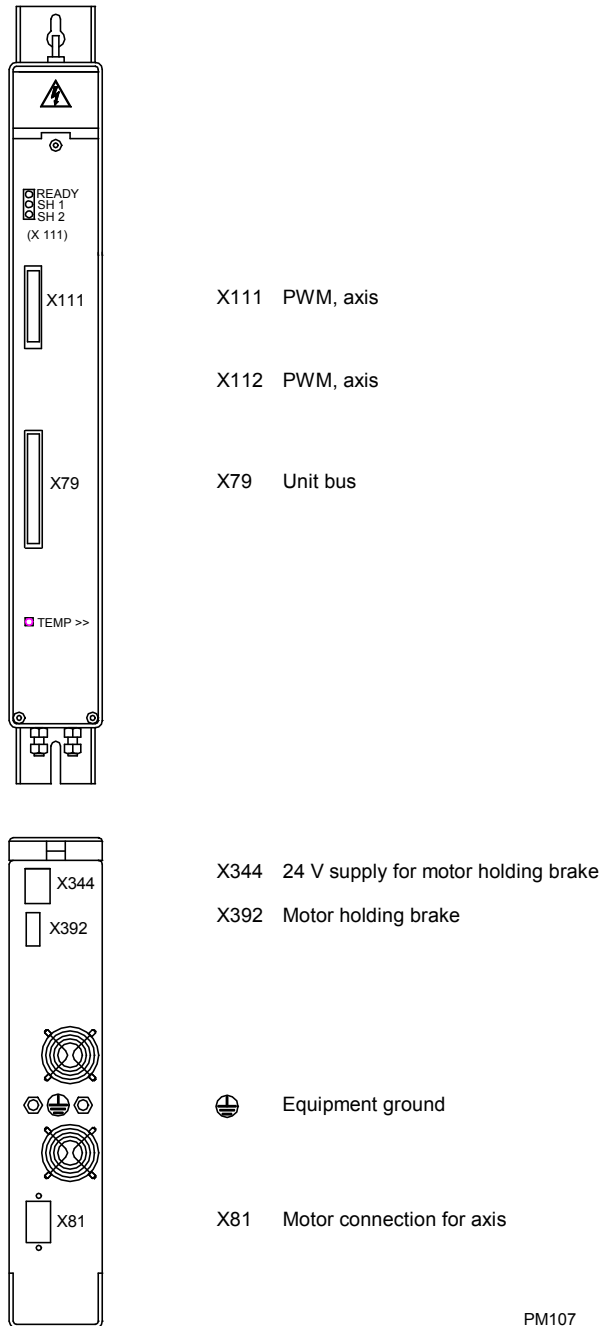
LED	Meaning	Signal Direction	Signal
<b>U<sub>DC LINK ON</sub></b>	Main contactor on	–	–
<b>READY</b>	End stage ready (only for service purposes)	–	–
<b>RESET</b>	Reset for end stage (only for service purposes)	–	–
<b>READY UV</b>	Supply unit ready	PS > CNC Chassis	RDY.PS
<b>POWER RESET</b>	Reset signal from the PS 145 to CNC Chassis	PS > CNC Chassis	$\overline{\text{RES.PS}}$
<b>POWER FAIL</b>	U <sub>Z</sub> too low, U <sub>Z</sub> < 410 A (e.g. line power < 290 V)	PS > CNC Chassis	$\overline{\text{PF.PS}}$
<b>U<sub>DC LINK &gt;&gt;</sub></b>	U <sub>Z</sub> too high (>approximately 800 V); power modules are switched off	PS > CNC Chassis	$\overline{\text{ERR.UZ.GR}}$
<b>I<sub>DC LINK &gt;&gt;</sub></b>	Warning signal to control at I <sub>Z</sub> > 103 A <sup>**1</sup>	PS > CNC Chassis	$\overline{\text{ERR.IZ.GR}}$
<b>I<sub>LEAK</sub></b>	Error current (e.g. through short to earth; warning signal to control)	PS > CNC Chassis	$\overline{\text{EFF.ILEAK}}$
<b>AC FAIL</b>	Phase missing	PS > CNC Chassis	$\overline{\text{PF.PS.AC}}$
<b>NC RESET</b>	Reset signal from the CNC Chassis to the PS 145	CNC Chassis > PS	$\overline{\text{RES.LE}}$
<b>TEMP &gt;&gt;</b>	Temperature of heat sink too high (>95 °C [203 °F])	PS > CNC Chassis	$\overline{\text{ERR.TEMP}}$
<b>AXES</b>	Safety relay for axes on	–	–
<b>SPINDLE</b>	Safety relay for spindle on	–	–

\*\*1 A further increase of approximately 10 % results in the drives being switched off.

### PM 107 Power Module

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

See Figure 6-4.



PM107

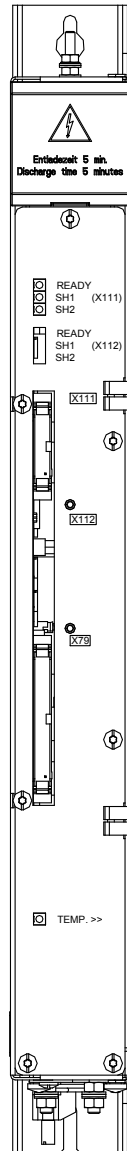
**Figure 6-4, PM 107 Power Module, Connections**



**PMD 107 Power Module**

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

See Figure 6-5.



CNTR	DESCRIPTION
X79	Unit BUS
X81	Motor connection for axis
X111	PWM, axis
X344	+24V supply for motor holding brake
X392	Motor holding brake

X81	Assignment
U	Motor connection U
V	Motor connection V
W	Motor connection W

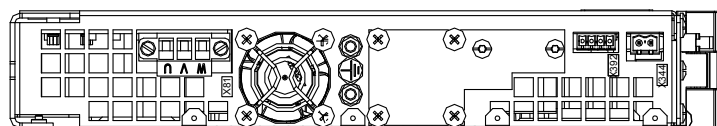
X344	Assignment
1	+24V
2	0V

X392	Assignment
1	Holding brake
2	0V

MAXIMUM CURRENT FOR HOLDING BRAKE AT CONNECTOR X392 IS 3.0A

LED	Meaning
READY	Pwr module ready
SH1	DSP error, PLC error w/E-STOP, hardware or software error
SH2	No drive enable
TEMP.>>	IGBT temperature too high

Equipment ground



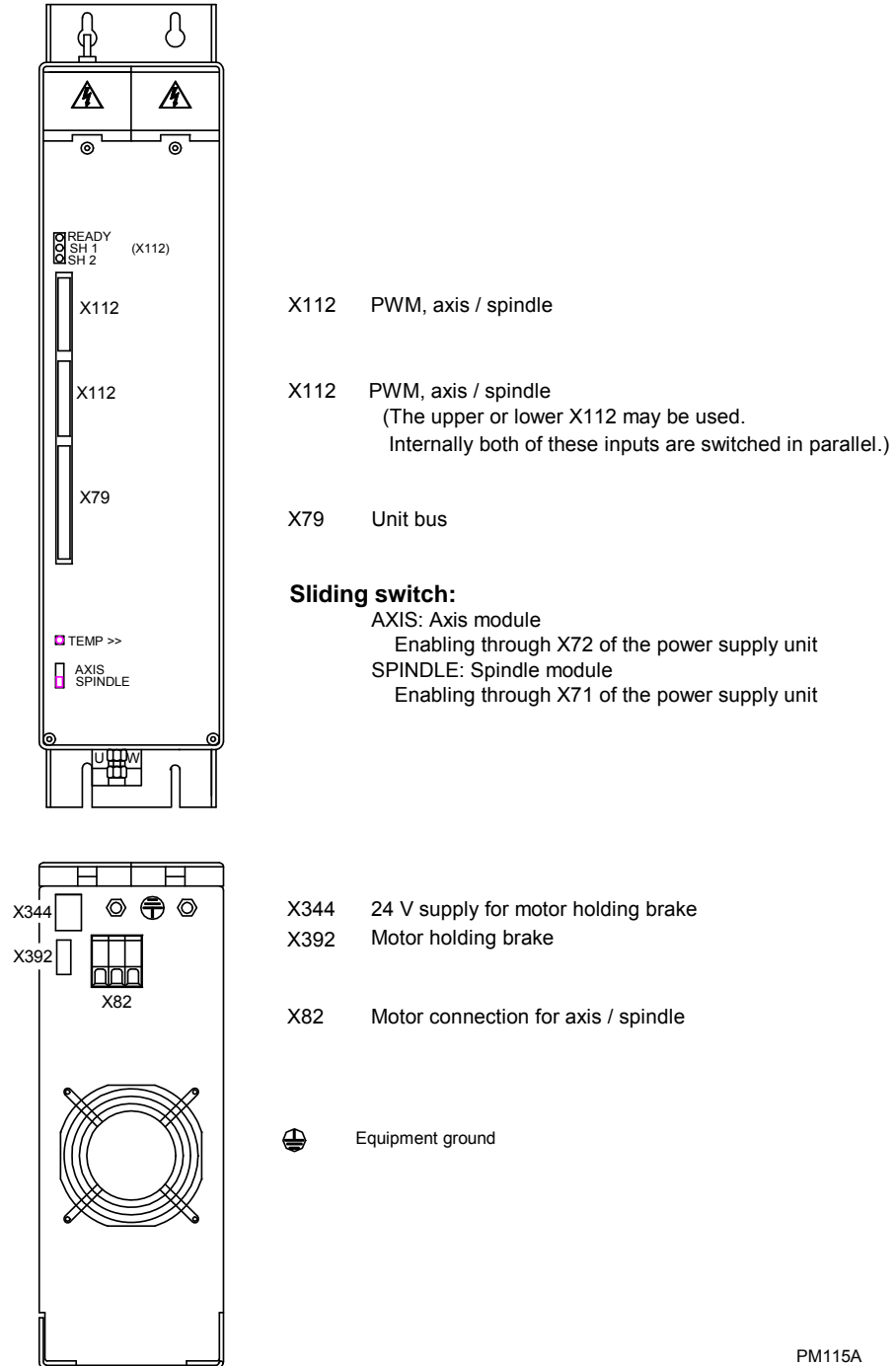
PMD 107 Power Module

**Figure 6-5, PMD 107 Power Module, Connections**

### PM 115A Power Module

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

See Figure 6-6.



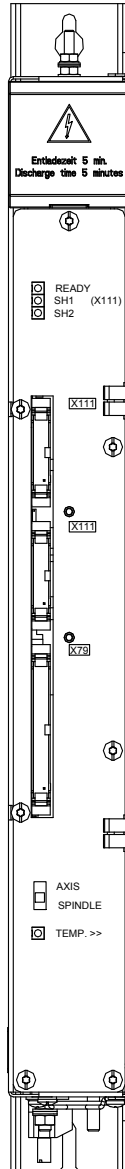
PM115A

**Figure 6-6, PM 115A Power Module, Connections**

**PMD 115 Power Module**

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

See Figure 6-7.



CNTR	DESCRIPTION
X79	Unit BUS
X81	Motor connection for axis / spindle
X111	PWM, axis / spindle
X344	+24V supply for motor holding brake
X392	Motor holding brake

X81	Assignment
U	Motor connection for U
V	Motor connection for V
W	Motor connection for W

X344	Assignment
1	+24V
2	0V

X392	Assignment
1	Holding brake
2	0V

MAXIMUM CURRENT FOR HOLDING BRAKE AT CONNECTOR X392 IS 2.0A

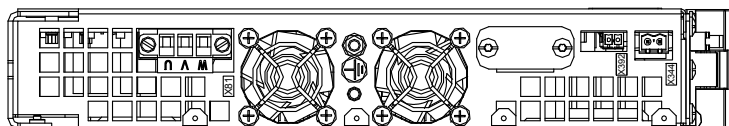
**Sliding switch:**

AXIS = axis module  
Enabling through X72 of power supply unit

SPINDLE = spindle module  
Enabling through X71 of power supply unit

LED	Meaning
READY	Pwr module ready
SH1	DSP error, PLC error w/E-STOP, hardware or software error
SH2	No drive enable
TEMP.>>	IGBT temperature too high

⊕ Equipment ground



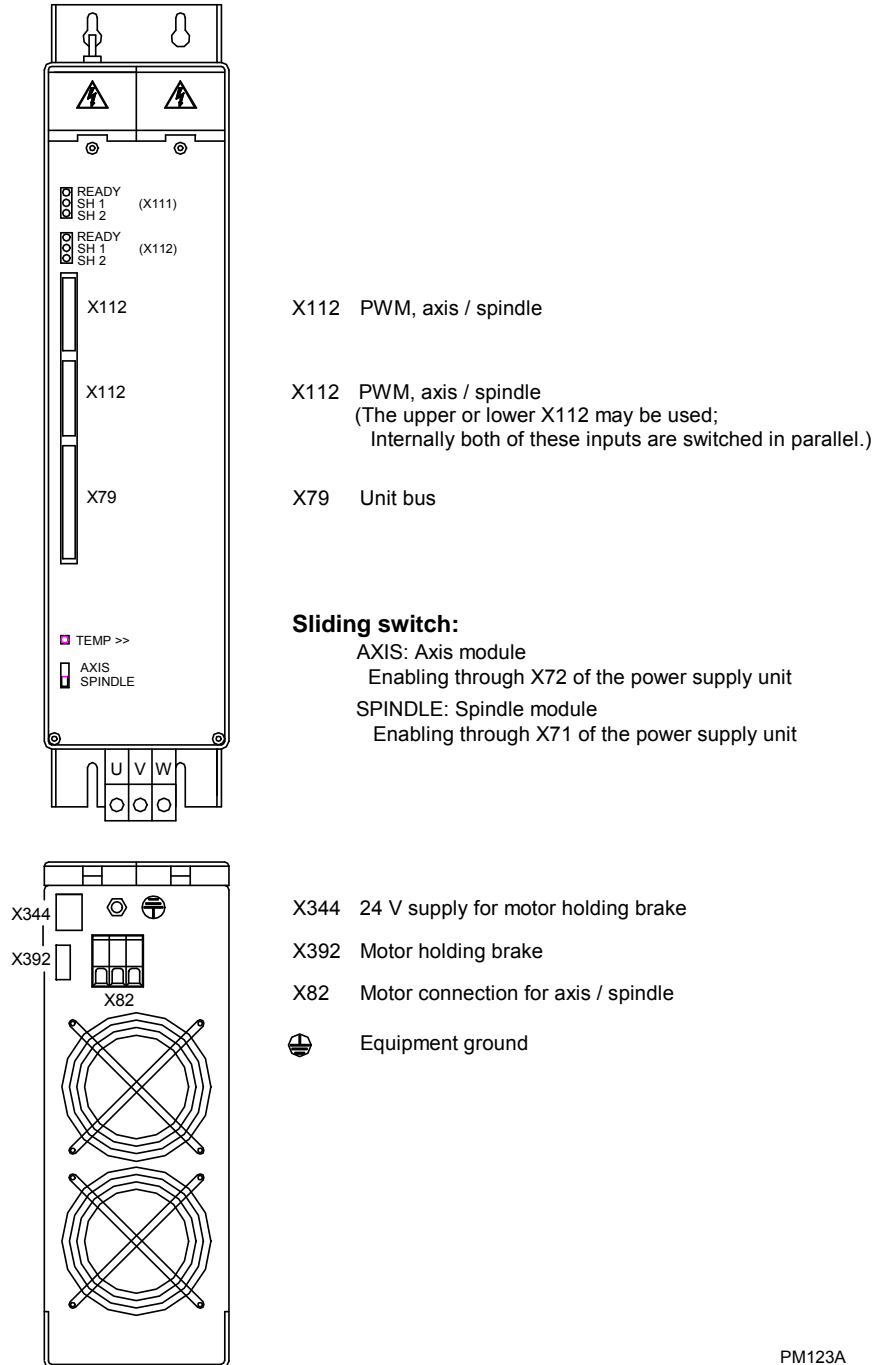
PMD 115 Power Module

**Figure 6-7, PMD 115 Power Module, Connections**

### PM 123A Power Module

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

See Figure 6-8.



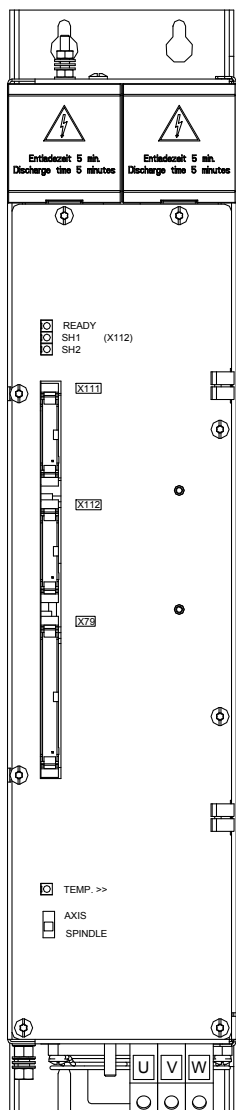
PM123A

**Figure 6-8, PM 123A Power Module, Connections**

**PMD 125 and PMD 140 Power Module**

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

See Figure 6-9.



CNTR	DESCRIPTION
X79	Unit BUS
X81	Motor connection for axis / spindle
X112	PWM, axis / spindle
X344	+24V supply for motor holding brake
X392	Motor holding brake

X81	Assignment
U	Motor connection for U
V	Motor connection for V
W	Motor connection for W

X344	Assignment
1	+24V
2	0V

X392	Assignment
1	Holding brake
2	0V


MAXIMUM CURRENT FOR HOLDING BRAKE AT CONNECTOR X392 IS 2.0A

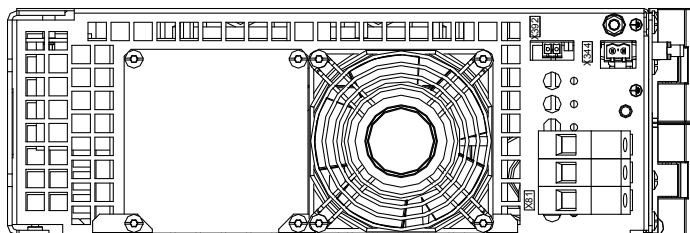
**Sliding switch:**

AXIS = axis module  
Enabling through X72 of power supply unit

SPINDLE = spindle module  
Enabling through X71 of power supply unit

LED	Meaning
READY	Pwr module ready
SH1	DSP error, PLC error w/E-STOP, hardware or software error
SH2	No drive enable
TEMP.>>	IGBT temperature too high

 Equipment ground



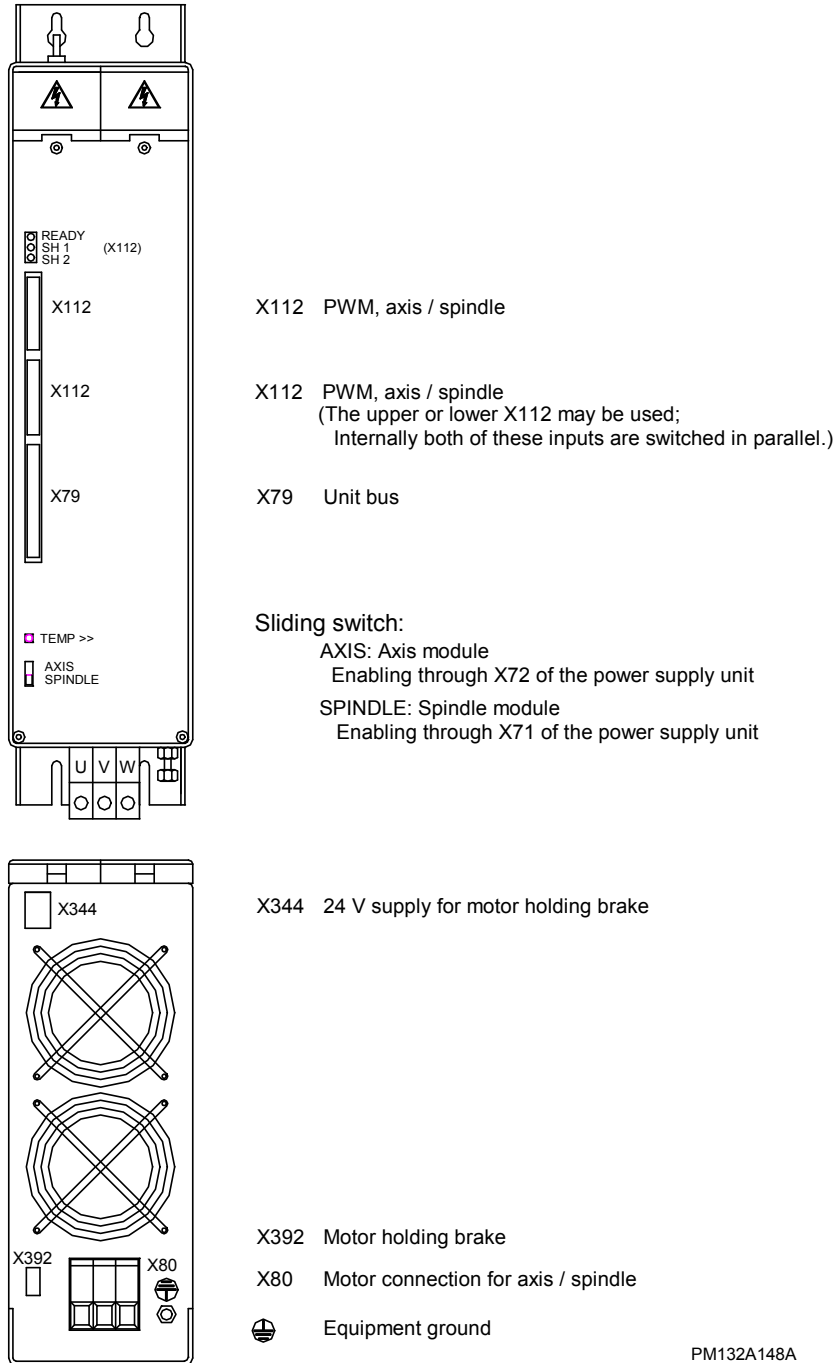
PMD 125-140 Power Module

**Figure 6-9, PMD 125 and PMD 140 Power Module, Connections**

### PM 132A and PM 148A Power Module

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

See Figure 6-10.

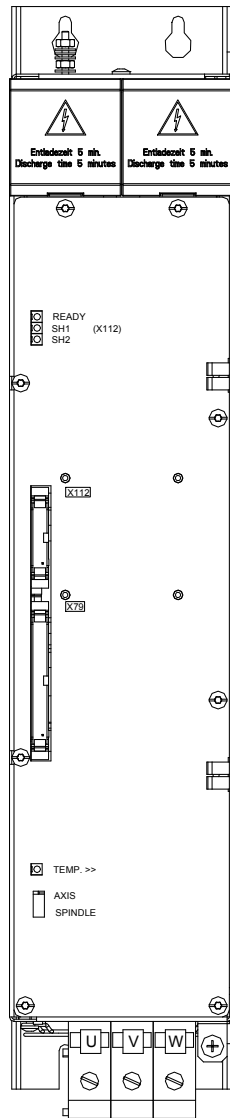


**Figure 6-10, PM 132A and PM 148A Power Module, Connections**

**PMD 160 Power Module**

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

See Figure 6-11.



CNTR	DESCRIPTION
X79	Unit BUS
X81	Motor connection for axis / spindle
X112	PWM, axis / spindle
X344	+24V supply for motor holding brake
X399	Motor holding brake

X81	Assignment
U	Motor connection for U
V	Motor connection for V
W	Motor connection for W

X344	Assignment
1	+24V
2	0V

X392	Assignment
1	Holding brake
2	0V

MAXIMUM CURRENT FOR HOLDING BRAKE AT CONNECTOR X392 IS 2.0A

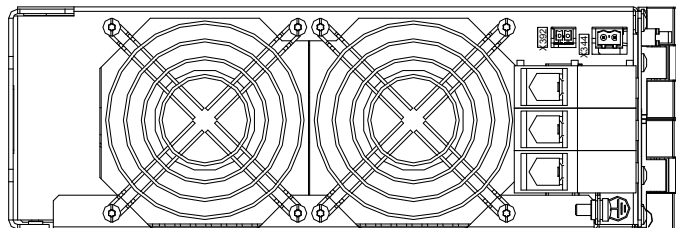
**Sliding switch:**

AXIS = axis module  
Enabling through X72 of power supply unit

SPINDLE = spindle module  
Enabling through X71 of power supply unit

LED	Meaning
READY	Pwr module ready
SH1	DSP error, PLC error w/E-STOP, hardware or software error
SH2	No drive enable
TEMP.>>	IGBT temperature too high

Equipment ground



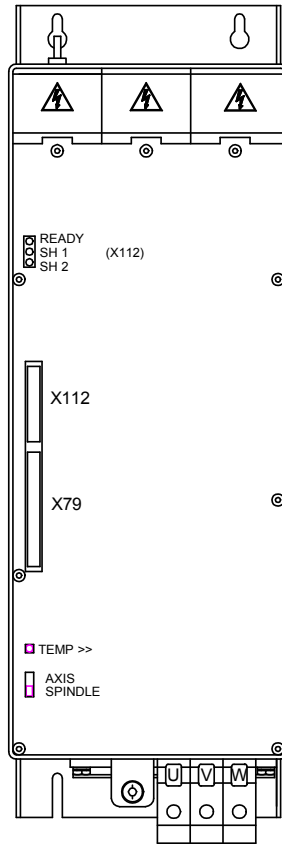
PMD 160 Power Module

**Figure 6-11, PMD 160 Power Module, Connections**

### PM 170A Power Module

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

See Figure 6-12.

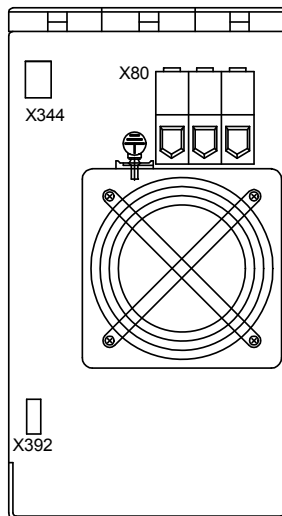


X112 PWM, axis / spindle

X79 Unit bus

**Sliding switch:**

AXIS: axis module  
 Enabling through XX72 of the power supply unit  
 SPINDLE: spindle module  
 Enabling through X71 of the power supply unit



X344 24 V supply for motor holding brake

X80 Motor connection for axis / spindle

Equipment ground

X392 Motor holding brake

PM170A

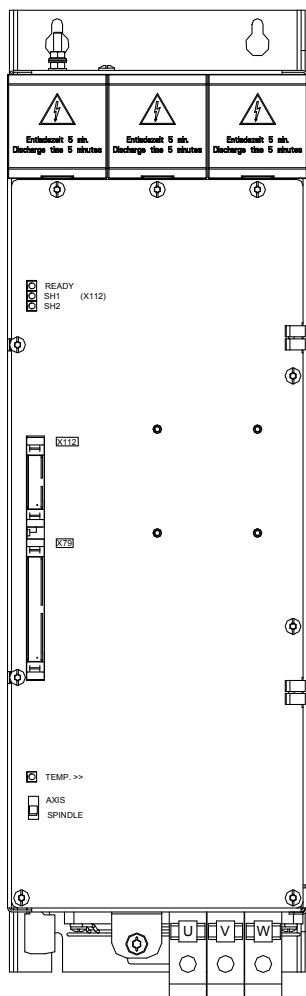
**Figure 6-12, PM 170A Power Module, Connections**



**PMD 196 Power Module**

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

See Figure 6-13.



CNTR	DESCRIPTION
X79	Unit BUS
X80	Motor connection for axis / spindle
X112	PWM, axis / spindle
X344	+24V supply for motor holding brake
X392	Motor holding brake

X80	Assignment
U	Motor connection for U
V	Motor connection for V
W	Motor connection for W

X344	Assignment
1	+24V
2	0V

X392	Assignment
1	Holding brake
2	0V

MAXIMUM CURRENT FOR HOLDING BRAKE AT CONNECTOR X392 IS 2.0A

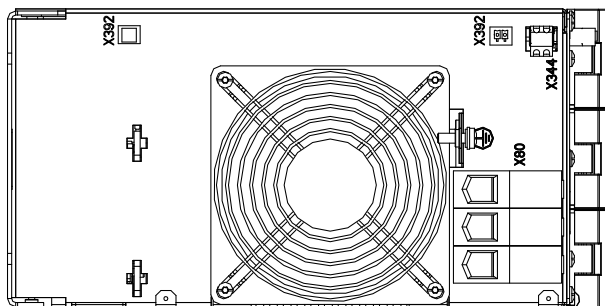
**Sliding switch:**

AXIS = axis module  
Enabling through X72 of power supply unit

SPINDLE = spindle module  
Enabling through X71 of power supply unit

LED	Meaning
READY	Pwr module ready
SH1	DSP error, PLC error w/E-STOP hardware or software error
SH2	No drive enable
TEMP.>>	IGBT temperature too high

⊕ Equipment ground



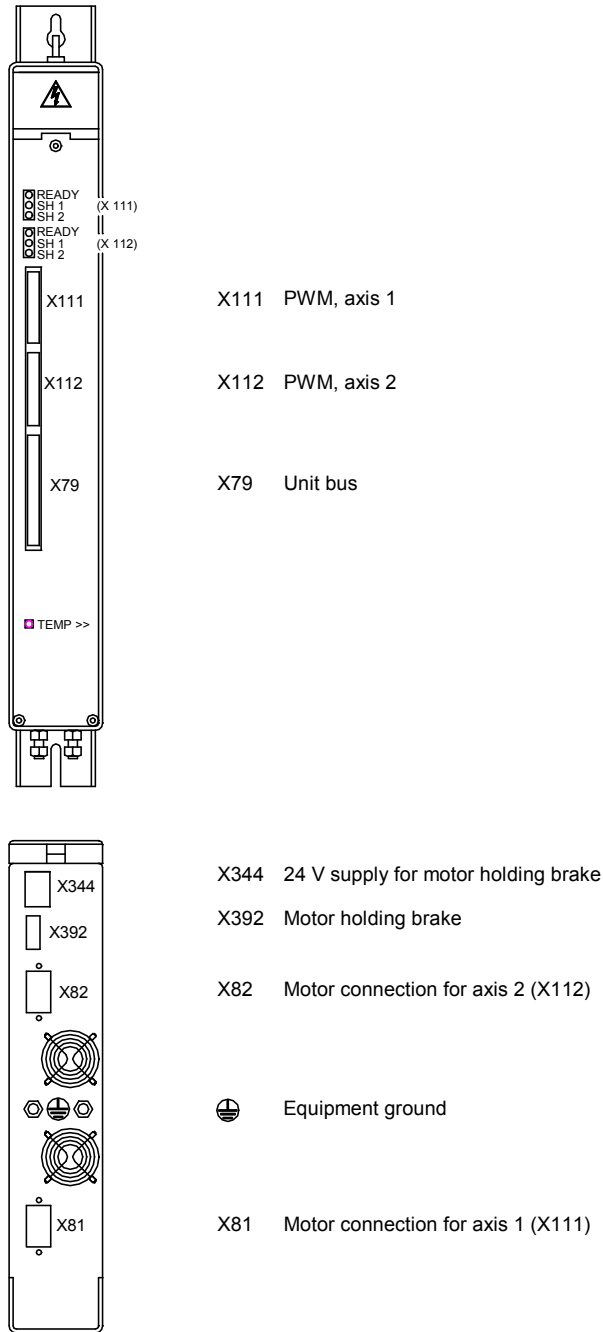
PMD 196 Power Module

**Figure 6-13, PMD 196 Power Module, Connections**

### PM 207 Power Module

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

See Figure 6-14.



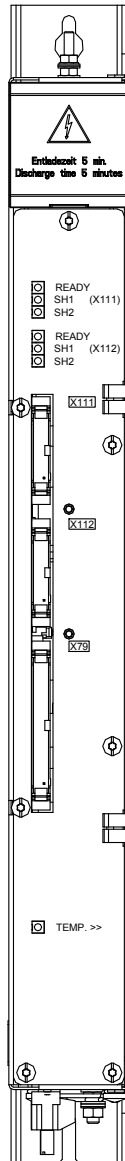
PM207

**Figure 6-14, PM 207 Power Module, Connections**

**PMD 207 Power Module**

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

See Figure 6-15.



CNTR	DESCRIPTION
X79	Unit BUS
X81	Motor connection for axis 1 (X111)
X82	Motor connection for axis 2 (X112)
X111	PWM, axis 1
X112	PWM, axis 2
X344	+24V supply for motor holding brake
X392	Motor holding brake

X81/X82	Assignment
U	Motor connection U
V	Motor connection V
W	Motor connection W

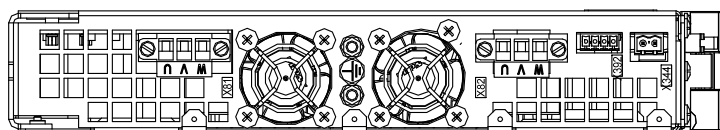
X344	Assignment
1	+24V
2	0V

X392	Assignment
1	Holding brake
2	0V

MAXIMUM CURRENT FOR HOLDING BRAKE AT CONNECTOR X392 IS 2.0A

LED	Meaning
READY	Pwr module ready
SH1	DSP error, PLC error w/E-STOP, hardware or software error
SH2	No drive enable
TEMP. >>	IGBT temperature too high

Equipment ground



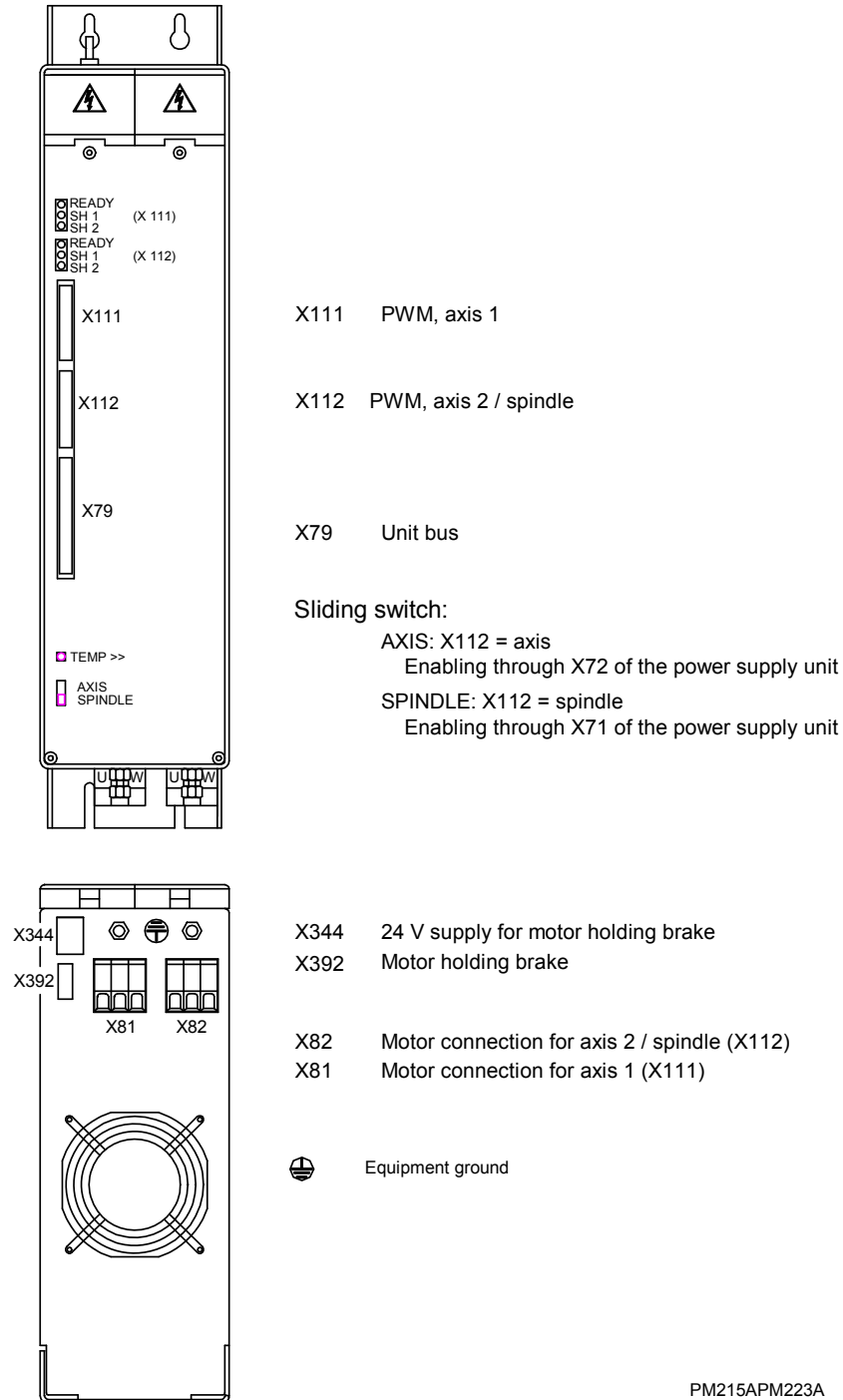
PMD 207 Power Module

**Figure 6-15, PMD 207 Power Module, Connections**

### PM 215A and PM 223A Power Module

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

See Figure 6-16.

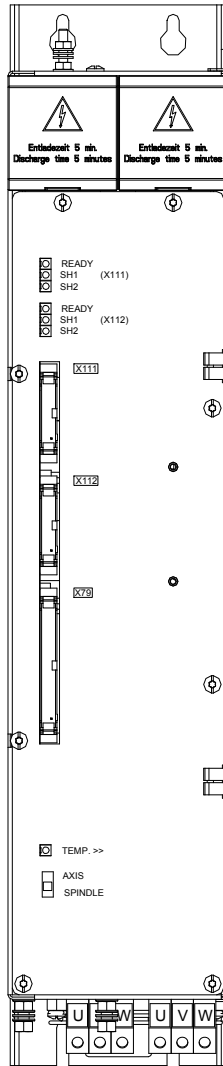


**Figure 6-16, PM 215A and PM 223A Power Module, Connections**

**PMD 215 and PMD 225 Power Module**

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

See Figure 6-17.



CNTR	DESCRIPTION
X79	Unit BUS
X81	Motor connection for axis 1 (X111)
X82	Motor connection for axis 2 / spindle (X112)
X111	PWM, axis 1
X112	PWM, axis 2 / spindle
X344	+24V supply for motor holding brake
X392	Motor holding brake

X81/X82	Assignment
U	Motor connection for U
V	Motor connection for V
W	Motor connection for W

X344	Assignment
1	+24V
2	0V

X392	Assignment
1	Holding brake
2	0V

MAXIMUM CURRENT FOR HOLDING BRAKE AT CONNECTOR X392 IS 2.0A

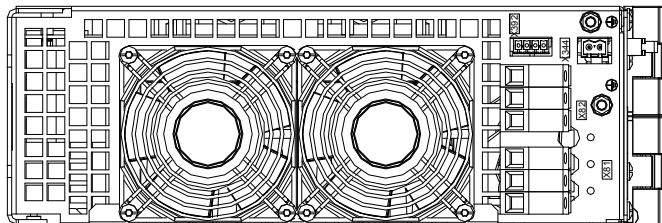
**Sliding switch:**

AXIS: X112 = axis  
Enabling through X72 of power supply unit

SPINDLE: X112 = spindle  
Enabling through X71 of power supply unit

LED	Meaning
READY	Pwr module ready
SH1	DSP error, PLC error w/E-STOP, hardware or software error
SH2	No drive enable
TEMP.>>	IGBT temperature too high

Equipment ground



PMD 215-225 Power Module

**Figure 6-17, PMD 215 and PMD 225 Power Module, Connections**

### Description of LEDs on PM and PMD Power Modules

For PM and PMD power modules description of the LEDs refer to **Table 6-4**.

**Table 6-4, PM and PMD Power Modules - LEDs Description**

LED	Meaning	Signal Direction	Signal
<b>READY</b>	Power module is ready	PM, PMD > CNC Chassis	RDY
<b>SH 1</b>	Flashing DSP error, PLC error with Emergency Stop, CNC Chassis hardware or software error	CNC Chassis > PM, PMD	$\overline{\text{SH1}}$
<b>SH 2</b>	No drive available (e.g. by the PLC, active via external signal or SH1)	CNC Chassis > PM, PMD	$\overline{\text{SH2}}$
<b>TEMP &gt;&gt;</b>	Warning signal for Insulated Gate Bipolar Transistor (IGBT) temperature too high	PM, PMD > CNC Chassis	$\overline{\text{ERR}}$

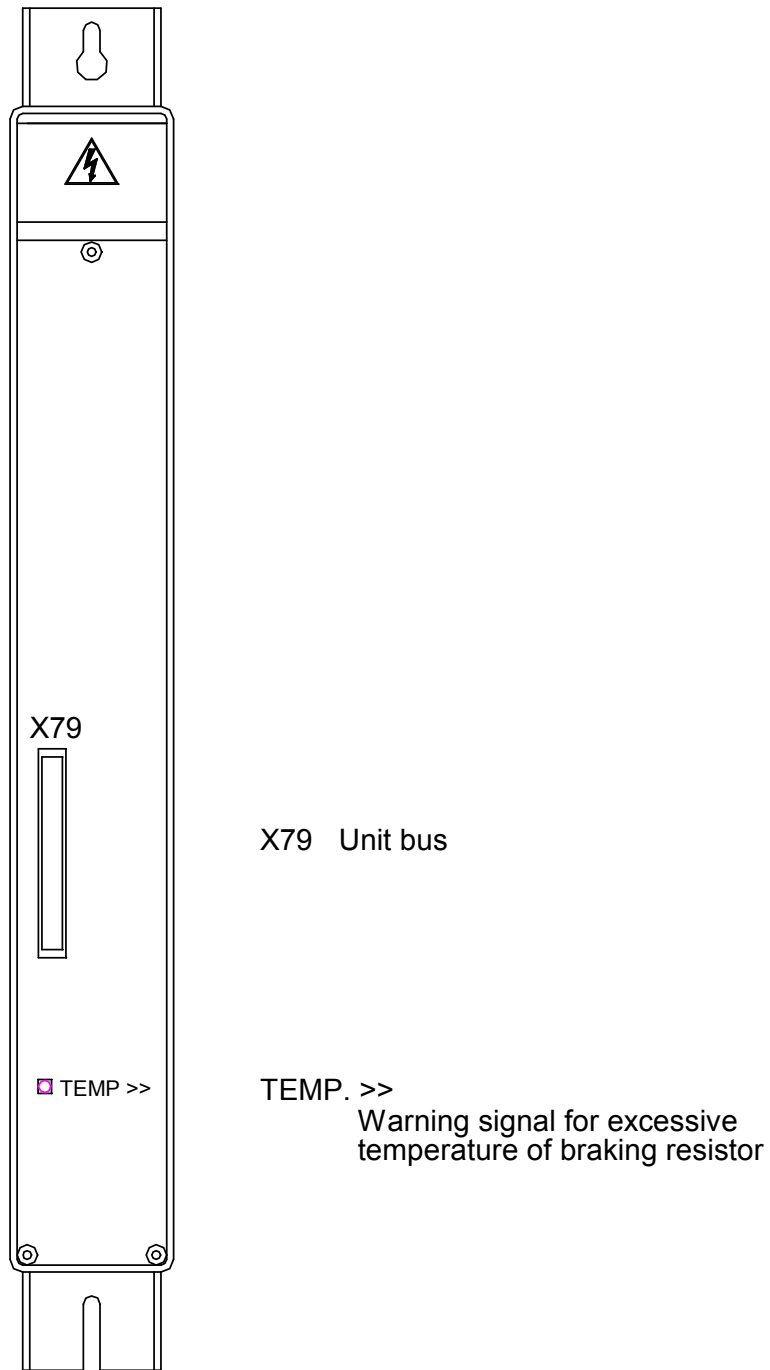
### PS 120A Power Supply Unit

Refer to **Figure 5-12, PS 120A Power Supply Unit** and "Section 5, "Connecting the PS 120A Power Supply Unit."

**BR 9 Braking Resistor**

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

See Figure 6-18.

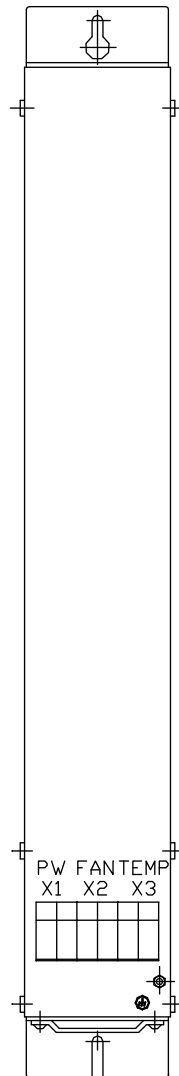


**Figure 6-18, BR 9 Connections**

### BR 10F and BR 18F Braking Resistor

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

See Figure 6-19.



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

BR10F18FConnect

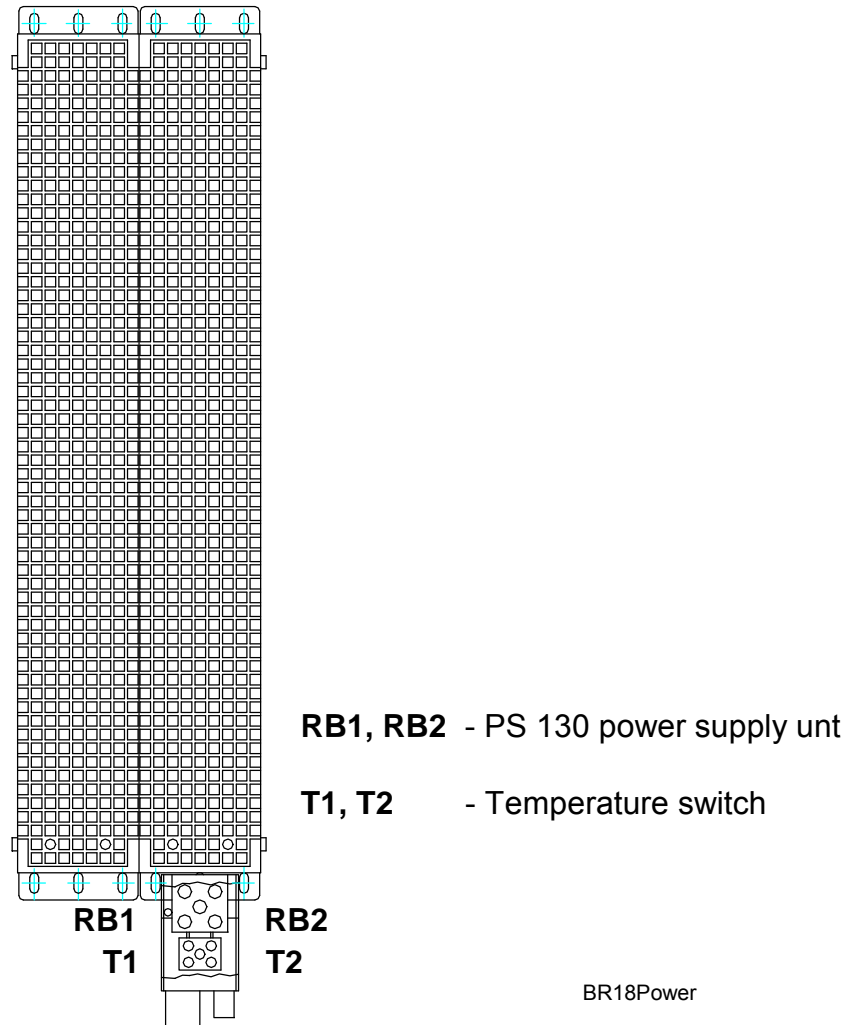
**Figure 6-19, BR 10F and BR 18F Connections**



**BR 18 Braking Resistor Module**

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

See Figure 6-20.



**Figure 6-20, BR 18 Braking Resistor Module, Connections**

### DLF 130 DC-Link Filter

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

See Figure 6-21.

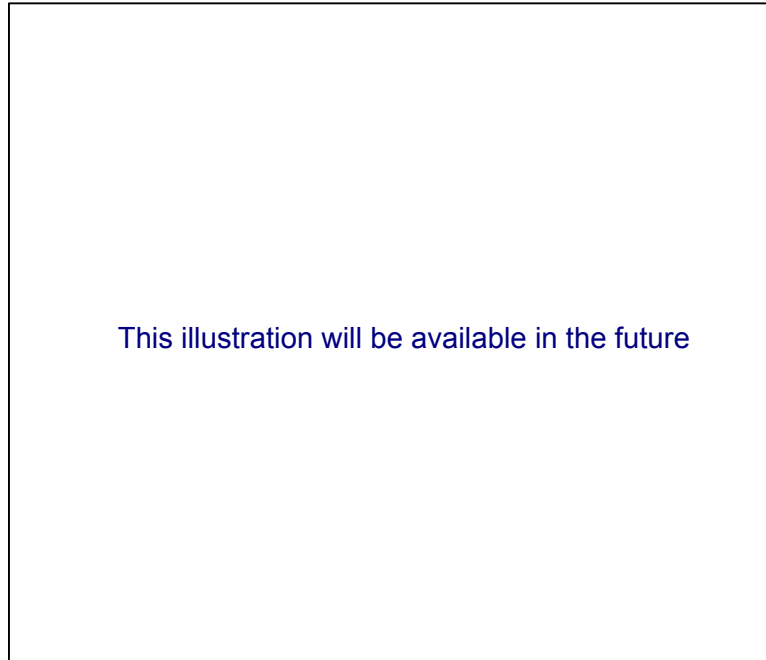


**Figure 6-21, DLF 130 DC-Link Filter, Connections**

**Adapter Module**

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

See **Figure 6-22**.



**Figure 6-22, Adapter Module, Connections**

### Mounting and Connection of the Modular Amplifier System

The following topics are described:

- ❑ **Arranging the Modules**
- ❑ **Connecting the Modules**
- ❑ **Direct Drives**
- ❑ **Module Covers**
- ❑ **Additional Power Supply**
- ❑ **Mounting the Modular Amplifier System**
- ❑ **Connecting the Motors**
- ❑ **Connections on the PS 130 Power Supply Units**
- ❑ **Connections on the PS 122R and PS 145R Power Supply Units**

#### Arranging the Modules

The power modules are arranged between the PS 1xx(R) power supply unit and the logic unit. The power module for the spindle is placed next to the PS 1xx(R) power supply unit, and the power modules for the axes are then placed in order of decreasing rated current.

If the BR 9 braking resistor module is used together with the PS 122R and PS 145R energy-recovery power modules, the braking resistor is arranged between the weakest power module and the CNC Chassis.

See **Figure 6-23**.

PS 1xx(R)	PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx for the first spindle	PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx for the second spindle (not on all controls)	Optional DLF 1x0	PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx	Optional BR 9 (only PS 122R or PS 145R)	CNC Chassis
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**Figure 6-23, Configuration of Amplifier, CNC, and Power Supply**

**Connecting the Modules**

The DC-link power supply  $U_Z$  is supplied to the amplifier modules for the PS 1xx power supply unit via power bars (screwed into each module, and if required, the BR 9 braking resistor).

A further power conductor bar establishes the ground connection between the individual modules.

Three power conductor bars are included as accessories with the power modules (two for the DC-link, one for the ground.)

The 50-line ribbon cable connects the CNC Chassis with the PS 1xx(R) and supplies the power to the CNC Chassis.

The 40-line ribbon cable connects the PS 1xx with the power modules and, if required, the BR 9, forming the unit base.

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

**Direct Drives**

Direct drives (linear motors, torque motors) used in conjunction with regenerative inverter systems require a DLF 1x0 DC-link filter, which is mounted to the left of the direct drives' power modules. The DC-link current is then led through this filter.

**Module Covers**

The ribbon cables must be covered to protect against interference.

A cover is supplied as an accessory with the PS 1xx(R) (P/N 12324567), which protects the following modules:

- PS 1xx(R)
- PM 170A or
- One power module (PM 1xx(A), PM 2xx(A), PMD 1xx, or PMD 2xx) (100 mm width), and  
One power module (PM 1xx(A), PM 2xx(A), PMD 1xx, or PMD 2xx) (50 mm width)

The cover for the CNC Chassis is supplied with the CNC Chassis.

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

**Additional Power Supply**

If several encoders with a high current consumption (e.g., encoders with EnDat interface) are connected, an additional power supply source used in conjunction with the amplifier or a power supply unit might become necessary. The additional PS 120A power supply unit can be used for this purpose. It is mounted next to the CNC at its left.

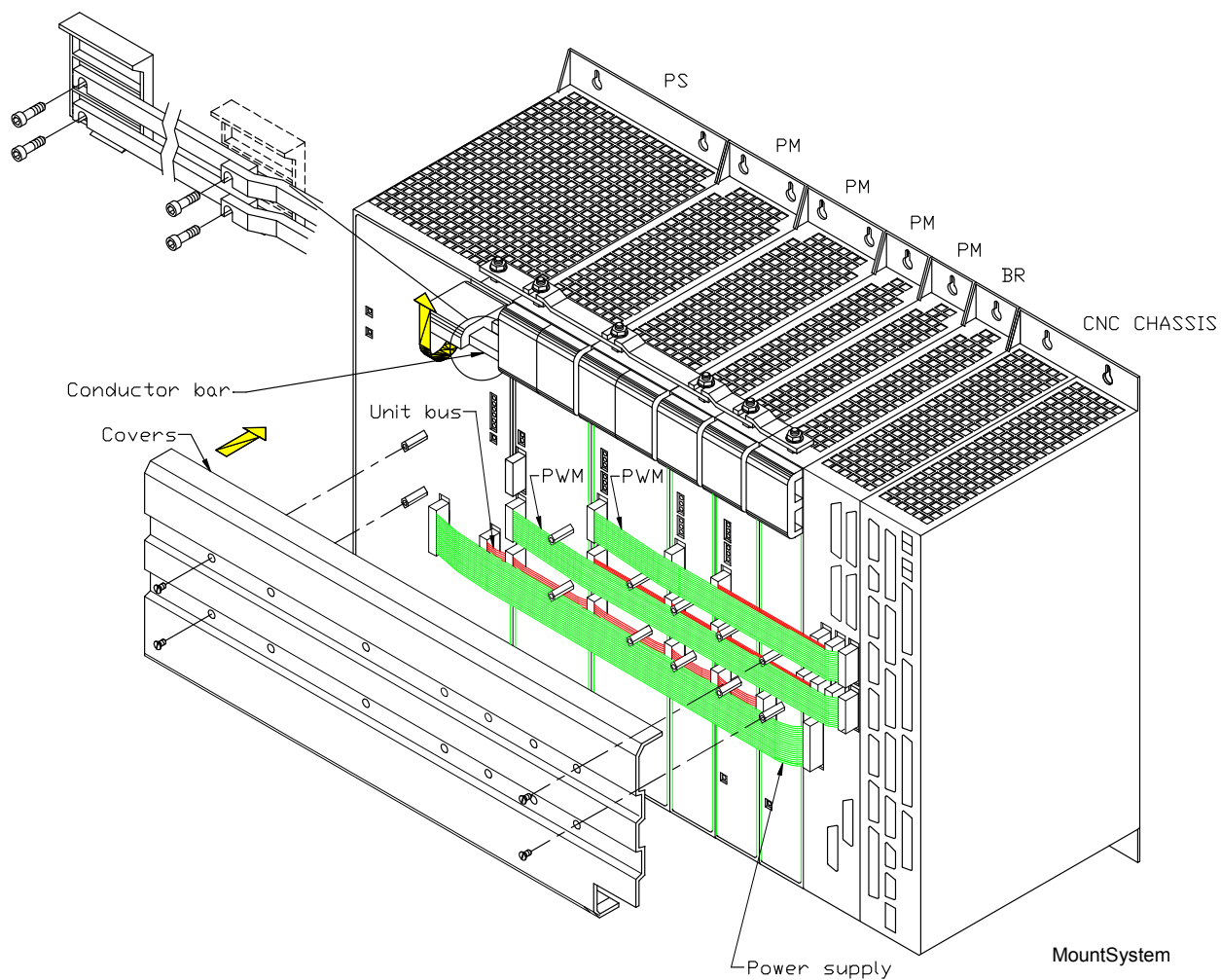
The power supply unit is connected to the DC-link voltage via the conductor bar of the previous left module. The upper conductor bar also establishes the ground connection of the DE-link.

The 50-line ribbon cable of the amplifier / power supply unit for transmitting the status signals is connected to X69 of the PS 120A. The free ribbon cable of the PS 120A is connected to X69 of the CNC.

The 5 V power supply (X74) of the PS 120A is connected to the terminals on the CNC (X74) by means of the wires included in the PS 120A items supplied.

**Mounting the Modular Amplifier System**

Refer to Figure 6-24.

