

# PROGRAMMABLE MULTI-AXIS SERVO DRIVE SYSTEM MSD



The image shows a MOOG MSD servo drive system. The main unit is a large, vertical, ribbed metal cabinet. A smaller, red control panel is attached to the front. This panel features several ports: an MMC slot, a USB port, a LAN/EC port, and a DIGITAL I/O port. Below these ports is a terminal block with various electrical connections labeled with pin numbers and abbreviations.

REL	24	12	RSH
REL	22	11	RSH
ISD5H	22	10	ENPG
ISD06	21	9	OSD02
ISD05	20	8	OSD01
ISD04	19	7	OSD06
ISD03	18	6	ISA1-
ISD02	17	5	ISA1+
ISD01	16	4	ISAG-
ISD00	15	3	ISAG+
+24V	14	2	

Rev. C, May 2013

DELIVERING ADVANCED MOTION CONTROL AND  
FLEXIBILITY FOR HIGH PERFORMANCE AXES  
APPLICATIONS

Whenever the highest levels of motion control performance and design flexibility are required, you'll find Moog expertise at work. Through collaboration, creativity and world-class technological solutions, we help you overcome your toughest engineering obstacles. Enhance your machine's performance. And help take your thinking further than you ever thought possible.

INTRODUCTION.....	2
MOTION CONTROLLER.....	5
SINGLE-AXIS COMPACT - SIZES C2 TO C4.....	11
SINGLE-AXIS STANDARD - SIZES 1 TO 7.....	25
MULTI-AXIS SERVO DRIVES AND PSU - SIZES 1 TO 6A.....	58
COMMUNICATION MODULES.....	97
TECHNOLOGY MODULES.....	106
FUNCTION PACKAGES.....	112
ACCESSORIES.....	114
BACKGROUND.....	137



This catalog is for users with technical knowledge. To ensure that all necessary characteristics for function and safety of the system are given, the user has to check the suitability of the products described herein. The products described herein are subject to change without notice. In case of doubt, please contact Moog.

For the most current information, visit [www.moog.com/servomotorsanddrives](http://www.moog.com/servomotorsanddrives)

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## SYSTEM OVERVIEW

### A whole new level of machine performance, precision and processing acceleration.

Higher performance machines can mean a real advantage in productivity and profitability for different markets.

The Moog Programmable Multi-Axis Servo Drive System answers the call for a new generation of servo drives that provides the highest levels of dynamic response, smooth performance and application versatility.

#### MSD includes:

- A motion controller to coordinate the motion across multiple axes
- Programmable Single-Axis Servo Drives Compact and Standard Version
- Multi-Axis Servo Drives and Power Supply Units

### Meeting your toughest machine challenges

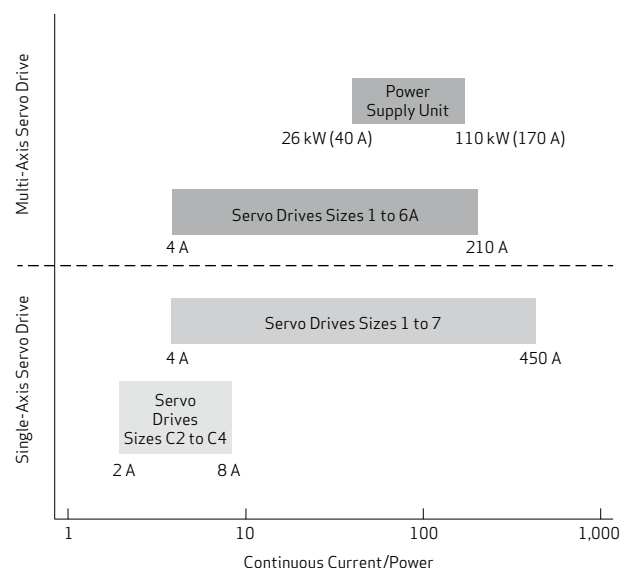
The Programmable Multi-Axis Servo Drive System is designed to give machine builders the edge in solving some of the industries' toughest challenges in a wide array of industrial applications. Its user-friendly features, unsurpassed flexibility and high-performance design provide unique advantages including:

- **Higher machine productivity**  
From lowering cycle times in an injection molding machine, to increasing feed rates in a metal forming press, MSD delivers a significant increase in machine output
- **Improved machine precision**  
More precise motion control results in higher accuracy, virtually no part variations and reduced scrap
- **Higher machine flexibility**  
The modularity of the Programmable Multi-Axis Servo Drive System coupled with the ability to tailor customer-specific solutions provides the perfect flexible platform for different machine types, putting them at the heart of today's leading-edge designs

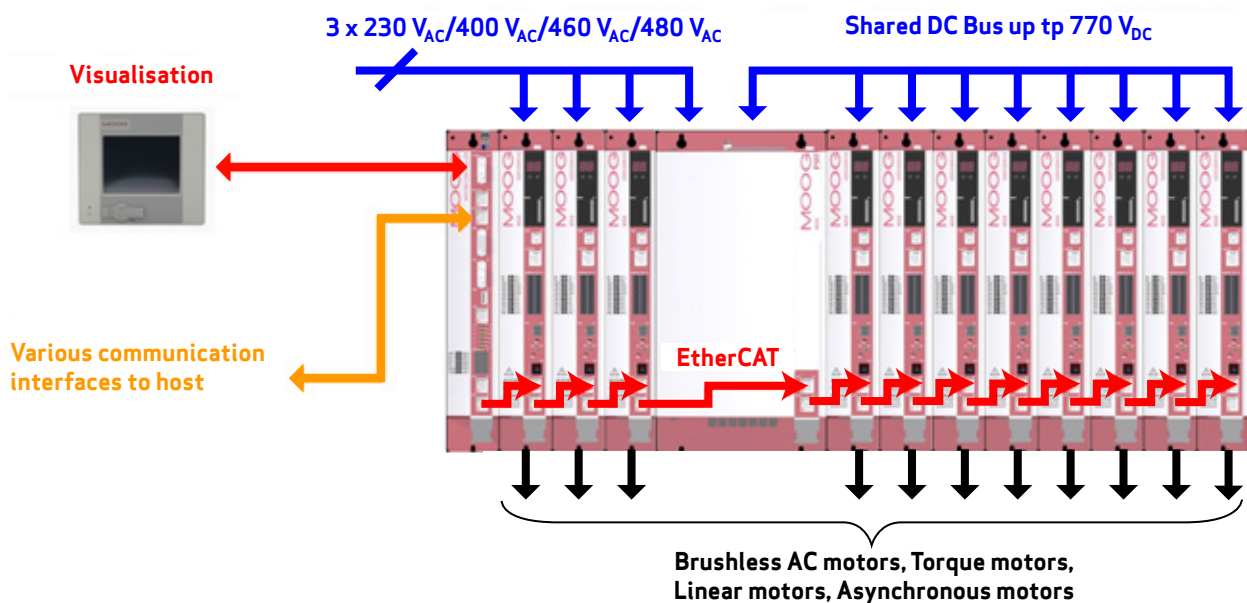
#### Features

- Servo drives from 2 to 450 A with the option of either the classic AC<sub>Mains</sub> connection or a DC feed with a central feeder unit

- Compact size. Suitable for 300 mm switch cabinet depth, extremely small housing width, for the best possible switch cabinet usage
- The Programmable MSD Compact Version in sizes C2 to C4 includes modular servo drives in a compact format increasing the offering of lower power requirements for single-axis-systems
- Extendable functionality via flexible MSD design
- Tailored software packages with Motion Control functionality for every application
- Support for simultaneous feedback from 3 feedback devices ensures precise positioning capability extending from resolver to Sin/Cos single-turn and multi-turn encoders
- High-speed communication via fieldbus connection to a wide range of control systems (including EtherCAT, CANopen, PROFIBUS, SERCOS among others)
- Built in PLC as per IEC 61131 provides functions adapted to the application with direct access to the servo drive peripherals, single and multi axis operating units
- Built in functional safety as per EN 61508, EN 62061, EN ISO 13849-1, IEC 61800-5-2, personnel safety directly into the servo drive



## SYSTEM OVERVIEW



### Total flexibility

The MSD System is designed to work with a wide spectrum of servo motors – brushless permanent magnet, AC motors, Torque motors, Linear motors and Asynchronous motors to ensure optimal control. Likewise, its rapid commissioning and control optimization afford consistently high manufacturing quality.

The MSD System is the ideal complement to Moog's wide array of high-performance servo motors that deliver dynamic performance, power density and reliability in plastics and metalforming machine applications.

### Designed for high-performance applications

Putting the MSD System to work on your motion control tasks is simple when you consider the range of performance features this new servo drive offers:

- Fast update rates for current, velocity and position control loops enable you to meet the toughest demands for machine precision
- High acceleration internal communication via EtherCAT allows for control and coordination across multiple axes
- Comprehensive software package with motion control functionality to suit your needs. The MSD supports IEC 61131 programming as well as programming of customised control loops using MathWorks/C/C++. Thus enabling the creation of application-specific templates for deeper integration with your machines
- Support for multiple communication protocols via fieldbus connection (SERCOS, EtherCAT, CANopen, PROFIBUS and others) plus the ability to develop custom protocols
- Flexible performance secured by up to three feedback devices like Sin/Cos single- and multi-turn encoders with EnDat or Hiperface®-interfaces used simultaneously for precise positioning with added ability to support any customized position feedback devices
- Safety is crucial – The MSD is designed to implement safety functions according to EN 61508
- A size for every application – Servo drives from 2 to 170 A<sub>rms</sub> air-cooled or even 450 A<sub>rms</sub> liquid-cooled with AC or DC infeed optional (i.e. with the classic AC<sub>Mains</sub> connection or a DC infeed with central infeed unit). This allows the MSD to be applied across a wide range of machine sizes
- Ease of use exemplified via user-friendly GUI for PC supported parameterization, data programming and firmware exchange via MMC card or USB stick. Your PC may be connected through USB locally, TCP/IP for remote access through factory Ethernet or even via Internet

## MOTION CONTROLLER OVERVIEW

### Designed for the Present and the Future

The Motion Controller is based on a 32-bit microprocessor to coordinate and synchronize axes, and communicate with host computers and other PLCs via multiple fieldbus protocols. With its PLC functionality, the MSD Motion Controller can control processes of the machine.

It is designed for closed-loop control of velocity and position for up to 30 axes. Additionally, it is able to control input and visualization devices. It supports various communication protocols such as EtherCAT, CANopen and PROFIBUS-DP to any host controller.

The Motion Controller includes 2xEtherCAT master interfaces for fast real time communication with the servo drives

Based on the IEC 61131 development standard, Moog Axis Control Software (MACS), with specialized motion libraries is provided to program the Motion Controller

### Features

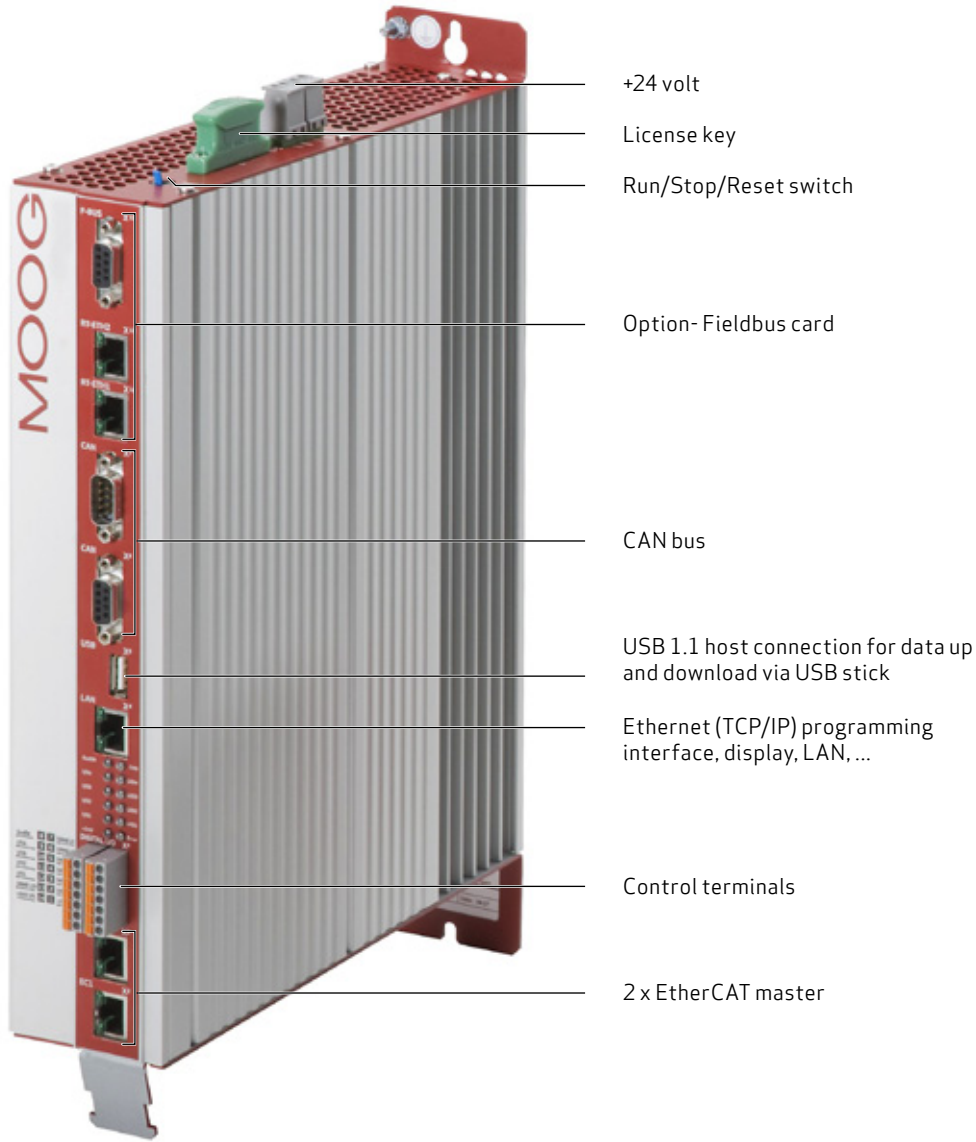
- Perfect servo drive control – As part of the Servo Drive system optimized for use with Moog Servo Drives for demanding servo control applications
- Accurate motion control – Fast and precise control of process variables such as position, speed, and power; short cycle times starting from 125  $\mu$ s and very low jitter (variation of time base) for optimum closed loop accuracy
- Unrestricted flexibility – Freely programmable multi-motion controllers with PLC functionality to meet the highest application demands
- Wide range of applications – Applicable with both electric and hydraulic drives for use in various motion control applications
- One-for-all software – One single standardized development environment MACS based on CODESYS for all Moog Motion Controllers
- Powerful software libraries – Special function blocks for applications with very complex motion control challenges
- Extensive error control – Wire fault monitoring for all digital sensor inputs and analog current outputs, LEDs for status and error display and sustained short circuit protection of the outputs for reliable processes

## ORDERING INFORMATION

G391	-	001	-	002
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Fieldbus Option	
001 =	None
002 =	PROFIBUS-DP
003 =	EtherCAT

# EQUIPMENT



- +24 volt
- License key
- Run/Stop/Reset switch

Option- Fieldbus card

CAN bus

USB 1.1 host connection for data up and download via USB stick

Ethernet (TCP/IP) programming interface, display, LAN, ...

Control terminals

2 x EtherCAT master

## TECHNICAL DATA

Ordering number	G391-001-001	G391-001-002	G391-001-003
<b>Integrated interfaces</b>			
Ethernet	1	1	1
USB	1	1	1
EtherCAT master	2	2	2
CAN/CANopen	1	1	1
<b>Optional interfaces</b>			
EtherCAT slave	-	-	1
PROFIBUS-DP slave	-	1	-
<b>Processor</b>			
Type	PowerPC Processor, 32-bit, RISC architecture with floating point unit		
RAM	128 MB		
Flash EEPROM	32 MB		
Data maintenance	Typically 10 years		
<b>General technical data</b>			
Connection technique	Plug-in terminal strips		
Mounting	On a backing plate		
Dimensions W x D x H	58.5 x 355 x 224 mm (2.30 x 13.98 x 8.82 in)		
Operating temperature range	-20 to +55 °C (-4 to +131 °F)		
Storage temperature range	-40 to +80 °C (-40 to +176 °F)		
Maximum mean temperature in operation for 24 hours	+50 °C (+122 °F)		
Relative air humidity	10 to 95 % (non-condensing)		
Maximum operation height	2,000 m (6,562 ft)		
Maximum storage height	3,000 m (9,843 ft)		
Maximum transport height	3,000 m (9,843 ft)		
Protection class	III		
Degree of Protection	IP20		
<b>Standards</b>			
Operating equipment demands and examinations	IEC 61131-2		
Interference emission	EN 61000-6-4		
Interference immunity	EN 61000-6-2, industrial part		
Shock resistance	IEC 60068-2-27		
Vibration resistance	IEC 60068-2-6		
Insulation strength	IEC 61131-2, test voltage 500 V <sub>DC</sub>		
<b>Power supply</b>			
Voltage supply of module electronics	24 V <sub>DC</sub> (18 to 36 V) SELV according to EN 60950-1		

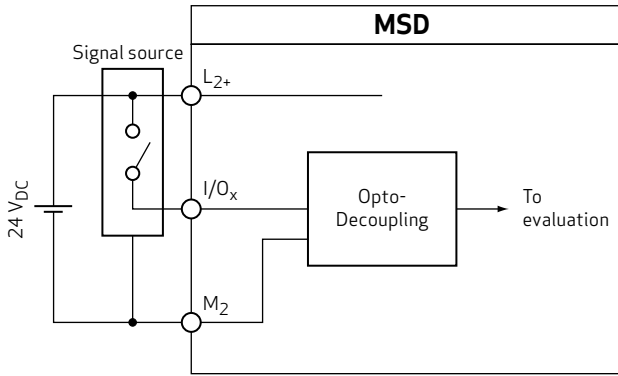


## TECHNICAL DATA

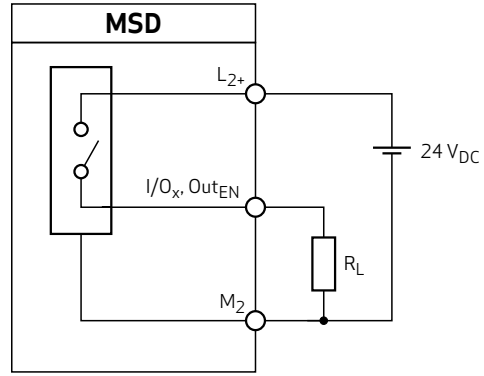
Ordering number	G391-001-001	G391-001-002	G391-001-003
<b>Current consumption of module electronics</b>			
Idling	0.3 A		
Full load	0.8 A		
Potential separation	Separate potentials for: <ul style="list-style-type: none"> <li>• Module electronics</li> <li>• +24 V supply</li> <li>• Digital inputs/outputs</li> <li>• Ethernet</li> </ul>		
Internal voltages	Generated via internal DC/DC converters		
Behavior at voltage features/cut-off of supply voltage	Necessary data are permanently stored. If the supply voltage fails (<18 V), buffer capacitors provide the necessary energy.		
<b>Interfaces</b>			
Ethernet	10/100 MBit/s with 8-pole RJ45 connector (100 Base-T)		
CAN	Connectors on the front cover, connected internally 1:1. Transmission rate adjustable from 10 kBit/s to 1 MBit/s.		
EtherCAT master	100 MBit/s		
EtherCAT slave	-	-	100 MBit/s
PROFIBUS-DP slave	-	12 MBit/s	-
USB	USB 1.1 host, USB-A connectors		
<b>Digital inputs/outputs</b>			
Type of digital inputs	Type 2 (current consuming) according to IEC 61131-2		
Number of digital inputs/outputs	4		
Configuration	Individually configurable as input or output in the MACS software		
Voltage supply	24 V <sub>DC</sub> (18 to 36 V), SELV according to EN 60950-1		
Maximum current consumption of single output	0.5 A		
<b>Protection</b>			
Sustained short-circuit	Yes		
Thermal overload	Yes		
<b>Diagnostics</b>			
Watchdog output: Outputs enabled signal	Digital outputs in operation. In the event of a fault, the watchdog output goes to an high impedance state.		

# TECHNICAL DATA

## Circuit diagrams - Inputs/outputs

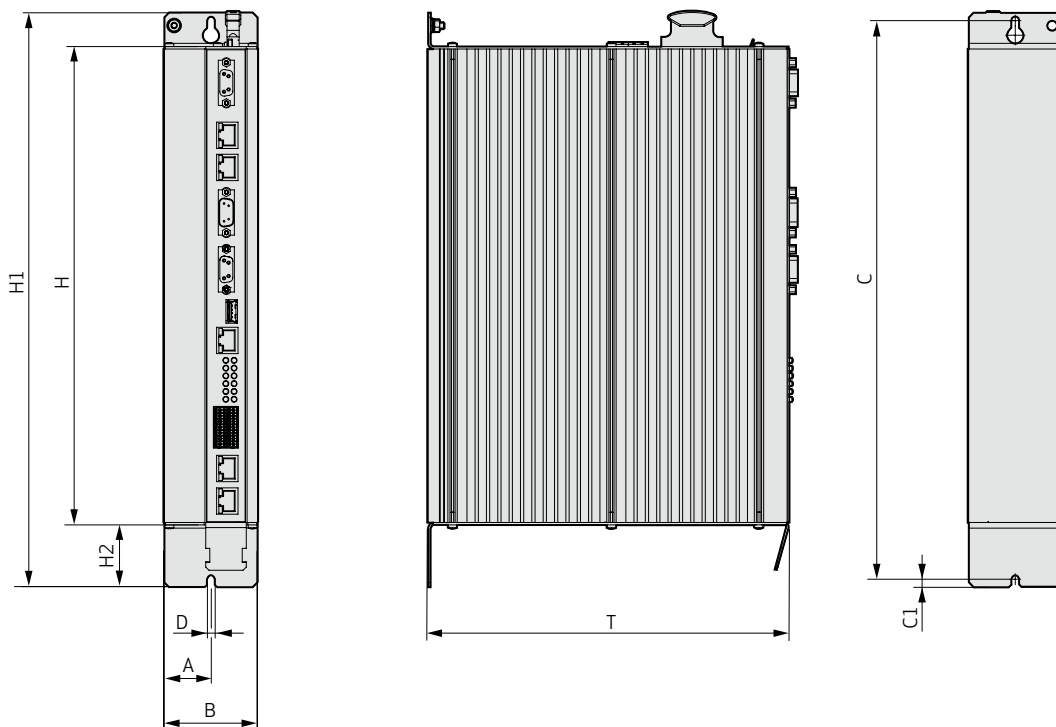


Digital input



Digital output

## Dimensional drawings



Dimensions	mm (in)
B (width)	58.5 (2.30)
H (height)	295 (11.61)
T (depth)	224 (8.82)
A	29.25 (1.15)
C/C1	344.5 (13.56)/13.5 (0.20)
D	∅ 4.8 (0.19)
H1/H2	355 (13.98)/13.9 (1.51)
T	73.5 (2.89)

## COMPACT VERSION OVERVIEW

### Designed for the Present and the Future

The low power Single-Axis Compact Versions (sizes C2 to C4) are designed for operating asynchronous (ASM) and synchronous motors such as PMSM.

Different PWM frequencies (4, 8 and 16 kHz) are available which can be set in the drive by a parameter.

For high-performance control loops, high update rates are supported: the Single-Axis Compact Version operates at cycle times of 62.5  $\mu$ s for current and 125  $\mu$ s for velocity and position control loops.

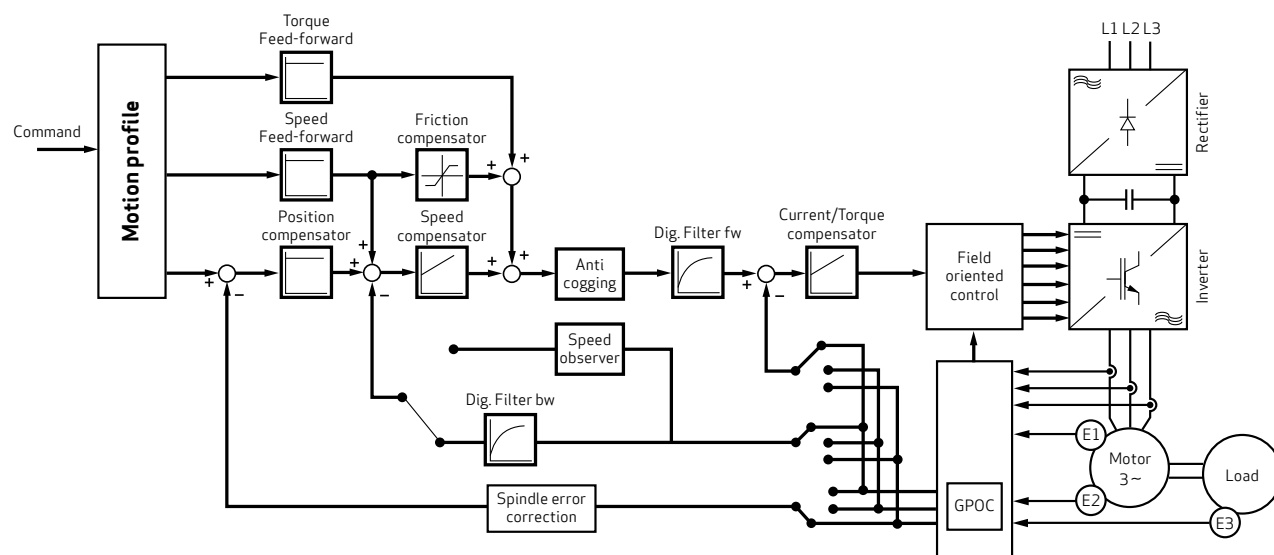
Currently, three mechanical sizes, based on output power, are available, ranging from 2 up to 8 A<sub>rms</sub>.

Feedback sensors such as Resolver, EnDat encoder or Hiperface® encoder are supported as standard. Beside that, application specific feedback sensors are possible on request!

The devices are available as air-cooled units.

### Features

- Standard cascaded servo loop control structure including current/torque, velocity and position control
- Feed forward structure for higher response time and reduced tracking error
- Compensation of friction and cogging torque
- Compensation of mechanic spindles errors for both directions
- Support for field weakening for asynchronous and synchronous AC motors
- Availability of observer methods (current and velocity observers) which can be switched on, on demand for improving the servo loop performance
- Patented method GPOC (Gain Phase Offset Correction) with correlation technique to compensate encoder and resolver errors
- Servo drives from 2 to 8 A<sub>rms</sub> supplied with the classic AC<sub>Mains</sub> connection (1 x 230 V/3 x 230 V or 3 x 400 V/460 V/480 V) and a 2 times overload capacity for 10 seconds
- Evaluation by up to 3 sensors  
For precise positioning even in systems with backlash and other mechanical errors
- Conformance to parts of EN 61508, EN 62061, EN ISO 13849-1, EN 61800-5-2 and EN 954-1 Category 4 is present to ensure personnel safety directly in the control unit of the drive
- Support of different fieldbus interfaces (CANopen, EtherCAT, PROFIBUS, SERCOS II, SERCOS III) via different option cards



## TECHNICAL DATA OVERVIEW - COMPACT VERSION



Sizes C2 to C4

### System voltage 1 x 230 V/3 x 230 V

Ordering number	Size	Rated current [A]	Current capacity	Technical data
G394-030	C2	3.0	<a href="#">Page 15</a>	<a href="#">Page 19</a>
G394-059	C3	5.9	<a href="#">Page 15</a>	<a href="#">Page 21</a>
G394-080	C4	8.0	<a href="#">Page 15</a>	<a href="#">Page 23</a>

### System voltage 3 x 400 V

Ordering number	Size	Rated current [A]	Current capacity	Technical data
G394-020	C2	2.0	<a href="#">Page 16</a>	<a href="#">Page 19</a>
G394-035	C3	3.5	<a href="#">Page 16</a>	<a href="#">Page 21</a>
G394-065	C4	6.5	<a href="#">Page 16</a>	<a href="#">Page 23</a>

# ORDERING INFORMATION

G394 - 030 - 210 - 001

Rated current/maximum current			
020 =	2.0/6.0 A	Size C2	- 400 V 3- <sup>2)</sup>
030 =	3.0/9.0 A	Size C2	- 230 V 3- 1- <sup>1)2)</sup>
035 =	3.5/10.5 A	Size C3	- 400 V 3-
059 =	5.9/17.7 A	Size C3	- 230 V 3- 1- <sup>1)</sup>
065 =	6.5/19.5 A	Size C4	- 400 V 3-
080 =	8.0/24.0 A	Size C4	- 230 V 3- 1- <sup>1)</sup>

Option 1: Fieldbus	
0 =	None
1 =	EtherCAT
2 =	CANopen
3 =	PROFIBUS
4 =	SERCOS II
5 =	n.a.
6 =	SERCOS III
7 =	n.a.
8 =	n.a.

Option 2: Sensors	
0 =	None
1 =	Second Sin/Cos encoder
2 =	TTL encoder simulation/TTL master encoder
3 =	n.a.
4 =	n.a.
5 =	TTL encoder with commutation signals
6 =	n.a.
7 =	n.a.

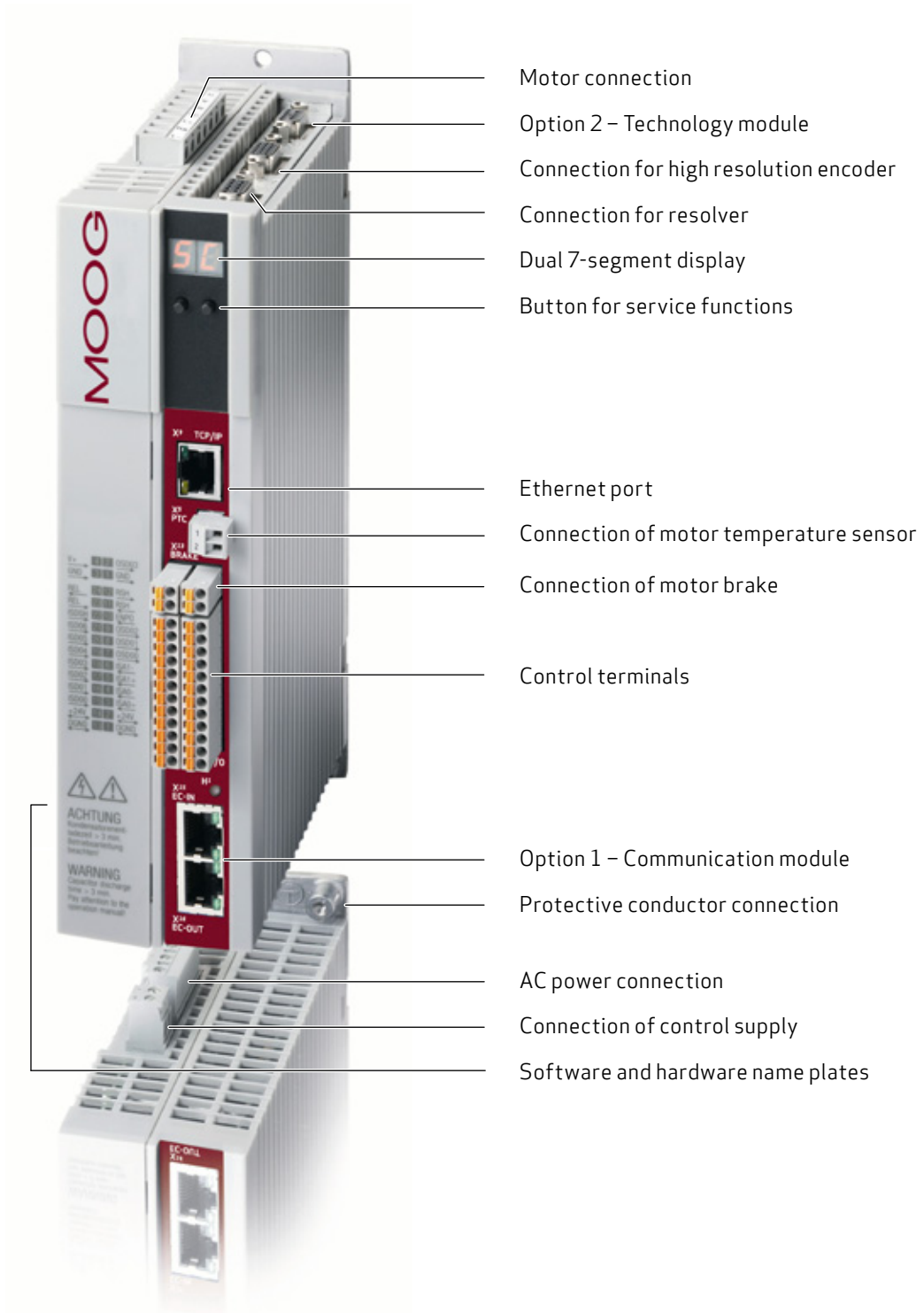
Option 3: Safety	
0 =	Standard
For future use	
1 =	Safety

Option 4: PLC functionality	
- =	without PLC
P =	with PLC
For future use	
H =	HF <sup>3)</sup>
F =	PLC + HF <sup>3)</sup>

Variant sequential numbering	
001	Standard
002	Internal brake resistor
003	Conformal coating
004	Internal brake resistor & conformal coating

1) Single phase with derating  
 2) Always with internal brake resistor  
 3) At option H, F the EG VO 428/2009, attachment I, pos. 3A225 has to be considered

# EQUIPMENT



- Motor connection
- Option 2 – Technology module
- Connection for high resolution encoder
- Connection for resolver
- Dual 7-segment display
- Button for service functions

- Ethernet port
- Connection of motor temperature sensor
- Connection of motor brake
- Control terminals

- Option 1 – Communication module
- Protective conductor connection

- AC power connection
- Connection of control supply
- Software and hardware name plates

## CURRENT CAPACITY

The rated current of the C2 to C4 sizes and the peak current are dependent on the mains voltage, the motor cable length, the power stage switching frequency and the ambient temperature. If the conditions change, the maximum permissible current capacity of the servo drives also changes.

### Sizes C2 to C4 for 1 x 230 V

Ordering number	Switching frequency of power stage [kHz]	Ambient temperature maximum [°C (°F)]	Rated current $I_N$ [A <sub>eff</sub> ] At 1 x 230 V	Peak current			
				200 % (2 $I_N$ )		300 % (3 $I_N$ )	
				[A <sub>eff</sub> ]	For time [s]	[A <sub>eff</sub> ]	For time [s]
G394-030	4	+45 (+113)	3.0	6.0	10	9.0	0.08
	8	+40 (+104)	3.0	6.0		9.0 <sup>1)</sup>	0.08 <sup>1)</sup>
	16	+40 (+104)	2.0	4.0		6.0 <sup>1)</sup>	0.08 <sup>1)</sup>
G394-059	4	+45 (+113)	5.9	11.8	10	-	-
	8	+40 (+104)					
	16	+40 (+104)					
G394-080	4	+45 (+113)	8.0	16.0	10	-	-
	8	+40 (+104)	8.0	16.0			
	16	+40 (+104)	5.4	10.0			

1) Automatic power stage switching frequency change to 4 kHz  
Data apply for a motor cable length of ≤10 m (32.80 ft). Maximum permissible motor cable length 30 m (98 ft)  
All current ratings with recommended mains choke

### Sizes C2 to C4 for 3 x 230 V

Ordering number	Switching frequency of power stage [kHz]	Ambient temperature maximum [°C (°F)]	Rated current $I_N$ [A <sub>eff</sub> ] At 3 x 230 V	Peak current			
				200 % (2 $I_N$ )		300 % (3 $I_N$ )	
				[A <sub>eff</sub> ]	For time [s]	[A <sub>eff</sub> ]	For time [s]
G394-030	4	+45 (+113)	3.0	6.0	10	9.0	0.08
	8	+40 (+104)	3.0	6.0		9.0 <sup>1)</sup>	
	16	+40 (+104)	2.0	4.0		6.0 <sup>1)</sup>	
G394-059	4	+45 (+113)	5.9	11.8	10	17.7	0.08
	8	+40 (+104)				17.7 <sup>1)</sup>	
	16	+40 (+104)				17.7 <sup>1)</sup>	
G394-080	4	+45 (+113)	8.0	16.0	10	24.0	0.08
	8	+40 (+104)	8.0	16.0		24.0 <sup>1)</sup>	
	16	+40 (+104)	5.4	10.8		16.2 <sup>1)</sup>	

1) Automatic power stage switching frequency change to 4 kHz  
Data apply for a motor cable length of ≤10 m (32.80 ft). Maximum permissible motor cable length 30 m (98 ft)

## CURRENT CAPACITY

### Sizes C2 to C4 for 3 x 400/460/480 V

Ordering number	Switching frequency of power stage [kHz]	Ambient temperature maximum [°C (°F)]	Rated current $I_N$ [A <sub>eff</sub> ]			Peak current <sup>1)</sup>			
			At 400 V	At 460 V	At 480 V	200 % ( $2 I_N$ )		300 % ( $3 I_N$ )	
						[A <sub>eff</sub> ]	For time [s]	[A <sub>eff</sub> ]	For time [s]
G394-020	4	+45 (+113)	2.0	2.0	2.0	4.0	10	6.0	0.08
	8	+40 (+104)	2.0	2.0	1.7	4.0		6.0 <sup>2)</sup>	
	16	+40 (+104)	0.7	0.7	-	1.4		2.1 <sup>2)</sup>	
G394-035	4	+45 (+113)	3.5	3.5	3.5	7.0	10	10.5	0.08
	8	+40 (+104)	3.5	3.5	2.6	7.0		10.5 <sup>2)</sup>	
	16	+40 (+104)	2.2	1.3	-	4.4		6.6 <sup>2)</sup>	
G394-065	4	+45 (+113)	6.5	6.5	6.5	13.0	10	19.5	0.08
	8	+40 (+104)	6.5	6.5	6.5	13.0		19.5 <sup>2)</sup>	
	16	+40 (+104)	4.0	2.4	1.9	8.0		12.0 <sup>2)</sup>	

1) Data referred to 3 x 400 V mains voltage

2) Automatic power stage switching frequency change to 4 kHz

Data apply for a motor cable length of ≤10 m (32.80 ft). Maximum permissible motor cable length 30 m (98 ft)



## AMBIENT CONDITIONS

<b>Ambient conditions</b>			
Protection	IP20 except terminals (IP00)		
Accident prevention regulations	According to local regulations (in Germany e.g. BGV A3)		
Type of installation height	Up to 1,000 m (3,280 ft) above MSL, over 1,000 m (3,280 ft) above MSL with power reduction (1 % per 100 m (328 ft), maximum 2,000 m (6,500 ft) above MSL)		
Pollution severity	2		
Type of installation	Built-in unit, only for vertical installation in a switch cabinet with minimum IP4x protection, when using STO safety function minimum IP54		
<b>Climatic conditions</b>			
In transit	As per EN 61800-2, IEC 60721-3-2 class 2K3 <sup>1)</sup>		
	Temperature -25 to +70 °C (-13 to +158 °F)		
	Relative air humidity 95 %, at maximum +40 °C (104 °F)		
In storage	As per EN 61800-2, IEC 60721-3-1 class 1K3 and 1K4 <sup>2)</sup>		
	Temperature -25 to +55 °C (-13 to +131 °F)		
	Relative air humidity 5 to 95 %		
In operation	As per EN 61800-2, IEC 60721-3-3 class 3K3 <sup>3)</sup>		
	Temperature -10 to +45 °C (+14 to +113 °F) (4 khz), to +55 °C (+131 °F) with power reduction (2 % per °C/°F) -10 to +40 °C (+14 to +104 °F) (8.16 khz), to +55 °C (+131 °F) with power reduction (2 % per °C/°F)		
	Relative air humidity 5 to 85 % without condensation		
<b>Mechanical conditions</b>			
Vibration limit in transit	As per EN 61800-2, IEC 60721-3-2 class 2M1		
	Frequency [Hz]	Amplitude [mm (in)]	Acceleration [ $m/s^2$ (in/ $s^2$ )]
	$2 \leq f < 9$	3.5 (0.14)	Not applicable
	$9 \leq f < 200$	Not applicable	10 (394.70)
	$200 \leq f < 500$	Not applicable	15 (590.55)
Shock limit in transit	As per EN 61800-2, IEC 60721-2-2 class 2M1		
	Drop height of packed device maximum 0.25 m (9.84 in)		
Vibration limits of the system <sup>2)</sup>	As per EN 61800-2, IEC 60721-3-3 class 3M1		
	Frequency [Hz]	Amplitude [mm (in)]	Acceleration [ $m/s^2$ (in/ $s^2$ )]
	$2 \leq f < 9$	0.3 (0.01)	Not applicable
	$9 \leq f < 200$	Not applicable	1 (39.37)

1) The absolute humidity is limited to maximum 60 g/m<sup>3</sup>. This means, at +70 °C (+158 °F) for example, that the relative humidity may only be maximum 40 %

2) The absolute humidity is limited to maximum 29 g/m<sup>3</sup>. So the maximum values for temperature and relative air humidity stipulated in the table must not occur simultaneously

3) The absolute humidity is limited to maximum 25 g/m<sup>3</sup>. That means that the maximum values for temperature and relative air humidity stipulated in the table must not occur simultaneously

**Note:** The devices are only designed for stationary use. The drive controllers must not be installed in areas where they would be permanently exposed to vibrations

## CERTIFICATIONS AND STANDARDS

### CE mark

The Single-Axis Compact Version (sizes C2 to C4) conform to the requirements of the Low Voltage Directive 2006/95/EC and the product standard EN 61800-5-1.

