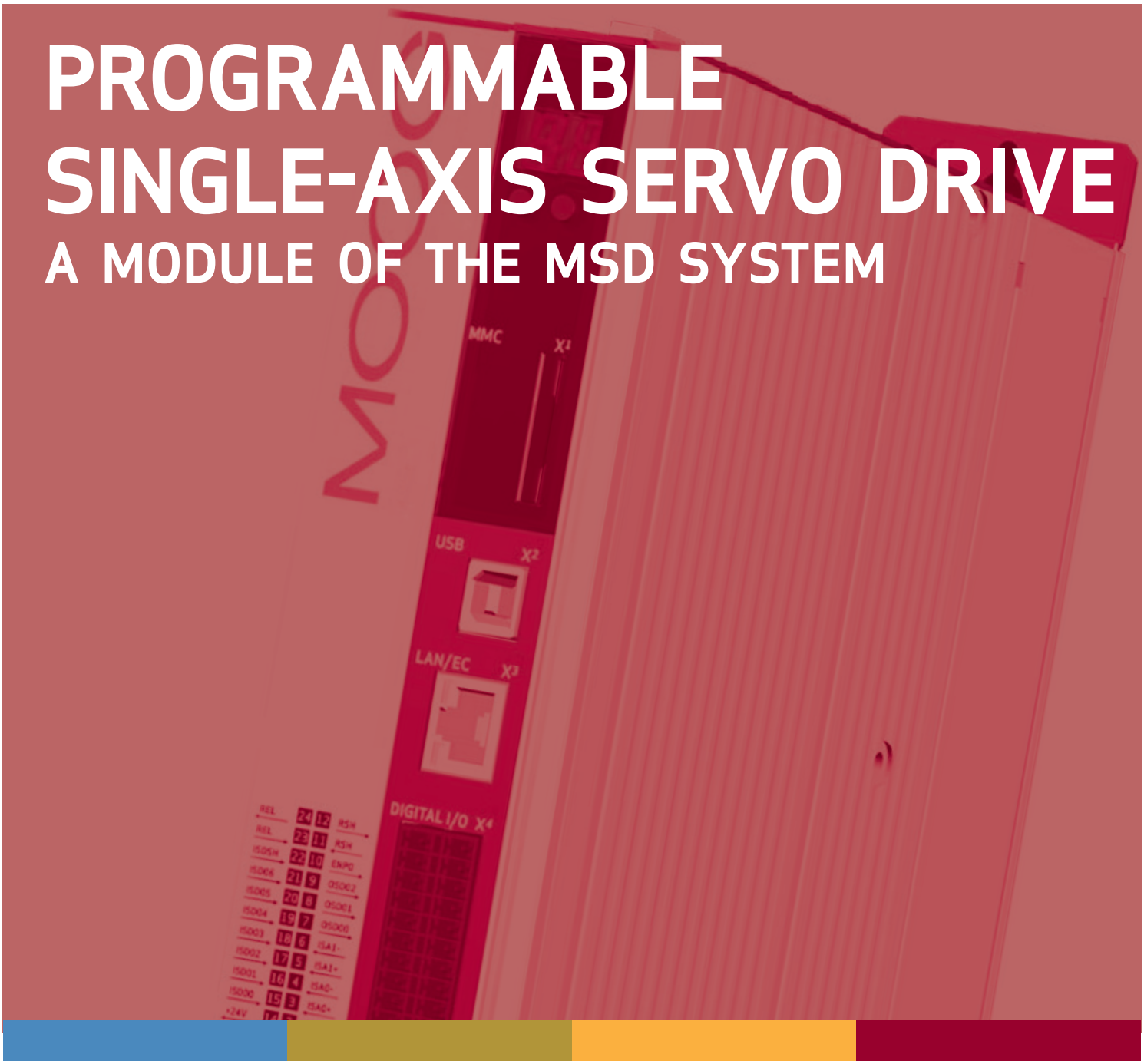
PROGRAMMABLE SINGLE-AXIS SERVO DRIVE

A MODULE OF THE MSD SYSTEM



Rev. A, April 2013

DELIVERING ADVANCED MOTION CONTROL AND FLEXIBILITY FOR HIGH PERFORMANCE AXES APPLICATIONS

MOOG

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.

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
Moog is a registered trademark of Moog Inc. and its subsidiaries. All trademarks as indicated herein are the property of Moog Inc. and its subsidiaries.

PRODUCT 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 Single-Axis Servo Drive (PSA) - a module of the Programmable Multi-Axis Servo Drive System (MSD), answers the call for a new generation of servo drives that provides the highest levels of dynamic response, smooth performance and application versatility.

This single-axis servo drive is part of Moog's Programmable Multi-Axis Servo Drive system (MSD) and can be used as a stand alone drive or in combination with the various other motion control and drive modules in the MSD family.

Programmable Single-Axis Servo Drive includes:

- Compact Version Servo Drives Sizes C2 to C4
- Standard Version Servo Drives Sizes 1 to 7

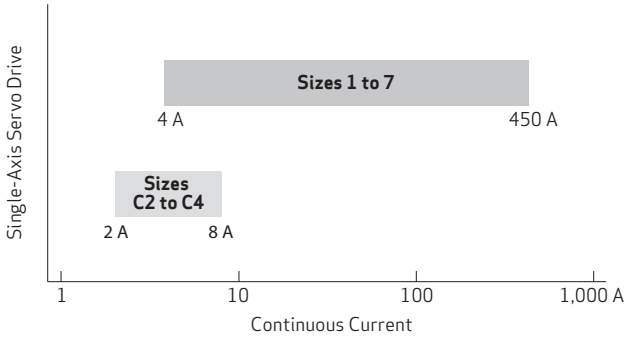
Meeting your toughest machine challenges

The servo drive 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:

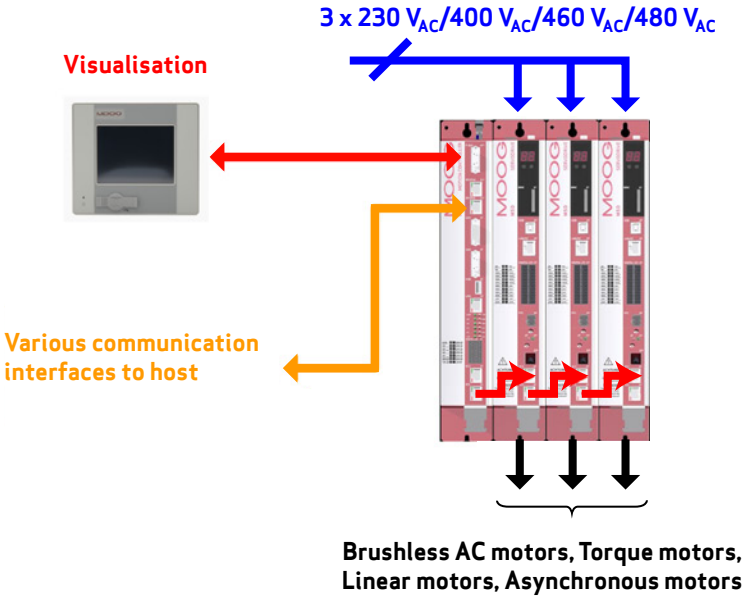
- **Higher machine productivity**
  From lowering cycle times in an injection molding machine, to increasing feed rates in a metal forming press, the servo drive delivers a significant increase in machine output
- **Improved machine precision**
  More precise motion control results in higher accuracy, virtually no part variations and reduced scrap
- **Higher machine flexibility**
  The wide power range 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
- Compact size. Suitable for 300 mm switch cabinet depth, extremely small housing width, for the best possible switch cabinet usage
- Extendable functionality via flexible 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 MSD PLC as per IEC61131 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 servo drive 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 servo drive 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.