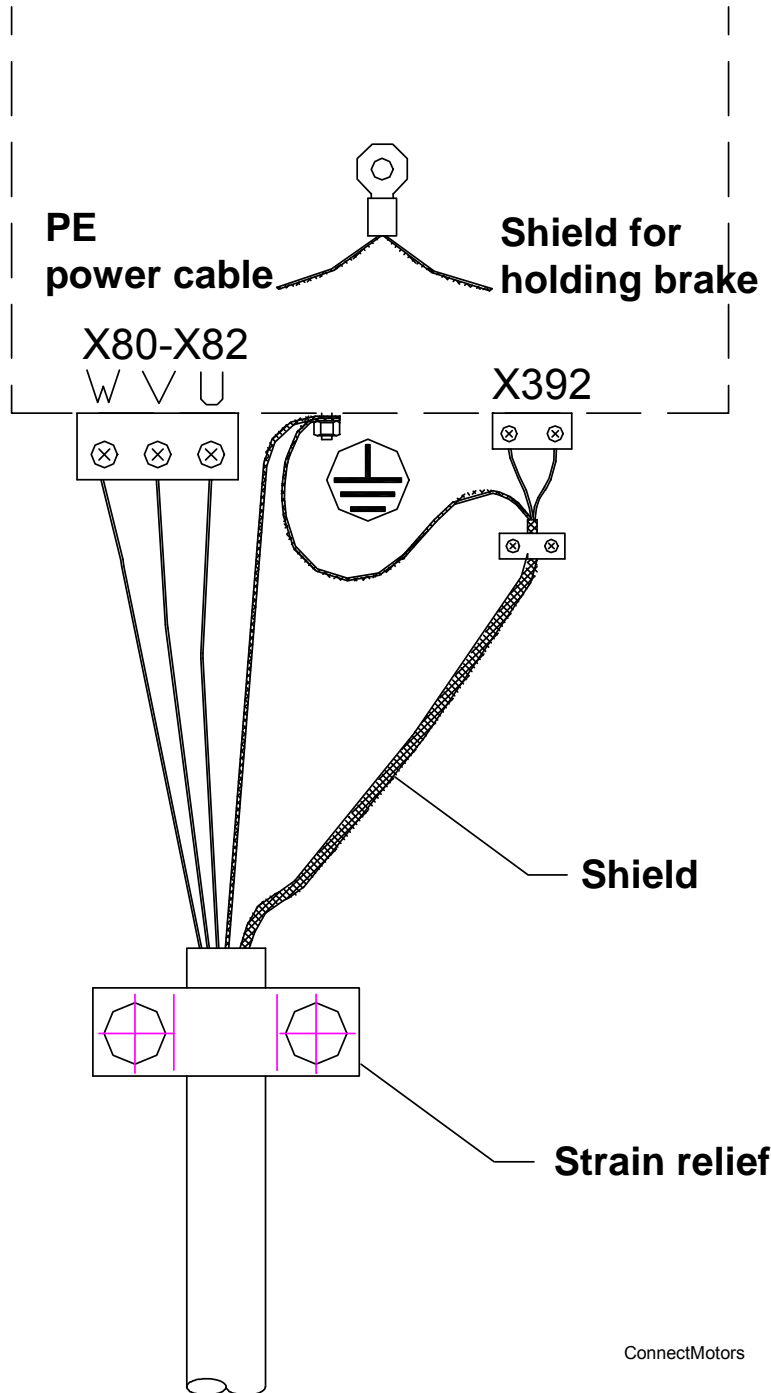


**Figure 6-24, Mounting the Modular Amplifier System**

**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 (< 1.18 in. [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. Refer to **Figure 6-25**.



ConnectMotors

**Figure 6-25, Connecting the Motors**



**Connections on the PS 130 Power Supply Units**

**DANGER: Danger of electrical shock!**  
 The power supply unit may be opened only by ANILAM service engineers.  
 Do not engage or disengage any terminals while they are under power.

**PS 130 - X31: Supply Voltage for U<sub>z</sub>**

With a power supply voltage of 400 V, the modular amplifier voltage U<sub>z</sub> is 565 VDC. Refer to **Table 6-5**.

**Table 6-5, PS 130 - X31: Supply Voltage for U<sub>z</sub>**

Terminals	Assignment PS 130
<b>L1</b>	400 VAC ± 10%
<b>L2</b>	50 Hz to 60 Hz
<b>L3</b>	
	Cable: (single conductor (HT wire)) Wire cross section: 16 mm <sup>2</sup> Line fuse: 63 A (gRL) Siemens Sitor type Grounding terminal: ≥ 10 mm <sup>2</sup>
<b>Tightening torque for connecting terminals:</b>	4–4.5 Nm (35–40 lb-in)

**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.

### PS 130 - Main Contactor and Safety Relay

#### PS 130 - X70: Main Contactor

Refer to Table 6-6.

**Table 6-6, PS 130 – X70: Main Contactor Pinout**

Connection Terminal X70	Assignment
1	+24 V output (maximum 250 mA)
2	0 V
3	+24 V input for U <sub>z</sub> ON
4	Do not assign
5	Do not assign
6**1	Normally closed contact (OE1)
7**1	Normally closed contact (OE2)

\*\*1 Maximum 125 V

**Warning: A recovery diode is required in the proximity of the inductive loads, (for example, relay or contactor coils).**

#### PS 130 - X71: Safety Relay Spindle, X72: Safety Relay Axes

Refer to Table 6-7.

**Table 6-7, PS 130 - X71: Safety Relay Spindle, X72: Safety Relay Axes Pinout**

Terminals X71 and X72	Assignment
1	+24 V output (maximum 250 mA)
2	0 V
3	+24 V input for Axis ON, Spindle ON
4	Do not assign
5	Do not assign
6**1	Normally closed contact (OE1A or OE1S)
7**1	Normally closed contact (OE2A or OES2)

\*\*1 Maximum 125 V

**Warning: A recovery diode is required in the proximity of the inductive loads, (for example, relay or contactor coils).**

**PS 130 – X90: 24 V Output (PS 130 only)**

Refer to **Table 6-8**.

**Table 6-8, PS 130 – X90: 24 V Output Pinout**

Connection Terminal X90	Assignment
+	+24 V (maximum 250 mA)
-	0 V

**PS 130 – X69: CNC Power Supply and Control Signals**

With lengths of 25.62 inches (600 mm) and longer, the 50-line ribbon cable for the CNC power supply and control signals is led doubled to the CNC Chassis to increase the wire cross section. Refer to **Table 6-9**.

**Table 6-9, PS 130 - X69: CNC Supply Voltage and Control Signals Pinout**

50-line Ribbon Connector	Assignment	50-line Ribbon Connector	Assignment
1a to 5b	+5 V	16b	GND
6a to 7b	+12 V	17a	RDY.PS
8a	+5 V (low-voltage separation)	17b	GND
8b	0 V (low-voltage separation)	18a	$\overline{\text{ERR.ILEAK}}$
9a	+15 V	18b	GND
9b	-15 V	19a	Do not assign
10a	UZAN	19b	GND
10b	0 V	20a	Do not assign
11a	IZAN	20b	GND
11b	0 V	21a	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.

### PS 130 – X74: 5 V Power Supply (PS 130 only)

Refer to Table 6-10.

**Table 6-10, PS 130 – X74: 5 V Power Supply Pinout**

Connection Terminal X74	Assignment
+	+5 V (load capacity 20 A)
–	0 V

### PS 130 – X79: Unit Bus

Refer to Table 6-11.

**Table 6-11, PS 130 - X79 Unit Bus Pinout**

40-line Ribbon Connector	Assignment	
1a to 3b	0 V **1	**1 These voltages may not be linked with other voltages (insulation limitation).
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	ERR.TEMP	
11a	PF.PS	
11b	0 V	
12a	RES.PS	
12b	0 V	
13a	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).

**Connecting the Braking Resistors to the PS 130 Power Supply Unit**

The following topics are described:

- **PS 130: Cross Section**
- **PS 130: X89: Terminal for Braking Resistors**
- **PS 130: BR 18 and BR 18F Temperature Switch**
- **PS 130: X2: Fan for the BR 10F and BR 18F External Braking Resistor**

One BR 10F, BR 18, BR 18F, or two BR 18 braking resistors in parallel must be connected with the PS 130 power supply unit.

The braking resistor is switched on when the modular amplifier 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 modular amplifier voltage  $U_z$  can increase and at  $U_z > 800$  V all power stages will be switched off (LED for  $U_{DC-LINK} >>$  lights up)!

**PS 130: Cross Section**

The following cross section is required for connecting the braking resistor. Refer to **Table 6-12**.

**Table 6-12, PS 130: Braking Resistors Cross Section**

<b>Braking Resistor</b>	<b>Cross Section</b>
<b>BR 18</b>	1.5 mm <sup>2</sup>
<b>2 x BR 18 in parallel</b>	4.0 mm <sup>2</sup>
<b>BR 18F</b>	1.5 mm <sup>2</sup>
<b>BR 10F</b>	4.0 mm <sup>2</sup>

### PS 130: X89: Terminal for Braking Resistors

For BR 18, refer to **Table 6-13**.

**Table 6-13, PS 130: X89: BR 18 Terminal Connection**

Connecting Terminal X89	Assignment	BR 18 Braking Resistor
1	+U <sub>Z</sub>	RB1
2	Switch against -U <sub>Z</sub>	RB2

For BR 10F and BR 18F, refer to **Table 6-14**.

**Table 6-14, PS 130: X89: BR 10F and BR 18F Terminal Connection**

Connecting Terminal X89	Assignment	BR 10F and BR 18F Braking Resistor, Connecting Terminal X1
1	+U <sub>Z</sub>	1
2	Switch against -U <sub>Z</sub>	2

### PS 130: BR 18 and BR 18F Temperature Switch

The temperature switch is a normally closed contact and is set to protect the braking resistor from being damaged. It can have maximum load: 250V, 5 A. The switch can be connected to a PLC input on the CNC Chassis and evaluated via the PLC. Refer to **Table 6-15** and **Table 6-16**.

**Table 6-15, PS 130: BR 18, Temperature Switch Pinout**

BR 18 Connecting Terminal	Assignment
T1	1
T2	2

**Table 6-16, PS 130: BR 18F, Temperature Switch Pinout**

BR 18F Connecting Terminal	Assignment
1	1
2	2

**PS 130: X2: Fan for the BR 10F and BR 18F External Braking Resistor**

Refer to **Table 6-17** for the external braking resistors: BR 10F and BR 18F.

**Table 6-17, PS 130 - X2 Fan for BR 10F and BR 18F**

Connecting Terminal X2	Assignment
+	+24 V (PLC)
-	0 V

**Connections on the PS 122R and PS 145R Power Supply Units**

**DANGER: Danger of electrical shock!**  
 The power supply unit may be opened only by ANILAM service engineers.  
 Do not engage or disengage any terminals while they are under power.

The following topics are described:

- ❑ **PS 122R and PS 145R: X31: Supply Voltage for U<sub>z</sub>**
- ❑ **PS 122R and PS 145R - Main Contactor and Safety Relay**
- ❑ **PS 122R and PS 145R: X69: CNC Power Supply and Control Signals**
- ❑ **PS 122R and PS 145R: X79: Unit Bus**
- ❑ **PS 122R and PS 145R: X74: 5 V Power Supply (PS 130 only)**

### PS 122R and PS 145R: X31: Supply Voltage for $U_z$

The modular amplifier voltage  $U_z$  is 650 VDC. Refer to **Table 6-18**.

The regenerative power supply units must be connected to the main power line via a commutating reactor and a line filter. This is necessary for keeping the main line free of disruptive higher harmonics.

**Table 6-18, PS 122R and PD 145R: X31: Supply Voltage for  $U_z$**

Terminals	Assignment PS 122R and PS 145R
L1	400 VAC $\pm$ 10% 50 Hz to 60 Hz
L2	
L3	
PE	
	<b>PS 122R:</b> Cable: (single conductor (HT wire)) Wire cross section: 10 mm <sup>2</sup> Single conductor: H07 V2-K: 6 mm <sup>2</sup> Line fuse: 35 A (gRL) Siemens Sitor type Grounding terminal: $\geq$ 10 mm <sup>2</sup>
<b>Tightening torque for connecting terminals:</b>	2.0–2.3 Nm (18–20.5 lb-in)
	<b>PS 142R:</b> Cable: (single conductor (HT wire)) Wire cross section: 35 mm <sup>2</sup> Single conductor: H07 V2-K: 25 mm <sup>2</sup> Line fuse: 80 A (gRL) Siemens Sitor type Grounding terminal: $\geq$ 16 mm <sup>2</sup>
<b>Tightening torque for connecting terminals:</b>	4.0–4.5 Nm (35–40 lb-in)

**NOTE:** The cables between the power supply unit and commutating reactor as well as between the commutating reactor and line filter must be as short as possible (< 1.3 ft (0.4 m)).



**PS 122R and PS 145R - Main Contactor and Safety Relay**

The following topics are described:

- **PS 122R and PS 145R: X70: Main Contactor**
- **PS 122R and PS 145R: X71: Safety Relay Spindle, X72: Safety Relay Axes**

**PS 122R and PS 145R: X70: Main Contactor**

Refer to **Table 6-19**.

**Table 6-19, PS 122R and PS 145R: X70: Main Contactor Pinout**

Connection Terminal X70	Assignment
1	+24 V output (maximum 250 mA)
2	0 V
3	+24 V input for U <sub>Z</sub> ON
4	Do not assign
5	Do not assign
6**1	Normally closed contact (OE1)
7**1	Normally closed contact (OE2)

\*\*1 Maximum 125 V

**Warning: A recovery diode is required in the proximity of the inductive loads, (for example, relay or contactor coils).**

**PS 122R and PS 145R: X71: Safety Relay Spindle, X72: Safety Relay Axes**

Refer to **Table 6-20**.

**Table 6-20, PS 122R and PS 145R: X71: Safety Relay Spindle, X72: Safety Relay Axes Pinout**

Terminals X71 and X72	Assignment
1	+24 V output (maximum 250 mA)
2	0 V
3	+24 V input for Axis ON, Spindle ON
4	Do not assign
5	Do not assign
6**1	Normally closed contact (OE1A or OE1S)
7**1	Normally closed contact (OE2A or OES2)

\*\*1 Maximum 125 V

**Warning: A recovery diode is required in the proximity of the inductive loads, (for example, relay or contactor coils).**

### PS 122R and PS 145R: X69: CNC Power Supply and Control Signals

With lengths of 25.62 inches (600 mm) and longer, the 50-line ribbon cable for the CNC power supply and control signals is led doubled to the CNC Chassis to increase the wire cross section. Refer to **Table 6-21**.

**Table 6-21, PS 122R and PS 145R: X69: CNC Supply Voltage and Control Signals Pinout**

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

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

**PS 122R and PS 145R: X79: Unit Bus**

Refer to Table 6-22.

**Table 6-22, PS 122R and PS 145R: X79: Unit Bus Pinout**

40-line Ribbon Connector	Assignment	
1a to 3b	0 V **1	**1 These voltages may not be linked with other voltages (insulation limitation).
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	ERR.TEMP	
11a	PF.PS	
11b	0 V	
12a	RES.PS	
12b	0 V	
13a	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).

**PS 122R and PS 145R: X74: 5 V Power Supply (PS 130 only)**

Refer to Table 6-23.

**Table 6-23, PS 122R and PS 145R: X74: 5 V Power Supply Pinout**

Connection Terminal X74	Assignment
+	+5 V (load capacity 20 A)
-	0 V

### Connections with BR 9 Braking Resistor Module

The BR 9 braking resistor module must be used when axis motors with brakes are used. In the event of power failure, it dissipates the energy returned by the motors to the DC-link. The BR 9 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. Refer to **Table 6-24**.

**DANGER: Danger of electrical shock!**  
**The BR 9 braking resistor module may be opened only by ANILAM service engineers.**  
**Do not engage or disengage any terminals while they are under power.**

**Table 6-24, BR 9 - X79: Unit Bus Pinout**

40-line Ribbon Connector	Assignment
1a to 3b	0 V **1
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	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

\*\*1 These voltages may not be linked with other voltages (insulation limitation).

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

## Connections on the PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx Power Modules

**DANGER: Danger of electrical shock!**

**Only ANILAM service engineers must open the PM 1xx and PM 2xx power supply unit.**

**Do not engage or disengage any terminals while they are under power.**

The following topics are described:

- **PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx – PWM connection to the CNC Chassis**
- **PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx – X79: Unit Bus**
- **PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx – Motor Connections**
- **PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx – Connection of the Motor Holding Brakes**

### PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx – PWM Connection to the CNC Chassis

For PM 107, PM 115A, PM 123A, PM 132A, PM 148A, PM 170A, PM 207, PM 215A, PM 223A, PMD 107, PMD 115, PMD 125, PMD 140, PMD160, PMD 196, PMD 207, PMD 215, and PMD 225 power modules PWM connection (X111, X112) to the CNC Chassis refer to **Table 6-25**.

**Table 6-25, X111, X112 PWM Connection to the CNC Chassis Pinout**

Ribbon Connector 20-pin	Assignment
1a	PWM U1
1b	0 V U1
2a	PWM U2
2b	0 V U2
3a	PWM U3
3b	0 V U3
4a	$\overline{\text{SH2}}$
4b	0 V ( $\overline{\text{SH2}}$ )
5a	$\overline{\text{SH1}}$
5b	0 V ( $\overline{\text{SH1}}$ )
6a	+I <sub>actl</sub> 1
6b	-I <sub>actl</sub> 1
7a	0 V (analog)
7b	+I <sub>actl</sub> 2
8a	-I <sub>actl</sub> 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.

**PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx – X79: Unit Bus**

For PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx power modules X79 unit bus connections pinout refer to **Table 6-26**.

**Table 6-26, PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx: X79: Unit Bus Pinout**

40-line Ribbon Connector	Assignment	
1a to 3b	0 V **1	**1 These voltages may not be linked with other voltages (insulation limitation).
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).

### PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx – Motor Connections

For PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx power modules X81 and X82 motor connections pinout refer to **Table 6-27**.

**Table 6-27, PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx: X81, X82: Axis/Spindle Motor Connections Pinout**

Terminals X81, X82	Assignment
<b>U</b>	Motor connection U
<b>V</b>	Motor connection V
<b>W</b>	Motor connection W

For information on synchronous (axis) motors, asynchronous (spindle) motors, and power cables, refer to “Section 7, Available Motors and Accessories.”

### PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx – Connection of the Motor Holding Brakes

The following topics are described:

- ❑ **PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx: X344: 24-V Supply for Motor Holding Brake**
- ❑ **PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx: X392: Motor Holding Brake**

#### **PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx: X344: 24-V Supply for Motor Holding Brake**

For PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx power modules X344 24-V supply for the motor holding brake pinout refer to **Table 6-28**.

**Table 6-28, PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx: X344: 24-V Supply for Motor Holding Brake Pinout**

Connecting Terminal X344	Assignment
<b>1</b>	+24 V
<b>2</b>	0 V



**PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx: X392: Motor Holding Brake**

For PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx power modules X392 connection of the motor holding brake pinout refer to **Table 6-29** (2-pin pinout) and/or **Table 6-30** (4-Pin Pinout). For X392 maximum current for controlling the holding brake, refer to **Table 6-31**.

**Table 6-29, PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx: X392: Motor Holding Brake (2-Pin Pinout)**

Connecting Terminal X392	Assignment
1	Holding brake
2	0 V

**Table 6-30, PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx: X392: Motor Holding Brake (4-Pin Pinout)**

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

**Table 6-31, PM 1xx(A), PM 2xx(A), PMD 1xx, PMD 2xx: X392: Maximum Current  $I_{max}$  for Controlling the Holding Brake**

Power Module	$I_{max}$
PM 1xx(A)	3.0 A
PM 2xx(A)	2.0 A

**Connecting the PS 120A Power Supply Unit**

Refer to “Section 5, Connecting the PS 120A Power Supply Unit.”

### Connecting the DLF 1x0 DC-Link Filter

Direct drives (linear motors, torque motors) used with regenerative inverter systems result in voltage peaks, which might destroy the drive. If you are using direct drives in conjunction with regenerative RA 201A, RA 301C, RA 411C inverters, you must use the DLF 1x0 DC-link filter.

#### X79: Unit bus (only DLF 130)

Refer to **Table 6-32**.

**Table 6-32, DLF 130: X79: Unit Bus Pinout**

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

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

**U<sub>z</sub>: DC-Link Voltage**

The inverters for the direct drives are mounted to the right of the DLF DC-link filter in order to separate the DC-link of the direct drives from the DC-link of the conventional drives through the filter. Refer to **Table 6-33**.

**Table 6-33, DC-Link Filter Connecting Terminals**

Connecting Terminals	Assignment
<b>-U<sub>zin</sub></b>	DC-link voltage -, from power supply unit
<b>+U<sub>zin</sub></b>	DC-link voltage +, from power supply unit
<b>-U<sub>zout</sub></b>	DC-link voltage -, to direct drives
<b>+U<sub>zout</sub></b>	DC-link voltage +, to direct drives

The DC-link is mounted by using:

- The conductor bars (for ANILAM inverter systems).
- A cable which is connected instead of the conductor bar (for non-ANILAM inverter systems).

## Connecting the Adapter Module

The following topics are described:

- ❑ **General**
- ❑ **Important Notes for the Connection**
- ❑ **Adapter Module – X69a: From the First Power Supply Unit (Diagnosable)**
- ❑ **Adapter Module – X69b: From the Second Power Supply Unit (No Diagnosis)**
- ❑ **Adapter Module – X69: Ribbon Cable to the CNC**
- ❑ **Adapter Module – X75: Service Connector**

### General

In modular regenerative inverter systems an additional power supply unit may become necessary if you are using inverters or motors with a high power demand. The adapter module gives you the possibility of connecting this power supply unit to the present inverter system. In this way one power supply unit can, for example, supply the power to high-performance spindle and the other power supply unit can be used for the axes.

The two power supply units are connected to the control via the supply bus (X69a/X69b – X69) and in this way integrated in the system monitoring.

The two supply buses are linked in the adapter module. The reset signal, analog signals, and the power supply are used by the module connected to X69a. The ready signals of the power supply units are AND-gated. All other digital signals are OE-gated. X75 is an interface for service purposes. This connector must not be wired.

### Important Notes for the Connection

For connection overview, see “Section 2, Accessories for Inverters and Modular Amplifiers.”

Please keep the following in mind for connecting the inverter system and for integrating the status and control signals in its diagnosis or monitoring functions:

- The two power supply units form two separate DC-links and must therefore not be connected through the DC-link conductor bars. The power of each DC-link must therefore be rated separately. Motors whose power exceeds that of an individual power supply module can **not** be operated with two power supply units either.

- Each of the power supply units must have a separate power connection. This means that upstream filters and other devices for noise suppression, such as the LF 1xxA Line Filter, commutating reactor, and three-phase capacitor, must be provided separately for each of the power supply lines.
  - If the machine requires the use of braking resistors (e.g., BR 9) a separate module must be used for each DC-link.
  - Since, in principle, two separate inverter systems result, each of the systems requires its own unit bus (X79).
  - Error messages from the power supply units are received by the adapter module and transmitted to the control. However, the control cannot determine which of the supply buses is responsible for error messages.
  - The ready signals from the power supply unit are combined in the adapter module and transmitted to the control. If a ready signal is missing, the control cannot determine which of the inverter systems has not sent the ready signal.
- **Supply Bus X69a/b:**

The DC-links to be monitored must be evaluated. The present system architecture allows monitoring of only one DC-link's voltage and current. The DC-link with the greater load or the more critical components should be monitored and the power supply module concerned must be connected to X69a. The other power supply module must be connected to X69b accordingly.
  - **Diagnosability:**

The information given above also applies to diagnosability. The control is able to diagnose power supply units, such as the PS 145R, only if the supply bus (X69) of the PS 145R is connected to X69a of the adapter module. The power supply unit connected to X69b cannot be addressed by the system diagnosis.
  - **5 V Power Supply X74:**

The 5 V power supply must be routed from the power supply unit connected to X69a to the control.

### Adapter Module – X69a: From the First Power Supply Unit (Diagnosable)

For lengths of  $\approx 23.62$ " (600 mm) and longer, the 50-line ribbon cable for the CNC power supply and control signals is led doubled to the CNC Chassis in order to increase the wire cross section. Refer to **Table 6-34**.

**Table 6-34, Adapter Module - X69a: CNC Supply Voltage and Control Signals Pinout**

50-line Ribbon Connector	Assignment	50-line Ribbon Connector	Assignment
1a to 5b	+5 V	16b	GND
6a to 7b	+12 V	17a	RDY.PS_U1
8a	+5 V (low-voltage separation)	17b	GND
8b	0 V (low-voltage separation)	18a	$\overline{\text{ERR.ILEAK\_U1}}$
9a	+15 V	18b	GND
9b	-15 V	19a	Not connected
10a	UZAN_U1	19b	GND
10b	0 V	20a	Not connected
11a	IZAN_U1	20b	GND
11b	0 V	21a	0 V
12a	$\overline{\text{RES.PS\_U1}}$	21b	GND
12b	0 V	22a	Not connected
13a	$\overline{\text{PF.PS\_U1}}$	22b	GND
13b	GND	23a	SDA
14a	$\overline{\text{ERR.UZ.GR\_U1}}$	23b	GND
14b	GND	24a	SCL
15a	$\overline{\text{ERR.IZ.GR\_U1}}$	24b	GND
15b	GND	25a	$\overline{\text{RES.LE}}$
16a	$\overline{\text{ERR.TEMP\_U1}}$ (PS, DLF, BR)	25b	GND

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

**Adapter Module – X69b: From the Second Power Supply Unit (No Diagnosis)**

For lengths of  $\approx 23.62''$  (600 mm) and longer, the 50-line ribbon cable for the CNC power supply and control signals is led doubled to the CNC Chassis in order to increase the wire cross section. Refer to **Table 6-35**.

**Table 6-35, Adapter Module - X69b: CNC Supply Voltage and Control Signals Pinout**

50-line Ribbon Connector	Assignment	50-line Ribbon Connector	Assignment
1a to 5b	+5 V	16b	GND
6a to 7b	Not connected	17a	RDY.PS_U2
8a	Not connected	17b	GND
8b	Not connected	18a	$\overline{\text{ERR.ILEAK\_U2}}$
9a	Not connected	18b	GND
9b	Not connected	19a	Not connected
10a	UZAN_U2	19b	GND
10b	Not connected	20a	Not connected
11a	IZAN_U2	20b	GND
11b	Not connected	21a	Not connected
12a	Not connected	21b	GND
12b	0 V	22a	Not connected
13a	$\overline{\text{PF.PS\_U2}}$	22b	GND
13b	GND	23a	Not connected
14a	$\overline{\text{ERR.UZ.GR\_U2}}$	23b	GND
14b	GND	24a	Not connected
15a	$\overline{\text{ERR.IZ.GR\_U2}}$	24b	GND
15b	GND	25a	$\overline{\text{RES.LE}}$
16a	$\overline{\text{ERR.TEMP\_U2}}$ (PS, DLF, BR)	25b	GND

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

### Adapter Module – X69: Ribbon Cable to the CNC

For lengths of  $\approx 23.62$ " (600 mm) and longer, the 50-line ribbon cable for the CNC power supply and control signals is led doubled to the CNC Chassis in order to increase the wire cross section. Refer to **Table 6-36**.

**Table 6-36, Adapter Module - X69: CNC Supply Voltage and Control Signals Pinout**

50-line Ribbon Connector	Assignment	50-line Ribbon Connector	Assignment
1a to 5b	+5 V	16b	GND
6a to 7b	+12 V	17a	RDY.PS
8a	+5 V (low-voltage separation)	17b	GND
8b	0 V (low-voltage separation)	18a	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	RES.PS	21b	GND
12b	0 V	22a	0 V
13a	PF.PS	22b	GND
13b	GND	23a	Reserved (SDA)
14a	ERR.UZ.GR	23b	GND
14b	GND	24a	Reserved (SCL)
15a	ERR.IZ.GR	24b	GND
15b	GND	25a	RES.LE
16a	ERR.TEMP (PS, DLF, BR)	25b	GND

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

### Adapter Module – X75: Service Connector

**WARNING:** X75F must not be assigned. It is only for service purposes.



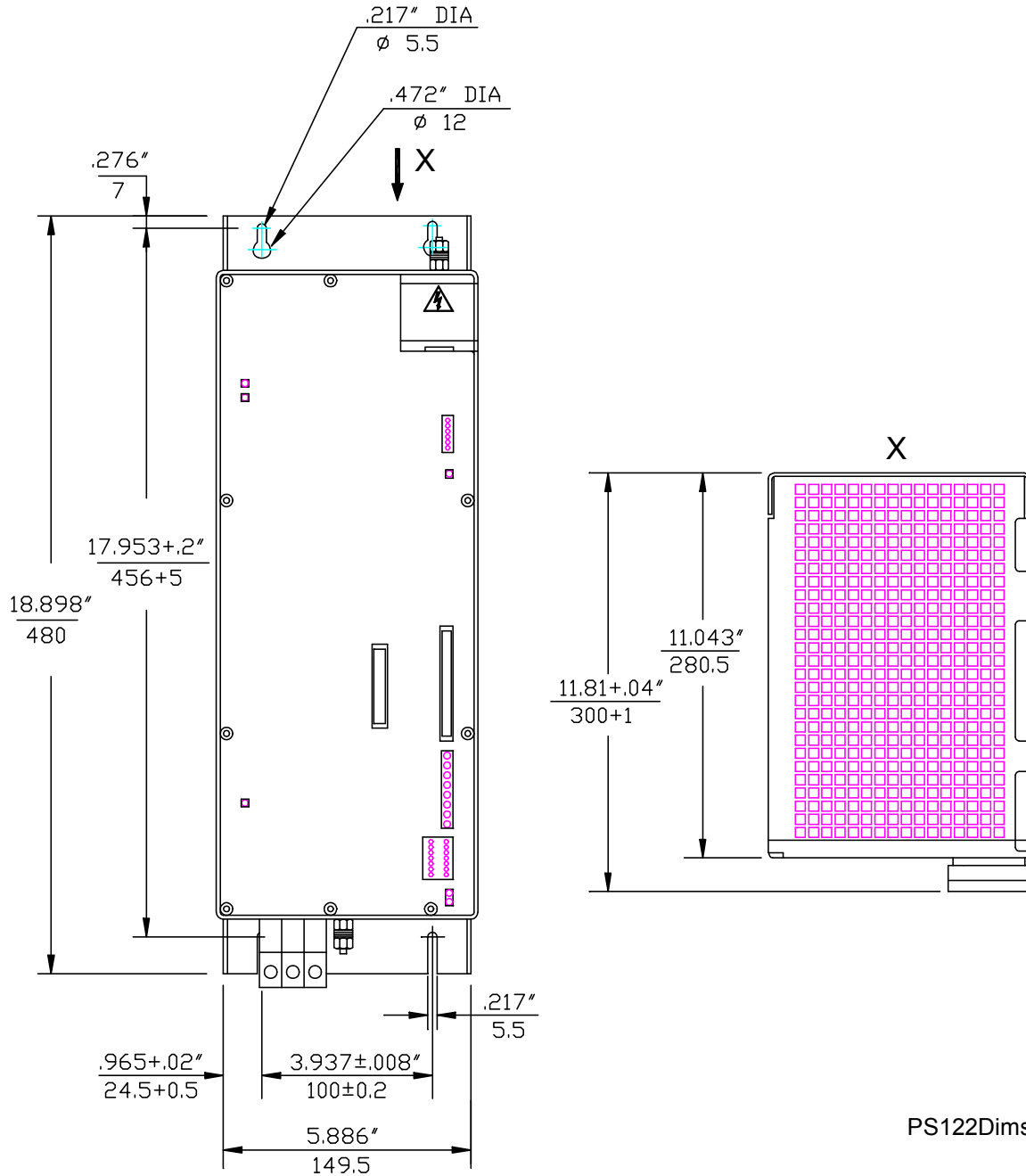
## Physical Dimensions

The following components dimensions are illustrated:

- ❑ **PS 122R Power Supply Unit**
- ❑ **PS 130 Power Supply Unit**
- ❑ **PS 145R Power Supply Unit**
- ❑ **PS 120A Power Supply Unit**
- ❑ **CR 135 Commutating Reactor**
- ❑ **CR 170, CR 180 Commutating Reactors**
- ❑ **LF 135A Line Filter**
- ❑ **LF 180A Line Filter**
- ❑ **BR 9 Braking Resistor**
- ❑ **BR 18 Braking Resistor**
- ❑ **BR 10F and BR 18F Braking Resistor**
- ❑ **Three-Phase Current Capacitor**
- ❑ **PM 107, PM 207 Power Modules**
- ❑ **PM 115A, PM 123A, PM 132A, PM 148A, PM 215A, and PM 223A Power Modules**
- ❑ **PM 107A Power Module**
- ❑ **PMD 107 Power Module**
- ❑ **PMD 115 Power Module**
- ❑ **PMD 125, PMD 140 Power Module**
- ❑ **PMD 160 Power Module**
- ❑ **PMD 196 Power Module**
- ❑ **PMD 207 Power Module**
- ❑ **PMD 215, PMD 225 Power Module**
- ❑ **DLF 110 DC-Link Filter**
- ❑ **DLF 120 DC-Link Filter**
- ❑ **DLF 130 DC-Link Filter**
- ❑ **Adapter Module**

### PS 122R Power Supply Unit

Refer to Figure 6-26.

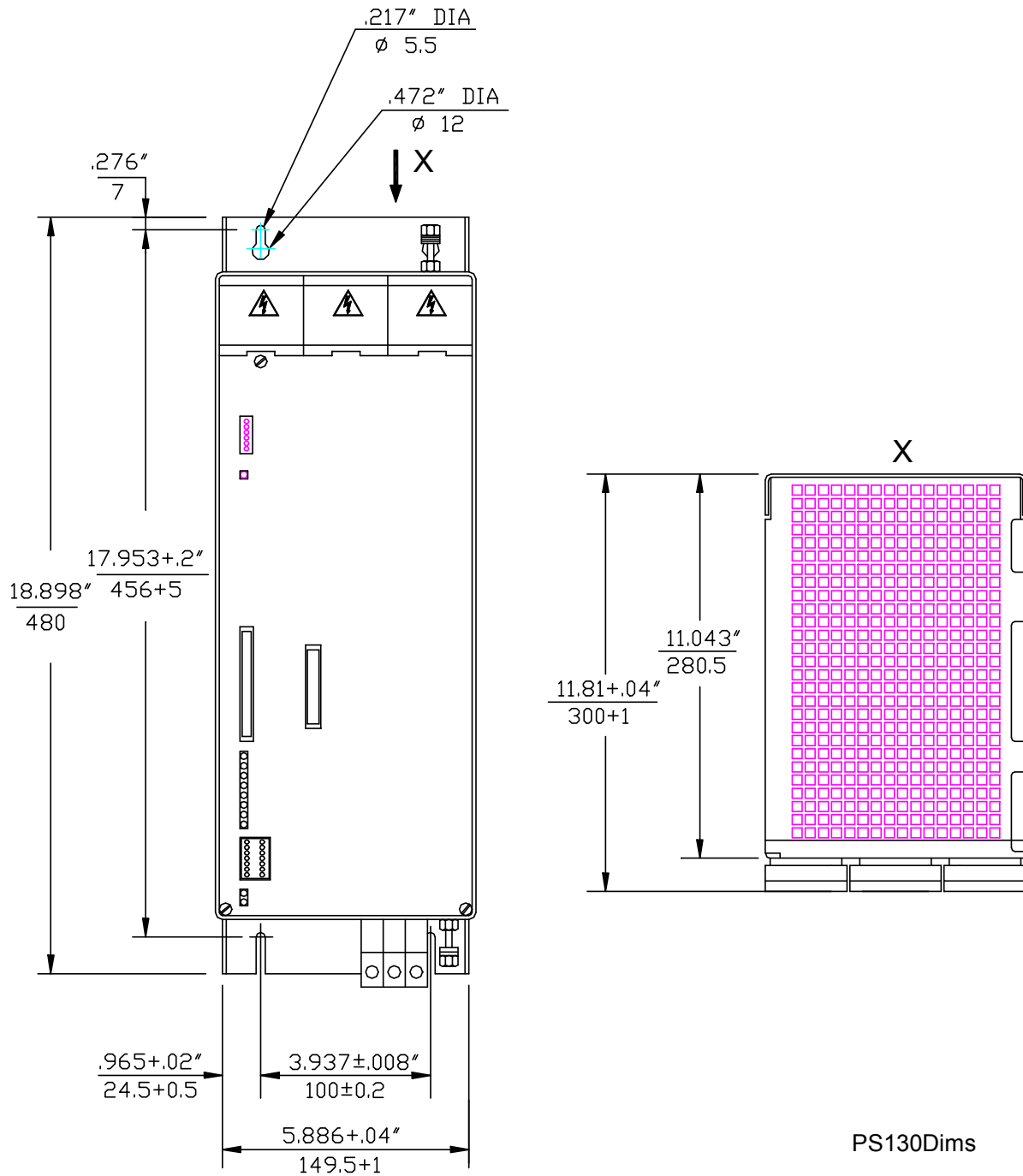


PS122Dims

Figure 6-26, PS 122R Power Supply Unit, Dimensions

**PS 130 Power Supply Unit**

Refer to **Figure 6-27**.



PS130Dims

**Figure 6-27, PS 130 Power Supply Unit, Dimensions**

### PS 145R Power Supply Unit

Refer to Figure 6-28.

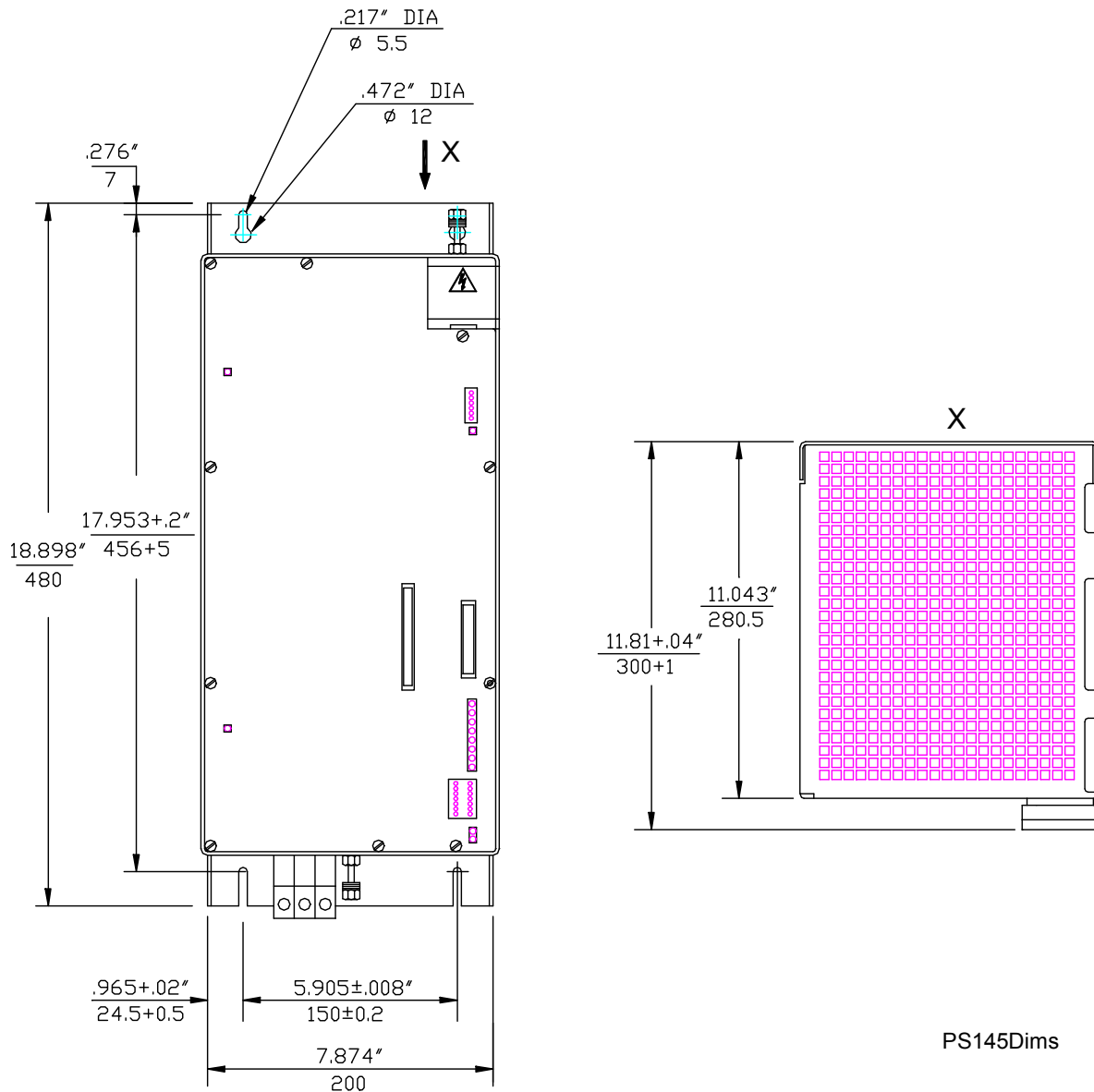


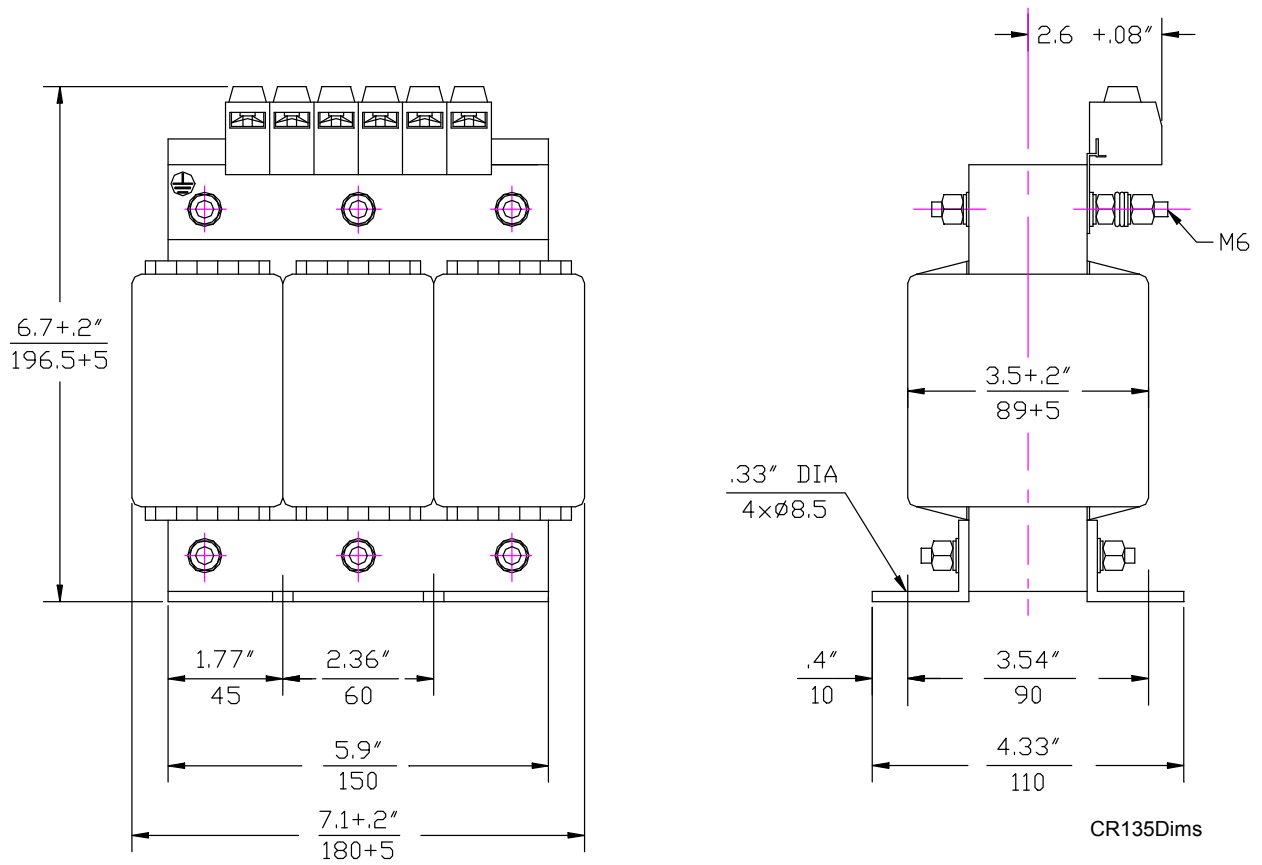
Figure 6-28, PS 145R Power Supply Unit, Dimensions

**PS 120A Power Supply Unit**

Refer to "Section 5, Physical Dimensions, PS 120A Power Supply Unit,"  
**Figure 5-30, PS 120A Power Supply Unit Dimensions.**

**CR 135 Commutating Reactor**

Refer to **Figure 6-29.**



**Figure 6-29, CR 135 Commutating Reactor, Dimensions**

### CR 170, CR 180 Commutating Reactor

Refer to Figure 6-30 and Table 6-37.

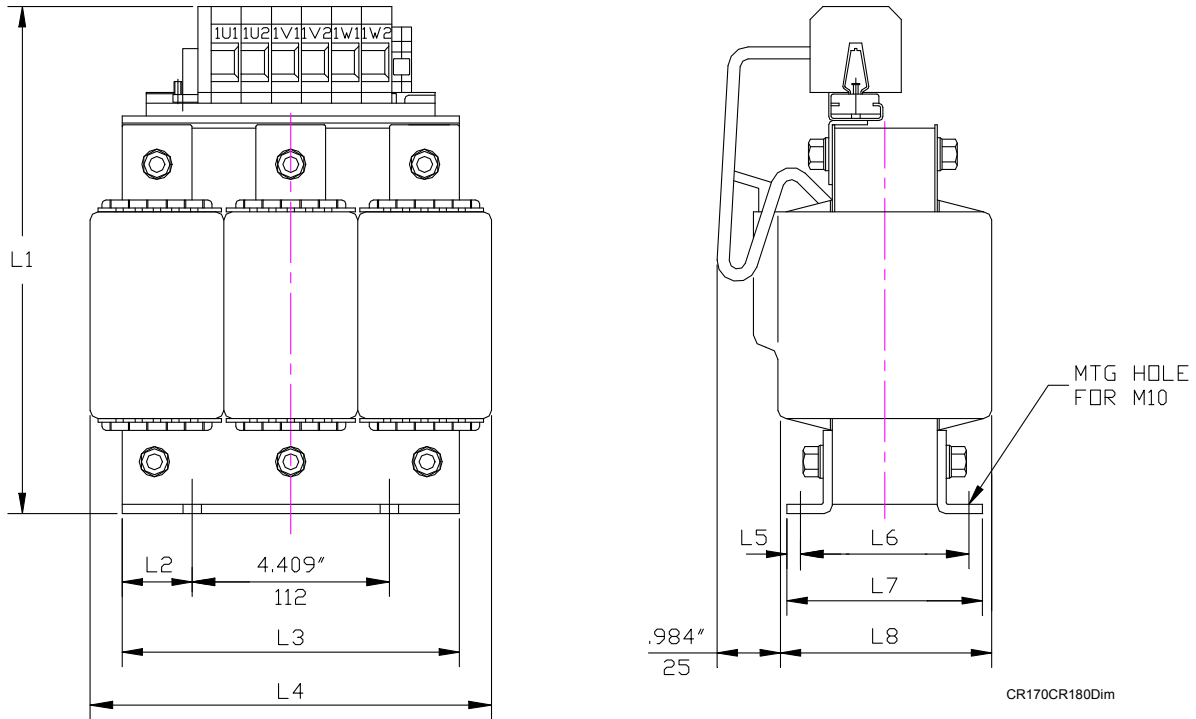


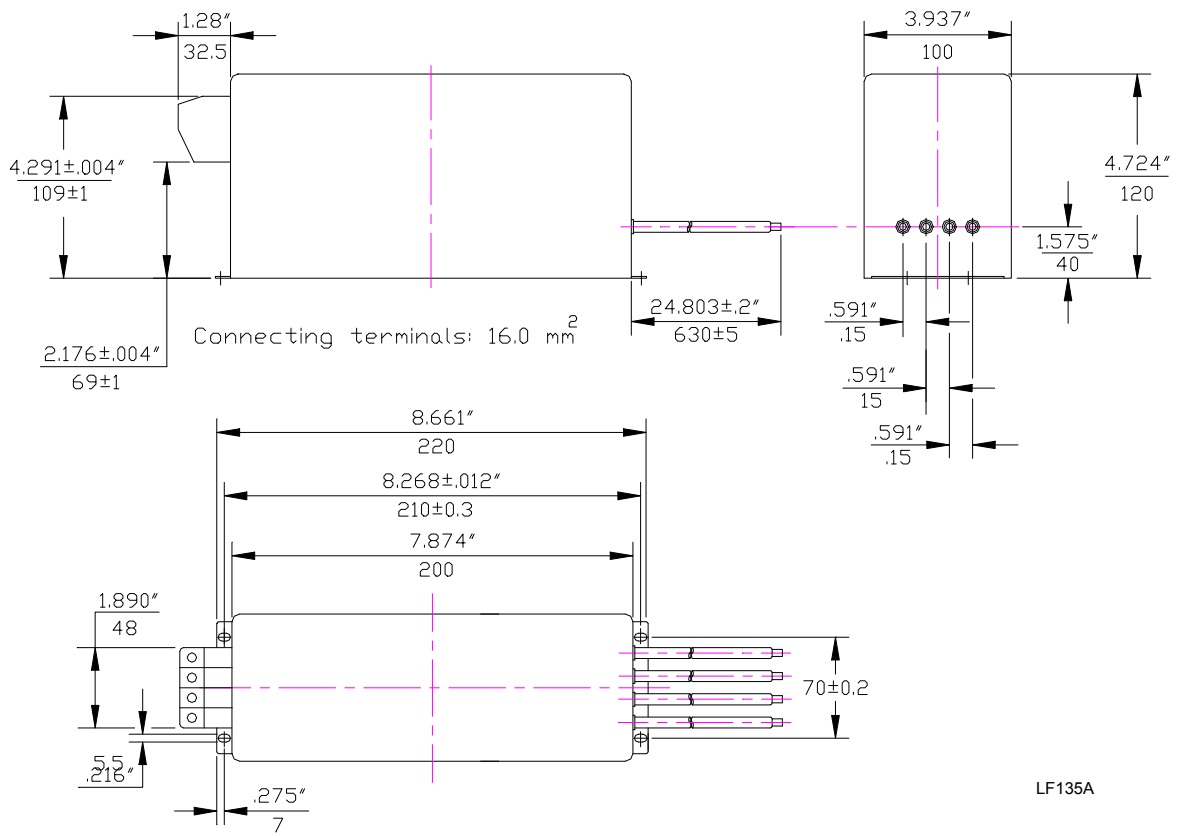
Figure 6-30, CR 170, CR 180 Commutating Reactor, Dimensions

Table 6-37, CR 170, CR 180 Commutating Reactor, Dimensions

Value	CR 170	CR 180
<b>L1</b>	<u>10.748"</u> 273 mm	<u>11.299"</u> 287 mm
<b>L2</b>	<u>1.535"</u> 39 mm	<u>1.732"</u> 44 mm
<b>L3</b>	<u>7.480"</u> 190 mm	<u>7.874"</u> 200 mm
<b>L4</b>	<u>9.448"</u> 240 mm	<u>9.842"</u> 250 mm
<b>L5</b>	<u>0.393"</u> 10 mm	<u>0.433"</u> 11 mm
<b>L6</b>	<u>3.740"</u> 95 mm	<u>4.055"</u> 103 mm
<b>L7</b>	<u>4.527"</u> 115 mm	<u>4.921"</u> 125 mm
<b>L8</b>	<u>4.527"</u> 115 mm	<u>5.118"</u> 130 mm

**LF 135A Line Filter**

Refer to Figure 6-31.



**Figure 6-31, LF 135A Line Filter, Dimensions**

### LF 180A Line Filter

Refer to Figure 6-32.