They thus conform to the requirements for installation in a machine or plant under the terms of the Machinery Directive 2006/42/EC.

The servo drives products are accordingly CE marked. The CE mark on the type plate indicates conformity with the above Directives.

### UL/UR approbation

The devices have the following approbation:

MSD Servo Drive Compact	Approbation
G394-030-xxx-xx1	UR
G394-059-xxx-xx1	UL
G394-080-xxx-xx1	UL
G394-020-xxx-xx1	UR
G394-035-xxx-xx1	UL
G394-065-xxx-xx1	UL

**Note:** For devices with integrated braking resistor UL-approbation is in preparation

### EMC acceptance tests

Sizes C2 to C4 are by design resistant to interference in accordance with EN 61800-3, environment classes 1 and 2.

To limit line-borne interference emission to the permissible level, external EMC mains filters are available (see "Accessories" section). The use of these mains filters ensures compliance with the EMC Directive 2004/108/EC:

- Public low-voltage network:  
"first environment" (residential C2) up to 10 m (32.8 ft) motor cable length
- Industrial low-voltage network:  
"second environment" (residential C2) up to 30 m (98.4 ft) motor cable length

### STO acceptance

The "STO" (Safe Torque Off) safety function integrated into the Single-Axis Compact Version is certified according to the following requirements of:

- EN 61800-5-2
- EN ISO 13849-1 "PL e"
- EN 61508 / EN 62061 "SIL 3"

Acceptance testing is carried out by the accredited certification agency, TÜV Rheinland.

## TECHNICAL DATA

### Size C2



Type G394-030

Ordering number	G394-030	G394-020
<b>Output, motor side</b>		
Voltage	3-phase $U_{\text{Mains}}$	
Rated current, effective ( $I_N$ ) <sup>1)</sup>	3 A	2 A <sup>2)</sup>
Peak current	Page 15	Page 15
Rotating field frequency	0 to 400 Hz	
Switching frequency of power stage	4/8/16 kHz	
<b>Input, mains side</b>		
Mains voltage ( $U_{\text{Mains}}$ )	$(1 \times 230 V_{AC}/3 \times 230 V_{AC}) -20\%/+15\%$	$(3 \times 400 V_{AC}/3 \times 460 V_{AC}/3 \times 480 V_{AC}) \pm 10\%$
Device connected load (with mains choke)	1.3 kVA	1.5 kVA
Current (with mains choke)	5.4 A ( $1 \times 230 V_{AC}$ )/3.3 A ( $3 \times 230 V_{AC}$ )	2.2 A <sup>2)</sup>
Asymetry of mains voltage	$\pm 3\%$ maximum (at $3 \times 230 V_{AC}$ )	$\pm 3\%$
Frequency	50/60 Hz $\pm 10\%$	
Power loss at 8 kHz and $I_N$	75 W	42 W <sup>2)</sup>
<b>DC link</b>		
Braking chopper switch-on-threshold	390 V <sub>DC</sub>	650 V <sub>DC</sub> <sup>2)</sup>
Minimum ohmic resistance of an externally installed braking resistor	72 $\Omega$	230 $\Omega$
Brake chopper continuous power with external braking resistor <sup>3)</sup>	2.1 kW	1.8 kW
Brake chopper peak power with external braking resistor <sup>3)</sup>	2.1 kW	1.8 kW
Internal braking resistor	550 $\Omega$ (PTC)	7,500 $\Omega$ (PTC)
Brake chopper continuous power with internal braking resistor <sup>3)</sup>	0 W	0 W
Brake chopper peak power with internal braking resistor <sup>3)</sup>	400 W	200 W <sup>2)</sup>

1) Data referred to 4 kHz and 8 kHz switching frequency

2) Data referred to 400 V<sub>AC</sub> mains voltage

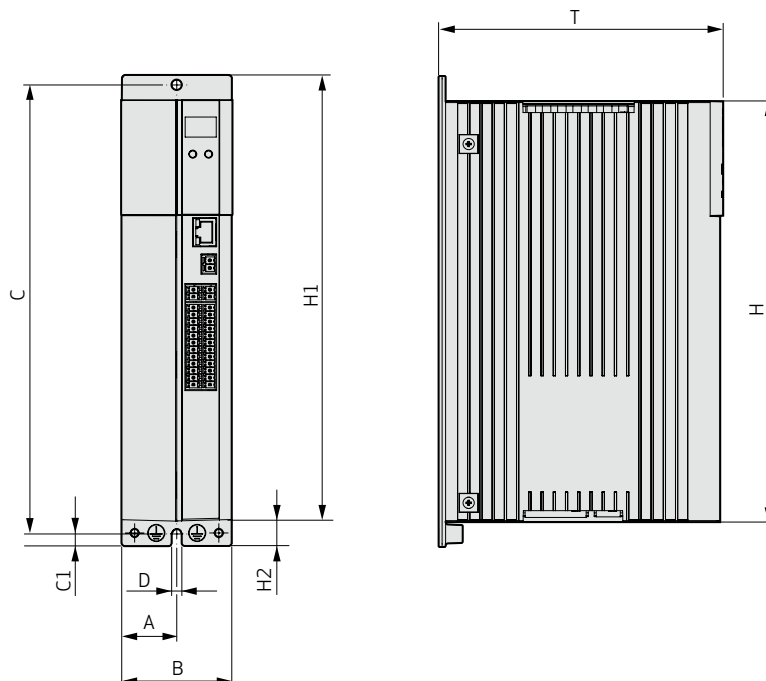
3) A braking resistor is always integrated; connection of an external resistor is permissible

Servo drive	G394-030	G394-020
Cooling method	Air-cooled	
Protection	IP20 except terminals (IP00)	
Cooling air temperature	Maximum +45 °C (+113 °F) (at 4 kHz power stage switching frequency)	
Weight	1.0 kg (2.2 lb)	
Mounting type	Vertical mounting with unimpeded air flow	
Mounting several servo drives	Direct side by side mounting	

## TECHNICAL DATA

### Size C2

#### Dimensional drawings



Dimensions	mm (in)
B (width)	55 (2.17)
H (height)	210 (8.27)
T (depth)	142 (5.59) (without mating connectors)
A	27.5 (1.08)
C/C1	225/5 (8.86/0.20)
D	∅ 4.8 (0.19)
H1/H2	235/12.5 (9.25/0.49)

#### Matching accessories

Servo drive	G394-030	G394-020
Mains choke	CA68926-001 (1 x 230 V) CA55830-001 (3 x 230 V)	CA55830-001
Braking resistor (external)	CA59737-001 (35 W, 90 Ω) CA59738-001 (150 W, 90 Ω) CA59739-001 (300 W, 90 Ω)	CB36903-001 (35 W, 260 Ω) CB36904-001 (150 W, 260 Ω)
Mains filter	CB09937-001 (1 x 230 V) CB09940-001 (3 x 230 V)	CB09940-001

# TECHNICAL DATA

## Size C3



Type G394-035

Ordering number	G394-059	G394-035
<b>Output, motor side</b>		
Voltage	3-phase $U_{Mains}$	
Rated current, effective ( $I_N$ ) <sup>1)</sup>	5.9 A	3.5 A <sup>2)</sup>
Peak current	<a href="#">Page 15</a>	<a href="#">Page 16</a>
Rotating field frequency	0 to 400 Hz	
Switching frequency of power stage	4/8/16 kHz	
<b>Input, mains side</b>		
Mains voltage ( $U_{Mains}$ )	$(1 \times 230 V_{AC} / 3 \times 230 V_{AC}) -20\%/+15\%$	$(3 \times 400 V_{AC} / 3 \times 460 V_{AC} / 3 \times 480 V_{AC}) \pm 10\%$
Device connected load (with mains choke)	2.6 kVA	2.7 kVA
Current (with mains choke)	10.6 A ( $1 \times 230 V_{AC}$ )/6.5 A ( $3 \times 230 V_{AC}$ )	3.9 A <sup>2)</sup>
Asymetry of mains voltage	$\pm 3\%$ maximum (at $3 \times 230 V_{AC}$ )	$\pm 3\%$ maximum
Frequency	50/60 Hz $\pm 10\%$	
Power loss at 8 kHz and $I_N$	150 W	80 W <sup>2)</sup>
<b>DC link</b>		
Braking chopper switch-on-threshold	390 V <sub>DC</sub>	650 V <sub>DC</sub> <sup>2)</sup>
Minimum ohmic resistance of an externally installed braking resistor	72 $\Omega$	180 $\Omega$
Brake chopper continuous power with external braking resistor	2.1 kW	2.3 kW
Brake chopper peak power with external braking resistor	2.1 kW	2.3 kW
Optional: Internal braking resistor	100 $\Omega$ (PTC)	420 $\Omega$ (PTC)
Brake chopper continuous power with internal braking resistor	Dependent on the effective loading of the servo drive in the corresponding application	
Brake chopper peak power with internal braking resistor <sup>1)</sup>	1,500 W	1,000 W <sup>2)</sup>

1) Data referred to 4 kHz and 8 kHz switching frequency

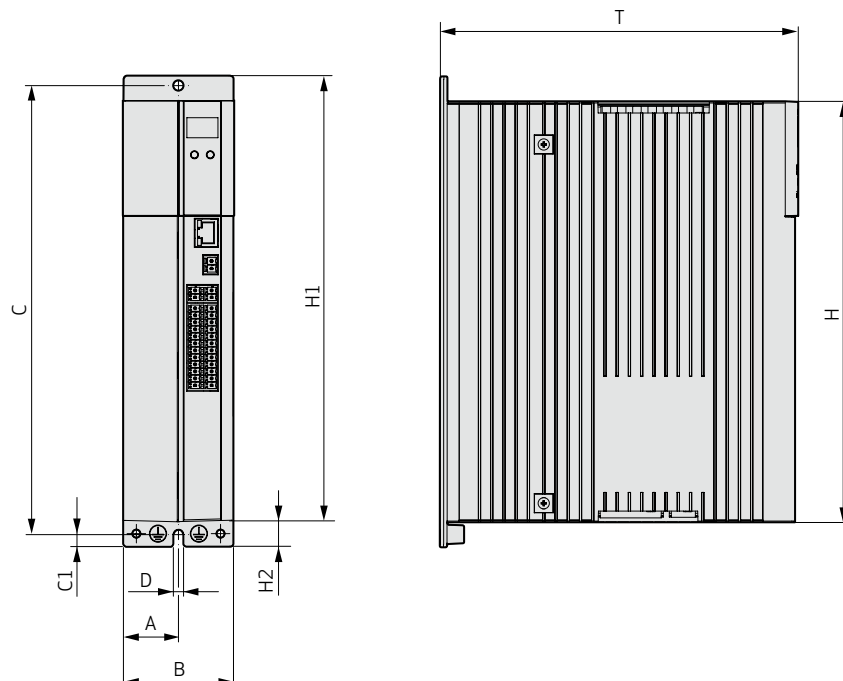
2) Data referred to 400 V<sub>AC</sub> mains voltage

Servo drive	G394-059	G394-035
Cooling method	Air-cooled	
Protection	IP20 except terminals (IP00)	
Cooling air temperature	Maximum +45 °C (+113 °F) (at 4 kHz power stage switching frequency)	
Weight	1.5 kg (3.3 lb)	
Mounting type	Vertical mounting with unimpeded air flow	
Mounting several servo drives	Direct side by side mounting	

## TECHNICAL DATA

### Size C3

#### Dimensional drawings



Dimensions	mm (in)
B (width)	55 (2.17)
H (height)	210 (8.27)
T (depth)	189 (7.44) (without mating connectors)
A	27.5 (1.08)
C/C1	225/5 (8.86/0.20)
D	∅ 4.8 (0.19)
H1/H2	235/12.5 (9.25/0.49)

#### Matching accessories

Servo drive	G394-059	G394-035
Mains choke	CA68926-001 (1 x 230 V) CA55832-001 (3 x 230 V)	CA55831-001
Braking resistor (external)	CA59737-001 (35 W, 90 Ω) CA59738-001 (150 W, 90 Ω) CA59739-001 (300 W, 90 Ω) CA59740-001 (1,000 W, 90 Ω)	CB09047-001 (35 W, 200 Ω) CB09048-001 (150 W, 200 Ω) CB09049-001 (300 W, 200 Ω)
Mains filter	CB09938-001 (1 x 230 V) CB09942-001 (3 x 230 V)	CB09940-001

# TECHNICAL DATA

## Size C4



Type G394-065

Ordering number	G394-080	G394-065
<b>Output, motor side</b>		
Voltage	3-phase $U_{Mains}$	
Rated current, effective ( $I_N$ ) <sup>1)</sup>	8.0 A	6.5 A <sup>2)</sup>
Peak current	<a href="#">Page 15</a>	<a href="#">Page 16</a>
Rotating field frequency	0 to 400 Hz	
Switching frequency of power stage	4/8/16 kHz	
<b>Input, mains side</b>		
Mains voltage ( $U_{Mains}$ )	$(1 \times 230 V_{AC} / 3 \times 230 V_{AC}) -20 \%/+15 \%$	$(3 \times 400 V_{AC} / 3 \times 460 V_{AC} / 3 \times 480 V_{AC}) \pm 10 \%$
Device connected load (with mains choke)	3.5 kVA	5.0 kVA
Current (with mains choke)	14.4 A ( $1 \times 230 V_{AC}$ )/8.8 A ( $3 \times 230 V_{AC}$ )	7.2 A <sup>2)</sup>
Asymetry of mains voltage	$\pm 3 \%$ maximum (at $3 \times 230 V_{AC}$ )	$\pm 3 \%$ maximum
Frequency	50/60 Hz $\pm 10 \%$	
Power loss at 8 kHz and $I_N$	200 W	150 W <sup>2)</sup>
<b>DC link</b>		
Braking chopper switch-on-threshold	390 V <sub>DC</sub>	650 V <sub>DC</sub> <sup>2)</sup>
Minimum ohmic resistance of an externally installed braking resistor	72 $\Omega$	72 $\Omega$
Brake chopper continuous power with external braking resistor	2.1 kW	5.9 kW
Brake chopper peak power with external braking resistor	2.1 kW	5.9 kW
Optional: Internal braking resistor	90 $\Omega$ (PTC)	90 $\Omega$ (PTC)
Brake chopper continuous power with internal braking resistor	Dependent on the effective loading of the servo drive in the corresponding application	
Brake chopper peak power with internal braking resistor	1.7 kW	4.7 kW <sup>2)</sup>

1) Data referred to 4 kHz and 8 kHz switching frequency

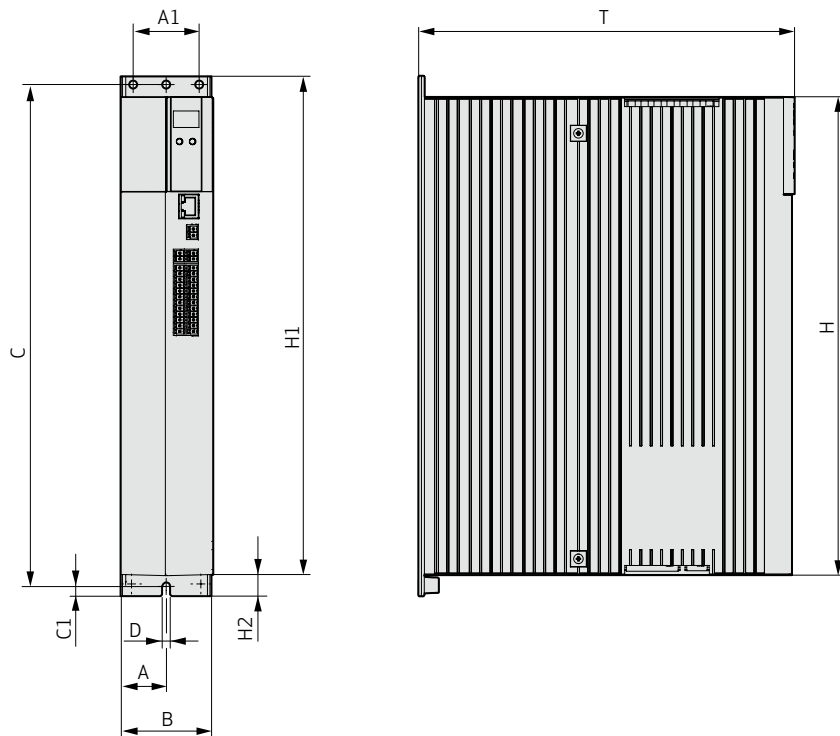
2) Data referred to 400 V<sub>AC</sub> mains voltage

Servo drive	G394-080	G394-065
Cooling method	Air-cooled	
Protection	IP20 except terminals (IP00)	
Cooling air temperature	Maximum +45 °C (+113 °F) (at 4 kHz power stage frequency)	
Weight	2.8 kg (6.2 lb)	
Mounting type	Vertical mounting with unimpeded airflow	
Mounting several servo drives	Direct side by side mounting	

## TECHNICAL DATA

### Size C4

#### Dimensional drawings



Dimensions	mm (in)
B (width)	55 (2.17)
H (height)	290 (11.42)
T (depth)	235.5 (9.27) (without mating connectors)
A/A1	27.5/40 (1.08/1.57)
C/C1	305/5 (12.01/0.20)
D	∅ 4.8 (0.19)
H1/H2	315/12.5 (12.40/0.49)

#### Matching accessories

Servo drive	G394-080	G394-065
Mains choke	CA55832-001	CA55832-001
Braking resistor (external)	CA59737-001 (35 W, 90 Ω) CA59738-001 (150 W, 90 Ω) CA59739-001 (300 W, 90 Ω) CA59740-001 (1000 W, 90 Ω)	
Mains filter	CB09942-001	CB09942-001



## TECHNICAL DATA OVERVIEW - STANDARD VERSION

### Designed for the Present and the Future

The Single-Axis Standard Version closes current loops (PWM frequencies 4, 8, 12 and 16 kHz). It is also able to close velocity and position control loops.

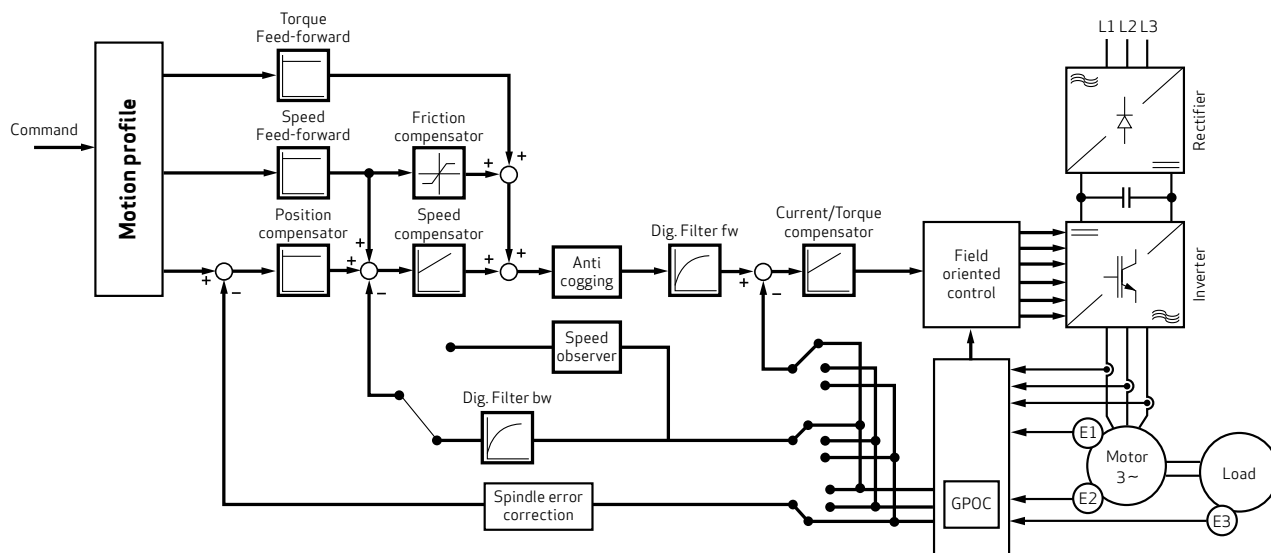
For high-performance control loops, high update rates are supported: the Single-Axis Standard Version operates at cycle times of 62.5  $\mu\text{s}$  for current and 125  $\mu\text{s}$  for velocity and position control loops.

Currently, 8 mechanical sizes, based on output power, are available, ranging from 4 up to 170  $A_{\text{rms}}$  with classical air cooling. Between 16 and 450  $A_{\text{rms}}$  the servo drives are also available as liquid-cooled devices.

It supports feedback sensors such as Resolver, EnDat encoder or Hiperface® encoder as standard. Beside that, application specific feedback sensors are possible on request!

### Features

- Standard cascaded servo loop control structure including current/torque, velocity and position control
- Feed forward structure for higher response time and reduced tracking error
- Compensation of friction and cogging torque
- Compensation of mechanic spindle errors for both directions
- Support for field weakening for asynchronous and synchronous AC motors
- Availability of observer methods (current and velocity observers) which can be switched on, on demand for improving the server loop performance
- Patented method GPOC (Gain Phase Offset Correction): correlation technique to compensate encoder and resolver errors
- Servo drives from 4 to 450  $A_{\text{rms}}$   
Supply with the classic  $AC_{\text{Mains}}$  connection
- Evaluation by up to 3 position sensors  
For precise positioning even in systems with backlash and other mechanical errors
- Built in functional safety as per EN 61508, EN 62061, EN ISO 13849-1, EN 61800-5-2,  
personnel safety directly into the servo drive



## TECHNICAL DATA OVERVIEW - STANDARD VERSION



Sizes 1 to 7

### System voltage 1 x 230 V

Ordering number	Size	Rated current [A]	Current capacity	Technical data
G392-004A	Size 1	4.0	<a href="#">Page 33</a>	<a href="#">Page 42</a>

### System voltage 3 x 400 V

Ordering number		Size	Rated current [A]		Current capacity	Technical data
Air-cooled	Liquid-cooled		Air-cooled	Liquid-cooled		
G392-004	-	Size 1	4.0	-	<a href="#">Page 34</a>	<a href="#">Page 42</a>
G392-006	-		6.0	-		
G392-008	-	Size 2	8.0	-	<a href="#">Page 34</a>	<a href="#">Page 44</a>
G392-012	-		12	-		
G392-016	G395-016	Size 3	16	16	<a href="#">Page 34/35</a>	<a href="#">Page 46</a>
G392-020	G395-020		20	20		
G392-024	G395-024	Size 4	24	24	<a href="#">Page 34/35</a>	<a href="#">Page 48</a>
G392-032	G395-032		32	32		
G392-045	G395-053	Size 5	45	53	<a href="#">Page 36/37</a>	<a href="#">Page 50</a>
G392-060	G395-070		60	70		
G392-072	G395-084		72	84		
G392-090	G395-110	Size 6	90	110	<a href="#">Page 36/37</a>	<a href="#">Page 52</a>
G392-110	G395-143		110	143		
G392-143	G395-170	Size 6A	143	170	<a href="#">Page 36/37</a>	<a href="#">Page 54</a>
G392-170	G395-210		170	210		
-	G395-250	Size 7	-	250	<a href="#">Page 38</a>	<a href="#">Page 56</a>
-	G395-325		-	325		
-	G395-450		-	450		

# ORDERING INFORMATION

## Air-cooled

G392 - 006 - 210 - 0 01

Rated current/maximum current			
004 =	4/8 A	Size 1	045 = 45/90 A Size 5 <sup>1)</sup>
006 =	6/12 A	Size 1	060 = 60/120 A Size 5 <sup>1)</sup>
008 =	8/16 A	Size 2	072 = 72/144 A Size 5 <sup>1)</sup>
012 =	12/24 A	Size 2	090 = 90/180 A Size 6 <sup>1)</sup>
016 =	16/32 A	Size 3	110 = 110/165 A Size 6 <sup>1)</sup>
020 =	20/40 A	Size 3	143 = 143/215 A Size 6 A <sup>1)</sup>
024 =	24/48 A	Size 4	170 = 170/315 A Size 6 A <sup>1)</sup>
032 =	32/64 A	Size 4	

Supply voltage	
- =	3x 230 V to 480 V
A =	1x 230 V

Option 1: Fieldbus	
0 =	None
1 =	EtherCAT
2 =	CANopen
3 =	PROFIBUS-DP
4 =	SERCOS II
5 =	CANopen + 2 analog outputs
6 =	SERCOS III

Availability on request:	
7 =	VARAN
8 =	PROFINET IRT

Option 2: Sensors	
0 =	None
1 =	Second Sin/Cos encoder
2 =	TTL encoder simulation/TTL master encoder
3 =	n.a.
4 =	TwinSync communication
5 =	TTL encoder with commutation signal
6 =	SSI encoder simulation
7 =	Analog I/O option card, 16-bit

Option 3: Safety	
0 =	Standard

For future use	
1 =	Safety

Option 4: PLC functionality	
- =	without PLC
P =	with PLC
Q =	PQ firmware
R =	PQ firmware + PLC

For future use	
H =	HF <sup>2)</sup>
F =	PLC + HF <sup>2)</sup>

Modification	
0 =	Standard
1 =	Analog input 4 to 20 mA on control card

Variant sequential numbering			
01	Standard	02	Internal brake resistor
03	Conformal coating	04	Internal brake resistor & conformal coating

1) Not with internal braking resistor available  
 2) At option H,F the EG VO 428/2009, attachment I, pos. 3A225 has to be considered

**Note:** As from Size 5 available only with conformal coating

# ORDERING INFORMATION

## Liquid-cooled

G395 - 070 - 210 - 0 01

Rated current/maximum current			
016 =	16/32 A	Size 3	110 = 110/187 A Size 6 <sup>1)</sup>
020 =	20/40 A	Size 3	143 = 143/215 A Size 6 <sup>1)</sup>
024 =	24/48 A	Size 4	170 = 170/255 A Size 6A <sup>1)</sup>
032 =	32/64 A	Size 4	210 = 210/255 A Size 6A <sup>1)</sup>
053 =	53/90 A	Size 5 <sup>1)</sup>	250 = 250/375 A Size 7 <sup>1),3)</sup>
070 =	70/120 A	Size 5 <sup>1)</sup>	325 = 325/485 A Size 7 <sup>1),3)</sup>
084 =	84/144 A	Size 5 <sup>1)</sup>	450 = 450/675 A Size 7 <sup>1),3)</sup>

Option 1: Fieldbus	
0 =	None
1 =	EtherCAT
2 =	CANopen
3 =	PROFIBUS-DP
4 =	SERCOS II
5 =	CANopen + 2 analog outputs
6 =	SERCOS III
Availability on request:	
7 =	VARAN
8 =	PROFINET IRT

Option 2: Sensors	
0 =	None
1 =	Second Sin/Cos encoder
2 =	TTL encoder simulation/TTL master encoder
3 =	n.a.
4 =	TwinSync communication
5 =	TTL encoder with commutation signal
6 =	SSI encoder simulation
7 =	Analog I/O option card, 16-bit

Option 3: Safety	
0 =	Standard
For future use	
1 =	Safety

Option 4: PLC functionality	
- =	without PLC
P =	with PLC
Q =	PQ firmware
R =	PQ firmware + PLC
For future use	
H =	HF <sup>2)</sup>
F =	PLC + HF <sup>2)</sup>

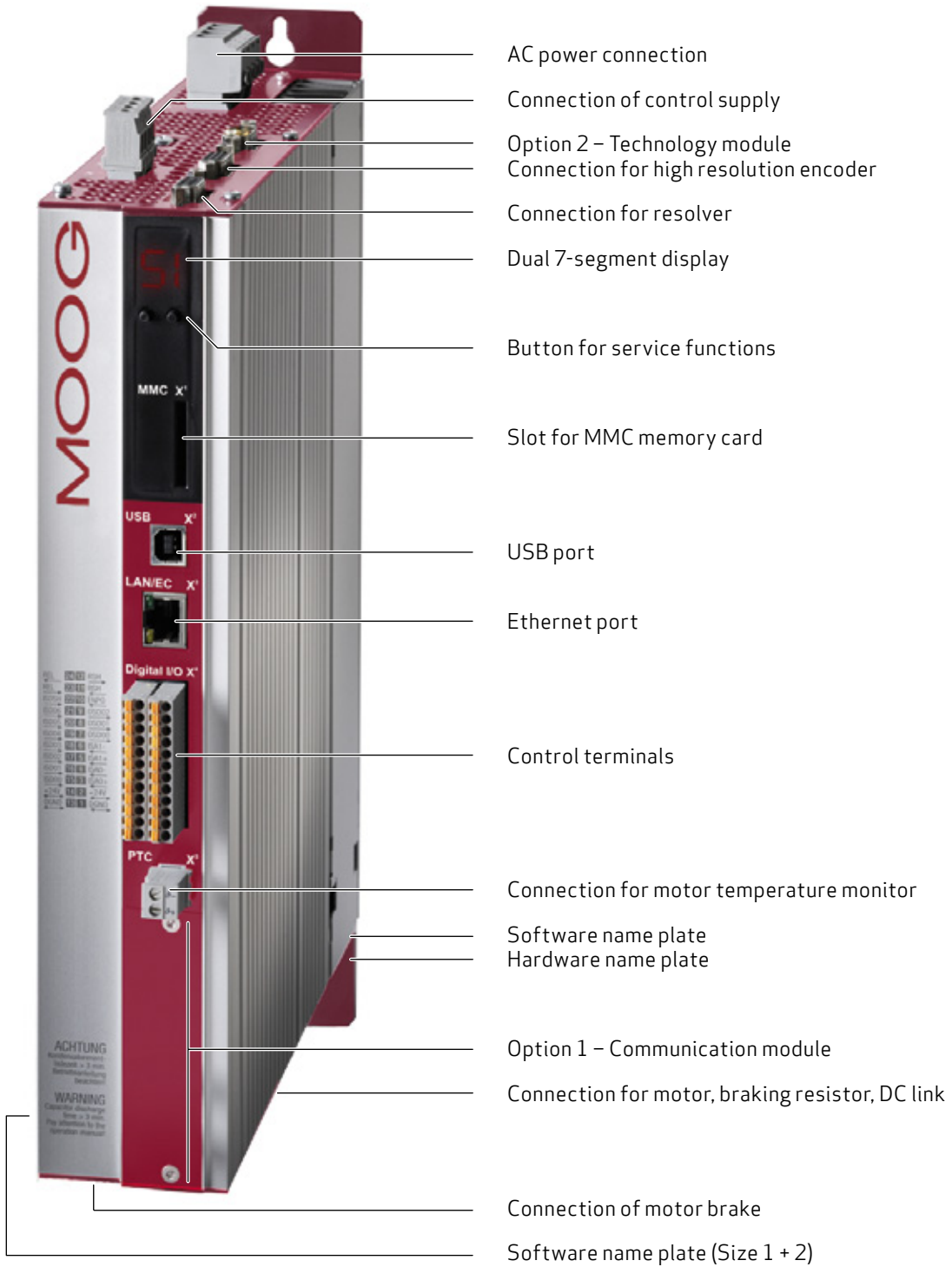
Modification	
0 =	Standard
1 =	Analog input 4 to 20 mA on control card

Variant sequential numbering			
01	Standard	02	Internal brake resistor
03	Conformal coating	04	Internal brake resistor & conformal coating

1) Not with internal braking resistor available  
 2) At option H,F the EG VO 428/2009, attachment I, pos. 3A225 has to be considered  
 3) 2 kHz switching frequency (PWM)

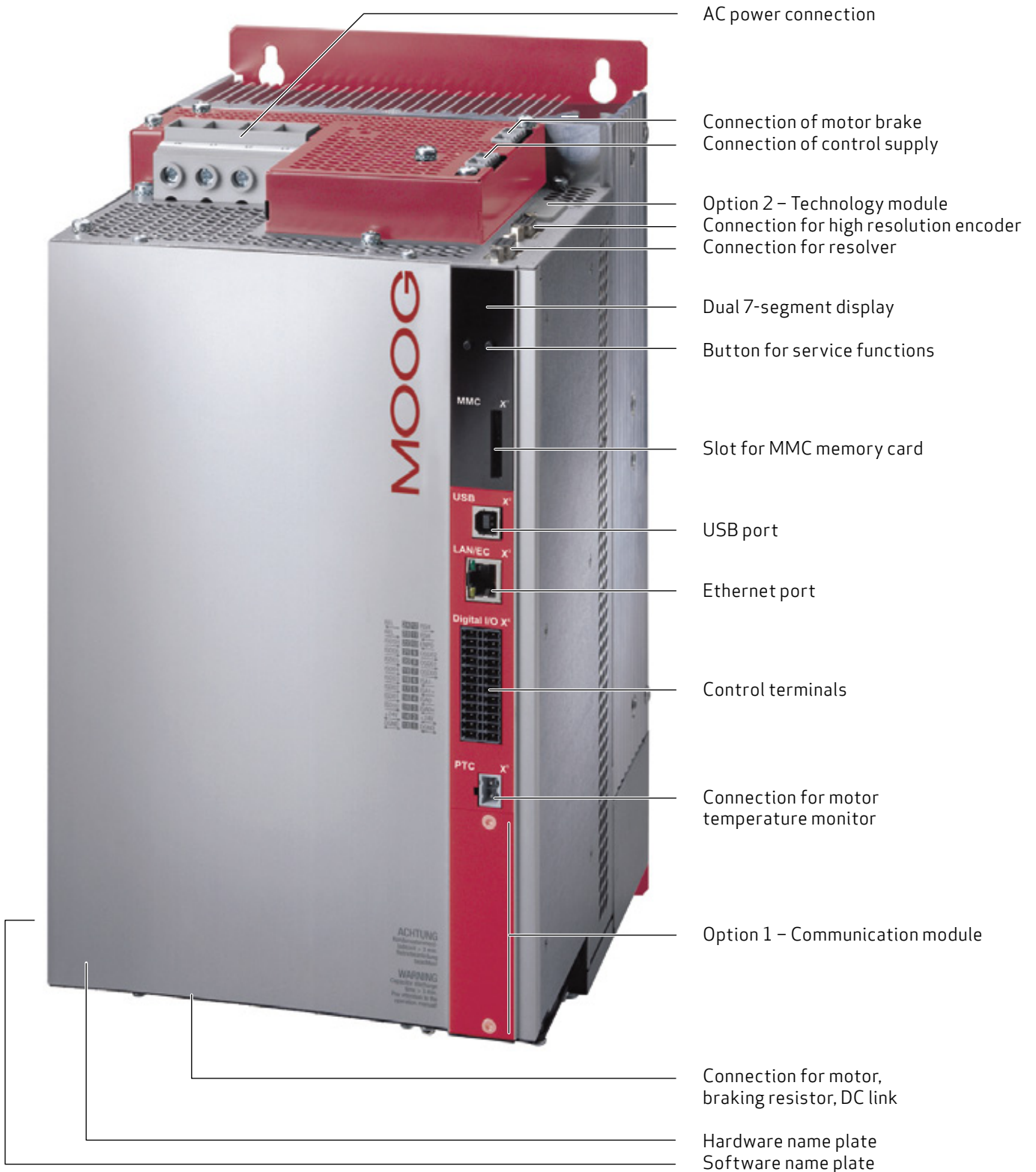
# EQUIPMENT

## Sizes 1 to 4 – Interface



# EQUIPMENT

## Size 5 - Interface



AC power connection

Connection of motor brake  
Connection of control supply

Option 2 - Technology module  
Connection for high resolution encoder  
Connection for resolver

Dual 7-segment display

Button for service functions

Slot for MMC memory card

USB port

Ethernet port

Control terminals

Connection for motor  
temperature monitor

Option 1 - Communication module

Connection for motor,  
braking resistor, DC link

Hardware name plate  
Software name plate

# EQUIPMENT

## Size 6A – Interface



- AC power connection
- Connection of control supply
- Connection of motor brake
- Option 2 – Technology module
- Connection for High resolution encoder
- Connection for resolver
- Dual 7- segment display
- Button for service functions
- Slot for MMC memory card
- USB port
- Ethernet port
- Control terminals
- Connection of motor temperature monitor
- Option 1 – Communication module
- Hardware name plate
- Connection for motor, braking resistor, DC link
- Software name plate

# EQUIPMENT

## Size 7 - Interface





## CURRENT CAPACITY

### Size 1 – 1-phase, Air-cooled

The maximum permissible servo drive rated current and peak current are dependent on the mains voltage, the motor cable length, the power stage switching frequency and the ambient temperature. If the conditions change, the maximum permissible current capacity of the servo drives also changes.