- Compact Dynamic Brushless Servo Motor
- Maximum Dynamic Brushless Servo Motor

Designed for high-performance applications

Putting the servo drive to work on your motion control tasks is simple when you consider the range of performance features this 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 servo drive 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 – designed to implement safety functions according to EN 61508
- A size for every application – servo drives from 2 to 170 A_{rms} air-cooled or even 450 A_{rms} liquid-cooled. This allows the servo drive 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

COMPACT VERSION OVERVIEW

Designed for the Present and the Future

The low power PSA Servo Drives (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 servo drive operates at cycle times of 62.5 µs for current and 125 µs for velocity and position control loops.

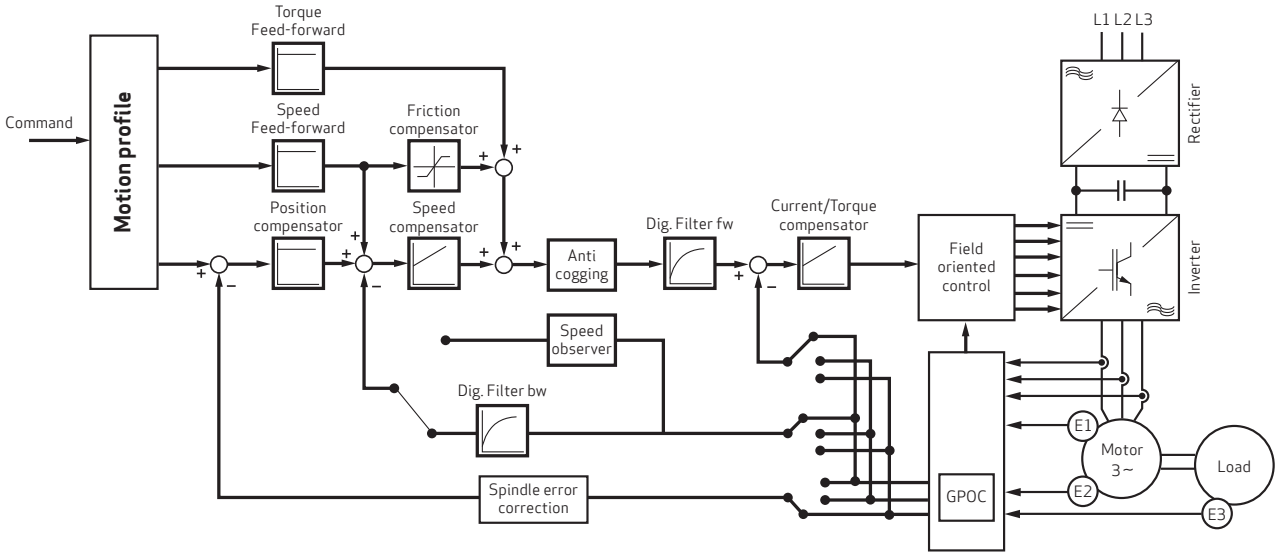
Currently, three mechanical sizes, based on output power, are available, ranging from 2 up to 8 A_{rms}.

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_{rms} supplied with the classic AC_{Mains} 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	Page 9	Page 13
G394-059	C3	5.9	Page 9	Page 15
G394-080	C4	8.0	Page 9	Page 17

System voltage 3 x 400 V

Ordering number	Size	Rated current [A]	Current capacity	Technical data
G394-020	C2	2.0	Page 10	Page 13
G394-035	C3	3.5	Page 10	Page 15
G394-065	C4	6.5	Page 10	Page 17

ORDERING INFORMATION

G394	-	030	-	210	-	001

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

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

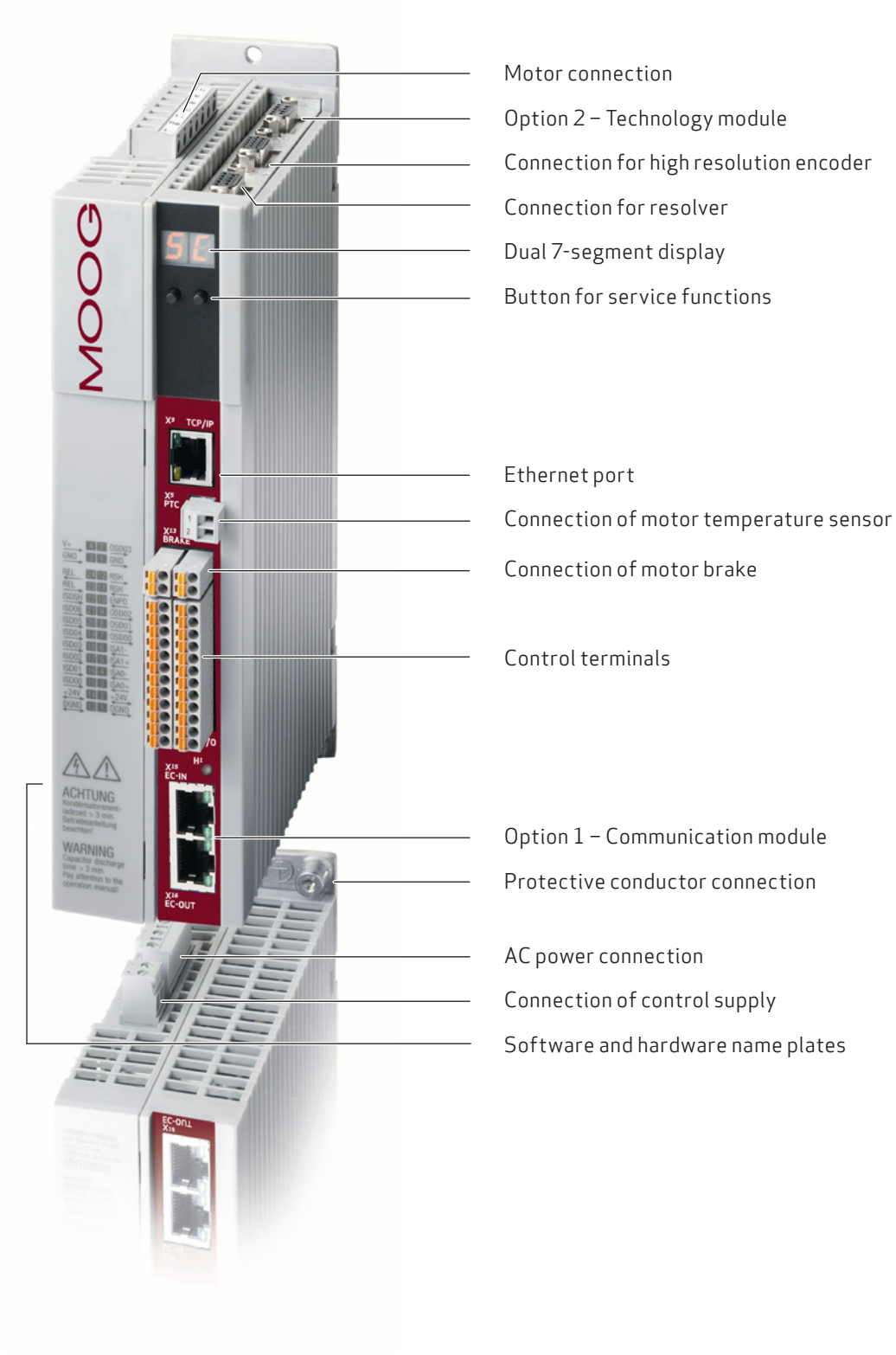
Option 4:	**PLC functionality**
– =	without PLC
P =	with PLC