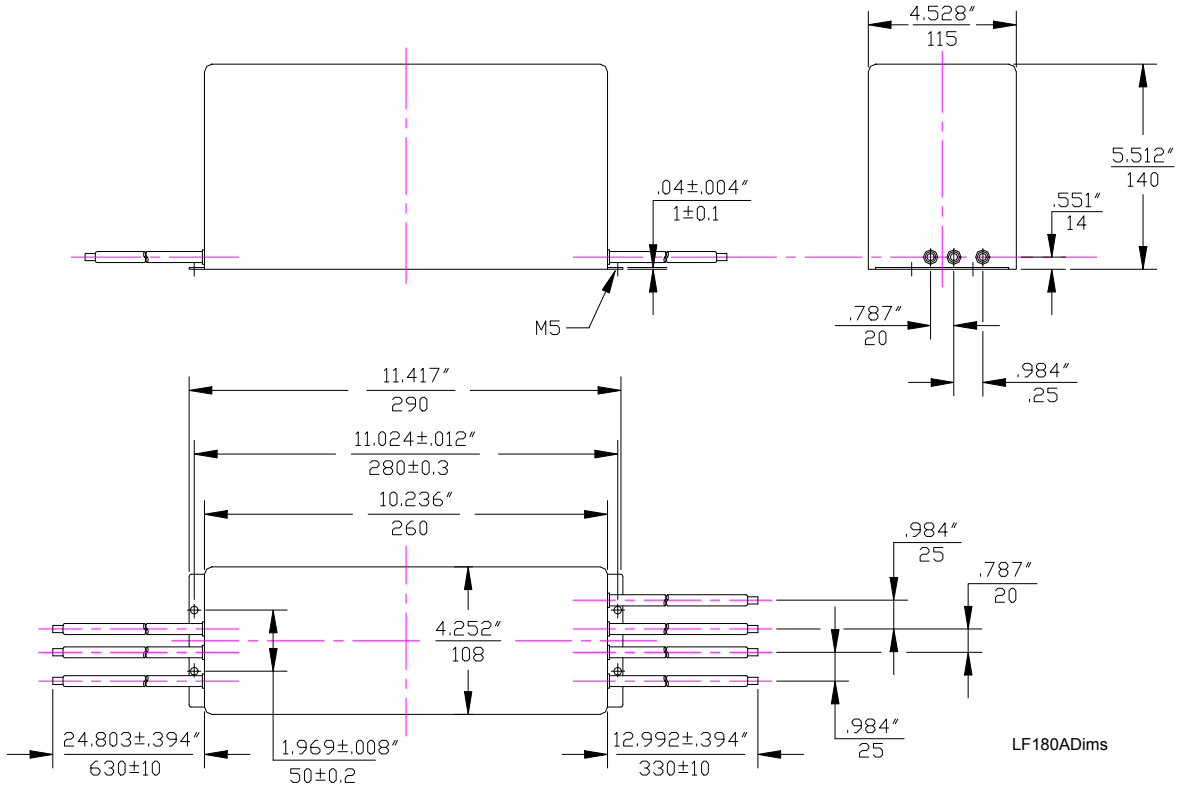


Figure 6-32, LF 180A Line Filter, Dimensions



**BR 9 Braking Resistor**

Refer to **Figure 5-31, BR 9 Dimensions.**

**BR 18 Braking Resistor**

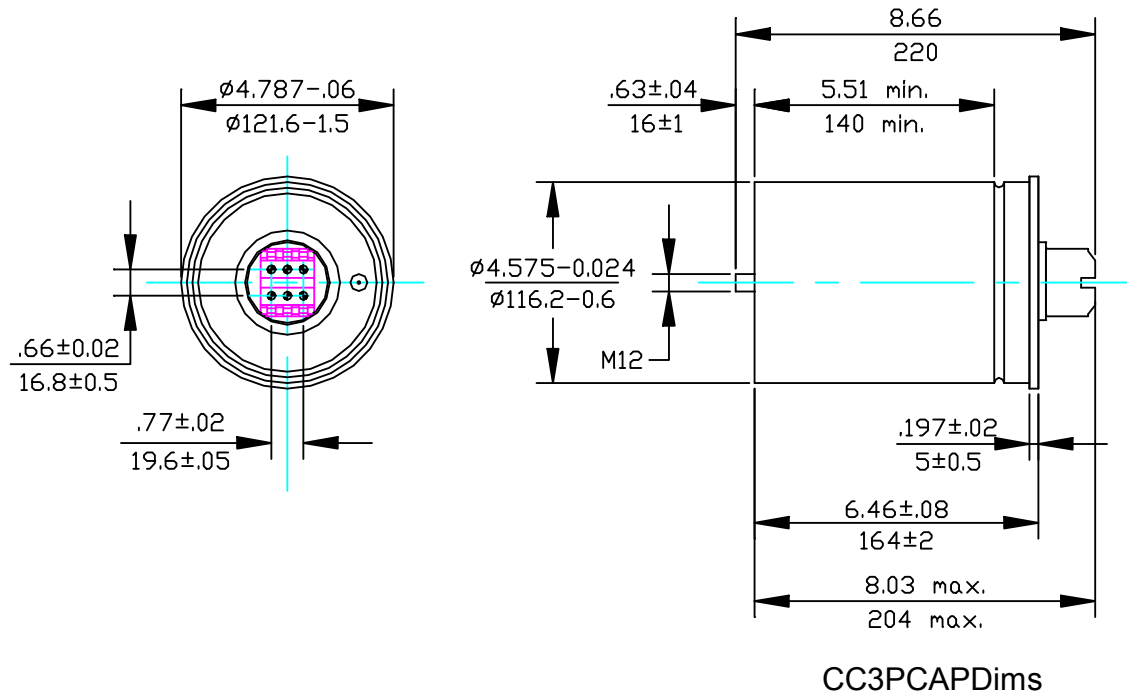
Refer to **Figure 5-32, BR 18 Dimensions.**

**BR 10F and BR 18F Braking Resistor**

Refer to **Figure 5-33, BR 10F and BR 18F Dimensions.**

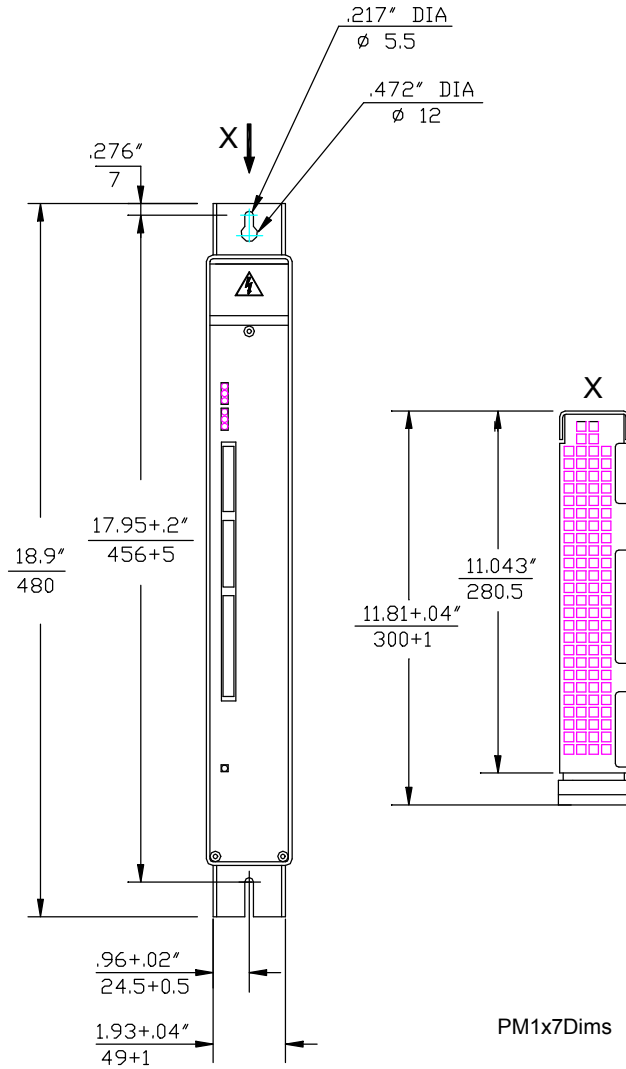
**Three-Phase Current Capacitor**

Refer to **Figure 6-33.**



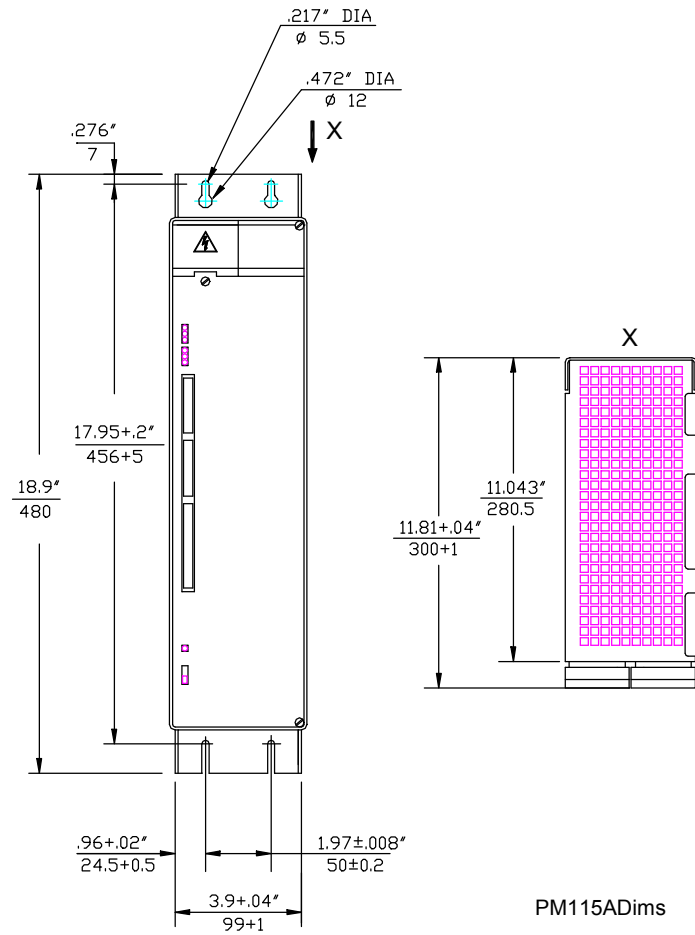
**Figure 6-33, Three-Phase Current Capacitor, CC 3P, Dimensions**

**PM 107, PM 207 Power Module**  
 Refer to **Figure 6-34**.



**Figure 6-34, PM 107, PM 207 Power Module, Dimensions**

**PM 115A, PM 123A, PM 132A, PM 148A, PM 215A, and PM 223A Power Modules**  
 Refer to **Figure 6-35**.



**Figure 6-35, PM 115A, PM 123A, PM 132A, PM 148A, PM 215A, and PM 223A Power Module, Dimensions**

### PM 170A Power Module

Refer to Figure 6-36.

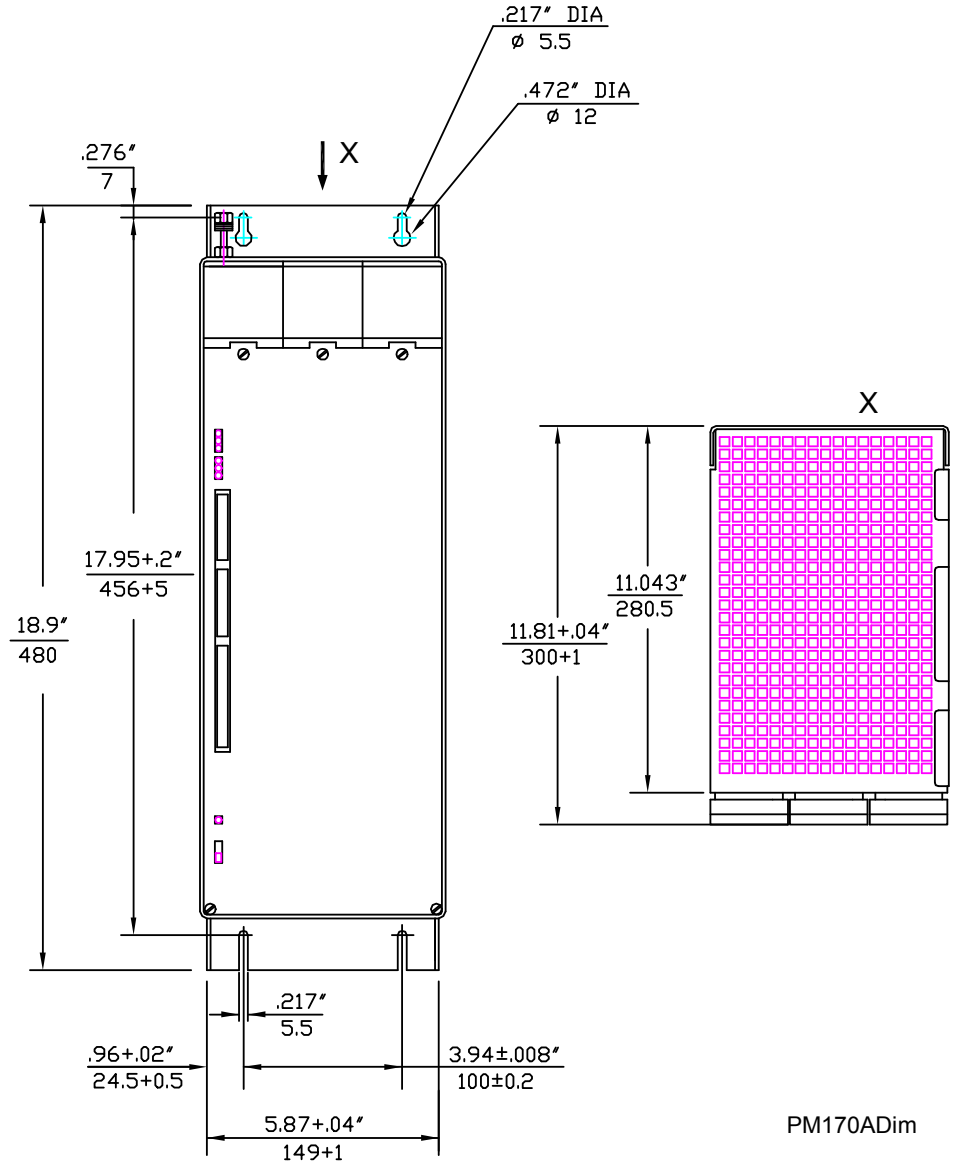
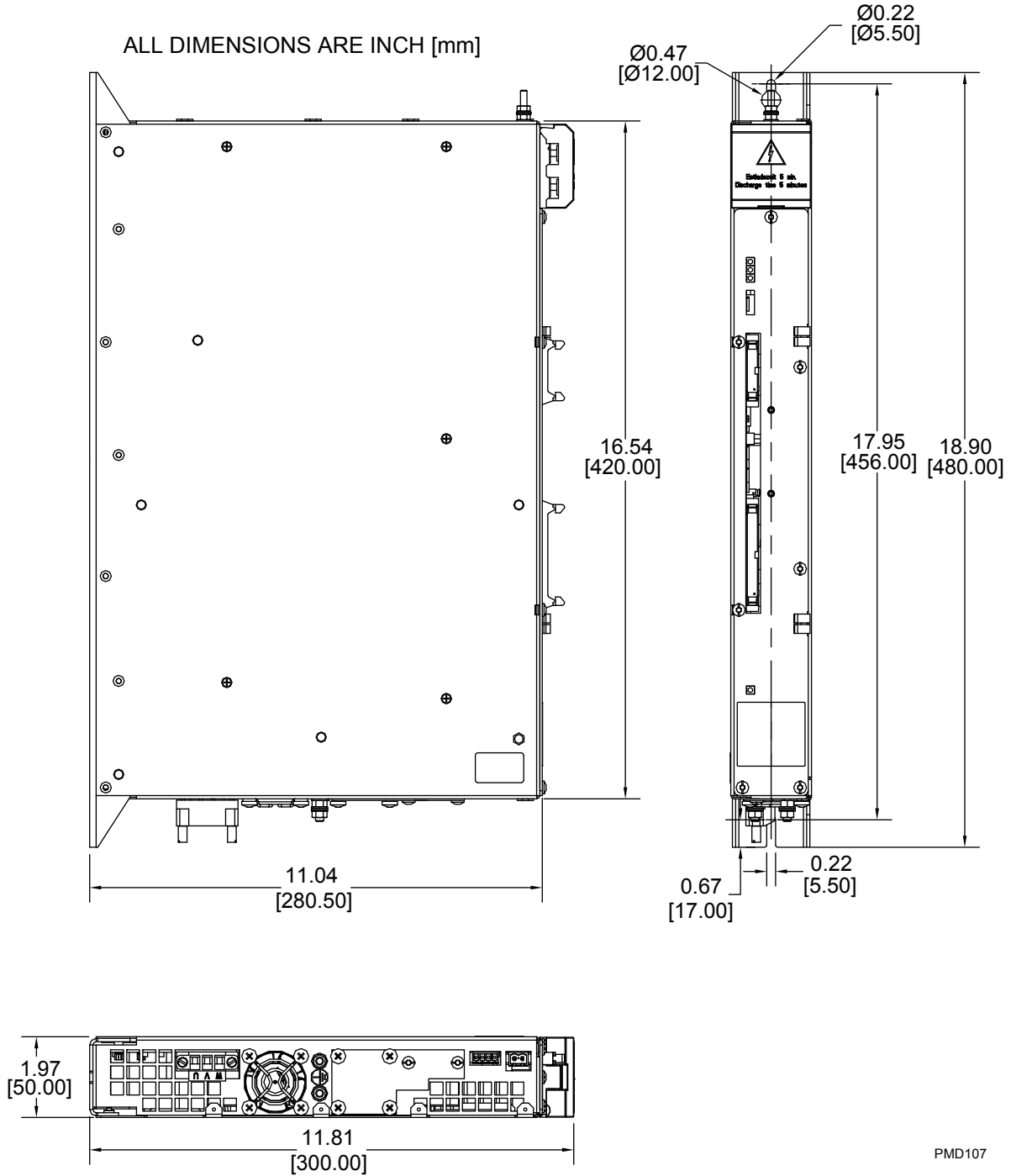


Figure 6-36, PM 170A Power Module, Dimensions

**PMD 107 Power Module**

Refer to **Figure 6-37**.



PMD107

**Figure 6-37, PMD 107 Power Module, Dimensions**

### PMD 115 Power Module

Refer to Figure 6-38.

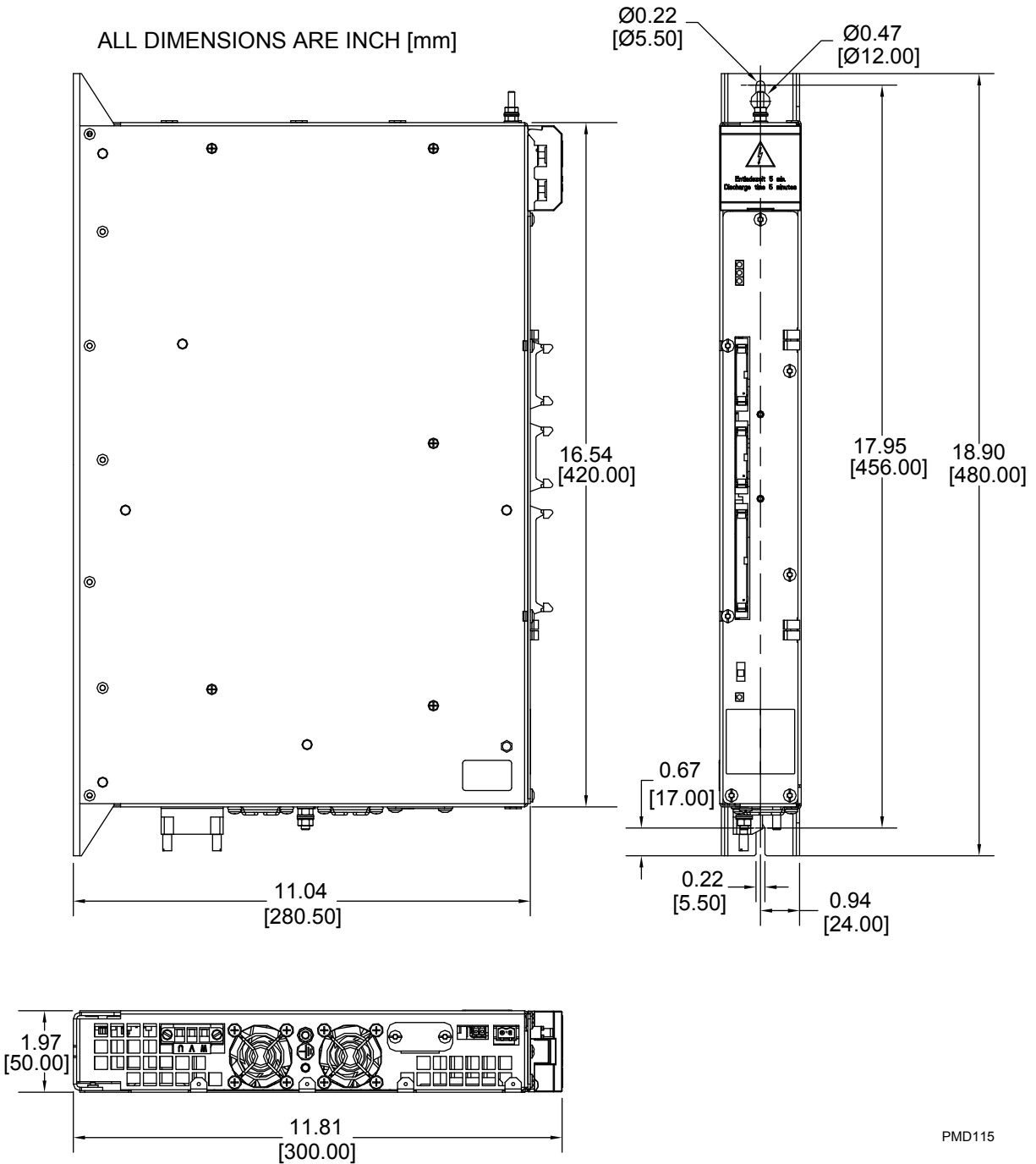
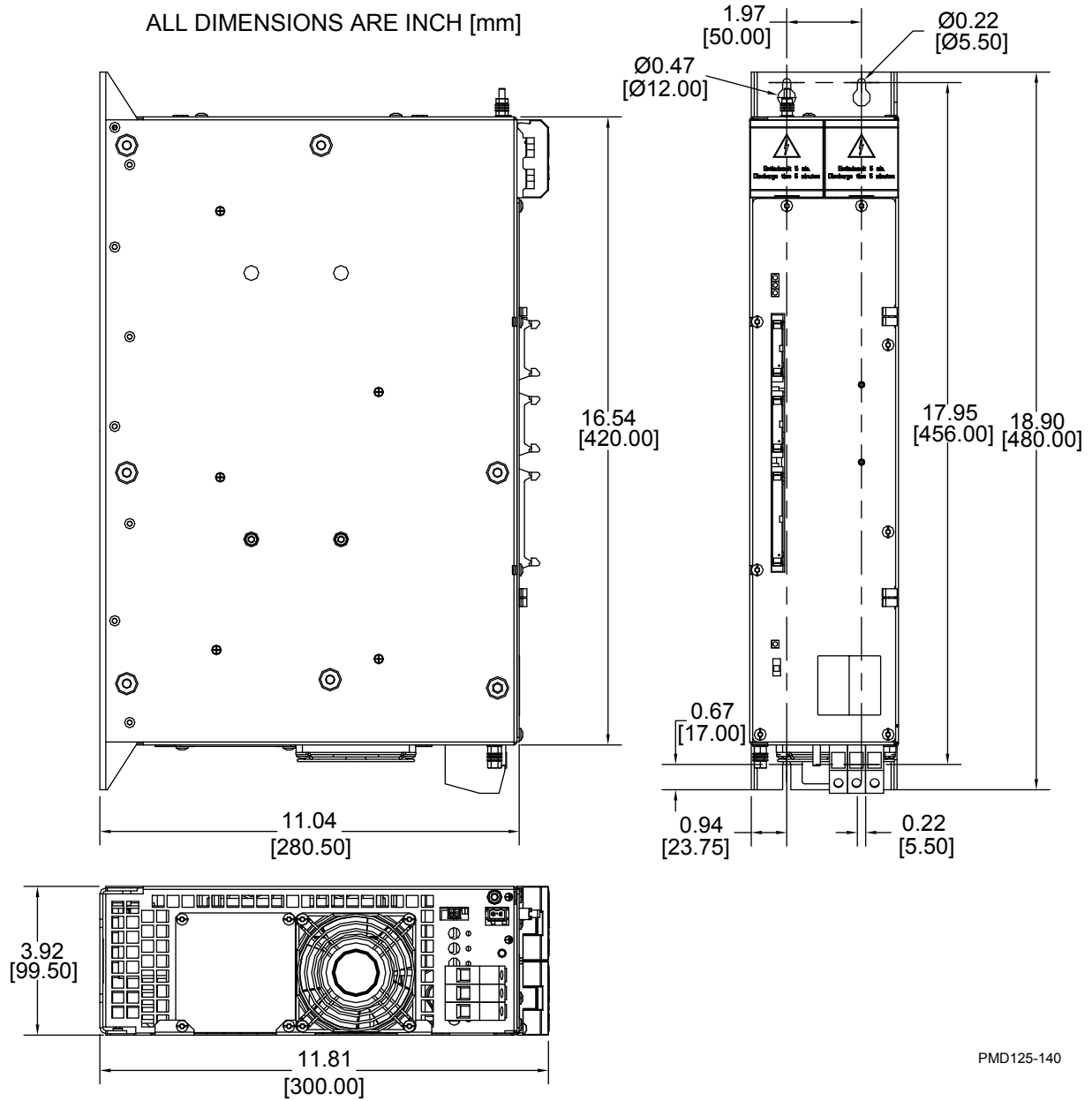


Figure 6-38, PMD 115 Power Module, Dimensions

**PMD 125, PMD 140 Power Module**

Refer to **Figure 6-39**.

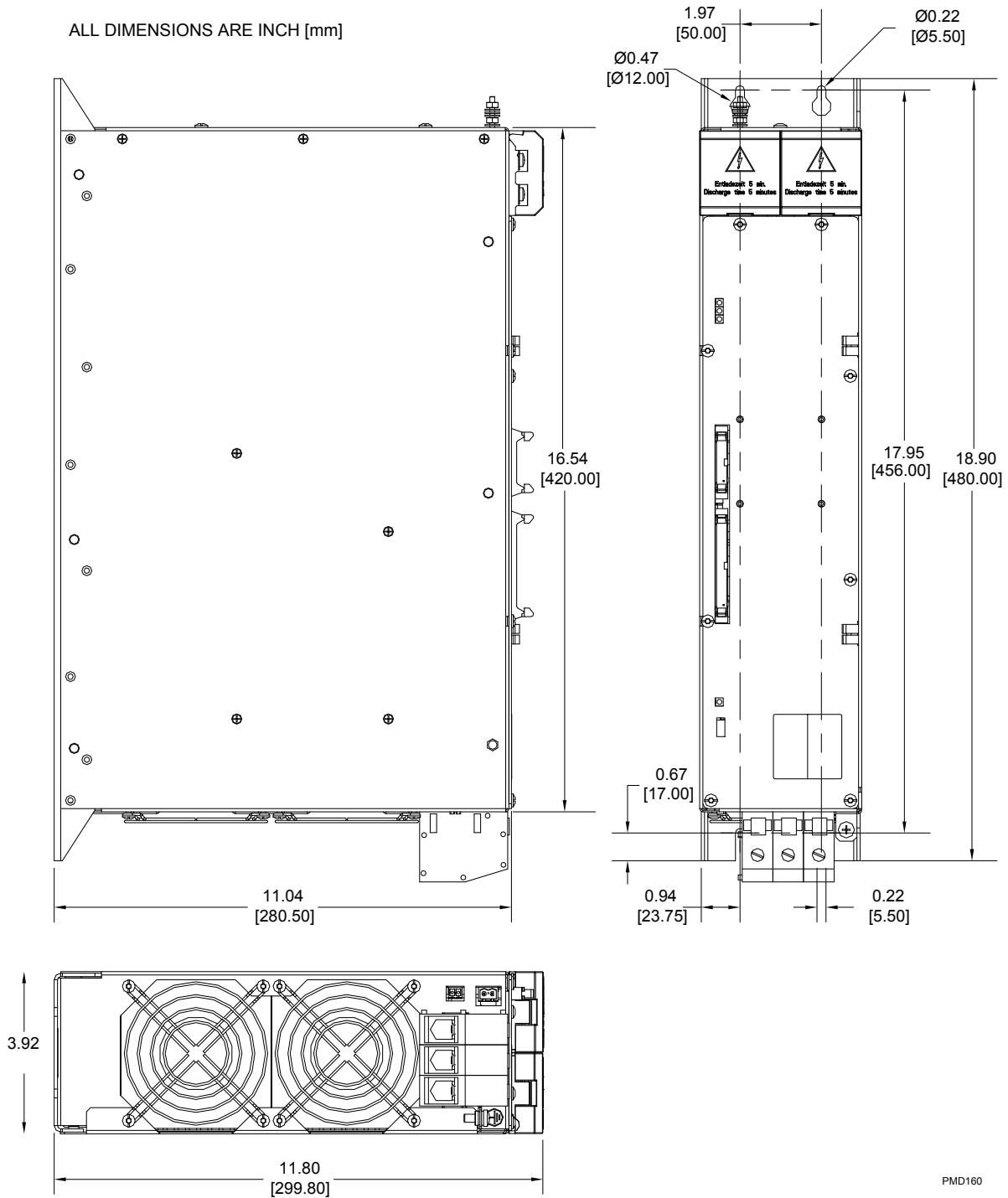


**Figure 6-39, PMD 125, PMD 140 Power Module, Dimensions**

### PMD 160 Power Module

Refer to Figure 6-40.

ALL DIMENSIONS ARE INCH [mm]



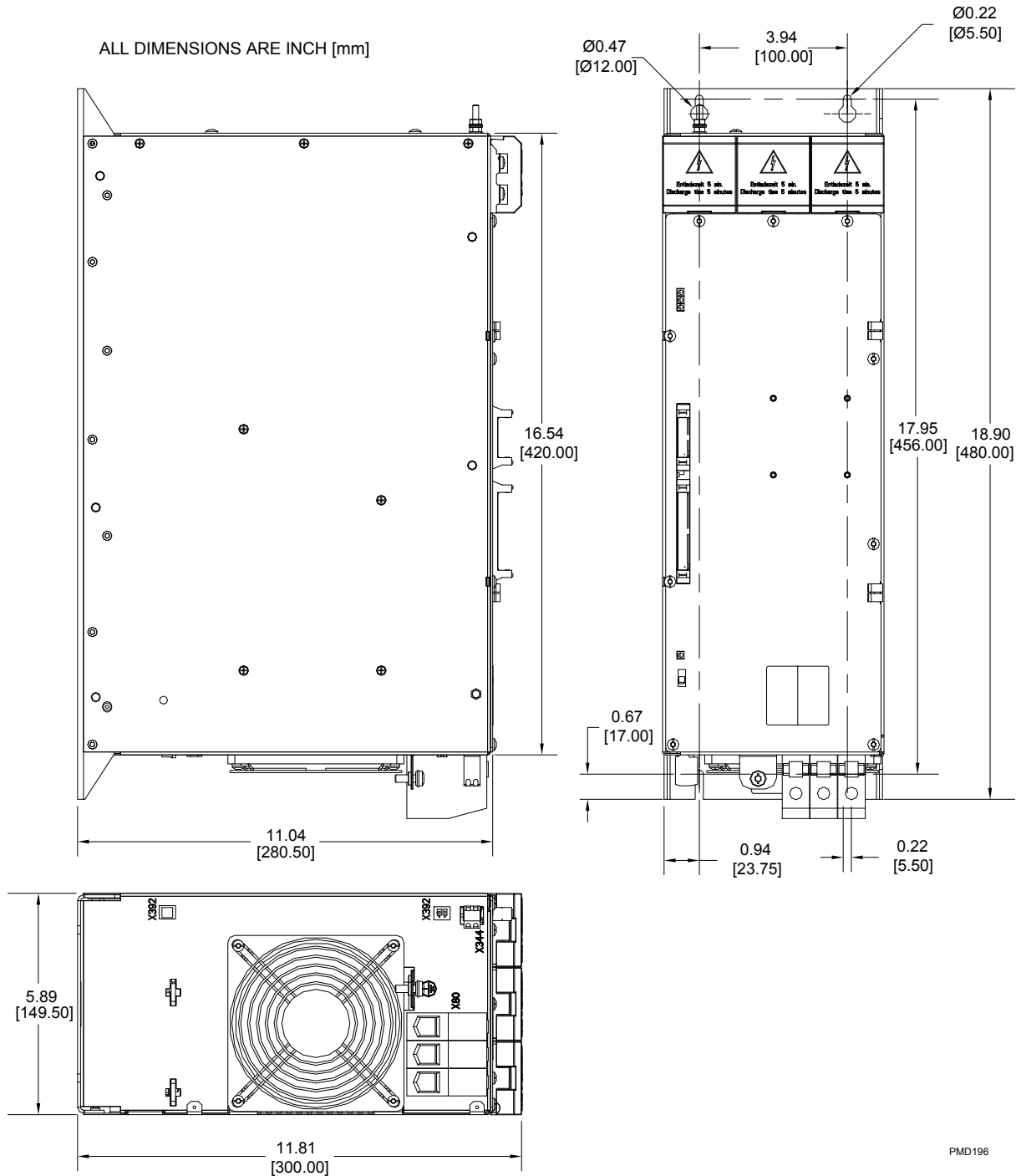
PMD160

Figure 6-40, PMD 160 Power Module, Dimensions



**PMD 196 Power Module**

Refer to Figure 6-41.



**Figure 6-41, PMD 196 Power Module, Dimensions**

### PMD 207 Power Module

Refer to Figure 6-42.

ALL DIMENSIONS ARE INCH [mm]

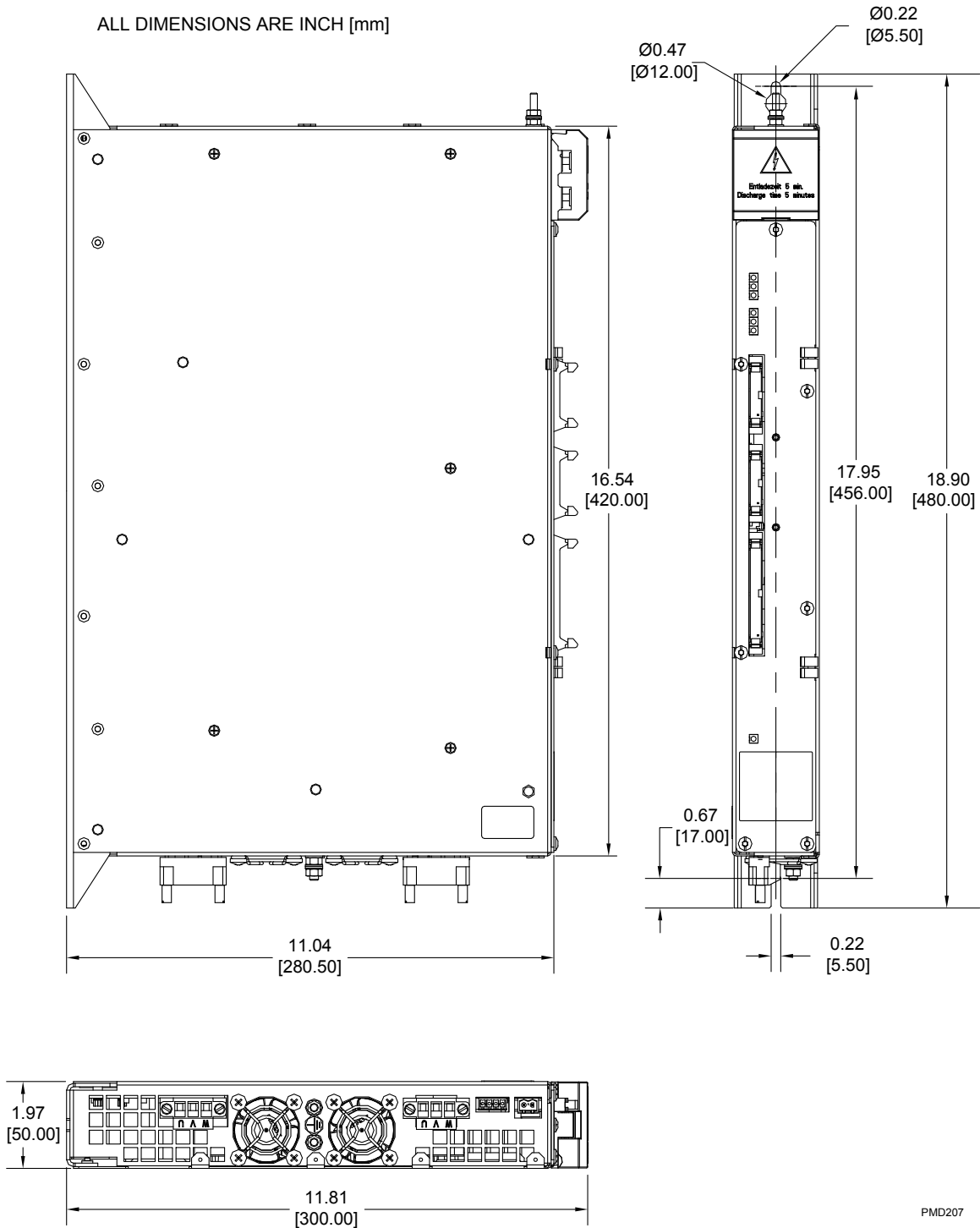
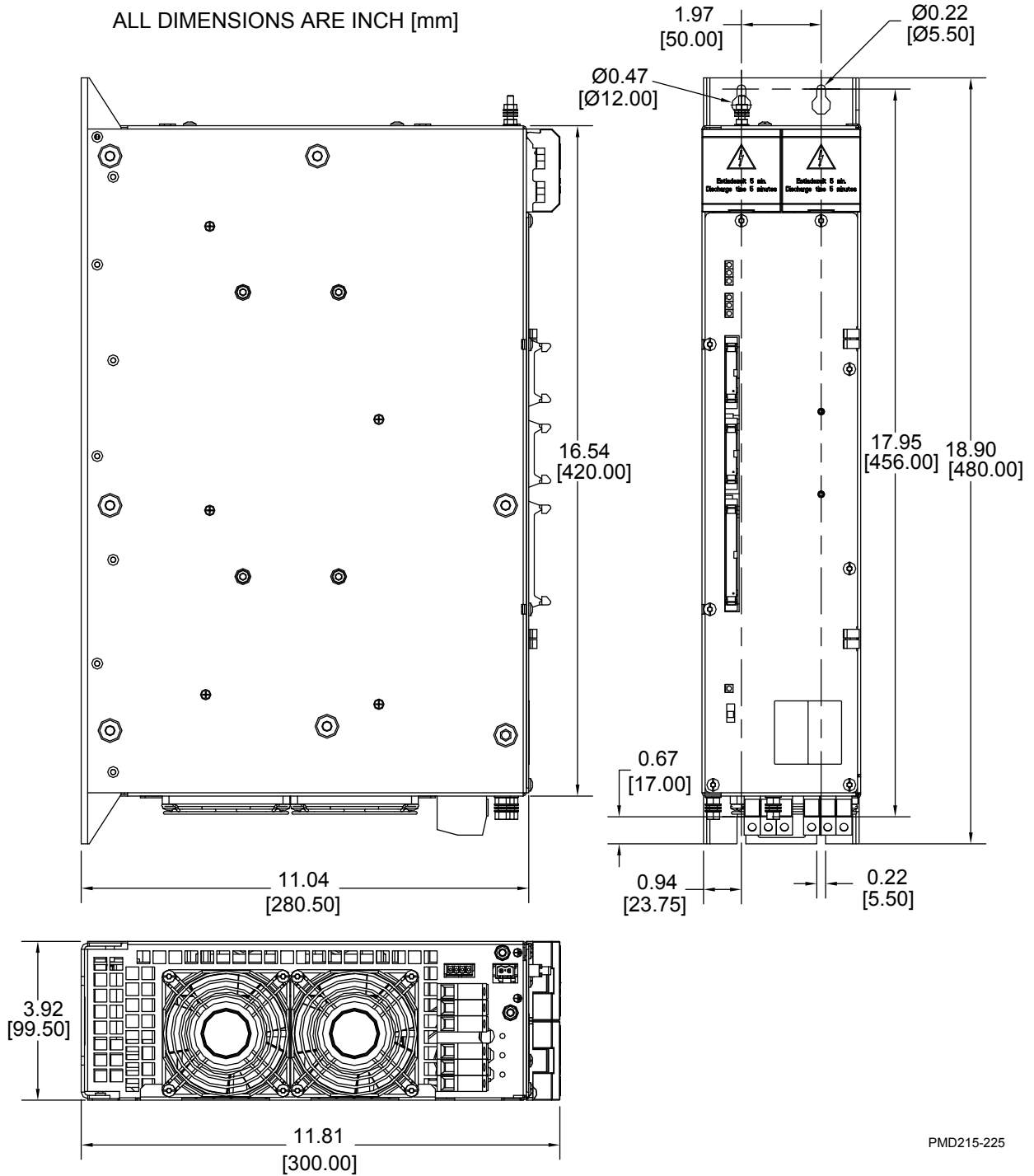


Figure 6-42, PMD 207 Power Module, Dimensions

**PMD 215, PMD 225 Power Module**

Refer to **Figure 6-43**.

ALL DIMENSIONS ARE INCH [mm]

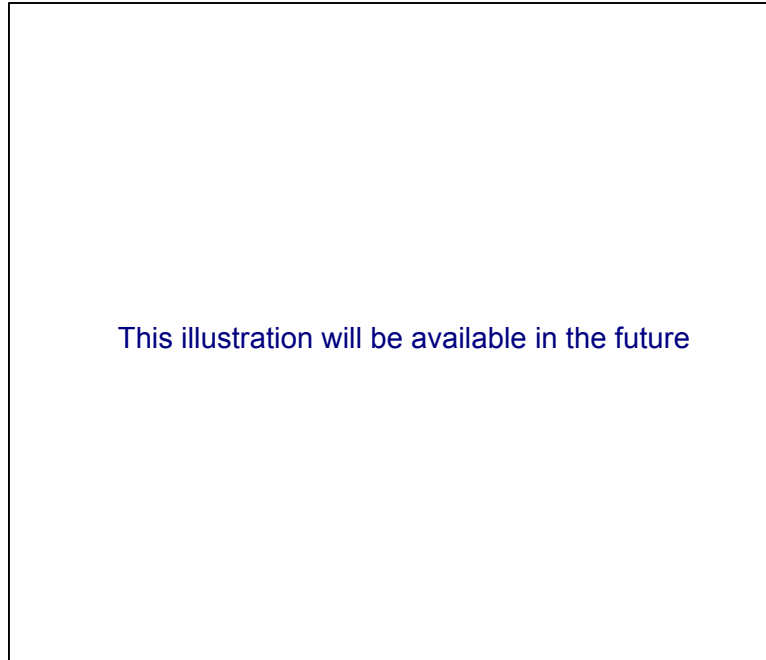


PMD215-225

**Figure 6-43, PMD 215, PMD 225 Power Module, Dimensions**

### DLF 110 DC-Link Filter

Refer to **Figure 6-44**.



**Figure 6-44, DLF 110 DC-Link Filter, Dimensions**

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**DLF 120 DC-Link Filter**

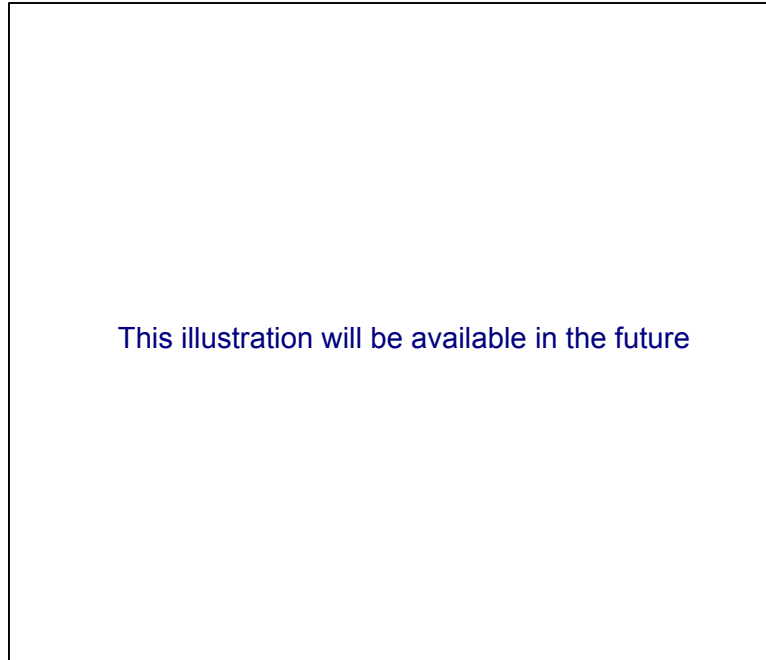
Refer to **Figure 6-45**.



**Figure 6-45, DLF 120 DC-Link Filter, Dimensions**

### DLF 130 DC-Link Filter

Refer to **Figure 6-46**.



**Figure 6-46, DLF 120 DC-Link Filter, Dimensions**

**Adapter Module**

Refer to **Figure 6-47**.



**Figure 6-47, Adapter Module, Dimensions**





## **Section 7 - Available Motors and Accessories**

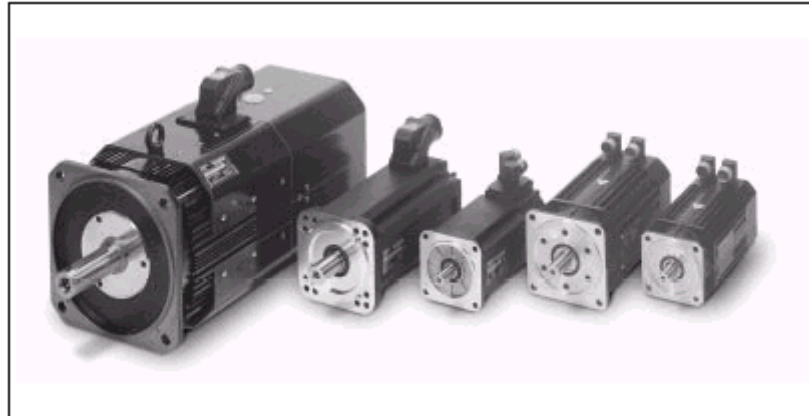
The following topics are described in this section:

- ❑ **Available Motors**
- ❑ **Cables and Connectors**
- ❑ **Maximum Torque of a Drive**
- ❑ **Safety and Labeling Information**
- ❑ **DC-Link Voltages for ANILAM Motors**
- ❑ **Connecting Speed (Rotary) Encoders to the Motors**
- ❑ **Power Connection of the ANILAM Motors**
- ❑ **Connecting the Holding Brake**
- ❑ **Connecting the Fan to the Spindle Motor**
- ❑ **Mechanical Data**
- ❑ **Axis Motors – AM Series**
- ❑ **Spindle Motors – SM Series**
- ❑ **Permissible Forces on the Motor Shaft**

### Available Motors

The following topics are described:

- ❑ **Spindle Motors**
- ❑ **Axis Motors**



### Spindle Motors

Refer to **Table 7-1** for spindle (asynchronous) motors.

**Table 7-1, Spindle Motor Specifications**

Model Number (features)	Rated Power	Rated Speed	P/N
SM 055 (with standard bearing & with key)	5.5 kW	1500 rpm	34100625
SM 055 (with spindle bearing & with key)	5.5 kW	1500 rpm	34100626
SM 055 (with standard bearing & without key)	5.5 kW	1500 rpm	34100627
SM 055 (with spindle bearing & without key)	5.5 kW	1500 rpm	34100628
SM 075 (with standard bearing & with key)	7.5 kW	1500 rpm	34100630
SM 075 (with spindle bearing & with key)	7.5 kW	1500 rpm	34100631
SM 075 (with standard bearing & without key)	7.5 kW	1500 rpm	34100632
SM 075 (with spindle bearing & without key)	7.5 kW	1500 rpm	34100633
SM 100 (with standard bearing & with key)	10.0 kW	1500 rpm	34100635
SM 100 (with spindle bearing & with key)	10.0 kW	1500 rpm	34100636
SM 100 (with standard bearing & without key)	10.0 kW	1500 rpm	34100637
SM 100 (with spindle bearing & without key)	10.0 kW	1500 rpm	34100638

*(Continued...)*

**Table 7-1, Spindle Motor Specifications (Continued)**

<b>Model Number (features)</b>	<b>Rated Power</b>	<b>Rated Speed</b>	<b>P/N</b>
SM 120 (with standard bearing & with key)	12.0 kW	750 rpm	34100640
SM 120 (with standard bearing & without key)	12.0 kW	750 rpm	34100642
SM 150 (with standard bearing & with key)	15.5 kW	1500 rpm	34100645
SM 150 (with spindle bearing & with key)	15.5 kW	1500 rpm	34100646
SM 150 (with standard bearing & without key)	15.5 kW	1500 rpm	34100647
SM 150 (with spindle bearing & without key)	15.5 kW	1500 rpm	34100648
SM 200 (with standard bearing & with key)	20.0 kW	1500 rpm	34100650
SM 200 (with spindle bearing & with key)	20.0 kW	1500 rpm	34100651
SM 200 (with standard bearing & without key)	20.0 kW	1500 rpm	34100652
SM 200 (with spindle bearing & without key)	20.0 kW	1500 rpm	34100653
SM 240 (with standard bearing & with key)	24.0 kW	1500 rpm	34100655
SM 240 (with spindle bearing & with key)	24.0 kW	1500 rpm	34100656
SM 240 (with standard bearing & without key)	24.0 kW	1500 rpm	34100657
SM 240 (with spindle bearing & without key)	24.0 kW	1500 rpm	34100658

### Axis Motors

Axis motors (synchronous motors) fulfill all requirements of a Numerical Control (NC) machine tool. Some special characteristics include:

- An excellent running smoothness
- An appropriate mass moment of inertia
- A very good ration of the rated torque to the stall torque
- A low torque ripple

Refer to **Table 7-2**. The B in the model number indicates that the motor has a brake. The –E in the model number indicates that the motor is an EcoDyn motor.

**Table 7-2, Axis Motor Specifications**

Model Number	Stall Torque (100 K)	Rated Speed	P/N
<b>AM 960A</b> with ERN 1387	5.2 Nm	4500 rpm	34100200
<b>AM 960AB</b> with ERN 1387	5.2 Nm	4500 rpm	34100201
<b>AM 1160A</b> with ERN 1387	5.2 Nm	3000 rpm	34100210
<b>AM 1160AB</b> with ERN 1387	5.2 Nm	3000 rpm	34100211
<b>AM 1160C</b> with ERN 1387	7.2 Nm	3000 rpm	34100220
<b>AM 1160CB</b> with ERN 1387	7.2 Nm	3000 rpm	34100221
<b>AM 1160E</b> with ERN 1387	10.0 Nm	3000 rpm	34100230
<b>AM 1160EB</b> with ERN 1387	10.0 Nm	3000 rpm	34100231
<b>AM 1160D-E</b> with ERN 1387	10.0 Nm	3000 rpm	664001-13
<b>AM 1160DB-E</b> with ERN 1387	10.0 Nm	3000 rpm	664001-14
<b>AM 1160K-E</b> with EQN 1325	10.0 Nm	3000 rpm	663984-63
<b>AM 1160KB-E</b> with EQN 1325	10.0 Nm	3000 rpm	663984-64
<b>AM 1300A–E</b> with ERN 1387	6.0 Nm	3000 rpm	34100240
<b>AM 1300AB–E</b> with ERN 1387	6.0 Nm	3000 rpm	34100241
<b>AM 1300C–E</b> with ERN 1387	9.0 Nm	3000 rpm	34100245
<b>AM 1300CB–E</b> with ERN 1387	9.0 Nm	3000 rpm	34100246
<b>AM 1300K-E</b> with EQN 1325	6 Nm	3000 rpm	663985-63
<b>AM 1300KB-E</b> with EQN 1325	6 Nm	3000 rpm	663985-64
<b>AM 1300M-E</b> with EQN 1325	9 Nm	3000 rpm	663986-63
<b>AM 1300MB-E</b> with EQN 1325	9 Nm	3000 rpm	663986-64

(Continued...)

**Table 7-2, Axis Motor Specifications (Continued)**

<b>Model Number</b>	<b>Stall Torque (100 K)</b>	<b>Rated Speed</b>	<b>P/N</b>
<b>AM 1550C</b> with ERN 1387	13.0 Nm	3000 rpm	34100250
<b>AM 1550CB</b> with ERN 1387	13.0 Nm	3000 rpm	34100251
<b>AM 1550E</b> with ERN 1387	17.7 Nm	3000 rpm	34100260
<b>AM 1550EB</b> with ERN 1387	17.7 Nm	3000 rpm	34100261
<b>AM 1550G</b> with ERN 1387	26.1 Nm	3000 rpm	34100270
<b>AM 1550GB</b> with ERN 1387	26.1 Nm	3000 rpm	34100271
<b>AM 1550A-E</b> with ERN 1387	13.0 Nm	3000 rpm	24100280
<b>AM 1550AB-E</b> with ERN 1387	13.0 Nm	3000 rpm	24100281
<b>AM 1550C-E</b> with ERN 1387	17.7 Nm	3000 rpm	34100285
<b>AM 1550CB-E</b> with ERN 1387	17.7 Nm	3000 rpm	34100286
<b>AM 1550D-E</b> with ERN 1387	21.6 Nm	3000 rpm	34100290
<b>AM 1550DB-E</b> with ERN 1387	21.6 Nm	3000 rpm	34100291
<b>AM 1550G-E</b> with ERN 1387	26.1 Nm	3000 rpm	34100295
<b>AM 1550GB-E</b> with ERN 1387	26.1 Nm	3000 rpm	34100296
<b>AM 1550K-E</b> with EQN 1325	13.0 Nm	3000 rpm	663987-63
<b>AM 1550KB-E</b> with EQN 1325	13.0 Nm	3000 rpm	663987-64
<b>AM 1550M-E</b> with EQN 1325	17.7 Nm	3000 rpm	663988-63
<b>AM 1550MB-E</b> with EQN 1325	17.7 Nm	3000 rpm	663988-64
<b>AM 1550N-E</b> with EQN 1325	21.6 Nm	3000 rpm	663989-63
<b>AM 1550NB-E</b> with EQN 1325	21.6 Nm	3000 rpm	663989-64
<b>AM 1550P-E</b> with EQN 1325	26.1 Nm	3000 rpm	663990-63
<b>AM 1550PB-E</b> with EQN 1325	26.1 Nm	3000 rpm	663990-64
<b>AM 1900K-E</b> with EQN 1325	28.0 Nm	3000 rpm	663991-63
<b>AM 1900KB-E</b> with EQN 1325	28.0 Nm	3000 rpm	663991-64
<b>AM 1900M-E</b> with EQN 1325	38.0 Nm	3000 rpm	663992-63
<b>AM 1900MB-E</b> with EQN 1325	38.0 Nm	3000 rpm	663992-63
<b>AM 1900N-E</b> with EQN 1325	47.6 Nm	3000 rpm	663993-63
<b>AM 1900NB-E</b> with EQN 1325	47.6 Nm	3000 rpm	663993-64
<b>AM 1900P-E</b> with EQN 1325	62.5 Nm	3000 rpm	663994-63
<b>AM 1900PB-E</b> with EQN 1325	62.5 Nm	3000 rpm	663994-64

### Cables and Connectors

The following topics are described:

- ❑ Power Cables for Axis Motors
- ❑ Power Cables for Spindle Motors
- ❑ Miscellaneous Cables and Connectors
- ❑ Maximum Bend Radii of Power Cables with UL Certification

**DANGER:** Ensure appropriate strain relief on all lines. Never work on the unit while it is powered up. Ensure that the motor is properly grounded. Ensure that the toroidal cores are mounted correctly. For cable lengths longer than 15 m (49.2 ft) between motor and inverter, additional noise suppression measures could be necessary.

### Power Cables for Axis Motors

All connections are to the SA Series compact inverter. Refer to **Table 7-3**.

**Table 7-3, Power Cables for Axis Motors**

Motors	Cable P/N	Axes Requiring Cables
<b>AM 960A Series,                      AM 1160A Series,                      AM 1160C Series,                      AM 1160D Series                      AM 1160E Series,                      AM 1160K Series,                      AM 1300A Series,                      AM 1300C Series                      AM 1300K Series,                      AM 1300M Series                      AM 1550C Series,                      AM 1550D Series,                      AM 1550M Series,                      AM 1550N Series,</b>	342001XX**1	Axes 1 to 4
<b>AM 1550E Series,                      AM 1550G Series,                      AM 1550P Series,                      AM 1900K Series,                      AM 1900M Series,                      AM 1900N Series,</b>	342002XX**1	Axes 1 to 4
<b>AM 1900P Series,</b>	342006XX**1	Axes 1 to 4

\*\*1 Sold as cable assemblies (that is, with connector) in 5-foot increments, where: XX = the length in feet.

**Power Cables for Spindle Motors**

Refer to **Table 7-4**.

**NOTE:** All cables have a UL certification and are suited for use at ambient temperatures of up to 40 °C (104 °F). The conductor material consists of copper (Cu).

**Table 7-4, Power and Fan Cables for Spindle Motors**

Motors	Cable P/N	Axes Requiring Cables	Fan Cable P/N
<b>SM 055</b>	34201305**2	Spindle	34201311**2
<b>SM 075</b>	34201305**2	Spindle	34201311**2
<b>SM 100</b>	34201306**2	Spindle	34201311**2
<b>SM 120</b>	34201306**2	Spindle	34201311**2
<b>SM 150</b>	34201307**2	Spindle	34201311**2
<b>SM 200</b>	34201307**2	Spindle	34201311**2
<b>SM 240</b>	34201308**2	Spindle	34201311**2

\*\*2 Sold by the foot.

**Miscellaneous Cables and Connectors**

Refer to **Table 7-5**.

**NOTE:** The last two digits of the cable P/N (XX) indicate the length of the cable. For example, 34300010 indicates a 10-foot cable.

**Table 7-5, Miscellaneous Cables and Connectors Specifications**

Cable Designation	Lengths (Ft)	P/N
<b>CNC to LCD</b>	05, 10, 15, 20, 25.... 65, 70, 75	343000XX
<b>CNC key input, CNC I/O</b>	05, 10, 15, 20, 25.... 65, 70, 75	343001XX
<b>CNC, MPG, PM300</b>	15, 20, 30, 45, 60	343003XX
<b>CNC, MPG, PM500</b>	05, 10, 15, 20, 25, 30, 35, 45, 60, 75	343004XX
<b>CNC, MPG, PM310</b>	05, 15, 20, 30, 45, 50, 60	343005XX
<b>CNC I/O Module</b>	02, 03, 06, 09, 15, 20, 25	624517-XX
<b>CNC I/O</b>	03, 10, 15, 20, 30, 45, 60	343007XX

**Maximum Bend Radii of Power Cables with UL Certification**

Refer to Table 7-6.

**Table 7-6, Maximum Bend Radii of Cables**

<b>Cable P/N</b>	<b>Cable Cross Section</b>	<b>Maximum Bend Radius <sup>**1</sup></b>
<b>342001xx</b>	4 x 1.5 mm <sup>2</sup> + (2 x 1 mm <sup>2</sup> )	≥ 2.56" (65 mm)
<b>342003xx</b>	4 x 1.5 mm <sup>2</sup> + (2 x 1 mm <sup>2</sup> )	≥ 2.56" (65 mm)
<b>342002xx</b>	4 x 4 mm <sup>2</sup> + (2 x 1 mm <sup>2</sup> )	≥ 2.95" (75 mm)
<b>34201309</b>	4 x 2.5 mm <sup>2</sup>	≥ 2.36" (60 mm)
<b>34201305</b>	4 x 4 mm <sup>2</sup>	≥ 2.76" (70 mm)
<b>34201306</b>	4 x 6 mm <sup>2</sup>	≥ 2.95" (75 mm)
<b>34201307</b>	4 x 16 mm <sup>2</sup>	≥ 5.31" (135 mm)
<b>34201308</b>	4 x 25 mm <sup>2</sup>	≥ 5.91" (150 mm)

<sup>\*\*1</sup> Frequent flexing



**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.

**Axis Motors:**

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

**Spindle Motors:**

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

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

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

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

$M_{Nmot}$ : 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

### Safety and Labeling Information

The following topics are described:

- ❑ **Safety Precautions and Warranty Regulations**
- ❑ **Motor Nameplate Conventions**

#### Safety Precautions and Warranty Regulations

Please observe the following precautions to prevent personal injury and damage to equipment. Damage caused by failure to observe safety precautions cannot be covered under the manufacturer's warranty.