Ordering number	Switching frequency of power stage [kHz]	Ambient temperature maximum [°C (°F)]	Rated current $I_N$ [A <sub>eff</sub> ] At 1 x 230 V <sub>AC</sub>	Peak current [A <sub>eff</sub> ]			For time <sup>1)</sup> [s]
				At rotating field frequency rising in linear mode 0 to 5 Hz		For intermittent operation > 5 Hz	
				0 Hz	5 Hz		
G392-004A Size 1	4	+45 (+113)	4.0	8.0	8.0	8.0	10
	8	+40 (+104)	4.0	8.0	8.0	8.0	
	12	+40 (+104)	3.7	7.4	7.4	7.4	
	16	+40 (+104)	2.7	5.4	5.4	5.4	

1) Shutdown as per  $I^2t$  characteristic

**Note:** Data apply for motor cable length ≤10 m (32.80 ft)

## CURRENT CAPACITY

### Sizes 1 to 4 – Air-cooled

Ordering number	Switching frequency of power stage  [kHz]	Ambient temperature  [°C (°F)]	Rated current [A <sub>eff</sub> ]			Peak current [A <sub>eff</sub> ] <sup>1)</sup>			For time <sup>2)</sup>  [s]
			At 3 x 230 V <sub>AC</sub> At 3 x 400 V <sub>AC</sub>	At 3 x 460 V <sub>AC</sub>	At 3 x 480 V <sub>AC</sub>	At rotating field frequency rising in linear mode 0 to 5 Hz		For intermittent operation > 5 Hz	
						0 Hz	5 Hz		
G392-004 Size 1	4	+45 (+113)	4.0	4.0	4.0	8.0	8.0	8.0	10
	8	+40 (+104)	4.0	4.0	4.0	8.0	8.0	8.0	
	12	+40 (+104)	3.7	2.9	2.7	7.4	7.4	7.4	
	16	+40 (+104)	2.7	1.6	1.3	5.4	5.4	5.4	
G392-006 Size 1	4	+45 (+113)	6.0	6.0	6.0	12.0	12.0	12.0	10
	8	+40 (+104)	6.0	6.0	6.0	12.0	12.0	12.0	
	12	+40 (+104)	5.5	4.4	4.0	11.0	11.0	11.0	
	16	+40 (+104)	4.0	2.4	1.9	8.0	8.0	8.0	
G392-008 Size 2	4	+45 (+113)	8.0	8.0	8.0	16.0	16.0	16.0	10
	8	+40 (+104)	8.0	7.2	6.9	16.0	16.0	16.0	
	12	+40 (+104)	6.7	5.3	4.9	13.4	13.4	13.4	
	16	+40 (+104)	5.0	3.7	3.3	10.0	10.0	10.0	
G392-012 Size 2	4	+45 (+113)	12.0	12.0	12.0	24.0	24.0	24.0	10
	8	+40 (+104)	12.0	10.8	10.4	24.0	24.0	24.0	
	12	+40 (+104)	10.0	8.0	7.4	20.0	20.0	20.0	
	16	+40 (+104)	7.6	5.6	5.0	15.2	15.2	15.2	
G392-016 Size 3	4	+45 (+113)	16.0	16.0	16.0	32.0	32.0	32.0	10
	8	+40 (+104)	16.0	13.9	13.3	32.0	32.0	32.0	
	12	+40 (+104)	11.0	8.8	8.0	22.0	22.0	22.0	
	16	+40 (+104)	8.0	5.9	5.2	16.0	16.0	16.0	
G392-020 Size 3	4	+45 (+113)	20.0	20.0	20.0	40.0	40.0	40.0	10
	8	+40 (+104)	20.0	17.4	16.6	40.0	40.0	40.0	
	12	+40 (+104)	13.8	11.0	10.0	27.6	27.6	27.6	
	16	+40 (+104)	10.0	7.4	6.5	20.0	20.0	20.0	
G392-024 Size 4	4	+45 (+113)	24.0	24.0	24.0	48.0	48.0	48.0	10
	8	+40 (+104)	24.0	21.0	20.0	48.0	48.0	48.0	
	12	+40 (+104)	15.8	12.4	11.3	31.6	31.6	31.6	
	16	+40 (+104)	11.3	9.2	8.4	22.6	22.6	22.6	
G392-032 Size 4	4	+45 (+113)	32.0	32.0	32.0	64.0	64.0	64.0	10
	8	+40 (+104)	32.0	28.0	26.7	64.0	64.0	64.0	
	12	+40 (+104)	21.0	16.5	15.0	42.0	42.0	42.0	
	16	+40 (+104)	15.0	12.2	11.2	30.0	30.0	30.0	

1) When supplied with 400 V<sub>AC</sub> at maximum 70 % preload2) Shutdown as per I<sup>2</sup>t characteristic**Note:** All data apply for motor cable length ≤10 m (32.80 ft)

## CURRENT CAPACITY

### Sizes 3 and 4 – Liquid-cooled

Ordering number	Switching frequency of power stage  [kHz]	Ambient temperature  [°C (°F)]	Rated current [ $A_{eff}$ ]			Peak current [ $A_{eff}$ ] <sup>1)</sup>			
			At 3 x 400 V <sub>AC</sub>	At 3 x 460 V <sub>AC</sub>	At 3 x 480 V <sub>AC</sub>	At rotating field frequency rising in linear mode 0 to 5 Hz		For intermittent operation > 5 Hz	For time <sup>2)</sup> [s]
						0 Hz	5 Hz		
G395-016 Size 3	4	+45 (+113)	16.0	16.0	16.0	32.0	32.0	32.0	10
	8	+40 (+104)	16.0	13.9	13.3	32.0	32.0	32.0	
	12	+40 (+104)	11.0	8.8	8.0	22.0	22.0	22.0	
	16	+40 (+104)	8.0	5.9	5.2	16.0	16.0	16.0	
G395-020 Size 3	4	+45 (+113)	20.0	20.0	20.0	10.0	10.0	10.0	10
	8	+40 (+104)	20.0	17.4	16.6	40.0	40.0	40.0	
	12	+40 (+104)	13.8	11.0	10.0	27.6	27.6	27.6	
	16	+40 (+104)	10.0	7.4	6.5	20.0	20.0	20.0	
G395-024 Size 4	4	+45 (+113)	24.0	24.0	24.0	48.0	48.0	48.0	10
	8	+40 (+104)	24.0	21.0	20.2	48.0	48.0	48.0	
	12	+40 (+104)	15.8	12.4	11.3	31.6	31.6	31.6	
	16	+40 (+104)	11.3	9.2	8.4	22.6	22.6	22.6	
G395-032 Size 4	4	+45 (+113)	32.0	32.0	32.0	64.0	64.0	64.0	10
	8	+40 (+104)	32.0	28.0	26.7	64.0	64.0	64.0	
	12	+40 (+104)	21.0	16.5	15.0	42.0	42.0	42.0	
	16	+40 (+104)	15.0	12.2	11.2	30.0	30.0	30.0	

1) When supplied with 400 V<sub>AC</sub> at maximum 70 % pre-load

2) Shutdown as per I<sup>2</sup>t characteristic

**Note:** All data apply for motor cable length ≤10 m (32.80 ft)

## CURRENT CAPACITY

### Sizes 5 to 6A – Air-cooled

Ordering number	Switching frequency of power stage  [kHz]	Ambient temperature  [°C (°F)]	Rated current [A <sub>eff</sub> ]			Peak current [A <sub>eff</sub> ] <sup>1)</sup>			
			At 3 x 400 V <sub>AC</sub>	At 3 x 460 V <sub>AC</sub>	At 3 x 480 V <sub>AC</sub>	At rotating field frequency rising in linear mode 0 to 5 Hz		For intermittent operation > 5 Hz	For time <sup>2)</sup> [s]
						0 Hz	5 Hz		
G392-045 Size 5	4	+45 (+113)	45	42	41	90	90	90	3
	8	+40 (+104)	45	42	41	90	90	90	
	12	+40 (+104)	45	42	41	90	90	90	
	16	+40 (+104)	42	39	38	84	84	84	
G392-060 Size 5	4	+45 (+113)	60	56	54	120	120	120	3
	8	+40 (+104)	60	56	54	120	120	120	
	12	+40 (+104)	58	54	52	116	116	116	
	16	+40 (+104)	42	39	38	84	84	84	
G392-072 Size 5	4	+45 (+113)	72	67	65	144	144	144	3
	8	+40 (+104)	72	67	65	144	144	144	
	12	+40 (+104)	58	54	52	116	116	116	
	16	+40 (+104)	42	39	38	84	84	84	
G392-090 Size 6	4	+45 (+113)	90	83	81	170	180	180	30
	8	+40 (+104)	90	83	81	134	180	180	
	12	+40 (+104)	90	83	81	107	144	144	
	16	+40 (+104)	72	67	65	86	115	115	
G392-110 Size 6	4	+45 (+113)	110	102	99	170	220	220	30
	8	+40 (+104)	110	102	99	134	165	165	
	12	+40 (+104)	90	83	81	107	144	144	
	16	+40 (+104)	72	67	65	86	115	115	
G392-143 Size 6A	4	+45 (+113)	143	132	129	190	286	286	30
	8	+40 (+104)	143	132	129	151	215	215	
	12	+40 (+104)	115	106	104	121	172	172	
	16	+40 (+104)	92	85	83	97	138	138	
G392-170 Size 6A	4	+45 (+113)	170	157	153	190	315	315	10
	8	+40 (+104)	170	157	153	151	220	220	10
	12	Not permitted							
	16	Not permitted							

1) When supplied with 400 V<sub>AC</sub> at maximum 70 % preload

2) Shutdown as per I<sup>2</sup>t characteristic

**Note:** All data apply for motor cable length ≤10 m (32.80 ft)

## CURRENT CAPACITY

### Sizes 5 to 6A – Liquid-cooled

Ordering number	Switching frequency of power stage  [kHz]	Ambient temperature  [°C (°F)]	Rated current [ $A_{eff}$ ]			Peak current [ $A_{eff}$ ] <sup>1)</sup>			For time <sup>2)</sup>  [s]
			At 3 x 400 V <sub>AC</sub>	At 3 x 460 V <sub>AC</sub>	At 3 x 480 V <sub>AC</sub>	At rotating field frequency rising in linear mode 0 to 5 Hz		For intermittent operation > 5 Hz	
						0 Hz	5 Hz		
G395-053 Size 5	4	+45 (+113)	53	49	48	90	90	90	30
	8		53	49	48	90	90	90	
	12		53	49	48	90	90	90	
	16		49	45	44	84	84	84	
G395-070 Size 5	4	+45 (+113)	70	65	63	120	120	120	30
	8		70	65	63	120	120	120	
	12		68	63	61	116	116	116	
	16		49	45	44	84	84	84	
G395-084 Size 5	4	+45 (+113)	84	78	76	144	144	144	30
	8		84	78	76	144	144	144	
	12		68	63	61	116	116	116	
	16		49	45	44	84	84	84	
G395-110 Size 6	4	+45 (+113)	110	102	99	205	220	220	30
	8		110	102	99	165	187	187	
	12		110	102	99	132	165	165	
	16		90	83	81	106	135	135	
G395-143 Size 6	4	+45 (+113)	143	132	129	230	286	286	30
	8		143	132	129	190	215	215	
	12		114	105	103	152	172	172	
	16		91	84	82	122	138	138	
G395-170 Size 6A	4	+45 (+113)	170	157	153	230	340	340	10
	8		170	157	153	190	255	255	
	12		136	126	122	152	204	204	
	16		109	101	98	122	163	163	
G395-210 Size 6A	4	+45 (+113)	210	194	189	230	340	340	10
	8		210	194	189	190	255	255	
	12		168	155	151	152	204	204	
	16		134	124	121	122	163	163	

1) When supplied with 400 V<sub>AC</sub> at maximum 70 % preload

2) Shutdown as per I<sup>2</sup>t characteristic

**Note:** All data apply for motor cable length ≤10 m (32.80 ft)

## CURRENT CAPACITY

### Size 7 – Liquid-cooled

Ordering number	Switching frequency of power stage  [kHz]	Ambient temperature  [°C (°F)]	Rated current [A <sub>eff</sub> ]			Peak current [A <sub>eff</sub> ] <sup>1)</sup>			
			At 3 x 400 V <sub>AC</sub>	At 3 x 460 V <sub>AC</sub>	At 3 x 480 V <sub>AC</sub>	At rotating field frequency rising in linear mode 0 to 5 Hz		For intermittent operation > 5 Hz	For time <sup>2)</sup> [s]
						0 Hz	5 Hz		
G395-250 Size 7	2	+40 (+104)	250	231	225	425		30	
	4					375			
G395-325 Size 7	2	+40 (+104)	325	300	292	552		30	
	4					485			
G395-450 Size 7	2	+40 (+104)	450	416	405	765		30	
	4					675			

1) When supplied with 400 V<sub>AC</sub> at maximum 70 % preload

2) Shutdown as per I<sup>2</sup>t characteristic

**Note:** All data apply for motor cable length ≤10 m (32.80 ft)

## AMBIENT CONDITIONS

<b>Ambient conditions</b>	
<b>Protection</b>	IP20 except terminals (IP00)
<b>Accident prevention regulations</b>	According to local regulations (in Germany e.g. BGV A3)
<b>Mounting height</b>	Up to 1,000 m (3,280 ft) above MSL, above with power reduction (1 % per 100 m (328 ft), maximum 2,000 m (6,561 ft) above MSL).
<b>Pollution severity</b>	2
<b>Type of installation</b>	Built-in unit, only for vertical installation in a switch cabinet with minimum IP4x protection, when using STO safety function minimum IP54

<b>Climatic conditions</b>			
<b>In transit</b>	As per EN 61800-2, IEC 60721-3-2 class 2K3 <sup>1)</sup>		
	Temperature: -25 to +70 °C (-13 to +158 °F)		
	Relative air humidity: 95 % at maximum +40 °C (+104 °F)		
<b>In storage</b>	As per EN 61800-2, IEC 60721-3-1 class 1K3 and 1K4 <sup>2)</sup>		
	Temperature: -25 to +55 °C (-13 to +131 °F)		
	Relative air humidity: 5 to 95 %		
<b>In operation</b>	As per EN 61800-2, IEC 60721-3-3 class 3K3 <sup>3)</sup>		
	Temperature	Air-cooled	<b>Size 1</b> -10 to +45 °C (+14 to +113 °F) (4 kHz) -10 to +40 °C (+14 to +104 °F) (8/12/16 kHz)
			<b>Size 2 to 4</b> -10 to +45 °C (+14 to +113 °F) (4 kHz) to 55 °C (131 °F) with power reduction (5 % per °C/°F) -10 to +40 °C (+14 to +104 °F) (8/12/16 kHz) to +55 °C (+131 °F) with power reduction (4 % per °C/°F)
	Temperature	Liquid-cooled	<b>Size 5 to 6A</b> -10 to +45 °C (+104 to +113 °F) (4 kHz), -10 to +40 °C (+131 to +104 °F) (8/12/16 kHz) to +55 °C (+131 °F) with power reduction (2 % per °C/°F)
			<b>Size 2 to 4</b> -10 to +45 °C (14 to 113 °F) (4 kHz), to +55 °C (+131 °F) with power reduction (5 % per °C/°F) -10 to +40 °C (+14 to +104 °F) (8/12/16 kHz), to +55 °C (+131 °F) with power reduction (4 % per °C/°F)
			<b>Size 5 to 6</b> -10 to +45 (+14 to +104 °F) (4/8/12/16 kHz), to +55 °C (+131 °F) with power reduction (2 % per °C/°F)
<b>Size 7</b> -10 to +40 °C (+14 to +104 °F) (2/4 kHz), to +55 °C (+131 °F) with power reduction (2 % per °C/°F)			
Relative air humidity: 5 to 85 % without condensation			

- 1) The absolute humidity is limited to maximum 60 g/m<sup>3</sup>  
This means, at +70 °C (+158 °F) for example, that the relative humidity may only be maximum 40 %
- 2) The absolute humidity is limited to maximum 29 g/m<sup>3</sup>  
So the maximum values for temperature and relative air humidity stipulated in the table must not occur simultaneously
- 3) The absolute humidity is limited to maximum 25 g/m<sup>3</sup>  
That means that the maximum values for temperature and relative air humidity stipulated in the table must not occur simultaneously

## AMBIENT CONDITIONS

<b>Mechanical conditions</b>			
<b>Vibration limit in transit</b>	As per EN 61800-2, IEC 60721-3-2 class 2M1		
	<b>Frequency [Hz]</b>	<b>Amplitude [mm (in)]</b>	<b>Acceleration [<math>m/s^2</math> (in/<math>s^2</math>)]</b>
	$2 \leq f < 9$	3.5 (0.14)	Not applicable
	$9 \leq f < 200$	Not applicable	10 (393.70)
	$200 \leq f < 500$	Not applicable	15 (590.55)
<b>Shock limit in transit</b>	As per EN 61800-2, IEC 60721-2-2 class 2M1		
	Drop height of packed device maximum 0.25 m (9.84 in)		
<b>Vibration limits of the system</b> <sup>1)</sup>	As per EN 61800-2, IEC 60721-3-3 class 3M1		
	<b>Frequency [Hz]</b>	<b>Amplitude [mm (in)]</b>	<b>Acceleration [<math>m/s^2</math> (in/<math>s^2</math>)]</b>
	$2 \leq f < 9$	0.3 (0.01)	Not applicable
	$9 \leq f < 200$	Not applicable	1 (39.37)

1) The devices are only designed for stationary use. The servo drives must not be installed in areas where they would be permanently exposed to vibrations



## CERTIFICATIONS AND STANDARDS

### CE mark

The Single-Axis Standard Version conform to the requirements of the Low Voltage Directive 2006/95/EC and the product standard EN 61800-5-1.

They thus conform to the requirements for installation in a machine or plant under the terms of the Machinery Directive 2006/42/EC.

The servo drives are accordingly CE marked. The CE mark on the type plate indicates conformity with the above Directives.

### UL approbation

For the Single-Axis Standard Version UL approval has been obtained up to a rated current of  $210 A_{rms}$  (size 6A with liquid cooling).

**Note:** For size 7 devices (250 to 450 A) and for size 2 to 4 devices with integrated braking resistor UL approbation is in preparation.

### EMC acceptance tests

All Single-Axis Standard Versions have an aluminium housing with an anodized finish (sizes 1 to 4) or an aluminium rear panel made of aluminized/galvanized sheet steel (sizes 5 to 7) to enhance interference immunity in accordance with EN 61800-3, environment classes 1 and 2.

To limit line-borne interference emission to the permissible level, the Single-Axis Standard Version Sizes 1 to 5 are fitted with integral mains filters. For Single-Axis Standard Version Size 6 to 7 external mains filters are available (see section 8, "Accessories"). This ensures compliance with the EMC Directive 2004/108/EC:

- Public low voltage system:  
Residential areas up to 10 m (32.80 ft) motor cable length
- Industrial low-voltage system:  
Industry up to 25 m (82 ft) motor cable length

Additional external mains filters are available for all single-axis drives sizes 1 to 5 (see section 8 "[Accessories](#)").

### STO-acceptance

The "STO" (Safe Torque Off) safety function integrated into the Single-Axis Standard Version is certified according to the requirements of:

- EN ISO 13849-1 "PL e" and
- EN 61508 / EN 62061 "SIL3"

Acceptance testing is carried out by the accredited certification agency, TÜV Rheinland.

# TECHNICAL DATA

## Size 1



Type G392-004

Ordering number	G392-004A	G392-004	G392-006
<b>Output, motor side</b>			
Voltage	3-phase $U_{\text{Mains}}$		
Rated current, effective ( $I_N$ ) <sup>1)</sup>	4 A	4 A <sup>2)</sup>	6 A <sup>2)</sup>
Peak current	<a href="#">Page 33</a>	<a href="#">Page 34</a>	
Rotating field frequency	0 to 400 Hz		
Switching frequency of power stage	4, 8, 12, 16 kHz (factory setting 8 kHz at +40 °C (+104 °F) cooling air temperature)		
<b>Input, mains side</b>			
Mains voltage ( $U_{\text{Mains}}$ )	1 x 230 V ±10 %	(3 x 230 V/3 x 400 V/3 x 460 V/3 x 480 V) ±10 %	
Device connected load (with mains choke)	1.6 kVA	2.8 kVA <sup>2)</sup>	4.2 kVA <sup>2)</sup>
Current (with mains choke)	9.5 A <sup>3)</sup>	4.2 A <sup>2)</sup>	6.4 A <sup>2)</sup>
Asymmetry of mains voltage	-	±3 % maximum	
Frequency	50/60 Hz ±10 %		
Power loss at $I_N$ <sup>1)</sup>	85 W	96 W <sup>2)</sup>	122 W <sup>2)</sup>
<b>DC link</b>			
DC link capacity	1,740 µF	400 µF	
Braking chopper switch-on-threshold	390 V <sub>DC</sub>	650 V <sub>DC</sub> <sup>2)</sup>	
Minimum ohmic resistance of an externally installed braking resistor <sup>4)</sup>	72 Ω	72 Ω	
Brake chopper continuous power with external braking resistor	2.1 kW	5.9 kW	
Brake chopper peak power with external braking resistor	2.1 kW	5.9 kW	
Optional: Internal braking resistor	PTC		
Brake chopper continuous power with internal braking resistor	Dependent on the effective loading of the servo drive in the corresponding application		
Brake chopper peak power with internal braking resistor	1.7 kW	4.7 kW	

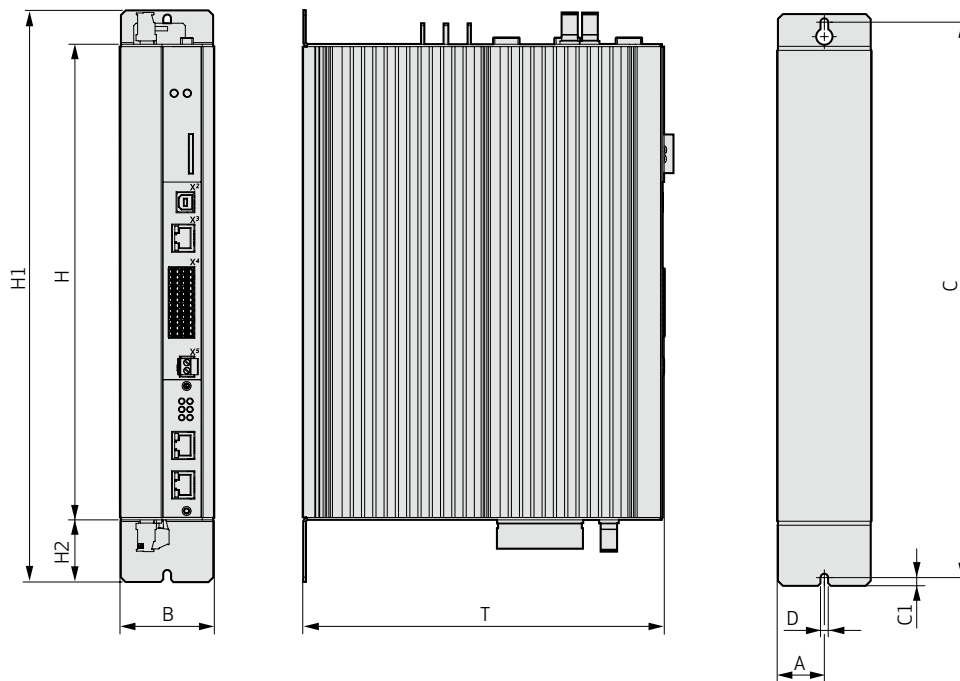
- 1) Data referred to 8 kHz switching frequency    2) Data referred to 3 x 400 V<sub>AC</sub> mains voltage    3) Without mains choke  
 4) Connection of an external braking resistor for device variant with internal braking resistor (G392-xxx-xxx-002) not permitted

Servo drive	G392-004A	G392-004	G392-006
Cooling method	Air-cooled		
Protection	IP20 except terminals (IP00)		
Cooling air temperature	Maximum +45 °C (+113 °F) (at 4 kHz Power stage switching frequency)		
Weight	3.4 kg (7.50 lb)		
Mounting type	Vertical mounting with unhindered air flow		
Mounting several servo drives	Direct side by side mounting		

# TECHNICAL DATA

## Size 1

### Dimensional drawings, Air-cooled



Dimensions	mm (in)
B (width)	58.5 (2.30)
H (height)	295 (11.61) without mating connectors
T (depth)	224 (8.82) without mating connectors
A	29.25 (1.15)
C/C1	344.5/5 (13.56/0.20)
D	ø 4.8 (0.19)
H1/H2	355/38.5 (13.98/1.52)

### Matching accessories

Servo drive	G392-004A	G392-004	G392-006
Mains choke	CA68926-001	CA55830-001	CA55831-001
Braking resistor	CA59737-001 (35 W, 90 Ω) CA59738-001 (150 W, 90 Ω) CA59739-001 (300 W, 90 Ω) CA59740-001 (1,000 W, 90 Ω)		
Mains filter	-	CA71184-001	CA71184-001

# TECHNICAL DATA

## Size 2



Type G392-008

Ordering number	G392-008	G392-012
<b>Output, motor side</b>		
Voltage	3-phase $U_{\text{Mains}}$	
Rated current, effective ( $I_N$ )	8 A <sup>1)</sup>	12 A <sup>1)</sup>
Peak current	<a href="#">Page 34</a>	
Rotating field frequency	0 to 400 Hz	
Switching frequency of power stage	4/8/12/16 kHz (factory setting 8 kHz at +40 °C (+104 °F) cooling air temperature)	
<b>Input, mains side</b>		
Mains voltage ( $U_{\text{Mains}}$ )	(3 x 230 V/3 x 400 V/3 x 460 V/3 x 480) ±10 %	
Device connected load (with mains choke)	5.9 kVA <sup>1)</sup>	8.8 kVA <sup>1)</sup>
Current (with mains choke)	8.7 A <sup>1)</sup>	13.1 A <sup>1)</sup>
Asymmetry of mains voltage	±3 % maximum	
Frequency	50/60 Hz ±10 %	
Power loss at $I_N$ <sup>1)</sup>	175 W <sup>1)</sup>	240 W <sup>1)</sup>
<b>DC link</b>		
DC link capacity	725 µF	
Braking chopper switch-on-threshold	650 V <sub>DC</sub> <sup>1)</sup>	
Minimum ohmic resistance of an externally installed braking resistor <sup>2)</sup>	39 Ω	
Brake chopper continuous power with external braking resistor	11 kW	
Brake chopper peak power with external braking resistor	11 kW	
Optional: Internal braking resistor	90 Ω	
Brake chopper continuous power with internal braking resistor	Dependent on the effective loading of the servo drive in the corresponding application	
Brake chopper peak power with internal braking resistor	4.7 kW <sup>1)</sup>	

1) Data referred to mains voltage 3 x 400 V<sub>AC</sub> and 8 kHz switching frequency

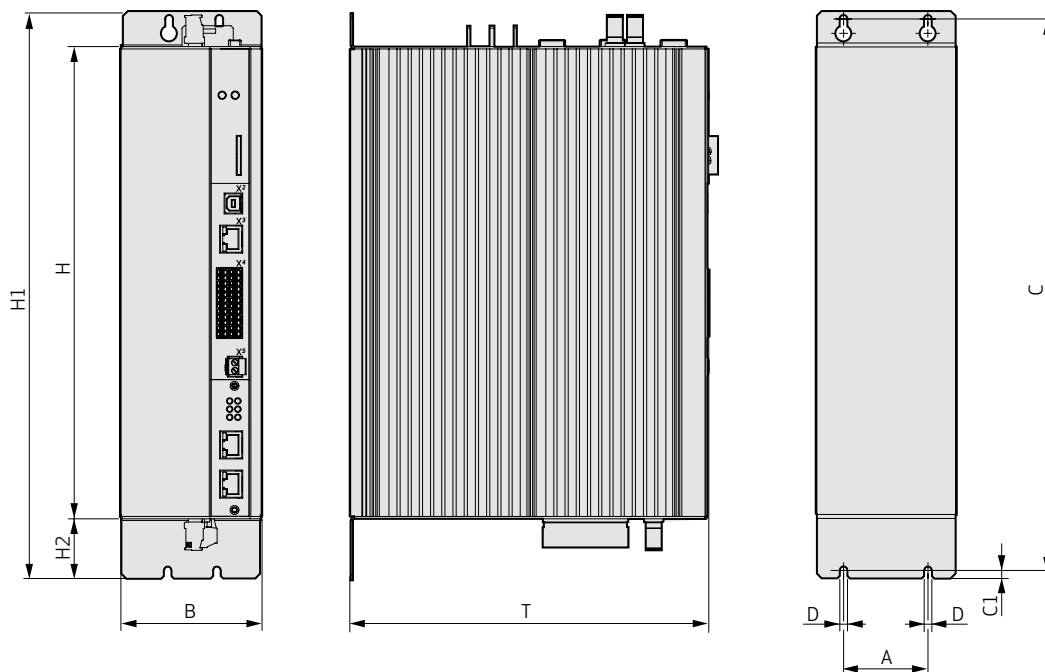
2) Connection of an external braking resistor for device variant with internal braking resistor (G392-xxx-xxx-xx2) not permitted

Servo drive	G392-008	G392-012
Cooling method	Air-cooled	
Protection	IP20 except terminals (IP00)	
Cooling air temperature	+45 °C (+113 °F) (at 4 kHz power stage switching frequency)	
Weight	4.9 kg (10.80 lb)	
Mounting type	Vertical mounting with unimpeded air flow	
Mounting several servo drives	Direct side by side mounting	

# TECHNICAL DATA

## Size 2

### Dimensional drawings, Air-cooled



Dimensions	mm (in)
B (width)	90 (3.54)
H (height)	295 (11.61) without mating connectors
T (depth)	224 (8.82) without mating connectors
A	50 (1.97)
C/C1	344.5/5 (13.56/0.20)
D	∅ 4.8 (0.19)
H1/H2	355/38.5 (13.98/1.52)

### Matching accessories

Servo drive	G392-008	G392-012
Mains choke	CA55832-001	CA55833-001
Braking resistor	CA59737-001 (35 W, 90 Ω) CA59738-001 (150 W, 90 Ω) CA59739-001 (300 W, 90 Ω) CA59740-001 (1,000 W, 90 Ω)	
Mains filter	CA71185-001	CA71185-001

# TECHNICAL DATA

## Size 3



Type G392-016

Ordering number	G392-016 Air-cooled	G395-016 Liquid-cooled	G392-020 Air-cooled	G395-020 Liquid-cooled
<b>Output, motor side</b>				
Voltage	3-phase $U_{\text{Mains}}$			
Rated current, effective ( $I_N$ )	16 A <sup>1)</sup>		20 A <sup>1)</sup>	
Peak current	<a href="#">Page 34</a>			
Rotating field frequency	0 to 400 Hz			
Switching frequency of power stage	4/8/12/16 kHz (factory setting 8 kHz at +40 °C (+104 °F) cooling air temperature)			
<b>Input, mains side</b>				
Mains voltage ( $U_{\text{Mains}}$ )	(3 x 230 V/3 x 400 V/3 x 460 V/3 x 480 V) ±10 %			
Device connected load (with mains choke)	11.1 kVA <sup>1)</sup>		13.9 kVA <sup>1)</sup>	
Current (with mains choke)	17.3 A <sup>1)</sup>		21.6 A <sup>1)</sup>	
Asymmetry of mains voltage	±3 % maximum			
Frequency	50/60 Hz ±10 %			
Power loss at $I_N$	330 W <sup>1)</sup>		400 W <sup>1)</sup>	
<b>DC link</b>				
DC link capacity	1,230 µF			
Braking chopper switch-on-threshold	650 V <sub>DC</sub> <sup>1)</sup>			
Minimum ohmic resistance of an externally installed braking resistor <sup>2)</sup>	20 Ω			
Brake chopper continuous power with external braking resistor	21 kW			
Brake chopper peak power with external braking resistor	21 kW			
Optional: Internal braking resistor	90 Ω			
Brake chopper continuous power with internal braking resistor	Dependent on the effective loading of the servo drive in the corresponding application			
Brake chopper peak power with internal braking resistor	4.7 kW <sup>1)</sup>			

1) Data referred to mains voltage 3 x 400 V<sub>AC</sub> and 8 kHz switching frequency

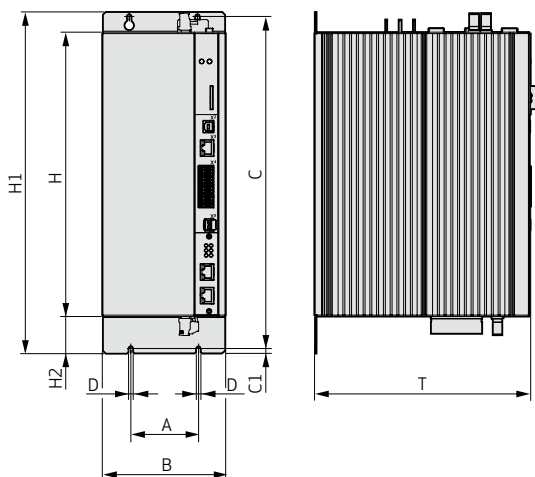
2) Connection of an external braking resistor for device variant with internal braking resistor (G392-xxx-xxx-xx2 or G395-xxx-xxx-xx2) not permitted

Servo drive	G392-016 Air-cooled	G395-016 Liquid-cooled	G392-020 Air-cooled	G395-020 Liquid-cooled
Cooling method	Air-cooled or liquid-cooled			
Protection	IP20 except terminals (IP00)			
Cooling air temperature	+45 °C (+113 °F) (at 4 kHz power stage switching frequency)			
Weight	6.5 kg (14.33 lb)			
Mounting type	Vertical mounting with unhindered air flow			
Mounting several servo drives	Direct side by side mounting			

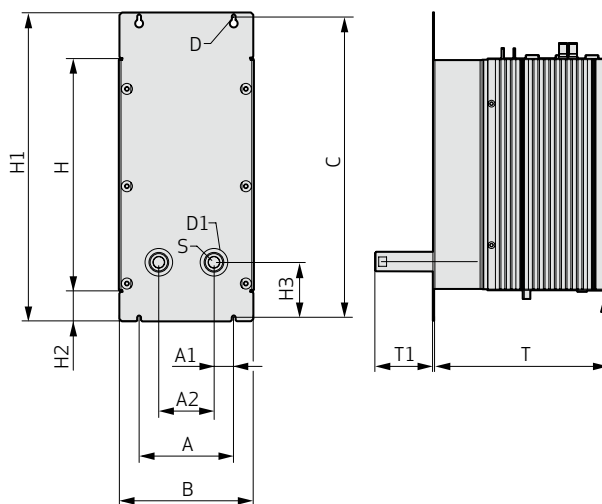
# TECHNICAL DATA

## Size 3

### Dimensional drawings, Air-cooled



### Dimensional drawings, Liquid-cooled



Dimensions	mm (in)
B (width)	130 (5.12)
H (height)	295 (11.61) without mating connectors
T (depth)	224 (8.82) without mating connectors
A/A1/A2	80/10/60 (3.15/0.39/2.36)
C (air/liquid-cooled)	344.5/382 (13.56/15.04)
C1	5 (0.20)
D	∅ 4.8 (0.19)
D1 (hole for pipe socket)	∅ 48 (1.89)
H1 (air/liquid-cooled)	355/392 (13.98/15.43)
H2/H3	38.5/75 (1.51/2.95)
S	3/8 inch (inside thread)
T1	74 (2.91)

### Matching accessories

Servo drive	G392-016/G395-016	G392-020/G395-020
Mains choke	CA55834-001	CA55835-001
Braking resistor	CA59741-001 (35 W, 26 Ω) CA59742-001 (150 W, 26 Ω) CA59743-001 (300 W, 26 Ω) CA59744-001 (1,000 W, 26 Ω)	
Mains filter	CA71185-001	CA71186-001

# TECHNICAL DATA

## Size 4



Type G392-024

Ordering number	G392-024 Air-cooled	G395-024 Liquid-cooled	G392-032 Air-cooled	G395-032 Liquid-cooled
<b>Output, motor side</b>				
Voltage	3-phase $U_{\text{Mains}}$			
Rated current, effective ( $I_N$ )	24 A <sup>1)</sup>		32 A <sup>1)</sup>	
Peak current	<a href="#">Page 34</a>			
Rotating field frequency	0 to 400 Hz			
Switching frequency of power stage	4/8/12/16 kHz (factory setting 8 kHz at +40 °C (+104 °F) cooling air temperature)			
<b>Input, mains side</b>				
Mains voltage ( $U_{\text{Mains}}$ )	(3 x 230 V/3 x 400 V/3 x 460 V/3 x 480 V) ±10 %			
Device connected load (with mains choke)	16.6 kVA <sup>1)</sup>		22.2 kVA <sup>1)</sup>	
Current (with mains choke)	26.2 A <sup>1)</sup>		34.9 A <sup>1)</sup>	
Asymmetry of mains voltage	±3 % maximum			
Frequency	50/60 Hz ±10 %			
Power loss at $I_N$ <sup>1)</sup>	475 W <sup>1)</sup>		515 W <sup>1)</sup>	
<b>DC link</b>				
DC link capacity	2,000 µF			
Braking chopper switch-on-threshold	650 V <sub>DC</sub> <sup>1)</sup>			
Minimum ohmic resistance of an externally installed braking resistor <sup>2)</sup>	12 Ω			
Brake chopper continuous power with external braking resistor	35 kW			
Brake chopper peak power with external braking resistor	35 kW			
Optional: Internal braking resistor	90 Ω			
Brake chopper continuous power with internal braking resistor	Dependent on the effective loading of the servo drive in the corresponding application			
Brake chopper peak power with internal braking resistor	4.7 kW <sup>1)</sup>			

1) Data referred to mains voltage 3 x 400 V<sub>AC</sub> and 8 kHz switching frequency

2) Connection of an external braking resistor for device variant with internal braking resistor (G392-xxx-xxx-xx2 bzw. G395-xxx-xxx-xx2) not permitted

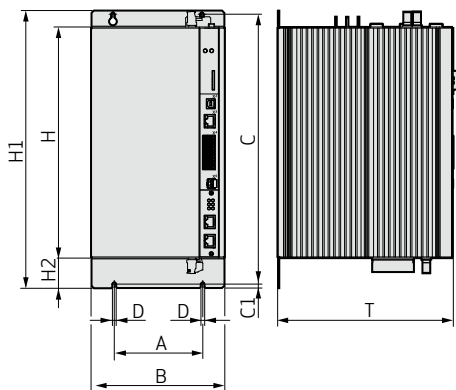
Servo drive	G392-024 Air-cooled	G395-024 Liquid-cooled	G392-032 Air-cooled	G395-032 Liquid-cooled
Cooling method	Air-cooled or liquid-cooled			
Protection	IP20 except terminals (IP00)			
Cooling air temperature	+45 °C (+113 °F) (at 4 kHz power stage switching frequency)			
Weight	7.48 kg (16,49 lb)			
Mounting type	Vertical mounting with unhindered air flow			
Mounting several servo drives	Direct side by side mounting			



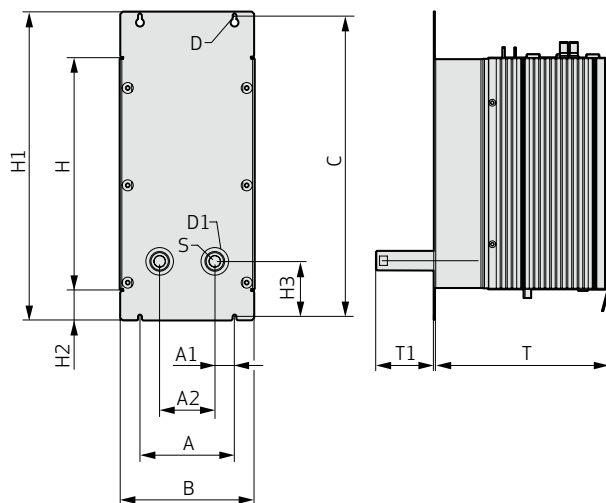
# TECHNICAL DATA

## Size 4

### Dimensional drawings, Air-cooled



### Dimensional drawings, Liquid-cooled



Dimensions	mm (in)
B (width)	171 (6.73)
H (height)	295 (11.61) without mating connectors
T (depth)	224 (8.82) without mating connectors
A/A1/A2	120/25/70 (4.72/0.98/2.76)
C (air/liquid-cooled)	344.5/382 (13.56/15.04)
C1	5 (0.20)
D	ø 4.8 (0.19)
D1 (hole for pipe socket)	ø 48 (1.89)
H1 (air/liquid-cooled)	355/392 (13.98/15.43)
H2/H3	38.5/75 (1.52/2.95)
S	3/8 inch (inside thread)
T1	74 (2.91)