For future use	
H =	HF [3]
F =	PLC + HF [3]

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
MOOG
TCP/IP
ACHTUNG
WARNING
EC-IN
EC-OUT

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	Ambient temperature maximum	Rated current I_N [A_{eff}]	Peak current			
				200 % (2 I_N)		300 % (3 I_N)	
	[kHz]	[°C (°F)]	at 1 x 230 V	[A_{eff}]	For time [s]	[A_{eff}]	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 [1)]	0.08 [1)]
	16	+40 (+104)	2.0	4.0		6.0 [1)]	0.08 [1)]
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	Ambient temperature maximum	Rated current I_N [A_{eff}]	Peak current			
				200 % (2 I_N)		300 % (3 I_N)	
	[kHz]	[°C (°F)]	at 3 x 230 V	[A_{eff}]	For time [s]	[A_{eff}]	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 [1)]	
	16	+40 (+104)	2.0	4.0		6.0 [1)]	
G394-059	4	+45 (+113)	5.9	11.8	10	17.7	0.08
	8	+40 (+104)				17.7 [1)]	
	16	+40 (+104)				17.7 [1)]	
G394-080	4	+45 (+113)	8.0	16.0	10	24.0	0.08
	8	+40 (+104)	8.0	16.0		24.0 [1)]	
	16	+40 (+104)	5.4	10.8		16.2 [1)]	

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	Ambient temperature maximum	Rated current I_N [A_{eff}]			Peak current [1]			
						200 % (2 I_N)		300 % (3 I_N)	
	[kHz]	[°C (°F)]	at 400 V	at 460 V	at 480 V	[A_{eff}]	For time [s]	[A_{eff}]	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 [2]	
	16	+40 (+104)	0.7	0.7	-	1.4		2.1 [2]	
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 [2]	
	16	+40 (+104)	2.2	1.3	-	4.4		6.6 [2]	
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 [2]	
	16	+40 (+104)	4.0	2.4	1.9	8.0		12.0 [2]	

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

Ambient conditions			
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		
Climatic conditions			
In transit	As per EN 61800-2, IEC 60721-3-2 class 2K3 [1]		
	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 [2]		
	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 [3]		
	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		
Mechanical conditions			
Vibration limit in transit	As per EN 61800-2, IEC 60721-3-2 class 2M1		
	Frequency [Hz]	**Amplitude [mm (in)]**	**Acceleration [m/s² (in/s²)]**
	2 ≤ f < 9	3.5 (0.14)	Not applicable
	9 ≤ f < 200	Not applicable	10 (394.70)
	200 ≤ 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 [2]	As per EN 61800-2, IEC 60721-3-3 class 3M1		
	Frequency [Hz]	**Amplitude [mm (in)]**	**Acceleration [m/s² (in/s²)]**
	2 ≤ f < 9	0.3 (0.01)	Not applicable
	9 ≤ f < 200	Not applicable	1 (39.37)

1) The absolute humidity is limited to maximum 60 g/m³. 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/m³. 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/m³. That means that the maximum values for temperature and relative air humidity stipulated in the table must not occursimultaneously

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 PRODUCT STANDARDS

CE mark

The servo drives (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 servo drive 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

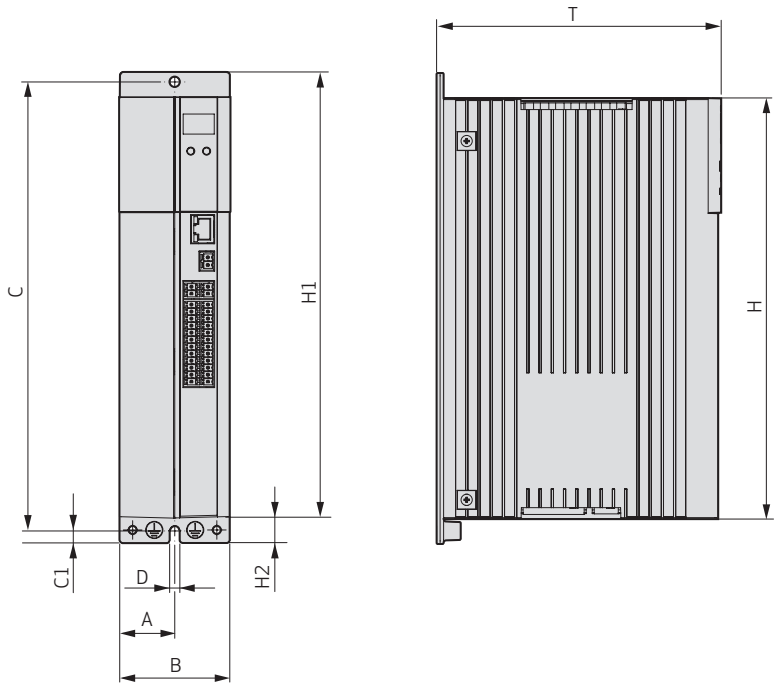
Ordering number	**G394-030**	**G394-020**
Output, motor side		
Voltage	3-phase U_{Mains}	
Rated current, effective (I_N) [1]	3 A	2 A [2]
Peak current	Page 15	Page 15
Rotating field frequency	0 to 400 Hz	
Switching frequency of power stage	4/8/16 kHz	
Input, mains side		
Mains voltage (U_{Mains})	(1 x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

1) Data referred to 4 kHz and 8 kHz switching frequency
2) Data referred to 400 V_{AC} 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 unhindered 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	ø 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

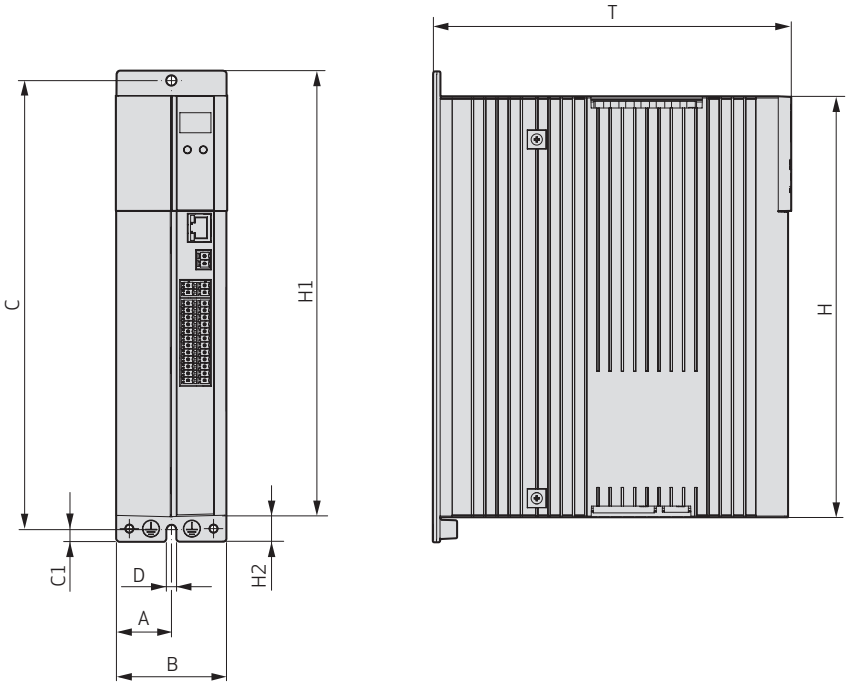
Ordering number	**G394-059**	**G394-035**
Output, motor side		
Voltage	3-phase U_{Mains}	
Rated current, effective (I_N) [1]	5.9 A	3.5 A [2]
Peak current	Page 15	Page 16
Rotating field frequency	0 to 400 Hz	
Switching frequency of power stage	4/8/16 kHz	
Input, mains side		
Mains voltage (U_{Mains})	(1 x 230 V_{AC} /3 x 230 V_{AC}) -20 %/+15 %	(3 x 400 V_{AC}/3 x 460 V_{AC}/3 x 480 V_{AC}) ±10 %
Device connected load (with mains choke)	2.6 kVA	2.7 kVA
Current (with mains choke)	10.6 A (1 x 230 V_{AC})/6.5 A (3 x 230 V_{AC})	3.9 A [2]
Asymetry of mains voltage	±3 % maximum (at 3 x 230 V_{AC})	±3 % maximum
Frequency	50/60 Hz ±10 %	
Power loss at 8 kHz and I_N	150 W	80 W [2]
DC link		
Braking chopper switch-on-threshold	390 V_{DC}	650 V_{DC} [2]
Minimum ohmic resistance of an externally installed braking resistor	72 Ω	180 Ω
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 Ω (PTC)	420 Ω (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 resisto)	1,500 W	1,000 W [2]