**DANGER:** During operation, several of the motor parts could be live or moving. Do not open the CNC cabinet, or make/break connections while the unit is powered up. Only trained personnel can repair or service the motor. Enclose the motor as shown in dimensional drawings throughout this section. Ensure that the motor is properly grounded. Do not connect inverter motors directly to three-phase line power. This could ruin the motor! Inverters must be operated via an electronic power converter.

If your motor is equipped with a feather key at the shaft end, you must secure the key with a collar before you start the motor for the first time. This prevents the key from backing out. Refer to detailed safety and maintenance information in the operating instructions included with each motor.

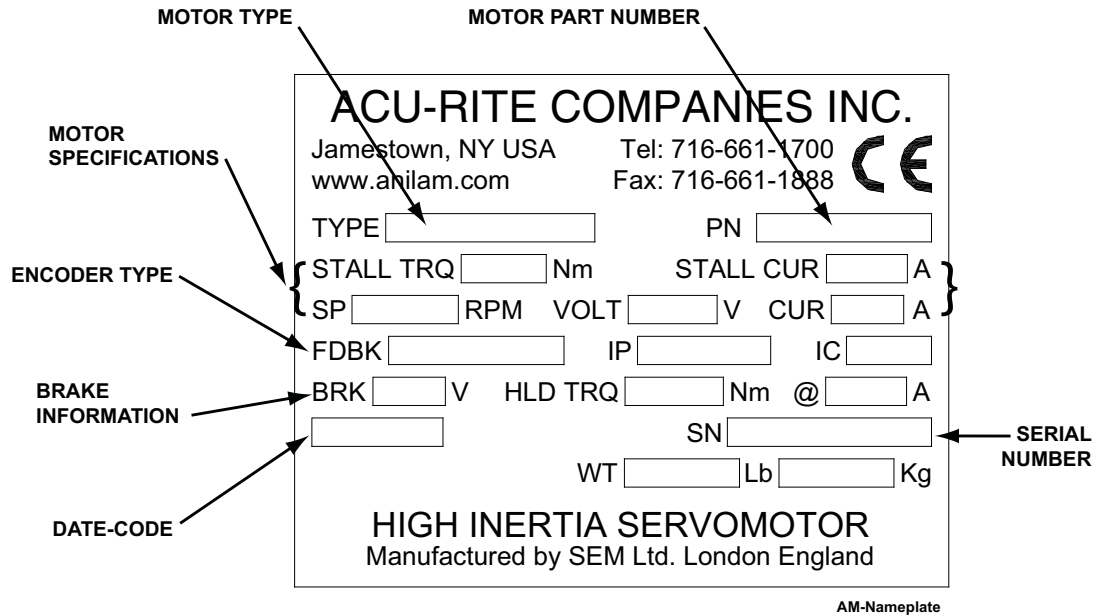
**WARNING:** Motor surface temperatures could exceed 145 °C (293 °F). When connecting the fan, ensure that the direction of rotation is correct. The arrow symbol on the fan housing indicates the correct turning direction.

The optional standstill brake is designed only for a limited number of emergency stops. After mounting the motor, you must verify the brake function. On motors with plug-in connections and built-in brakes, a varistor is required for wiring the brake when commissioning the motor. See "Connecting the Holding Brake" for Motors.

**Motor Nameplate Conventions**

**Axis Motors**

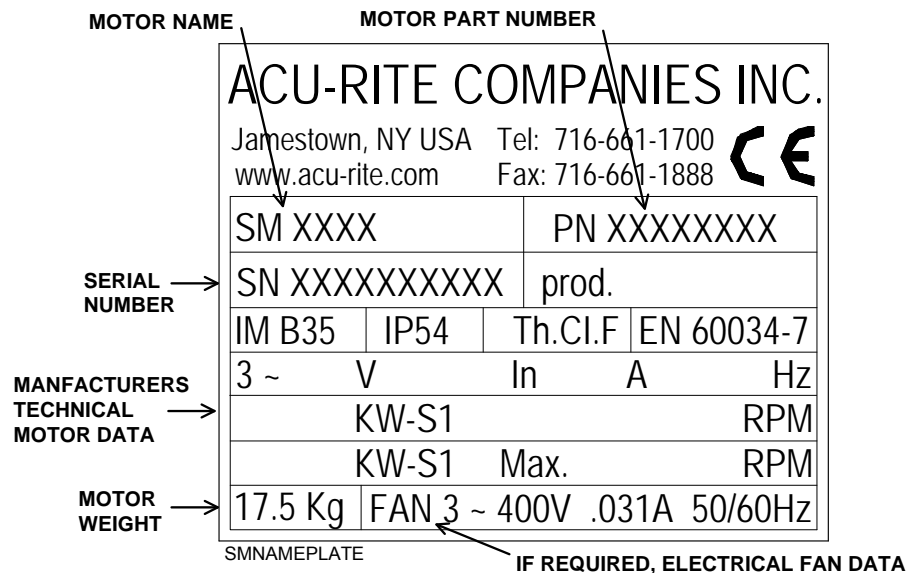
For AM Series AC brushless motors, the nameplate is a foil/metallic label. Refer to **Figure 7-1**.



**Figure 7-1, Axis Motor Nameplate**

**Spindle Motors**

For SM Series motors, the nameplate is an aluminum label. Refer to **Figure 7-2**.



**Figure 7-2, Spindle Motor Nameplate**

### DC-Link Voltages for ANILAM Motors

The following topics are described:

- **Axis Motors**
- **Axis EcoDyn Motors**
- **Spindle Motors**

The ANILAM inverter systems supply different DC-link voltages:

- SA Series non-regeneration compact inverters: 565 V
- Modular amplifiers with PS 130: 565 V
- Modular amplifiers with PS 122, PS 145: 650 V

### Axis Motors

The characteristic curves for the ANILAM axis motors were determined with a DC-link voltage of 565 V. Refer to **Figure 7-3**.

If an axis motor is operated at a different DC-link voltage, the voltage limit curve must be displaced in parallel. Calculate the displacement as follows:

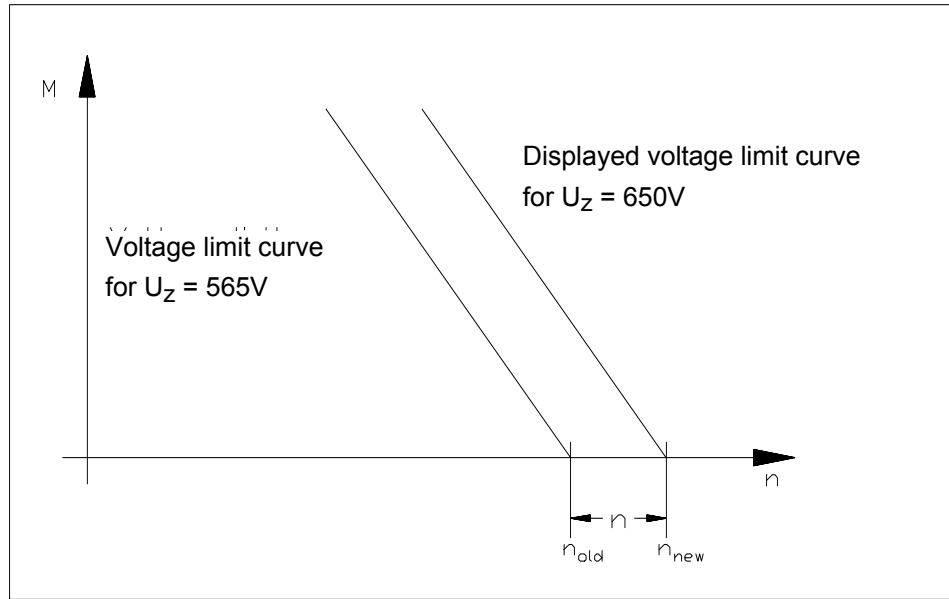
$$\Delta n = n_{\text{old}} \cdot \frac{U_{Z_{\text{new}}}}{U_{Z_{\text{old}}}} - n_{\text{old}}$$

For example:

$$U_{Z_{\text{old}}} = 565 \text{ V}, \quad U_{Z_{\text{new}}} = 650 \text{ V}, \quad n_{\text{old}} = 3300 \text{ rpm}, \quad \Delta n = ?, \quad n_{\text{new}} = ?$$

$$\Delta n = 3300 \text{ rpm} \cdot \frac{650 \text{ V}}{560 \text{ V}} - 3300 \text{ rpm} = 497 \text{ rpm}$$

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

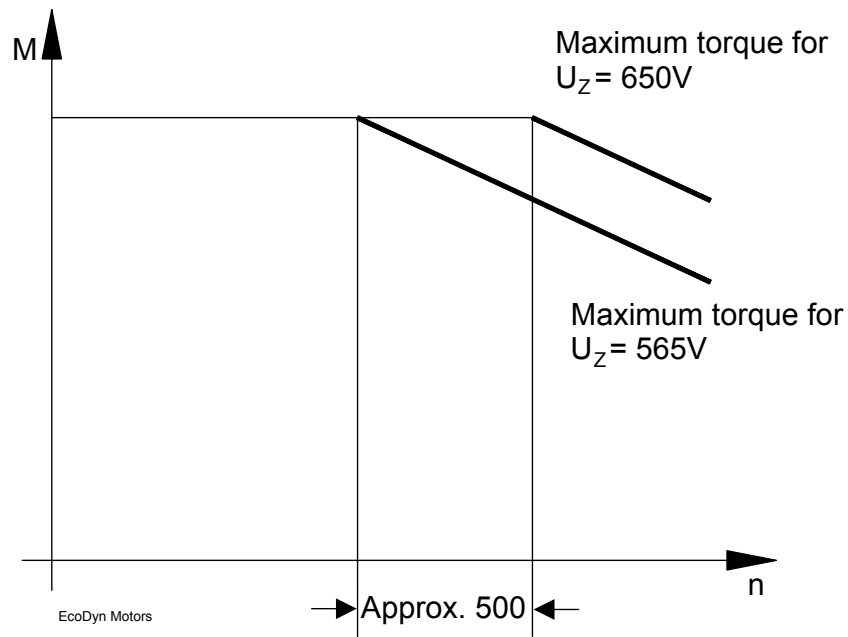


**Figure 7-3, Characteristic Curves for Axis Motors**

### Axis EcoDyn Motors

The characteristic curves for the ANILAM axis EcoDyn motors were determined with a DC-link voltage of 650 V. Refer to **Figure 7-4**.

If the EcoDyn axis motors are operated with a DC-link voltage of 565 V, the falling component of the characteristic curve of the maximum torque must be moved parallel to the left by approximately 500 rpm.



**Figure 7-4, Characteristic Curves for Axis EcoDyn Motors**

**Spindle Motors**

The characteristic curves for ANILAM spindle motors were determined with a DC-link voltage of 565 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, you must multiply it by the factor k.

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

Given:

$$k = \frac{(U_{Z\text{new}})^2}{(U_{Z\text{old}})^2}$$

The torque characteristic above the breakdown torque speed must be recalculated as follows:

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

For example, with the SM 120:

$P_{\text{old}} = 10.5 \text{ kW}$  where  $n = 7000 \text{ rpm}$  with 565 V.

$P_{\text{new}}$  with  $n = 7000 \text{ rpm}$  with 650 V ?

$M_{\text{new}}$  with  $n = 7000 \text{ rpm}$  with 650 V ?

$$k = \frac{(650 \text{ V})^2}{(565 \text{ V})^2} = 1.32$$

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

$$M_{\text{new}} = \frac{13900 \text{ W} \cdot 60}{2 \cdot \pi \cdot 7000 \text{ rpm}} = 19 \text{ Nm}$$

### Connecting Speed (Rotary) Encoders to the Motors

All ANILAM motors are equipped with speed (rotary) encoders. The rotary encoder signals and the signals from the temperature sensors are transmitted via a 17-pin (male) flange socket. Refer to **Table 7-7 and 7-8**.

**NOTE:** Cables for encoder-to-motor connection are available in lengths of 10, 15, 20, 25, 30, 35, 40, and 45 ft.

**Table 7-7, Speed (Rotary) Encoder (1 Vpp) Flange Socket – Pinout**

Motor		Cable for Speed Encoder P/N 342000XX		
17-Pin Male	Assignment	17-Pin Female Connector	Color(s)	25-Pin Male D-Sub Connector
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	2
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:** This interface meets requirements per EN 50 178 for “low voltage electrical separation.”



**Table 7-8, Speed (Rotary) Encoder with EnDat interface Flange Socket – Pinout**

Motor		Cable for Speed Encoder P/N 668360-XX		
17-Pin Male	Assignment	17-Pin Female Connector	Color(s)	25-Pin Male D-Sub Connector
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:** This interface meets requirements per EN 50 178 for “low voltage electrical separation.”

### Power Connection of the ANILAM Motors

The following topics are described:

- ❑ **AM 960, AM 1160, AM 1300, AM 1550, AM 1900 Series Axis Motors, Power Connection**
- ❑ **SM 055, SM 075, SM 100, SM 120, SM150, and SM 240 Spindle Motors, Power Connection**

#### **AM 960, AM 1160, AM 1300, AM 1550, AM 1900 Series Axis Motors, Power Connection**

**NOTE:** The shielded line for the holding brake included in the power cable must have intermediate terminals. Keep the shield as near to ground as possible.

Cables for axis motor connection are available in lengths of 10, 15, 20, 25, 30, 35, 40, and 45 ft.

The power connection for these axis motors is made via a 6-pin flange socket. Refer to **Table 7-9**.

**Table 7-9, AM 960, AM 1160, AM 1300, AM 1550, AM 1900 Series Axis Motor Connection - Pinout**

<b>6-Pin Male Flange Socket</b>	<b>Assignment</b>	<b>6-Pin Female Connector</b>	<b>Cable P/Ns 342001XX</b>	<b>3-Pin Inverter Terminal</b>
1	U	1	Black 1	U
2	V	2	Black 2	V
Ground	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

**SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, and SM 240 Spindle Motors, Power Connection**

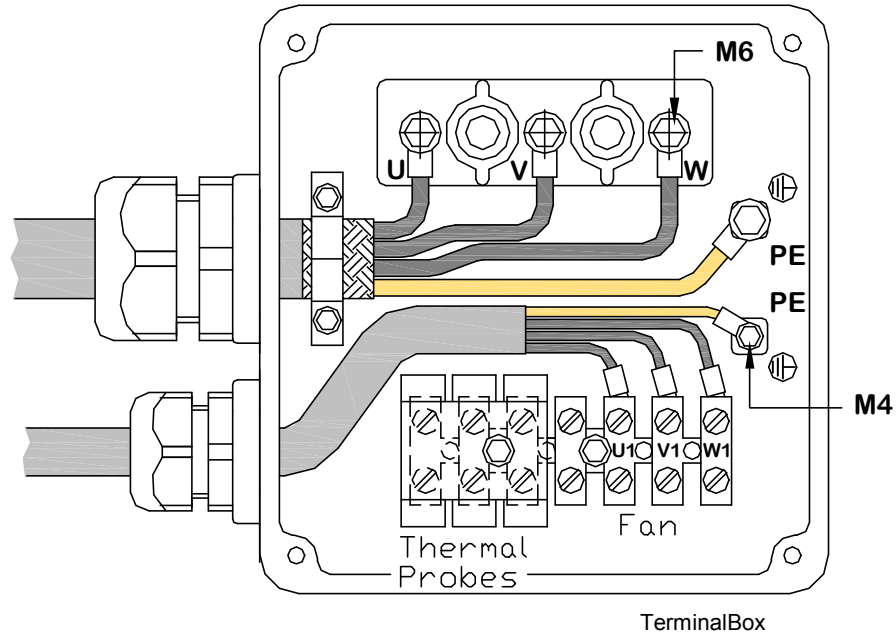
The power connection for these spindle motors is made via a terminal box. The power cables are sold per foot. Refer to **Table 7-11** and **Table 7-12**. Refer to **Figure 7-5, Terminal Box with Connections for SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, and SM 240** and **Table 7-12, SM Terminal Box Pinout**.

**Table 7-10, SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, and SM 240 Spindle Motor Power Cable P/Ns**

Spindle Motor	Cable P/N
SM 055	34201305
SM 075	34201305
SM 100	34201306
SM 120	34201306
SM 150	34201307
SM 200	34201307
SM 240	34201308

**Table 7-11, SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, and SM 240 Spindle Motor Power Connection – Pinout**

11-Pin Male Flange Socket	Assignment	11-Pin Female Connector	Cable P/N (See Table 7-9)	3-Pin Inverter Terminal
A	U	A	Black 1	U
B	V	B	Black 2	V
C	W	C	Black 3	W
D	PE	D	Green / Yellow	Ground
E to L	Do not assign			



**Figure 7-5, Terminal Box with Connections for SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, and SM 240**

**Table 7-12, SM Terminal Box Pinout**

Terminal Strip for Motors	Power Cable	Inverter Terminal 3-pin
U	Black 1	U
V	Black 2	V
W	Black 3	W
Ground	Green/Yellow	Ground

**Warning: Do not use any connections other than U, V, W, U1, V1, and W1. Their purpose is to lead the temperature sensor lines through the motor.**

## Connecting the Holding Brake

Each ANILAM axis motor can be equipped with an optional holding brake.

This permanent-magnet single-disk brake operates on direct current and holds the motor at a standstill without backlash. The brake is connected to the power source via the power connection. See **“Power Connection of the ANILAM Motors.”**

**NOTE:** The brake is a holding brake; not a service brake.

When connecting the brake, consider electrical noise immunity. The brake is engaged when it is not powered up.

The voltage required to release the brake is 24 V ( $\pm 10\%$ ).

**WARNING:** Holding brakes are permanent-magnet brakes. Ensure that the polarity of the DC voltage is correct. Otherwise, the brake will not be released.

The shield of the lines for the holding brake is to be kept as close as possible ( $< 1.18$  in [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. Refer to **Figure 7-7, Shield for Holding Brake Installation.**

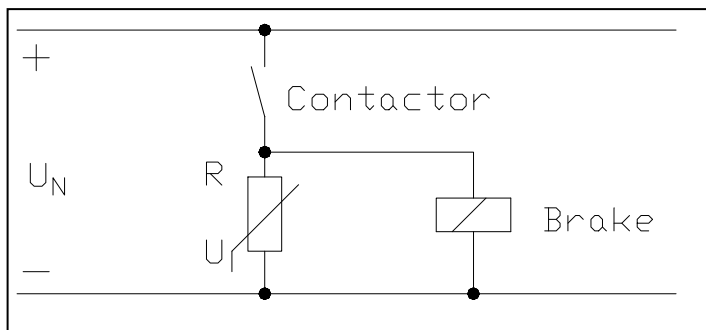
**NOTE:** After installing the motor, you must verify the trouble-free functioning of the brake.

Due to the inductance of the holding brake, a voltage peak could exceed 1000 V when the exciting current is switched off.

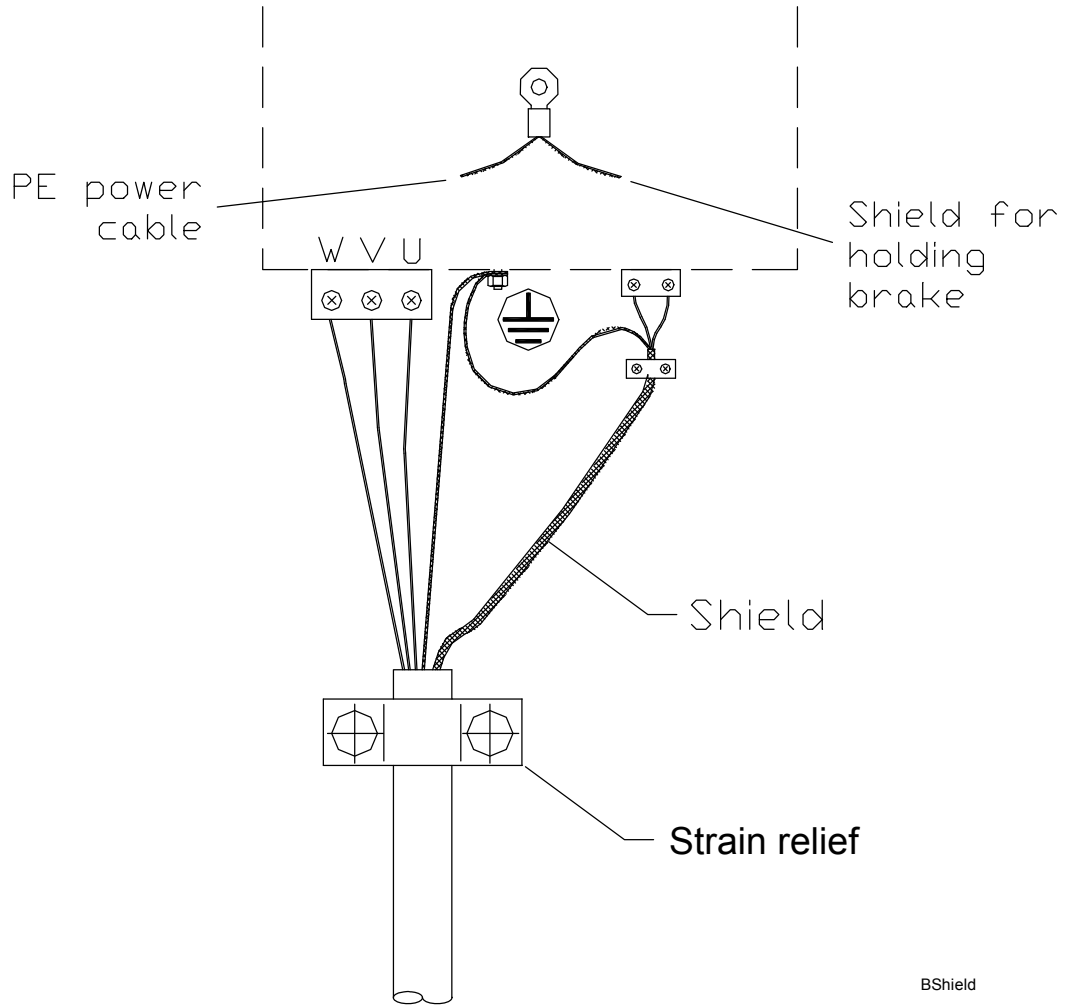
A protective circuit is not necessary if the holding brakes are controlled via the inverters, since the internal electronic switches limit the voltage.

To avoid the voltage peak that occurs when controlling the holding brakes by relay, use a protective circuit with an R varistor, recommended type Q69-X3022.

The following circuitry is suggested for the protective circuit of the brake. See **Figure 7-6.**



**Figure 7-6, Protective Circuit for Holding Brake**



**Figure 7-7, Shield for Holding Brake Installation**

### Connecting the Fan to the Spindle Motor

Axial fans are standard equipment on ANILAM spindle motors. All fan cables are sold per foot.

**NOTE:** To ensure that the blades will turn in the proper direction, refer to the direction arrow on the fan housing.

The electrical connecting values for the fan are listed in the technical data of **Table 7-4, Power and Fan Cables for Spindle Motors.**

The fan can be supplied only via a line with a cross section of 0.75 mm<sup>2</sup>.

#### **SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, and SM 240 Spindle Motor Fan**

On the SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, and SM 240 motors, the fan is connected via the terminal box of the power connection. This connector is supplied as a motor accessory. Refer to **Table 7-13** and **Figure 7-5, Terminal Box with Connections for SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, and SM 240.**

**Table 7-13, SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, and SM 240 Spindle Motor Fan - Pinout**

Terminal Row for Fan	Assignment	Fan Cable P/N 34201311
<b>U1</b>	U	Black 1
<b>V1</b>	V	Black 2
<b>W1</b>	W	Black 3
<b>Ground</b>	PE	Green/Yellow

### Mechanical Data

The following topics are described:

- ❑ **Mounting Flange and Design**
- ❑ **Mounting the Motor**
- ❑ **Shaft End**
- ❑ **Vibration Severity Grade**
- ❑ **Center Holes**
- ❑ **Feather Keys**
- ❑ **Rotatable Flange Sockets**



### Mounting Flange and Design

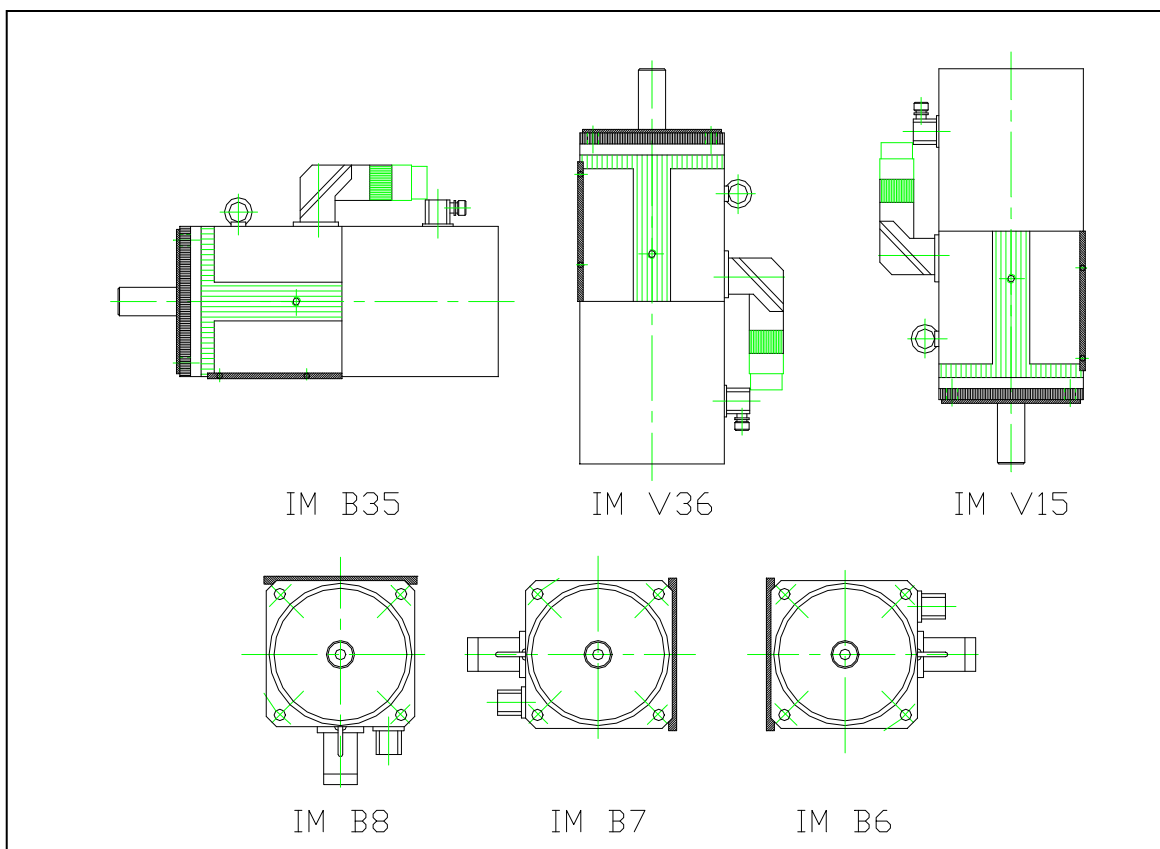
Each ANILAM motor is equipped with mounting flange according to DIN 42948 and IEC 72.

A flange-mounted motor lessens power loss. If the motor is mounted so that it is thermally insulated, i.e., heat cannot be dissipated through the flange, reduce motor torque by  $\approx 5\%$  to  $15\%$  to avoid overheating the motor.

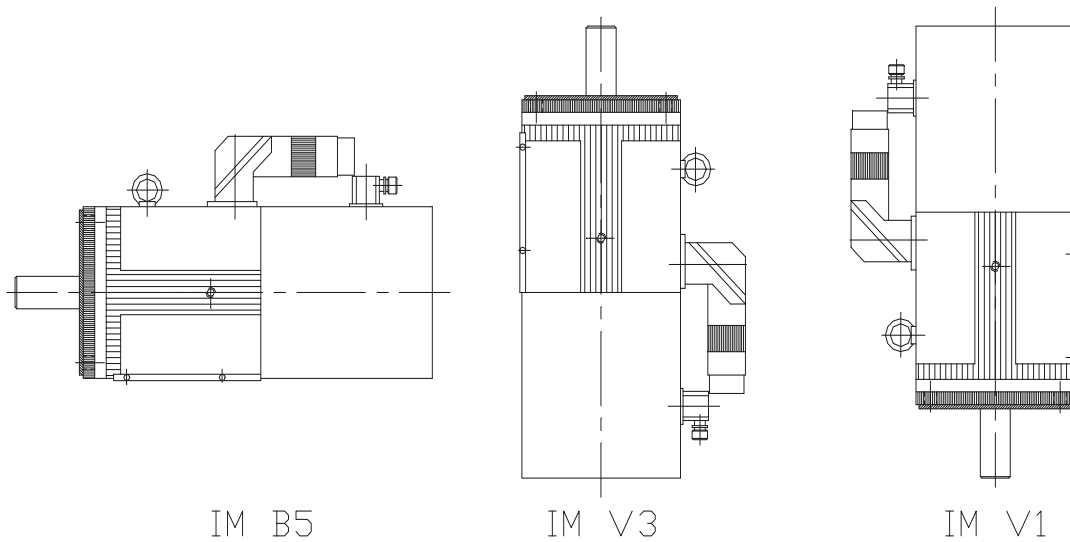
All operating specifications in this section assume a maximum ambient temperature of  $+40\text{ }^{\circ}\text{C}$  ( $104\text{ }^{\circ}\text{F}$ ).

If you are using a self-cooling motor, ensure adequate heat dissipation. If the space in which the motor is mounted is too narrow, heat dissipation could be impeded.

The ANILAM spindle motors are available in IM B35 design according to EN 60 034-7 (see **Figure 7-8**). The ANILAM axis motors are available in IM B5 design (see **Figure 7-9, Design B5 – Securing the Motor**) according to EN 60 034-7.



**Figure 7-8, Design B35 - Mounting Flange Configurations**



**Figure 7-9, Design B5 – Securing the Motor**

### Mounting the Motor

According to EN 24017 or DIN 912, ANILAM recommends the following screws to secure motors. Refer to **Figure 7-9** and **Table 7-14**.

**Table 7-14, Recommended Motor Mounting Screws**

Motor(s)	To Secure Flange	To Secure Block
<b>AM 960 Series</b>	M6	–
<b>AM 1160 Series</b>	M8	–
<b>AM 1300 Series</b>	M8	–
<b>AM 1550 Series</b>	M10	–
<b>AM 1900 Series</b>	ISO 4017 – M12 x 40	–
<b>SM 055, SM 075, SM 100</b>	ISO 4017 – M12 x 30	ISO 4017 – M10 x 30
<b>SM 120C, SM 150, SM 200, SM 240</b>	ISO 4017 – M16 x 40	ISO 4017 – M10 x 35

**Shaft End**

ANILAM motors have cylindrical shafts, per ISO-R775 and IEC 72 requirements.

**Vibration Severity Grade**

The shaft of the motor has a vibration severity grade of S according to EN 60034. The motors of the SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, and SM 240 comply with grade SR. These motors can be high precision balanced externally.

**Center Holes**

Some ANILAM motors have one center hole in the drive shaft. For dimensions, refer to **Table 7-15**.

**Table 7-15, Motor Central Bore Specifications**

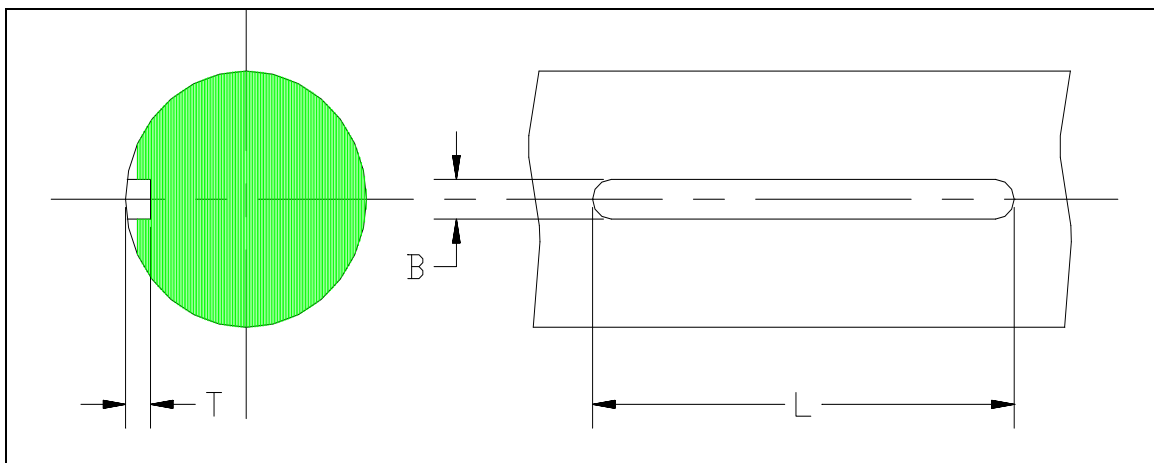
<b>Motor(s)</b>	<b>Central Bore Hole</b>
<b>AM 960 Series</b>	ISO 866 BS 5 M6 x 15
<b>AM 1160 Series</b>	ISO 866 BS 5 M8 x 20
<b>AM 1300 Series</b>	ISO 866 BS 5 M8 x 20
<b>AM 1550 Series</b>	ISO 866 BS 5 M12 x 30
<b>AM 1900 Series</b>	ISO 866 BS 5 M12 x 30
<b>SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, SM 240</b>	DIN 332 – DR M12

### Feather Keys

Feather keys are standard equipment on all ANILAM spindle (asynchronous) motors. The feather key prevents rotational motion around the shaft while permitting lengthwise motion. Axis motors are not supplied with feather keys. Motors are available with or without feather keys, upon request. Refer to **Table 7-16** and **Figure 7-10**.

**Table 7-16, Feather Key Specifications**

Motor(s)	Key	Slot Dimensions		
		L	B	T
<b>SM 055</b> <b>SM 075</b> <b>SM 100</b>	DIN 6885 – E 10 × 8 × 70 mm  DIN 6885 Sheet 1 AS 10 x 8 x 70	70 mm (2.75 in.)	10 mm (0.39 in.)	5 mm (0.19 in.)
<b>SM 120, SM 150</b> <b>SM 200, SM 240</b>	DIN 6885 Sheet 1 AS 12 x 8 x 90	90 mm (3.54 in.)	12 mm (0.47 in.)	5 mm (0.19 in.)



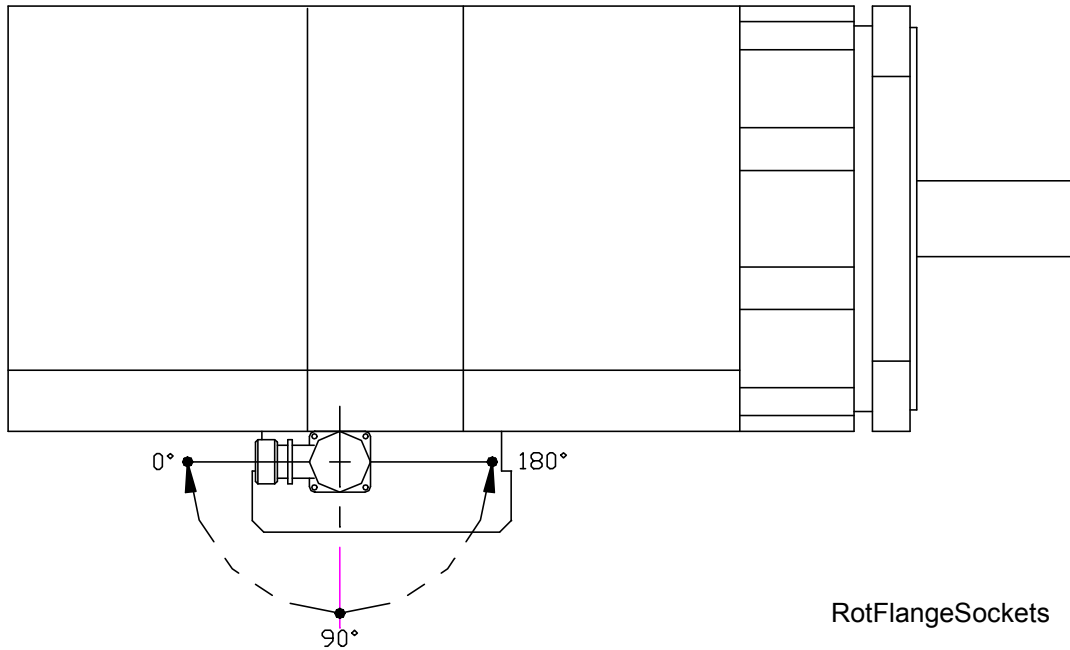
**Figure 7-10, Feather Key Configuration**

**Rotatable Flange Sockets**

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

**Spindle Motors**

For SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, and SM 240, refer to **Figure 7-11**.



**Figure 7-11, SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, SM 240 - Rotatable Flange Socket**

### Axis Motors

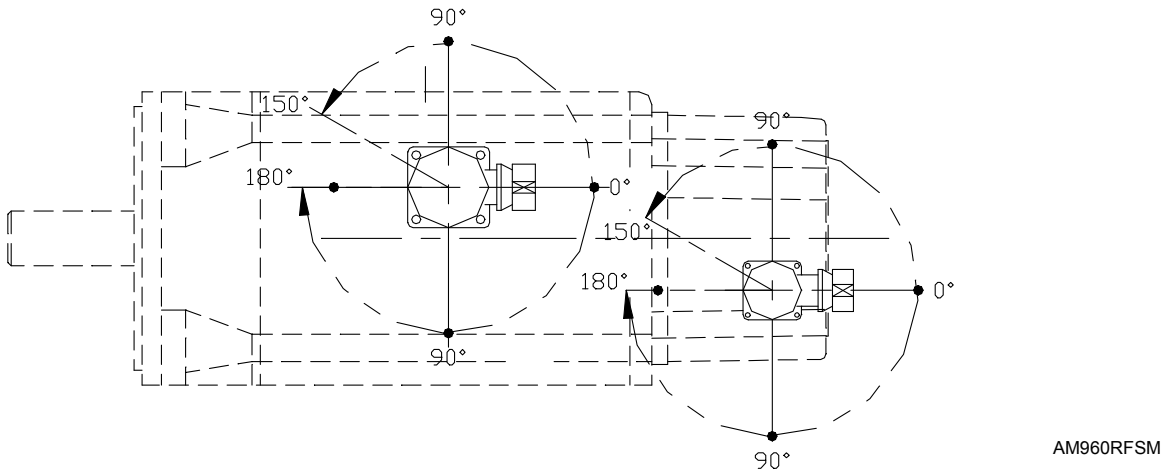
For AM 960 Series, AM 1160 Series (starting in mid-2002) refer to **Figure 7-12.**

For AM 960 Series and AM 1160 Series (until mid-2002), refer to **Figure 7-13.**

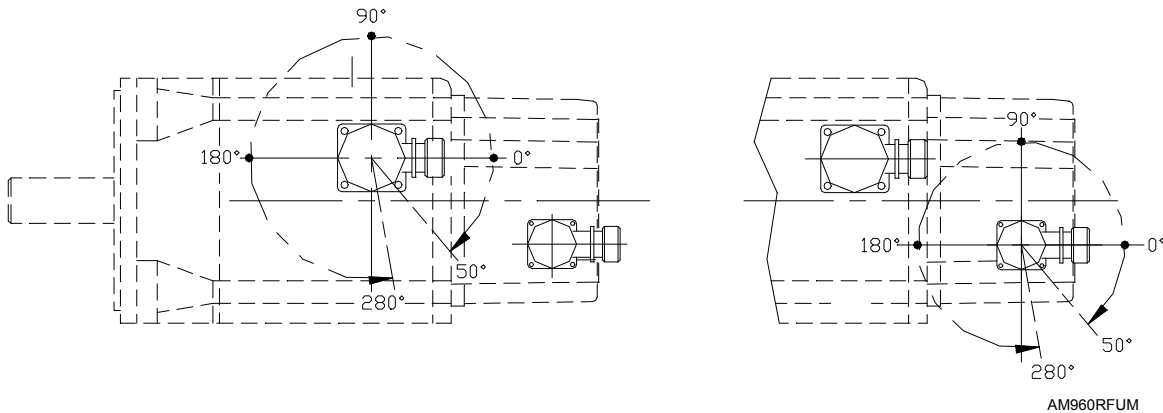
For AM 1550 Series (starting in mid-2002), refer to **Figure 7-14, AM 1550 Series (starting in mid-2002) Rotatable Flange Socket.**

For AM 1550 Series (until mid-2002), refer to **Figure 7-15, AM 1550 Series (until mid-2002) Rotatable Flange Socket.**

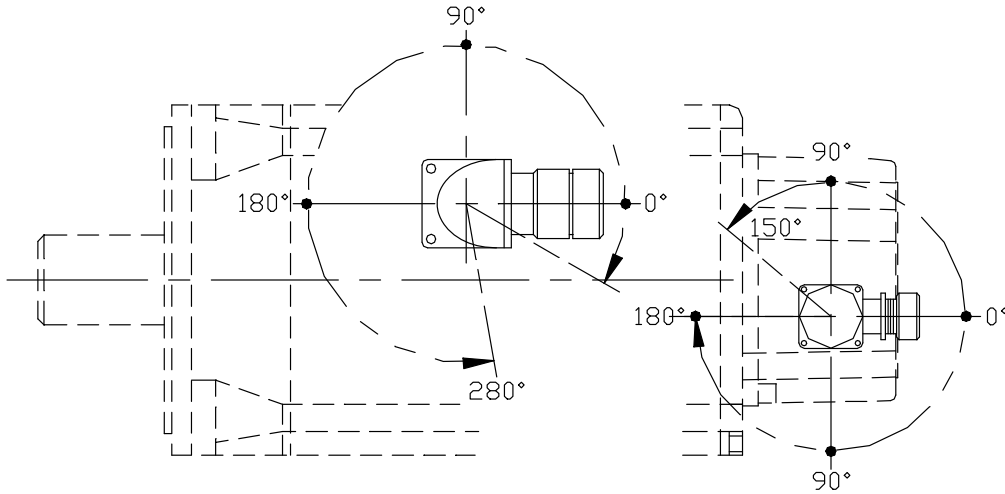
For AM 1300-E, AM 1550-E and AM 1900-E Series, refer to **Figure 7-16, AM 1550E Series Rotatable Flange Socket.**



**Figure 7-12, AM 960, AM 1160 Series (starting in mid-2002) Rotatable Flange Socket**

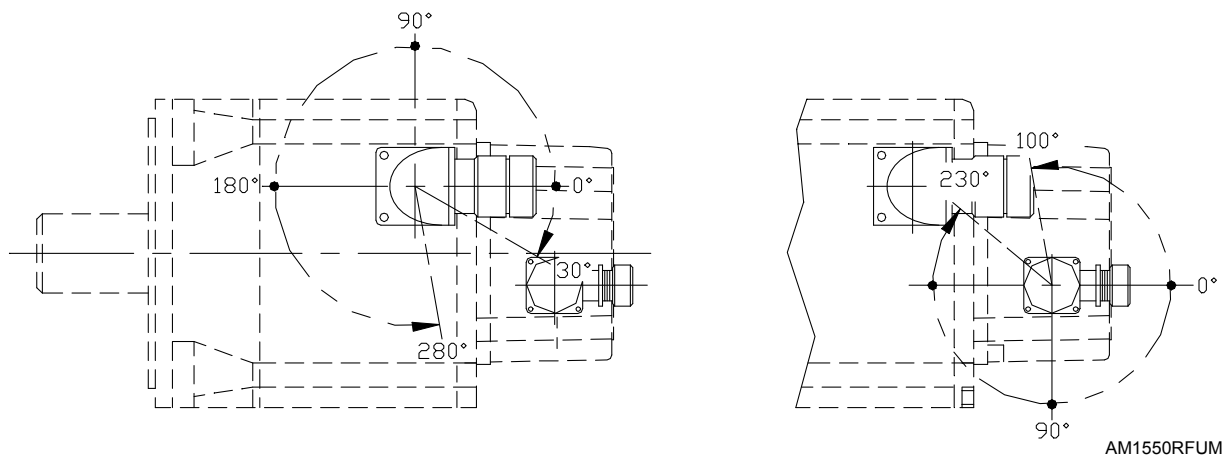


**Figure 7-13, AM 960, AM 1160 Series (until mid-2002) Rotatable Flange Socket**



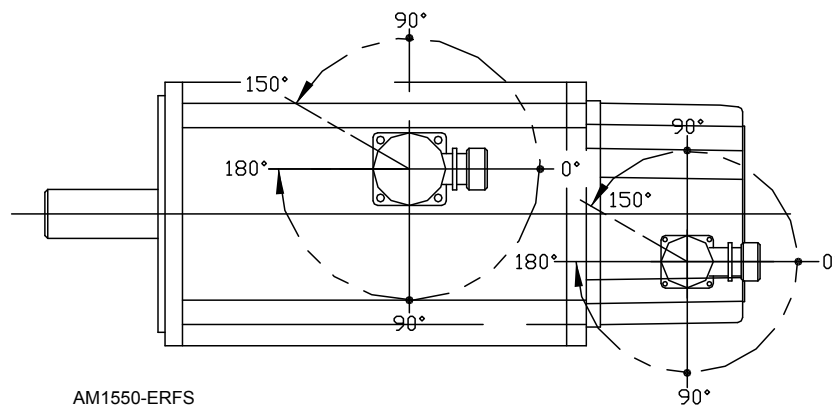
AM1550RFSM

**Figure 7-14, AM 1550 Series (starting in mid-2002) Rotatable Flange Socket**



AM1550RFUM

**Figure 7-15, AM 1550 Series (until mid-2002) Rotatable Flange Socket**



AM1550-ERFS

**Figure 7-16, AM 1300-E, AM 1550-E, AM 1900-E Series Rotatable Flange Socket**

### Axis Motors – AM Series

ANILAM axis motors offer the following features:

- Sine commutation
- Axis motors feature incremental ERN 1387 rotary encoder or EQN 1325 absolute multiturn rotary encoder for speed measurement.
- Self-cooling
- IM B5 design (for securing by flange) according to EN 60 034-7 (See **Figure 7-9, Design B5 – Securing the Motor**).
- Protection class IP 65 according to EN 60 529 (shaft exit IP 64)
- Shaft end:
  - Cylindrical as per DIN 748 and IEC 72
  - Without feather key (with feather key by request)
  - With centering hole as per ISO 866 BS 5 and thread
- AM 960 Series, AM 1160 Series, AM 1550 Series, AM 1900 Series: Flange dimensions according to DIN 42 948 and IEC 72
- Maintenance-free bearings
- Natural cooling
- KTY 84-130 resistor probe to monitor temperature in the stator winding
- Thermal class F insulation
- Optional: Integrated preloaded holding brake

<p><b>NOTE:</b> In the performance diagrams that follow, characteristic curves are shown as broken lines. In addition, each diagram shows characteristic curves as determined on a test stand for one motor, mounted without thermal insulation. All dimensions are shown in inch and millimeter.</p>
---

The following topics are described:

- ❑ **Axis Motors General Technical Information**
- ❑ **Axis Motors Mechanical Life**
- ❑ **AM 960A Series – Axis Motor Specifications**
- ❑ **AM 960A Series – Speed-torque Characteristics Graph**
- ❑ **AM 1160A Series – Axis Motor Specifications**
- ❑ **AM 1160A Series – Speed-torque Characteristics Graph**
- ❑ **AM 1160C Series – Axis Motor Specifications**
- ❑ **AM 1160C Series – Speed-torque Characteristics Graph**
- ❑ **AM 1160E Series – Axis Motor Specifications**
- ❑ **AM 1160E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1160D-E Series – Axis Motor Specifications**



- ❑ **AM 1160D-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1160K-E Series – Axis Motor Specifications**
- ❑ **AM 1160K-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1300A-E Series – Axis Motor Specifications**
- ❑ **AM 1300A-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1300C-E Series – Axis Motor Specifications**
- ❑ **AM 1300C-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1300K-E Series – Axis Motor Specifications**
- ❑ **AM 1300K-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1300M-E Series – Axis Motor Specifications**
- ❑ **AM 1300M-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1550C Series – Axis Motor Specifications**
- ❑ **AM 1550C Series – Speed-torque Characteristics Graph**
- ❑ **AM 1550E Series – Axis Motor Specifications**
- ❑ **AM 1550E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1550G Series – Axis Motor Specifications**
- ❑ **AM 1550G Series – Speed-torque Characteristics Graph**
- ❑ **AM 1550A-E Series – Axis Motor Specifications**
- ❑ **AM 1550A-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1550C-E Series – Axis Motor Specifications**
- ❑ **AM 1550C-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1550D-E Series – Axis Motor Specifications**
- ❑ **AM 1550D-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1550G-E Series – Axis Motor Specifications**
- ❑ **AM 1550G-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1550K-E Series – Axis Motor Specifications**
- ❑ **AM 1550K-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1550M-E Series – Axis Motor Specifications**
- ❑ **AM 1550M-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1550N-E Series – Axis Motor Specifications**
- ❑ **AM 1550N-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1550P-E Series – Axis Motor Specifications**
- ❑ **AM 1550P-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1900K-E Series – Axis Motor Specifications**
- ❑ **AM 1900K-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1900M-E Series – Axis Motor Specifications**
- ❑ **AM 1900M-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1900N-E Series – Axis Motor Specifications**
- ❑ **AM 1900N-E Series – Speed-torque Characteristics Graph**
- ❑ **AM 1900P-E Series – Axis Motor Specifications**
- ❑ **AM 1900P-E Series – Speed-torque Characteristics Graph**
- ❑ **Axis Motors Dimension Drawings**
- ❑ **AM 960 Series – Dimension Drawing**
- ❑ **AM 960 Series – Connector Illustrations**

- **AM 1160, AM 1160-E Series – Dimension Drawing**
- **AM 1160, AM 1160-E Series – Connector Illustrations**
- **AM 1300-E Series – Dimension Drawing**
- **AM 1300-E Series – Connector Illustrations**
- **AM 1550 Series – Dimension Drawing**
- **AM 1550 Series – Connector Illustrations**
- **AM 1550-E Series – Dimension Drawing**
- **AM 1550-E Series – Connector Illustrations**
- **AM 1900-E Series – Dimension Drawing**
- **AM 1900-E Series – Connector Illustrations**

### **Axis Motors General Technical Information**

The specifications and the characteristic curves apply to motors mounted without thermal insulation. The temperature of the winding may differ from the maximum permissible ambient temperature of 40°C by a maximum of 100K. If the motor is mounted so that it is thermally insulated, it is necessary to reduce the motor torque in order to avoid thermal overloading of the motor.

### **Axis Motors Mechanical Life**

The service life of the bearings depends on the shaft load and the mean rotational speed (see “**Permissible Forces on the Motor Shaft**”).

### **Motors with Absolute Rotary Encoders**

If you are using axis motors with EQN 1325 absolute rotary encoder, remember to reduce the rated torque by approx. 10 %. The reason is the reduced maximum temperature of the rotary encoder. The stall torque and the maximum torque are not reduced. Refer to **Table 7-2, Axis Motor Specifications**

**AM 960A Series - Axis Motor Specifications**

Refer to Table 7-17, Figure 7-17, AM 960A Series - Speed-Torque Characteristics Graph, and Figure 7-42, AM 960 Series - Dimensional Drawing.

**Table 7-17, AM 960A Series - Specifications**

	<b>AM 960A (Without Brake)</b>	<b>AM 960AB (With Brake)</b>
<b>P/N</b>	34100200	34100201
<b>Rated Voltage <math>U_N</math></b>	288 V	
<b>Rated Power Output <math>P_N</math></b>	1.4 kW	
<b>Rated Speed <math>n_N</math></b>	4500 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	3.0 Nm (4.1 Nm with 3000 rpm)	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	3.3 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	5.2 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	5.2 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	25.4 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	22.0 Nm	
<b>Maximum Speed</b>	6000 rpm	
<b>Pole Pairs <math>PZ</math></b>	3	
<b>Winding Resistance (in one phase)</b>	1.20 $\Omega$	
<b>Winding Inductance (in one phase)</b>	3.20 mH	
<b>Weight <math>m</math></b>	<u>15.87 lb</u> 7.20 kg	<u>17.86 lb</u> 8.10 kg
<b>Rotor Inertia <math>J</math></b>	6.30 kgcm <sup>2</sup>	6.60 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		0.5 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		5.0 Nm

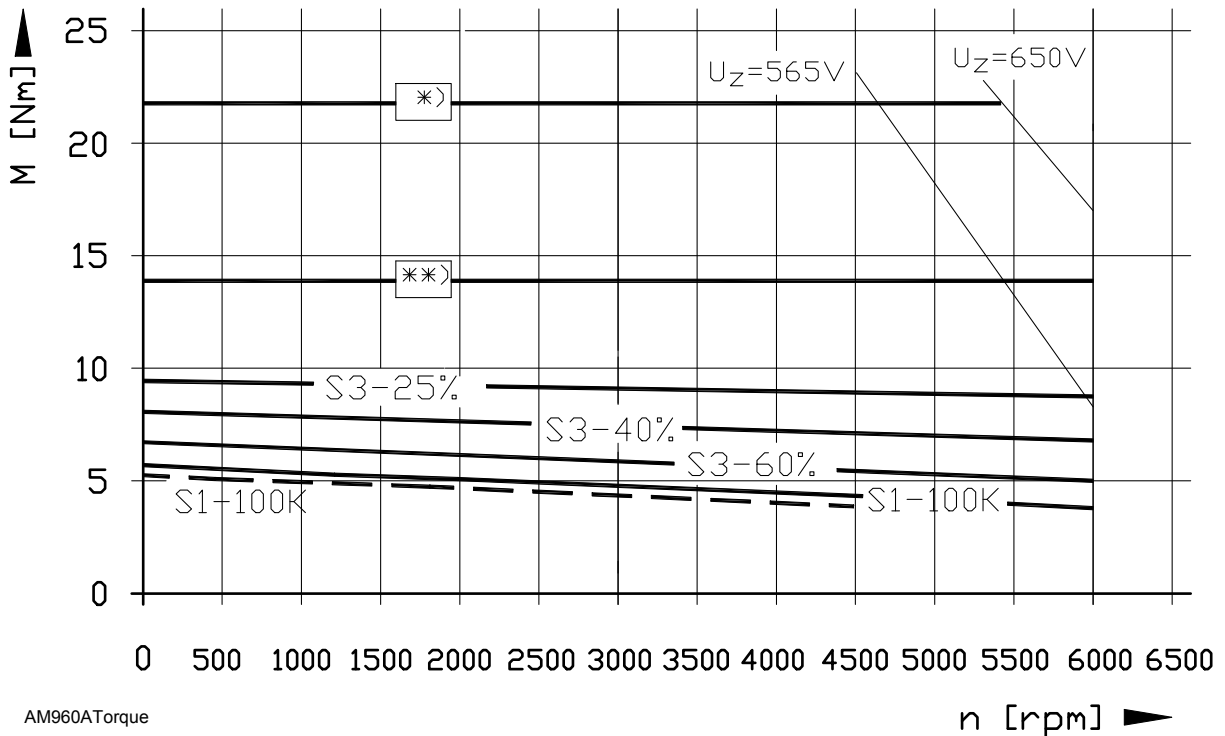
(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 960A Series - Speed-Torque Characteristics Graph

Refer to Figure 7-17.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\*>  $M_{max.} = 22 \text{ Nm}$  with  $I_{max.} = 25.4 \text{ A}_{eff.}$   
 \*\*>  $M_{max.} = 14 \text{ Nm}$  with  $I_{max.} = 15 \text{ A}_{eff.}$



**Figure 7-17, AM 960A Series - Speed-Torque Characteristics Graph**

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1160A Series - Axis Motor Specifications**

Refer to **Table 7-18, Figure 7-18, AM 1160A Series - Speed-Torque Characteristics Graph**, and **Figure 7-44, AM 1160, AM 1160-E Series - Dimensional Drawing**.