### Matching accessories

Servo drive	G392-024/G395-024	G392-032/G395-032
Mains choke	CA55836-001	CA55836-001
Braking resistor	CA59741-001 (35 W, 26 Ω) CA59742-001 (150 W, 26 Ω) CA59743-001 (300 W, 26 Ω) CA59744-001 (1,000 W, 26 Ω)	
Mains filter	CA71186-001	CA71186-001

# TECHNICAL DATA

## Size 5



Type G392-045

Ordering number	G392-045 Air-cooled	G395-053 Liquid-cooled	G392-060 Air-cooled	G395-070 Liquid-cooled	G392-072 Air-cooled	G395-084 Liquid-cooled
<b>Output, motor side</b>						
Voltage	3-phase $U_{Mains}$					
Rated current, effective $I_N$	45 A <sup>1)</sup>	53 A <sup>1)</sup>	60 A <sup>1)</sup>	70 A <sup>1)</sup>	72 A <sup>1)</sup>	84 A <sup>1)</sup>
Peak current	Page 36 (air-cooled) and Page 37 (liquid-cooled)					
Rotating field frequency	0 to 400 Hz					
Switching frequency of power stage	4/8/12/16 kHz (factory setting 8 kHz at +40 °C (+104 °F) cooling air temperature)					
<b>Input, mains side</b>						
Mains voltage ( $U_{Mains}$ )	(3 x 230 V/3 x 400 V/3 x 460/3 x 480 V) ±10 %					
Device connected load (with mains choke)	31 kVA <sup>1)</sup>	37 kVA <sup>1)</sup>	42 kVA <sup>1)</sup>	50 kVA <sup>1)</sup>	50 kVA <sup>1)</sup>	58 kVA <sup>1)</sup>
Current (with mains choke)	45 A <sup>1)</sup>	53 A <sup>1)</sup>	60 A <sup>1)</sup>	70 A <sup>1)</sup>	72 A <sup>1)</sup>	84 A <sup>1)</sup>
Asymmetry of mains voltage	±3 % maximum					
Frequency	50/60 Hz ±10 %					
Power loss at $I_N$	610 W <sup>1)</sup>	690 W <sup>1)</sup>	830 W <sup>1)</sup>	930 W <sup>1)</sup>	1,010 W <sup>1)</sup>	1,130 W <sup>1)</sup>
<b>DC link</b>						
DC link capacity	430 µF		900 µF			
Braking chopper switch-on-threshold	820 V <sub>DC</sub>					
Minimum ohmic resistance of an externally installed braking resistor	18 Ω	10 Ω	18 Ω	10 Ω	13 Ω	10 Ω
Brake chopper continuous power with external braking resistor	37 kW	67 kW	37 kW	67 kW	52 kW	67 kW
Brake chopper peak power with external braking resistor	37 kW	67 kW	37 kW	67 kW	52 kW	67 kW
Optional: Internal braking resistor	- <sup>2)</sup>	20 Ω	- <sup>2)</sup>	10 Ω	- <sup>2)</sup>	10 Ω
Brake chopper continuous power with internal braking resistor	-	675 W	-	1,350 W	-	1,350 W
Brake chopper peak power with internal braking resistor	-	34 kW	-	67 kW	-	67 kW

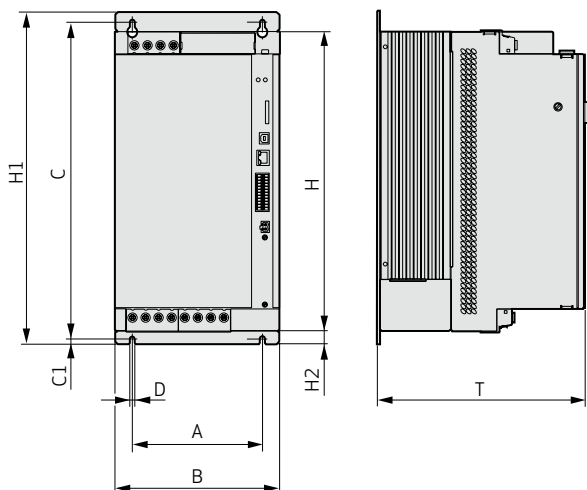
1) Data referred to mains voltage 3 x 400 V<sub>AC</sub> and 8 kHz switching frequency 2) Not with internal braking resistor available

Servo drive	G392-045	G395-053	G392-060	G395-070	G392-072	G395-084
Cooling method	Air-cooled or liquid-cooled					
Protection	IP20 except terminals (IP00)					
Cooling air temperature	+45 °C (+113 °F) (at 4 kHz power stage switching frequency)					
Weight	13 kg/16.5 kg (28.66 lb/36.38 lb)					
Mounting type	Vertical mounting with unimpeded air flow					
Mounting several servo drives	Possible at a distance of 20 mm (0.79 in) (air-cooled) or 2 mm (0.08 in) (liquid-cooled)					

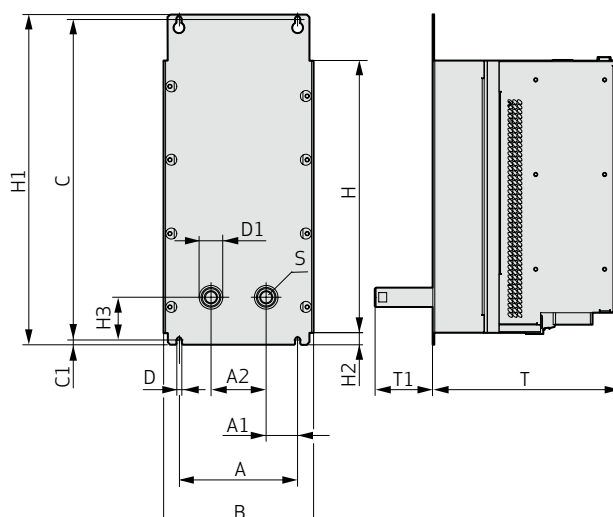
# TECHNICAL DATA

## Size 5

### Dimensional drawings, Air-cooled



### Dimensional drawings, Liquid-cooled



Dimensions	mm (in)
B (width)	190 (7.48)
H (height) (air/liquid-cooled)	345/346.5 (13.58/13.64) without mating connectors
T (depth) (air/liquid-cooled)	240/198.3 (9.44/7.80) without mating connectors
A (air/liquid-cooled)	150/148 (5.91/5.83)
A1/A2	39/70 (1.54/2.76)
C (air/liquid-cooled)	365/377.25 (14.37/14.85)
C1	6 (0.24)
D (air/liquid-cooled)	∅ 5.6/7 (0.22/0.28)
D1 (hole for pipe socket)	∅ 48 (1.89)
H1 (air/liquid-cooled)	387.5/420 (15.26/16.54)
H2/H3	15/53.75 (0.59/2.12)
S	3/8 inch (inside thread)
T1	73.5 (2.89)

### Matching accessories

Servo drive	G392-045	G395-053	G392-060	G395-070	G392-072	G395-084
Mains choke	CA55837-001	CA55838-001	CA55838-001	CA55839-001	CA55839-001	CA55840-001
Braking resistor	CA59741-001 (35 W, 26 Ω) CA59742-001 (150 W, 26 Ω) CA59743-001 (300 W, 26 Ω) CA59744-001 (1,000 W, 26 Ω)		CB09050-001 (2,000 W, 26 Ω) CB36901-001 (300 W, 20 Ω) CB36902-001 (300 W, 15 Ω) (not for G392-045 and G392-060)			
Mains filter	CA71187-001	CA71187-001	CA71187-001	CA71188-001	CA71188-001	CA71188-001

# TECHNICAL DATA

## Size 6



Type G392-045

Ordering number	G392-090 Air-cooled	G395-110 Liquid-cooled	G392-110 Air-cooled	G395-143 Liquid-cooled
<b>Output, motor side</b>				
Voltage	3-phase $U_{\text{Mains}}$			
Rated current, effective ( $I_N$ )	90 A <sup>1)</sup>	110 A <sup>1)</sup>	110 A <sup>1)</sup>	143 A <sup>1)</sup>
Peak current	Page 36 (air-cooled) and Page 37 (liquid-cooled)			
Rotating field frequency	0 to 400 Hz			
Switching frequency of power stage	4/8/12/16 kHz (factory setting 8 kHz at +40 °C (+104 °F) cooling air temperature)			
<b>Input, mains side</b>				
Mains voltage ( $U_{\text{Mains}}$ )	(3 x 230 V/3 x 400 V/3 x 460 V/3 x 480 V) -15 %/+10 %			
Device connected load (with mains choke)	62 kVA <sup>1)</sup>	76 kVA <sup>1)</sup>	76 kVA <sup>1)</sup>	99 kVA <sup>1)</sup>
Current (with mains choke)	90 A <sup>1)</sup>	110 A <sup>1)</sup>	110 A <sup>1)</sup>	143 A <sup>1)</sup>
Asymmetry of mains voltage	±3 % maximum			
Frequency	50/60 Hz ±10 %			
Power loss at $I_N$	1,300 W <sup>1)</sup>	1,500 W <sup>1)</sup>	1,600 W <sup>1)</sup>	1,940 W <sup>1)</sup>
<b>DC link</b>				
DC link capacity	1,060 µF	2,120 µF	2,120 µF	
Braking chopper switch-on-threshold	820 V <sub>DC</sub>			
Minimum ohmic resistance of an externally installed braking resistor	12 Ω		10 Ω	
Brake chopper continuous power with external braking resistor	56 kW	56 kW	65 kW	67 kW
Brake chopper peak power with external braking resistor	56 kW	56 kW	67 kW	67 kW
Optional: Internal braking resistor	- <sup>2)</sup>	7.5 Ω	- <sup>2)</sup>	7.5 Ω
Brake chopper continuous power with internal braking resistor	-	2,650 W	-	2,650 W
Brake chopper peak power with internal braking resistor	-	90 kW	-	90 kW

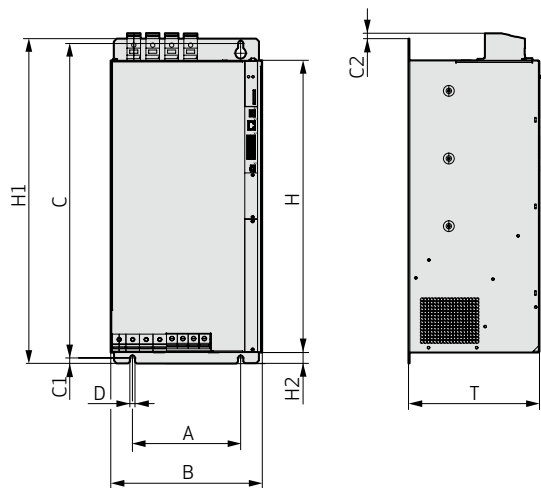
1) Data referred to mains voltage 3 x 400 V<sub>ac</sub> and 8 kHz switching frequency 2) Not with internal braking resistor available

Servo drive	G392-090	G395-110	G392-110	G395-143
Cooling method	Air-cooled or liquid-cooled			
Protection	IP20 except terminals (IP00)			
Cooling air temperature	+45 °C (+113 °F) (at 4 kHz Power stage switching frequency)			
Weight (air/liquid-cooled)	28 kg/31.5 kg (61.73 lb/69.44 lb)			
Mounting type	Vertical mounting with unimpeded air flow			
Mounting several servo drives	Possible at a distance of 40 mm (1.57 in) (air-cooled) or 2 mm (0.08 in) (liquid-cooled)			

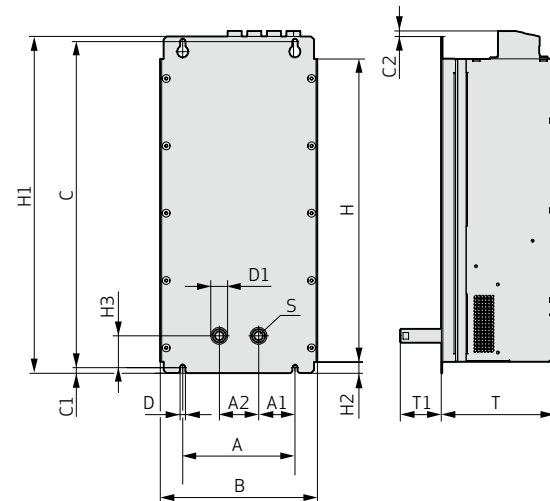
# TECHNICAL DATA

## Size 6

### Dimensional drawings, Air-cooled



### Dimensional drawings, Liquid-cooled



Dimensions	mm (in)
B (width)	280 (11.02)
H (height)	540 (21.26) (without mating connectors)
T (depth) (air/liquid-cooled)	242/202 (9.53/7.95) (without mating connectors)
A/A1/A2	200/65/70 (7.87/2.56/2.76)
C/C1/C2	581/10/10 (22.87/0.39/0.39)
D	ø 9.5 (0.37)
D1 (hole for pipe socket)	ø 48 (1.89)
H1/H2/H3	600/20/56.5 (23.62/0.79/2.22)
S	3/8 inch (inside thread)
T1	73.5 (2.89)

### Matching accessories

Servo drive	G392-045	G395-053	G392-060	G395-070	G392-072	G395-084
Mains choke	CA55837-001	CA55838-001	CA55838-001	CA55839-001	CA55839-001	CA55840-001
Braking resistor	CA59741-001 (35 W, 26 Ω) CA59742-001 (150 W, 26 Ω) CA59743-001 (300 W, 26 Ω) CA59744-001 (1,000 W, 26 Ω)		CB09050-001 (2,000 W, 26 Ω) CB36901-001 (300 W, 20 Ω) CB36902-001 (300 W, 15 Ω)			
Mains filter	CA71187-001	CA71187-001	CA71187-001	CA71188-001	CA71188-001	CA71188-001

# TECHNICAL DATA

## Size 6A



Type G392-170

Ordering number	G392-143 Air-cooled	G395-170 Liquid-cooled	G392-170 Air-cooled	G395-210 Liquid-cooled
<b>Output, motor side</b>				
Voltage	3-phase $U_{\text{Mains}}$			
Rated current, effective ( $I_N$ )	143 A <sup>1)</sup>	170 A <sup>1)</sup>	170 A <sup>1)</sup>	210 A <sup>1)</sup>
Peak current	<a href="#">Page 36</a> (air-cooled) and <a href="#">Page 37</a> (liquid-cooled)			
Rotating field frequency	0 to 400 Hz			
Switching frequency of power stage	4/8/12/16 kHz (factory setting 8 kHz at +40 °C (+104 °F) cooling air temperature)			
<b>Input, mains side</b>				
Mains voltage ( $U_{\text{Mains}}$ )	(3 x 230 V/3 x 400 V/3 x 460 V/3 x 480 V) -15 %/+10 %			
Device connected load (with mains choke)	99 kVA <sup>1)</sup>	118 kVA <sup>1)</sup>	118 kVA <sup>1)</sup>	128 kVA <sup>1)</sup>
Current (with mains choke)	143 A <sup>1)</sup>	170 A <sup>1)</sup>	170 A <sup>1)</sup>	185 A <sup>1)</sup>
Asymmetry of mains voltage	±3 % maximum			
Frequency	50/60 Hz ±10 %			
Power loss at $I_N$	2,100 W <sup>1)</sup>	2,380 W <sup>1)</sup>	2,500 W <sup>1)</sup>	2,650 W <sup>1)</sup>
<b>DC link</b>				
DC link capacity	3,180 µF	4,240 µF	4,240 µF	
Braking chopper switch-on-threshold	820 V <sub>DC</sub>			
Minimum ohmic resistance of an externally installed braking resistor	8.5 Ω		6.5 Ω	
Brake chopper continuous power with external braking resistor	65 kW	79 kW	65 kW	103 kW
Brake chopper peak power with external braking resistor	79 kW	79 kW	103 kW	103 kW
Optional: Internal braking resistor	- <sup>2)</sup>	5 Ω	- <sup>2)</sup>	5 Ω
Brake chopper continuous power with internal braking resistor	-	4,000 W	-	4,000 W
Brake chopper peak power with internal braking resistor	-	135 kW	-	135 kW

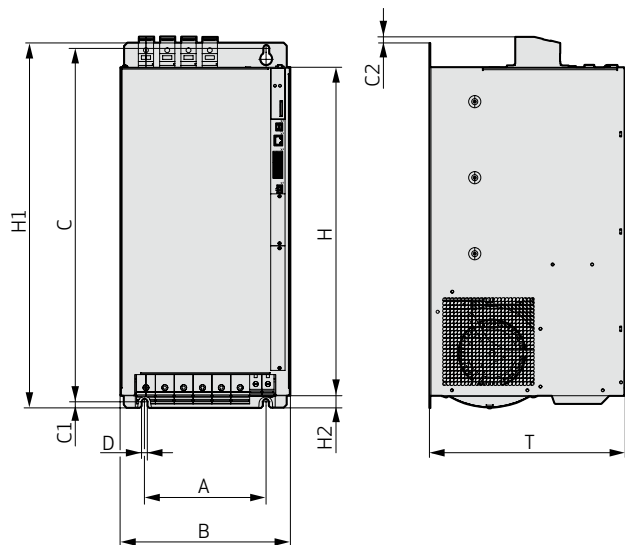
1) Data referred to mains voltage 3 x 400 V<sub>ac</sub> and 8 kHz switching frequency 2) Not with internal braking resistor available

Servo drive	G392-143	G395-170	G392-170	G395-210
Cooling method	Air-cooled or liquid-cooled			
Protection	IP20 except terminals (IP00)			
Cooling air temperature	+45°C (+113 °F) (at 4 kHz power stage switching frequency)			
Weight (air/liquid-cooled)	32 kg/41.1 kg (70.55 lb/90.61 lb)			
Mounting type	Vertical mounting with unimpeded air flow			
Mounting several servo drives	Possible at a distance of 40 mm (1.57 in) (air-cooled) or 2 mm (0.08 in) liquid-cooled			

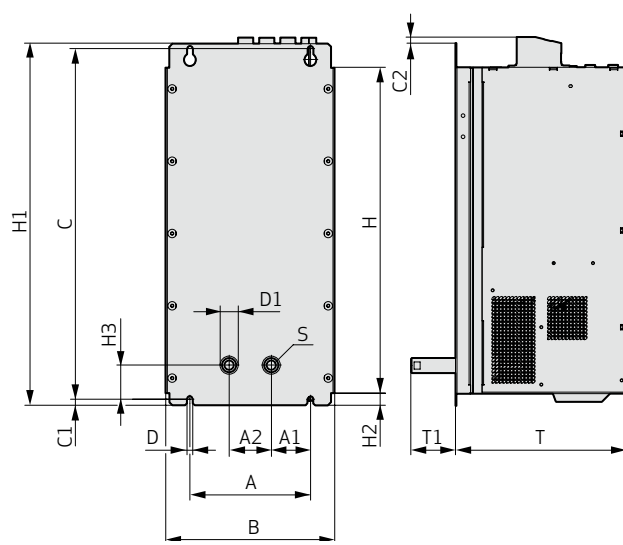
# TECHNICAL DATA

## Size 6A

**Dimensional drawings, Air-cooled**



**Dimensional drawings, Liquid-cooled**



Dimensions	mm (in)
B (width)	280 (11.02)
H (height)	540 (21.26) (without mating connectors)
T (depth) (air/liquid-cooled)	322/282 (12.68/11.10) (without mating connectors)
A/A1/A2	200/65/70 (7.87/2.56/2.76)
C/C1/C2	581/10/10 (22.87/0.39/0.39)
D	ø 9.5 (0.37)
D1 (hole for pipe socket)	ø 48 (1.89)
H1/H2/H3	600/20/56.5 (23.62/0.79/2.22)
S	3/8 inch (inside thread)
T1	73.5 (2.89)

### Matching accessories

Servo drive	G392-143	G395-170	G392-170	G395-210
Mains choke	CA55842-001	CA55843-001	CA55843-001	CB09045-001
Braking resistor	CA59741-001 (35 W, 26 Ω) CA59742-001 (150 W, 26 Ω) CA59743-001 (300 W, 26 Ω) CA59744-001 (1,000 W, 26 Ω)	CB09050-001 (2,000 W, 26 Ω) CB36901-001 (300 W, 20 Ω) CB36902-001 (300 W, 15 Ω)		
Mains filter	CA71189-001	CA71190-001	CA71190-001	CB09932-001

# TECHNICAL DATA

## Size 7



**Type G392-250**

Ordering number	G395-250	G395-325	G395-450
<b>Output, motor side</b>			
Voltage	3-phase $U_{\text{Mains}}$		
Rated current, effective ( $I_N$ )	250 A <sup>1)</sup>	325 A <sup>1)</sup>	450 A <sup>1)</sup>
Peak current	<a href="#">Page 38</a>		
Rotating field frequency	0 to 400 Hz		
Switching frequency of power stage	2, 4 kHz (factory setting 2 kHz at +40 °C (+104 °F))		
<b>Input, mains side</b>			
Mains voltage ( $U_{\text{Mains}}$ )	(3 x 230 V/3 x 400 V/3 x 460 V/3 x 480 V) ±10 %		
Device connected loa (with mains choke)	173 kVA <sup>1)</sup>	225 kVA <sup>1)</sup>	310 kVA <sup>1)</sup>
Current (with mains choke)	250 A <sup>1)</sup>	325 A <sup>1)</sup>	450 A <sup>1)</sup>
Asymmetry of mains voltage	±3 % maximum		
Frequency	50/60 Hz ±10 %		
Power loss at $I_N$	3,960 W <sup>1)</sup>	4,800 W <sup>1)</sup>	6,750 W <sup>1)</sup>
<b>DC link</b>			
DC link capacity	3,600 µF	5,400 µF	7,200 µF
Braking chopper switch-on-threshold	820 V <sub>DC</sub>		
Minimum ohmic resistance of an externally installed braking resistor	3.2 Ω	2.5 Ω	1.7 Ω
Brake chopper continuous power with external braking resistor	210 kW	269 kW	395 kW
Brake chopper peak power with external braking resistor	210 kW	269 kW	395 kW
Optional: Internal braking resistor	3.3 Ω		
Brake chopper continuous power with internal braking resistor	5,000 W		
Brake chopper peak power with internal braking resistor	204 kW		

1) Data referred to mains voltage 3 x 400 V<sub>AC</sub> and 2 kHz switching frequency

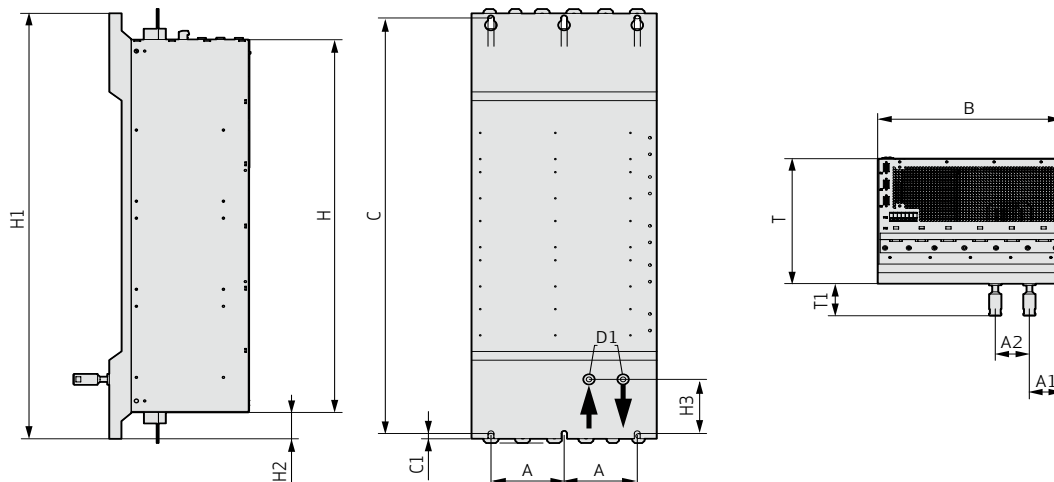
Servo drive	G395-250	G395-325	G395-450
Cooling method	Liquid-cooled		
Protection	IP20 except terminals (IP00)		
Cooling air temperature	Maximum +40 °C (+104 °F), not more than 10 °C (+50 °F) below the ambient temperature		
Weight (air/liquid-cooled)	100 kg (220.46 lb)		
Mounting type	Vertical mounting		
Mounting several servo drives	Direct side by side mounting		



# TECHNICAL DATA

## Size 7

### Dimensional drawings, Liquid-cooled



Dimensions	mm (in)
B (width)	380 (14.96) (with terminal covers: 392)
H (height)	952 (37.48) (with terminal covers and shield plates: 1305)
T (depth)	286.5 (11.28) (without mating connectors)
A/A1/A2	150/29/70 (5.91/1.14/2.76)
C/C1	952/12 (37.47/0.47)
D	∅ 12 (0.47)
D1 (hole for pipe socket)	∅ 48 (1.89)
H1/H2/H3	971/60/124 (38.23/2.36/4.88)
S	3/8 inch (inside thread)
T1	73.5 (2.90)

### Matching accessories

Servo drive	395-250	G395-325	G392-450
Mains choke	CA96898-001	CA96899-001	CA96900-001
Braking resistor	CA59744-001 (1000 W, 26 Ω) CB09050-001 (2000 W, 26 Ω) CB36901-001 (300 W, 20 Ω) CB36902-001 (300 W, 15 Ω)		
Mains filter	CB09933-001	CB09934-001 <sup>1)</sup> CB09935-001 <sup>1)</sup>	CB09935-001 <sup>1)</sup> CB09936-001 <sup>1)</sup>

1) Depends on the effective power

# MULTI-AXIS-SYSTEM OVERVIEW

## Designed for the Present and the Future

The Multi-Axis-System closes current loops (PWM frequencies 4, 8, 12 and 16 kHz). It is also able to close velocity and position control loops.

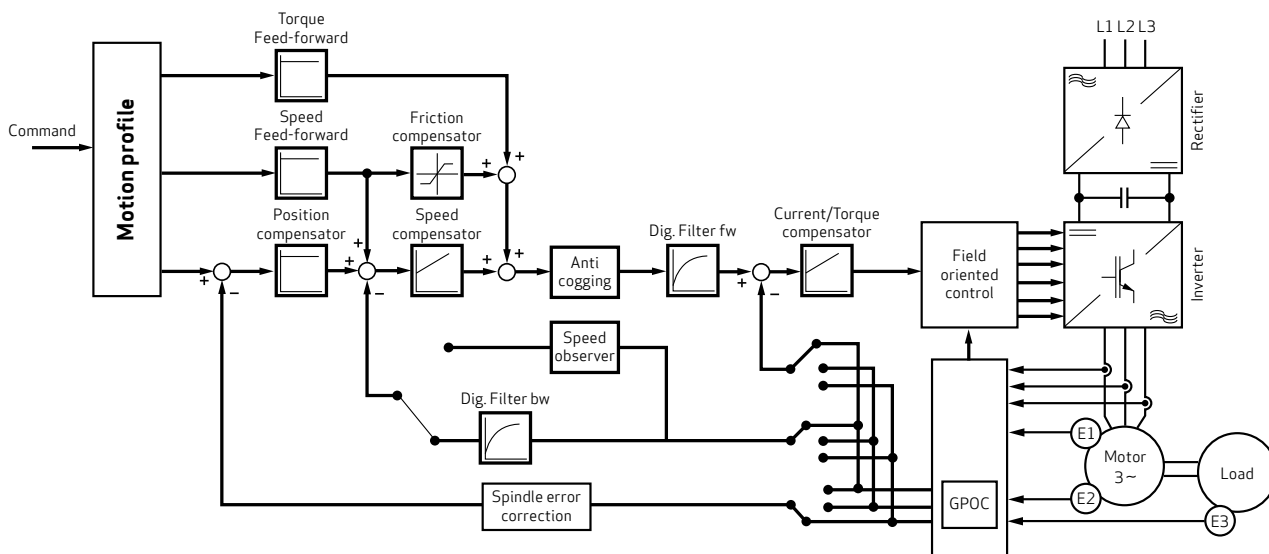
For high-performance control loops, high update rates are supported: the Multi-Axis-System operates at cycle times of 62.5  $\mu$ s for current and 125  $\mu$ s for velocity and position control loops.

Currently, 6 mechanical sizes, based on output power, are available, ranging from 4 up to 170 A<sub>rms</sub> with classical air cooling. Between 20 and 210 A<sub>rms</sub> the drives are also available as liquid-cooled devices.

It supports feedback devices such as Resolver, EnDat encoder or Hiperface® encoder as standard (Customer application specific position feedback is possible upon request). Beside air cooling as standard; cold plate and liquid cooling are available on request.

## Features

- Standard cascaded servo loop control structure including current/torque, velocity and position control
- Feed forward structure for higher response time and reduced tracking error
- Compensation of friction and cogging torque
- Compensation of mechanic spindle errors for both directions
- Support for field weakening for asynchronous and synchronous AC motors
- Availability of observer methods (current and velocity observers) which can be switched on, on demand for improving the server loop performance
- Patented method GPOC (Gain Phase Offset Correction): correlation technique to compensate encoder and resolver errors
- Servo drives from 4 to 210 A  
Supply via a DC connection from central power supply unit
- Evaluation by up to 3 position sensors  
For precise positioning even in systems with backlash and other mechanical errors
- Built in functional safety as per EN 61508, EN 62061, EN ISO 13849-1, EN 61800-5-2, personnel safety directly into the servo drive



## TECHNICAL DATA OVERVIEW - MULTI-AXIS-SYSTEM

### Intelligent solutions for modular drives systems

Active front-end power supply with sinusoidal regeneration PSU-AR are complementary parts of the PMA Servo Drives family.

The PSU-AR is available in two mechanical sizes. Each mechanical size is available in two power sizes ( $P_{nom}/P_{max}$ ) with 10 s overload capacity. The power electronics for the best ratio of size/efficiency is set to 4 kHz and synchronized with servo drive modules.

- Size 5
  - 26/52 kW
  - 50/94 kW
- Size 6A
  - 75/127 kW
  - 110/160 kW

400 V is the  $AC_{Mains}$  nominal input voltage. The DC bus voltage can be stabilized at minimal 770 V.

Reliability of the PSU-AR is ensured by means of proven power electronics platform combined with advanced control techniques extended by active harmonics shaping of the  $AC_{Mains}$ . Overall system robustness is further improved by presence of passive braking resistors. 7.5/96.3 kW for Size 5 and 4.7/153.7 kW for Size 6A.

PSU-AR can be set up via a user friendly graphical user interface and status display located in the front panel of the device.

### Features

- Enabling the best electric motor utilization all over the world through the DC-bus voltage boost and stabilization (stabilization possible at supply range of 200 to 480 V  $\pm 10\%$ , 50 Hz and 60 Hz)
- Running with TN and TT IT networks is not permitted
- Single DC supply for multiple axes through a short circuit protected bus streamlines cabling and reduces footprint
- Improving efficiency of process through the power factor control
- Returning energy to the  $AC_{Mains}$  allows for low energy consumption
- Regulating and controlling  $AC_{Mains}$  disturbances (blackouts under/over-voltage, spikes, etc.)
- Effective communication with the rest of the motion control system

All above in accordance with regulations of the international standards and the certificates (EMC, CE, UL etc.).

## TECHNICAL DATA OVERVIEW - MULTI-AXIS-SYSTEM



Sizes 1 to 6A

### Multi-Axis-System

Ordering number		Size	Rated current [A]		Current capacity		Technical data	
Air-cooled	Liquid-cooled		Air-cooled	Liquid-cooled	Air-cooled	Liquid-cooled	Air-cooled	Liquid-cooled
G393-004	-	Size 1	4.0	-	<a href="#">Page 70</a>	-	<a href="#">Page 81</a>	-
G393-006	-	Size 1	6.0	-	<a href="#">Page 70</a>	-	<a href="#">Page 81</a>	-
G393-008	-	Size 2	8.0	-	<a href="#">Page 70</a>	-	<a href="#">Page 83</a>	-
G393-012	-	Size 2	12	-	<a href="#">Page 70</a>	-	<a href="#">Page 83</a>	-
G393-016	G397-020	Size 3	16	20	<a href="#">Page 70</a>	<a href="#">Page 75</a>	<a href="#">Page 85</a>	<a href="#">Page 85</a>
G393-020	G397-025	Size 3	20	25	<a href="#">Page 70</a>	<a href="#">Page 74</a>	<a href="#">Page 85</a>	<a href="#">Page 85</a>
G393-024	G397-026	Size 4	24	26	<a href="#">Page 70</a>	<a href="#">Page 74</a>	<a href="#">Page 87</a>	<a href="#">Page 87</a>
G393-032	G397-035	Size 4	32	35	<a href="#">Page 70</a>	<a href="#">Page 74</a>	<a href="#">Page 87</a>	<a href="#">Page 87</a>
G393-045	G397-053	Size 5	45	53	<a href="#">Page 73</a>	<a href="#">Page 74</a>	<a href="#">Page 89</a>	<a href="#">Page 89</a>
G393-060	G397-070	Size 5	60	70	<a href="#">Page 73</a>	<a href="#">Page 74</a>	<a href="#">Page 89</a>	<a href="#">Page 89</a>
G393-072	G397-084	Size 5	72	84	<a href="#">Page 73</a>	<a href="#">Page 74</a>	<a href="#">Page 89</a>	<a href="#">Page 89</a>
G393-090	G397-110	Size 6A	90	110	<a href="#">Page 73</a>	<a href="#">Page 74</a>	<a href="#">Page 91</a>	<a href="#">Page 91</a>
G393-110	G397-143	Size 6A	110	143	<a href="#">Page 73</a>	<a href="#">Page 74</a>	<a href="#">Page 91</a>	<a href="#">Page 91</a>
G393-143	G397-170	Size 6A	143	170	<a href="#">Page 73</a>	<a href="#">Page 74</a>	<a href="#">Page 91</a>	<a href="#">Page 91</a>
G393-170	G397-210	Size 6A	170	210	<a href="#">Page 73</a>	<a href="#">Page 74</a>	<a href="#">Page 91</a>	<a href="#">Page 91</a>

### Power Supply Unit (PSU)

Ordering number	Size	Rated current [A]	Current capacity	Technical data
G396-026	Size 5	40	<a href="#">Page 77</a>	<a href="#">Page 93</a>
G396-050	Size 5	76	<a href="#">Page 77</a>	<a href="#">Page 93</a>
G396-075	Size 6A	115	<a href="#">Page 77</a>	<a href="#">Page 95</a>
G396-110	Size 6A	170	<a href="#">Page 77</a>	<a href="#">Page 95</a>

# ORDERING INFORMATION

## Air-cooled

G393 - 006 - 210 - 0 01

Rated current/maximum current			
004 =	4/8 A	Size 1	045 = 45/90 A Size 5
006 =	6/12 A	Size 1	060 = 60/120 A Size 5
008 =	9/16 A	Size 2	072 = 72/144 A Size 5
012 =	14/24 A	Size 2	090 = 90/180 A Size 6A
016 =	16/33 A	Size 3	110 = 110/165 A Size 6A
020 =	20/42 A	Size 3	143 = 143/215 A Size 6A
024 =	24/48 A	Size 4	170 = 170/220 A Size 6A
032 =	32/64 A	Size 4	

Option 1: Fieldbus	
0 =	None
1 =	EtherCAT
2 =	CANopen
3 =	PROFIBUS-DP
4 =	SERCOS II
5 =	CANopen + 2 analog outputs
6 =	SERCOS III

Availability on request:	
7 =	VARAN
8 =	PROFINET IRT

Option 2: Sensors	
0 =	None
1 =	Second Sin/Cos encoder
2 =	TTL encoder simulation/TTL master encoder
3 =	n.a.
4 =	TwinSync communication
5 =	TTL encoder with commutation signal
6 =	SSI encoder simulation
7 =	Analog I/O option card, 16-Bit

Option 3: Safety	
0 =	Standard

For future use	
1 =	Safety

Option 4: PLC functionality	
- =	without PLC
P =	with PLC
Q =	PQ firmware
R =	PQ firmware + PLC

For future use	
H =	HF <sup>1)</sup>
F =	PLC + HF <sup>1)</sup>

Modification	
0 =	Standard
1 =	Analog input 4 to 20 mA on control card

Variant sequential numbering	
01	Standard
03	Conformal coating

1) At option H,F the EG VO 428/2009, attachment I, pos. 3A225 has to be considered

**Note:** As from Size 5 available only with conformal coating

# ORDERING INFORMATION

## Liquid-cooled

G397 - 070 - 210 - 0 01

Rated current/maximum current			
020 =	20/33 A	Size 3	084 = 84/144 A Size 5
025 =	25/42 A	Size 3	110 = 110/187 A Size 6A
026 =	26/48 A	Size 4	143 = 143/215 A Size 6A
035 =	35/64 A	Size 4	170 = 170/255 A Size 6A
053 =	53/90 A	Size 5	210 = 210/255 A Size 6A
070 =	70/120 A	Size 5	

Option 1: Fieldbus	
0 =	None
1 =	EtherCAT
2 =	CANopen
3 =	PROFIBUS-DP
4 =	SERCOS II
5 =	n.a.
6 =	SERCOS III

Availability on request:	
7 =	VARAN
8 =	PROFINET IRT

Option 2: Sensors	
0 =	None
1 =	Second Sin/Cos encoder
2 =	TTL encoder simulation/TTL master encoder
3 =	n.a.
4 =	TwinSync communication
5 =	TTL encoder with commutation signal
6 =	SSI encoder simulation
7 =	Analog I/O option card, 16-Bit

Option 3: Safety	
0 =	Standard

For future use	
1 =	Safety

Option 4: PLC functionality	
- =	without PLC
P =	with PLC
Q =	PQ firmware
R =	PQ firmware + PLC

For future use	
H =	HF <sup>1)</sup>
F =	PLC + HF <sup>1)</sup>

Modification	
0 =	Standard
1 =	Analog input 4 to 20 mA on control card

Variant sequential numbering	
01	Standard
03	Conformal coating

1) At option H,F the EG VO 428/2009, attachment I, pos. 3A225 has to be considered

# ORDERING INFORMATION

## Power Supply Unit (PSU)

G396 - 050 - 001 - 001

Rated power/maximum power		
026 =	26/52 kW	Size 5
050 =	50/94 kW	Size 5
075 =	75/127 kW	Size 6A
110 =	110/160 kW	Size 6A

Option 1: Fieldbus	
0 =	None
1 =	EtherCAT
2 =	CANopen
3 =	PROFIBUS-DP
4 =	SERCOS II
5 =	n.a.
6 =	SERCOS III