1) Data referred to 4 kHz and 8 kHz switching frequency
2) Data referred to 400 V_{AC} 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 unhindered 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	ø 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

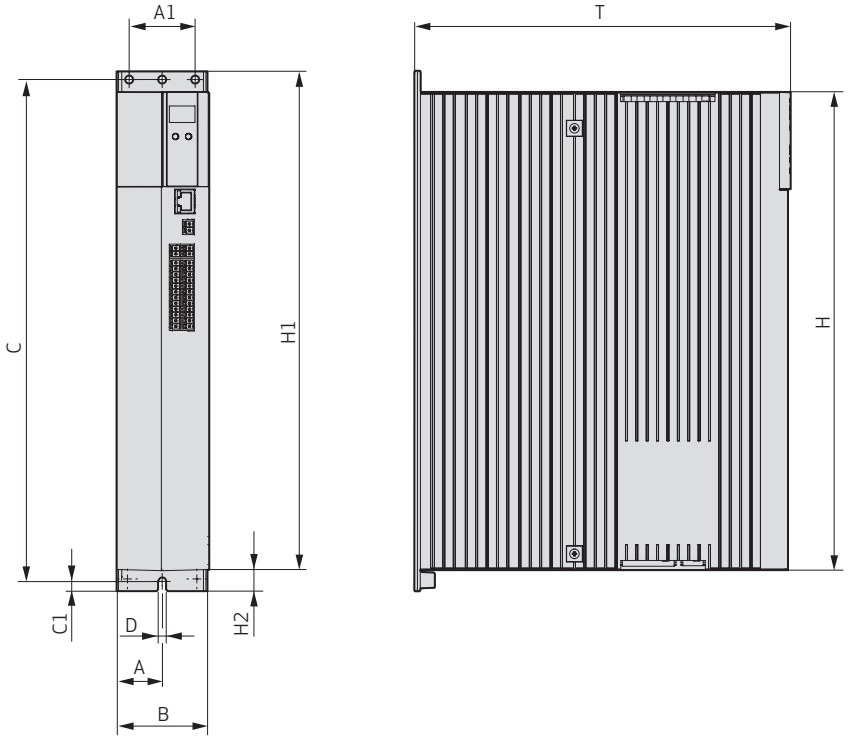
Ordering number	**G394-080**	**G394-065**
Output, motor side		
Voltage	3-phase U_{Mains}	
Rated current, effective (I_N) [1]	8.0 A	6.5 A [2]
Peak current	Page 15	Page 16
Rotating field frequency	0 to 400 Hz	
Switching frequency of power stage	4/8/16 kHz	
Input, mains side		
Mains voltage (U_{Mains})	(1 x 230 V_{AC}/3 x 230 V_{AC}) -20 %/+15 %	(3 x 400 V_{AC}/3 x 460 V_{AC}/3 x 480 V_{AC}) ±10 %
Device connected load (with mains choke)	3.5 kVA	5.0 kVA
Current (with mains choke)	14.4 A (1 x 230 V_{AC})/8.8 A (3 x 230 V_{AC})	7.2 A [2]
Asymetry of mains voltage	±3 % maximum (at 3 x 230 V_{AC})	±3 % maximum
Frequency	50/60 Hz ±10 %	
Power loss at 8 kHz and I_N	200 W	150 W [2]
DC link		
Braking chopper switch-on-threshold	390 V_{DC}	650 V_{DC} [2]
Minimum ohmic resistance of an externally installed braking resistor	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	90 Ω (PTC)	90 Ω (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 [2]

1) Data referred to 4 kHz and 8 kHz switching frequency
2) Data referred to 400 V_{AC} 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 unhindered 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	ø 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

STANDARD VERSION OVERVIEW

Designed for the Present and the Future

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

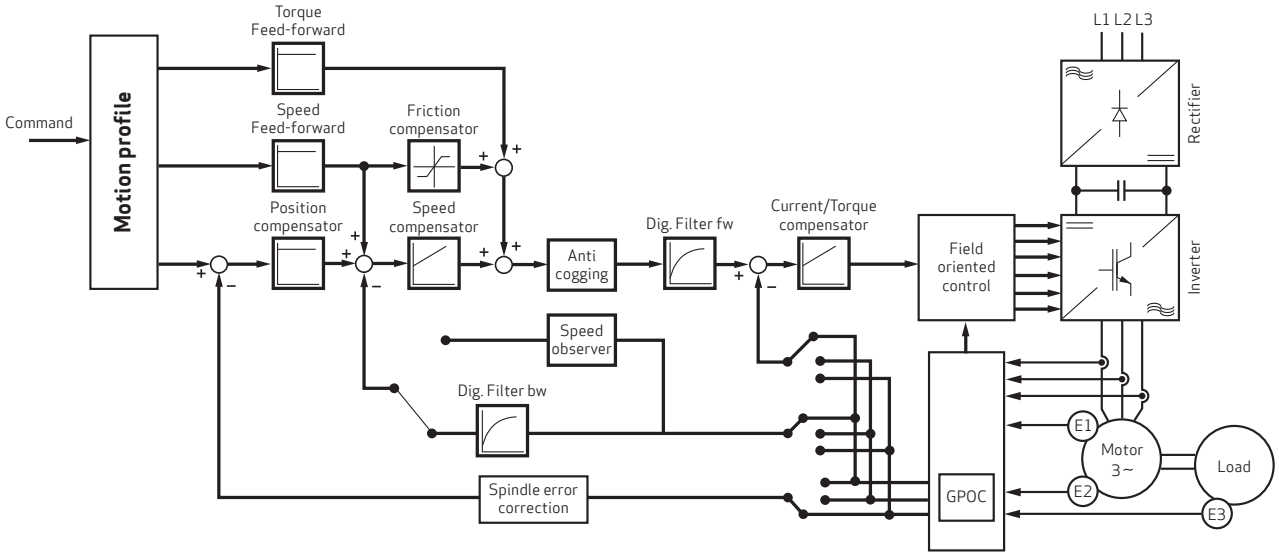
For high-performance control loops, high update rates are supported: the servo drive operates at cycle times of 62.5 µs for current and 125 µs for velocity and position control loops.