**Table 7-18, AM 1160A Series - Specifications**

	<b>AM 1160A (Without Brake)</b>	<b>AM 1160AB (With Brake)</b>
<b>P/N</b>	34100210	34100211
<b>Rated Voltage <math>U_N</math></b>	306 V	
<b>Rated Power Output <math>P_N</math></b>	1.45 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	4.6 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	3.3 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	5.2 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	3.4 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	12.7 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	16.0 Nm	
<b>Maximum speed</b>	5400 rpm	
<b>Pole Pairs PZ</b>	3	
<b>Winding Resistance (in one phase)</b>	3.80 $\Omega$	
<b>Winding Inductance (in one phase)</b>	13.50 mH	
<b>Weight m</b>	<u>15.21 lb</u> 6.90 kg	<u>17.12 lb</u> 7.80 kg
<b>Rotor Inertia J</b>	7.50 kgcm <sup>2</sup>	7.90 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		0.6 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		13.5 Nm

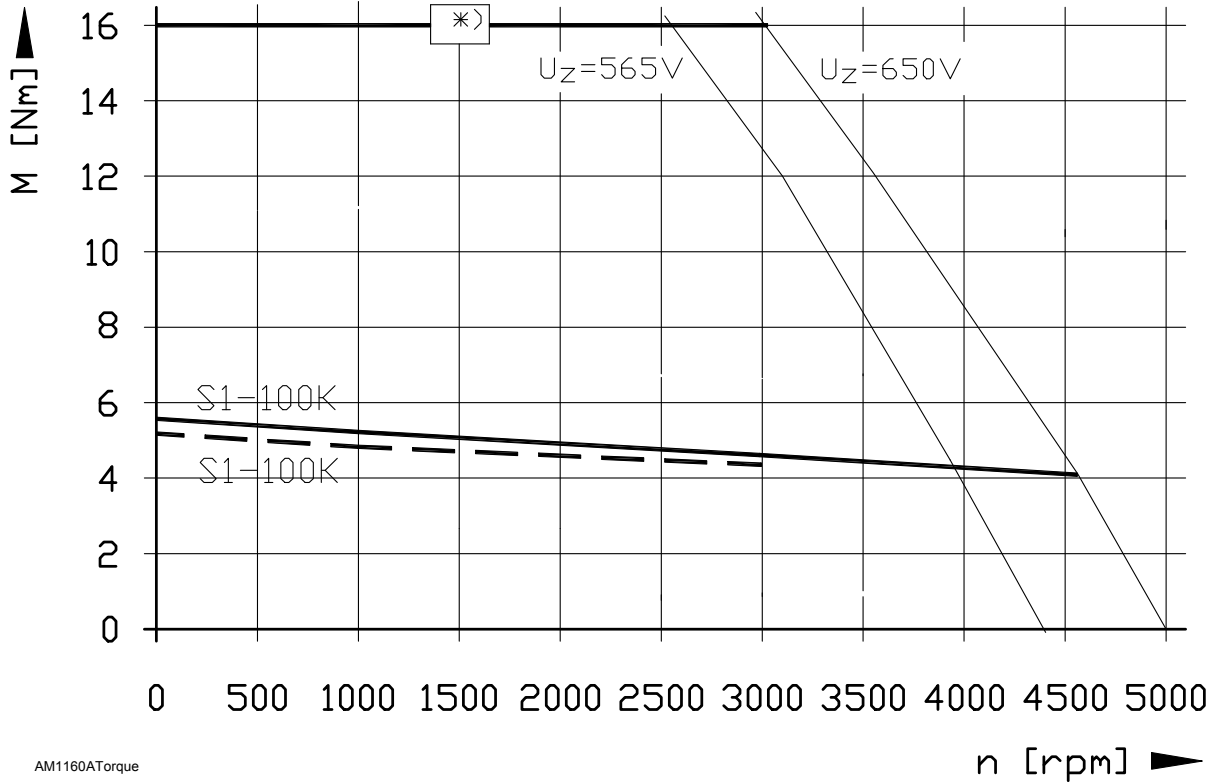
(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1160A Series - Speed-Torque Characteristics Graph

Refer to Figure 7-18.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\* $\rangle$   $M_{max.} = 16Nm$  with  $I_{max.} = 12.7A_{eff.}$



**Figure 7-18, AM 1160A Series - Speed-Torque Characteristics Graph**

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.  
The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1160C Series - Axis Motor Specifications**

Refer to Table 7-19, Figure 7-19, AM 1160C Series - Speed-Torque Characteristics Graph, and Figure 7-44, AM 1160, AM 1160-E Series - Dimensional Drawing.

**Table 7-19, AM 1160C Series - Specifications**

	<b>AM 1160C (Without Brake)</b>	<b>AM 1160CB (With Brake)</b>
<b>P/N</b>	34100220	34100221
<b>Rated Power <math>U_N</math></b>	296 V	
<b>Rated Power Output <math>P_N</math></b>	1.85 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	5.9 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	4.1 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	7.2 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	4.8 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	19.0 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	25.0 Nm	
<b>Maximum speed</b>	5400 rpm	
<b>Pole Pairs <math>PZ</math></b>	3	
<b>Winding Resistance (in one phase)</b>	2.05 $\Omega$	
<b>Winding Inductance (in one phase)</b>	8.50 mH	
<b>Weight <math>m</math></b>	<u>18.96 lb</u> 8.60 kg	<u>20.94 lb</u> 9.50 kg
<b>Rotor Inertia <math>J</math></b>	9.90 kgcm <sup>2</sup>	10.30kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		0.6 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		13.5 Nm

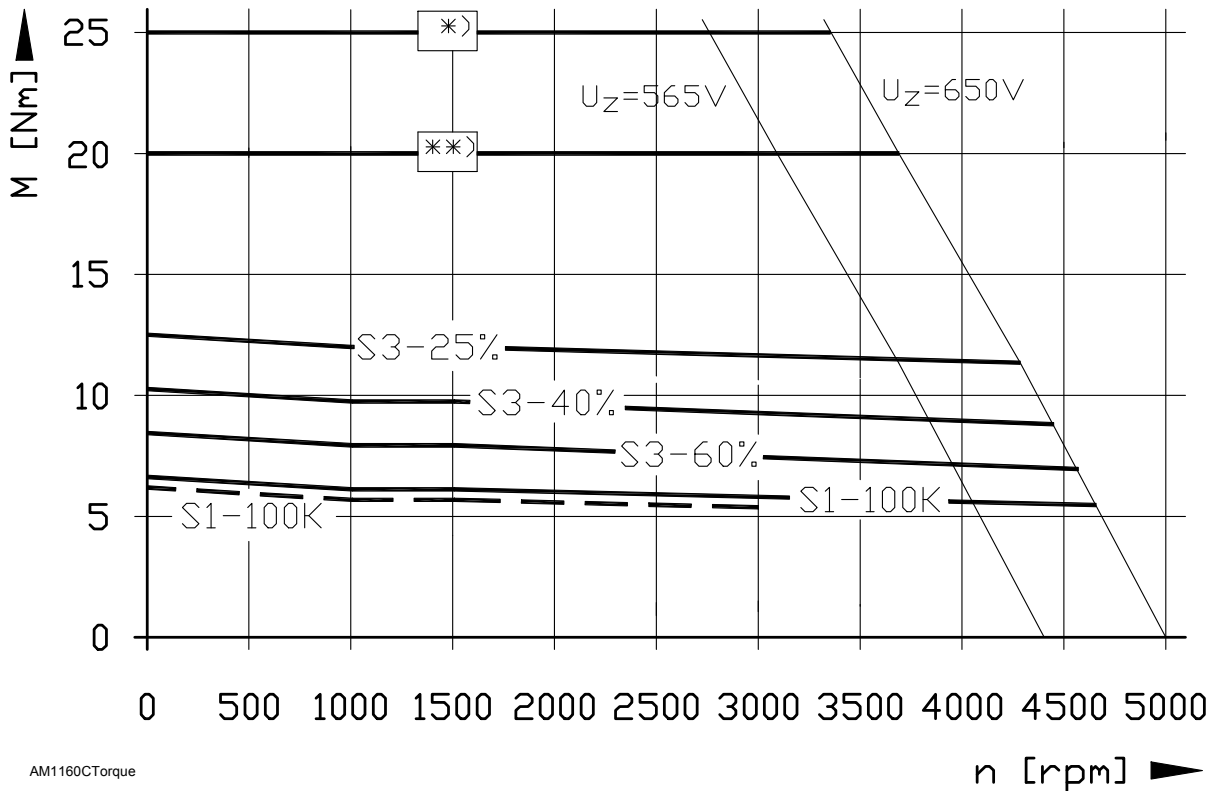
(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1160C Series - Speed-Torque Characteristics Graph

Refer to Figure 7-19.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\*)  $M_{max} = 25 \text{ Nm}$  with  $I_{max} = 19 \text{ A}_{eff}$ .  
 \*\*)  $M_{max} = 21 \text{ Nm}$  with  $I_{max} = 15 \text{ A}_{eff}$ .



AM1160CTorque

Figure 7-19, AM 1160C Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.  
 The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.



**AM 1160E Series - Axis Motor Specifications**

Refer to Table 7-20, Figure 7-20, AM 1160E Series - Speed-Torque Characteristics Graph, and Figure 7-44, AM 1160, AM 1160-E Series - Dimensional Drawing.

**Table 7-20, AM 1160E Series - Specifications**

	<b>AM 1160E (Without Brake)</b>	<b>AM 1160EB (With Brake)</b>
<b>P/N</b>	34100230	34100231
<b>Rated Voltage <math>U_N</math></b>	287 V	
<b>Rated Power Output <math>P_N</math></b>	2.42 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	7.7 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	5.35 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	10.0 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	6.8 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	32.6 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	41.0 Nm	
<b>Maximum speed</b>	5400 rpm	
<b>Pole Pairs PZ</b>	3	
<b>Winding Resistance (in one phase)</b>	0.85 $\Omega$	
<b>Winding Inductance (in one phase)</b>	4.75 mH	
<b>Weight m</b>	<u>26.45 lb</u> 12.0 kg	<u>28.44 lb</u> 12.90 kg
<b>Rotor Inertia J</b>	15.00 kgcm <sup>2</sup>	15.40kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		0.6 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		13.5 Nm

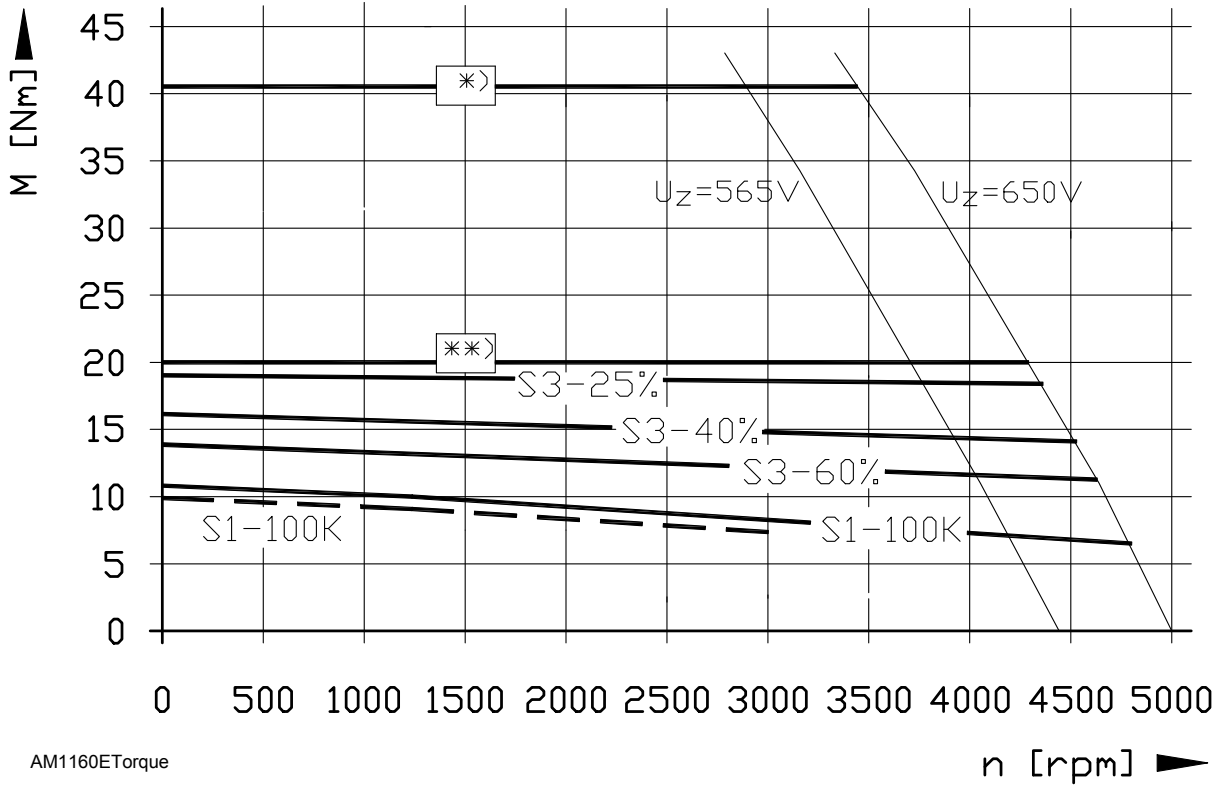
(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1160E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-20.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\* )  $M_{max.} = 41 \text{ Nm}$  with  $I_{max.} = 32.6 \text{ A}_{eff.}$   
 \*\* )  $M_{max.} = 21 \text{ Nm}$  with  $I_{max.} = 15 \text{ A}_{eff.}$



AM1160ETorque

**Figure 7-20, AM 1160E Series - Speed-Torque Characteristics Graph**

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.  
 The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1160D-E Series - Axis Motor Specifications**

Refer to Table 7-21, Figure 7-21, AM 1160D-E Series - Speed-Torque Characteristics Graph, and Figure 7-44, AM 1160, AM 1160-E - Dimensional Drawing.

**Table 7-21, AM 1160D-E Series - Specifications**

	<b>AM 1160D-E (Without Brake)</b>	<b>AM 1160DB-E (With Brake)</b>
<b>P/N</b>	664001-13	664001-14
<b>Rated Voltage <math>U_N</math></b>	399 V	
<b>Rated Power Output <math>P_N</math></b>	2.38 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	7.6 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	3.9 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	10.0 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	5.0 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	23.0 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	41.0 Nm	
<b>Maximum Speed</b>	4200 rpm	
<b>Pole Pairs <math>PZ</math></b>	3	
<b>Winding Resistance (in one phase)</b>	1.93 $\Omega$	
<b>Winding Inductance (in one phase)</b>	8.6 mH	
<b>Weight <math>m</math></b>	<u>26.5 lb</u> 12.0 kg	<u>28.4 lb</u> 12.9 kg
<b>Rotor Inertia <math>J</math></b>	15.0 kgcm <sup>2</sup>	15.4 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		0.6 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		13.5 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1160D-E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-21.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\*)  $M_{max} = 41 \text{ Nm}$  when  $I_{max} = 23 \text{ A}$

\*\*)  $M_{max} = 29 \text{ Nm}$  when  $I_{max} = 15 \text{ A}$

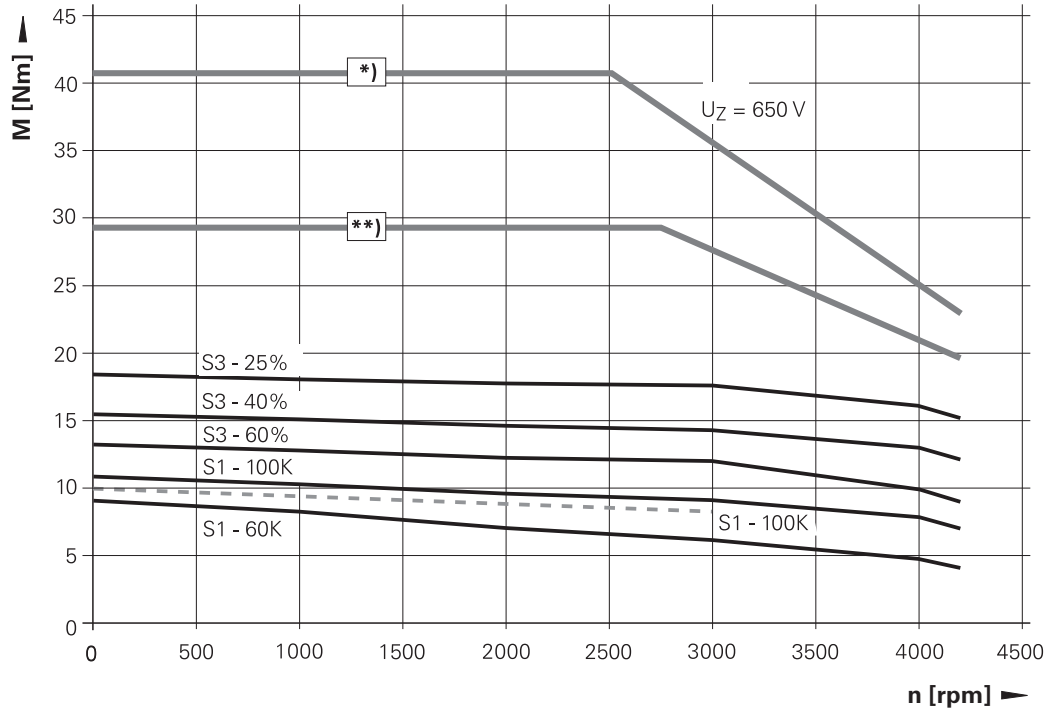


Figure 7-21, AM 1160D-E Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1160K-E Series - Axis Motor Specifications**

Refer to Table 7-22, Figure 7-22, AM 1160K-E Series - Speed-Torque Characteristics Graph, and Figure 7-44, AM 1160, AM 1160-E - Dimensional Drawing.

**Table 7-22, AM 1160K-E Series - Specifications**

	<b>AM 1160K-E (Without Brake)</b>	<b>AM 1160KB-E (With Brake)</b>
<b>P/N</b>	663984-63	663984-64
<b>Rated Voltage <math>U_N</math></b>	399 V	
<b>Rated Power Output <math>P_N</math></b>	2.38 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	7.6 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	3.9 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	10.0 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	5.0 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	23.0 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	41.0 Nm	
<b>Maximum Speed</b>	4200 rpm	
<b>Pole Pairs <math>PZ</math></b>	3	
<b>Winding Resistance (in one phase)</b>	1.93 $\Omega$	
<b>Winding Inductance (in one phase)</b>	8.6 mH	
<b>Weight <math>m</math></b>	<u>26.5 lb</u> 12.0 kg	<u>28.4 lb</u> 12.9 kg
<b>Rotor Inertia <math>J</math></b>	15.0 kgcm <sup>2</sup>	15.4 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		0.6 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		13.5 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1160K-E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-22.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\*)  $M_{max} = 41 \text{ Nm}$  when  $I_{max} = 23 \text{ A}$

\*\*\*)  $M_{max} = 29 \text{ Nm}$  when  $I_{max} = 15 \text{ A}$

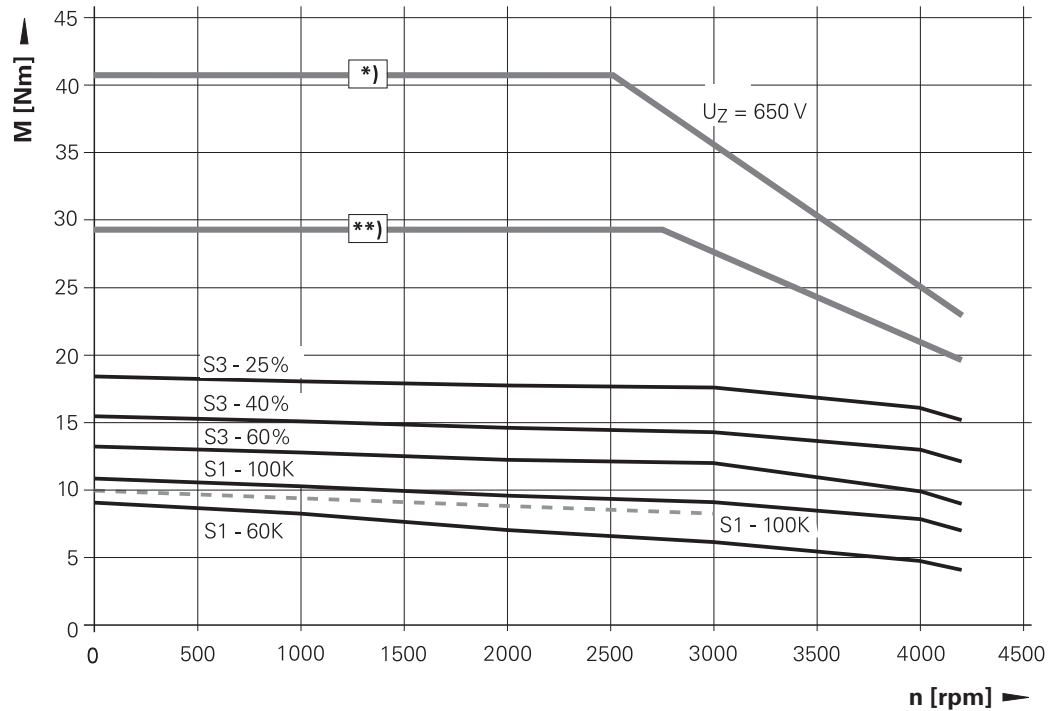


Figure 7-22, AM 1160K-E Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1300A–E Series - Axis Motor Specifications**

Refer to Table 7-23, Figure 7-23, AM 1300A–E Series - Speed-Torque Characteristics Graph, Figure 7-45, AM 1300-E Series - Dimensional Drawing, and Table 7-44, AM 1300-E Series - Motor Dimensions.

**Table 7-23, AM 1300A–E Series - Specifications**

	<b>AM 1300A–E (Without Brake)</b>	<b>AM 1300AB–E (With Brake)</b>
<b>P/N</b>	34100240	34100241
<b>Rated Voltage <math>U_N</math></b>	408 V	
<b>Rated Power Output <math>P_N</math></b>	1.6 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	5.2 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	2.7 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	6.0 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	3.0 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	8.6 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	16 Nm	
<b>Maximum Speed</b>	4200 rpm	
<b>Pole Pairs PZ</b>	4	
<b>Winding Resistance (in one phase)</b>	3.85 $\Omega$	
<b>Winding Inductance (in one phase)</b>	13.5 mH	
<b>Weight m</b>	<u>17.42 lb</u> 7.9 kg	<u>19.40 lb</u> 8.8 kg
<b>Rotor Inertia J</b>	16.0 kgcm <sup>2</sup>	16.4 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		0.6 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		13.5 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1300A-E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-23.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\* $M_{max} = 16 \text{ Nm}$  when  $I_{max} = 8.6 \text{ A}$

\*\* $M_{max} = 14.5 \text{ Nm}$  when  $I_{max} = 7.5 \text{ A}$

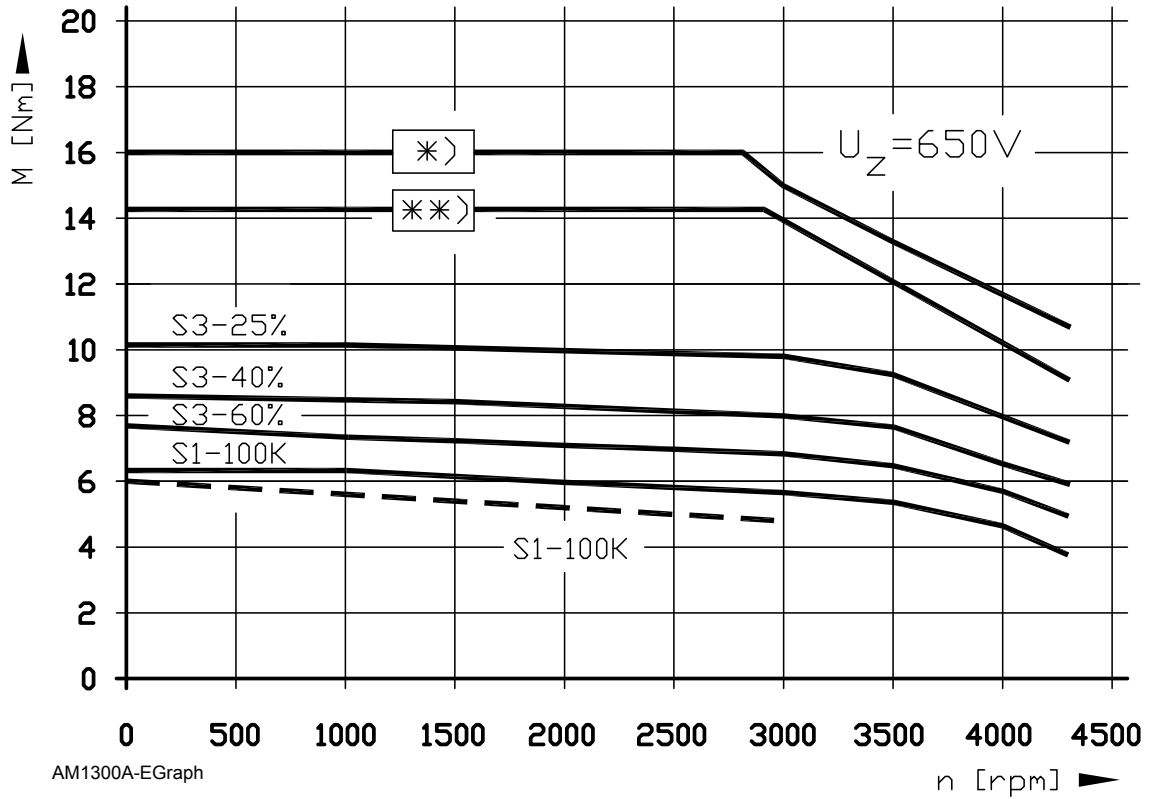


Figure 7-23, AM 1300A-E Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.



**AM 1300C–E Series - Axis Motor Specifications**

Refer to Table 7-24, Figure 7-24, AM 1300C–E Series - Speed-Torque Characteristics Graph, Figure 7-45, AM 1300-E Series - Dimensional Drawing, and Table 7-44, AM 1300-E Series - Motor Dimensions.

**Table 7-24, AM 1300C–E Series - Specifications**

	<b>AM 1300C–E (Without Brake)</b>	<b>AM 1300CB–E (With Brake)</b>
<b>P/N</b>	34100245	34100246
<b>Rated Voltage <math>U_N</math></b>	401 V	
<b>Rated Power Output <math>P_N</math></b>	2.3 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	7.4 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	3.8 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	9.0 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	4.5 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	12.7 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	23 Nm	
<b>Maximum Speed</b>	4200 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	2.0 $\Omega$	
<b>Winding Inductance (in one phase)</b>	8.5 mH	
<b>Weight <math>m</math></b>	<u>21.38 lb</u> 9.7 kg	<u>23.37 lb</u> 10.6 kg
<b>Rotor Inertia <math>J</math></b>	21.0 kgcm <sup>2</sup>	21.4 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		0.6 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		13.5 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1300C-E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-24.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\* $M_{max} = 23 \text{ Nm}$  when  $I_{max} = 12.7 \text{ A}$

\*\* $M_{max} = 14.5 \text{ Nm}$  when  $I_{max} = 7.5 \text{ A}$

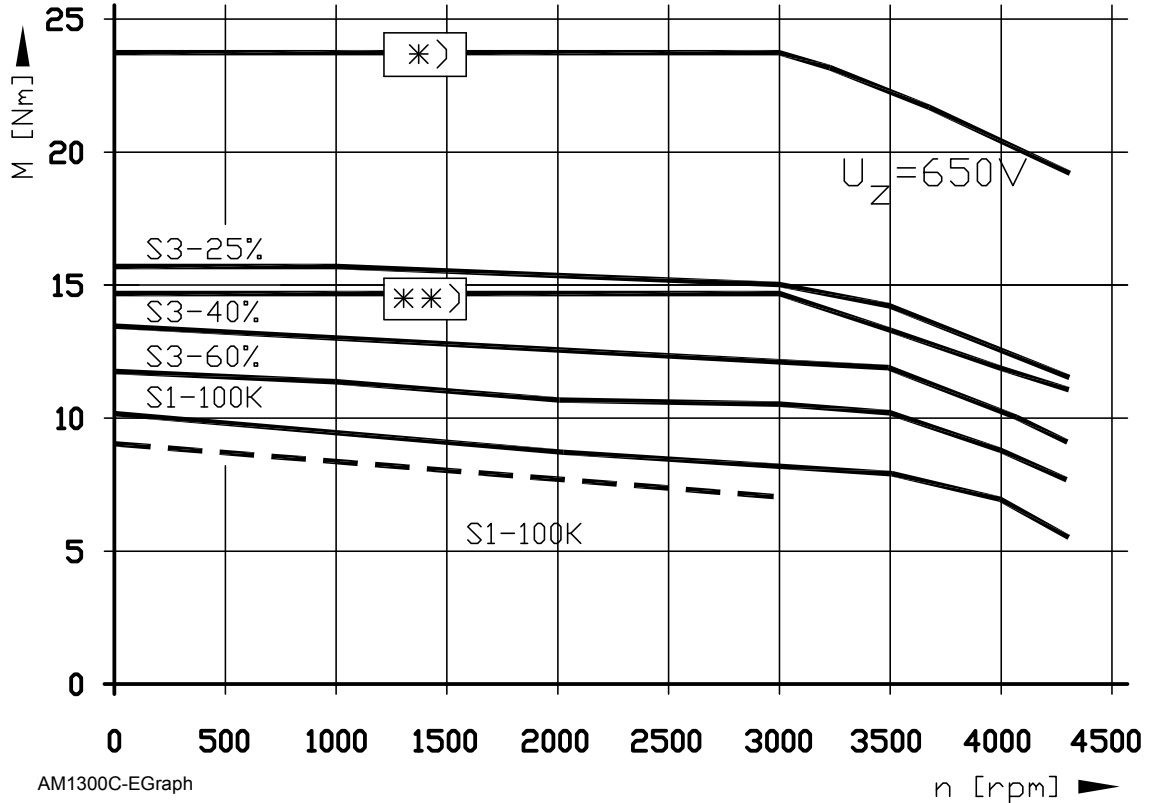


Figure 7-24, AM 1300C-E Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1300K-E Series - Axis Motor Specifications**

Refer to Table 7-25, Figure 7-25, AM 1300K-E Series - Speed-Torque Characteristics Graph, Figure 7-45, AM 1300K-E - Dimensional Drawing and Table 7-44 AM 1300-E Series - Motor Dimensions.

**Table 7-25, AM 1300K-E Series - Specifications**

	<b>AM 1300K-E (Without Brake)</b>	<b>AM 1300KB-E (With Brake)</b>
<b>P/N</b>	663985-63	663985-64
<b>Rated Voltage <math>U_N</math></b>	404 V	
<b>Rated Power Output <math>P_N</math></b>	1.5 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	4.7 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	2.4 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	6.0 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	3.0 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	8.6 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	16 Nm	
<b>Maximum Speed</b>	4200 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	3.85 $\Omega$	
<b>Winding Inductance (in one phase)</b>	13.5 mH	
<b>Weight <math>m</math></b>	<u>17.4 lb</u> 7.9 kg	<u>19.4 lb</u> 8.8 kg
<b>Rotor Inertia <math>J</math></b>	16.0 kgcm <sup>2</sup>	16.4 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		0.6 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		13.5 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1300K-E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-25.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\*)  $M_{max} = 16 \text{ Nm}$  when  $I_{max} = 8.6 \text{ A}$

\*\*\*)  $M_{max} = 14.5 \text{ Nm}$  when  $I_{max} = 7.5 \text{ A}$

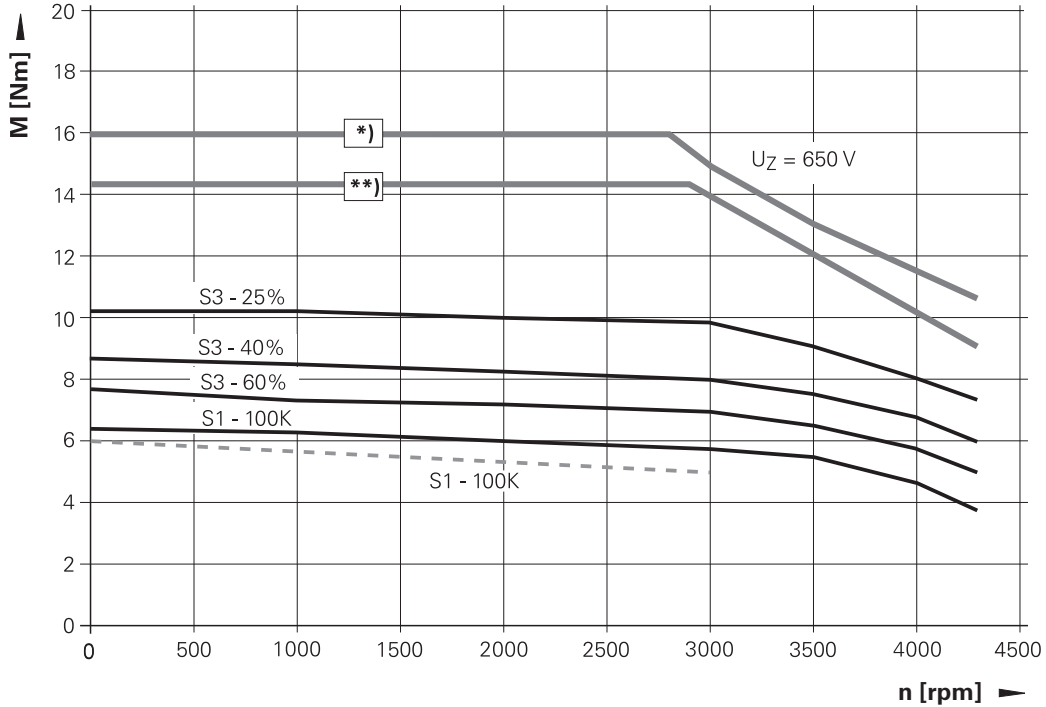


Figure 7-25, AM 1300K-E Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1300M-E Series - Axis Motor Specifications**

Refer to Table 7-26, Figure 7-26, AM 1300M-E Series - Speed-Torque Characteristics Graph, Figure 7-45, AM 1300-E Series - Dimensional Drawing and Table 7-44, AM 1300-E Series - Motor Dimensions.

**Table 7-26, AM 1300M-E Series - Specifications**

	<b>AM 1300M-E (Without Brake)</b>	<b>AM 1300MB-E (With Brake)</b>
<b>P/N</b>	663986-63	663986-64
<b>Rated Voltage <math>U_N</math></b>	399 V	
<b>Rated Power Output <math>P_N</math></b>	2.1 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	6.7 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	3.4 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	9.0 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	4.5 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	12.7 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	23 Nm	
<b>Maximum Speed</b>	4200 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	2.0 $\Omega$	
<b>Winding Inductance (in one phase)</b>	8.5 mH	
<b>Weight <math>m</math></b>	<u>21.4 lb</u> 9.7 kg	<u>23.4 lb</u> 10.6 kg
<b>Rotor Inertia <math>J</math></b>	21.0 kgcm <sup>2</sup>	21.4 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		0.6 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		13.5 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

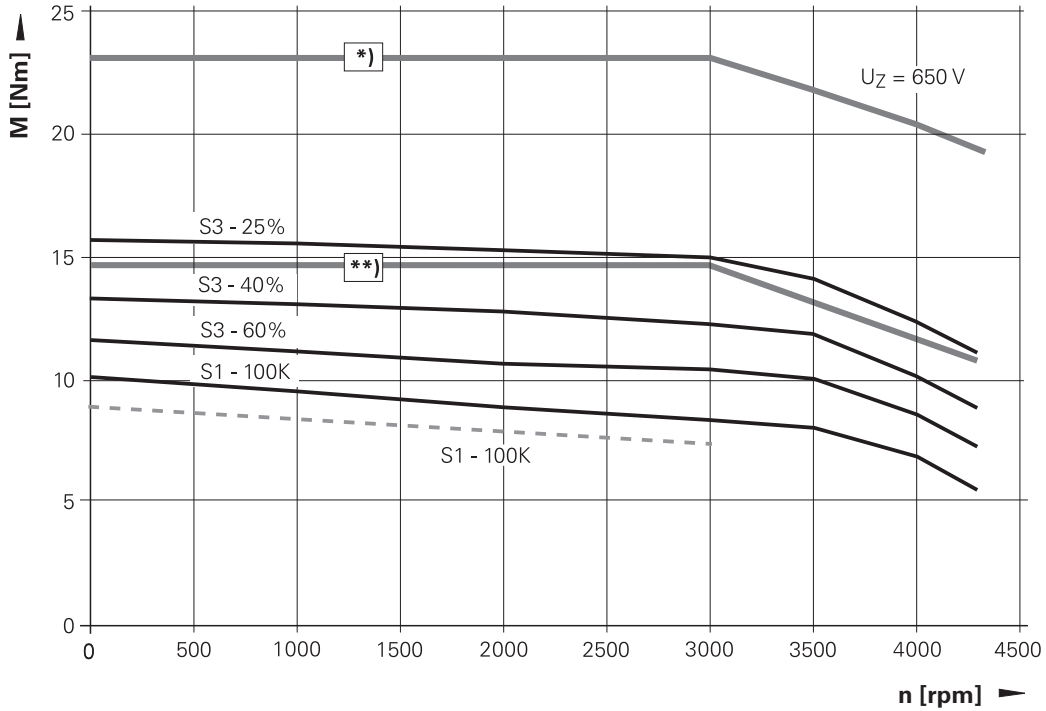
### AM 1300M-E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-26.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\*)  $M_{max} = 23 \text{ Nm}$  when  $I_{max} = 12.7 \text{ A}$

\*\*\*)  $M_{max} = 14.5 \text{ Nm}$  when  $I_{max} = 7.5 \text{ A}$



**Figure 7-26, AM 1300M-E Series - Speed-Torque Characteristics Graph**

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1550C Series - Axis Motor Specifications**

Refer to Table 7-27, Figure 7-27, AM 1550C Series - Speed-Torque Characteristics Graph, Figure 7-48, AM 1550 Series - Dimensional Drawing and Table 7-45, AM 1550 Series - Motor Dimensions.

**Table 7-27, AM 1550C Series - Specifications**

	<b>AM 1550C (Without Brake)</b>	<b>AM 1550CB (With Brake)</b>
<b>P/N</b>	34100250	34100251
<b>Rated Voltage <math>U_n</math></b>	295 V	
<b>Rated Power Output <math>P_n</math></b>	2.9 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_n</math></b>	9.2 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	6.9 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_{I_0}</math></b>	13 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_0</math></b>	9.1 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	29.7 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	39 Nm	
<b>Maximum Speed</b>	5000 rpm	
<b>Pole Pairs PZ</b>	4	
<b>Winding Resistance (in one phase)</b>	0.67 $\Omega$	
<b>Winding Inductance (in one phase)</b>	5.40 mH	
<b>Weight m</b>	<u>33.07 lb</u> 15.0 kg	<u>38.36 lb</u> 17.40 kg
<b>Rotor Inertia J</b>	33.0 kgcm <sup>2</sup>	35.0 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		1.1 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		40 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1550C Series - Speed-Torque Characteristics Graph

Refer to Figure 7-27 ( $n_N = 3000$  rpm).

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\*)  $M_{max.} = 39$  Nm with  $I_{max.} = 29.7$  A<sub>eff.</sub>  
 \*\*)  $M_{max.} = 21$  Nm with  $I_{max.} = 15$  A<sub>eff.</sub>

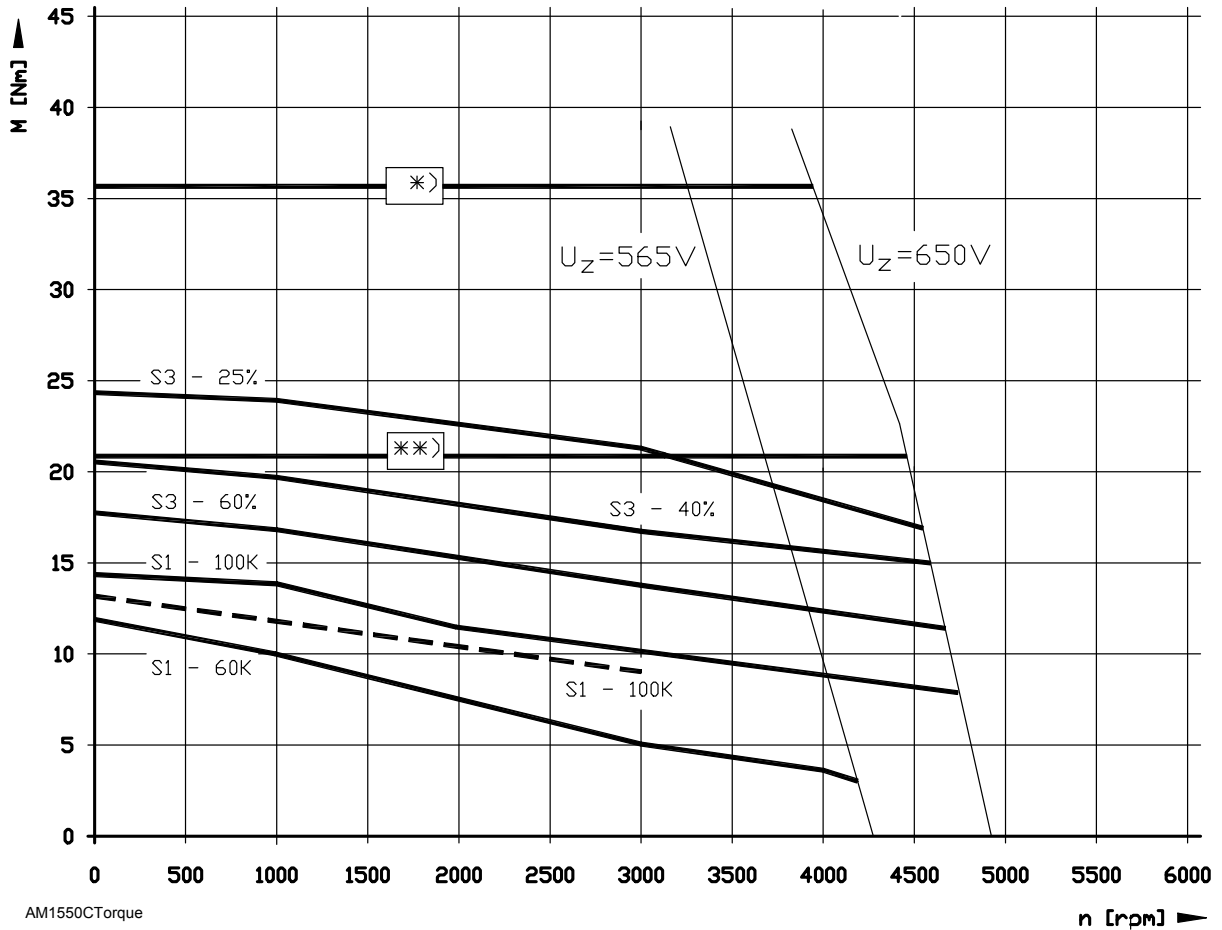


Figure 7-27, AM 1550C Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.



**AM 1550E Series - Axis Motor Specifications**

Refer to Table 7-28, Figure 7-28, AM 1550E Series - Speed-Torque Characteristics Graph, Figure 7-48, AM 1550 Series - Dimensional Drawing and Table 7-45, AM 1550 Series - Motor Dimensions.

**Table 7-28, AM 1550E Series - Specifications**

	<b>AM 1550E (Without Brake)</b>	<b>AM 1550EB (With Brake)</b>
<b>P/N</b>	34100260	34100261
<b>Rated Voltage <math>U_N</math></b>	291 V	
<b>Rated Power Output <math>P_N</math></b>	4.6 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	14.8 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	10.6 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	21.6 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	14.6 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	49.5 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	64 Nm	
<b>Maximum Speed</b>	5000 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	0.32 $\Omega$	
<b>Winding Inductance (in one phase)</b>	3.10 mH	
<b>Weight <math>m</math></b>	<u>44.09 lb</u> 20.0 kg	<u>49.38 lb</u> 22.4 kg
<b>Rotor Inertia <math>J</math></b>	54.0 kgcm <sup>2</sup>	56.0 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		1.1 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		40 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1550E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-28.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\* $\rangle$   $M_{max.} = 64 \text{ Nm}$  with  $I_{max.} = 49.5 \text{ A}_{eff}$ .  
 \*\* $\rangle$   $M_{max.} = 42 \text{ Nm}$  with  $I_{max.} = 30 \text{ A}_{eff}$ .

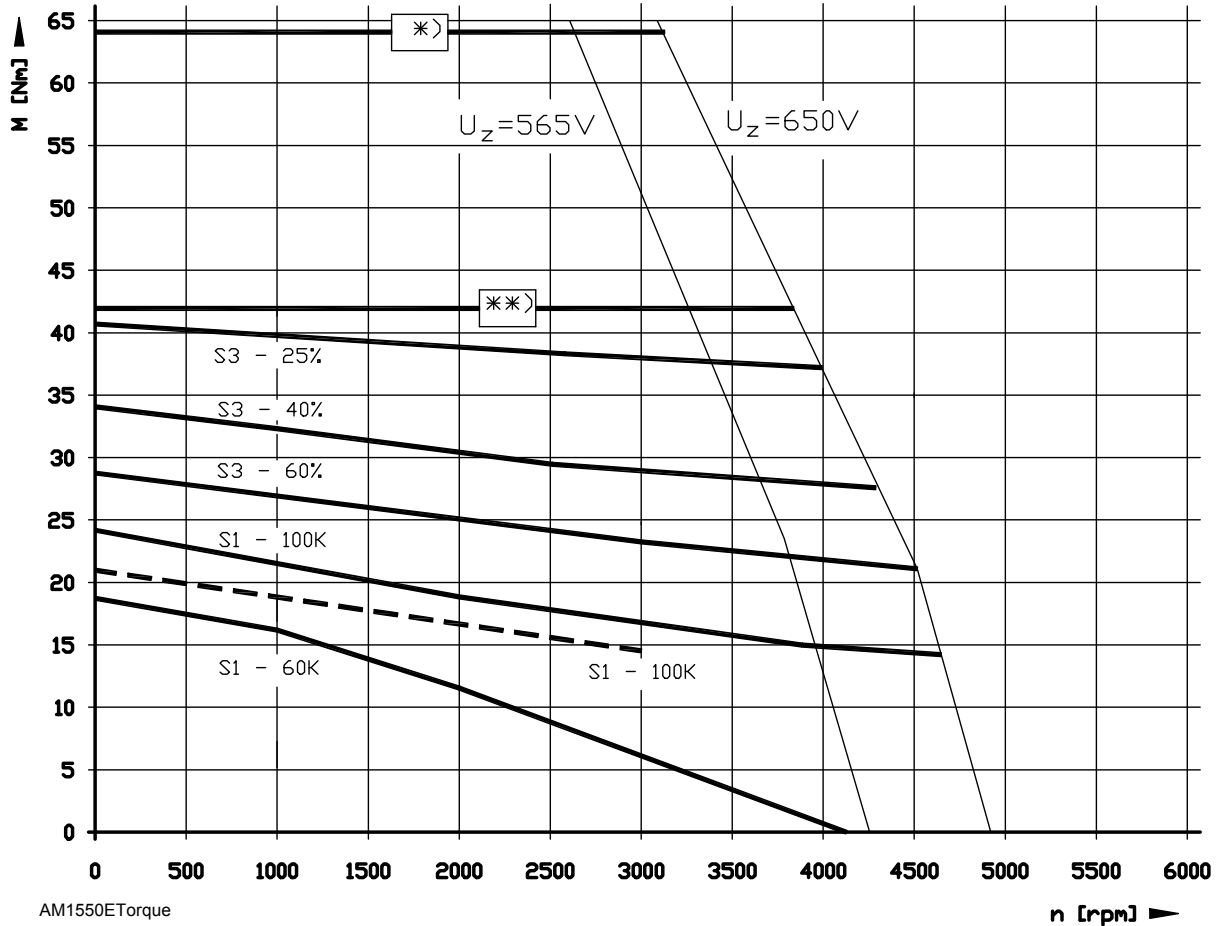


Figure 7-28, AM 1550E Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1550G Series - Axis Motor Specifications**

Refer to Table 7-29, Figure 7-29, AM 1550G Series - Speed-Torque Characteristics Graph, Figure 7-48, AM 1550 Series - Dimensional Drawing and Table 7-45, AM 1550 Series - Motor Dimensions.

**Table 7-29, AM 1550G Series - Specifications**

	<b>AM 1550G (Without brake)</b>	<b>AM 1550GB (With brake)</b>
<b>P/N</b>	34100270	34100271
<b>Rated Voltage <math>U_N</math></b>	287 V	
<b>Rated Power Output <math>P_N</math></b>	5.2 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	16.7 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	12.0 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	26.1 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	18.0 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	68.6 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	90 Nm	
<b>Maximum Speed</b>	5000 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	0.23 $\Omega$	
<b>Winding Inductance (in one phase)</b>	2.25 mH	
<b>Weight <math>m</math></b>	<u>55.11 lb</u> 25.0 kg	<u>60.04 lb</u> 27.4 kg
<b>Rotor Inertia <math>J</math></b>	75.0 kgcm <sup>2</sup>	77.0 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		1.1 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		40 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1550G Series - Speed-Torque Characteristics Graph

Refer to Figure 7-29.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\* )  $M_{max.} = 90 \text{ Nm}$  with  $I_{max.} = 68.6 \text{ A}_{eff}$ ,  
 \*\* )  $M_{max.} = 64 \text{ Nm}$  with  $I_{max.} = 46 \text{ A}_{eff}$ .

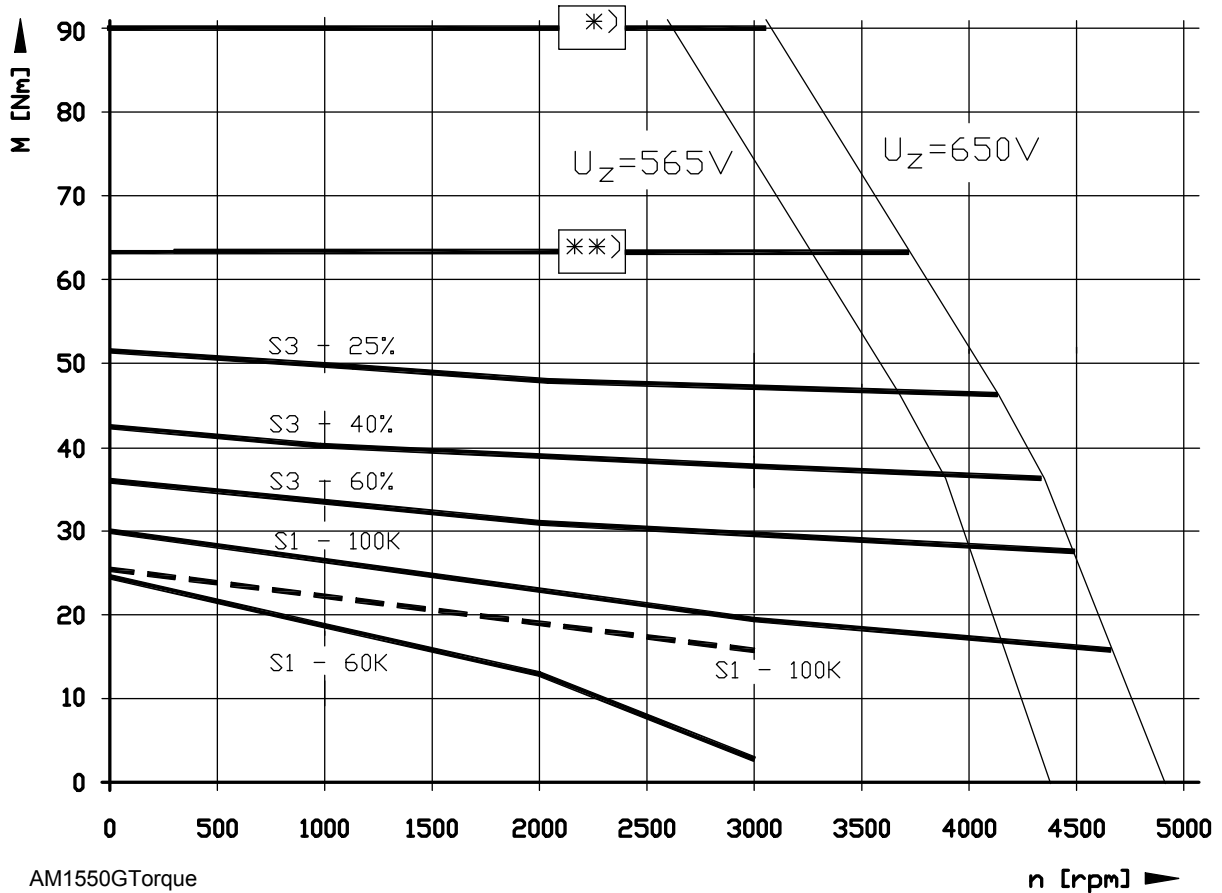


Figure 7-29, AM 1550G Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1550A–E Series - Axis Motor Specifications**

Refer to Table 7-30, Figure 7-30, AM 1550A–E Series - Speed-Torque Characteristics Graph, Figure 7-48, AM 1550-E Series - Dimensional Drawing, and Table 7-46, AM 1550-E Series - Motor Dimensions.

**Table 7-30, AM 1550A–E Series - Specifications**

	<b>AM 1550A–E (Without brake)</b>	<b>AM 1550AB–E (With brake)</b>
<b>P/N</b>	34100280	34100281
<b>Rated Voltage <math>U_N</math></b>	412 V	
<b>Rated Power Output <math>P_N</math></b>	3.5 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	11.0 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	5.6 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	13.0 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	6.5 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	21.2 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	39 Nm	
<b>Maximum Speed</b>	4200 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	1.3 $\Omega$	
<b>Winding Inductance (in one phase)</b>	9.8 mH	
<b>Weight <math>m</math></b>	<u>33.07 lb</u> 15.0 kg	<u>38.36 lb</u> 17.4 kg
<b>Rotor Inertia <math>J</math></b>	33.0 kgcm <sup>2</sup>	35.0 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		1.1 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		40 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1550A–E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-30.

--- Characteristic curve according to specifications

— Measured characteristic curve of one motor

\* )  $M_{max} = 39 \text{ Nm}$  when  $I_{max} = 21.2 \text{ A}$

\*\* )  $M_{max} = 29 \text{ Nm}$  when  $I_{max} = 15 \text{ A}$

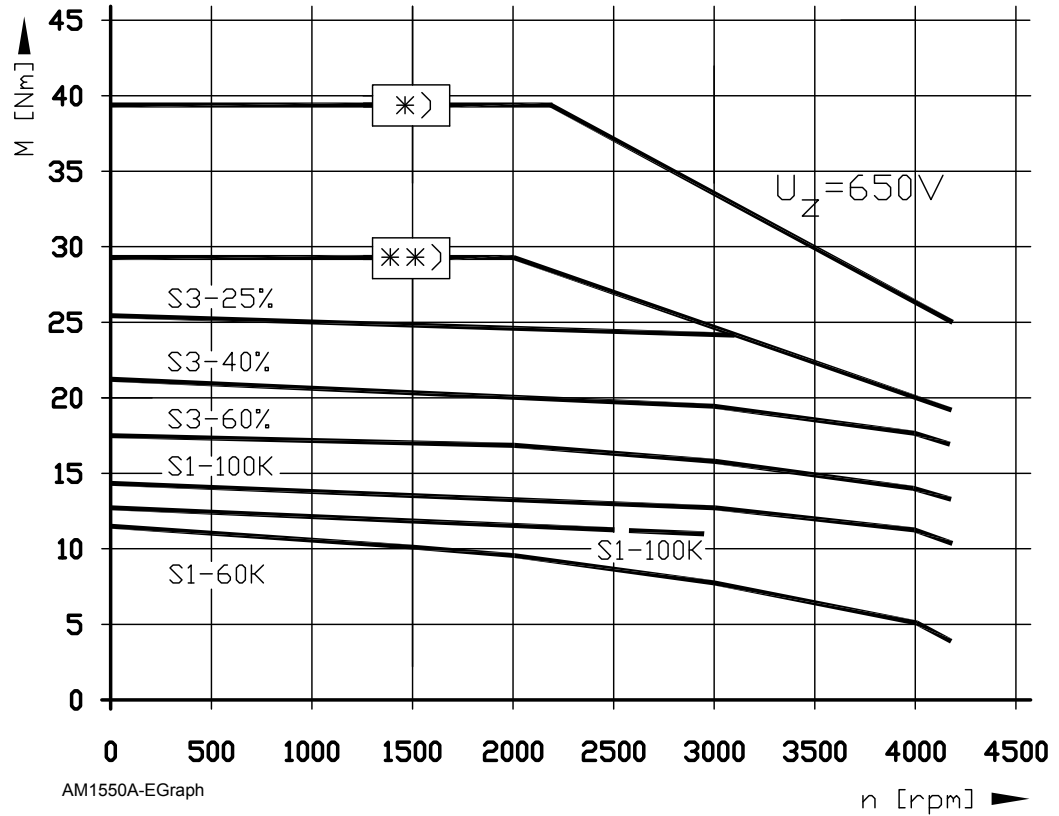


Figure 7-30, AM 1550A–E Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1550C–E Series - Axis Motor Specifications**

Refer to Table 7-31, Figure 7-31, AM 1550C–E Series - Speed-Torque Characteristics Graph, Figure 7-48, AM 1550-E Series - Dimensional Drawing, and Table 7-46, AM 1550-E Series - Motor Dimensions.