Availability on request:	
7 =	VARAN
8 =	PROFINET IRT

For future use

Housing/cooling method	
1 =	Air-cooled
2 =	Liquid-cooled

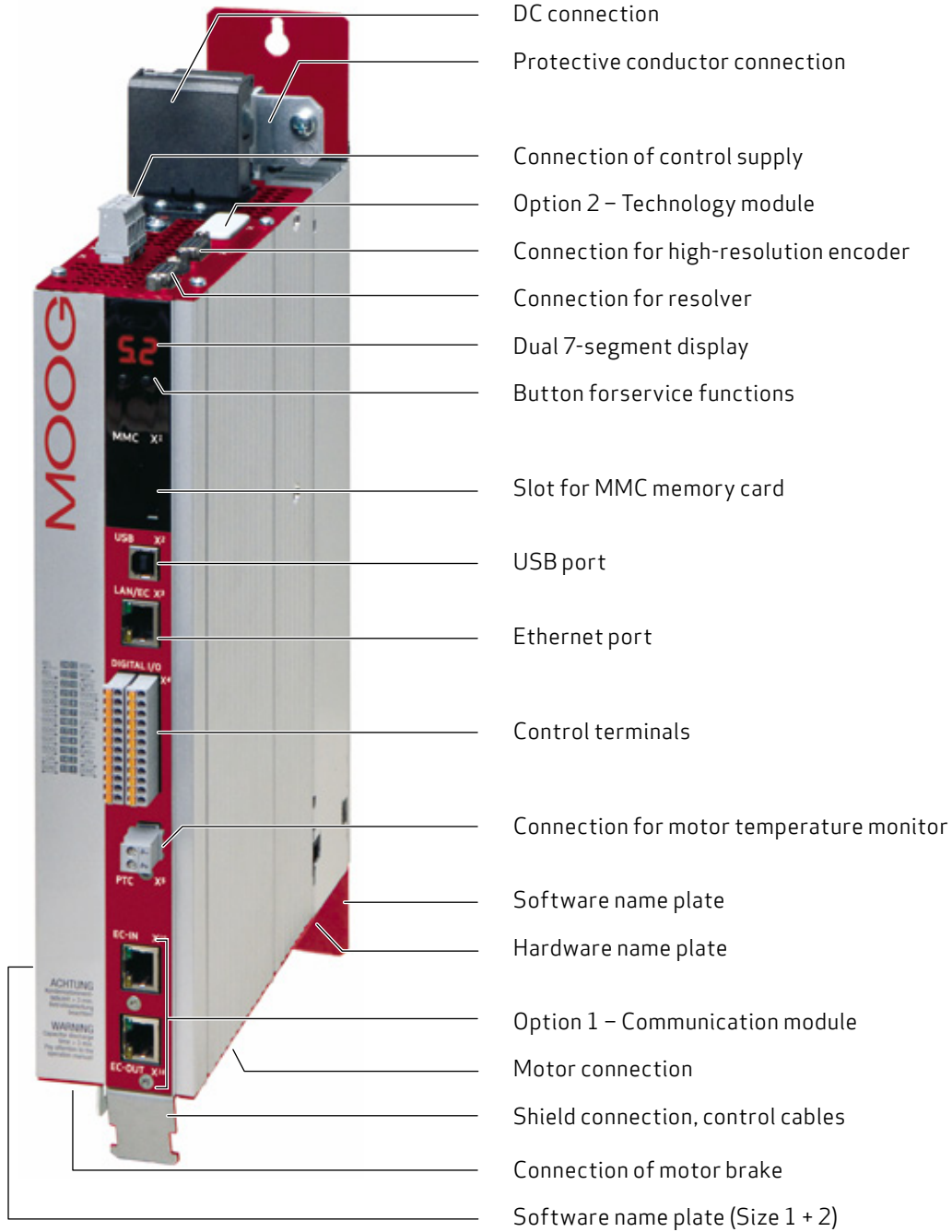
Option 4: PLC functionality	
- =	without PLC
P =	with PLC

Variant sequential numbering	
001	Standard
002	Internal brake resistor <sup>1)</sup>
003	Conformal coating

1) only with liquid-cooled housing

# EQUIPMENT

## Sizes 1 to 4

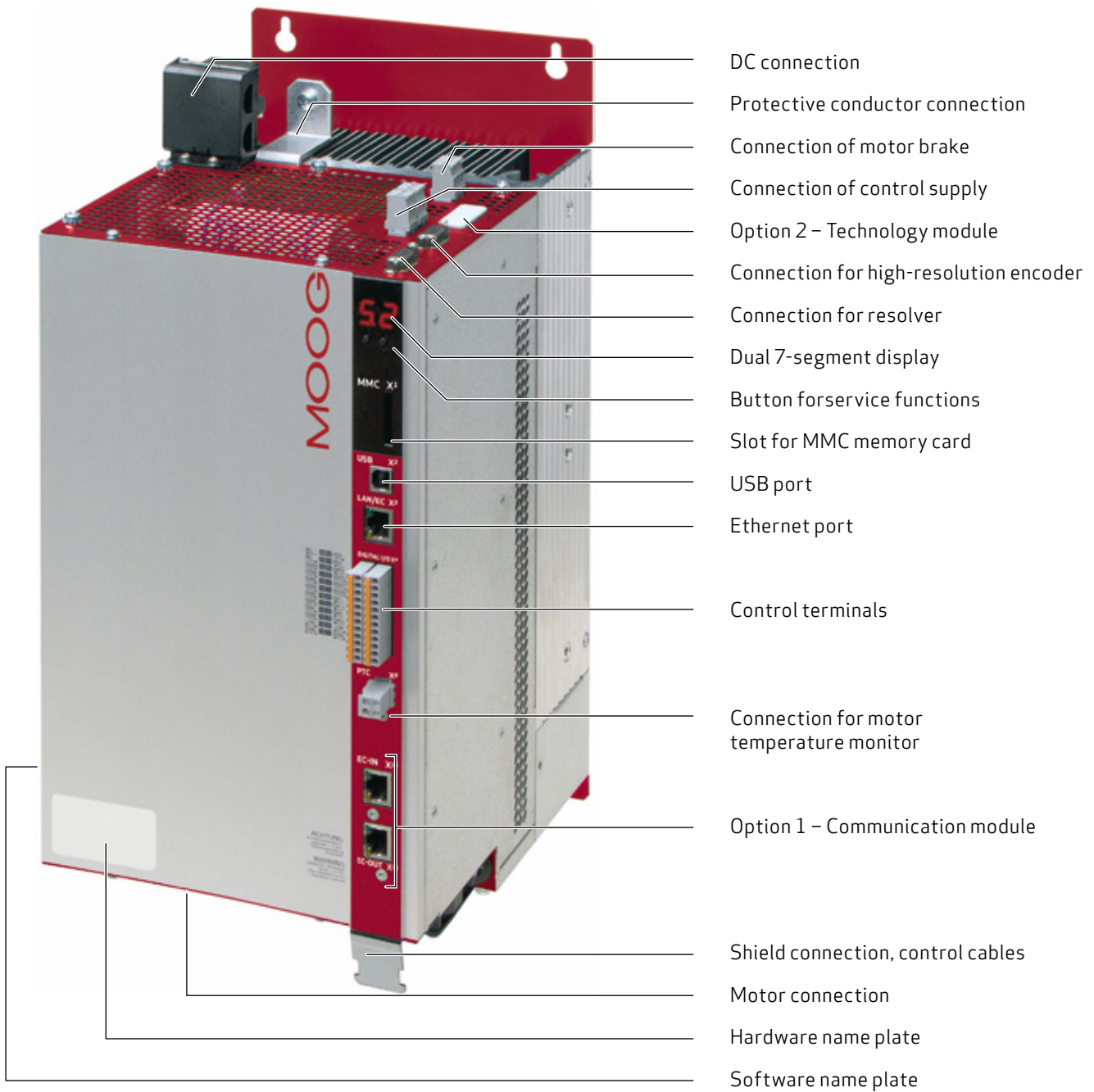


- DC connection
- Protective conductor connection
- Connection of control supply
- Option 2 – Technology module
- Connection for high-resolution encoder
- Connection for resolver
- Dual 7-segment display
- Button for service functions
- Slot for MMC memory card
- USB port
- Ethernet port
- Control terminals
- Connection for motor temperature monitor
- Software name plate
- Hardware name plate
- Option 1 – Communication module
- Motor connection
- Shield connection, control cables
- Connection of motor brake
- Software name plate (Size 1 + 2)



# EQUIPMENT

## Size 5



- DC connection
- Protective conductor connection
- Connection of motor brake
- Connection of control supply
- Option 2 - Technology module
- Connection for high-resolution encoder
- Connection for resolver
- Dual 7-segment display
- Button for service functions
- Slot for MMC memory card
- USB port
- Ethernet port
- Control terminals
- Connection for motor temperature monitor
- Option 1 - Communication module
- Shield connection, control cables
- Motor connection
- Hardware name plate
- Software name plate

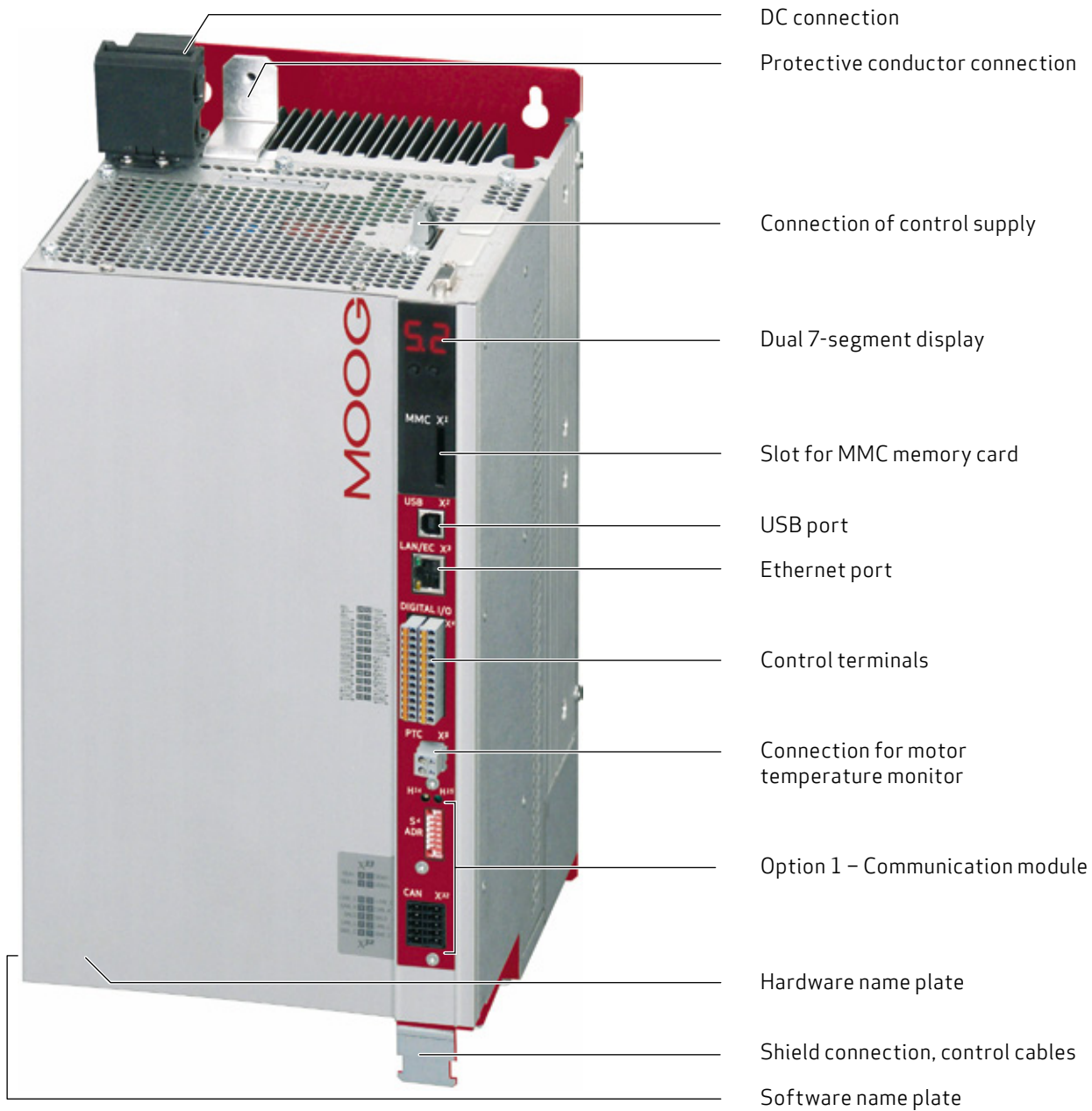
**EQUIPMENT**  
**Size 6A**



- Protective conductor connection
- DC power connection
- Connection of control supply
- Connection of motor brake
- Option 2 – Technology module
- Connection for High resolution encoder
- Connection for resolver
- Dual 7- segment display
- Button for service functions
- Slot for MMC memory card
- USB port
- Ethernet port
- Control terminals
- Connection of motor temperature monitor
- Option 1 – Communication module
- Hardware name plate
- Motor connection
- Software name plate

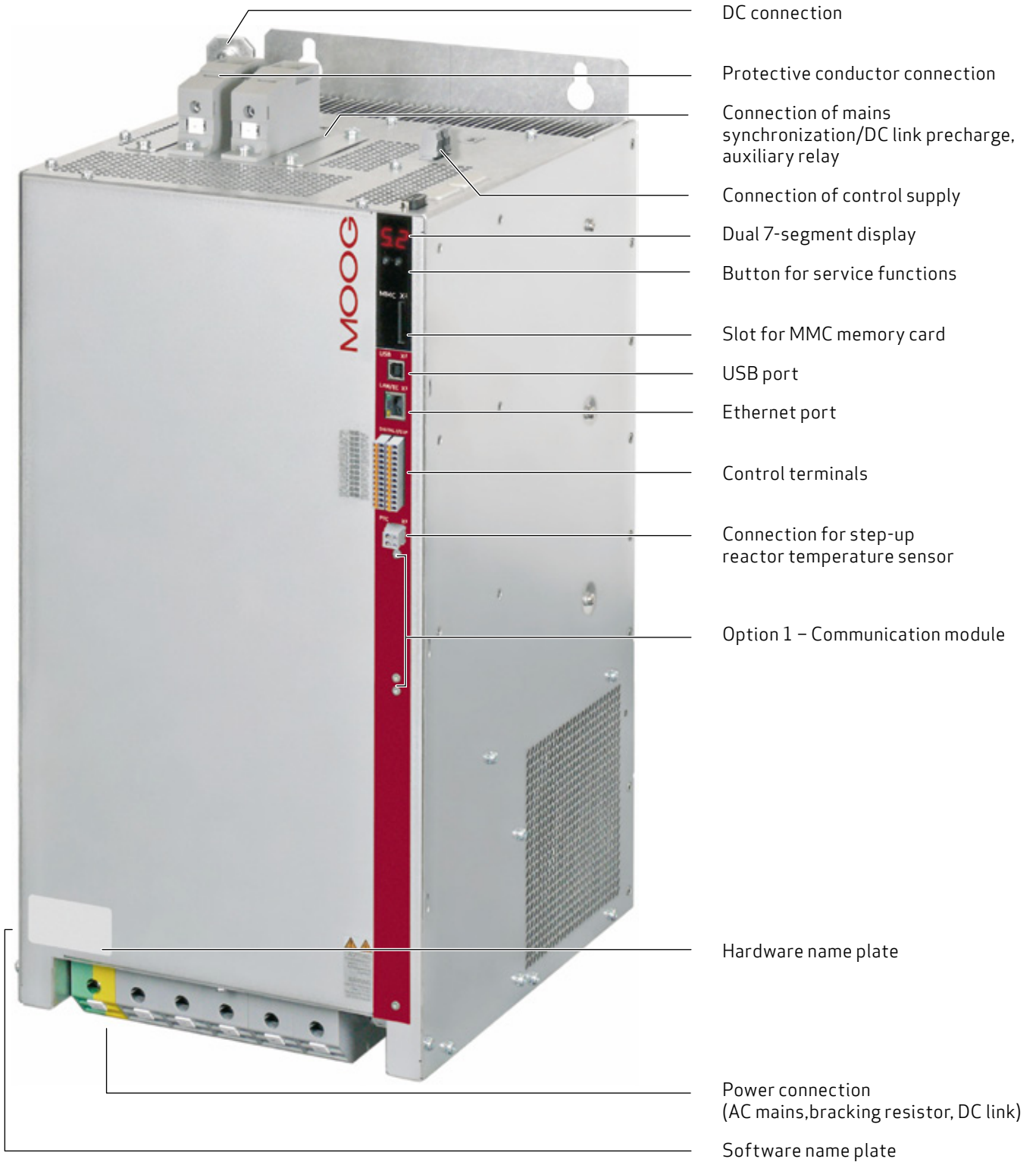
# EQUIPMENT

## Size 5 – Power Supply Unit (PSU)



## EQUIPMENT

### Size 6A – Power Supply Unit (PSU)



# CURRENT CAPACITY

## Sizes 1 to 4

The maximum permissible output current of the axis controllers and the Peak current are dependent on the DC supply voltage, the motor cable length, the power stage switching frequency and the ambient temperature.

If the conditions change, the maximum permissible current capacity of the MSD Servo Drive DC-AC controllers also changes.

### Air-cooled, 565 V<sub>DC</sub> (400 V<sub>AC</sub>)

Ordering number	Switching frequency of power stage [kHz]	Ambient temperature [°C (°F)]	Rated current [A <sub>eff</sub> ]	Peak current <sup>1)</sup>				
				I <sub>Maximum</sub> 0 Hz [A <sub>eff</sub> ]	I <sub>1 Maximum</sub> ≥ 5 Hz [A <sub>eff</sub> ]	t <sub>1</sub> <sup>2)</sup> [s]	I <sub>2 Maximum</sub> ≥ 5 Hz [A <sub>eff</sub> ]	t <sub>2</sub> <sup>2)</sup> [s]
G393-004 Size 1	4	40 (104)	5.3	8.4	8.4	10	11.9	0.5
	8		4.0	8.4	8.4		-	-
	12		3.7	6.6	6.6		-	-
	16		2.7	5.2	5.2		-	-
G393-006 Size 1	4	40 (104)	8.0	12.7	12.7	10	18.0	0.5
	8		6.0	12.7	12.7		-	-
	12		5.5	9.9	9.9		-	-
	16		4.0	7.7	7.7		-	-
G393-008 Size 2	4	40 (104)	9.3	15.9	15.9	10	23.9	0.5
	8		9.3	15.9	15.9		-	-
	12		6.7	9.4	9.4		-	-
	16		5.5	7.7	7.7		-	-
G393-012 Size 3	4	40 (104)	14.0	24.0	24.0	10	36.0	0.5
	8		14.0	24.0	24.0		-	-
	12		10.0	14.1	14.1		-	-
	16		8.2	11.5	11.5		-	-
G393-0016 Size 3	4	40 (104)	20.0	33.6	33.6	10	48.0	0.5
	8		16.0	33.6	33.6		-	-
	12		11.0	23.6	23.6		-	-
	16		8.5	19.4	19.4		-	-
G393-020 Size 3	4	40 (104)	25.0	42.0	42.0	10	60.0	0.5
	8		20.0	42.0	42.0		-	-
	12		13.8	29.6	29.6		-	-
	16		10.0	22.8	22.8		-	-
G393-0024 Size 4	4	40 (104)	30.0	48.0	48.0	10	72.0	0.5
	8		24.0	48.0	48.0		-	-
	12		15.8	31.6	31.6		-	-
	16		11.3	22.6	22.6		-	-
G393-032 Size 4	4	40 (104)	40.0	64.0	64.0	10	96.0	0.5
	8		32.0	64.0	64.0		-	-
	12		21.0	42.0	42.0		-	-
	16		15.0	30.0	30.0		-	-

1) At maximum 70 % preload 2) Shutdown as per I<sup>2</sup>t characteristic

Note: All data apply for motor cable length ≤10m (32.80 ft)

# CURRENT CAPACITY

## Sizes 1 to 4

Air-cooled, 650 V<sub>DC</sub> (460 V<sub>AC</sub>)

Ordering number	Switching frequency of power stage [kHz]	Ambient temperature [°C (°F)]	Rated current [A <sub>eff</sub> ]	Peak current <sup>1)</sup>				
				I <sub>Maximum</sub> 0 Hz [A <sub>eff</sub> ]	I <sub>1 Maximum</sub> ≥ 5 Hz [A <sub>eff</sub> ]	t <sub>1</sub> <sup>2)</sup> [s]	I <sub>2 Maximum</sub> ≥ 5 Hz [A <sub>eff</sub> ]	t <sub>2</sub> <sup>2)</sup> [s]
G393-004 Size 1	4	40 (104)	5.3	8.4	8.4	10	11.9	0.5
	8		3.4	7.2	7.2		-	-
	12		2.8	5.0	5.0		-	-
	16		1.9	3.6	3.6		-	-
G393-006 Size 1	4	40 (104)	8.0	12.7	12.7	10	18.0	0.5
	8		5.1	10.8	10.8		-	-
	12		4.2	7.5	7.5		-	-
	16		2.9	5.6	5.6		-	-
G393-008 Size 2	4	40 (104)	8.5	14.6	14.6	10	21.8	0.5
	8		6.7	11.5	11.5		-	-
	12		5.6	7.9	7.9		-	-
	16		4.1	5.8	5.8		-	-
G393-012 Size 2	4	40 (104)	11.8	20.2	20.2	10	30.3	0.5
	8		10.0	17.1	17.1		-	-
	12		8.4	11.8	11.8		-	-
	16		6.2	8.7	8.7		-	-
G393-016 Size 3	4	40 (104)	20.0	33.6	33.6	10	48.0	0.5
	8		13.9	29.1	29.1		-	-
	12		8.8	18.9	18.9		-	-
	16		6.5	14.8	14.8		-	-
G393-020 Size 3	4	40 (104)	25.0	42.0	42.0	10	60.0	0.5
	8		17.4	36.5	36.5		-	-
	12		11.0	23.6	23.6		-	-
	16		7.4	16.8	16.8		-	-
G393-024 Size 4	4	40 (104)	26.0	41.6	41.6	10	62.4	0.5
	8		21.0	42.0	42.0		-	-
	12		12.4	24.8	24.8		-	-
	16		8.9	17.8	17.8		-	-
G393-032 Size 4	4	40 (104)	33.7	53.9	53.9	10	80.9	0.5
	8		28.0	56.0	56.0		-	-
	12		16.5	33.0	33.0		-	-
	16		11.9	23.8	23.8		-	-

1) At maximum 70 % preload

2) Shutdown as per I<sup>2</sup>t characteristic

**Note:** All data apply for motor cable length ≤10 m (32.80 ft)

## CURRENT CAPACITY

## Sizes 1 to 4

Air-cooled, 678 V<sub>DC</sub> (480 V<sub>AC</sub>)

Ordering number	Switching frequency of power stage [kHz]	Ambient temperature [°C (°F)]	Rated current [A <sub>eff</sub> ]	Peak current <sup>1)</sup>				
				I <sub>Maximum</sub> 0 Hz [A <sub>eff</sub> ]	I <sub>Maximum</sub> ≥ 5 Hz [A <sub>eff</sub> ]	t <sub>1</sub> <sup>2)</sup> [s]	I <sub>Maximum</sub> ≥ 5 Hz [A <sub>eff</sub> ]	t <sub>2</sub> <sup>2)</sup> [s]
G393-004 Size 1	4	40 (104)	5.3	8.4	8.4	10	11.9	0.5
	8		3.3	7.0	7.0		-	-
	12		2.7	4.8	4.8		-	-
	16		1.8	3.4	3.4		-	-
G393-006 Size 1	4	40 (104)	8.0	12.7	12.7	10	18.0	0.5
	8		5.0	10.6	10.6		-	-
	12		4.0	7.2	7.2		-	-
	16		2.7	5.2	5.2		-	-
G393-008 Size 2	4	40 (104)	8.5	14.6	14.6	10	21.8	0.5
	8		6.1	10.4	10.4		-	-
	12		5.4	7.6	7.6		-	-
	16		3.9	5.5	5.5		-	-
G393-012 Size 2	4	40 (104)	11.4	19.5	19.5	10	29.3	0.5
	8		9.2	15.8	15.8		-	-
	12		8.1	11.4	11.4		-	-
	16		5.8	8.2	8.2		-	-
G393-016 Size 3	4	40 (104)	20.0	33.6	33.6	10	48.0	0.5
	8		13.3	27.9	27.9		-	-
	12		8.5	18.3	18.3		-	-
	16		6.0	13.7	113.7		-	-
G393-020 Size 3	4	40 (104)	25.0	42.0	42.0	10	60.0	0.5
	8		16.6	34.8	34.8		-	-
	12		10.0	21.5	21.5		-	-
	16		6.5	14.8	14.8		-	-
G393-024 Size 4	4	40 (104)	26.0	41.6	41.6	10	62.4	0.5
	8		20.0	40.0	40.0		-	-
	12		11.3	22.6	22.6		-	-
	16		8.4	16.8	16.8		-	-
G393-032 Size 4	4	40 (104)	32.5	52.0	52.0	10	78.0	0.5
	8		26.7	53.4	53.4		-	-
	12		15.0	30.0	30.0		-	-
	16		11.2	22.4	22.4		-	-

1) At maximum 70 % preload

2) Shutdown as per I<sup>2</sup>t characteristic**Note:** All data apply for motor cable length ≤10 m (32.80 ft)

## CURRENT CAPACITY

## Sizes 1 to 4

Air-cooled, 770 V<sub>DC</sub>

Ordering number	Switching frequency of power stage [kHz]	Ambient temperature [°C (°F)]	Rated current [A <sub>eff</sub> ]	Peak current <sup>1)</sup>				
				I <sub>Maximum</sub> 0 Hz [A <sub>eff</sub> ]	I <sub>Maximum</sub> ≥ 5 Hz [A <sub>eff</sub> ]	t <sub>1</sub> <sup>2)</sup> [s]	I <sub>Maximum</sub> ≥ 5 Hz [A <sub>eff</sub> ]	t <sub>2</sub> <sup>2)</sup> [s]
G393-004 Size 1	4	40 (104)	5.1	8.1	8.1	10	11.5	0.5
	8		3.2	6.8	6.8		-	-
	12		2.1	3.8	3.8		-	-
	16		1.1	2.1	2.1		-	-
G393-006 Size 1	4	40 (104)	7.6	12.1	12.1	10	17.1	0.5
	8		4.8	10.2	10.2		-	-
	12		3.2	5.7	5.7		-	-
	16		1.6	3.1	3.1		-	-
G393-008 Size 2	4	40 (104)	8.0	13.7	13.7	10	20.6	0.5
	8		5.9	10.1	10.1		-	-
	12		5.3	7.4	7.4		-	-
	16		3.7	5.2	5.2		-	-
G393-012 Size 2	4	40 (104)	11.2	19.2	19.2	10	28.8	0.5
	8		8.8	15.1	15.1		-	-
	12		7.9	11.1	11.1		-	-
	16		5.5	7.7	7.7		-	-
G393-016 Size 3	4	40 (104)	20.0	33.6	33.6	10	48.0	0.5
	8		11.2	23.5	23.5		-	-
	12		7.0	15.0	15.0		-	-
	16		4.5	10.2	10.2		-	-
G393-020 Size 3	4	40 (104)	25.0	42.0	42.0	10	60.0	0.5
	8		14.0	29.4	29.4		-	-
	12		7.5	16.1	16.1		-	-
	16		5.0	11.4	11.4		-	-
G393-024 Size 4	4	40 (104)	26.0	41.6	41.6	10	62.4	0.5
	8		18.9	37.8	37.8		-	-
	12		10.5	21.0	21.0		-	-
	16		7.9	15.8	15.8		-	-
G393-032 Size 4	4	40 (104)	32.0	51.2	51.2	10	76.8	0.5
	8		25.2	50.4	50.4		-	-
	12		14.0	28.0	28.0		-	-
	16		10.5	21.0	21.0		-	-

1) At maximum 70 % preload

2) Shutdown as per I<sup>2</sup>t characteristic**Note:** All data apply for motor cable length ≤10 m (32.80 ft)



# CURRENT CAPACITY

## Sizes 5 to 6A

### Air-cooled

Ordering number	Switching frequency of power stage  [kHz]	Ambient temperature  [°C (°F)]	Rated current				Peak current [ $I_{eff}$ ] <sup>1)</sup>			For time <sup>2)</sup>  [s]
			At 565 V <sub>DC</sub> (400 V <sub>AC</sub> ) <sup>3)</sup>	At 650 V <sub>DC</sub> (460 V <sub>AC</sub> ) <sup>3)</sup>	At 678 V <sub>DC</sub> (480 V <sub>AC</sub> ) <sup>3)</sup>	At 770 V <sub>DC</sub>	At rotating field frequency rising in linear mode 0 to 5 Hz		For intermittent operation	
			[A <sub>eff</sub> ]	[A <sub>eff</sub> ]	[A <sub>eff</sub> ]	[A <sub>eff</sub> ]	0 Hz	5 Hz	> 5 Hz	
G393-045 Size 5	4	40 (104)	45	42	41	41	90	90	90	3
	8		45	42	41	41	90	90	90	
	12		45	42	41	37	90	90	90	
	16		42	39	38	34	84	84	84	
G393-060 Size 5	4	40 (104)	60	56	54	54	120	120	120	3
	8		60	56	54	54	120	120	120	
	12		58	54	52	48	116	116	116	
	16		42	39	38	34	84	84	84	
G393-072 Size 5	4	40 (104)	72	67	65	65	144	144	144	3
	8		72	67	65	65	144	144	144	
	12		58	54	52	48	116	116	116	
	16		42	39	38	34	84	84	84	
G393-090 Size 6A	4	40 (104)	90	83	81	73	170	180	180	10
	8		90	83	81	73	134	180	180	
	12		90	83	81	73	107	144	144	
	16		72	67	65	59	86	115	115	
G393-110 Size 6A	4	40 (104)	110	102	99	90	170	220	220	10
	8		110	102	99	90	134	165	165	
	12		90	83	81	73	107	144	144	
	16		72	67	65	59	86	115	115	
G393-143 Size 6A	4	40 (104)	143	132	129	116	190	286	286	10
	8		143	132	129	116	151	215	215	
	12		115	106	104	94	121	172	172	
	16		92	85	83	75	97	138	138	
G393-170 Size 6A	4	40 (104)	170	157	153	138	190	315	315	10
	8		170	157	153	138	151	220	220	
	12		136	126	122	110	121	164	164	
	16		109	101	98	88	97	131	131	

1) When supplied with 565 V<sub>DC</sub> (corresponding to 400 V<sub>AC</sub>) at maximum 70 % preload  
 2) Shutdown as per I<sup>2</sup>t characteristic  
 3) When supplied with AC Servo drive

**Note:** All data apply for motor cable length ≤10 m (32.80 ft)

## CURRENT CAPACITY

## Sizes 3 to 4

Liquid-cooled, 565 V<sub>DC</sub> (400 V<sub>AC</sub>)

Ordering number	Switching frequency of power stage [kHz]	Ambient temperature [°C (°F)]	Rated current [A <sub>eff</sub> ]	Peak current <sup>1)</sup>				
				I <sub>Maximum</sub> 0 Hz [A <sub>eff</sub> ]	I <sub>1 Maximum</sub> ≥5 Hz [A <sub>eff</sub> ]	t <sub>1</sub> <sup>2)</sup> [s]	I <sub>2 Maximum</sub> ≥5 Hz [A <sub>eff</sub> ]	t <sub>2</sub> <sup>2)</sup> [s]
G397-020 Size 3	4	40 (104)	20.0	33.6	33.6	10	48.0	0.5
	8		20.0	33.6	33.6		-	-
	12		17.4	26.4	26.4		-	-
	16		12.0	18.2	18.2		-	-
G397-025 Size 3	4	40 (104)	25.0	42.0	42.0	10	60.0	0.5
	8		25.0	42.0	42.0		-	-
	12		21.8	33.1	33.1		-	-
	16		15.0	22.8	22.8		-	-
G397-026 Size 4	4	40 (104)	30.0	48.0	48.0	10	72.0	0.5
	8		26.3	48.1	48.1		-	-
	12		22.5	31.5	31.5		-	-
	16		16.1	22.5	22.5		-	-
G397-035 Size 4	4	40 (104)	40.0	64.0	64.0	10	96.0	0.5
	8		35.0	64.0	64.0		-	-
	12		30.0	42.0	42.0		-	-
	16		21.4	29.9	29.9		-	-

Liquid-cooled, 650 V<sub>DC</sub> (460 V<sub>AC</sub>)

Ordering number	Switching frequency of power stage [kHz]	Ambient temperature [°C (°F)]	Rated current [A <sub>eff</sub> ]	Peak current <sup>1)</sup>				
				I <sub>Maximum</sub> 0 Hz [A <sub>eff</sub> ]	I <sub>1 Maximum</sub> ≥5 Hz [A <sub>eff</sub> ]	t <sub>1</sub> <sup>2)</sup> [s]	I <sub>2 Maximum</sub> ≥5 Hz [A <sub>eff</sub> ]	t <sub>2</sub> <sup>2)</sup> [s]
G397-020 Size 3	4	40 (104)	20.0	33.6	33.6	10	48.0	0.5
	8		17.4	29.2	29.2		-	-
	12		12.5	19.0	19.0		-	-
	16		9.1	13.8	13.8		-	-
G397-025 Size 3	4	40 (104)	25.0	42.0	42.0	10	60.0	0.5
	8		21.8	36.6	36.6		-	-
	12		15.6	23.7	23.7		-	-
	16		11.4	17.3	17.3		-	-
G397-026 Size 4	4	40 (104)	26.0	41.6	41.6	10	62.4	0.5
	8		23.0	42.0	42.0		-	-
	12		17.7	24.8	24.8		-	-
	16		12.8	17.9	17.9		-	-
G397-035 Size 4	4	40 (104)	33.7	53.9	53.9	10	80.9	0.5
	8		30.6	55.9	55.9		-	-
	12		23.6	33.0	33.0		-	-
	16		17.0	23.8	23.8		-	-

1) At maximum 70 % preload 2) Shutdown as per I<sup>2</sup>t characteristic **Note:** All data apply for motor cable length ≤10 m (32.80 ft)

## CURRENT CAPACITY

## Sizes 3 to 4

Liquid-cooled, 678 V<sub>DC</sub> (480 V<sub>AC</sub>)

Ordering number	Switching frequency of power stage [kHz]	Ambient temperature [°C (°F)]	Rated current [A <sub>eff</sub> ]	Peak current <sup>1)</sup>				
				I <sub>Maximum</sub> 0 Hz [A <sub>eff</sub> ]	I <sub>1 Maximum</sub> ≥5 Hz [A <sub>eff</sub> ]	t <sub>1</sub> <sup>2)</sup> [s]	I <sub>2 Maximum</sub> ≥5 Hz [A <sub>eff</sub> ]	t <sub>2</sub> <sup>2)</sup> [s]
G397-020 Size 3	4	40 (104)	20.0	33.6	33.6	10	48.0	0.5
	8		16.6	27.9	27.9		-	-
	12		11.4	17.3	17.3		-	-
	16		8.5	12.9	12.9		-	-
G397-025 Size 3	4	40 (104)	25.0	42.0	42.0	10	60.0	0.5
	8		20.8	34.9	34.9		-	-
	12		14.3	21.7	21.7		-	-
	16		10.6	16.1	16.1		-	-
G397-026 Size 4	4	40 (104)	26.0	41.6	41.6	10	62.4	0.5
	8		21.9	40.0	40.0		-	-
	12		16.1	22.5	22.5		-	-
	16		12.0	16.8	16.8		-	-
G397-035 Size 4	4	40 (104)	32.5	52.0	52.0	10	78.0	0.5
	8		29.2	53.4	53.4		-	-
	12		21.4	30.0	30.0		-	-
	16		16.0	22.4	22.4		-	-

Liquid-cooled, 770 V<sub>DC</sub>

Ordering number	Switching frequency of power stage [kHz]	Ambient temperature [°C (°F)]	Rated current [A <sub>eff</sub> ]	Peak current <sup>1)</sup>				
				I <sub>Maximum</sub> 0 Hz [A <sub>eff</sub> ]	I <sub>1 Maximum</sub> ≥5 Hz [A <sub>eff</sub> ]	t <sub>1</sub> <sup>2)</sup> [s]	I <sub>2 Maximum</sub> ≥5 Hz [A <sub>eff</sub> ]	t <sub>2</sub> <sup>2)</sup> [s]
G393-020 Size 3	4	40 (104)	20.0	33.6	33.6	10	48.0	0.5
	8		15.8	26.5	26.5		-	-
	12		10.7	16.2	16.2		-	-
	16		8.1	12.3	12.3		-	-
G393-025 Size 3	4	40 (104)	25.0	42.0	42.0	10	60.0	0.5
	8		19.8	33.2	33.2		-	-
	12		13.4	20.3	20.3		-	-
	16		10.1	15.3	15.3		-	-
G393-026 Size 4	4	40 (104)	26.0	41.6	41.6	10	62.4	0.5
	8		20.7	37.8	37.8		-	-
	12		15.4	21.5	21.5		-	-
	16		11.3	15.8	15.8		-	-
G393-035 Size 4	4	40 (104)	32.0	51.2	51.2	10	76.8	0.5
	8		27.6	50.5	50.5		-	-
	12		20.5	28.7	28.7		-	-
	16		15.0	21.0	21.0		-	-

1) At maximum 70 % preload 2) Shutdown as per I<sup>2</sup>t characteristic **Note:** All data apply for motor cable length ≤10 m (32.80 ft)

# CURRENT CAPACITY

## Sizes 5 to 6A

### Liquid-cooled

Ordering number	Switching frequency of power stage  [kHz]	Ambient temperature  [°C (°F)]	Rated current				Peak current [A <sub>eff</sub> ] <sup>1)</sup>			For time <sup>2)</sup>  [s]
			At 565 V <sub>DC</sub> (400 V <sub>AC</sub> ) <sup>3)</sup>	At 650 V <sub>DC</sub> (460 V <sub>AC</sub> ) <sup>3)</sup>	At 678 V <sub>DC</sub> (480 V <sub>AC</sub> ) <sup>3)</sup>	At 770 V <sub>DC</sub>	At rotating field frequency rising in linear mode 0 to 5 Hz		For intermittent operation	
			[A <sub>eff</sub> ]	[A <sub>eff</sub> ]	[A <sub>eff</sub> ]	[A <sub>eff</sub> ]	0 Hz	5 Hz	> 5 Hz	
G397-053 Size 5	4	40 (104)	53	49	48	48	90	90	90	3
	8		53	49	48	48	90	90	90	
	12		53	49	48	42	90	90	90	
	16		49	45	44	39	84	84	84	
G397-070 Size 5	4	40 (104)	70	65	63	63	120	120	120	3
	8		70	65	63	63	120	120	120	
	12		68	63	61	55	116	116	116	
	16		49	45	44	39	84	84	84	
G397-084 Size 5	4	40 (104)	84	78	76	76	144	144	144	3
	8		84	78	76	76	144	144	144	
	12		68	63	61	55	116	116	116	
	16		49	45	44	39	84	84	84	
G397-110 Size 6A	4	40 (104)	110	102	99	90	205	220	220	10
	8		110	102	99	90	165	187	187	
	12		110	102	99	90	132	165	165	
	16		90	83	81	73	106	135	135	
G397-143 Size 6A	4	40 (104)	143	132	129	116	230	286	286	10
	8		143	132	129	116	190	215	215	
	12		114	105	103	93	152	172	172	
	16		91	84	82	74	122	138	138	
G397-170 Size 6A	4	40 (104)	170	157	153	138	230	340	340	10
	8		170	157	153	138	190	255	255	
	12		136	126	122	110	152	204	204	
	16		109	101	98	88	122	163	163	
G397-210 Size 6A	4	40 (104)	210	194	189	170	230	340	340	10
	8		210	194	189	170	190	255	255	
	12		168	155	151	136	152	204	204	
	16		134	124	121	109	122	163	163	

1) When supplied with 565 V<sub>DC</sub> (corresponding to 400 V<sub>AC</sub>) at maximum 70% preload

2) Shutdown as per I<sup>2</sup>t characteristic

3) When supplied with AC Servo drive

**Note:** All data apply for motor cable length ≤10 m (32.80 ft)

## CURRENT CAPACITY

### Sizes 5 to 6A – Power Supply Units (PSU)

#### Air and Liquid-cooled

Ordering number	Switching frequency of power stage [kHz]	Ambient temperature [°C (°F)]	Rated current		Peak current [ $I_{eff}$ ] <sup>1)</sup>		
			At 650 V <sub>DC</sub> [A <sub>eff</sub> ]	At 770 V <sub>DC</sub> [A <sub>eff</sub> ]	At 650 V <sub>DC</sub> 0 Hz	At 770 V <sub>DC</sub> > 5 Hz	For time <sup>2)</sup> [s]
G396-026 (Size 5)	12	40 (104)	40	34	76	64	10
G396-050 (Size 5)	4	40 (104)	80	68	144	122	10
G396-075 (Size 6A)	8	40 (104)	115	97	195	165	10
G396-110 (Size 6A)	4	40 (104)	170	144	246	207	10

1) When supplied with 565 V<sub>DC</sub> (corresponding to 400 V<sub>AC</sub>) at maximum 70% preload

2) Shutdown as per  $I^2t$  characteristic

3) When supplied with AC Servo drive

**Note:** All data apply for motor cable length ≤10 m (32.80 ft)

## AMBIENT CONDITIONS

<b>Ambient conditions</b>	
<b>Protection</b>	IP20 except terminals (IP00)
<b>Accident prevention regulations</b>	According to local regulations (in Germany e.g. BGV A3)
<b>Mounting height</b>	Up to 1,000 m (3,280 ft) above MSL, above with power reduction (1 % per 100 m (328 ft), maximum 2,000 m (6,561 ft) above MSL).
<b>Pollution severity</b>	2
<b>Type of installation</b>	Built-in unit, only for vertical installation in a switch cabinet with minimum IP4x protection, when using STO safety function minimum IP54

<b>Climatic conditions</b>		
<b>In transit</b>	As per EN 61800-2, IEC 60721-3-2 class 2K3 <sup>1)</sup>	
	Temperature: -25 to +70 °C (-13 to +158 °F)	
	Relative air humidity: 95 % at maximum +40 °C (+104 °F)	
<b>In storage</b>	As per EN 61800-2, IEC 60721-3-1 class 1K3 and 1K4 <sup>2)</sup>	
	Temperature: -25 to +55 °C (-13 to +131 °F)	
	Relative air humidity: 5 to 95 %	
<b>In operation</b>	As per EN 61800-2, IEC 60721-3-3 class 3K3 <sup>3)</sup>	
	Temperature	<b>Size 1</b> -10 to +40 °C (+14 to +104 °F) (4/8/12/16 kHz)
		<b>Size 2 to 4</b> -10 to +45 °C (+14 to +113 °F) (4 kHz), to +55 °C (+131 °F) with power reduction (5 % per °C/°F) -10 to +40 °C (+14 to +104 °F) (8/12/16 kHz), to +55 °C (+131 °F) with power reduction (4 % per °C/°F)
		<b>Size 5 to 6A</b> -10 to +40 °C (+14 to +104 °F) (4/8/12/16 kHz) to +55 °C (+131 °F) with power reduction (2 % per °C/°F)
	Relative air humidity: 5 to 85 % without condensation	

- 1) The absolute humidity is limited to maximum 60 g/m<sup>3</sup>  
This means, at +70 °C (+158 °F) for example, that the relative humidity may only be maximum 40 %
- 2) The absolute humidity is limited to maximum 29 g/m<sup>3</sup>  
So the maximum values for temperature and relative air humidity stipulated in the table must not occur simultaneously
- 3) The absolute humidity is limited to maximum 25 g/m<sup>3</sup>  
That means that the maximum values for temperature and relative air humidity stipulated in the table must not occur simultaneously

## AMBIENT CONDITIONS

<b>Mechanical conditions</b>			
<b>Vibration limit in transit</b>	As per EN 61800-2, IEC 60721-3-2 class 2M1		
	<b>Frequency [Hz]</b>	<b>Amplitude [mm (in)]</b>	<b>Acceleration [<math>m/s^2</math> (in/s<sup>2</sup>)]</b>
	$2 \leq f < 9$	3.5 (0.14)	Not applicable
	$9 \leq f < 200$	Not applicable	10 (393.70)
	$200 \leq f < 500$	Not applicable	15 (590.55)
<b>Shock limit in transit</b>	As per EN 61800-2, IEC 60721-2-2 class 2M1		
	Drop height of packed device maximum 0.25 m (9.84 in)		
<b>Vibration limits of the system</b> <sup>1)</sup>	As per EN 61800-2, IEC 60721-3-3 class 3M1		
	<b>Frequency [Hz]</b>	<b>Amplitude [mm (in)]</b>	<b>Acceleration [<math>m/s^2</math> (in/s<sup>2</sup>)]</b>
	$2 \leq f < 9$	0.3 (0.01)	Not applicable
	$9 \leq f < 200$	Not applicable	1 (39.37)

1) The devices are only designed for stationary use. The servo drives must not be installed in areas where they would be permanently exposed to vibrations

## CERTIFICATIONS AND STANDARDS

### CE mark

The MSD Multi-Axis-System conforms to the requirements of the Low Voltage Directive 2006/95/EC and the product standard EN 61800-5-1.