Currently, 8 mechanical sizes, based on output power, are available, ranging from 4 up to 170 A_{rms} with classical air cooling. Between 16 and 450 A_{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_{rms}
  Supply with the classic AC_{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	Page 27	Page 42

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	-	Page 28	Page 36
G392-006	-		6.0	-		
G392-008	-	Size 2	8.0	-	Page 28	Page 38
G392-012	-		12	-		
G392-016	G395-016	Size 3	16	16	Page 28/29	Page 40
G392-020	G395-020		20	20		
G392-024	G395-024	Size 4	24	24	Page 28/29	Page 42
G392-032	G395-032		32	32		
G392-045	G395-053	Size 5	45	53	Page 30/31	Page 44
G392-060	G395-070		60	70		
G392-072	G395-084		72	84		
G392-090	G395-110	Size 6	90	110	Page 30/31	Page 46
G392-110	G395-143		110	143		
G392-143	G395-170	Size 6A	143	170	Page 30/31	Page 48
G392-170	G395-210		170	210		
-	G395-250	Size 7	-	250	Page 32	Page 50
-	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 [1]
006 =	6/12 A	Size 1	060 =	60/120 A	Size 5 [1]
008 =	8/16 A	Size 2	072 =	72/144 A	Size 5 [1]
012 =	12/24 A	Size 2	090 =	90/180 A	Size 6 [1]
016 =	16/32 A	Size 3	110 =	110/165 A	Size 6 [1]
020 =	20/40 A	Size 3	143 =	143/215 A	Size 6 A [1]
024 =	24/48 A	Size 4	170 =	170/315 A	Size 6 A [1]
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 [2]
F =	PLC + HF [2]

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 [1]
020 =	20/40 A	Size 3	143 =	143/215 A	Size 6 [1]
024 =	24/48 A	Size 4	170 =	170/255 A	Size 6A [1]
032 =	32/64 A	Size 4	210 =	210/255 A	Size 6A [1]
053 =	53/90 A	Size 5 [1]	250 =	250/375 A	Size 7 [1], [3]
070 =	70/120 A	Size 5 [1]	325 =	325/485 A	Size 7 [1], [3]
084 =	84/144 A	Size 5 [1]	450 =	450/675 A	Size 7 [1] [3]

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 [2]
F =	PLC + HF [2]

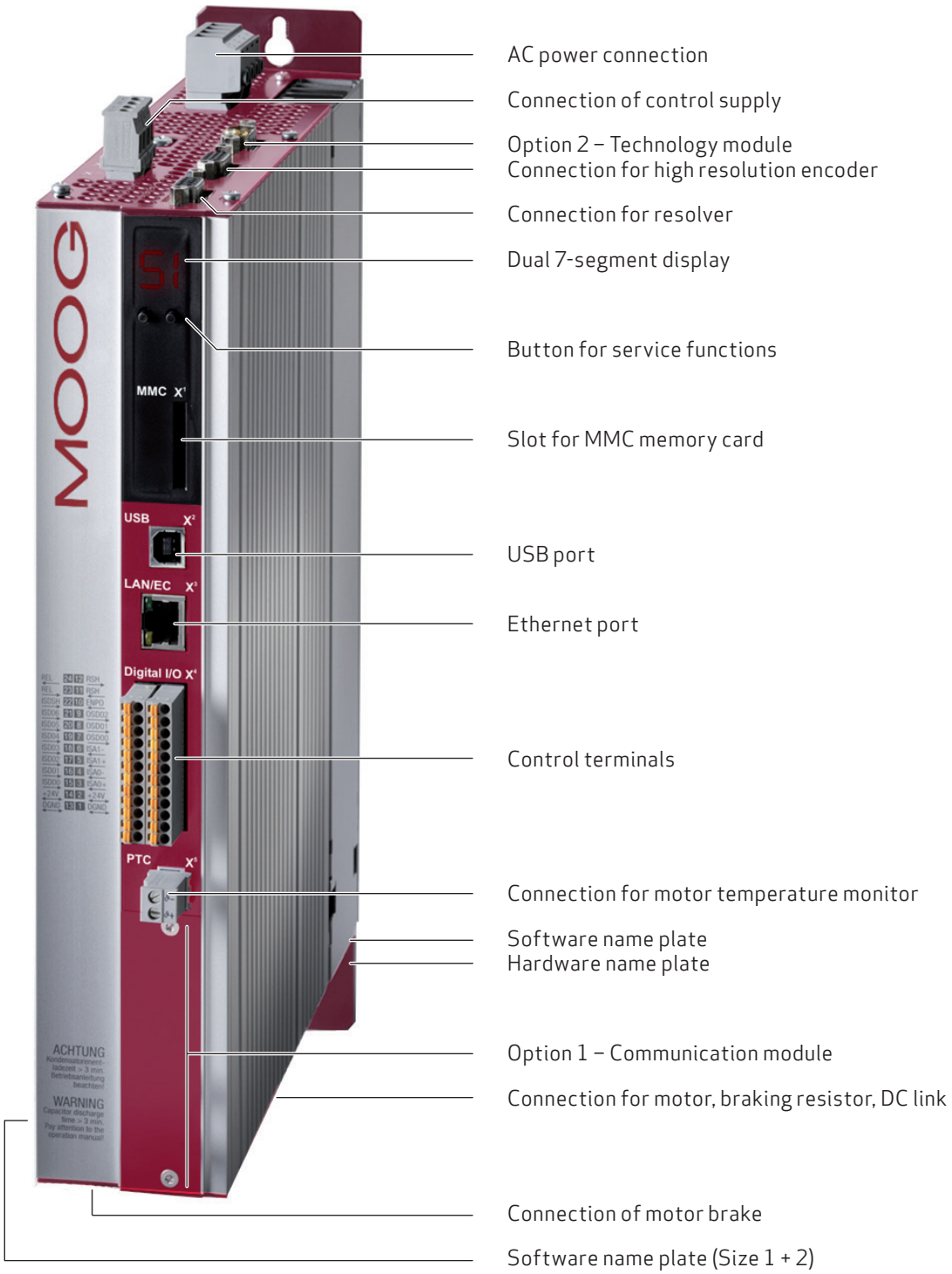
Modification	
0 =	Standard
1 =	Analog input 4 to 20 mA on control card