**Table 7-31, AM 1550C–E Series - Specifications**

	<b>AM 1550C–E (Without brake)</b>	<b>AM 1550CB–E (With brake)</b>
<b>P/N</b>	34100285	34100286
<b>Rated Voltage <math>U_N</math></b>	416 V	
<b>Rated Power Output <math>P_N</math></b>	5.0 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	16.0 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	8.2 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	17.7 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	8.5 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	27.6 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	52 Nm	
<b>Maximum Speed</b>	4200 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	0.86 $\Omega$	
<b>Winding Inductance (in one phase)</b>	7.4 mH	
<b>Weight <math>m</math></b>	<u>38.58 lb</u> 17.5 kg	<u>43.87 lb</u> 19.9 kg
<b>Rotor Inertia <math>J</math></b>	43.0 kgcm <sup>2</sup>	45.0 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		1.1 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		40 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1550C-E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-31.

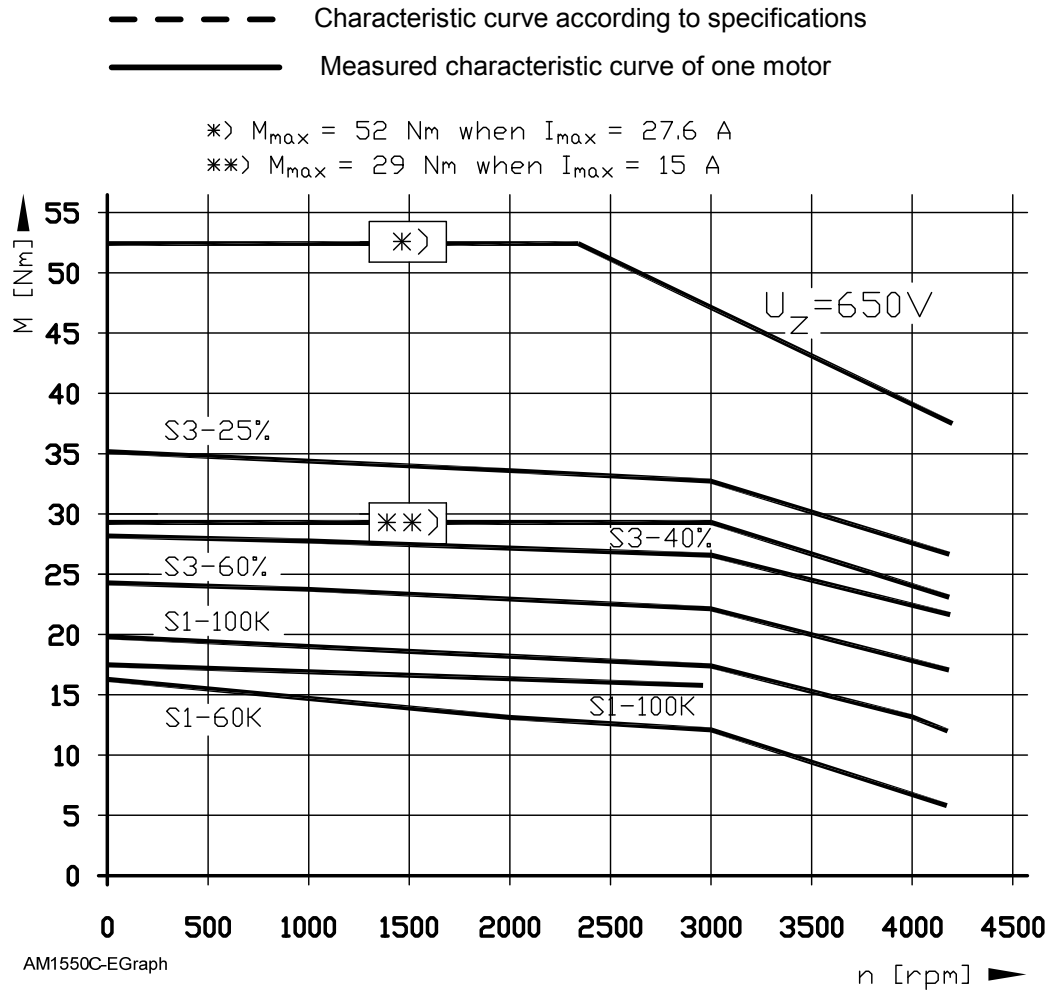


Figure 7-31, AM 1550C-E Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.



**AM 1550D–E Series - Axis Motor Specifications**

Refer to Table 7-32, Figure 7-32, AM 1550D–E Series - Speed-Torque Characteristics Graph, Figure 7-48, AM 1550-E Series - Dimensional Drawing, and Table 7-46, AM 1550-E Series - Motor Dimensions.

**Table 7-32, AM 1550D–E Series - Specifications**

	<b>AM 1550D–E (Without brake)</b>	<b>AM 1550DB–E (With brake)</b>
<b>P/N</b>	34100290	34100291
<b>Rated Voltage <math>U_N</math></b>	408 V	
<b>Rated Power Output <math>P_N</math></b>	5.7 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	18.1 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	9.1 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	21.6 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	10.6 A	
<b>Maximum-Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	35.0 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	64 Nm	
<b>Maximum Speed</b>	4200 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	0.61 $\Omega$	
<b>Winding Inductance (in one phase)</b>	5.8 mH	
<b>Weight <math>m</math></b>	<u>44.09 lb</u> 20.0 kg	<u>49.38 lb</u> 22.4 kg
<b>Rotor Inertia <math>J</math></b>	54.0 kgcm <sup>2</sup>	56.0 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		1.1 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		40 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1550D–E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-32.

--- Characteristic curve according to specifications

— Measured characteristic curve of one motor

\*>  $M_{max} = 64 \text{ Nm}$  when  $I_{max} = 35 \text{ A}$

\*\*>  $M_{max} = 59 \text{ Nm}$  when  $I_{max} = 30 \text{ A}$

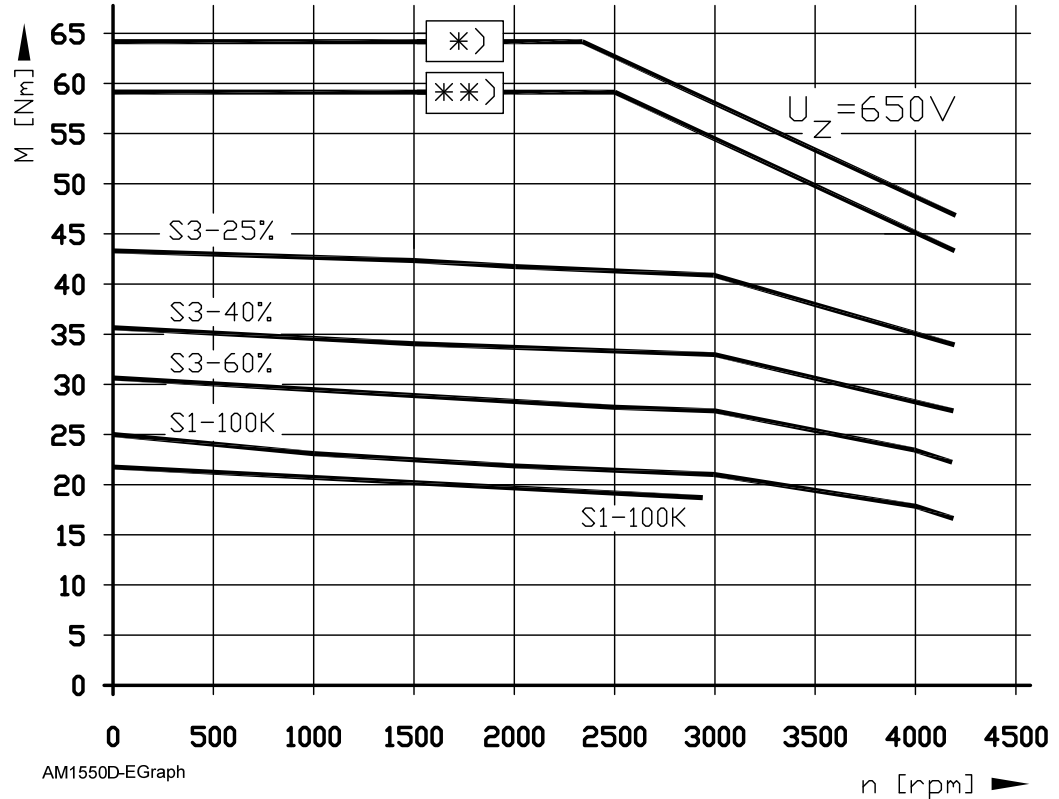


Figure 7-32, AM 1550D–E Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1550G–E Series - Axis Motor Specifications**

Refer to Table 7-33, Figure 7-33, AM 1550G–E Series - Speed-Torque Characteristics Graph, Figure 7-48, AM 1550-E Series - Dimensional Drawing, and Table 7-46, AM 1550-E Series - Motor Dimensions.

**Table 7-33, AM 1550G–E Series - Specifications**

	<b>AM 1550G–E (Without brake)</b>	<b>AM 1550GB–E (With brake)</b>
<b>P/N</b>	34100295	34100296
<b>Rated Voltage <math>U_N</math></b>	396 V	
<b>Rated Power Output <math>P_N</math></b>	6.0 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	19.2 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	9.8 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	26.1 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	12.8 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	49.5 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	90 Nm	
<b>Maximum Speed</b>	4200 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	0.38 $\Omega$	
<b>Winding Inductance (in one phase)</b>	3.7 mH	
<b>Weight <math>m</math></b>	<u>55.11 lb</u> 25.0 kg	<u>60.41 lb</u> 27.4 kg
<b>Rotor Inertia <math>J</math></b>	75.0 kgcm <sup>2</sup>	77.0 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		1.1 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		40 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1550G-E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-33.

--- Characteristic curve according to specifications

— Measured characteristic curve of one motor

\*>  $M_{max} = 90 \text{ Nm}$  when  $I_{max} = 49.5 \text{ A}$

\*\*>  $M_{max} = 59 \text{ Nm}$  when  $I_{max} = 30 \text{ A}$

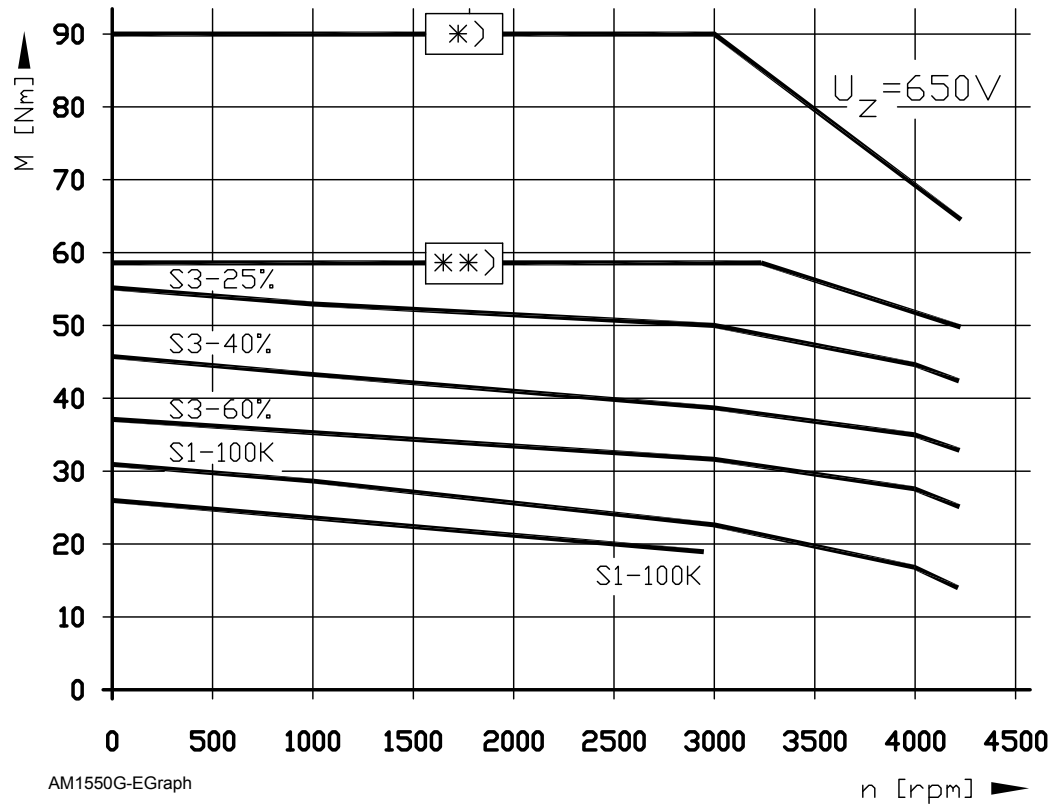


Figure 7-33, AM 1550G-E Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1550K-E Series - Axis Motor Specifications**

Refer to Table 7-34, Figure 7-34, AM 1550K-E Series - Speed-Torque Characteristics Graph, Figure 7-48, AM 1550-E Series - Dimensional Drawing and Table 7-46, AM 1550-E Series - Motor Dimensions

**Table 7-34, AM 1550K-E Series - Specifications**

	<b>AM 1550K-E (Without Brake)</b>	<b>AM 1550KB-E (With Brake)</b>
<b>P/N</b>	663987-63	663987-64
<b>Rated Voltage <math>U_N</math></b>	408 V	
<b>Rated Power Output <math>P_N</math></b>	3.1 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	9.9 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	5.0 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	13.0 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	6.5 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	21.2 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	39 Nm	
<b>Maximum Speed</b>	4200 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	1.3 $\Omega$	
<b>Winding Inductance (in one phase)</b>	9.8 mH	
<b>Weight <math>m</math></b>	<u>33.1 lb</u> 15.0 kg	<u>38.4 lb</u> 17.4 kg
<b>Rotor Inertia <math>J</math></b>	33.0 kgcm <sup>2</sup>	35.0 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		1.1 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		40 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

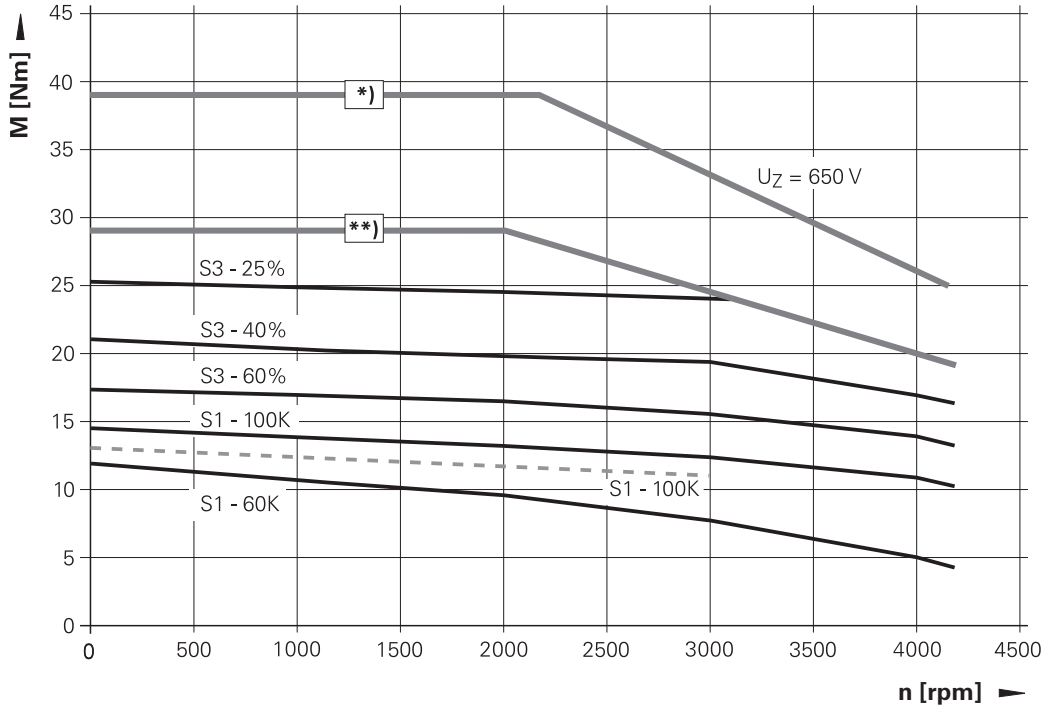
### AM 1550K-E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-34.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\*)  $M_{max} = 39 \text{ Nm}$  when  $I_{max} = 21.2 \text{ A}$

\*\*\*)  $M_{max} = 29 \text{ Nm}$  when  $I_{max} = 15 \text{ A}$



**Figure 7-34, AM 1550K-E Series - Speed-Torque Characteristics Graph**

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1550M-E Series - Axis Motor Specifications**

Refer to Table 7-35 1550M-E, Figure 7-35, AM 1550M-E Series - Speed-Torque Characteristics Graph, Figure 7-48, AM 1550-E Series - Dimensional Drawing and Table 7-46, AM 1550-E Series - Motor Dimensions.

**Table 7-35, AM 1550M-E Series - Specifications**

	<b>AM 1550M-E (Without Brake)</b>	<b>AM 1550MB-E (With Brake)</b>
<b>P/N</b>	663988-63	663988-63
<b>Rated Voltage <math>U_N</math></b>	411 V	
<b>Rated Power Output <math>P_N</math></b>	4.5 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	14.4 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	7.4 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	17.7 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	8.5 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	27.6 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	52.0 Nm	
<b>Maximum Speed</b>	4200 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	0.86 $\Omega$	
<b>Winding Inductance (in one phase)</b>	7.4 mH	
<b>Weight <math>m</math></b>	<u>38.6 lb</u> 17.5 kg	<u>43.9 lb</u> 19.9 kg
<b>Rotor Inertia <math>J</math></b>	43.0 kgcm <sup>2</sup>	19.9 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		
		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		
		1.1 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		
		40 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1550M-E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-35.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\*)  $M_{max} = 52 \text{ Nm}$  when  $I_{max} = 27.6 \text{ A}$

\*\*\*)  $M_{max} = 29 \text{ Nm}$  when  $I_{max} = 15 \text{ A}$

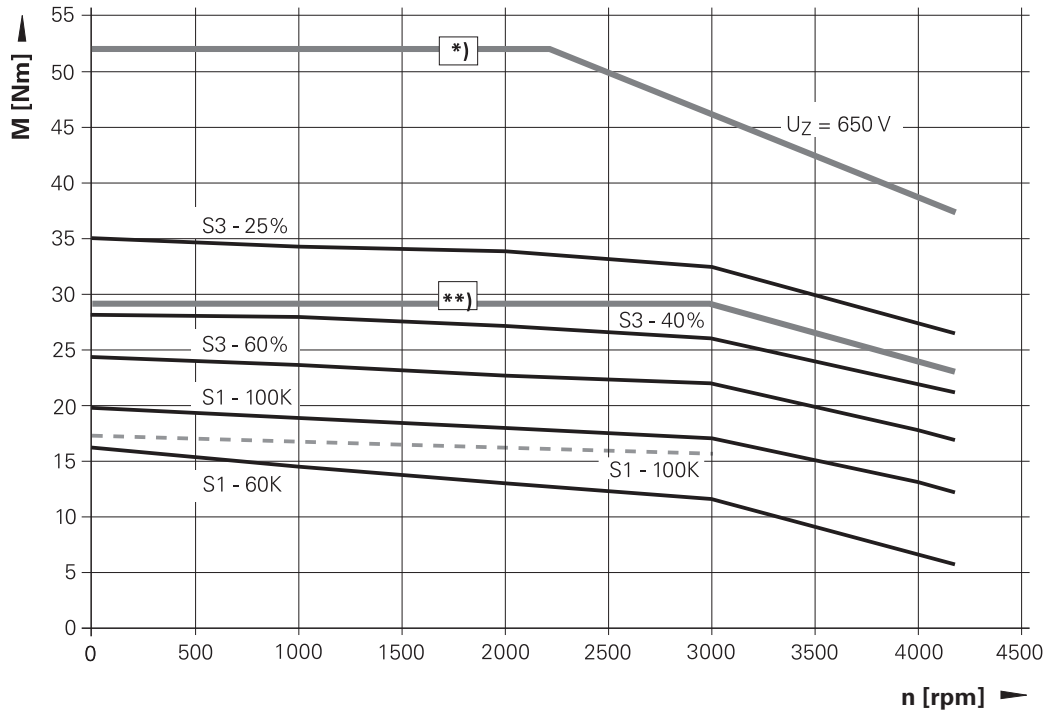


Figure 7-35, AM 1550M-E Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.



**AM 1550N-E Series - Axis Motor Specifications**

Refer to Table 7-36, Figure 7-36, AM 1550N-E Series - Speed-Torque Characteristics Graph, Figure 7-48, AM 1550-E Series - Dimensional Drawing and Table 7-46, AM 1550-E Series - Motor Dimensions.

**Table 7-36, AM 1550N-E Series - Specifications**

	<b>AM 1550N-E (Without Brake)</b>	<b>AM 1550NB-E (With Brake)</b>
<b>P/N</b>	663989-63	663989-63
<b>Rated Voltage <math>U_N</math></b>	404 V	
<b>Rated Power Output <math>P_N</math></b>	5.1 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	16.3 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	8.2 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	21.6 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	10.6 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	35.0 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	64 Nm	
<b>Maximum Speed</b>	4200 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	0.61 $\Omega$	
<b>Winding Inductance (in one phase)</b>	5.8 mH	
<b>Weight <math>m</math></b>	<u>44.1 lb</u> 20.0 kg	<u>49.4 lb</u> 22.4 kg
<b>Rotor Inertia <math>J</math></b>	54.0 kgcm <sup>2</sup>	56.0 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		1.1 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		40 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1550N-E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-36.

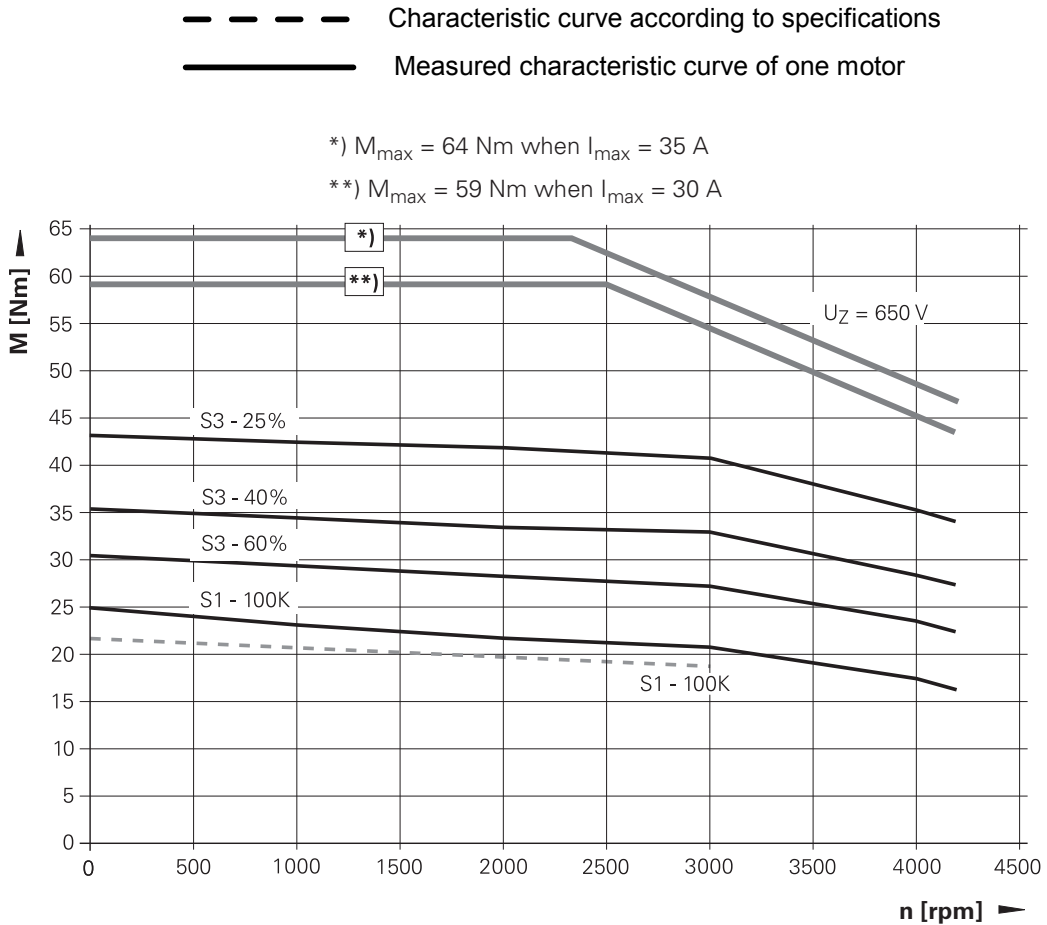


Figure 7-36, AM 1550N-E Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1550P-E Series - Axis Motor Specifications**

Refer to Table 7-37, Figure 7-37, AM 1550P-E Series - Speed-Torque Characteristics Graph, Figure 7-48, AM 1550-E Series - Dimensional Drawing and Table 7-46, AM 1550-E Series - Motor Dimensions.

**Table 7-37, AM 1550P-E Series - Specifications**

	<b>AM 1550P-E (Without Brake)</b>	<b>AM 1550PB-E (With Brake)</b>
<b>P/N</b>	663990-63	663990-64
<b>Rated Voltage <math>U_N</math></b>	394 V	
<b>Rated Power Output <math>P_N</math></b>	5.4 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	17.3 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	8.8 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	26.1 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	12.8 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	49.5 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	90 Nm	
<b>Maximum Speed</b>	4200 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	0.38 $\Omega$	
<b>Winding Inductance (in one phase)</b>	3.7 mH	
<b>Weight <math>m</math></b>	<u>55.1 lb</u> 25.0 kg	<u>60.4 lb</u> 27.4 kg
<b>Rotor Inertia <math>J</math></b>	x.x kgcm <sup>2</sup>	x.x kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		1.1 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		40 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1550P-E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-37.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\*)  $M_{max} = 90 \text{ Nm}$  when  $I_{max} = 49.5 \text{ A}$

\*\*\*)  $M_{max} = 59 \text{ Nm}$  when  $I_{max} = 30 \text{ A}$

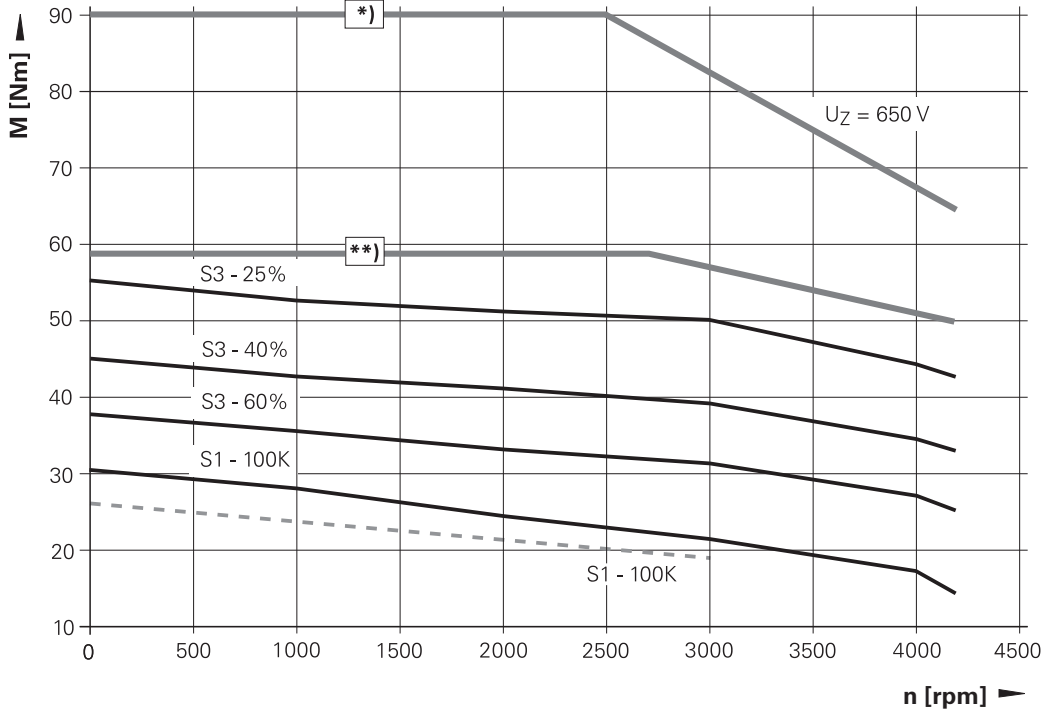


Figure 7-37, AM 1550P-E Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1900K-E Series - Axis Motor Specifications**

Refer to Table 7-38, Figure 7-38, AM 1900K-E Series - Speed-Torque Characteristics Graph, Figure 7-49, AM 1900-E Series - Dimensional Drawing and Table 7-47, AM 1900-E Series - Motor Dimensions.

**Table 7-38, AM 1900K-E Series - Specifications**

	<b>AM 1900K-E (Without Brake)</b>	<b>AM 1900KB-E (With Brake)</b>
<b>P/N</b>	663991-63	663991-63
<b>Rated Voltage <math>U_N</math></b>	416 V	
<b>Rated Power Output <math>P_N</math></b>	6.5 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	20.7 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	10.6 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	28.0 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	14.0 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	40.0 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	78 Nm	
<b>Maximum Speed</b>	3900 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	0.525 $\Omega$	
<b>Winding Inductance (in one phase)</b>	6.2 mH	
<b>Weight <math>m</math></b>	<u>64.6 lb</u> 29.3 kg	<u>82.9 lb</u> 37.6 kg
<b>Rotor Inertia <math>J</math></b>	106 kgcm <sup>2</sup>	115 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		1.7 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		70 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1900K-E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-38.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\*)  $M_{max} = 78 \text{ Nm}$  when  $I_{max} = 40 \text{ A}$

\*\*\*)  $M_{max} = 59 \text{ Nm}$  when  $I_{max} = 30 \text{ A}$

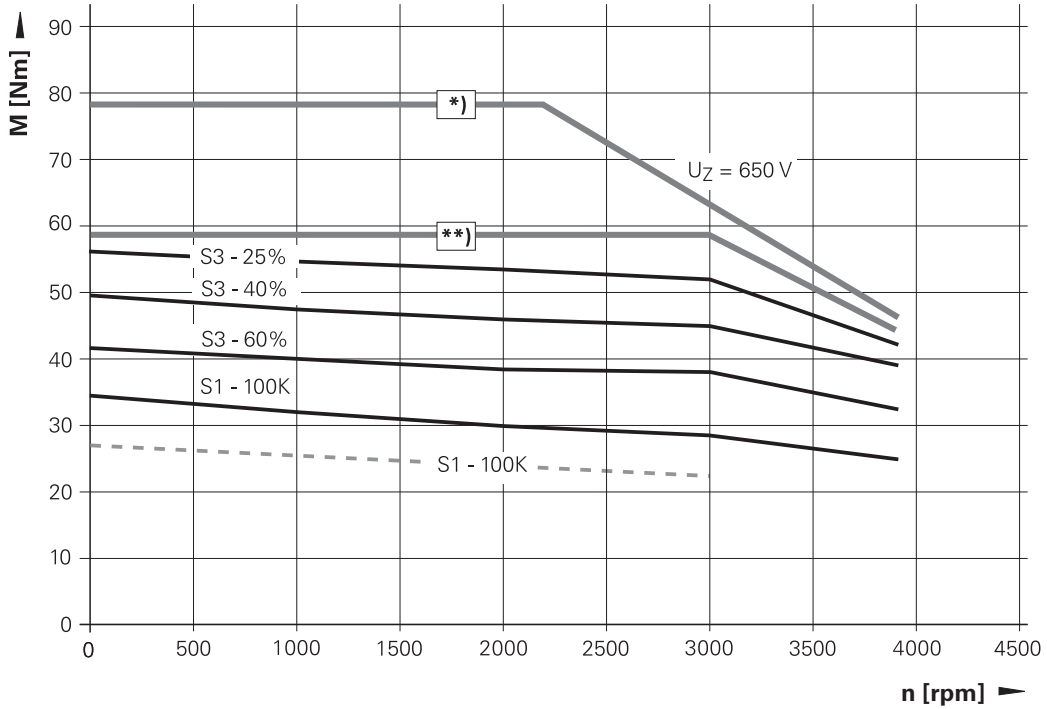


Figure 7-38, AM 1900K-E Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1900M-E Series - Axis Motor Specifications**

Refer to Table 7-39, Figure 7-39, Figure 7-49, AM 1900-E Series - Dimensional Drawing and Table 7-47, AM 1900-E Series - Motor Dimensions.

**Table 7-39, AM 1900M-E Series - Specifications**

	<b>AM 1900M-E (Without Brake)</b>	<b>AM 1900MB-E (With Brake)</b>
<b>P/N</b>	663992-63	663992-64
<b>Rated Voltage <math>U_N</math></b>	412 V	
<b>Rated Power Output <math>P_N</math></b>	8.6 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	27.5 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	13.1 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	38.0 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	18.1 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	54.4 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	104 Nm	
<b>Maximum Speed</b>	3900 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	0.317 $\Omega$	
<b>Winding Inductance (in one phase)</b>	4.8 mH	
<b>Weight <math>m</math></b>	<u>73.9 lb</u> 33.5 kg	<u>92.2 lb</u> 41.8 kg
<b>Rotor Inertia <math>J</math></b>	130 kgcm <sup>2</sup>	139 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		1.7 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		70 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1900M-E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-39.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\*)  $M_{max} = 104 \text{ Nm}$  when  $I_{max} = 54.4 \text{ A}$

\*\*\*)  $M_{max} = 59 \text{ Nm}$  when  $I_{max} = 30 \text{ A}$

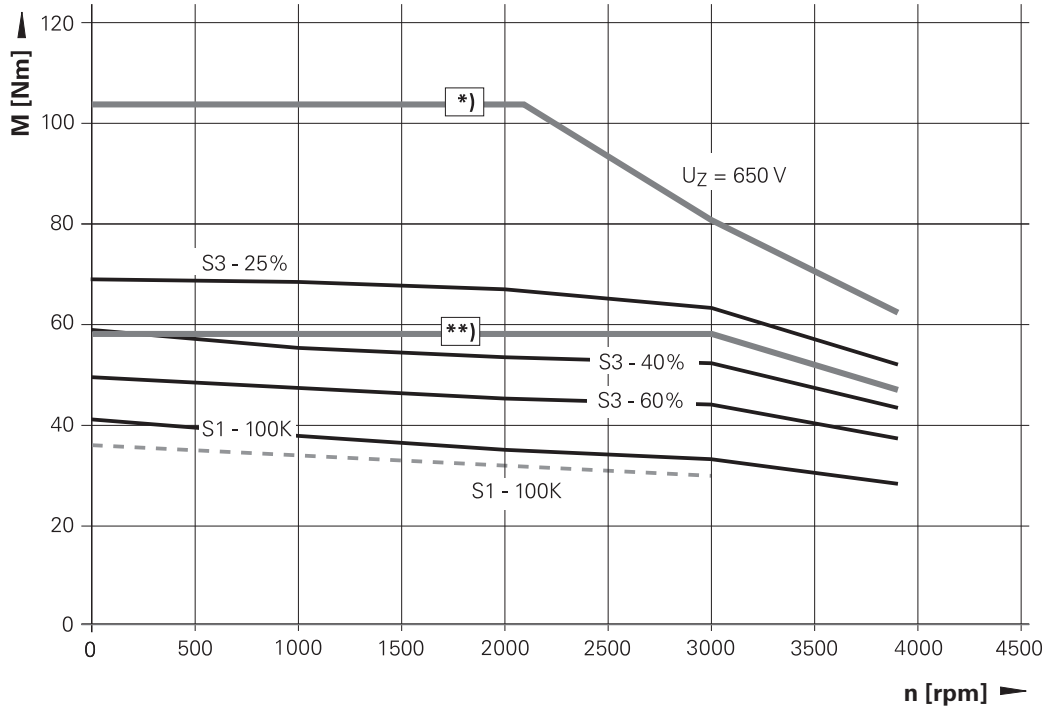


Figure 7-39, AM 1900M-E Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.



**AM 1900N-E Series - Axis Motor Specifications**

Refer to Table 7-40, Figure 7-40, Figure 7-49, AM 1900-E Series - Dimensional Drawing and Table 7-47, AM 1900-E Series - Motor Dimensions.

**Table 7-40, AM 1900N-E Series - Specifications**

	<b>AM 1900N-E (Without Brake)</b>	<b>AM 1900NB-E (With Brake)</b>
<b>P/N</b>	663993-63	663993-64
<b>Rated Voltage <math>U_N</math></b>	401 V	
<b>Rated Power Output <math>P_N</math></b>	8.9kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	28.4 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	13.5 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	47.6 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	22.7 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	75.0 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	135 Nm	
<b>Maximum Speed</b>	3900 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	0.228 $\Omega$	
<b>Winding Inductance (in one phase)</b>	3.6 mH	
<b>Weight <math>m</math></b>	<u>93.7 lb</u> 42.5 kg	<u>112.0 lb</u> 50.8 kg
<b>Rotor Inertia <math>J</math></b>	190 kgcm <sup>2</sup>	199 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		1.7 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		70 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

### AM 1900N-E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-40.

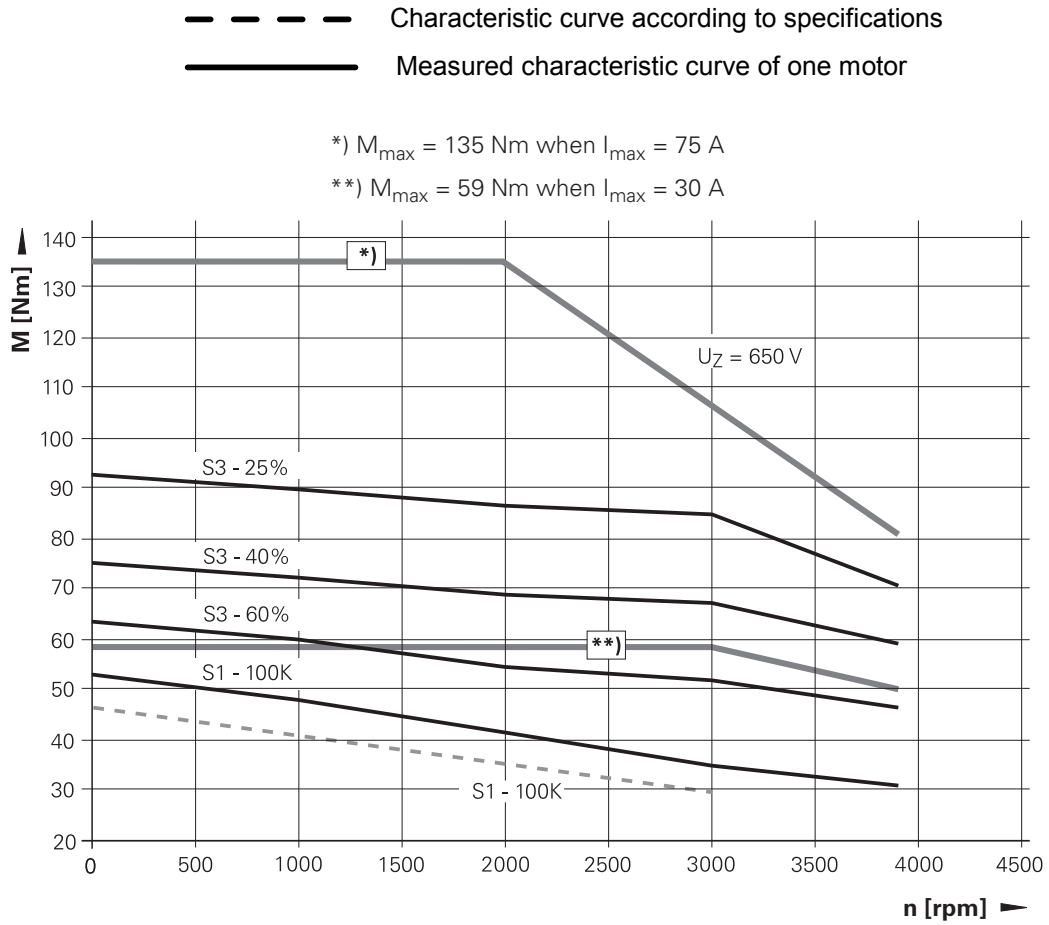


Figure 7-40, AM 1900N-E Series - Speed-Torque Characteristics Graph

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**AM 1900P-E Series - Axis Motor Specifications**

Refer to Table 7-41, Figure 7-41, Figure 7-49, AM 1900-E Series - Dimensional Drawing and Table 7-47, AM 1900-E Series - Motor Dimensions.

**Table 7-41, AM 1900P-E Series - Specifications**

	<b>AM 1900P-E (Without Brake)</b>	<b>AM 1900PB-E (With Brake)</b>
<b>P/N</b>	663994-63	663994-63
<b>Rated Voltage <math>U_N</math></b>	395 V	
<b>Rated Power Output <math>P_N</math></b>	11.0 kW	
<b>Rated Speed <math>n_N</math></b>	3000 rpm	
<b>Rated Torque (100 K) <sup>**1</sup> <math>M_N</math></b>	35.1 Nm	
<b>Rated Current (100 K) <sup>**1</sup> <math>I_N</math></b>	18.2 A	
<b>Stall Torque (100 K) <sup>**1</sup> <math>M_O</math></b>	62.5 Nm	
<b>Stall Current (100 K) <sup>**1</sup> <math>I_O</math></b>	29.8 A	
<b>Maximum Current (for <math>\leq 200</math> ms) <math>I_{max}</math></b>	113.0 A	
<b>Maximum Torque (for <math>\leq 200</math> ms) <math>M_{max}</math></b>	210 Nm	
<b>Maximum Speed</b>	3900 rpm	
<b>Pole Pairs <math>PZ</math></b>	4	
<b>Winding Resistance (in one phase)</b>	0.12 $\Omega$	
<b>Winding Inductance (in one phase)</b>	2.1 mH	
<b>Weight <math>m</math></b>	<u>134.5 lb</u> 61 kg	<u>153.0 lb</u> 69.3 kg
<b>Rotor Inertia <math>J</math></b>	290 kgcm <sup>2</sup>	299 kgcm <sup>2</sup>
<b>Rated Voltage for Brake <math>U_{Br}</math></b>		24 VDC
<b>Rated Current for Brake <math>I_{Br}</math></b>		1.7 A
<b>Holding Torque for Brake <math>M_{Br}</math></b>		70 Nm

(100K) <sup>\*\*1</sup> 100 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

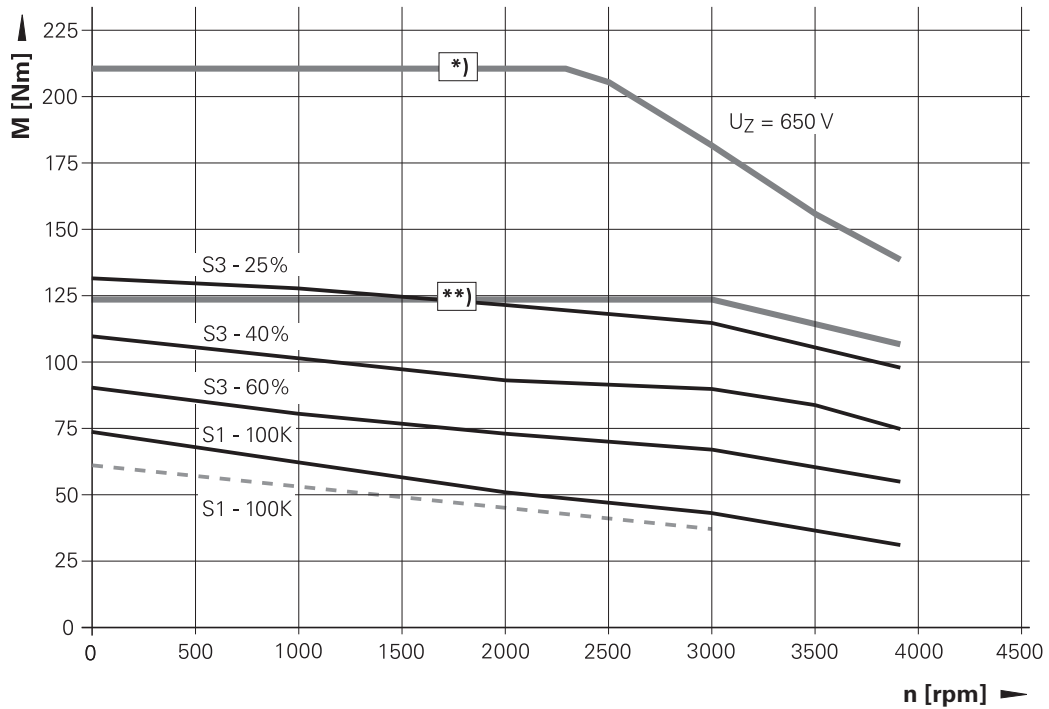
### AM 1900P-E Series - Speed-Torque Characteristics Graph

Refer to Figure 7-41.

- Characteristic curve according to specifications
- Measured characteristic curve of one motor

\*)  $M_{max} = 210 \text{ Nm}$  when  $I_{max} = 113 \text{ A}$

\*\*\*)  $M_{max} = 123 \text{ Nm}$  when  $I_{max} = 64 \text{ A}$



**Figure 7-41, AM 1900P-E Series - Speed-Torque Characteristics Graph**

**NOTE:** In the performance diagram, the characteristic curves are shown as broken lines.

The diagram shows the characteristic curves as determined on a test stand for one motor mounted without thermal insulation.

**Axis Motors Dimension Drawings**

The dimensional drawings for the following Axis Motors are illustrated:

- ❑ **AM 960 Series – AM 960A and AM 960AB**
- ❑ **AM 960 Series – Connector illustrations**
- ❑ **AM 1160, AM1160-E Series – AM 1160A and AM 1160AB, AM 1160C, and AM 1160CB, AM 1160E and AM 1160EB, AM 1160D-E and AM 1160DB-E, AM 1160K-E and AM1160KB-E**
- ❑ **AM 1160 Series – Connector illustrations**
- ❑ **AM 1300-E Series – AM 1300A–E and AM 1300AB–E, AM 1300C–E and AM 1300CB–E, AM 1300K-E and AM 1300KB-E, AM 1300M-E and AM 1300MB-E**
- ❑ **AM 1300-E Series – Connector Illustrations**
- ❑ **AM 1550 Series – AM 1550C and AM 1550CB, AM 1550E and AM 1550EB, AM 1550G and AM 1550GB**
- ❑ **AM 1550 Series – Connector illustrations**
- ❑ **AM 1550-E Series - AM 1550A–E and AM 1550AB–E, AM 1550C–E and AM 1550CB–E, AM 1550D–E and AM 1550DB–E, AM 1550G–E and AM 1550GB–E, AM 1550K–E and AM 1550KB–E, AM 1550M–E and AM 1550MB–E, AM 1550N–E and AM 1550NB–E, AM 1550P–E and AM 1550PB–E**
- ❑ **AM 1900-E Series - AM 1900K–E and AM 1900KB–E, AM 1900M–E and AM 1900MB–E, AM 1900N–E and AM 1900NB–E, AM 1900P–E and AM 1550PB–E**
- ❑ **AM 1900-E Series – Connector illustrations**

### AM 960 Series - Dimensional Drawing

Refer to Figure 7-42, Table 7-42, and Figure 7-43.

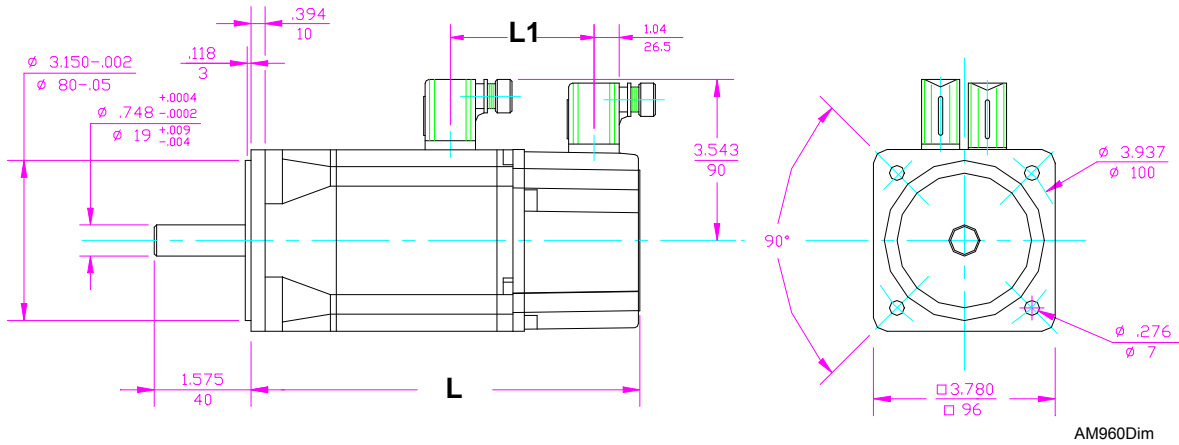


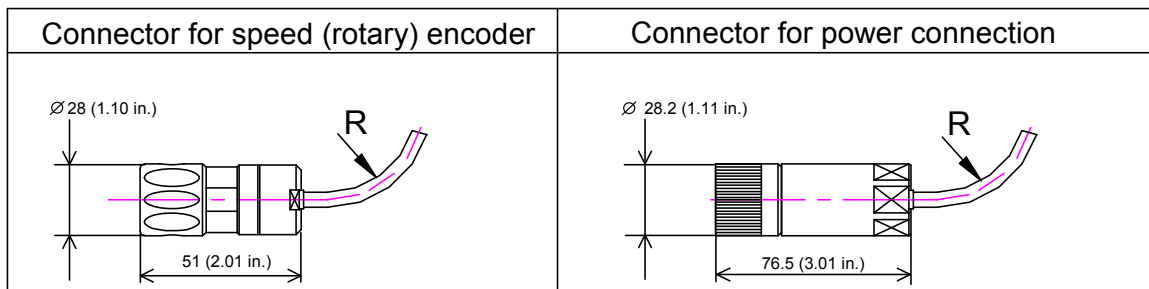
Figure 7-42, AM 960A and AM 960AB - Dimensional Drawing

Table 7-42, AM 960 Series - Motor Dimensions

Motor	L	L1
AM 960A (without brake)	<u>10.55 in</u> 268 mm	<u>2.76 in</u> 70 mm
AM 960AB (with brake)	<u>12.13 in</u> 308 mm	<u>4.25 in</u> 108 mm

### AM 960 Series - Connector Illustrations

Refer to Figure 7-43. Refer to Table 7-6, Maximum Bend Radii of Cables.

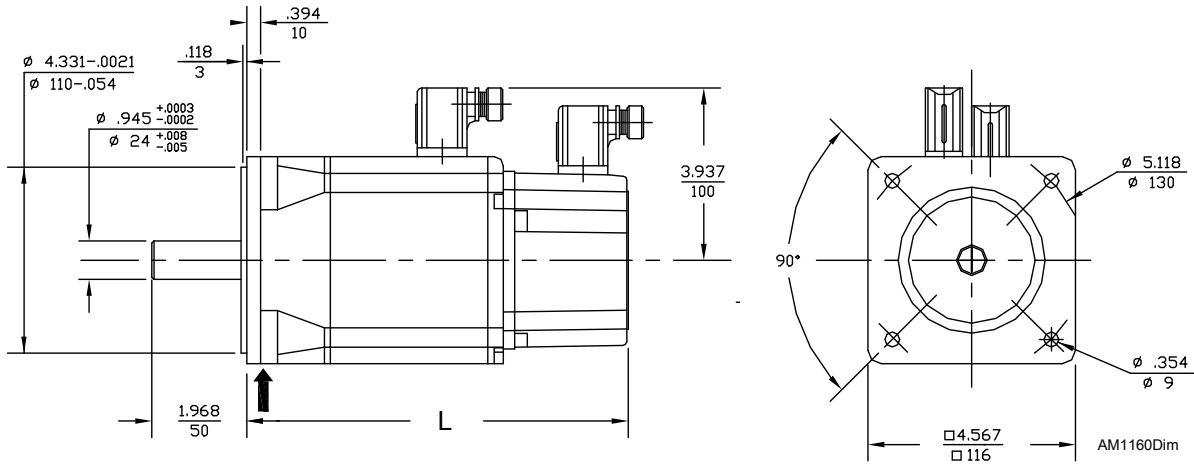


AMConnector

Figure 7-43, AM 960 Series, AM 1160 Series, AM 1300 Series - Connector Illustrations

**AM 1160, AM 1160-E Series - Dimensional Drawing**

Refer to Figure 7-44 and Table 7-43.



**Figure 7-44, AM 1160 Series - Dimensional Drawing**

**Table 7-43, AM 1160 Series - Motor Dimensions**

Motor	L
<b>AM 1160A (without brake)</b>	<u>8.70 in</u> 221 mm
<b>AM 1160AB (with brake)</b>	<u>10.11 in</u> 257 mm
<b>AM 1160C (without brake)</b>	<u>9.72 in</u> 246 mm
<b>AM 1160CB (with brake)</b>	<u>11.10 in</u> 282 mm
<b>AM 1160E (without brake)</b> <b>AM 1160D-E (without brake)</b> <b>AM 1160K-E (without brake)</b>	<u>11.65 in</u> 296 mm
<b>AM 1160EB (with brake)</b> <b>AM 1160DB-E (with brake)</b> <b>AM 1160KB-E (with brake)</b>	<u>3.07 in</u> 332 mm

**AM 1160 Series - Connector Illustrations**

Refer to Figure 7-43, AM 960 Series, AM 1160 Series, AM 1300 Series - Connector Illustrations.

### AM 1300-E Series - Dimensional Drawing

Refer to Figure 7-45 and Table 7-44.

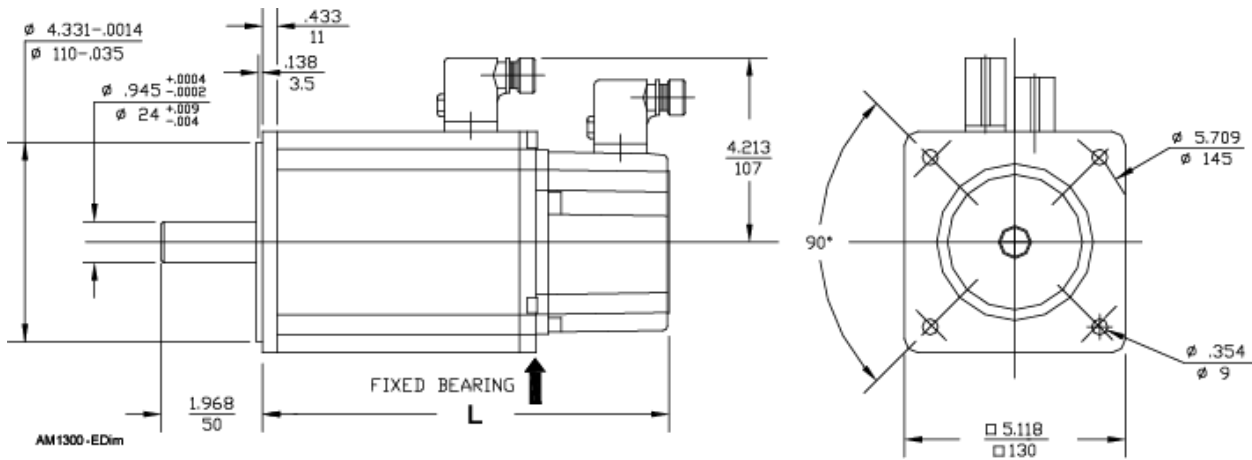


Figure 7-45, AM 1300-E Series - Dimensional Drawing

Table 7-44, AM 1300-E Series - Motor Dimensions

Motor	L
AM 1300A-E (without brake)	<u>8.29 in</u> 210.5 mm
AM 1300AB-E (with brake)	<u>9.94 in</u> 252.5 mm
AM 1300C-E (without brake)	<u>9.11 in</u> 231.5 mm
AM 1300CB-E (with brake)	<u>10.77 in</u> 273.5 mm
AM 1300K-E (without brake)	<u>8.29 in</u> 210.5 mm
AM 1300KB-E (with brake)	<u>9.94 in</u> 252.5 mm
AM 1300M-E (without brake)	<u>9.11 in</u> 231.5 mm
AM 1300MB-E (with brake)	<u>10.77 in</u> 273.5 mm

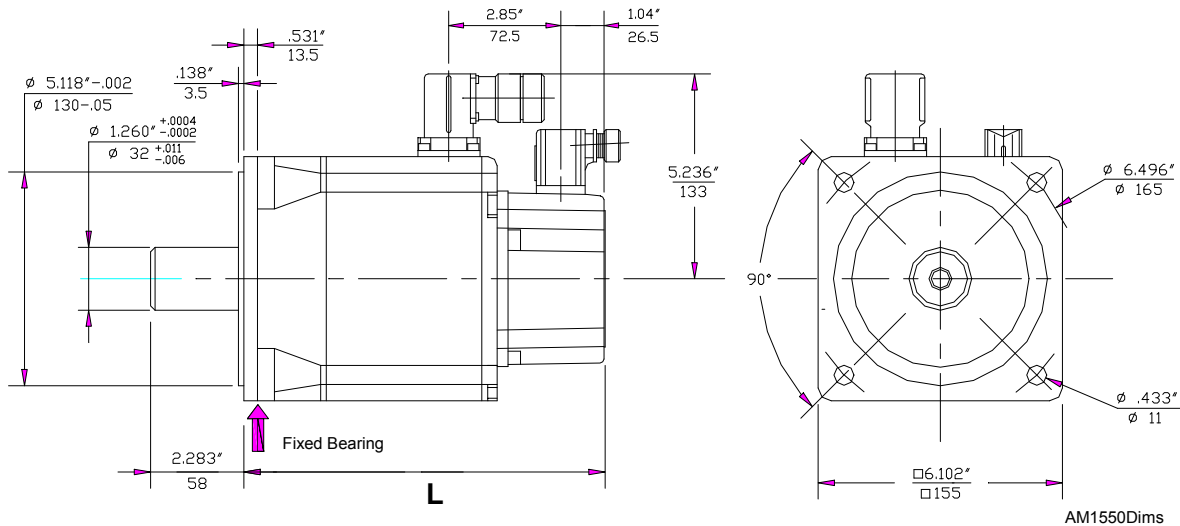
### AM 1300-E Series - Connector Illustrations

Refer to Figure 7-43, AM 960 Series, AM 1160 Series, AM 1300 Series - Connector Illustrations.