The MSD Multi-Axis-System and supply units thus conform to the requirements for installation in a machine or plant under the terms of the Machinery Directive 2006/42/EC.

The servo drive DC-AC and supply units are accordingly CE marked. The CE mark on the type plate indicates conformity with the above Directives.

### UL approbation

For the MSD Multi-Axis-Systems, UL approbation has been obtained for device Size 5 and 6A (45 to 210 A rated current) and for the supply units.

**Note:** For the servo drives in Size 1 to 4 (4 to 35 A) UL approbation is in preparation.

### EMC acceptance tests

All MSD Multi-Axis-Systems G39x.xxx have an aluminium housing with an anodized finish (Size 1 to 4) or an aluminium rear panel made of aluminized/galvanized sheet steel (Size 5 to 6A) to enhance interference immunity in accordance with EN 61800-3, environment classes 1 and 2.

To limit line-borne interference emission to the permissible level and to comply with the EMC Directive 2004/108/EC, external filter sets are available for the supply units (see Technical data of supply units starting on page 93).

### STO acceptance

The "STO" (Safe Torque Off) safety function integrated into the MSD axis controller is certified according to the requirements of:

EN ISO 13849-1 „PL e“ and

EN 61508 / EN 62061 „SIL3“.

Acceptance testing is carried out by the accredited certification agency, TÜV Rheinland.



# TECHNICAL DATA

## Sizes 1 to 6A



Type G393-004

Ordering number	G393-004	G393-006
<b>Output, motor side</b>		
Voltage	3-phase $U_{ZK}/\sqrt{2}$	
Rated current, effective ( $I_N$ )	Air-cooled: 4 A <sup>1)</sup>	Air-cooled: 6 A <sup>1)</sup>
	Liquid-cooled: Size 1 not available with liquid cooling	
Peak current	Air-cooled: <a href="#">Page 69 to 72</a>	
	Liquid-cooled: Size 1 not available with liquid cooling	
Rotating field frequency	0 to 400 Hz	
Switching frequency of power stage	4/8/12/16 kHz	
<b>DC input</b>		
DC voltage ( $U_{ZK}$ ) nominal <sup>2)</sup>	565 V <sub>DC</sub> /650 V <sub>DC</sub> /678 V <sub>DC</sub> /770 V <sub>DC</sub>	
Current (RMS-approximation value)	$1.7 \times I_{Motor}$	
Device connected load <sup>3)</sup>	$U_{ZK} \times 1.7 \times I_{Motor}$	
Power loss at $I_N$	Air-cooled: 110 W <sup>1)</sup>	Air-cooled: 140 W <sup>1)</sup>
	Liquid-cooled: Size 1 not available with liquid cooling	
<b>DC link</b>		
DC link capacity	60 $\mu$ F	

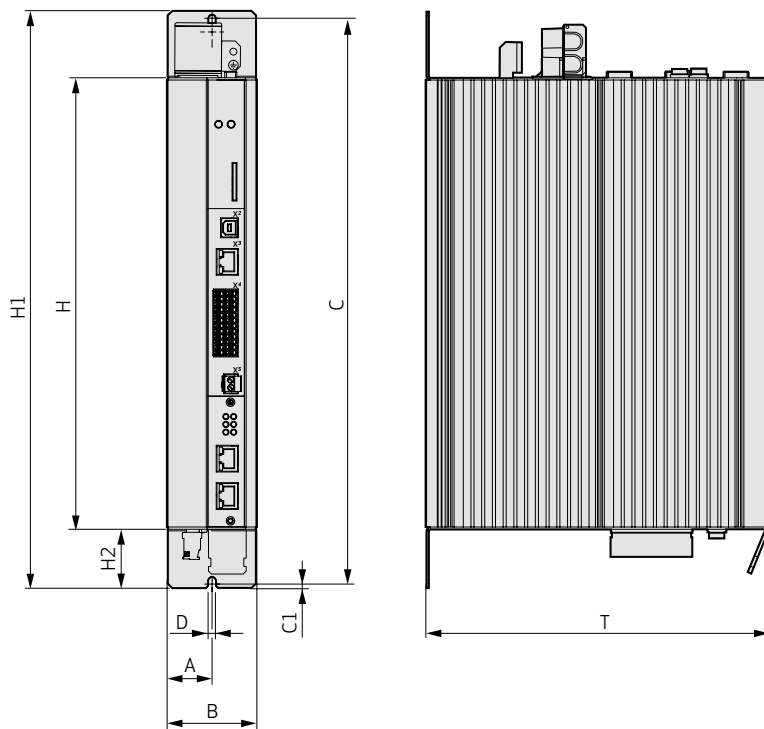
1) All data referred to output voltage 400 V<sub>eff</sub> and switching frequency 8 kHz  
 2) Generated from rectified TN system with grounded neutral point and external conductor voltages 3 x 400 V<sub>AC</sub>, 3 x 460 V<sub>AC</sub> or 3 x 480 V<sub>AC</sub> with the approved Moog Servo Drive devices (MSD Servo Drive or Power Supply Unit). Insulation voltage as per EN 61800-5-1, system voltage 277 V, overvoltage category III  
 3) Approximation value

Servo drive	G393-004	G394-006
Cooling method	Air-cooled	
Protection	IP20 except terminals (IP00)	
Cooled air temperature	+40 °C (+104 °F)	
Weight	3.4 kg (7.50 lb)	
Mounting type	Vertical mounting with unhindered air flow	
Mounting several servo drives	Direct side by side mounting, maximum 2 mm (0.08 in)	

# TECHNICAL DATA

## Size 1

### Dimensional drawings, Air-cooled



Dimensions	mm (in)
B (width)	58.5 (2.30)
H (height)	295 (11.61) (without mating connectors)
T (depth)	224 (8.82) (without mating connectors)
A	29.25 (1.15)
C/C1	382/5 (15.04/0.20)
D	ø 4.8 (0.19)
H1/H2	392/38.5 (15.43/1.52)

# TECHNICAL DATA

## Size 2



Type G393-008

Ordering number	G393-008	G393-012
<b>Output, motor side</b>		
Voltage	3-phase $U_{ZK}/\sqrt{2}$	
Rated current, effective ( $I_N$ )	Air-cooled: 8 A <sup>1)</sup>	Air-cooled: 12 A <sup>1)</sup>
	Liquid-cooled: Size 2 not available with liquid cooling	
Peak current	Air-cooled: <a href="#">Page 69 to 72</a>	
	Liquid-cooled: Size 2 not available with liquid cooling	
Rotating field frequency	0 to 400 Hz	
Switching frequency of power stage	4/8/12/16 kHz	
<b>DC input</b>		
DC voltage ( $U_{ZK}$ ) nominal <sup>2)</sup>	565 V <sub>DC</sub> /650 V <sub>DC</sub> /678 V <sub>DC</sub> /770 V <sub>DC</sub>	
Current (RMS-approximation value)	$1.7 \times I_{Motor}$	
Device connected load <sup>3)</sup>	$U_{ZK} \times 1.7 \times I_{Motor}$	
Power loss at $I_N$	Air-cooled: 185 W <sup>1)</sup>	Air-cooled: 255 W <sup>1)</sup>
	Liquid-cooled: Size 2 not available with liquid cooling	
<b>DC link</b>		
DC link capacity	105 µF	

1) All data referred to output voltage 400 V<sub>eff</sub> and switching frequency 8 kHz

2) Generated from rectified TN system with grounded neutral point and external conductor voltages 3 x 400 V<sub>AC</sub>, 3 x 460 V<sub>AC</sub> or 3 x 480 V<sub>AC</sub> with the approved Moog Servo Drive devices (MSD Servo Drive or Power Supply Unit). Insulation voltage as per EN 61800-5-1, system voltage 277 V, overvoltage category III

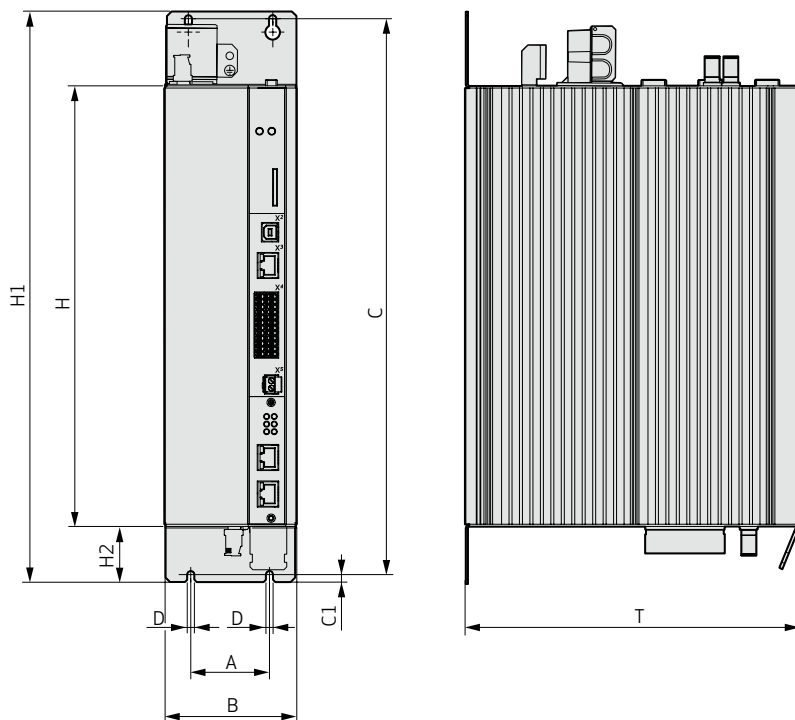
3) Approximation value

Servo drive	G393-008	G393-012
Cooling method	Air-cooled	
Protection	IP20 except terminals (IP00)	
Cooled air temperature	+45 °C (+113 °F) at 4 kHz power stage switching frequency)	
Weight	4.9 kg (10.80 lb)	
Mounting type	Vertical mounting with unhindered air flow	
Mounting several servo drives	Direct side by side mounting, maximum 2 mm (0.08 in)	

# TECHNICAL DATA

## Size 2

### Dimensional drawings, Air-cooled



Dimensions	mm (in)
B (width)	90 (3.54)
H (height)	295 (11.6) (without mating connectors)
T depth)	224 (8.82) (without mating connectors)
A	50 (1.97)
C/C1	382/5 (15.04/0.20)
D	ø 4.8 (0.19)
H1/H2	392/38.5 (15.43/1.52)

# TECHNICAL DATA

## Size 3



Type G397-020

Ordering number	Air-cooled G393-016	Liquid-cooled G397-020	Air-cooled G393-020	Liquid-cooled G397-025
<b>Output, motor side</b>				
Voltage	3-phase $U_{ZK}/\sqrt{2}$			
Rated current, effective ( $I_N$ )	16 A <sup>1)</sup>	20 A <sup>1)</sup>	20 A <sup>1)</sup>	25 A <sup>1)</sup>
Peak current	<a href="#">Page 67 to 72</a>	<a href="#">Page 74 and 75</a>	<a href="#">Page 67 to 72</a>	<a href="#">Page 74 and 75</a>
Rotating field frequency	0 to 400 Hz			
Switching frequency of power stage	4/8/12/16 kHz			
<b>DC input</b>				
DC voltage ( $U_{ZK}$ ) nominal <sup>2)</sup>	565 V <sub>DC</sub> /650 V <sub>DC</sub> /678 V <sub>DC</sub> /770 V <sub>DC</sub>			
Current (RMS-approximation value)	$1.7 \times I_{Motor}$			
Device connected load <sup>3)</sup>	$U_{ZK} \times 1.7 \times I_{Motor}$			
Power loss at $I_N$	320 W <sup>1)</sup>	390 W <sup>1)</sup>	390 W <sup>1)</sup>	480 W <sup>1)</sup>
<b>DC link</b>				
DC link capacity	288 $\mu$ F			

1) All data referred to output voltage 400 V<sub>eff</sub> and switching frequency 8 kHz

2) Generated from rectified TN system with grounded neutral point and external conductor voltages 3 x 400 V<sub>AC</sub>, 3 x 460 V<sub>AC</sub> or 3 x 480 V<sub>AC</sub> with the approved Moog Servo Drive devices (MSD Servo Drive or Power Supply Unit). Insulation voltage as per EN 61800-5-1, system voltage 277 V, overvoltage category III

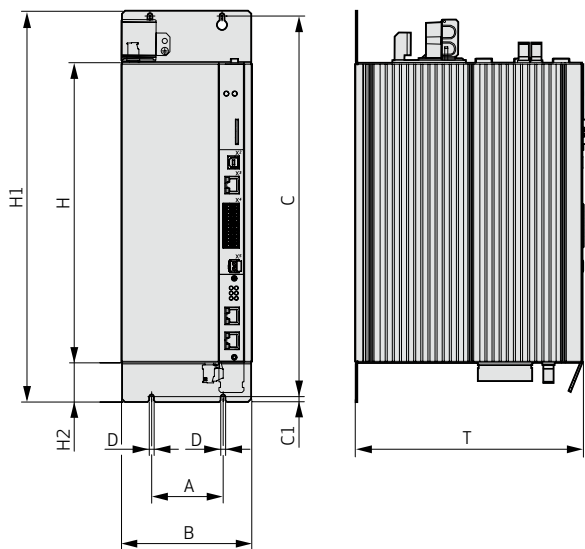
3) Approximation value

Servo drive	Air-cooled G393-016	Liquid-cooled G393-020	Air-cooled G397-020	Liquid-cooled G397-025
Cooling method	Air-cooled or liquid-cooled			
Protection	IP20 except terminals (IP00)			
Cooled air temperature	+45 °C (+113 °F) at 4 kHz power stage switching frequency			
Weight	6.5 kg (14.33 lb)			
Mounting type	Vertical mounting with unimpeded air flow			
Mounting several servo drives	Direct side by side mounting, maximum 2 mm (0.08 in)			

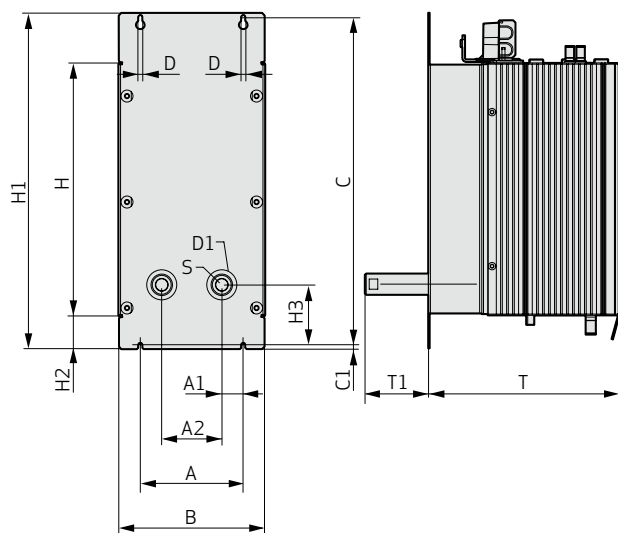
# TECHNICAL DATA

## Size 3

Dimensional drawings, Air-cooled



Dimensional drawings, Liquid-cooled



Dimensions	mm (in)
B (width)	130 (5.12)
H (height)	295 (11.61) (without mating connectors)
T (depth)	224 (8.82) (without mating connectors)
A/A1/A2	80/10/60 (3.15/0.39/2.36)
C/C1	382/5 (15.04/0.20)
D	∅ 4.8 (0.19)
D1 (hole for pipe socket)	∅ 48 (1.89)
H1/H2/H3	392/38.5/70 (15.43/1.52/2.76)
S	3/8 inch (inside thread)
T1	74 (2.91)

# TECHNICAL DATA

## Size 4



Type G397-026

Ordering number	Air-cooled G393-024	Liquid-cooled G397-026	Air-cooled G393-032	Liquid-cooled G397-035
<b>Output, motor side</b>				
Voltage	3-phase $U_{ZK}/\sqrt{2}$			
Rated current, effective ( $I_N$ )	24 A <sup>1)</sup>	26 A <sup>1)</sup>	32 A <sup>1)</sup>	35 A <sup>1)</sup>
Peak current	<a href="#">Page 67 to 72</a>	<a href="#">Page 74 and 75</a>	<a href="#">Page 67 to 72</a>	<a href="#">Page 74 and 75</a>
Rotating field frequency	0 to 400 Hz			
Switching frequency of power stage	4/8/12/16 kHz			
<b>DC input</b>				
DC voltage ( $U_{ZK}$ ) nominal <sup>2)</sup>	565 V <sub>DC</sub> /650 V <sub>DC</sub> /678 V <sub>DC</sub> /770 V <sub>DC</sub>			
Current (RMS-approximation value)	$1.7 \times I_{Motor}$			
Device connected load <sup>3)</sup>	$U_{ZK} \times 1.7 \times I_{Motor}$			
Power loss at $I_N$	420 W <sup>1)</sup>	455 W <sup>1)</sup>	545 W <sup>1)</sup>	595 W <sup>1)</sup>
<b>DC link</b>				
DC link capacity	504 $\mu$ F			

1) All data referred to output voltage 400 V<sub>eff</sub> and switching frequency 8 kHz

2) Generated from rectified TN system with grounded neutral point and external conductor voltages 3 x 400 V<sub>AC</sub>, 3 x 460 V<sub>AC</sub> or 3 x 480 V<sub>AC</sub> with the approved Moog Servo Drive devices (MSD Servo Drive or Power Supply Unit). Insulation voltage as per EN 61800-5-1, system voltage 277 V, overvoltage category III

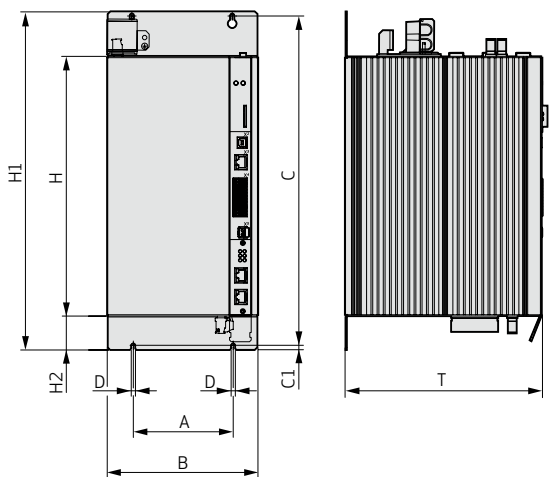
3) Approximation value

Servo drive	Air-cooled G393-024	Liquid-cooled G397-026	Air-cooled G393-032	Liquid-cooled G397-035
Cooling method	Air-cooled or liquid-cooled			
Protection	IP20 except terminals (IP00)			
Cooled air temperature	+45 °C (+113 °F) at 4 kHz power stage switching frequency			
Weight	7.5 kg (16.53 lb)			
Mounting type	Vertical mounting with unimpeded air flow			
Mounting several servo drives	Direct side by side mounting, maximum 2 mm (0.08 in)			

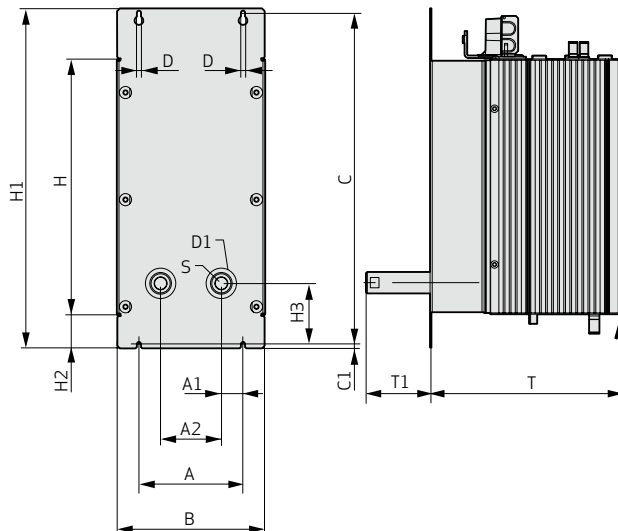
# TECHNICAL DATA

## Size 4

### Dimensional drawings, Air-cooled



### Dimensional drawings, Liquid-cooled



Dimensions	mm (in)
B (width)	171 (6.73)
H (height)	295 (11.61) (without mating connectors)
T (depth)	224 (8.82) (without mating connectors)
A/A1/A2	120/25/70 (4.72/0.98/2.76)
C/C1	382/5 (15.04/0.20)
D	ø 4.8 (0.19)
D1 (hole for pipe socket)	ø 48 (1.89)
H1/H2/H3	392/38.5/70 (15.43/1.52/2.76)
S	3/8 inch (inside thread)
T1	74 (2.91)



# TECHNICAL DATA

## Size 5



Type G393-045

Ordering number	Air-cooled G393-045	Liquid-cooled G397-053	Air-cooled G393-060	Liquid-cooled G397-070	Air-cooled G393-072	Liquid-cooled G397-084
<b>Output, motor side</b>						
Voltage	3-phase $U_{ZK}/\sqrt{2}$					
Rated current, effective ( $I_N$ )	45 A <sup>1)</sup>	53 A <sup>1)</sup>	60 A <sup>1)</sup>	70 A <sup>1)</sup>	72 A <sup>1)</sup>	84 A <sup>1)</sup>
Peak current	<a href="#">Page 73</a>	<a href="#">Page 74</a>	<a href="#">Page 73</a>	<a href="#">Page 74</a>	<a href="#">Page 73</a>	<a href="#">Page 74</a>
Rotating field frequency	0 to 400 Hz					
Switching frequency of power stage	4/8/12/16 kHz					
<b>DC input</b>						
DC voltage ( $U_{ZK}$ ) nominal <sup>2)</sup>	565 V <sub>DC</sub> /650 V <sub>DC</sub> /678 V <sub>DC</sub> /770 V <sub>DC</sub>					
Current (RMS-approximation value)	$1.7 \times I_{Motor}$					
Device connected load <sup>3)</sup>	$U_{ZK} \times 1.7 \times I_{Motor}$					
Power loss at $I_N$	610 W <sup>1)</sup>	690 W <sup>1)</sup>	830 W <sup>1)</sup>	930 W <sup>1)</sup>	1,010 W <sup>1)</sup>	1,130 W <sup>1)</sup>
<b>DC link</b>						
DC link capacity	430 µF	900 µF	900 µF	900 µF	900 µF	900 µF

1) All data referred to output voltage 400 V<sub>eff</sub> and switching frequency 8 kHz

2) Generated from rectified TN system with grounded neutral point and external conductor voltages 3 x 400 V<sub>AC</sub>, 3 x 460 V<sub>AC</sub> or 3 x 480 V<sub>AC</sub> with the approved Moog Servo Drive devices (MSD Servo Drive or Power Supply Unit). Insulation voltage as per EN 61800-5-1, system voltage 277 V, overvoltage category III

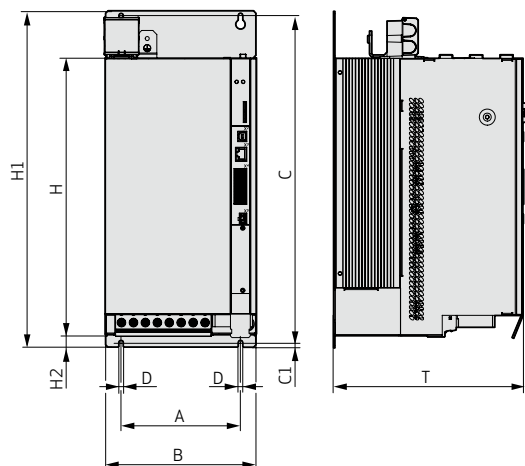
3) Approximation value

Servo drive	Air-cooled G393-045	Liquid-cooled G397-053	Air-cooled G393-060	Liquid-cooled G397-070	Air-cooled G393-072	Liquid-cooled G397-084
Cooling method	Air-cooled or liquid-cooled					
Protection	IP20 except terminals (IP00)					
Cooled air temperature	+40 °C (+104 °F) at 4 kHz power stage switching frequency					
Weight	13 kg (28.66 lb)					
Mounting type	Vertical mounting with unimpeded air flow					
Mounting several servo drives	Direct side by side mounting, maximum 2 mm (0.08 in)					

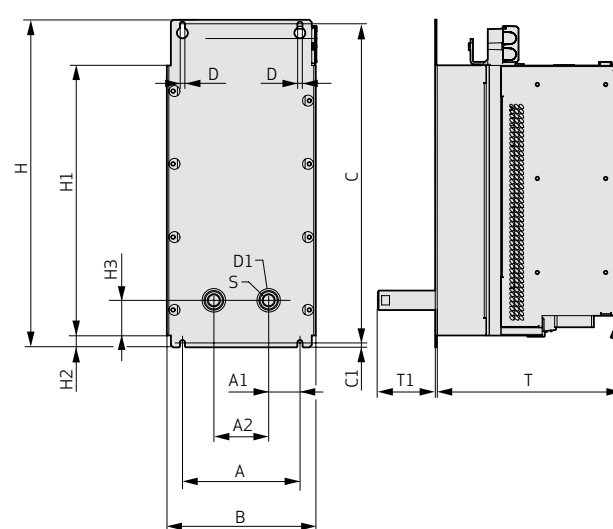
# TECHNICAL DATA

## Size 5

**Dimensional drawings, Air-cooled**



**Dimensional drawings, Liquid-cooled**



Dimensions	mm (in)
B (width)	190 (7.48)
H (height)	345/346.5 (13.58/13.64) (without mating connectors)
T (depth)	240/238.5 (9.45/9.39) (without mating connectors)
A/A1/A2	150/40/70 (5.91/1.57/2.76)
C/C1	406.5/6 (16.00/0.24)
D	ø 5.6/6.5 (0.22/0.26)
D1 (hole for pipe socket)	ø 4.8 (0.19)
H1/H2/H3	418.5/15/54 (16.48/0.59/2.13)
S	3/8 inch (inside thread)
T1	73.5 (2.89)

# TECHNICAL DATA

## Size 6A



Type G393-170

Ordering number	Air-cooled G393-090	Liquid-cooled G397-110	Air-cooled G393-110	Liquid-cooled G397-143	Air-cooled G393-143	Liquid-cooled G397-170	Air-cooled G393-170	Liquid-cooled G397-210
<b>Output, motor side</b>								
Voltage	3-phase $U_{ZK}/\sqrt{2}$							
Rated current, effective ( $I_N$ )	90 A <sup>1)</sup>	110 A <sup>1)</sup>	110 A <sup>1)</sup>	143 A <sup>1)</sup>	143 A <sup>1)</sup>	170 A <sup>1)</sup>	170 A <sup>1)</sup>	210 A <sup>1)</sup>
Peak current	<a href="#">Page 73</a>	<a href="#">Page 76 and 77</a>	<a href="#">Page 73</a>	<a href="#">Page 76 and 77</a>	<a href="#">Page 73</a>	<a href="#">Page 76 and 77</a>	<a href="#">Page 73</a>	<a href="#">Page 76 and 77</a>
Rotating field frequency	0 to 400 Hz							
Switching frequency of power stage	4/8/12/16 kHz							
<b>DC input</b>								
DC voltage ( $U_{ZK}$ ) nominal <sup>2)</sup>	565 V <sub>DC</sub> /650 V <sub>DC</sub> /678 V <sub>DC</sub> /770 V <sub>DC</sub>							
Current (RMS-approximation value)	$1.7 \times I_{Motor}$							
Device connected load <sup>3)</sup>	$U_{ZK} \times 1.7 \times I_{Motor}$							
Power loss at $I_N$ and 8 kHz/400 V	1,300 W <sup>1)</sup>	1,500 W <sup>1)</sup>	1,600 W <sup>1)</sup>	1,940 W <sup>1)</sup>	2,100 W <sup>1)</sup>	2,380 W <sup>1)</sup>	2,500 W <sup>1)</sup>	2,650 W <sup>1)</sup>
<b>DC link</b>								
DC link capacity	1,060 µF	2,120 µF	2,120 µF	2,120 µF	3,180 µF	4,240 µF	4,240 µF	4,240 µF

1) All data referred to output voltage 400 V<sub>eff</sub> and switching frequency 8 kHz

2) Generated from rectified TN system with grounded neutral point and external conductor voltages 3 x 400 V<sub>AC</sub>, 3 x 460 V<sub>AC</sub> or 3 x 480 V<sub>AC</sub> with the approved Moog Servo Drive devices (MSD Servo Drive or Power Supply Unit). Insulation voltage as per EN 61800-5-1, system voltage 277 V, overvoltage category III

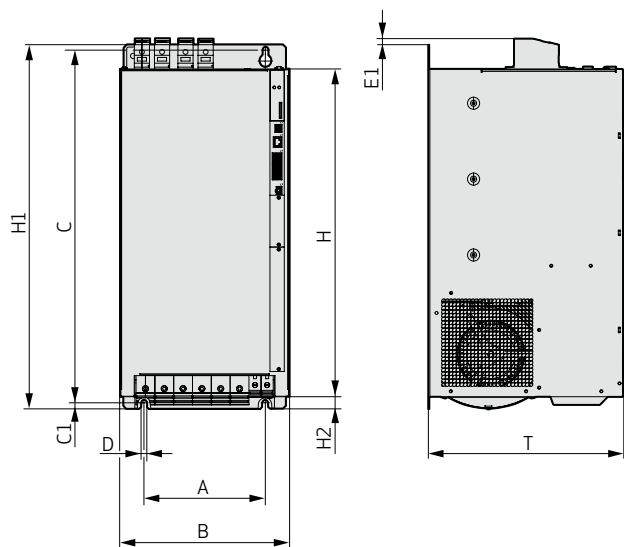
3) Approximation value

Servo drive	Air-cooled G393-090	Liquid-cooled G397-110	Air-cooled G393-110	Liquid-cooled G397-130	Air-cooled G393-143	Liquid-cooled G397-170	Air-cooled G393-170	Liquid-cooled G397-210
Cooling method	Air-cooled or liquid-cooled							
Protection	IP20 except terminals (IP00)							
Cooled air temperature	+40 °C (+104 °F) at 4 kHz power stage switching frequency							
Weight	32 kg (70.55 lb)							
Mounting type	Vertical mounting with unhindered air flow							
Mounting several servo drives	Direct side by side mounting, maximum 2 mm (0.08 in)							

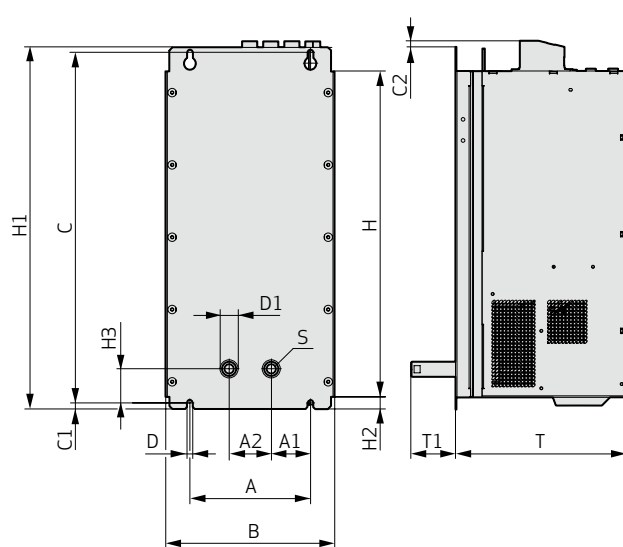
# TECHNICAL DATA

## Size 6A

**Dimensional drawings, Air-cooled**



**Dimensional drawings, Liquid-cooled**



Dimensions	mm (in)
B (width)	280 (11.02)
H (height)	540 (21.26) (without mating connectors)
T (depth) (air/liquid-cooled)	322/285 (12.68/11.22) (without mating connectors)
A/A1/A2	200/65/70 (7.87/2.56/2.76)
C/C1/C2	581/10/10 (22.87/0.39/0.39)
D	ø 9.5 (0.37)
D1 (hole for pipe socket)	ø 48 (1.89)
E1	10 (0.39)
H1 (air/liquid-cooled)	600/540 (23.62/21.26)
H2/H3	20/56.5 (0.79/2.22)
S	3/8 inch (inside thread)
T1	73.5 (2.89)

# TECHNICAL DATA

## Size 5 – Power Supply Unit (PSU)



Type G396-026

Ordering number	G396-026				G396-050			
	At 650 V <sub>DC</sub>	At 770 V <sub>DC</sub>	At 400 V <sub>AC</sub>	At 460/480 V <sub>AC</sub>	At 650 V <sub>DC</sub>	At 770 V <sub>DC</sub>	At 400 V <sub>AC</sub>	At 460/480 V <sub>AC</sub>
<b>DC link output</b>								
Voltage	650 V <sub>DC</sub> /770 V <sub>DC</sub>							
Rated current, effective (I <sub>N</sub> )	40 A	34 A	-	-	76 A	64 A	-	-
Peak current (for 10 s)	80 A	68 A	-	-	144 A	122 A	-	-
Continuous power	26 kW	26 kW	-	-	50 kW	50 kW	-	-
Peak current (for 10 s)	52 kW	52 kW	-	-	94 kW	94 kW	-	-
DC link capacity <sup>1)</sup>	900 µF	900 µF	-	-	900 µF	900 µF	-	-
<b>Input mains</b>								
Voltage	400 V <sub>AC</sub> /460 V <sub>AC</sub> /480 V <sub>AC</sub> ±10 %							
Continuous current, effective	-	-	40 A	33 A	-	-	76 A	63 A
Peak current (for 10 s)	-	-	80 A	67 A	-	-	144 A	120 A
Clock frequency	-	-	12 kHz	12 kHz	-	-	4 kHz	4 kHz
Continuous power	-	-	27.5 kW	27.5 kW	-	-	52.5 kW	52.5 kW
Power loss	1,010 W							
Asymetry of mains voltage	±3 % maximum							
Frequeny	50/60 Hz							

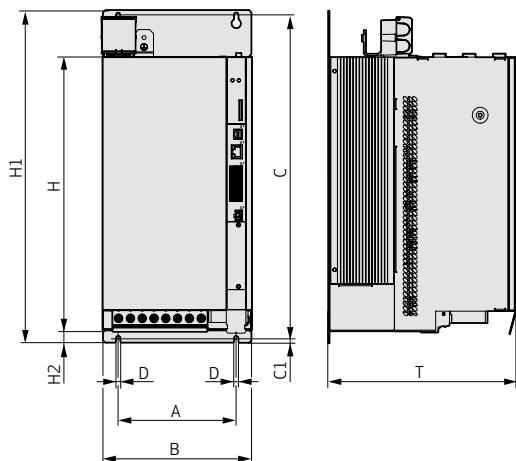
1) The maximum overall capacity of the multi-axis system DC link for a MSD Power Supply Unit Size 5 (inclusive) must not exceed 20,000 µF