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

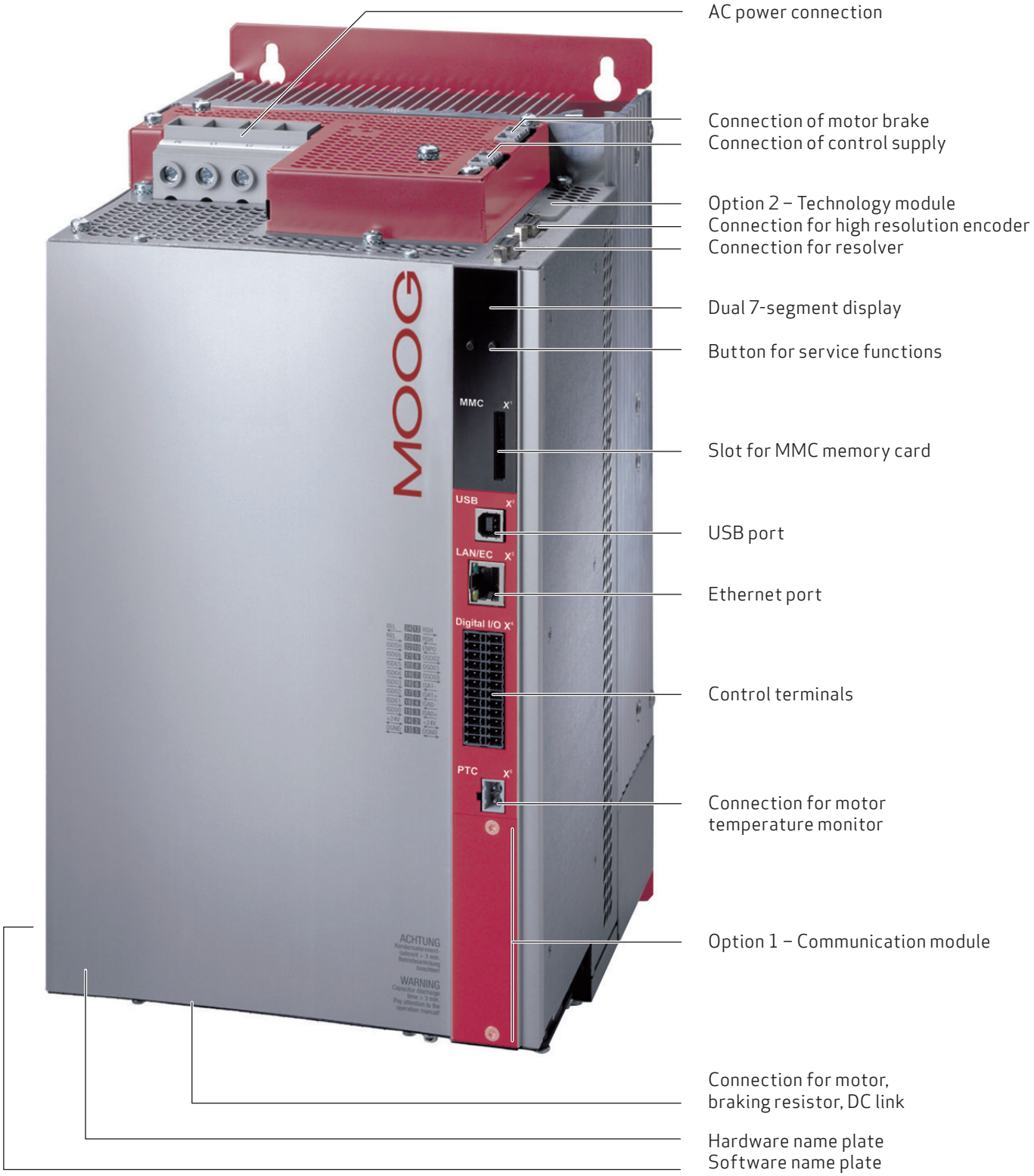
1) Not with internal braking resistor available
2) At option H,F the EG VO 428/2009, attachment I, pos. 3A225 has to be considered
3) 2 kHz switching frequency (PWM)