**AM 1550 Series - Dimensional Drawing**

Refer to Figure 7-46 and Table 7-45.



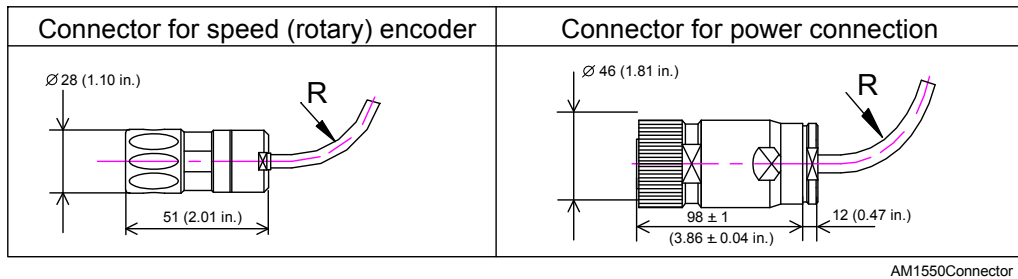
**Figure 7-46, AM 1550 Series - Dimensional Drawing**

**Table 7-45, AM 1550 Series - Motor Dimensions**

Motor	L
AM 1550C (without brake)	<u>10.20 in</u> 259 mm
AM 1550CB (with brake)	<u>11.93 in</u> 303 mm
AM 1550E (without brake)	<u>11.93 in</u> 303 mm
AM 1550EB (with brake)	<u>13.66 in</u> 347 mm
AM 1550G (without brake)	<u>13.66 in</u> 347 mm
AM 1550GB (with brake)	<u>15.19 in</u> 386 mm

**AM 1550 Series - Connector Illustrations**

Refer to Figure 7-47. Refer to Table 7-6, Maximum Bend Radii of Cables.



**Figure 7-47, AM 1550 Series - Connector Illustrations**

### AM 1550-E Series - Dimensional Drawing

Refer to Figure 7-48 and Table 7-46.

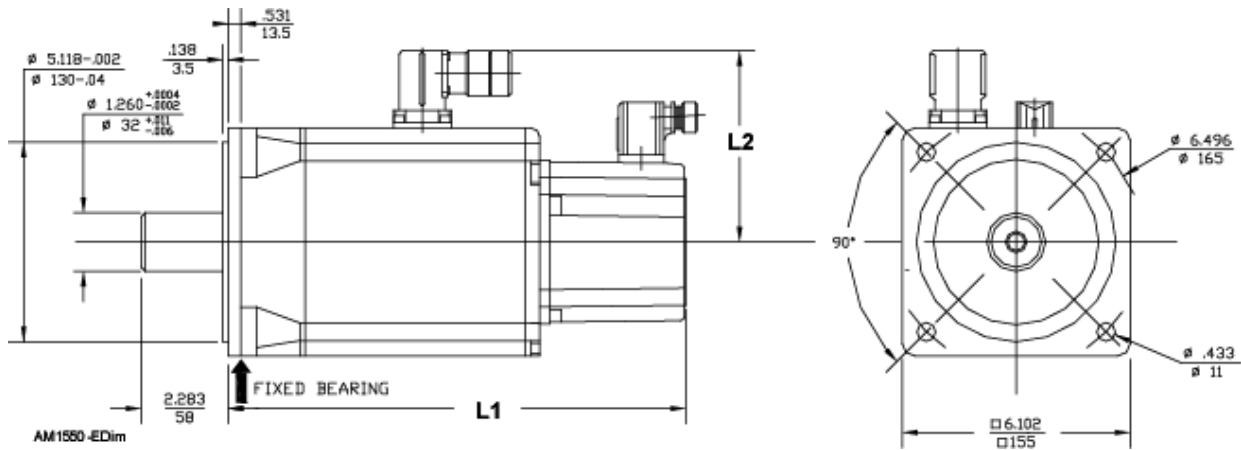


Figure 7-48, AM 1550-E Series - Dimensional Drawing

Table 7-46, AM 1550-E Series - Motor Dimensions

Motor	L1	L2
AM 1550A-E (without brake)	<u>10.20 in</u> 259 mm	<u>4.69 in</u> 119 mm
AM 1550AB-E (with brake)	<u>11.93 in</u> 303 mm	
AM 1550C-E (without brake)	<u>11.06 in</u> 281 mm	<u>4.69 in</u> 119 mm
AM 1550CB-E (with brake)	<u>12.80 in</u> 325 mm	
AM 1550D-E (without brake)	<u>11.93 in</u> 303 mm	<u>4.69 in</u> 119 mm
AM 1550DB-E (with brake)	<u>13.66 in</u> 347 mm	
AM 1550G-E (without brake)	<u>13.66 in</u> 347 mm	<u>5.24 in</u> 133 mm
AM 1550GB-E (with brake)	<u>15.20 in</u> 386 mm	
AM 1550K-E (without brake)	<u>10.20 in</u> 259 mm	<u>4.69 in</u> 119 mm
AM 1550KB-E (with brake)	<u>11.93 in</u> 303 mm	
AM 1550M-E (without brake)	<u>11.06 in</u> 281 mm	<u>4.69 in</u> 119 mm
AM 1550MB-E (with brake)	<u>12.80 in</u> 325 mm	

(Continued...)

**Table 7-46, AM 1550-E Series - Motor Dimensions (Continued)**

<b>Motor</b>	<b>L1</b>	<b>L2</b>
<b>AM 1550N-E (without brake)</b>	<u>11.93 in</u> 303 mm	<u>4.69 in</u> 119 mm
<b>AM 1550NB-E (with brake)</b>	<u>13.66 in</u> 347 mm	
<b>AM 1550P-E (without brake)</b>	<u>13.66 in</u> 347 mm	<u>5.24 in</u> 133 mm
<b>AM 1550PB-E (with brake)</b>	<u>15.20 in</u> 386 mm	

**AM 1550-E Series - Connector Illustrations**

Refer to **Figure 7-47, AM 1550 Series - Connector Illustrations**. Refer to **Table 7-6, Maximum Bend Radii of Cables**.

### AM 1900-E Series - Dimensional Drawing

Refer to Figure 7-49 and Table 7-47.

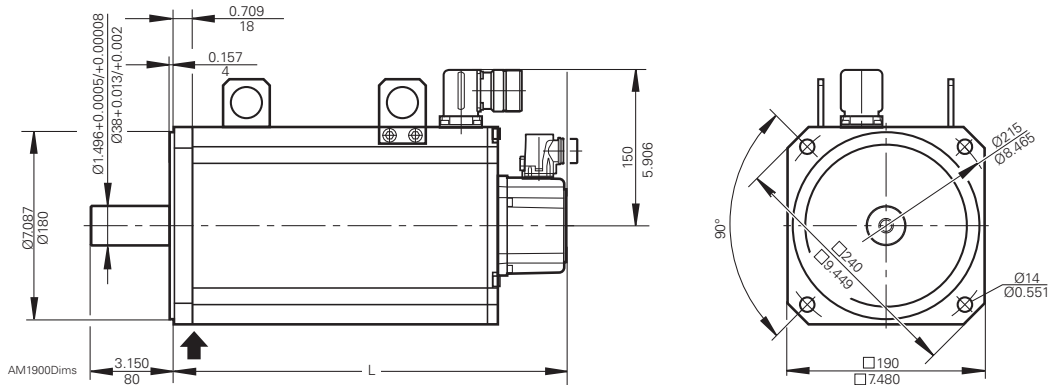


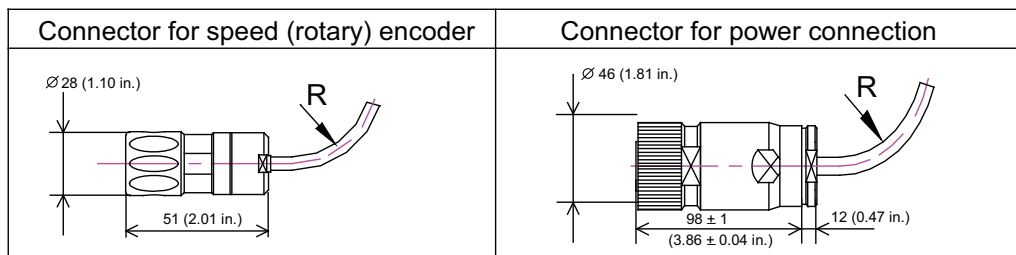
Figure 7-49, AM 1900-E Series - Dimensional Drawing

Table 7-47, AM 1900-E Series - Motor Dimensions

Motor	L
AM 1900K-E (without brake)	<u>12.83 in</u> 326 mm
AM 1900KB-E (with brake)	<u>14.80 in</u> 376 mm
AM 1900M-E (without brake)	<u>13.82 in</u> 351 mm
AM 1900MB-E (with brake)	<u>15.79 in</u> 401 mm
AM 1900N-E (without brake)	<u>15.79 in</u> 401 mm
AM 1900NB-E (with brake)	<u>17.76 in</u> 451 mm
AM 1900P-E (without brake)	<u>19.72 in</u> 501 mm
AM 1900PB-E (with brake)	<u>21.69 in</u> 551 mm

### AM 1900-E Series - Connector Illustrations

Refer to Figure 7-50. Refer to Table 7-6, Maximum Bend Radii of Cables.



AM1900Connector

Figure 7-50, AM 1900-E Series - Connector Illustrations

## Spindle Motors - SM Series

In general, the spindle (asynchronous) motor designation is of the form SM ppp where: SM = Spindle Motor – ppp = rated power in kW

Spindle motors offer the following features:

- Rotary encoder for speed measurement
- Precision balancing – spindle (asynchronous) motor can be balanced at any time
- Separate cooling via integrated fan
- IM B5 design, per EN 60 034-7 requirements (for securing by flange/base)
- Protection class IP 54, per EN 60 529 requirements
- Cylindrical shaft end per DIN 748 with feather key and threaded central bore hole per ISO 866 BS5 requirements
- Flange dimensions per DIN 42 948 and IEC 72 requirements
- Maintenance-free bearings
- Separate cooling through integral fan
- Resistor probe to monitor temperature in the stator winding
- Thermal Class F
- Vibration severity grade S for A and B family; SR for C, D, E, F, G, and H family
- Feather-key balanced

The following topics are described:

- ❑ **Spindle Motors General Technical Information**
- ❑ **Spindle Motors Mechanical Life**
- ❑ **Shaft Bearings**
- ❑ **Shaft End**
- ❑ **SM 055, SM 075, SM 100 Specifications Summary**
- ❑ **SM 055 - Specifications**
- ❑ **SM 055 - Power and Torque Characteristics**
- ❑ **SM 075 - Specifications**
- ❑ **SM 075 - Power and Torque Characteristics**
- ❑ **SM 100 - Specifications**
- ❑ **SM 100 - Power and Torque Characteristics**
- ❑ **SM 120, SM 150, SM 240- Specifications Summary**
- ❑ **SM 120 - Specifications**
- ❑ **SM 120 - Power and Torque Characteristics**
- ❑ **SM 150 - Specifications**

- ❑ **SM 150 - Power and Torque Characteristics**
- ❑ **SM 200 - Specifications**
- ❑ **SM 200 - Power and Torque Characteristics**
- ❑ **SM 240 - Specifications**
- ❑ **SM 240 - Power and Torque Characteristics**
- ❑ **Spindle Motors Dimension Drawings**
- ❑ **SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, SM 240 - Connector for Speed (Rotary) Encoder**
- ❑ **SM 055, SM 075, SM 100 - Dimensional Drawing**
- ❑ **SM 120, SM 240 - Dimensional Drawing**
- ❑ **SM 150 - Dimensional Drawing**
- ❑ **SM 200 - Dimensional Drawing**

### **Spindle Motors General Technical Information**

The specifications and the characteristic curves apply to motors mounted without thermal insulation. The temperature of the winding may differ from the maximum permissible ambient temperature of 40°C by a maximum of 1005. If the motor is mounted so that it is thermally insulated, it is necessary to reduce the motor torque in order to avoid thermal overloading o the motor.

### **Spindle Motors Mechanical Life**

The service life of the bearings depends on the shaft load and the mean rotational speed (see “**Permissible Forces on the Motor Shaft**”).

### Shaft Bearing

The spindle (asynchronous) motor is equipped with maintenance-free bearings. The shaft bearing is optionally available as either standard bearing or as spindle bearing. The version with spindle bearing can withstand greater lateral forces and allows higher spindle speeds:

- Standard bearing: maximum 8000/9000 rpm
- Spindle bearing: maximum 10000/12000 rpm

Motors with spindle bearing have slightly larger overall length.

### Shaft End

The spindle (asynchronous) motors have a cylindrical shaft end as per DIN 748 with a centering hold as per DIN 332-DR.

Spindle (asynchronous) motors with standard bearing are supplied with keyway and feather key as per DIN 6885 Sheet 1 and are balanced. They are also available with smooth shaft upon request.

Feather key (see **Table 7-16, Feather Key Specifications**):

SM 075: AS 10 x 8 x 70

SM 200: AS 12 x 8 x 90

The standard version of the spindle (asynchronous) motors with spindle bearing has a smooth shaft (without keyway and feather key). Upon request, it is available with keyway and feather key as per DIN 6885 Sheet 1.

### SM 055, SM 075, SM 100 Specifications Summary

Refer to Table 7-48.

Table 7-48, SM 055, SM 075, SM 100 – Specifications Summary

	SM 055	SM 075	SM 100
Reference for details	Table 7-48	Table 7-51	Table 7-53
Fan	+ <sup>**1</sup>	+	+
Holding Brake	- <sup>**2</sup>	-	-
Rated Voltage $U_N$	250 V	305 V	330 V
Rated power output $P_N$	5.5 kW	7.5 kW	10.0 kW
Rated speed $n_N$ (105 K) <sup>**3</sup>	1500 rpm		
Rated torque $M_N$ (105 K) <sup>**3</sup>	35.0 Nm	47.8 Nm	63.7 Nm
Rated current $I_N$	18.0 A	20.1 A	25 A
Efficiency $\eta$	0.85		
Maximum Continuous Speed $n_{\max \text{ cont}}$ with standard bearing with spindle bearing	7,500 rpm 10,000 rpm		
Maximum Speed <sup>**4</sup> $n_{\max}$ with standard bearing with spindle bearing	9,000 rpm 12,000 rpm		
Maximum Current $I_{\max}$	33 A	36 A	44 A
Pole Pairs $PZ$	2		
Weight $m$	$\frac{112.4 \text{ lb}}{51 \text{ kg}}$	$\frac{149.9 \text{ lb}}{68 \text{ kg}}$	$\frac{182.9 \text{ lb}}{83 \text{ kg}}$
Rotor Inertia $J$	245 kgcm <sup>2</sup>	353 kgcm <sup>2</sup>	405 kgcm <sup>2</sup>

#### Fan

Rated Voltage for Fan $U_L$	3 x 400 V
Rated Current for Fan $I_L$	0.31 A
Frequency $f_L$	50 Hz/60 Hz

+<sup>\*\*1</sup> + Available

-<sup>\*\*2</sup> - Not Available

<sup>\*\*3</sup> 105 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

<sup>\*\*4</sup> For cycle duration of 10 minutes: 3 min.( $n_{\max}$ ); 6 min.  $\frac{2}{3} \times (n_{\max})$ ; standstill of 1 min.



**SM 055 - Specifications**

Refer to Table 7-49 and “SM 055 - Power and Torque Characteristics.”

**Table 7-49, SM 055 - Specifications**

		<b>SM 055</b>	
<b>P/N</b>	<b>With Key</b>	With standard bearing 34100625	With spindle bearing 34100626
<b>P/N</b>	<b>Without Key</b>	With standard bearing 34100627	With spindle bearing 34100628
<b>Rated Voltage <math>U_N</math></b>		250 V	
<b>Rated Power Output <math>P_N</math></b>		5.5 kW	
<b>Rated Speed <math>n_N</math> (105 K) **1</b>		1500 rpm	
<b>Rated Torque <math>M_N</math> (105 K) **1</b>		35.0 Nm	
<b>Rated Current <math>I_N</math></b>		18.0 A	
<b>Efficiency <math>\eta</math></b>		0.85	
<b>Maximum Continuous Speed <math>n_{max\ cont}</math></b>		7500 rpm	9000 rpm
<b>Maximum Speed **2 <math>n_{max}</math></b>		9000 rpm	12000 rpm
<b>Maximum Current <math>I_{max}</math></b>		33 A	
<b>Pole Pairs <math>PZ</math></b>		2	
<b>Weight <math>m</math></b>		112.4 lb 51 kg	
<b>Rotor Inertia <math>J</math></b>		245 kgcm <sup>2</sup>	

\*\*1 105 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

\*\*2 For cycle duration of 10 minutes: 3 min.( $n_{max}$ ); 6 min. 2/3 x ( $n_{max}$ ); standstill of 1 min

**Fan**

<b>Rated Voltage for Fan <math>U_L</math></b>	3 x 400 V
<b>Rated Current for Fan <math>I_L</math></b>	0.31 A
<b>Frequency <math>f_L</math></b>	50 Hz/60 Hz

**Accessories**

<b>Power Cable, without Connector</b>	Up to 24.7 A, P/N 34201301
<b>Cable for Fan, without Connector</b>	P/N 34201310
<b>Encoder Cable, Complete with Connectors</b>	P/N 342000xx

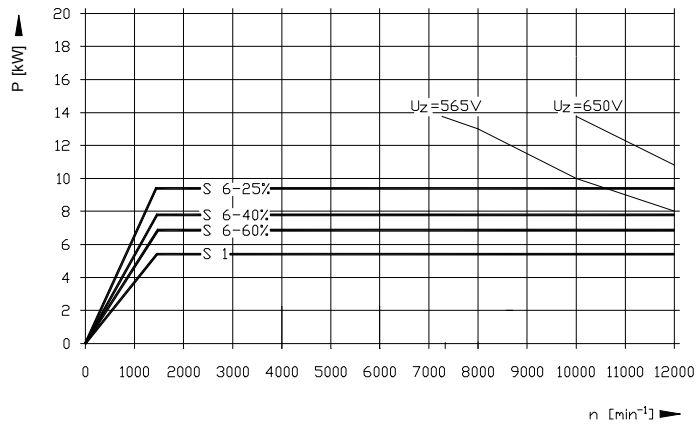
### SM 055 - Power and Torque Characteristics

Refer to Table 7-50, Figure 7-51, and Figure 7-52.

**Table 7-50, SM 055 - Power and Torque Characteristics**

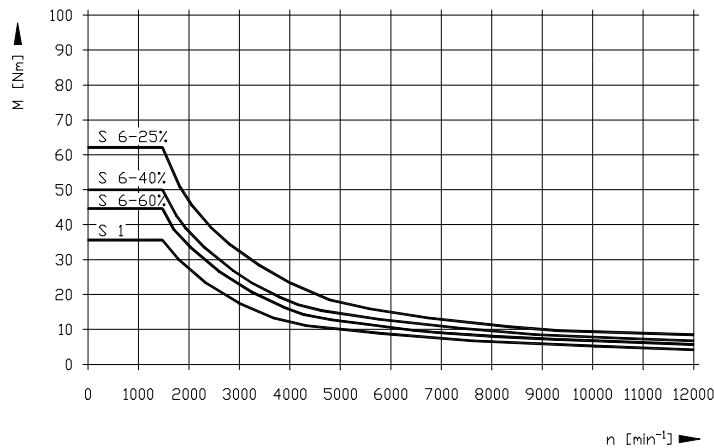
Duty Cycle	Speed n	Power P	Torque M	Current I (for 1500 rpm)
<b>S1</b>	1500 rpm	5.5 kW	35.1 Nm	18.0 A
	6000 rpm	5.5 kW	8.8 Nm	—
	12000 rpm	5.5 kW	4.4 Nm	—
<b>S6-60%</b>	1500 rpm	7.0 kW	44.7 Nm	22.0 A
	6000 rpm	7.0 kW	11.2 Nm	—
	12000 rpm	7.0 kW	5.6 Nm	—
<b>S6-40%</b>	1500 rpm	7.9 kW	50.4 Nm	24.0 A
	6000 rpm	7.9 kW	12.6 Nm	—
	12000 rpm	7.9 kW	6.3 Nm	—
<b>S6-25%</b>	1500 rpm	9.5 kW	60.7 Nm	28.0 A
	6000 rpm	9.5 kW	15.2 Nm	—
	12000 rpm	9.5 kW	7.6 Nm	—

### SM 055 - Power Characteristics Graph



**Figure 7-51, SM 055 - Power Characteristics Graph**

### SM 055 - Torque Characteristics Graph



**Figure 7-52, SM 055 - Torque Characteristics**

**SM 075 - Specifications**

Refer to Table 7-51 and “SM 075 - Power and Torque Characteristics.”

**Table 7-51, SM 075 - Specifications**

		<b>SM 075</b>	
<b>P/N</b>	<b>With Key</b>	With standard bearing 34100630	With spindle bearing 34100631
<b>P/N</b>	<b>Without Key</b>	With standard bearing 34100632	With spindle bearing 34100633
<b>Rated Voltage <math>U_N</math></b>		305 V	
<b>Rated Power Output <math>P_N</math></b>		7.5 kW	
<b>Rated Speed <math>n_N</math> (105 K) <sup>**1</sup></b>		1500 rpm	
<b>Rated Torque <math>M_N</math> (105 K) <sup>**1</sup></b>		47.8 Nm	
<b>Rated Current <math>I_N</math></b>		20.1 A	
<b>Efficiency <math>\eta</math></b>		0.85	
<b>Maximum Continuous Speed <math>n_{max\ cont}</math></b>		7500 rpm	10000 rpm
<b>Maximum Speed <sup>**2</sup> <math>n_{max}</math></b>		9000 rpm	1200 rpm
<b>Maximum Current <math>I_{max}</math></b>		at 9,000 rpm 36 A at 12,000 rpm 36 A	
<b>Pole Pairs <math>PZ</math></b>		2	
<b>Weight <math>m</math></b>		<u>149.9 lb</u> 68 kg	
<b>Rotor Inertia <math>J</math></b>		353 kgcm <sup>2</sup>	

<sup>\*\*1</sup> 105 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

<sup>\*\*2</sup> For cycle duration of 10 minutes: 3 min.( $n_{max}$ ); 6 min. 2/3 x ( $n_{max}$ ); standstill of 1 min.

**Fan**

<b>Rated Voltage for Fan <math>U_L</math></b>	3 x 400 V
<b>Rated Current for Fan <math>I_L</math></b>	0.31 A
<b>Frequency <math>f_L</math></b>	50 Hz/60 Hz

**Accessories**

<b>Power Cable, without Connector</b>	Up to 24.7 A, P/N 34201301
<b>Cable for Fan, without Connector</b>	P/N 34201310
<b>Encoder Cable, Complete with Connectors</b>	P/N 342000xx

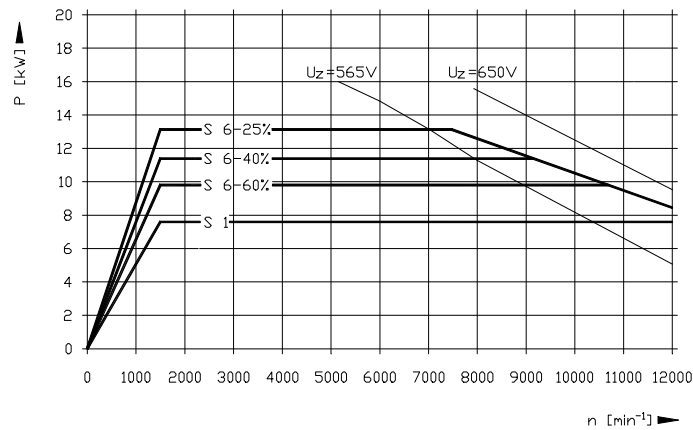
### SM 075 - Power and Torque Characteristics

Refer to Table 7-52, Figure 7-53, and Figure 7-54.

**Table 7-52, SM 075 - Power and Torque Characteristics**

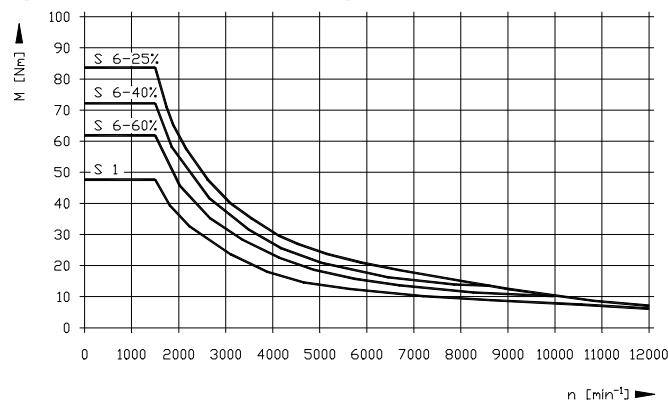
Duty Cycle	Speed n	Power P	Torque M	Current I (for 1500 rpm)
<b>S1</b>	1500 rpm	7.5 kW	47.9 Nm	20.1 A
	6000 rpm	7.5 kW	12.0 Nm	—
	12000 rpm	7.5 kW	6.0 Nm	—
<b>S6-60%</b>	1500 rpm	9.8 kW	62.6 Nm	24.0 A
	10700 rpm	9.8 kW	23.4 Nm	—
	12000 rpm	8.5 kW	6.8 Nm	—
<b>S6-40%</b>	1500 rpm	11.5 kW	73.4 Nm	27.0 A
	9000 rpm	11.5 kW	27.5 Nm	—
	12000 rpm	8.5 kW	6.8 Nm	—
<b>S6-25%</b>	1500 rpm	13.0 kW	83.0 Nm	31.0 A
	7500 rpm	13.0 kW	16.6 Nm	—
	12000 rpm	8.5 kW	6.8 Nm	—

### SM 075 - Power Characteristics Graph



**Figure 7-53, SM 075 - Power Characteristics Graph**

### SM 075 - Torque Characteristics Graph



**Figure 7-54, SM 075 - Torque Characteristics Graph**

**SM 100 - Specifications**

Refer to Table 7-53 and “SM 100 - Power and Torque Characteristics.”

**Table 7-53, SM 100 - Specifications**

		<b>SM 100F</b>	
<b>P/N</b>	<b>With Key</b>	With standard bearing 34100635	With spindle bearing 34100636
<b>P/N</b>	<b>Without Key</b>	With standard bearing 34100637	With spindle bearing 34100638
<b>Rated Voltage <math>U_N</math></b>		330 V	
<b>Rated Power Output <math>P_N</math></b>		10.0 kW	
<b>Rated Speed <math>n_N</math></b>		1500 rpm	
<b>Rated Torque <math>M_N</math> (105 K) <sup>**1</sup></b>		63.7 Nm	
<b>Rated Current <math>I_N</math> (105 K) <sup>**1</sup></b>		25 A	
<b>Efficiency <math>\eta</math></b>		0.85	
<b>Maximum Continuous Speed <math>n_{max\ cont}</math></b>		7500 rpm	10000 rpm
<b>Maximum Speed <sup>**2</sup> <math>n_{max}</math></b>		9000 rpm	12000 rpm
<b>Maximum Current <math>I_{max}</math></b>		44 A	
<b>Pole Pairs <math>PZ</math></b>		2	
<b>Weight <math>m</math></b>		<u>182.9 lb</u> 83 kg	
<b>Rotor Inertia <math>J</math></b>		405 kgcm <sup>2</sup>	

<sup>\*\*1</sup> 105 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

<sup>\*\*2</sup> For cycle duration of 10 minutes: 3 min.( $n_{max}$ ); 6 min. 2/3 x ( $n_{max}$ ); standstill of 1 min.

**Fan**

<b>Rated Voltage for Fan <math>U_L</math></b>	3 x 400 V
<b>Rated Current for Fan <math>I_L</math></b>	0.31 A
<b>Frequency <math>f_L</math></b>	50 Hz/60 Hz

**Accessories**

<b>Power Cable, without Connector</b>	Up to 29.8 A, P/N 34201302
<b>Cable for Fan, without Connector</b>	P/N 34201310
<b>Encoder Cable, Complete with Connectors</b>	P/N 342000xx

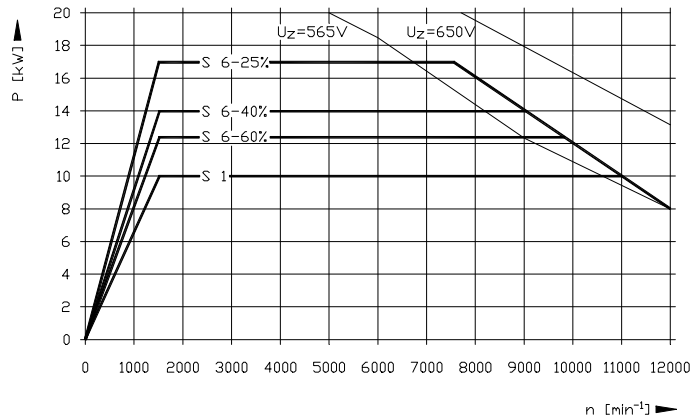
### SM 100 - Power and Torque Characteristics

Refer to Table 7-54, Figure 7-55, and Figure 7-56.

**Table 7-54, SM 100 - Power and Torque Characteristics**

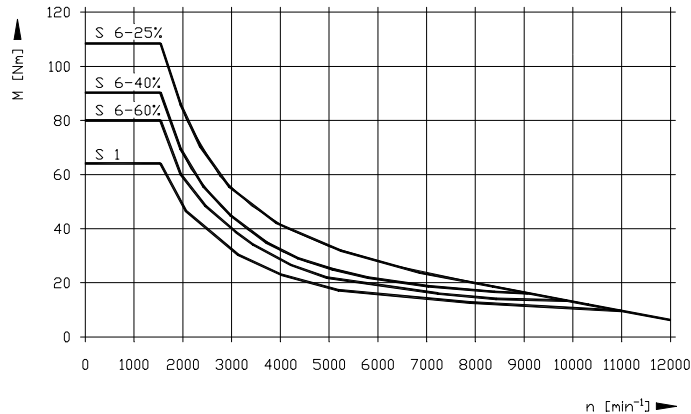
Duty Cycle	Speed n	Power P	Torque M	Current I (for 1500 rpm)
<b>S1</b>	1500 rpm	10.0 kW	63.9 Nm	25.0 A
	11000 rpm	10.0 kW	23.9 Nm	—
	12000 rpm	8.0 kW	6.4 Nm	—
<b>S6-60%</b>	1500 rpm	12.5 kW	79.8 Nm	29.0 A
	9800 rpm	12.5 kW	12.2 Nm	—
	12000 rpm	8.0 kW	6.4 Nm	—
<b>S6-40%</b>	1500 rpm	14.0 kW	89.4 Nm	32.0 A
	9000 rpm	14.0 kW	19.1 Nm	—
	12000 rpm	8.0 kW	6.4 Nm	—
<b>S6-25%</b>	1500 rpm	17.0 kW	108.6 Nm	37.0 A
	7500 rpm	17.0 kW	21.7 Nm	—
	12000 rpm	8.0 kW	6.4 Nm	—

### SM 100 - Power Characteristics Graph



**Figure 7-55, SM 100 - Power Characteristics Graph**

### SM 100 - Torque Characteristics Graph



**Figure 7-56, SM 100 - Torque Characteristics Graph**

**SM 120, SM 150, SM 200, SM 240 Specifications Summary**

Refer to **Table 7-55**.

**Table 7-55, SM 120, SM 150, SM 200, SM 240 – Specifications Summary**

	<b>SM 120</b>	<b>SM 150</b>	<b>SM 200</b>	<b>SM 240</b>
<b>Reference for details</b>	<b>Table 7-55</b>	<b>Table 7-58</b>	<b>Table 7-60</b>	<b>Table 7-62</b>
<b>Fan</b>	+ <sup>**1</sup>	+	+	+
<b>Holding Brake</b>	- <sup>**2</sup>	-	-	-
<b>Rated Voltage <math>U_N</math></b>	335 V	348 V	331 V	318 V
<b>Rated power output <math>P_N</math></b>	12 kW	15 kW	20 kW	24 kW
<b>Rated speed <math>n_N</math></b>	750 rpm	1500 rpm		
<b>Rated torque <math>M_N</math> (105 K)<sup>**3</sup></b>	152.8 Nm	95.5 Nm	127.3 Nm	152.8 Nm
<b>Rated current <math>I_N</math> (105 K)<sup>**3</sup></b>	29.0 A	35.0 A	46.0 A	58.0
<b>Efficiency <math>\eta</math></b>	0.85			
<b>Maximum Continuous Speed <math>n_{max\ cont}</math></b> with standard bearing with spindle bearing	7000 rpm —	7000 rpm 8500 rpm		
<b>Maximum Speed<sup>**4</sup> <math>n_{max}</math></b> with standard bearing with spindle bearing	8000 rpm —	8000 rpm 10000 rpm		
<b>Maximum Current <math>I_{max}</math></b>	62 A	70 A	96 A	116 A
<b>Pole Pairs <math>PZ</math></b>	2			
<b>Weight <math>m</math></b>	<u>348.3 lb</u> 158 kg	<u>246.8 lb</u> 112 kg	<u>297.6 lb</u> 135 kg	<u>348.3 lb</u> 158 kg
<b>Rotor Inertia <math>J</math></b>	1100 kgcm <sup>2</sup>	700 kgcm <sup>2</sup>	920 kgcm <sup>2</sup>	1100 kgcm <sup>2</sup>
<b>Protection</b>	IP 54			

**Fan**

<b>Rated Voltage for Fan <math>U_L</math></b>	3 x 400 V
<b>Rated Current for Fan <math>I_L</math></b>	0.25 A
<b>Frequency <math>f_L</math></b>	50 Hz/60 Hz

+<sup>\*\*1</sup> + Available

-<sup>\*\*2</sup> - Not Available

<sup>\*\*3</sup> 105 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

<sup>\*\*4</sup> For cycle duration of 10 minutes: 3 min.( $n_{max}$ ); 6 min.  $2/3 \times (n_{max})$ ; standstill of 1 min.

### SM 120 - Specifications

Refer to Table 7-56 and “SM 120 - Power and Torque Characteristics.”

Table 7-56, SM 120 - Specifications

		SM 120E
P/N	With Key	With standard bearing 34100640
P/N	Without Key	With standard bearing 34100642
Rated Voltage $U_N$		335 V
Rated Power Output $P_N$		12 kW
Rated Speed $n_N$		750 rpm
Rated Torque $M_N$ (105 K) <sup>**1</sup>		152.8 Nm
Rated Current $I_N$ (105 K) <sup>**1</sup>		29.0 A
Efficiency $\eta$		0.85
Maximum Continuous Speed $n_{\max \text{ cont}}$		7000 rpm
Maximum Speed <sup>**2</sup> $n_{\max}$		8000 rpm
Maximum Current $I_{\max}$		62 A
Pole Pairs PZ		2
Weight m		<u>348.3 lb</u> 158 kg
Rotor Inertia J		1100 kgcm <sup>2</sup>
Protection		IP 54

\*\*1 105 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

\*\*2 For cycle duration of 10 minutes: 3 min.( $n_{\max}$ ); 6 min. 2/3 x ( $n_{\max}$ ); standstill of 1 min.

#### Fan

Rated Voltage for Fan $U_L$	3 x 400 V
Rated Current for Fan $I_L$	0.25 A
Frequency $f_L$	50 Hz/60 Hz

#### Accessories

Power Cable, without Connector	P/N 34201306
Cable for Fan, without Connector	P/N 34201310
Encoder Cable, Complete with Connectors	P/N 342000xx



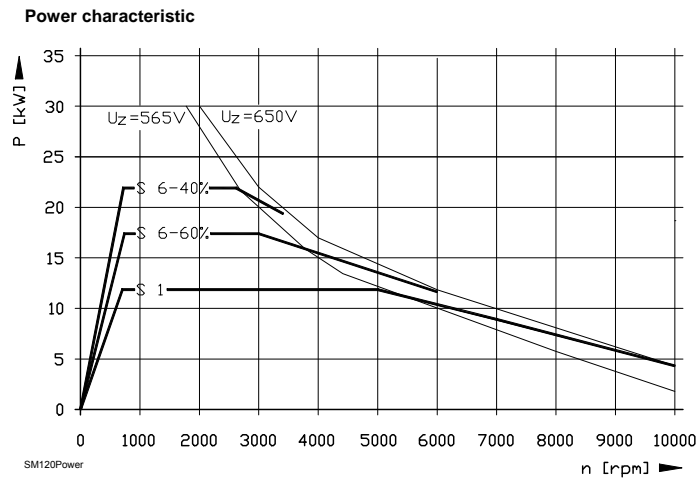
**SM 120 - Power and Torque Characteristics**

Refer to Table 7-57, Figure 7-57, and Figure 7-58.

**Table 7-57, SM 120 - Power and Torque Characteristics**

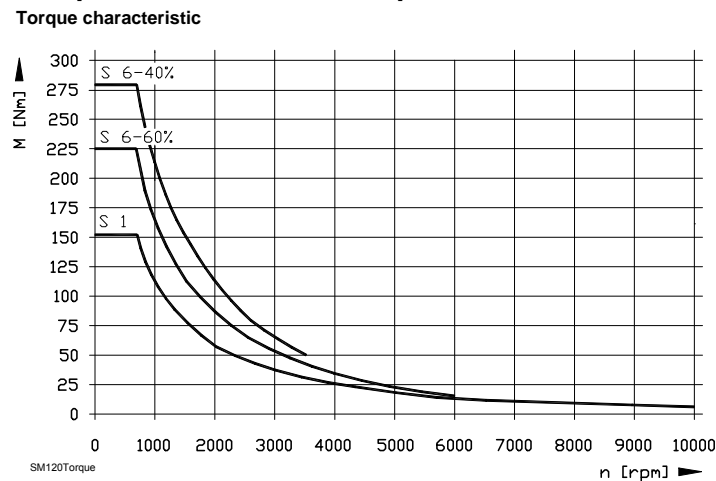
Duty Cycle	Speed n	Power P	Torque M	Current I (for 750 rpm)
<b>S1</b>	750 rpm	12.0 kW	152.8 Nm	29.0 A
	5000 rpm	12.0 kW	22.9 Nm	—
	10000 rpm	4.0 kW	3.8 Nm	—
<b>S6-60%</b>	750 rpm	17.5 kW	222.8 Nm	38.1 A
	3000 rpm	17.5 kW	55.7 Nm	—
	6000 rpm	11.3 kW	18.0 Nm	—
<b>S6-40%</b>	750 rpm	22.0 kW	280.1 Nm	46.4 A
	2500 rpm	22.0 kW	84.0 Nm	—
	3500 rpm	19.0 kW	51.8 Nm	—

**SM 120 - Power Characteristics Graph**



**Figure 7-57, SM 120 - Power Characteristics Graph**

**SM 120 - Torque Characteristics Graph**



**Figure 7-58, SM 120 - Torque Characteristics Graph**

### SM 150 - Specifications

Refer to Table 7-58 and “SM 150 - Power and Torque Characteristics.”

Table 7-58, SM 150 - Specifications

		SM 150	
<b>P/N</b>	<b>With Key</b>	With standard bearing 34100645	With spindle bearing 34100646
<b>P/N</b>	<b>Without Key</b>	With standard bearing 34100647	With spindle bearing 34100648
<b>Rated Voltage <math>U_N</math></b>		348 V	
<b>Rated Power Output <math>P_N</math></b>		15 kW	
<b>Rated Speed <math>n_N</math></b>		1500 rpm	
<b>Rated Torque <math>M_N</math> (105 K) <sup>**1</sup></b>		95.5 Nm	
<b>Rated Current <math>I_N</math> (105 K) <sup>**1</sup></b>		35.0 A	
<b>Efficiency <math>\eta</math></b>		0.85	
<b>Maximum Continuous Speed <math>n_{max\ cont}</math></b>		7000 rpm	8500 rpm
<b>Maximum Speed <sup>**2</sup> <math>n_{max}</math></b>		8000 rpm	10000 rpm
<b>Maximum Current <math>I_{max}</math></b>		70 A	
<b>Pole Pairs <math>PZ</math></b>		2	
<b>Weight <math>m</math></b>		<u>246.9 lb</u> 112 kg	
<b>Rotor Inertia <math>J</math></b>		700 kgcm <sup>2</sup>	
<b>Protection</b>		IP 54	

<sup>\*\*1</sup> 105 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

<sup>\*\*2</sup> For cycle duration of 10 minutes: 3 min.( $n_{max}$ ); 6 min. 2/3 x ( $n_{max}$ ); standstill of 1 min.

#### Fan

<b>Rated Voltage for Fan <math>U_L</math></b>	3 x 400 V
<b>Rated Current for Fan <math>I_L</math></b>	0.25 A
<b>Frequency <math>f_L</math></b>	50 Hz/60 Hz

#### Accessories

<b>Power Cable, without Connector</b>	Up to 24.7 A, P/N 34201301
<b>Cable for Fan, without Connector</b>	P/N 34201310
<b>Encoder Cable, Complete with Connectors</b>	P/N 342000xx

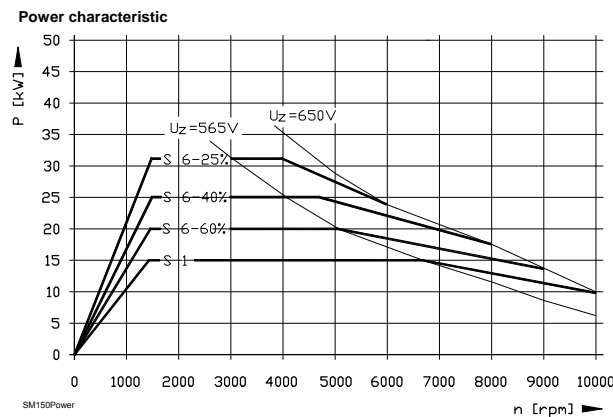
**SM 150 - Power and Torque Characteristics**

Refer to Table 7-59, Figure 7-59, and Figure 7-60.

**Table 7-59, SM 150 - Power and Torque Characteristics**

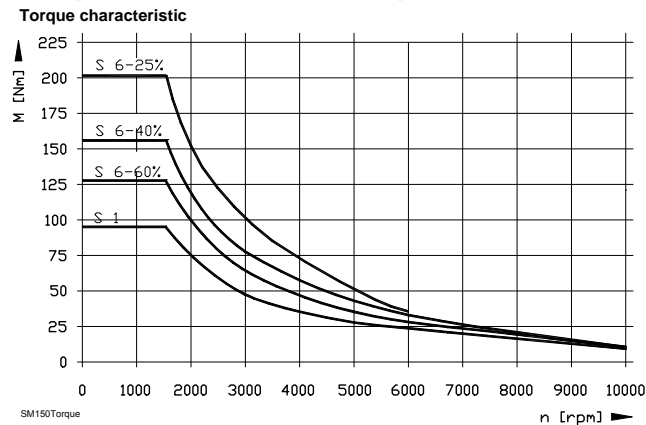
Duty Cycle	Speed n	Power P	Torque M	Current I (for 1500 rpm)
<b>S1</b>	1500 rpm	15.0 kW	95.5 Nm	35.0 A
	6500 rpm	15.0 kW	22.0 Nm	–
	10000 rpm	10.0 kW	9.5 Nm	–
<b>S6-60%</b>	1500 rpm	20.0 kW	127.3 Nm	43.3 A
	5000 rpm	20.0 kW	38.2 Nm	–
	9000 rpm	13.5 kW	14.3 Nm	–
<b>S6-40%</b>	1500 rpm	25.0 kW	159.2 Nm	52.3 A
	4500 rpm	25.0 kW	53.1 Nm	–
	8000 rpm	16.8 kW	20.1 Nm	–
<b>S6-25%</b>	1500 rpm	32.0 kW	203.7 Nm	65.0 A
	4000 rpm	32.0 kW	76.4 Nm	–
	6000 rpm	23.7 kW	37.7 Nm	–

**SM 150 - Power Characteristics Graph**



**Figure 7-59, SM 150 - Power Characteristics Graph**

**SM 150 - Torque Characteristics Graph**



**Figure 7-60, SM 150 - Torque Characteristics Graph**

### SM 200 - Specifications

Refer to Table 7-60 and “SM 200 - Power and Torque Characteristics.”

Table 7-60, SM 200 - Specifications

		SM 200	
<b>P/N</b>	<b>With Key</b>	With standard bearing 34100650	With spindle bearing 34100651
<b>P/N</b>	<b>Without Key</b>	With standard bearing 34100652	With spindle bearing 34100653
<b>Rated Voltage <math>U_N</math></b>		331 V	
<b>Rated Power Output <math>P_N</math></b>		20 kW	
<b>Rated Speed <math>n_N</math></b>		1500 rpm	
<b>Rated Torque <math>M_N</math> (105 K) <sup>**1</sup></b>		127.3 Nm	
<b>Rated Current <math>I_N</math> (105 K) <sup>**1</sup></b>		46.0 A	
<b>Efficiency <math>\eta</math></b>		0.85	
<b>Maximum Continuous Speed <math>n_{max\ cont}</math></b>		7000 rpm	8500 rpm
<b>Maximum Speed <math>n_{max}</math></b>		8000 rpm	10000 rpm
<b>Maximum Current <math>I_{max}</math></b>		96 A	
<b>Pole Pairs <math>PZ</math></b>		2	
<b>Weight <math>m</math></b>		297.6 lb 135 kg	
<b>Rotor Inertia <math>J</math></b>		920 kgcm <sup>2</sup>	
<b>Protection</b>		IP 54	

\*\*1 105 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

\*\*2 For cycle duration of 10 minutes: 3 min.( $n_{max}$ ); 6 min.  $2/3 \times (n_{max})$ ; standstill of 1 min.

#### Fan

<b>Rated Voltage for Fan <math>U_L</math></b>	3 x 400 V
<b>Rated Current for Fan <math>I_L</math></b>	0.25 A
<b>Frequency <math>f_L</math></b>	50 Hz/60 Hz

#### Accessories

<b>Power Cable, without Connector</b>	Up to 24.7 A, P/N 34201301
<b>Cable for Fan, without Connector</b>	P/N 34201310
<b>Encoder Cable, Complete with Connectors</b>	P/N 342000xx

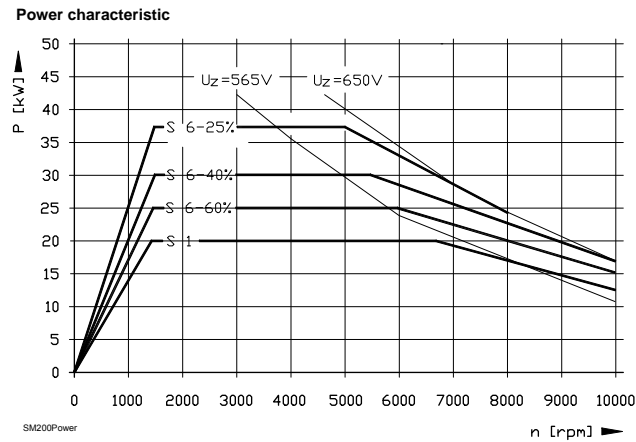
**SM 200 - Power and Torque Characteristics**

Refer to Table 7-61, Figure 7-61, and Figure 7-62.

**Table 7-61, SM 200 - Power and Torque Characteristics**

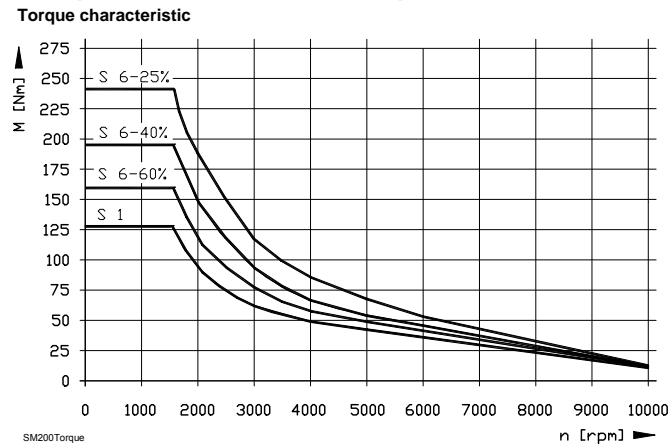
Duty Cycle	Speed n	Power P	Torque M	Current I (for 1500 rpm)
<b>S1</b>	1500 rpm	20.0 kW	127.3 Nm	46.0 A
	6500 rpm	20.0 kW	29.4 Nm	—
	10000 rpm	13.0 kW	12.4 Nm	—
<b>S6-60%</b>	1500 rpm	25.0 kW	159.2 Nm	56.0 A
	6000 rpm	25.0 kW	39.4 Nm	—
	10000 rpm	16.0 kW	15.3 Nm	—
<b>S6-40%</b>	1500 rpm	30.0 kW	191.0 Nm	65.0 A
	5500 rpm	30.0 kW	52.1 Nm	—
	10000 rpm	17.5 kW	16.7 Nm	—
<b>S6-25%</b>	1500 rpm	37.0 kW	235.5 Nm	79.0 A
	5000 rpm	37.0 kW	70.7 Nm	—
	8000 rpm	24.0 kW	28.6 Nm	—

**SM 200 - Power Characteristics Graph**



**Figure 7-61, SM 200 - Power Characteristics Graph**

**SM 200 - Torque Characteristics Graph**



**Figure 7-62, SM 200 - Torque Characteristics Graph**

### SM 240 - Specifications

Refer to Table 7-62 and “SM 240 - Power and Torque Characteristics.”

Table 7-62, SM 240 - Specifications

		SM 240	
P/N	With Key	With standard bearing 34100655	With spindle bearing 34100656
P/N	Without Key	With standard bearing 34100657	With spindle bearing 34100658
Rated Voltage $U_N$		318 V	
Rated Power Output $P_N$		24 kW	
Rated Speed $n_N$		1500 rpm	
Rated Torque $M_N$ (105 K) <sup>**1</sup>		152.8 Nm	
Rated Current $I_N$ (105 K) <sup>**1</sup>		58.0 A	
Efficiency $\eta$		0.85	
Maximum Continuous Speed $n_{max\ cont}$		7000 rpm	8500 rpm
Maximum Speed <sup>**2</sup> $n_{max}$		8000 rpm	10000 rpm
Maximum Current $I_{max}$		116 A	
Pole Pairs PZ		2	
Weight $m$		348.3 lb 158 kg	
Rotor Inertia $J$		1100 kgcm <sup>2</sup>	
Protection		IP 54	

<sup>\*\*1</sup> 105 K is the temperature difference in Kelvin's between the ambient temperature and the motor temperature.

<sup>\*\*2</sup> For cycle duration of 10 minutes: 3 min.( $n_{max}$ ); 6 min. 2/3 x ( $n_{max}$ ); standstill of 1 min.

#### Fan

Rated Voltage for Fan $U_L$	3 x 400 V
Rated Current for Fan $I_L$	0.25 A
Frequency $f_L$	50 Hz/60 Hz

#### Accessories

Power Cable, without Connector	Up to 24.7 A, P/N 34201301
Cable for Fan, without Connector	P/N 34201310
Encoder Cable, Complete with Connectors	P/N 342000xx

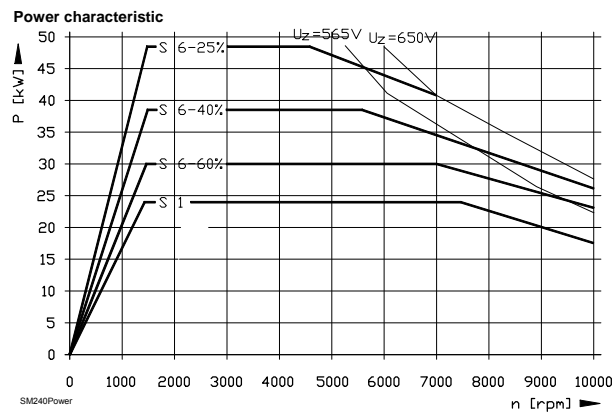
**SM 240 - Power and Torque Characteristics**

Refer to Table 7-63, Figure 7-63, and Figure 7-64.

**Table 7-63, SM 240 - Power and Torque Characteristics**

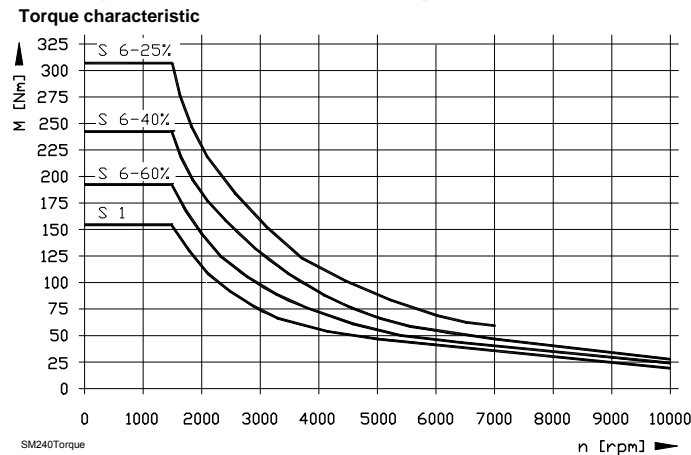
Duty Cycle	Speed n	Power P	Torque M	Current I (for 1500 rpm)
<b>S1</b>	1500 rpm	24.0 kW	152.8 Nm	58.0 A
	7400 rpm	24.0 kW	31.0 Nm	—
	10000 rpm	18.0 kW	17.2 Nm	—
<b>S6-60%</b>	1500 rpm	30.0 kW	191.0 Nm	67.2 A
	7000 rpm	30.0 kW	40.9 Nm	—
	10000 rpm	22.5 kW	21.5 Nm	—
<b>S6-40%</b>	1500 rpm	38.0 kW	241.9 Nm	81.8 A
	5500 rpm	38.0 kW	66.0 Nm	—
	10000 rpm	26.0 kW	24.8 Nm	—
<b>S6-25%</b>	1500 rpm	48.0 kW	305.6 Nm	100.6 A
	4500 rpm	48.0 kW	101.9 Nm	—
	7000 rpm	41.0 kW	55.9 Nm	—

**SM 240 - Power Characteristics Graph**



**Figure 7-63, SM 240 - Power Characteristics Graph**

**SM 240 - Torque Characteristics Graph**



**Figure 7-64, SM 240 - Torque Characteristics Graph**

### Spindle Motors Dimension Drawings

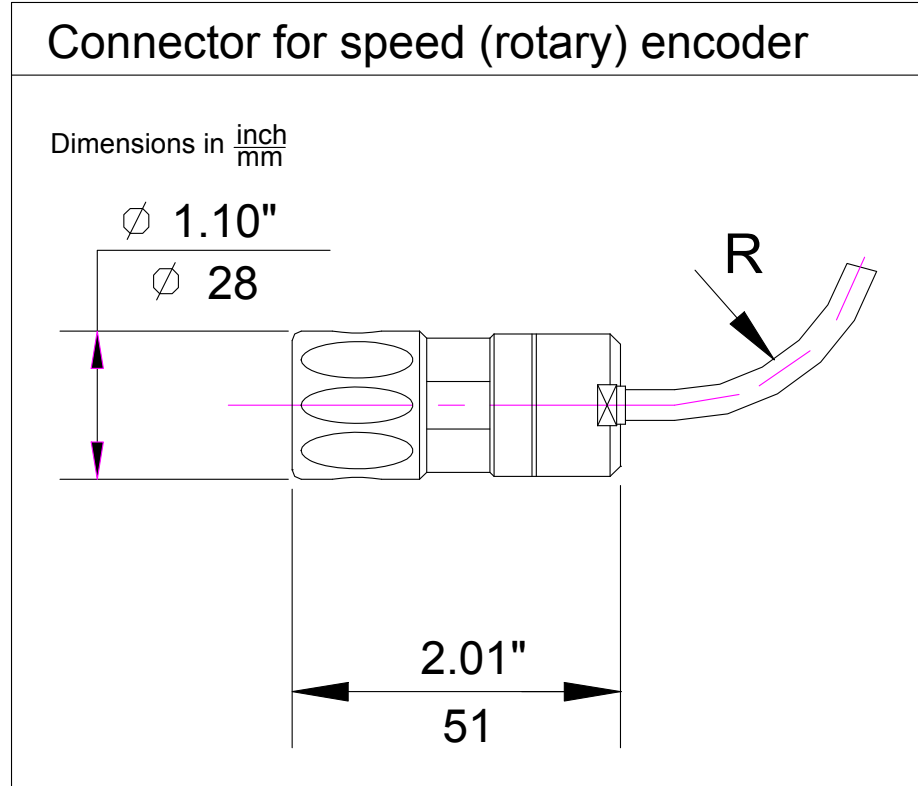
The dimensional drawings for the following Spindle Motors and Connectors are illustrated:

- **SM 055, SM 100, SM 120, SM 150, SM 200, SM 240 - Connector for Speed (Rotary) Encoder**
- **SM 055, SM 075, SM 100 - Dimensional Drawing**
- **SM 120, SM 240 - Dimensional Drawing**
- **SM 150 - Dimensional Drawing**
- **SM 200 - Dimensional Drawing**



**SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, SM 240 - Connector for Speed (Rotary) Encoder**

Refer to **Figure 7-65**. Refer to **Table 7-6, Maximum Bend Radii of Cables**.