Servo drive	G396-026	G396-050
Cooling method	Air-cooled or liquid-cooled	
Protection	IP20 except terminals (IP00)	
Cooled air temperature	+40 °C (+104 °F)	
Weight	13 kg (28.66 lb)	
Mounting type	Vertical mounting with unhindered air flow	
Mounting several servo drives	Direct side by side mounting, maximum 2 mm (0.08 in)	

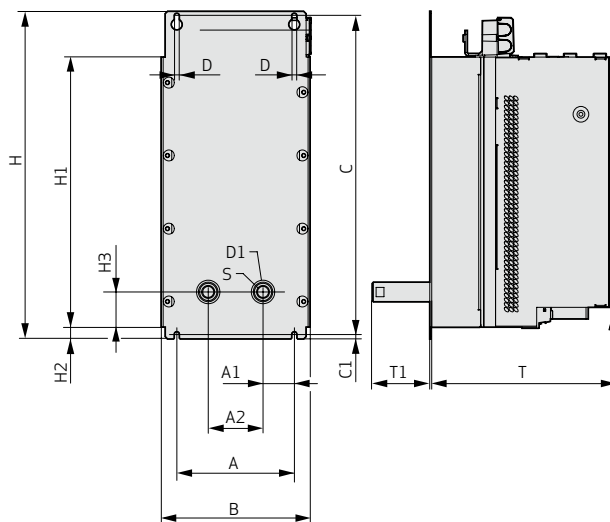
# TECHNICAL DATA

## Size 5 – Power Supply Unit (PSU)

### Dimensional drawings, Air-cooled



### Dimensional drawings, Liquid-cooled



Dimensions	mm (in)
B (width)	190 (7.48)
H (height) (air/liquid-cooled)	345/346.5 (13.58/13.64) (without mating connectors)
T (depth) (air/liquid-cooled)	240/238.5 (9.45/9.39) (without mating connectors)
A/A1/A2	150/40/70 (5.91/1.57/2.76)
C/C1	406.5/6 (16.00/0.24)
D (air/liquid-cooled)	ø 5.6/6.5 (0.22/0.26)
D1 (hole for pipe socket)	ø 48 (1.89)
H1/H2/H3	418.5/15/54 (16.48/0.59/2.13)
S	3/8 inch (inside thread)
T1	73.5 (2.89)

### Matching accessories

Power Supply Unit	G396-026	G396-050
Line reactor	<b>CB10356-001</b> included components in the line reactor: Mains filter FFU 3x56K, input reactor 40 A including capacitor, step-up reactor 40 A, EMC mounting set	<b>CA99591-001</b> included components in the line reactor: Mains filter FFU 3x80K, input reactor 76 A including capacitor, step-up reactor 76 A, EMC mounting set

# TECHNICAL DATA

## Size 6A – Power Supply Unit (PSU)



Type G396-075

Ordering number	G396-075				G396-110			
	At 650 V <sub>DC</sub>	At 770 V <sub>DC</sub>	At 400 V <sub>AC</sub>	At 460/480 V <sub>AC</sub>	At 650 V <sub>DC</sub>	At 770 V <sub>DC</sub>	At 400 V <sub>AC</sub>	At 460/480 V <sub>AC</sub>
<b>DC link output</b>								
Voltage	650 V <sub>DC</sub> /770 V <sub>DC</sub>							
Rated current, effective (I <sub>N</sub> )	115 A	97 A	-	-	170 A	144 A	-	-
Peak current (for 10 s)	195 A	165 A	-	-	246 A	207 A	-	-
Continuous power	75 kW	75 kW	-	-	110 kW	110 kW	-	-
Peak current (for 10 s)	127 kW	127 kW	-	-	160 kW	160 kW	-	-
DC link capacity <sup>1)</sup>	4,240 µF	4,240 µF	-	-	4,240 µF	4,240 µF	-	-
<b>Input mains</b>								
Voltage	400 V <sub>AC</sub> /460 V <sub>AC</sub> /480 V <sub>AC</sub> ±10 %							
Continuous current, effective	-	-	115 A	96 A	-	-	170 A	142 A
Peak current (for 10 s)	-	-	195 A	163 A	-	-	245 A	204 A
Clock frequency	-	-	8 kHz	8 kHz	-	-	4 kHz	4 kHz
Continuous power	-	-	80 kW	80 kW	-	-	118 kW	118 kW
Power loss	2,500 W							
Asymetry of mains voltage	±3 % maximum							
Frequency	50/60 Hz							

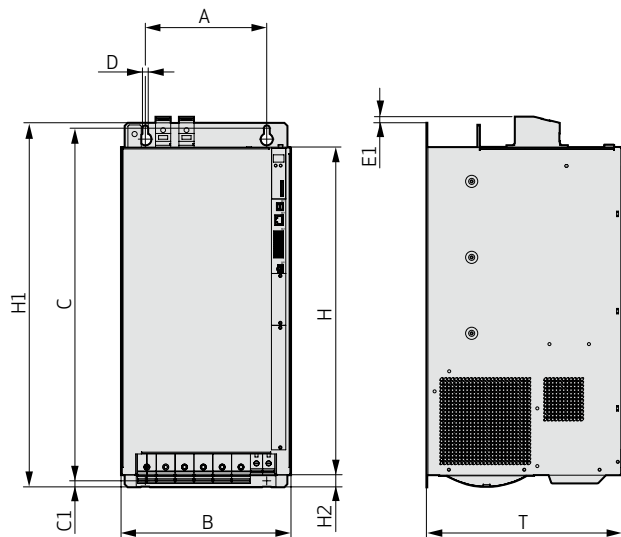
1) The maximum overall capacity of the multi-axis system DC link for a MSD Power Supply Unit Size 6A (inclusive) must not exceed 20,000 µF

Mechanism Size 6A	G396-075	G396-110
Cooling method	Air-cooled or liquid-cooled	
Protection	IP20 except terminals (IP00)	
Cooled air temperature	+40 °C (+104 °F)	
Weight	32 kg (70.55 lb)	
Mounting type	Vertical mounting with unhindered air flow	
Mounting several servo drives	Direct side by side mounting, 40 mm (1.57 in) between two Size 6A devices with air cooling	

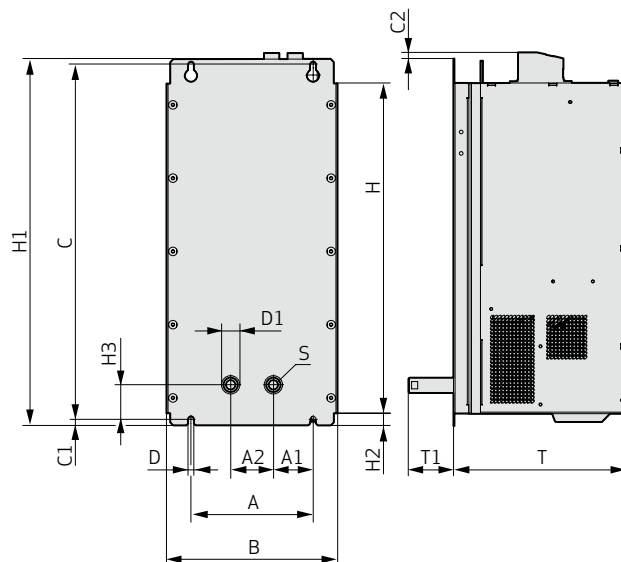
# TECHNICAL DATA

## Size 6A – Power Supply Unit (PSU)

### Dimensional drawings, Air-cooled



### Dimensional drawings, Liquid-cooled



Dimensions	mm (in)
B (width)	280 (11.02)
H (height) (air/liquid-cooled)	540 (21.26) (without mating connectors)
T (depth) (air/liquid-cooled)	321/281 (12.64/11.06) (without mating connectors)
A/A1/A2	200/65/70 (7.87/2.56/2.76)
C/C1/C2	581/10/10 (22.87/0.39/0.39)
D (air/liquid-cooled)	ø 9.5 (0.37)
D1 (hole for pipe socket)	ø 48 (1.89)
E1	10 (0.39)
H1/H2/H3	600/20/56.5 (23.62/0.79/2.22)
S	3/8 inch (inside thread)
T1	73.5 (2.89)

### Matching accessories

Power Supply Unit	G396-075	G396-110
Line reactor	<p><b>CB10356-001</b>                      included components in the line reactor:                      Mains filter FFU 3x56K, input reactor 40 A including capacitor, step-up reactor 40 A, EMC mounting set</p>	<p><b>CA99591-001</b>                      included components in the line reactor:                      Mains filter FFU 3x80K, input reactor 76 A including capacitor, step-up reactor 76 A, EMC mounting set</p>



# OVERVIEW



Communication module

Type	Page	Motion Controller	Single-Axis-System Sizes C2 to C4	Single-Axis-System Sizes 1 to 7	Multi-Axis-System Sizes 1 to 6A	PSU
Fieldbus module for EtherCAT	<a href="#">98</a>	-	•	•	•	•
Fieldbus module for CANopen	<a href="#">99</a>	-	•	•	•	•
Fieldbus module for PROFIBUS-DP	<a href="#">100</a>	-	•	•	•	•
Fieldbus module for SERCOS II	<a href="#">101</a>	-	•	•	•	•
Fieldbus module for CANopen plus 2 analog outputs	<a href="#">102</a>	-	-	•	•	-
Fieldbus module for SERCOS III	<a href="#">103</a>	-	•	•	•	-
Fieldbus module for VARAN	<a href="#">104</a>	-	-	•	•	-
Fieldbus module for PROFINET IRT	<a href="#">105</a>	-	-	•	•	-



**Note:** The communication module can only be ordered together with the servo drive. It is always shipped ready-installed from the factory.

## ETHERCAT

### Short description

EtherCAT is an Ethernet-based, real-time capable, synchronous fieldbus system. It is classed as one of the fastest real-time Ethernet solutions for automation.

Technical data	EtherCAT
Standardization	IEC 61158 / IEC 61784-2 / IEC 61800-7
Transfer rate	Up to 100 Mbit/s
Transfer medium	Standardized Ethernet to IEEE 802.3
Sampling time	$\geq 125 \mu\text{s}$
Synchronization jitter	$\leq 1 \mu\text{s}$ (distributed clocks)
Communication profile	CoE (CiA 301) (V1.0.2)
Device profile	CiA 402 (Rev. 2.0)
Network topology	Line, tree or star possible
Connection	RJ45 (shielded)
Cable type	CAT5

Order code	G39x	-	xxx	-	1xx	-	xxx
------------	------	---	-----	---	-----	---	-----



**Note:** Only available built-in ex factory

## CANOPEN

### Short description

Communication interface for CANopen, isolated from device electronics.

Type	CANopen
Standardization	ISO 11898 / IEC 61800-7
Communication	CiA 301 (Rev. 4.01)
Device profile	CiA 402 (Rev. 2.0)
Transfer rate/cable length	20 kbit/s up to 1,000 m (3,280 ft) 1 Mbit/s up to 40 m (131 ft)
Connections	2 x Phoenix contact connectors (Type FMC 1,5/5-ST-3,5 GY RAL7042) 5-pin (as per CiA 303)
Supply voltage ext.	24 V $\pm$ 20 % (as per IEC 61131-2)

Order code	G39x	-	xxx	-	2xx	-	xxx
------------	------	---	-----	---	-----	---	-----



**Note:** Only available built-in ex factory

# PROFIBUS

## Short description

Communications interface for PROFIBUS-DP.

<b>Type</b>	<b>PROFIBUS</b>
Standardization	EN 50170
Communication	Directive 2.082
Device profile	PROFIdrive V3.1
Transfer rate/cable length	9.6 kbit/s up to 1,200 m (3,937ft) 12 Mbit/s up to 100 m (328 ft)
Connection	PROFIBUS D-SUB connector 9-pin

Order code	G39x	-	xxx	-	3xx	-	xxx
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**Note:** Only available built-in ex factory

## SERCOS II

### Short description

Communications interface for SERCOS II.

<b>Type</b>	<b>SERCOS II</b>
Application note	AN17.2 (dated 2003-02-11)
Transfer rate	2/4/8 and 16 Mbit/s
Connections	1 transmitter, 1 receiver, optical waveguides conform to SERCOS Interface Specification (version 2.4)

Order code	G39x	-	xxx	-	4xx	-	xxx
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**Note:** Only available built-in ex factory  
SERCOS III is also available as Option 1. For details see [page 103](#).

## CANOPEN + 2AO

### Short description

Communication interface for CANopen (isolated from device electronics) and two analog outputs (2AO).

Type	CANopen + 2AO
Standardization	ISO 11898
Communication	CiA 301 (Rev. 4.01)
Device profile	CiA 402 (Rev. 2.0)
Transfer rate/cable length	20 kbit/s up to 1,000 m (3,280 ft) 1 Mbit/s up to 40 m (131 ft)
Connections	2 x Phoenix contact connectors (Type FMC 1.5/ 5-ST-3,5 GY RAL7042) 5-pin (as per CiA303)
Supply voltage ext.	24 V $\pm$ 20 % (as per. IEC 61131-2)

Technical data	2AO
Number of channels	2
Voltage range	$\pm$ 10 V differential
Current capacity	Maximum 3 mA, short-circuit-proof
Resolution	12 Bit
Accuracy	Maximum $\pm$ 2 % referred to 10 V, offset error $<$ $\pm$ 0.1 V
Sampling time	125 $\mu$ s
Connections	2 x Phoenix contact connectors (Type FMC 1.5/ 2-ST- 3,5 GY RAL7042)

Order code	G39x	-	xxx	-	5xx	-	xxx
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**Note:** Only available built-in ex factory

## SERCOS III

### Short description

The interface conforms to IEC 61491/EN 61491 for SERCOS interfaces and ensures optimum interworking of digital drives and controllers from different manufacturers. The basis for SERCOS III implementation in the servo drive is the specification V1.1.2 from SERCOS International.

Technical data	SERCOS III
Application note	AN17.2 (dated 2003-02-11)
Communication profile	SERCOS Communication (V1.1.2.1.7) (SERCOS International)
Device profile	Generic Device profile (V1.1.2.1.1) (SERCOS International)
Sampling time	125 µs to 65 ms (multiples of 125 µs programmable)
Network topology	Line or ring possible
Connection	RJ45 shielded
Cable type	CAT5e

Order code	G39x	-	xxx	-	6xx	-	xxx
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**Note:** Only available built-in ex factory  
SERCOS II is also available as Option 1. For details see [page 101](#).

## VARAN

### Short description

The interface conforms to the international standards IEC 61158-2-11 and IEC 61158-6-12.

Technical data	VARAN
Sampling time	125 $\mu$ s to 65 ms (multiples of 125 $\mu$ s programmable)
Network topology	Line
Connection	RJ45 shielded
Cable type	CAT5

Order code	G39x	-	xxx	-	7xx	-	xxx
------------	------	---	-----	---	-----	---	-----



**Note:** Only available built-in ex factory



## PROFINET IRT

### Short description

The interface conforms to the international standards IEC 61158-5-10 and IEC 61158-6-10.

Technical data	PROFINET IRT
Sampling time	500 $\mu$ s to 65 ms (multiples of 500 $\mu$ s programmable)
Network topology	Line
Connection	RJ45 shielded
Cable type	CAT5

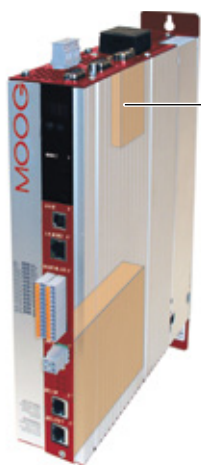
Order code	G39x	-	xxx	-	8xx	-	xxx
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**Note:** Only available built-in ex factory

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# OVERVIEW



Technology module

Type	Page	Motion Controller	Single-Axis-System Sizes C2 to C4	Single-Axis-System Sizes 1 to 7	Multi-Axis-System Sizes 1 to 6A	PSU
Interface for Second Sin/Cos encoder	<a href="#">107</a>	-	•	•	•	-
Interface for TTL encoder simulation/TTL master encoder	<a href="#">108</a>	-	•	•	•	-
Interface for TwinSync communication	<a href="#">109</a>	-	-	•	•	-
Interface for TTL encoder with commutation signals	<a href="#">110</a>	-	•	-	-	-
Interface for SSI encoder simulation	<a href="#">111</a>	-	-	•	•	-



**Note:** The technology module can only be ordered together with the servo drive. It is always shipped ready-installed from the factory.

## SECOND SIN/COS ENCODER

### Short description

This option enables parallel evaluation of two Sin/Cos encoders. Evaluation of only one Sin/Cos encoder is included in the device standard (connection via X7). With this encoder interface option it is possible to support the following encoder interfaces: SSI encoder, EnDat 2.1 and 2.2 encoder, TTL encoder and Sin/Cos encoder with and without zero pulse.

Technical data	Sin/Cos encoders
Signals	A/B, zero pulse
Signals level	Sin/Cos, 1 V <sub>ss</sub> + analog zero pulse
Signal frequency	500 kHz maximum

Technical data	Absolute value sender
Interface	SSI, EnDat 2.1, EnDat 2.2, TTL, Sin/Cos
Signals	DATA, CLK
Signal level	EIA485-conforming
Switching frequency EnDat	2 MHz maximum
Switching frequency SSI	1 MHz maximum

Technical data	General
Supply voltage ext. encoder	5 V ±5 %/250 mA
Cable length	50 m (164 ft) maximum (MSD Compact 30 m (98 ft) maximum)
Wave terminating resistance	120 Ω (integrated)

Order code	G39x	-	xxx	-	x1x	-	xxx
------------	------	---	-----	---	-----	---	-----



**Note:** Only available built-in ex factory

# TTL ENCODER SIMULATION/TTL MASTER ENCODER

## Short description

This option permits TTL encoder simulation of a connected encoder and/or connection of a TTL master encoder. The following operation modes are possible:

- Evaluation of a TTL encoder
- Simulation of a TTL encoder (signals from other encoders are converted into TTL signals and made available as output signals)
- TTL-Repeater  
Evaluation of encoder connected to X7 or X8 and direct floating transmission via encoder simulation

Technical data	TTL encoder simulation
Signals	A/B, zero pulse
Signal level	TTL differential (EIA422), electrically isolated from the servo drive
Signal frequency	1 MHz maximum

Technical data	TTL master encoder
Signals	A/B, zero pulse or pulse/direction
Signal level	TTL-differential (EIA422)
Signal frequency	500 kHz maximum

Technical data	General
Supply voltage ext. encoder	5 V ±5 %/250 mA
Cable length	Maximum 10 m (32.80 ft)
Wave terminating resistance	120 Ω (integrated)

Order code	G39x	-	xxx	-	x2x	-	xxx
------------	------	---	-----	---	-----	---	-----



**Note:** Only available built-in ex factory

# TWINSYNC COMMUNICATION

## Short description

By way of the TwinSync option, two drives can be synchronized in master/slave mode. The data mapping for bidirectional cyclic communication between the drives can be flexibly parameterized. The master drive can transmit setpoint (reference) values and control information for the slave drive via TwinSync.

Technical data	TwinSync communication
Signal level	TTL differential (EIA422), electrically isolated from the servo drive
User data	8 bytes bidirectional, spread across maximum three objects
Transfer mode	Asynchronous, synchronized via Sync pulse
Transfer rate	Maximum 8 kHz
Cable length	Maximum 10 m (32.80 ft)
Wave terminating resistance	120 Ω (integrated)

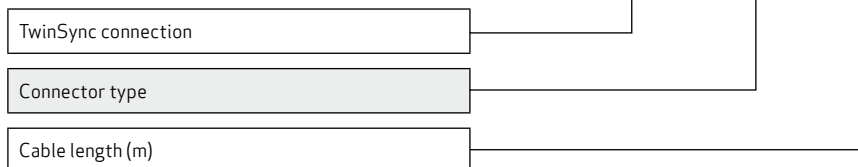
Order code	G39x	-	xxx	-	x4x	-	xxx
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**Note:** Only available built-in ex factory

## TwinSync connecting

CB36987 - xxx - yyy<sup>1)</sup>



Technical data	CB36987-xxx-yyy <sup>1)</sup>
Connections	2 x SUB-D 9-pin mole
Cross-section	4 x 2 x 0.25 mm <sup>2</sup> + 2 x 0.50 mm <sup>2</sup> (4 x 2 x 0.0004 in <sup>2</sup> + 2 x 0.0008 in <sup>2</sup> )

1) yyy stands for length in meters. Standard length: 1 m (3.28 ft)  
Further length on request

## TTL ENCODER WITH COMMUTATION SIGNALS

### Short description

This option permits evaluation of a TTL encoder with additional 120° phase-shifted differential commutation signals.

Technical data	TTL encoder with commutation signals
Signals	A/B tracks, zero pulse, U, V, W commutation signals
Signal level	TTL-differential (EIA422)
Signal frequency	500 kHz maximum
Supply voltage external encoder	5 V ±5 %/250 mA
Cable length	Maximum 10 m (32.80 ft)
Wave terminating resistance	120 Ω (integrated)

Order code	G39x	-	xxx	-	x5x	-	xxx
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**Note:** Only available built-in ex factory

## SSI ENCODER SIMULATION

### Short description

This option permits SSI encoder simulation for output of position information. The length and the protocol for SSI data transfer can be flexibly parameterized. Synchronization of the control cycle to the external SSI clock signal is possible as an option.

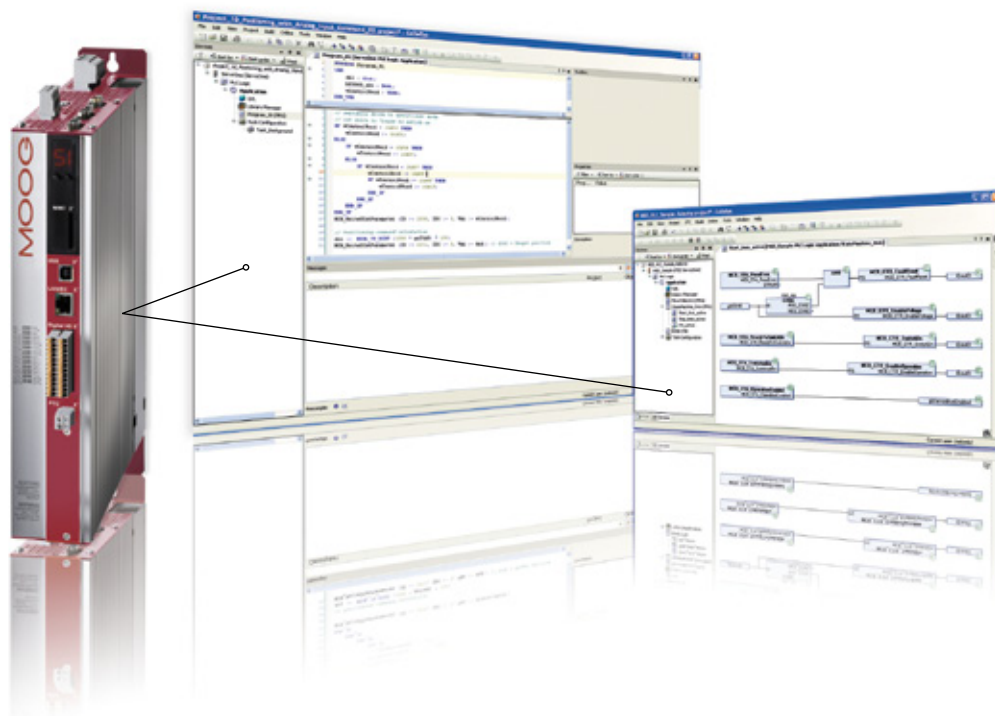
Technical data	TTL encoder with commutation signals
Signal level	TTL differential (EIA422), electrically isolated from the servo drive
Baud rate	250, 500, 750, 1000 kBaud
Coding	Gray, binary
Cable length	Maximum 10 m (32.80 ft)
Wave terminating resistance	120 Ω (integrated)

Order code	G39x	-	xxx	-	x6x	-	xxx
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**Note:** Only available built-in ex factory

# OVERVIEW



Type	Page	Motion Controller	Single-Axis-System Sizes C2 to C4	Single-Axis-System Sizes 1 to 7	Multi-Axis-System Sizes 1 to 6A	PSU
MSD PLC function package for programming in IEC 61131	<a href="#">113</a>	-	•	•	•	•



# MSD PLC FUNCTION PACKAGE FOR PROGRAMMING IN IEC 61131

## Short description

The MSD PLC, programmable in IEC 61131, shares the microcontroller platform of the MSD with the drive control, so permitting optimized, fast access to all system and control parameters and interfaces. Extensive motion and interface libraries permit easy, flexible creation of applications and provide a wide range of solution options.

Technical data	General
Platform	Microcontroller 32 Bit FPU (integrated in standard drive µC)
Flash program memory	512 kB
Data memory SDRAM	512 kB
Data memory remanent NVRAM	512 Byte (retain), 512 Byte (persistant)
Real-time clock	No

Technical data	Open-loop control
Processing time	Depends on CPU workload
Real-time tasks	Cyclic (maximum 3 tasks), free-running (maximum 3 tasks)
Minimum cycle time	2 ms (5 ms recommended)
Online programm change	Yes
Watchdog timer	Yes
Fieldbus access to variables	20 x Integer 32-bit, 20 x Integer 16-bit, 10 x floating point variables

Technical data	Programming and debugging
Programming environment	CODESYS V3
Programming languages	<ul style="list-style-type: none"> <li>• Continuous Function Chart</li> <li>• Ladder Diagram</li> <li>• Function Block Diagram</li> <li>• Structured Text</li> <li>• Instruction List</li> <li>• Sequential Function Chart</li> </ul>
Command set	IEC 61131-3
Debug, Single Step, Watch function	Yes
Simulation, Online Trace	Yes
Breakpoints	Yes
Source Code Download	No
Program management	No
Connection between PC and servo drive	Ethernet TCP/IP

Order code	
MSD PLC function package	G39x - xxx - xxx P xxx



**Note:** Available built-in ex factory and seperatly for existing devices

## OVERVIEW



Content	Ordering number	Page
<b>PC User Software Moog DriveAdministrator</b>	Full version	<a href="#">115</a>
Selection of motor cables	C08336-xxx-yyy CB05708-xxx-yyy C08733-xxx-yyy B47916-xxx-yyy CA98676-xxx-yyy	<a href="#">116</a>
Selection of encoder cables	C08335-011-yyy CA58876-002-yyy CA58877-002-yyy	<a href="#">117</a>
Mains chokes	CA68926-001 CA55830-001 to CA55843-001 CA96898-001 to CA96900-001 CB09045-001	<a href="#">119</a>
Braking resistors	CB09047-001 to CB09049-001 CA59737-001 to CA59744-001 CB36901-001 to CB36904-001 CB09050-001 CB53860-001	<a href="#">123</a>
Mains filters - Sizes C2 to C4	CB09937-001 to CB09940-001 CB09942-001	<a href="#">127</a>
Mains filters - Sizes 1 to 7	CA71184-001 to CA71190-001 CB09932-001 to CB09936-001	<a href="#">130</a>
NTC Adapter - MSD	CA72290-001	<a href="#">134</a>
Liquid cooling connection set	CB37132-001	<a href="#">135</a>
Spare connector kits	CA65115-001 CA70545-001 to CA70548-001 CB40512-001 to CB40515-001 CB59705-001 to CB59722-001	<a href="#">136</a>

# PC USER SOFTWARE Moog DriveAdministrator

## Short description

The Moog DriveAdministrator parameterization software, featuring extensive integrated online help and autotuning, cuts commissioning times substantially. The Moog DriveAdministrator of course offers full network capability. This means multiple axis modules can be managed simultaneously in a project.

Technical data	Moog DriveAdministrator
Support for the following functions	Initial commissioning of one or more servo drives
	Operator control and diagnosis with cockpit, 6-channel oscilloscope, and others
	Fast serial commissioning with a configurable commissioning file (containing firmware, parameters, PLC program)
	Project management

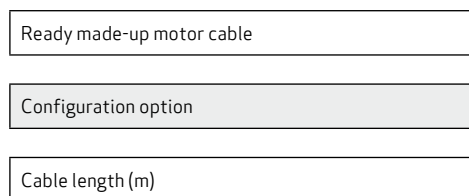
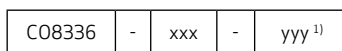
## Parameterization Software



# SELECTION OF MOTOR CABLES



## Ordering code



Technical data	C08336-xxx-yyy <sup>1)2)</sup>	CB05708-xxx-yyy <sup>1)2)</sup>	C08733-xxx-yyy <sup>1)2)</sup>	B47916-xxx-yyy <sup>1)2)</sup>	CA98676-xxx-yyy <sup>1)2)</sup>					
Continuous rated current	10 A	TBD	44 A	61 A	82 A					
Surge current	30 A (90 s at +55 °C) (+131 °F)	TBD	TBD	TBD	TBD					
Minimum bend radius	In fixed installation: 60 mm (2.36 in) In flexible use: 120 mm (4.72 in)	TBD	In fixed installation: 60 mm (2.36 in) In flexible use: 120 mm (4.72 in)	TBD	TBD					
Cable diameter range	9 to 14.5 mm (0.35 to 0.57 in)	TBD	16.2 ±3 mm (0.63 ±0.11 in)	TBD	TBD					
Cable cross-section	4 x 1.5 mm <sup>2</sup> + 2 x 1 mm <sup>2</sup> (4 x 0.0024 in <sup>2</sup> + 2 x 0.0016 in <sup>2</sup> )	4 x 4 mm <sup>2</sup> + 2 x 1,5 mm <sup>2</sup> (4 x 0.0062 in <sup>2</sup> + 2 x 0.0023 in <sup>2</sup> )	4 x 6 mm <sup>2</sup> + 2 x 1 mm <sup>2</sup> (4 x 0.0093 in <sup>2</sup> + 2 x 0.0015 in <sup>2</sup> )	4 x 10 mm <sup>2</sup> + 2 x 1.5 mm <sup>2</sup> (4 x 0.0155 in <sup>2</sup> + 2 x 0.0023 in <sup>2</sup> )	4 x 16 mm <sup>2</sup> + 2 x 1.5 mm <sup>2</sup> (4 x 0.0248 in <sup>2</sup> + 2 x 0.0023 in <sup>2</sup> )					
Temperature range	-40 to +125 °C (-40 to +257 °F)	TBD	-50 to +90 °C (-58 to +194 °F)	TBD	TBD					
Wiring	Connector pin	Wiring	Connector pin	Wiring	Connector pin	Wiring	Connector pin	Wiring	Connector pin	Wiring
	2	U	2	U	U	U	U	U	U	U
	4	VV	4	VV	V	VV	V	VV	V	VV
	1	WWW	1	WWW	W	WWW	W	WWW	W	WWW
	PE	yellow / green	PE	yellow / green	PE	yellow / green	PE	yellow / green	PE	yellow / green
	5	Brake + / white	5	Brake + / white	+	Brake + / white	+	Brake + / white	+	Brake + / white
	6	Brake - / black	6	Brake - / black	-	Brake - / black	-	Brake - / black	-	Brake - / black
Connector housing	Screen	Connector housing	Screen	Connector housing	Screen	Connector housing	Screen	Connector housing	Screen	
Connector type	Size 1	Size 1	Size 1.5	Size 1.5	Size 1.5					

1) yyy stands for length in meters  
Standard length: 1 m (3.28 ft), 5 m (16.40 ft), 10 m (32.80 ft), 15 m (49 ft),  
20 m (65 ft), 50 m (164 ft)  
Further lengths on request

2) xxx = 001 for standard configuration option, others on request

## SELECTION OF ENCODER CABLES



### Ordering code

C08335 - 011 - yyy<sup>1)</sup>

Ready made-up encoder cable  
 Resolver cable  
 Encoder cable SSI, EnDat  
 Encoder cable Hiperface®

Version

Cable length (m)

Technical data	C08335-011-yyy <sup>1)</sup>	CA58876-002-yyy <sup>1)</sup>	CA58877-002-yyy <sup>1)</sup>
Motor with encoder system	Resolver	(single-/multi-turn encoder with SSI/EnDat interface)	(single-/multi-turn encoder with Hiperface® interface)
Controller-end assignment (sub-D connector)	1 = S2 2 = S4 3 = S1 4 = n.c. 5 = PTC+ 6 = R1 7 = R2 8 = S3 9 = PTC-	1 = A- 2 = A+ 3 = VCC (+5 V) 4 = Data+ 5 = Data- 6 = B- 8 = GND 11 = B+ 12 = VCC (Sense) 13 = GND (Sense) 14 = CLK+ 15 = CLK- 7, 9, 10 = n.c.	1 = REFCOS 2 = +COS 3 = Us 7 - 12 V 4 = Data+ EIA485 5 = Data- EIA485 6 = REFSIN 7 = Jumper to pin 12 8 = GND 11 = +SIN 12 = Jumper to pin 7 9, 10, 13, 14, 15 = n.c.
Capable for energy chains	Yes		
Minimum bend radius	90 mm (3.54 in)	100 mm (3.93 in)	90 mm (3.54 in)

1) yyy stands for length in meters  
 Standard length: 1 m (3.28 ft), 5 m (16.40 ft), 10 m (32.80 ft), 15 m (49 ft),  
 20 m (65 ft), 50 m (164 ft)  
 Further lengths on request

## SELECTION OF ENCODER CABLES

	<b>C08335-011-yyy<sup>1)</sup></b>	<b>CA58876-002-yyy<sup>1)</sup></b>	<b>CA58877-002-yyy<sup>1)</sup></b>
Temperature range	-40 to +85 °C (-40 to +185 °F)	-35 to +80 °C (-31 to +176 °F)	-40 to +85 °C (-40 to +185 °F)
Cable diameter approx.	8.8 mm (0.34 in)		
Material of outer sheath	Polyurethane		
Resistance	Resistant to oil, hydrolysis and microbic attack (VDE0472)		
Approvals	UL-Style 20233,+80 °C (+176 °F) -300 V CSA-C22.2N.210-M90, +75 °C (+167 °F) -300 V FT1		

1) yyy stands for length in meters  
 Standard length: 1 m (3.28 ft), 5 m (16.40 ft), 10 m (32.80 ft), 15 m (49 ft),  
 20 m (65 ft), 50 m (164 ft)  
 Further lengths on request

## MAINS CHOKES



CA55832-001

Ambient conditions	CA68926-001	CA55830-001 to CA55843-001, CA96898-001 to CA96900-001, CB09045-001
Mains voltage	1 x 230 V, -20 % +15 %, 50/60 Hz <sup>1)</sup>	3 x 460 V, -25 % +10 %, 50/60 Hz <sup>1)</sup>
Overload factor	1.8 x I <sub>N</sub> for 40 s	2.0 x I <sub>N</sub> for 30 s
Ambient temperature	Typically -25 to +45 °C (-13 to +113 °F), with power reduction up to +60 °C (+140 °F) (1.3 % per °C/°F)	
Mounting height	1,000 m (3,280 ft), with power reduction up to 2,000 m (6,500 ft) (6 % per 1,000 m (3,280 ft))	
Relative humidity	15 to 95 %, condensation not permitted	
Storage temperature	-25 °C to +70 °C (-13 °F to +158 °F)	
Protection	IP00	
Short-circuit voltage	U <sub>k</sub> 4 % (corresponding to 9.2 V at 230 V)	U <sub>k</sub> 4 % (corresponding to 9.2 V at 400 V) applies to mains chokes with I <sub>N</sub> = 4.0 A to 32 A <sup>2)</sup> U <sub>k</sub> 2 % (corresponding to 4.6 V at 400 V) applies to mains chokes with I <sub>N</sub> = 45 A to 450 A <sup>3)</sup>
Permissible contamination	P2 as per EN 61558-1	
Thermal configuration	I <sub>eff</sub> ≤ I <sub>N</sub>	
UL recognition	All versions have UL Recognition for the USA and Canadian markets	

1) At mains frequency 60 Hz the power loss increases by approximately 5 to 10 %

2) Only for drives up to 32 A

3) Only for drives from 45 A



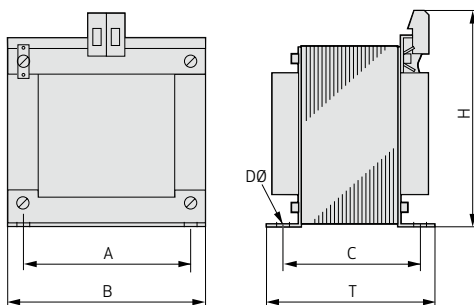
**Note:** For recommended combinations of controllers and mains chokes refer to the relevant controller catalog page

## MAINS CHOKES

### Single-phase mains chokes

Ordering number	Rated current [A]	$U_K$ [%]	Power loss tot. [W]	Inductance [mH]	Weight [kg (lb)]	Connection [mm <sup>2</sup> (in <sup>2</sup> )]
CA68926-001	14	4	16	2.1	1.5 (3.3)	4 (0.15)

#### Dimensional drawings



Dimensions [mm(in)]	CA68926-001
B (width)	85 (3.35)
H (height)	100 (3.94)
T (depth)	65 (2.56)
A	64 (2.52)
C	50 (1.97)
D	ø 4.8 (0.19)



## MAINS CHOKES

### Three-phase mains chokes

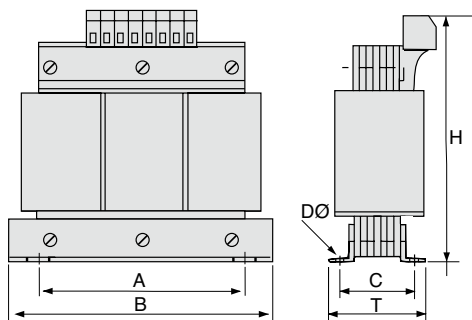
Ordering number	Rated current [A]	$U_k$ [%]	Power loss tot. [W]	Inductance [mH]	Weight [kg (lb)]	Connection [mm <sup>2</sup> (in <sup>2</sup> )]
CA55830-001	4.2	4	20	7	2.5 (5.51)	4 (0.006)
CA55831-001	6	4	25	4.88	2.5 (5.51)	4 (0.006)
CA55832-001	8	4	25	3.66	2.5 (5.51)	4 (0.006)
CA55833-001	14	4	45	2.09	4 (8.82)	4 (0.006)
CA55834-001	17	4	45	1.72	4 (8.82)	4 (0.006)
CA55835-001	24	4	50	1.22	5 (11.02)	16 (0.02)
CA55836-001	32	4	70	0.92	6 (13.23)	16 (0.02)
CA55837-001	45	2	60	0.33	5 (11.02)	16 (0.02)
CA55838-001	60	2	70	0.25	7 (15.43)	16 (0.02)
CA55839-001	72	2	80	0.20	10 (22.05)	16 (0.02)
CA55840-001	90	2	120	0.16	13 (28.66)	35 (0.05)
CA55841-001	110	2	140	0.13	15 (33.07)	35 (0.05)
CA55842-001	143	2	160	0.10	25 (55.12)	70 (0.10)
CA55843-001	170	2	170	0.09	25 (55.12)	70 (0.10)
CB09045-001	210	2	268	0.07	27 (59.52)	M12
CA96898-001	250	2	285	0.059	28 (61.73)	M12
CA96899-001	325	2	351	0.045	43 (94.80)	M12
CA96900-001	450	2	296	0.033	46 (101.41)	2 × M10