EQUIPMENT

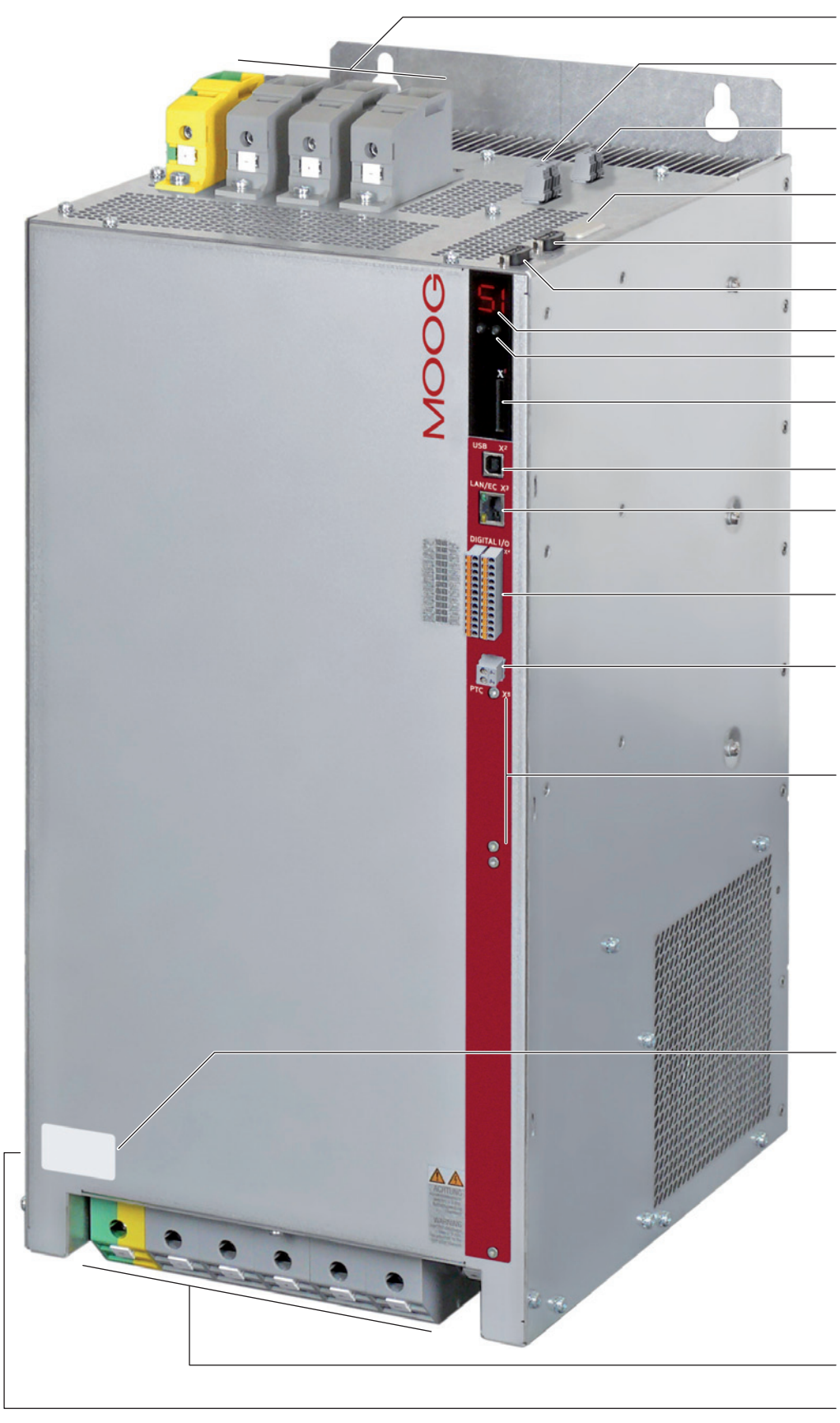
Sizes 1 to 4 – Interface



EQUIPMENT
Size 5 – Interface



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

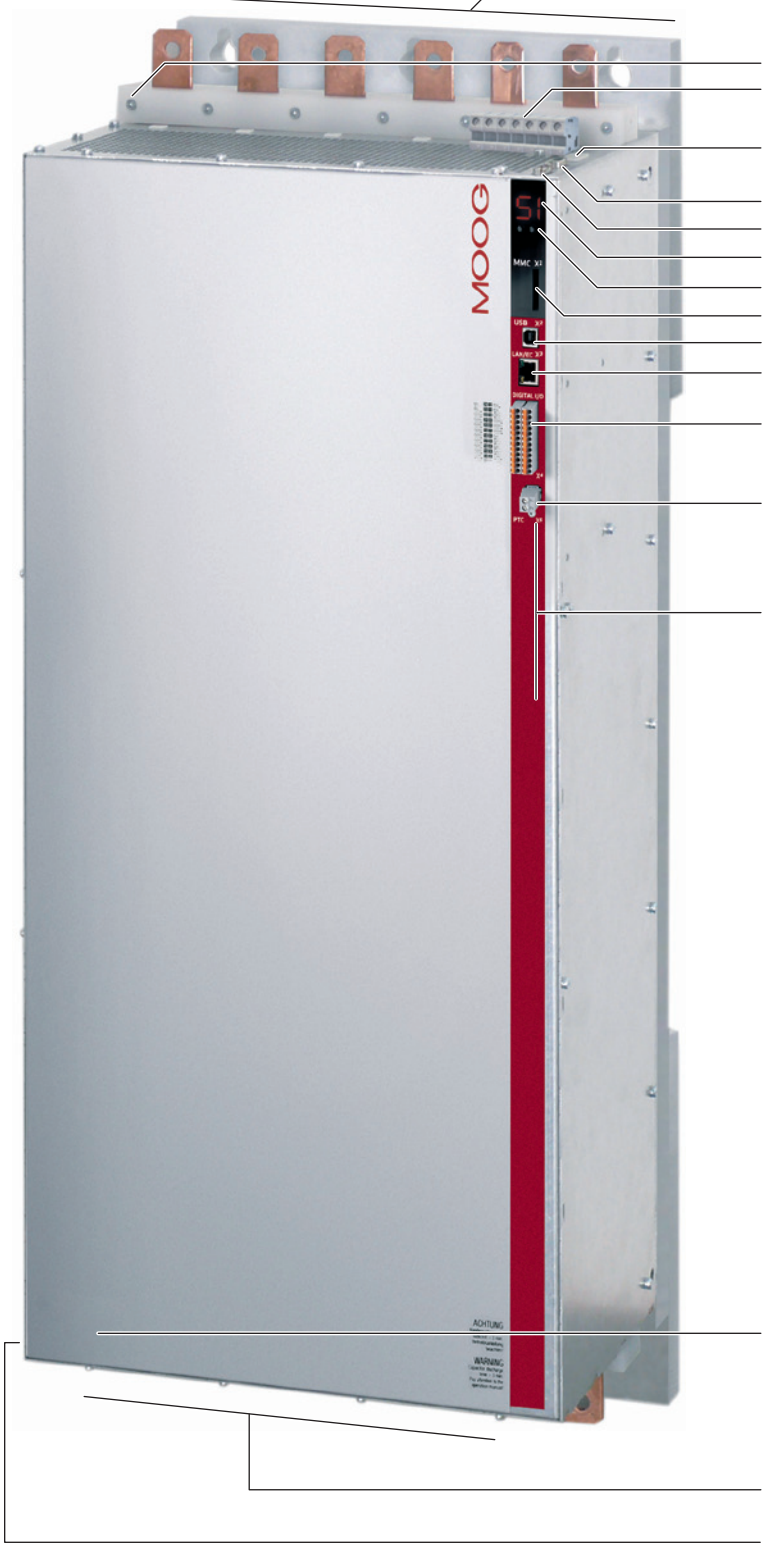
Option 1 – Communication module

Hardware name plate

Connection for motor, braking resistor, DC link
Software name plate

EQUIPMENT

Size 7 – Interface



AC power connection and DC link

Connection of precharge
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

Software name plate

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	Ambient temperature maximum	Rated current I_N [A_{eff}]	Peak current [A_{eff}]			
				At rotating field frequency rising in linear mode 0 to 5 Hz		For intermittent operation	For time [1]
	[kHz]	[°C (°F)]	at 1 x 230 V_{AC}	0 Hz	5 Hz	> 5 Hz	[s]
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	Ambient temperature	Rated current [A_{eff}]			Peak current [A_{eff}] [1]			
						At rotating field frequency rising in linear mode 0 to 5 Hz		For intermittent operation	For time [2]
	[kHz]	[°C (°F)]	at 3 x 230 V_{AC} at 3 x 400 V_{AC}	at 3 x 460 V_{AC}	at 3 x 480 V_{AC}	0 Hz	5 Hz	> 5 Hz	[s]
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_{AC} at maximum 70 % preload
2) Shutdown as per I^2t 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	Ambient temperature	Rated current [A_{eff}]			Peak current [A_{eff}] [1]			
						At rotating field frequency rising in linear mode 0 to 5 Hz		For intermittent operation	For time [2]
	[kHz]	[°C (°F)]	at 3 x 400 V_{AC}	at 3 x 460 V_{AC}	at 3 x 480 V_{AC}	0 Hz	5 Hz	> 5 Hz	[s]
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_{AC} at maximum 70 % preload
2) Shutdown as per I^2t 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	Ambient temperature	Rated current [A_{eff}]			Peak current [A_{eff}] [1]			
						At rotating field frequency rising in linear mode 0 to 5 Hz		For intermittent operation	For time [2]
	[kHz]	[°C (°F)]	At 3 x 400 V_{AC}	At 3 x 460 V_{AC}	At 3 x 480 V_{AC}	0 Hz	5 Hz	> 5 Hz	[s]
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								

1) When supplied with 400 V_{AC} at maximum 70 % preload
2) Shutdown as per I^2t 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	Ambient temperature	Rated current [A_{eff}]			Peak current [A_{eff}] [1]			
						At rotating field frequency rising in linear mode 0 to 5 Hz		For intermittent operation	For time [2]
	[kHz]	[°C (°F)]	At 3 x 400 V_{AC}	At 3 x 460 V_{AC}	At 3 x 480 V_{AC}	0 Hz	5 Hz	> 5 Hz	[s]
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_{AC} at maximum 70 % preload
2) Shutdown as per I^2t 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	Ambient temperature	Rated current [A_{eff}]			Peak current [A_{eff}] [1]			
						At rotating field frequency rising in linear mode 0 to 5 Hz		For intermittent operation	For time [2]
	[kHz]	[°C (°F)]	At 3 x 400 V_{AC}	At 3 x 460 V_{AC}	At 3 x 480 V_{AC}	0 Hz	5 Hz	> 5 Hz	[s]
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_{AC} at maximum 70 % preload
2) Shutdown as per I^2t characteristic

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

AMBIENT CONDITIONS

Ambient conditions	
Protection	IP20 except terminals (IP00)
Accident prevention regulations	According to local regulations (in Germany e.g. BGV A3)
Mounting height	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).
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

Climatic conditions			
In transit	As per EN 61800-2, IEC 60721-3-2 class 2K3 [1]		
	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 [2]		
	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 [3]		
	Temperature	Air-cooled	**Size 1** -10 to +45 °C (+14 to +113 °F) (4 kHz) -10 to +40 °C (+14 to +104 °F) (8/12/16 kHz)
			Size 2 to 4 -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)
			Size 5 to 6A -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)
		Liquid-cooled	**Size 2 to 4** -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)
			Size 5 to 6 -10 to +45 (+14 to +104 °F) (4/8/12/16 kHz), to +55 °C (+131 °F) with power reduction (2 % per °C/°F)
			Size 7 -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/m³
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/m³
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/m³
That means that the maximum values for temperature and relative air humidity stipulated in the table must not occur simultaneously