**Figure 7-65, SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, SM 240 - Connector for Speed (Rotary) Encoder**

### SM 055, SM 075, SM 100 - Dimensional Drawing

Refer to Figure 7-66, Table 7-64, SM 055, SM 075, SM 100 - Motor Dimensions, Figure 7-11, SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, SM 240 - Rotatable Flange Socket, and Figure 7-65, SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, SM 240 - Connector for Speed (Rotary) Encoder.

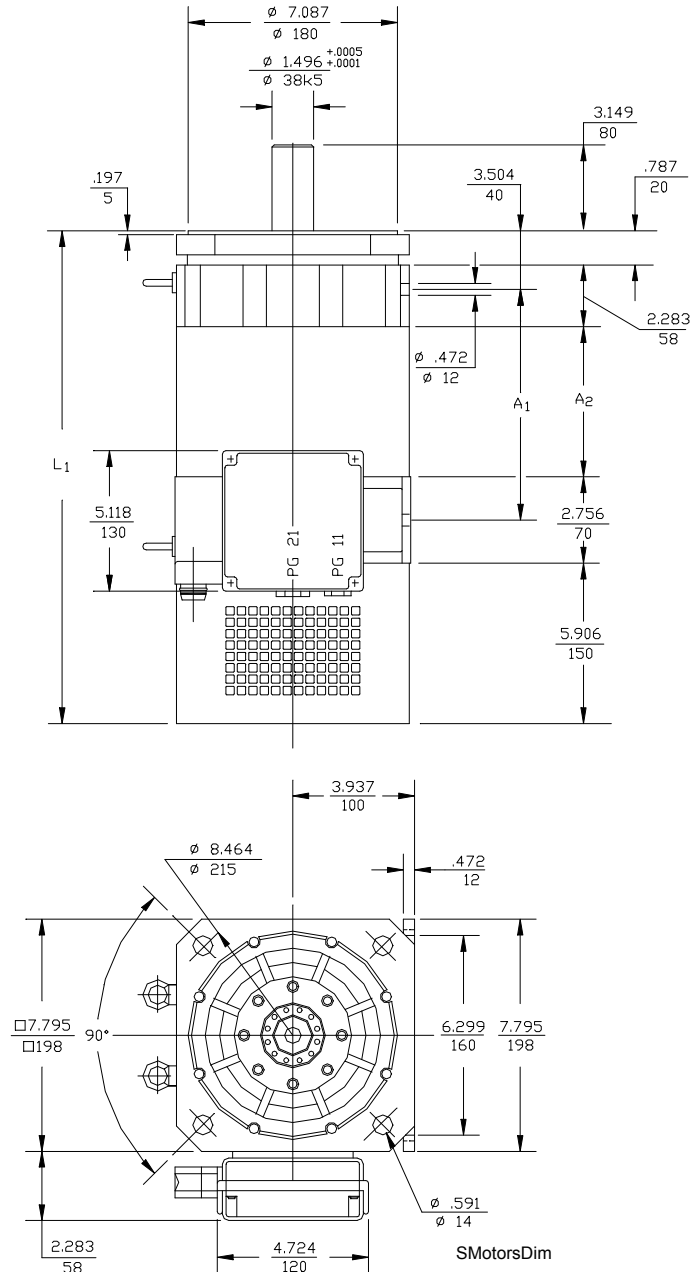


Figure 7-66, SM 055, SM 075, SM 100 - Dimensional Drawing

**Table 7-64, SM 055, SM 075, SM 100 - Motor Dimensions**

<b>Motor</b>	<b>Length L<sub>1</sub></b>	<b>Distance A<sub>1</sub></b>	<b>Distance A<sub>2</sub></b>
<b>SM 055 (with standard bearing)</b>	<u>17.24</u> 438 mm	<u>8.38</u> 213 mm	<u>5.51</u> 140 mm
<b>SM 055 (with spindle bearing)</b>	<u>17.95</u> 456 mm	<u>8.38</u> 213 mm	<u>5.51</u> 140 mm
<b>SM 075 (with standard bearing)</b>	<u>20.19</u> 513 mm	<u>11.34</u> 288 mm	<u>8.46</u> 215 mm
<b>SM 075 (with spindle bearing)</b>	<u>20.90</u> 531mm	<u>11.34</u> 288 mm	<u>8.46</u> 215 mm
<b>SM 100 (with standard bearing)</b>	<u>22.95</u> 583 mm	<u>14.09</u> 358 mm	<u>11.22</u> 285 mm
<b>SM 100 (with spindle bearing)</b>	<u>23.66</u> 601 mm	<u>14.09</u> 358 mm	<u>11.22</u> 285 mm

Dimensions = inch / mm

### SM 120, SM 240 - Dimensional Drawing

Refer to Figure 7-67, Figure 7-11, SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, SM 240 - Rotatable Flange Socket, and Figure 7-65, SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, SM 240 - Connector for Speed (Rotary) Encoder.

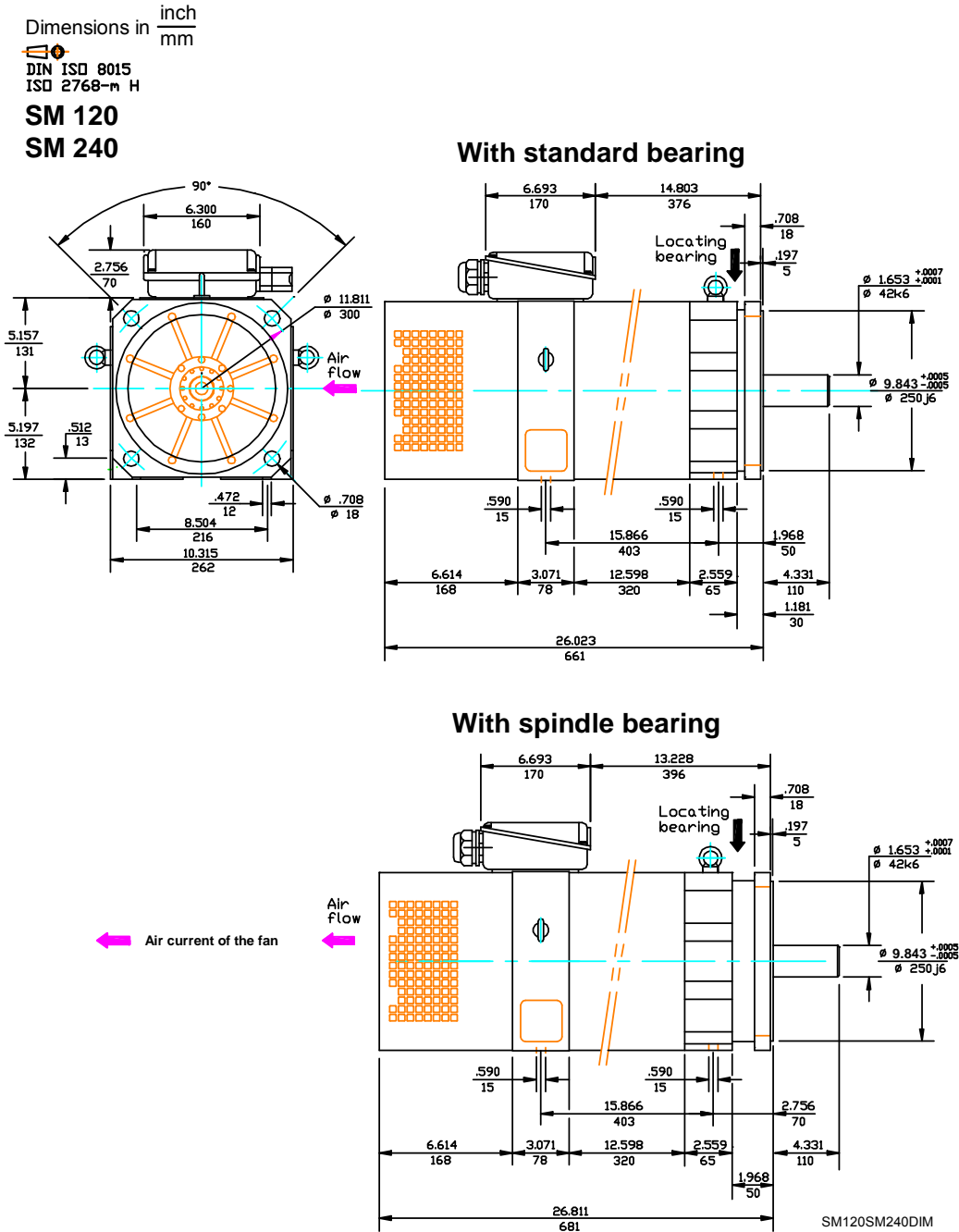
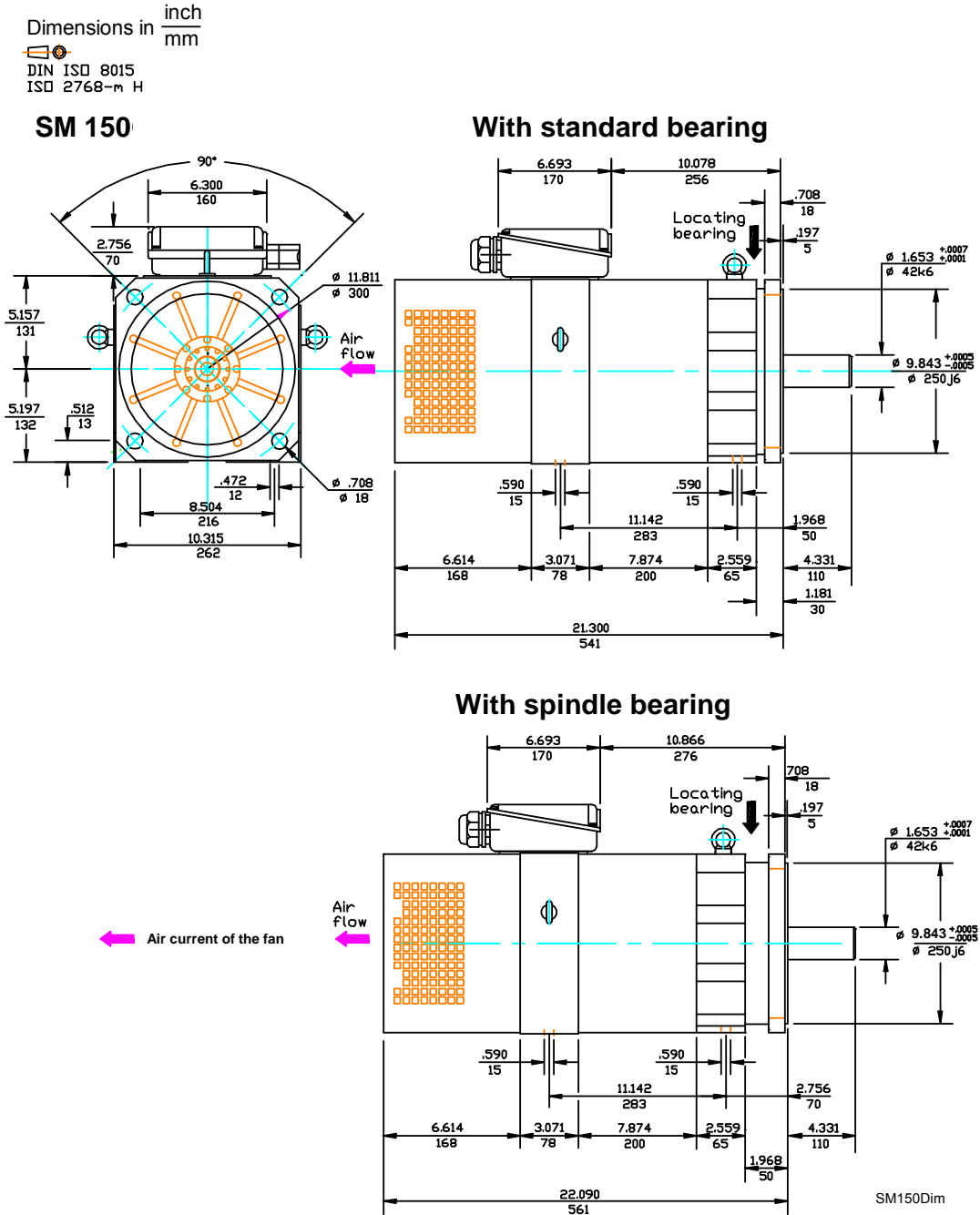


Figure 7-67, SM 120, SM 240 - Dimensional Drawing

**SM 150 - Dimensional Drawing**

Refer to Figure 7-68, Figure 7-12, SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, SM 240 - Rotatable Flange Socket, and Figure 7-65, SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, SM 240 - Connector for Speed (Rotary) Encoder.



**Figure 7-68, SM 150 - Dimensional Drawing**

### SM 200 - Dimensional Drawing

Refer to Figure 7-69, Figure 7-11, SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, SM 240 - Rotatable Flange Socket, and Figure 7-65, SM 055, SM 075, SM 100, SM 120, SM 150, SM 200, SM 240 - Connector for Speed (Rotary) Encoder.

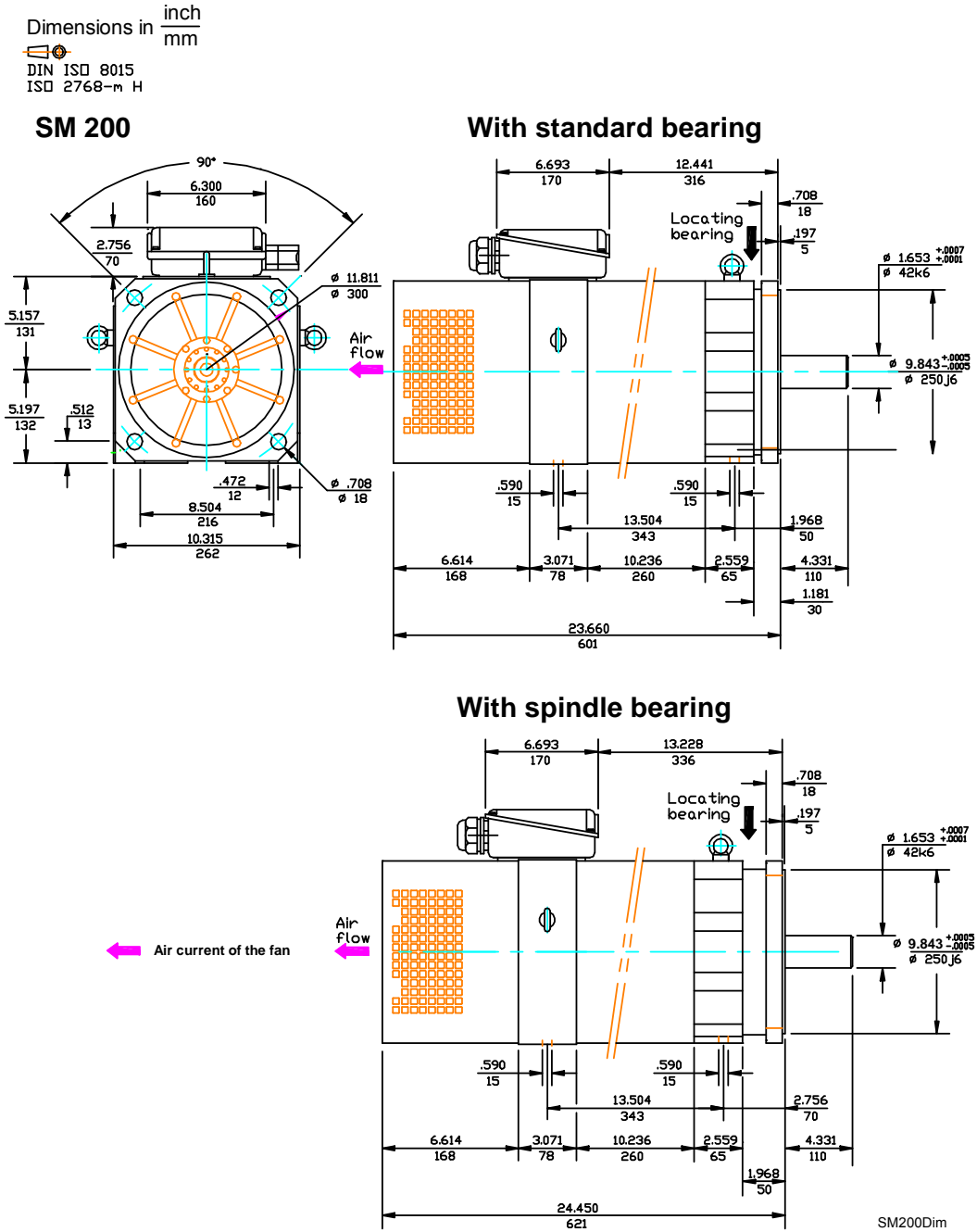


Figure 7-69, SM 200 - Dimensional Drawing

## **Permissible Forces on the Motor Shaft**

The following topics are described:

- **General**
- **AM 960A, AM 960AB Axis Motors – Permissible Forces**
- **Combined Load on AM 1160 Series and AM 1550 Series**
- **SM 055, SM 075, SM 100 – Permissible Forces**
- **SM 120, SM 150, SM 200, SM 240 – Permissible Forces**

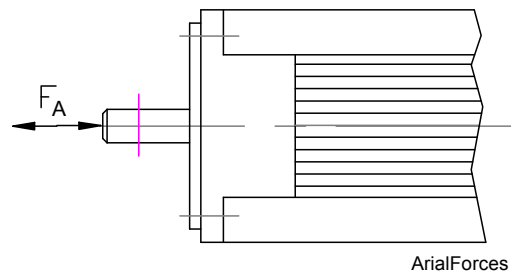
### General

All diagram values given for permissible axial and radial forces on the motor shafts apply to the nominal bearing life, depending on the specific motor.

In the diagram, the nominal bearing life values are specified for the maximum permissible forces.

### Axial Forces

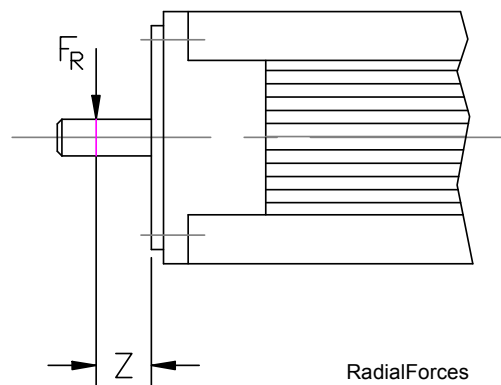
Refer to **Figure 7-70** for the point of axial force on the motor shaft.



**Figure 7-70, AM Series, SM Series - Point of Axial Force on the Motor Shaft**

### Radial Forces

Refer to **Figure 7-71** for the point of radial force on the motor shaft.



**Figure 7-71, AM Series, SM Series - Point of Radial Force on the Motor Shaft**

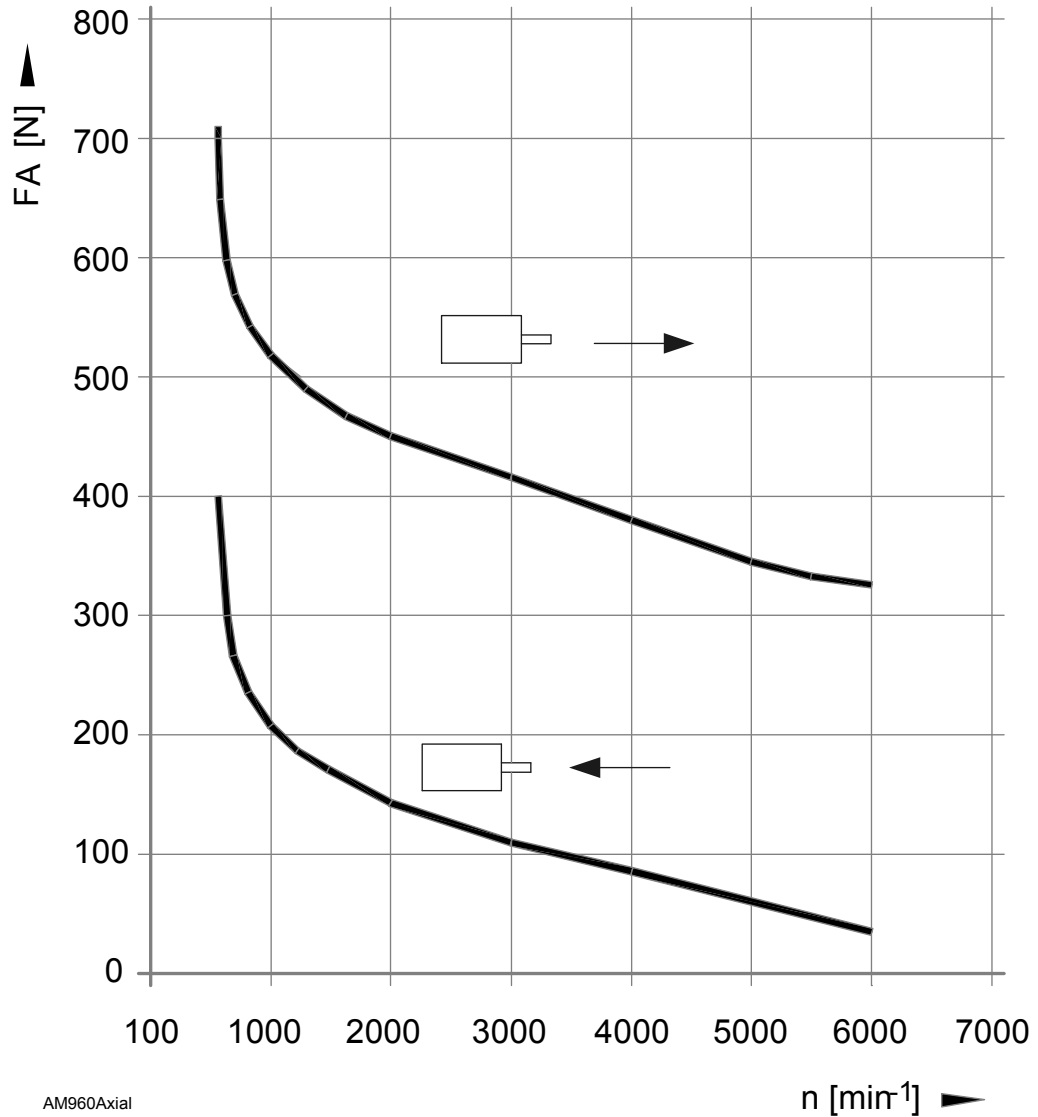
The maximum permissible radial force may also depend on the motor speed and the point of the radial force on the motor shaft. The point of the force is defined by the distance **Z** and is shown as an axis in the load diagrams.



**AM 960A, AM 960AB Axis Motors - Permissible Forces**

**AM 960A, AM 960AB Axis Motors - Axial Force  $F_A$  on a Bearing**

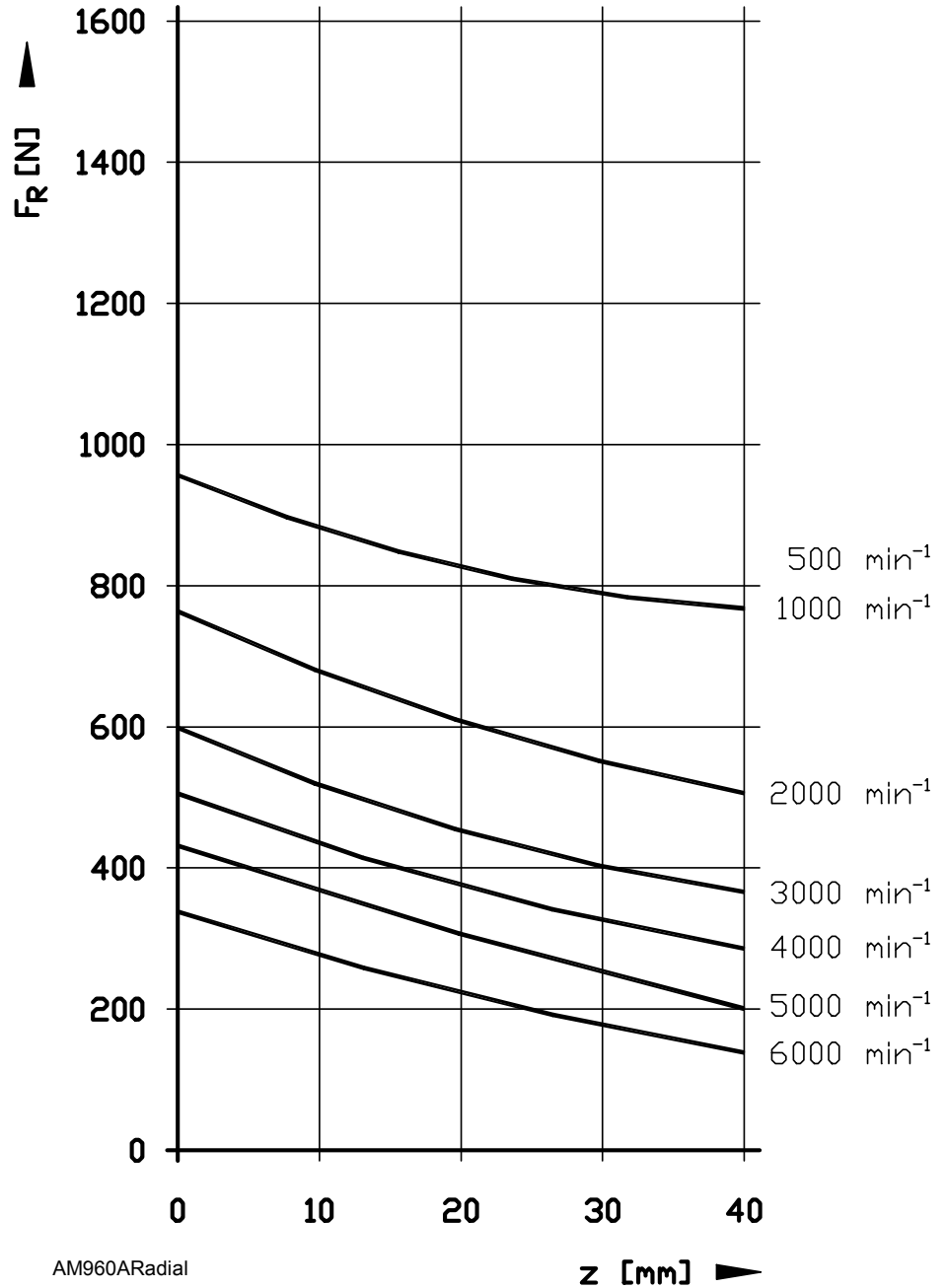
Refer to **Figure 7-72** for the maximum permissible axial force for a bearing with a rated service life of 30,000 hours.



**Figure 7-72, AM 960A, AM 960AB - Maximum Permissible Axial Force ( $F_A$ )**

### AM 960A, AM 960AB Axis Motors - Radial Force $F_R$ on a Bearing

Refer to **Figure 7-73** for the maximum permissible radial force  $F_{Rmax}$  for a bearing with a rated service life of 30,000 hours, depending on the point of radial force and the average speed.



**Figure 7-73, AM 960A, AM 960AB - Maximum Permissible Radial Force ( $F_{Rmax}$ )**

### Combined Load on AM 1160 Series and AM 1550 Series

Determine the combined load that results from axial and radial forces on the AM 1160 and AM 1550 Series motor shafts as follows:

- Use the first diagram to determine the maximum permissible radial force  $F_R$  over the distance  $z$  and average speed (for example, refer to **Figure 7-74, AM 1160 Series - Permissible Radial Force on the Motor Shaft ( $F_R$ )**).
- Use the first diagram to determine the equivalent axial force  $F_{A2}$  over the applied axial force  $F_A$  (for example, refer to **Figure 7-75, AM 1160 Series - Permissible Axial Force on the Motor Shaft ( $F_{A2}$ )**). 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  $F_{A2}$ :

$$F_{com} = (0.56 \times F_R) + F_{A2}$$

The following requirements must be met in order to achieve a bearing service life of 30,000 hours:

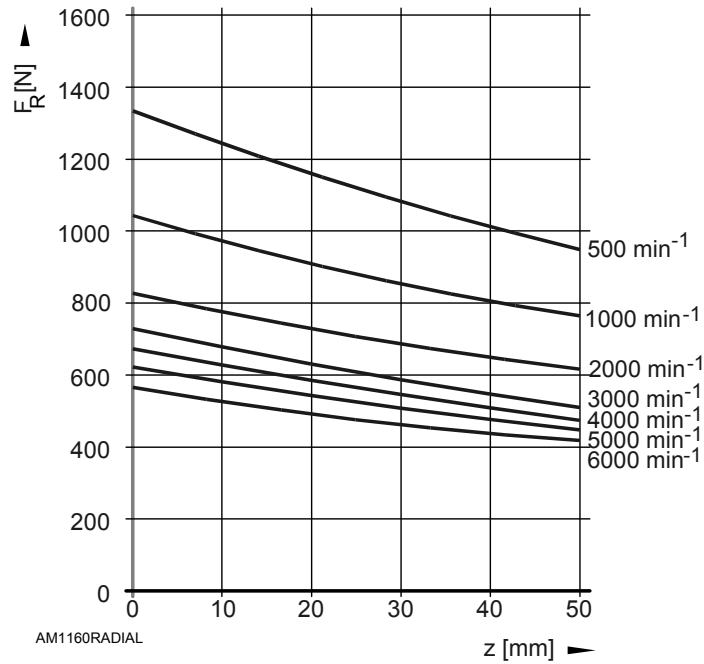
- The applied axial force  $F_A$  must not exceed 1000 N.
- The applied radial force  $F_R$  must not exceed the permissible radial force from the illustration for radial forces.
- The combined load  $F_{com}$  must not exceed the permissible radial force  $F_R$  for the first diagram (for example, refer to **Figure 7-74, AM 1160 Series - Permissible Radial Force on the Motor Shaft ( $F_R$ )**).

For the AM 1160 Series, to calculate the combined load  $F_{com}$  refer to:

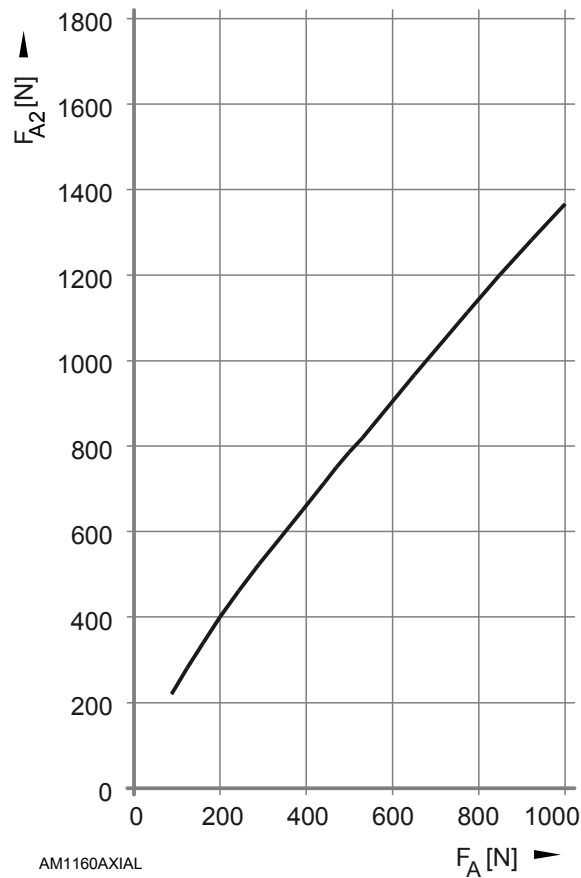
- **Figure 7-74, AM 1160 Series - Permissible Radial Force on the Motor Shaft ( $F_R$ )**
- **Figure 7-75, AM 1160 Series - Permissible Axial Force on the Motor Shaft ( $F_{A2}$ )**

For the AM 1550 Series, to calculate the combined load  $F_{com}$  refer to:

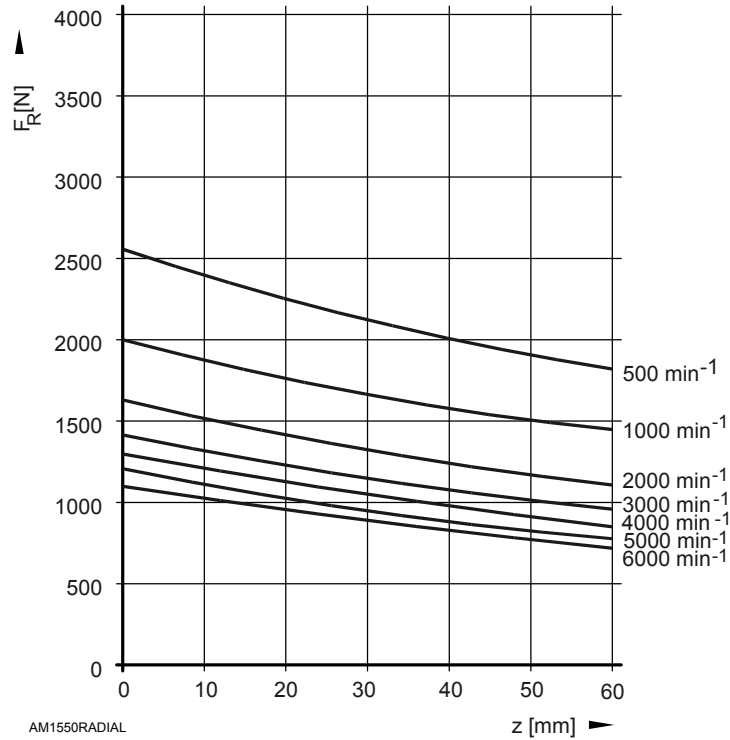
- **Figure 7-76, AM 1550 Series - Permissible Radial Force on the Motor Shaft ( $F_R$ )**
- **Figure 7-77, AM 1550 Series - Permissible Axial Force on the Motor Shaft ( $F_{A2}$ )**



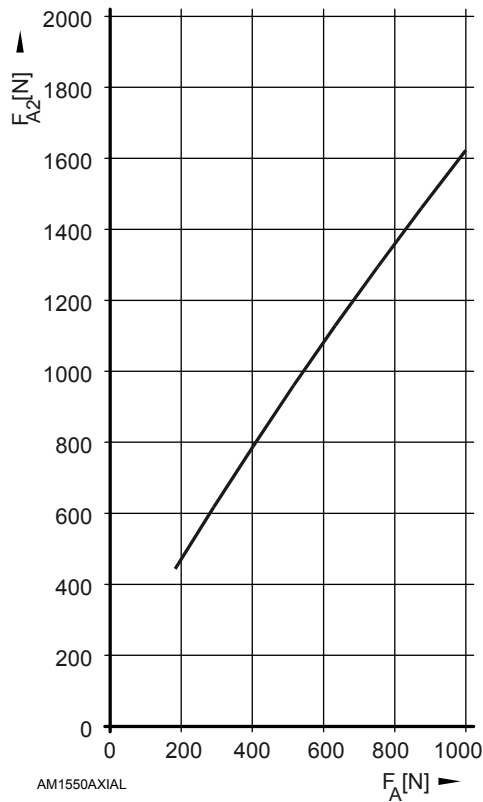
**Figure 7-74, AM 1160 Series - Permissible Radial Force on the Motor Shaft ( $F_R$ )**



**Figure 7-75, AM 1160 Series - Permissible Axial Force on the Motor Shaft ( $F_{A2}$ )**



**Figure 7-76, AM 1550 Series - Permissible Radial Force on the Motor Shaft (F<sub>R</sub>)**



**Figure 7-77, AM 1550 Series - Permissible Axial Force on the Motor Shaft (F<sub>A2</sub>)**

**Combined Load on AM 1900 Series**

Determine the combined load that results from axial and radial forces on the AM 1900 Series motor shafts as follows:

- Use the first diagram to determine the maximum permissible radial force  $F_R$  over the distance  $z$  and average speed (for example, refer to **Figure 7-78, AM 1900 Series - Permissible Radial Force on the Motor Shaft ( $F_R$ )**).
- Use the first diagram to determine the equivalent axial force  $F_{A2}$  over the applied axial force  $F_A$  (for example, refer to **Figure 7-79, AM 1900 Series - Permissible Axial Force on the Motor Shaft ( $F_{A2}$ )**). 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  $F_{A2}$ :

$$F_{com} = (0.56 \times F_R) + F_{A2}$$

The following requirements must be met in order to achieve a bearing service life of 30,000 hours:

- The applied axial force  $F_A$  must not exceed 1500 N.
- The applied radial force  $F_R$  must not exceed the permissible radial force from the illustration for radial forces.
- The combined load  $F_{com}$  must not exceed the permissible radial force  $F_R$  for the first diagram (for example, refer to **Figure 7-78, AM 1900 Series - Permissible Radial Force on the Motor Shaft ( $F_R$ )**).

For the AM 1900 Series, to calculate the combined load  $F_{com}$  refer to:

- **Figure 7-78, AM 1900 Series - Permissible Radial Force on the Motor Shaft ( $F_R$ )**
- **Figure 7-79, AM 1900 Series - Permissible Axial Force on the Motor Shaft ( $F_{A2}$ )**

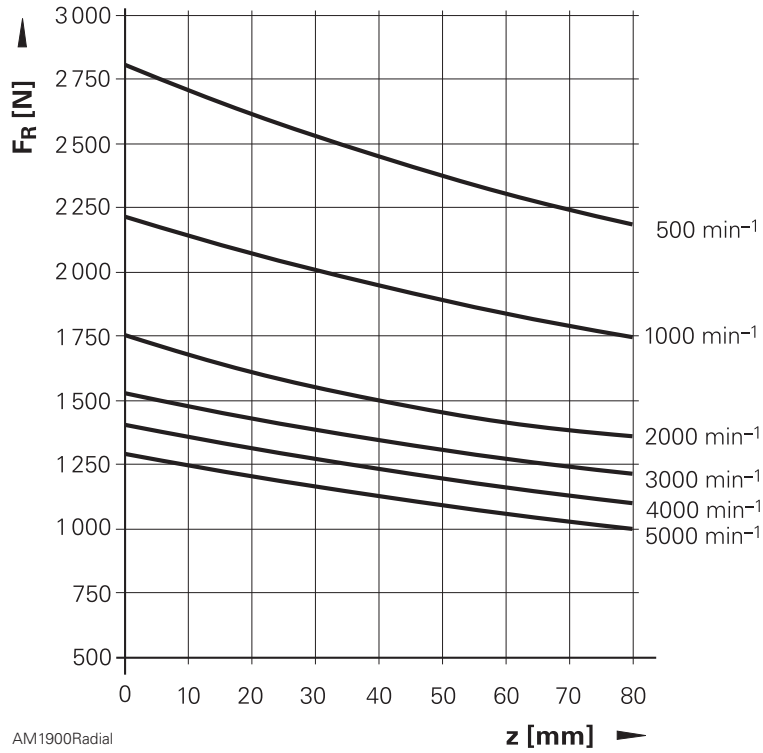


Figure 7-78, AM 1900 Series - Permissible Radial Force on the Motor Shaft ( $F_R$ )

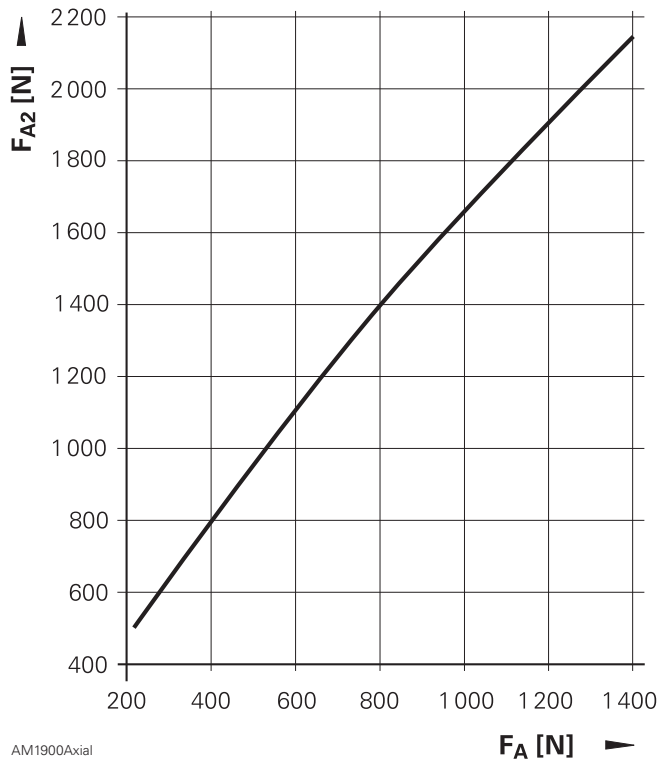


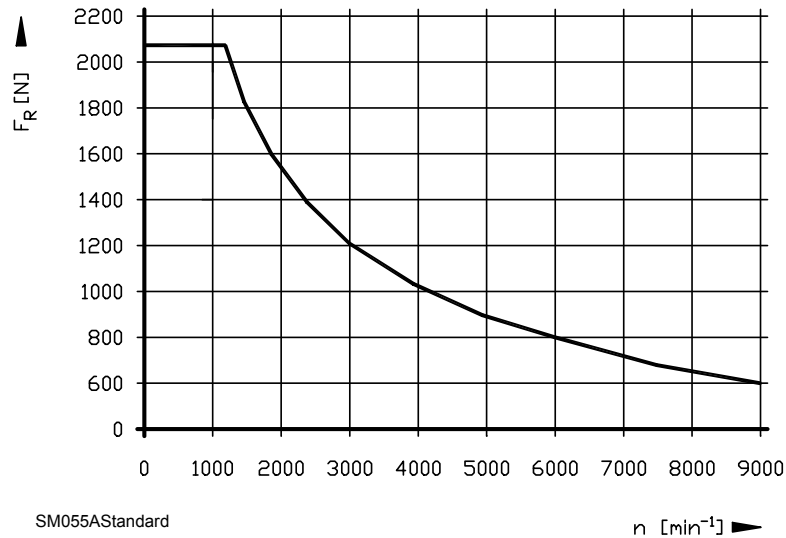
Figure 7-79, AM 1900 Series - Permissible Axial Force on the Motor Shaft ( $F_{A2}$ )

### SM 055, SM 075, SM 100 - Permissible Forces

The following graphs show the maximum permissible axial forces  $F_A$  and the radial force  $F_R$  for a bearing life of 10,000 hours. This also applies to the grease service life.

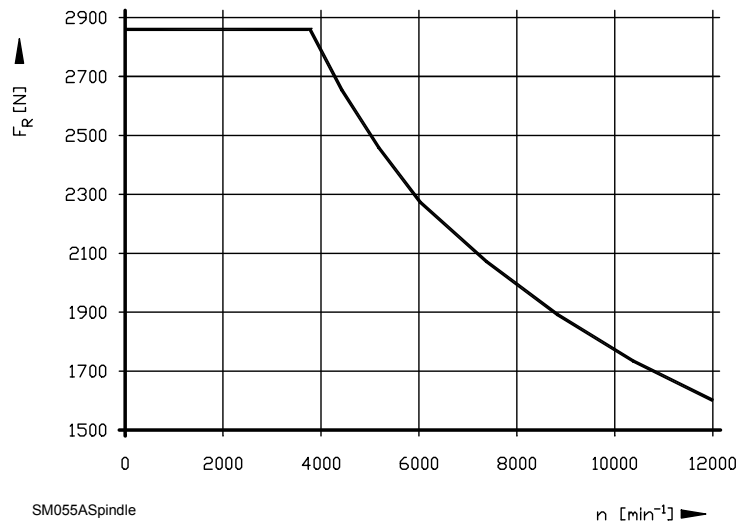
#### Axial Force $F_A$

For SM 055, SM 075, SM 100 – with standard bearing, refer to **Figure 7-80**.



**Figure 7-80, SM 055, SM 075, SM 100 - with Standard Bearing - Permissible Axial Force on the Motor Shaft**

For SM 055, SM 075, SM 100 – with spindle bearing, refer to **Figure 7-81**.



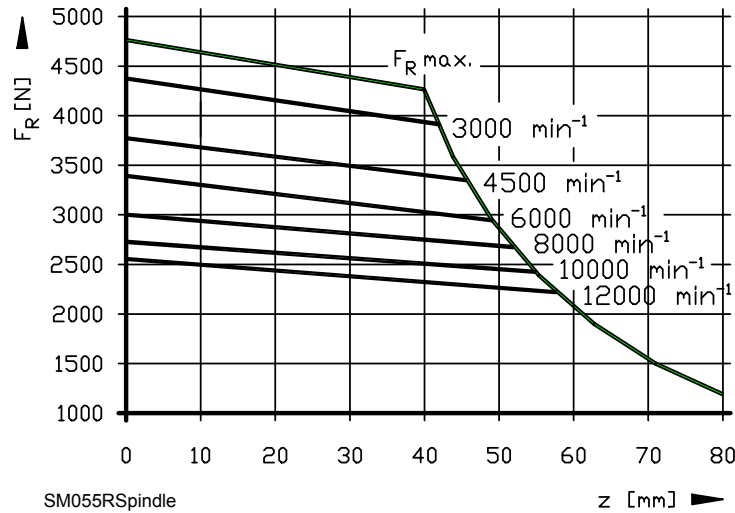
**Figure 7-81, SM 055, SM 075, SM 100 - with Spindle Bearing - Permissible Axial Force on the Motor Shaft**



**Radial Force  $F_R$**

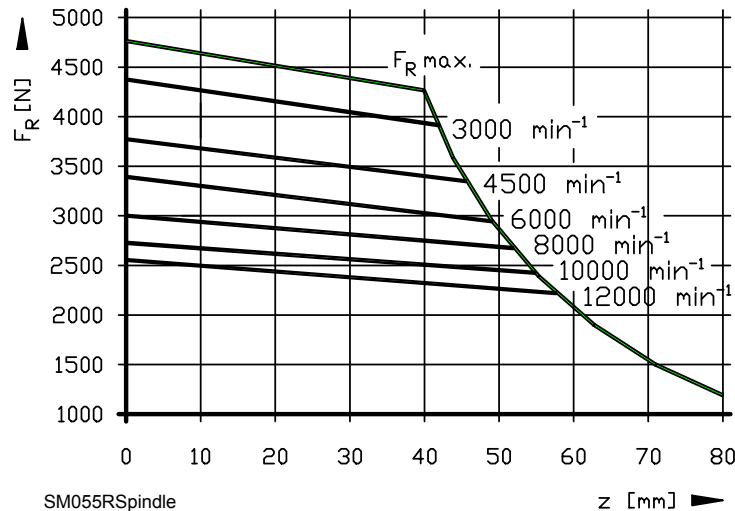
The maximum permissible radial forces  $F_{Rmax}$  shown in the following figures are valid for a bearing service life of 10,00 hours, depending on the point of the radial force and the average speed.

For SM 055, SM 075, SM 100 – with standard bearing, refer to **Figure 7-82**.



**Figure 7-82, SM 055, SM 075, SM 100 - with Standard Bearing - Permissible Radial Force on the Motor Shaft**

For SM 055, SM 075, SM 100 – with spindle bearing, refer to **Figure 7-83**.



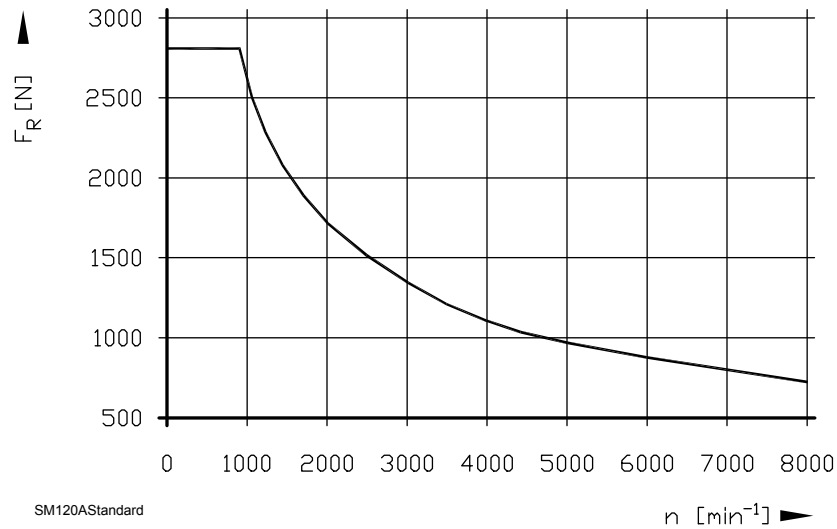
**Figure 7-83, SM 055, SM 075, SM 100 - with Spindle Bearing - Permissible Radial Force on the Motor Shaft**

### SM 120, SM 150, SM 200, SM 240 - Permissible Forces

The following graphs show the maximum permissible axial forces  $F_A$  and the radial force  $F_R$  for a bearing life of 10,000 hours. This also applies to the grease service life.

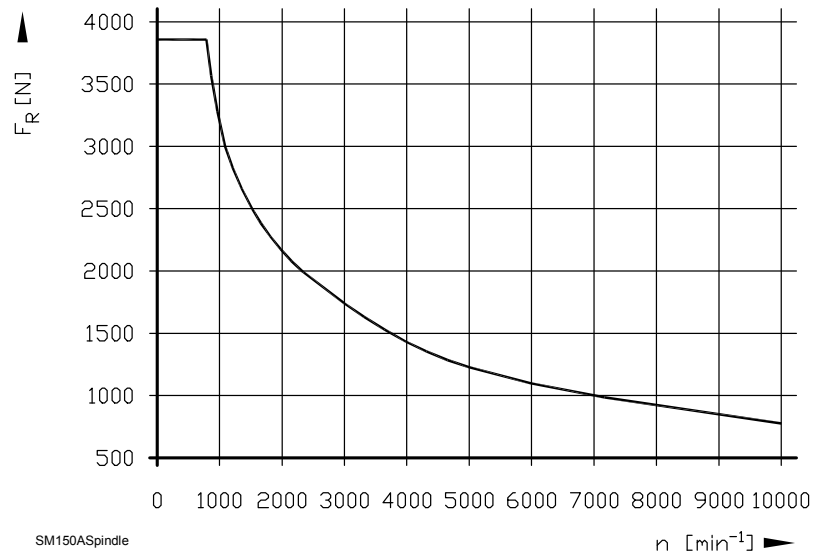
#### Axial Force $F_A$

For SM 120, SM 150, SM 200, SM 240 – with standard bearing, refer to **Figure 7-84**.



**Figure 7-84, SM 120, SM 150, SM 200, SM 240, - with Standard Bearing - Permissible Axial Force on the Motor Shaft**

For SM 150, SM 200, SM 240 – with spindle bearing, refer to **Figure 7-85**.

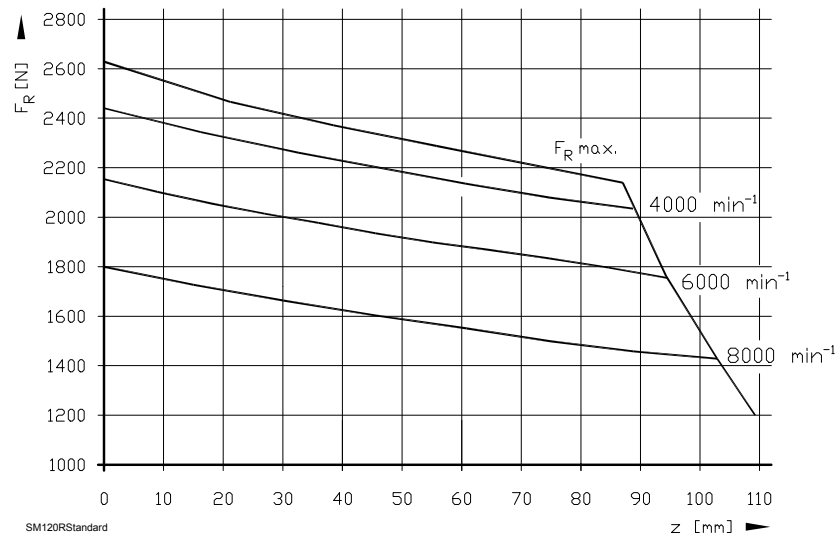


**Figure 7-85, SM 150, SM 200, SM 240 - with Spindle Bearing - Permissible Axial Force on the Motor Shaft**

**Radial Force  $F_R$**

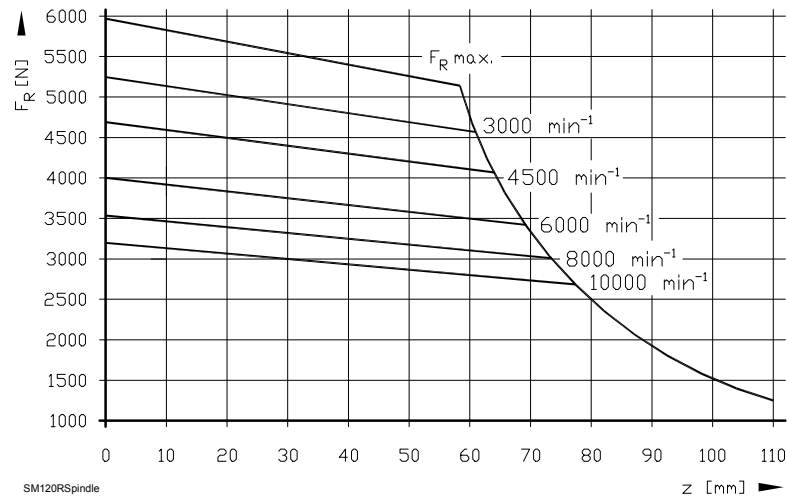
The maximum permissible radial forces  $F_{Rmax}$  shown in the following figures are valid for a bearing service life of 10,00 hours, depending on the point of the radial force and the average speed.

For SM 120, SM 150, SM 200, SM 240 – with standard bearing, refer to **Figure 7-86**.



**Figure 7-86, SM 120, SM 150, SM 200, SM 240 - with Standard Bearing - Permissible Radial Force on the Motor Shaft**

For SM 150, SM 200, SM 240 – with spindle bearing, refer to **Figure 7-85**.



**Figure 7-85, SM 150, SM 200, SM 240 - with Spindle Bearing - Permissible Radial Force on the Motor Shaft**



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