# MAINS CHOKES

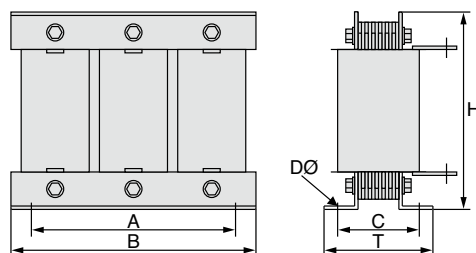
## Three-phase mains chokes

### Dimensional drawings

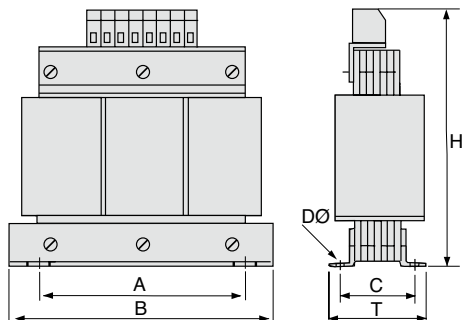
CA55830-001 to CA55838-001



CA96898-001 to CA96900-001, CB09045-001



CA55839-001 to CA55843-001

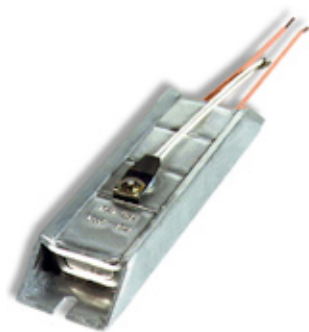


Dimensions [mm(in)]	CA68930-001	CA55831-001	CA55832-001	CA55833-001	CA55834-001	CA55835-001
B (width)		125 (4.92)			155 (6.10)	
H (height)		130 (5.12)		160 (6.30)	160 (6.30)	170 (6.69)
T (depth)		75 (2.95)		80 (3.15)	80 (3.15)	120 (4.72)
A		100 (3.94)			130 (5.12)	
C		55 (2.17)		59 (2.32)	59 (2.32)	72 (2.83)
D		ø 5 (0.20)			ø 8 (0.31)	

Dimensions [mm(in)]	CA55836-001	CA55837-001	CA55838-001	CA55839-001	CA55840-001	CA55841-001
B (width)	190 (7.48)	155 (6.10)	190 (7.48)	190 (7.48)	230 (9.06)	230 (9.06)
H (height)	200 (7.87)	170 (6.69)	200 (7.87)	240 (9.45)	300 (11.81)	300 (11.81)
T (depth)	110 (4.33)	120 (4.72)	120 (4.72)	110 (4.33)	160 (6.30)	180 (7.09)
A	170 (6.69)	130 (5.12)	170 (6.69)	170 (6.69)	180 (7.09)	180 (7.09)
C	58 (2.28)	72 (2.83)	68 (2.68)	78 (3.07)	98 (3.86)	122 (4.80)
D	ø 8 (0.31)					

Dimensions [mm(in)]	CA55842-001	CA55843-001	CB09045-001	CA96898-001	CA96899-001	CA96900-001
B (width)	240 (8.45)		265 (10.43)		300 (11.81)	
H (height)	330 (12.99)		230 (9.06)		275 (10.83)	
T (depth)	200 (7.87)		152 (5.98)	152 (5.98)	177 (6.97)	192 (7.56)
A	190 (7.48)		215 (9.45)	215 (9.45)	240 (9.45)	240 (9.45)
C	125 (4.92)		126 (4.96)	120 (4.72)	145 (5.71)	160 (6.30)
D	ø 11 (0.43)					

## BRAKING RESISTORS



CA59737-001



CA59738-001

Technical data	As per fig. A1	As per fig. A2	As per fig. A3	As per fig. A4	As per fig. A5
Surface temperature	> +250 °C (+482 °F)				
Touch protection	No				
Voltage	Maximum 970 V <sub>DC</sub>				
High-voltage strength	4,000 V <sub>DC</sub>				
Temperature monitoring	Yes, with bimetallic protector (breaking capacity 0.5 A/230 V)				
Acceptance tests	CE-compliant; UL recognition				
Connection	1 m (39.37 in) long PTFE-insulated flex wire			Terminal box with PG glands (M12 x 1.5 and M25 x 1.5)	



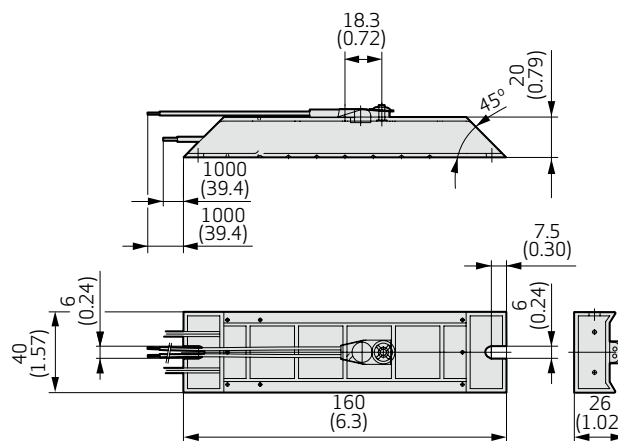
**Note:** For recommended combinations of drives and braking resistors refer to the relevant drives catalog page

# BRAKING RESISTORS

Ordering number	Continuous power <sup>1)</sup> [W]	Resistance $\Omega \pm 10\%$	Peak power [W]			Protection	Connection		Diagram
			390 V <sub>DC</sub>	650 V <sub>DC</sub>	750 V <sub>DC</sub>		Resistance	Bimetallic protector	
CB36903-001	35	260	580	1,620	2,160	IP54	AWG 16	AWG 18	A1
CB36904-001	150	260	580	1,620	2,160	IP54	AWG 14	AWG 18	A2
CB09047-001	35	200	760	2,100	2,800	IP54	AWG 16	AWG 18	A1
CB09048-001	150	200	760	2,100	2,800	IP54	AWG 14	AWG 18	A2
CB09049-001	300	200	760	2,100	2,800	IP54	AWG 14	AWG 18	A3
CA59737-001	35	90	1,690	4,690	6,250	IP54	AWG 16	AWG 18	A1
CA59738-001	150	90	1,690	4,690	6,250	IP54	AWG 14	AWG 18	A2
CA59739-001	300	90	1,690	4,690	6,250	IP54	AWG 14	AWG 18	A3
CA59740-001	1,000	90	1,690	4,690	6,250	IP65	Maximum AWG 6	Maximum AWG 12	A4
CA59741-001	35	26	-	16,250	21,600	IP54	AWG 16	AWG 18	A1
CA59742-001	150	26	-	16,250	21,600	IP54	AWG 14	AWG 18	A2
CA59743-001	300	26	-	16,250	21,600	IP54	AWG 14	AWG 18	A3
CA59744-001	1,000	26	-	16,250	21,600	IP65	Maximum AWG 6	Maximum AWG 12	A4
CB09050-001	2,000	26	-	16,250	21,600	IP65	Maximum AWG 6	Maximum AWG 12	A5
CB36901-001	300	20	7,600	21,100	28,100	IP54	AWG 14	AWG 18	A3
CB36902-001	300	15	10,100	28,100	37,500	IP54	AWG 14	AWG 18	A3
CB53860-001	2,000	90	1,690	4,690	6,250	IP64	Maximum AWG 6	Maximum AWG 12	A5

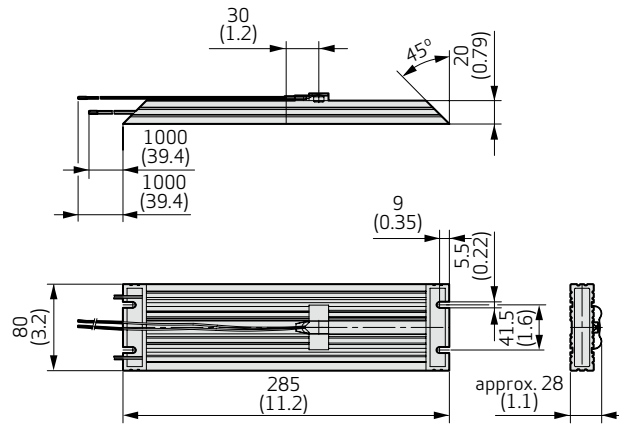
1) At cycle times of maximum 150 s the required rated continuous power can be calculated according to the following formula: Rated continuous power (W) = maximum pulse duration (s) x peak power (W) / cycle time (s)

## Dimensional braking resistors, A1

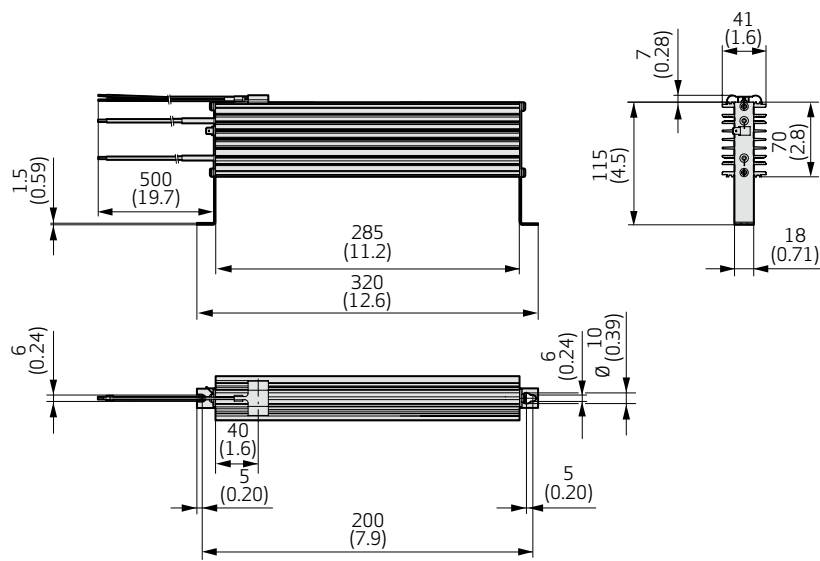


## BRAKING RESISTORS

### Dimensional braking resistors, A2



### Dimensional braking resistors, A3





## MAINS FILTERS - SIZES C2 TO C4

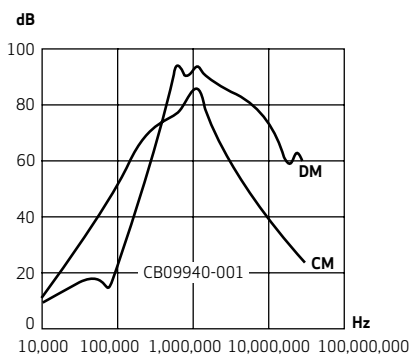
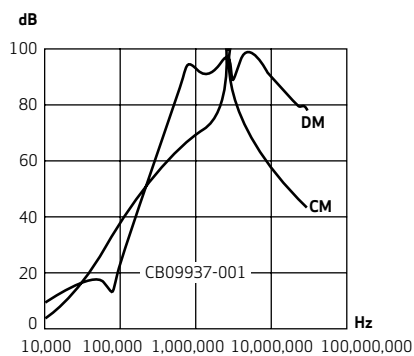


CB09939-001

Ambient conditions	CB09937-001 to CB09939-001	CB09940-001 and CB09942-001
Rated voltage	1 x 230 V <sub>AC</sub> +10 % at 50/60 Hz	3 x 480 V <sub>AC</sub> +10 % at 50/60 Hz
Overload	2 for 10 s, repeatable after 6 min <sup>1)</sup>	
Ambient temperature	Maximum +45 °C (+113 °F)	
IEC climate category	25/085/21	
Protection	IP00	
Acceptance tests	IEC 60939, UL 508	IEC 60939, UL 1238, UL 508
RFI suppression to EN 61800-3 -residential-	Motor cable length up to 10 m (32.80 ft) permitted	
RFI suppression to EN 61800-3 -industrial-	Motor cable length up to 30 m (98 ft) permitted	
Connections	Input: touch-protected terminals (IP20); output: litz wire	

1) Precondition: Mains filter mounting vertically on metallicly bright base plate

### Insertion loss curves



**Note:** For recommended combinations of drives and mains filters refer to the relevant drive catalog page

## MAINS FILTERS - SIZES C2 TO C4

### Single-phase mains filters

Suitable for Servo drives	Ordering number	Rated current	Power loss	Leakage current <sup>1)</sup>	Touch current <sup>2)</sup> [mA]		Weight [kg (lb)]
		[A]	[W]	[mA]	N	F	
G394-030	CB09937-001	8	2.5	7.9	15	25	0.75 (1.65)
G394-059	CB09938-001	14	5.8	7.9	15	25	0.75 (1.65)
G394-080	CB09939-001	19	6.1	7.9	15	25	0.75 (1.65)

- 1) Effective value of leakage current to EN 60939 (2009) at 50 Hz and rated voltage. The leakage current may increase further due to the suppressed device
- 2) Peak value measurement with measurement circuit to EN 60990 at 50 Hz and rated voltage.  
 N: Peak value of occurring touch current in normal operation with PE conductor circuit open. At a touch current >3.5 mA the mains filter must be provided with a fixed connection as per EN 50178  
 F: Peak value of worst-case touch current in case of fault with PE conductor and N conductor circuits open

### Three-phase mains filters

Suitable for servo drives	Ordering number	Rated current	Power loss	Leakage current <sup>1)</sup>	Touch current <sup>2)</sup> [mA]		Weight [kg (lb)]
		[A]	[W]	[mA]	N	F	
G394-030	CB09940-001	5	2	1.7	2.3	70	0.7 (1.54)
G394-020	CB09940-001	5	2	1.7	2.3	70	0.7 (1.54)
G394-035	CB09940-001	5	2	1.7	2.3	70	0.7 (1.54)
G394-059	CB09942-001	11	7	1.7	2.3	70	0.7 (1.54)
G394-080	CB09942-001	11	7	1.7	2.3	70	0.7 (1.54)
G394-065	CB09942-001	11	7	1.7	2.3	70	0.7 (1.54)

- 1) Effective value of leakage current to EN 60939 (2009) at 50 Hz and rated voltage. The leakage current may increase further due to the suppressed device
- 2) Peak value measurement with measurement circuit to EN 60990 at 50 Hz and rated voltage.  
 N: Peak value of occurring touch current in normal operation with PE conductor circuit open. At a touch current >3.5 mA the mains filter must be provided with a fixed connection as per EN 50178  
 F: Peak value of worst-case touch current in case of fault with PE conductor and N conductor circuits open



## MAINS FILTERS - SIZES C2 TO C4

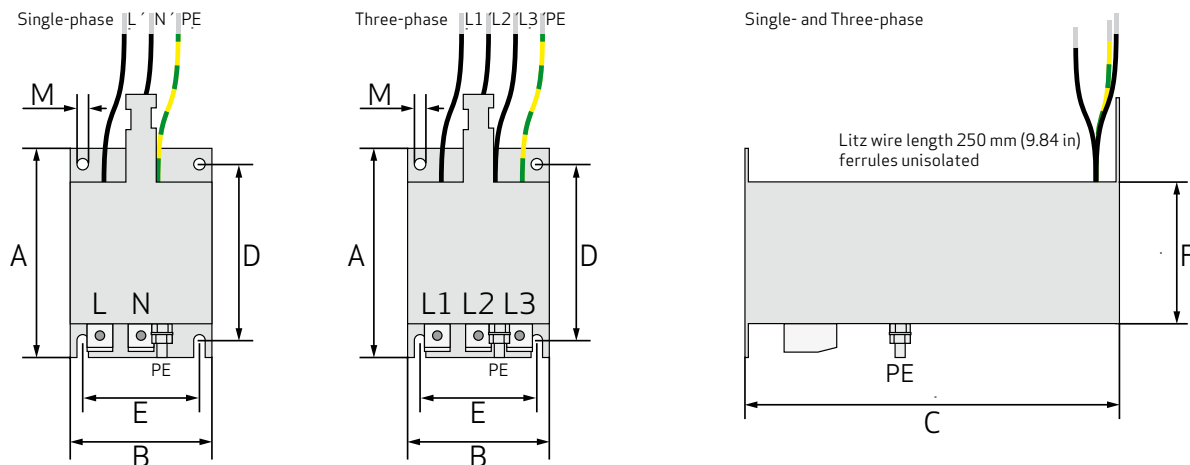
### Single-phase mains filters

Ordering number	Dimensions [mm (in)]							PE	Input		Output Wire cross section
	A	B	C	D	E	F	M		Clamping area [mm <sup>2</sup> (in <sup>2</sup> )]	Tightening torque [Nm (lbf in)]	
CB09937-001	81 (3.91)	55 (2.17)	145 (5.71)	68 (2.68)	45 (1.77)	55 (2.17)	ø 4 (0.16)	M4	0.2 to 4.0 (0.0003 to 0.0062)	0.6 to 0.8 (5.3 to 7.1)	AWG 16
CB09938-001											AWG 16
CB09939-001											AWG 14

### Three-phase mains filters

Ordering number	Dimensions [mm (in)]							PE	Input		Output Wire cross section
	A	B	C	D	E	F	M		Clamping area [mm <sup>2</sup> (in <sup>2</sup> )]	Tightening torque [Nm (lbf in)]	
CB09940-001	81 (3.19)	55 (2.17)	145 (5.71)	68 (2.68)	45 (1.77)	55 (2.17)	4 (0.16)	M4	0.2 to 4.0 (0.0003 to 0.0062)	0.6 to 0.8 (5.3 to 7.1)	AWG 16
CB09942-001											

### Dimensional drawings



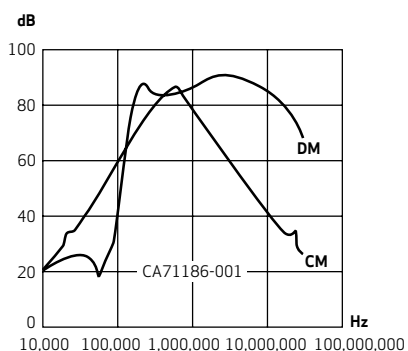
## MAINS FILTERS - SIZES 1 TO 7



CA71190-001

Ambient conditions	CB09937-001 to CB09939-001
Rated voltage	3 x 480 V <sub>AC</sub> +10 % at 50/60 Hz
Ambient temperature	-25 to +40 °C (-13 to +104 °F), with power reduction to +60 °C (+140 °F) (1.3 % per °C/°F)
Mounting height	1,000 m (3,280 ft), with power reduction up to 4,000 m (13,120 ft) 6 % per 1,000 m (3,280 ft)
Relative air humidity	15 to 85 %, condensation not permitted
Storage/transportation temperature	-25 °C to +70 °C / -40 °C to +85 °C (-13 °F to +158 °F / -40 °F to +185 °F)
Protection	IP00
Permissible contamination	P2 as per EN 61558-1
Acceptance tests	CE-compliant UL recognition (CA71184-001 to CA71189-001)
RFI suppression to EN 61800-3 -residential-	Motor cable length up to 100 m (328 ft) permitted
RFI suppression to EN 61800-3 -industrial-	Motor cable length up to 150 m (492 ft) permitted

### Insertion loss curves



**Note:** For recommended combinations of drives and mains filters refer to the relevant drive catalog page

## MAINS FILTERS - SIZES 1 TO 7

### Three-phase mains filters

Ordering number	Rated current [A]	Overload <sup>1)</sup> [A]	Power loss [W]	Leakage current <sup>2)</sup> [mA]	Touch current <sup>3)</sup> [mA]		Weight [kg (lb)]
					N	F	
CA71184-001	7	14	7.5	11.7	7.6	195	1.65 (3.64)
CA71185-001	16	32	11	11.7	6.8	194	2.0 (4.41)
CA71186-001	35	64	34	11.7	8.3	225	3.4 (7.50)
CA71187-001	63	125	30	5.5	6.8	195	5.0 (11.02)
CA71188-001	100	150	40	16.9	9.8	252	6.0 (13.23)
CA71189-001	150	225	55	16.9	9.8	253	6.8 (14.99)

- 1) For 10 s, repeatable after 6 min; precondition: Mains filter Type of installation vertically on metallicly bright base plate
- 2) Effective value of leakage current to EN 60939 (2009) at 50 Hz and rated voltage with 2 % asymmetry. The leakage current may increase further due to the suppress device
- 3) Peak value measurement with measurement circuit to EN 60990 at 50 Hz and rated voltage with 2 % asymmetry  
 N: Peak value of occurring touch current in normal operation with PE conductor circuit open. At a touch current >3.5 mA the mains filter must be provided with a fixed connection as per EN 50178  
 F: Peak value of worst-case touch current in case of fault with PE conductor circuit open and two of three phase open

### Three-phase mains filters

Ordering number	Rated current [A]	Overload <sup>4)</sup> [A]	Power loss [W]	Leakage current <sup>5)</sup> [mA]	Touch current <sup>6)</sup> [mA]		Weight [kg (lb)]
					N	F	
CA71190-001	180	270	15	33.8	7.2	225	7.0 (15.43)
CB09932-001	220	330	20	33.8	7.2	225	7.5 (16.53)
CB09933-001	250	375	40	33.8	7.2	225	8.5 (18.74)
CB09934-001	300	450	40	33.8	7.2	225	9.5 (20.94)
CB09935-001	400	600	55	33.8	7.2	225	11.0 (24.25)
CB09936-001	500	750	60	33.8	7.2	225	12.5 (27.56)

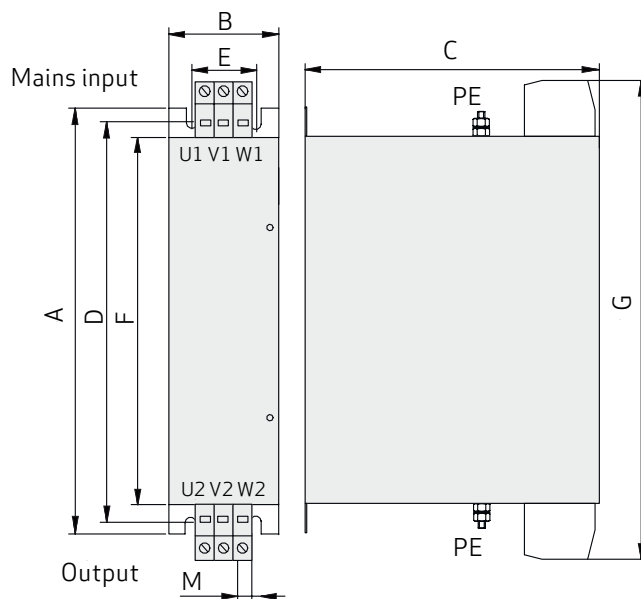
- 4) For 60 s, repeatable after 30 min; precondition: Mains filter Type of installation vertically on metallicly bright base plate
- 5) Effective value of leakage current to EN 60939 (2009) at 50 Hz and rated voltage with 2 % asymmetry. The leakage current may increase further due to the suppressed device
- 6) Peak value measurement with measurement circuit to EN 60990 at 50 Hz and rated voltage with 2 % asymmetry  
 N: Peak value of occurring touch current in normal operation with PE conductor circuit open. At a touch current >3.5 mA the mains filter must be provided with a fixed connection as per EN 50178.  
 F: Peak value of worst-case touch current in case of fault with PE conductor circuit open and two of three phase open

## MAINS FILTERS - SIZES 1 TO 7

### Three-phase mains filters

Ordering number	Dimensions [mm (in)]								PE	Input	
	A	B	C	D	E	F	G	M		Clamping area [mm <sup>2</sup> (in <sup>2</sup> )]	Tightening torque [Nm]
CA71184-001	210 (8.27)	55 (2.17)	90 (3.54)	205 (8.07)	40 (1.57)	180 (7.09)	202 (7.95)	∅ 4 (0.16)	M5	0.2 to 4.0 (0.0003 to 0.0062)	0.6 to 0.8
CA71185-001	210 (8.27)	55 (2.17)	90 (3.54)	205 (8.07)	40 (1.57)	180 (7.09)	202 (7.95)	∅ 4 (0.16)	M5	0.2 to 4.0 (0.0003 to 0.0062)	0.6 to 0.8
CA71186-001	270 (10.63)	62 (2.44)	145 (5.71)	255 (10.04)	40 (1.57)	240 (9.45)	271 (10.7)	∅ 5.5 (0.22)	M5	0.5 to 16 (0.0007 to 0.0248)	2.0 to 2.3
CA71187-001	280 (11.02)	62 (2.44)	180 (7.09)	270 (10.63)	40 (1.57)	240 (9.45)	305 (9.84)	∅ 7.0 (0.28)	M6	0.5 to 16 (0.0007 to 0.0248)	2.0 to 2.3
CA71188-001	290 (11.42)	75 (2.95)	200 (7.87)	270 (10.63)	45 (1.77)	250 (9.84)	336 (13.23)	∅ 7.0 (0.28)	M8	16 to 50 (0.0248 to 0.0775)	6.0 to 8.0
CA71189-001	320 (12.6)	90 (3.54)	220 (8.66)	300 (11.81)	60 (2.36)	280 (11.02)	380 (14.96)	∅ 7.0 (0.28)	M8	16 to 50 (0.0248 to 0.0775)	15 to 20

### Dimensional drawings

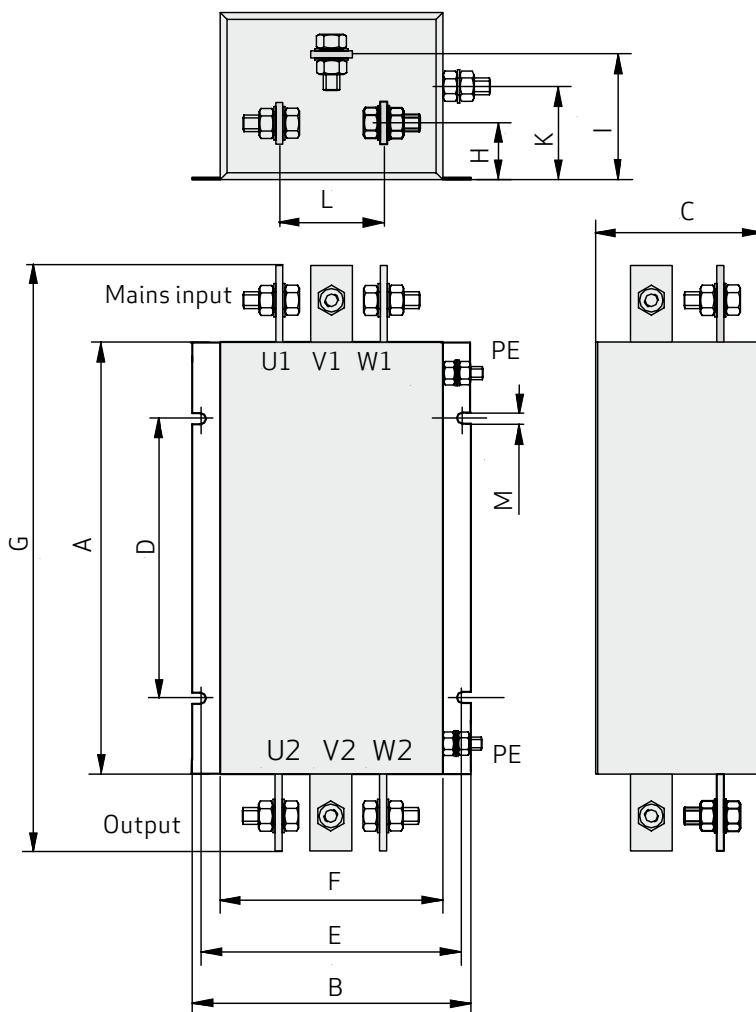


# MAINS FILTERS - SIZES 1 TO 7

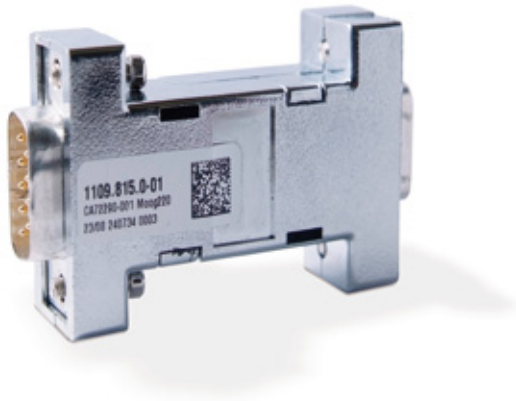
## Three-phase mains filters

Ordering number	Dimensions [mm (in)]												PE	Input/output [mm (in)]	
	A	B	C	D	E	F	G	H	I	K	L	M		Busbar	Hole
CA71190-001	310 (12.20)	200 (7.87)	120 (4.72)	180 (7.09)	180 (7.09)	160 (6.30)	410 (16.14)	45 (1.77)	86 (3.39)	30 (1.18)	91 (3.58)	ø 8.5 (0.33)	M10	3 x 25 (0.12 x 0.98)	ø 11 (0.43)
CB09032-001	310 (12.20)	200 (7.87)	120 (4.72)	180 (7.09)	180 (7.09)	160 (6.30)	410 (16.14)	45 (1.77)	86 (3.39)	30 (1.18)	91 (3.58)	ø 8.5 (0.33)	M10	4 x 25 (0.16 x 0.98)	ø 11 (0.43)
CB09933-001	310 (12.20)	200 (7.87)	120 (4.72)	180 (7.09)	180 (7.09)	160 (6.30)	410 (16.14)	54 (2.13)	86 (3.39)	30 (1.18)	91 (3.58)	ø 8.5 (0.33)	M10	5 x 25 (0.20 x 0.98)	ø 11 (0.43)
CB09934-001	310 (12.20)	200 (7.87)	120 (4.72)	180 (7.09)	180 (7.09)	160 (6.30)	410 (16.14)	54 (2.13)	86 (3.39)	30 (1.18)	91 (3.58)	ø 8.5 (0.33)	M12	6 x 25 (0.24 x 0.98)	ø 11 (0.43)
CB09935-001	350 (13.78)	240 (9.44)	150 (5.91)	200 (7.87)	220 (8.66)	200 (7.87)	480 (18.90)	69 (2.71)	110 (2.72)	30 (1.18)	128 (5.04)	ø 8.5 (0.33)	M12	8 x 25 (0.31 x 0.98)	ø 11 (0.43)
CB09936-001	350 (13.78)	240 (9.44)	150 (5.91)	200 (7.87)	220 (8.66)	200 (7.87)	480 (18.90)	69 (2.71)	110 (2.72)	30 (1.18)	128 (5.04)	ø 8.5 (0.33)	M12	8 x 30 (0.31 x 1.81)	ø 13 (0.51)

## Dimensional drawings



## NTC ADAPTER



CA72290 -001

### Short description

The NTC Adapter is used for motors with a 220 k $\Omega$  NTC temperature sensor.

The Adapter converts the NTC signal so that the servo drive is able to measure the temperature of the motor. The NTC adapter is only necessary for sizes C2, C3, C4.

## LIQUID COOLING CONNECTION SET



CB37132-001

### Short description

The connection set includes all the components needed to connect a liquid-cooled servo drive devices to the cooling system (intake and return lines). It consists of a roll of Teflon strip, two elbow sections, two quick-fasteners, two couplings and two hose clamps.



**Note:** Fits all liquid-cooled servo drive devices

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## SPARE CONNECTOR KITS



Normally all needed mating connectors are delivered with each module. These kits are only needed for spare or repair reasons.

Type	Ordering number	Description
MCTRL connector kit	CA65115-001	2 x mating connector for x <sup>3</sup> - 7 pole, 1 x mating connector for x <sup>9</sup> - 2 pole, 1 x mating connector for x <sup>10</sup> - 2 pole
Servo drive control connector kit (G392/G395 Size 1 to 4)	CA70545-001	2 x mating connector for x <sup>4</sup> - 12 pole, 1 x mating connector for x <sup>5</sup> - 2 pole, 1 x mating connector for x <sup>9</sup> - 2 pole, 1 x mating connector for x <sup>10</sup> - 2 pole, 1 x mating connector for x <sup>13</sup> - 2 pole
Servo drive power connector kit (G392/G395 Size 1 + 2 with 400 V)	CA70546-001	1 x mating connector for x <sup>11</sup> - 4 pole, 1 x mating connector for x <sup>12</sup> - 7 pole
Servo drive power connector kit (G392/G395 Size 1 + 2 with 230 V)	CB59705-001	1 x mating connector for x <sup>11</sup> - 4 pole, 1 x mating connector for x <sup>12</sup> - 7 pole
Servo drive power connector kit (G392/G395 Size 3 + 4 with 400 V)	CA70547-001	1 x mating connector for x <sup>11</sup> - 4 pole, 1 x mating connector for x <sup>12</sup> - 7 pole
Servo drive control connector kit (G392/G395 Size 5 to 7 + G393/G397 Size 5 to 6A)	CB59706-001	2 x mating connector for x <sup>4</sup> - 12 pole, 1 x mating connector for x <sup>5</sup> - 2 pole, 1 x mating connector for x <sup>9</sup> - 2 pole, 1 x mating connector for x <sup>10</sup> - 2 pole, 1 x mating connector for x <sup>20</sup> - 3 pole
Servo drive control connector kit (G392 Size7)	CB59708-001	2 x mating connector for x <sup>4</sup> - 12 pole, 1 x mating connector for x <sup>5</sup> - 2 pole
Servo drive seals (G395 Size 5 to 7, G397 Size 5 to 6A + G396)	CB59707-001	
Servo drive shield clamps (G392/G395 + G393/G397 Size 1 to 4)	CB59709-001	
Servo drive connector kit CANopen (G392/G395, G393/G397 + G396)	CB59710-001	2 x mating connector for x <sup>32</sup> - 5 pole
Servo drive connector kit CANopen + 2 analog outputs (G392/G395, G393/G397 + G396)	CA70548-001	2 x mating connector for x <sup>32</sup> - 5 pole, 1 x mating connector for x <sup>33</sup> - 2 pole, 1 x mating connector for x <sup>33</sup> - 2 pole
Servo drive control connector kit (G393/G397 Size 1 to 4)	CB59711-001	2 x mating connector for x <sup>4</sup> - 12 pole, 1 x mating connector for x <sup>5</sup> - 2 pole, 1 x mating connector for x <sup>9</sup> - 2 pole, 1 x mating connector for x <sup>10</sup> - 2 pole, 1 x mating connector for x <sup>13</sup> - 4 pole
Servo drive power connector kit (G393/G397 Size 1)	CB59712-001	1 x mating connector for x <sup>12</sup> - 7 pole
DC-Link bar (G393/G397 Size 1)	CB59713-001	
Servo drive power connector kit (G393/G397 Size 2)	CB59714-001	1 x mating connector for x <sup>12</sup> - 7 pole
DC-Link bar (G393/G397 Size 2)	CB59715-001	
Servo drive power connector kit (G393/G397 Size 3)	CB59716-001	1 x mating connector for x <sup>12</sup> - 7 pole
DC-Link bar (G393/G397 Size 3)	CB59717-001	
Servo drive power connector kit (G393/G397 Size 4)	CB59718-001	1 x mating connector for x <sup>12</sup> - 7 pole
DC-Link bar (G393/G397 Size 4)	CB59719-001	
DC-Link bar (G393/G397 Size 5 + G396 Size 5)	CB59720-001	
DC-Link bar (G393/G397 Size 6A + G396 Size 6A)	CB59721-001	
Servo drive Compact control connector kit (Size C2 to C4)	CB40512-001	2 x mating connector for x <sup>4</sup> - 12 pole, 1 x mating connector for x <sup>5</sup> - 2 pole, 1 x mating connector for x <sup>13</sup> - 2 pole, 1 x mating connector for x <sup>13</sup> - 2 pole
Servo drive Compact power connector kit (Size C2 + C3)	CB40513-001	1 x mating connector for x <sup>1</sup> - 7 pole, 1 x mating connector for x <sup>2</sup> - 2 pole, 1 x mating connector for x <sup>3</sup> - 4 pole
Servo drive Compact power connector kit (Size C4)	CB40515-001	1 x mating connector for x <sup>1</sup> - 7 pole, 1 x mating connector for x <sup>2</sup> - 2 pole, 1 x mating connector for x <sup>3</sup> - 4 pole
Servo drive Compact screening clamps	CB40514-001	
Power supply unit control connector kit (G396)	CB59722-001	2 x mating connector for x <sup>4</sup> - 12 pole, 1 x mating connector for x <sup>5</sup> - 2 pole, 1 x mating connector for x <sup>9</sup> - 2 pole, 1 x mating connector for x <sup>10</sup> - 2 pole, 1 x mating connector for x <sup>21</sup> - 6 pole



## ABOUT MOOG

Moog Inc. is a worldwide designer, manufacturer and integrator of precision control components and systems. Moog's Industrial Group designs and manufactures high performance motion control solutions combining electric, hydraulic, and hybrid technologies with expert consultative support in a range of applications including energy production and generation machinery, industrial production machinery and simulation and test equipment. We help performance-driven companies design and develop their next-generation machines. Moog Industrial Group, with fiscal year 2012 sales of USD 634 million and over 40 locations worldwide, is part of Moog Inc. (NYSE:MOG.A and MOG.B) which has sales of USD 2.47 billion.

Moog maintains facilities in 26 countries around the globe. This vast scope ensures that our engineers remain close to the needs of machine builders and provide flexible design solutions and technical expertise tailored to our customers' toughest challenges.

Moog experts work in close collaboration with machine builders and application engineers to design motion control systems for greater productivity, higher reliability, superior connectivity, less costly maintenance and more effective operations. Our regional presence, industry knowledge and design flexibility ensures Moog motion control solutions are tailored to their environment – from meeting operating regulations and performance standards, to taking machine performance to a higher level.

### Products

At the heart of every Moog solution is an array of products engineered for precision, high performance and reliability. For more than six decades, Moog products have been specified for critical machine applications.

Some are developed specifically for unique operating environments. Others are standard equipment on machines across many industries. All are continuously improved to take advantage of the latest technology breakthroughs and advancements.

Moog products include:

- Servo Valves and Proportional Valves
- Servo Motors and Servo Drives
- Servo Controllers and Software
- Radial Piston Pumps
- Actuators
- Integrated Hydraulic Manifold Systems and Cartridge Valves
- Slip Rings
- Motion Bases



Servo Drives



Servo Motors



Servo Valves



Radial Piston Pumps

## ABOUT MOOG

### Hydraulic solutions

Since Bill Moog invented the first commercially viable Servo Valve in 1951, Moog has set the standard for world-class hydraulic technology. Today, Moog products are used in a variety of applications - providing high power, enhanced productivity and ever better performance for some of the worlds most demanding applications.

### Electric solutions

Clean operation, low noise generation, less maintenance and reduced power consumption make Moog electric solutions ideal for applications worldwide. Moog is the ideal partner for applications where transitioning technologies requires special expertise.

### Hybrid solutions

By incorporating the advantages of existing hydraulic and electric technologies - including modular flexibility, increased efficiency and cleanliness - into innovative hybrid solutions, Moog offers new performance potential in specialized applications.



### Moog Global Support

Moog Global Support is our promise to offer world-class Repair and Maintenance Services delivered expertly by our trained technicians. With the reliability only available from a leading manufacturer with facilities around the world, Moog offers you service and expertise you can count on to keep your equipment operating as it should.

#### This promise offers many benefits to our customers including:

- Reduce your downtime by keeping critical machines running in peak performance
- Protect your investment by ensuring reliability, versatility and long-life of products
- Better plan your maintenance activities and make systematic upgrades
- Leverage our flexible programs to meet the unique service requirements of your facility

#### Look to Moog for global support including:

- Repair services using OEM parts are performed by trained technicians to the latest specifications
- Stock management of spare parts and products to prevent unplanned downtime
- Flexible programs, tailored to your needs such as upgrades, preventative maintenance and annual/multi-year contracts
- On-site services bring the expertise to you, providing quicker commissioning, set-up and diagnostics
- Access to reliable services that are guaranteed to offer consistent quality anywhere in the world

For more information on Moog Global Support, visit [www.moog.com/industrial/service](http://www.moog.com/industrial/service)



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Moog designs a range of motion control products that complement the performance of those featured in this catalog. Visit our website for more information and contact the Moog facility nearest you.

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