AMBIENT CONDITIONS

Mechanical conditions			
Vibration limit in transit	As per EN 61800-2, IEC 60721-3-2 class 2M1		
	Frequency [Hz]	**Amplitude [mm (in)]**	**Acceleration [m/s² (in/s²)]**
	2 ≤ f < 9	3.5 (0.14)	Not applicable
	9 ≤ f < 200	Not applicable	10 (393.70)
	200 ≤ 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 [1)]	As per EN 61800-2, IEC 60721-3-3 class 3M1		
	Frequency [Hz]	**Amplitude [mm (in)]**	**Acceleration [m/s ² (in/s²)]**
	2 ≤ f < 9	0.3 (0.01)	Not applicable
	9 ≤ 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 servo drive (Size 1 to 7) 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 servo drives 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 servo drive, 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 servo drives Sizes 1 to 5 are fitted with integral mains filters. For servo drives 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 servo drive is certified accordingto 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

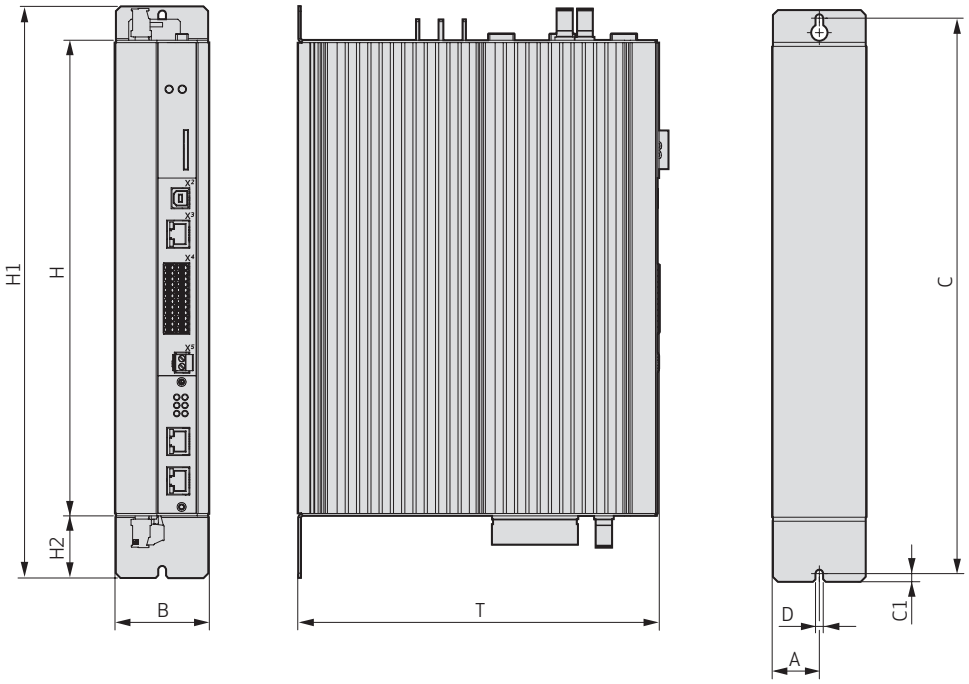
Ordering number	G392-004A	G392-004	G392-006
Output, motor side			
Voltage	3-phase U_{Mains}		
Rated current, effective (I_N) [1]	4 A	4 A [2]	6 A [2]
Peak current	Page 33	Page 34	
Rotating field frequency	0 to 400 Hz		
Switching frequency of power stage	4, 8, 12, 16 kHz (factory setting 8 kHz at +40 °C (+104 °F) cooling air temperature)		
Input, mains side			
Mains voltage (U_{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 [2]	4.2 kVA [2]
Current (with mains choke)	9.5 A [3]	4.2 A [2]	6.4 A [2]
Asymmetry of mains voltage	-	±3 % maximum	
Frequency	50/60 Hz ±10 %		
Power loss at I_N [1]	85 W	96 W [2]	122 W [2]
DC link			
DC link capacity	1,740 µF	400 µF	
Braking chopper switch-on-threshold	390 V_{DC}	650 V_{DC} [2]	
Minimum ohmic resistance of an externally installed braking resistor [4]	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_{AC} 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

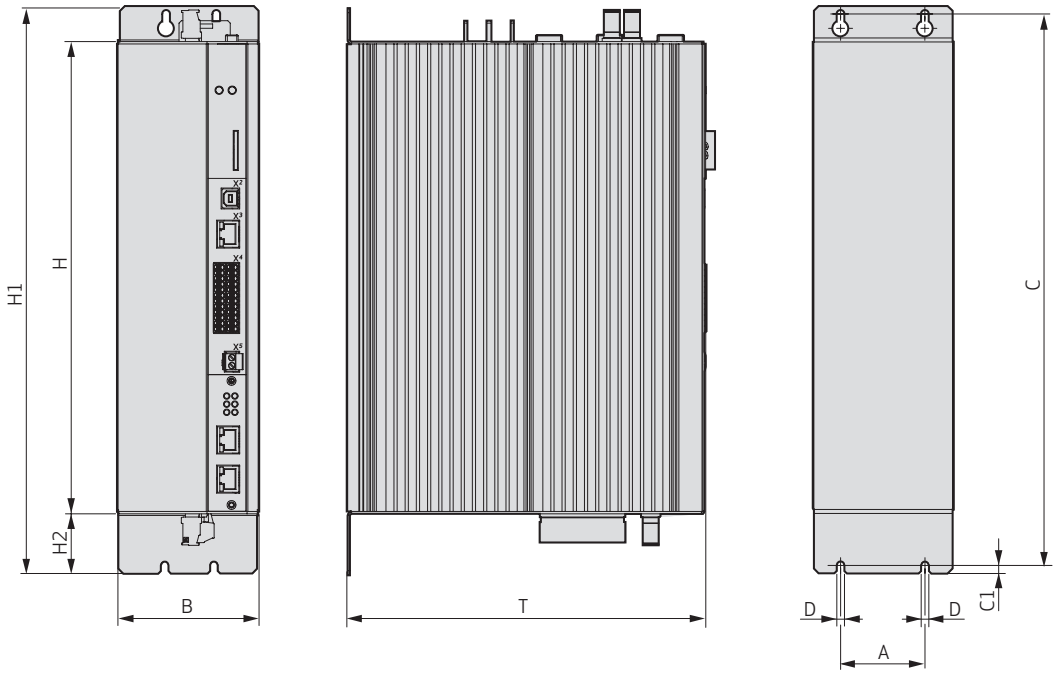
Ordering number	G392-008	G392-012
Output, motor side		
Voltage	3 -phase U_{Mains}	
Rated current, effective (I_N)	8 A [1]	12 A [1]
Peak current	Page 34	
Rotating field frequency	0 to 400 Hz	
Switching frequency of power stage	4/8/12/16 kHz (factory setting 8 kHz at +40 °C (+104 °F) cooling air temperature)	
Input, mains side		
Mains voltage (U_{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 [1]	8.8 kVA [1]
Current (with mains choke)	8.7 A [1]	13.1 A [1]
Asymmetry of mains voltage	±3 % maximum	
Frequency	50/60 Hz ±10 %	
Power loss at I_N [1]	175 W [1]	240 W [1]
DC link		
DC link capacity	725 µF	
Braking chopper switch-on-threshold	650 V_{DC} [1]	
Minimum ohmic resistance of an externally installed braking resistor [2]	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 [1]	

1) Data referred to mains voltage 3 x 400 V_{AC} 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 unhindered 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	ø 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

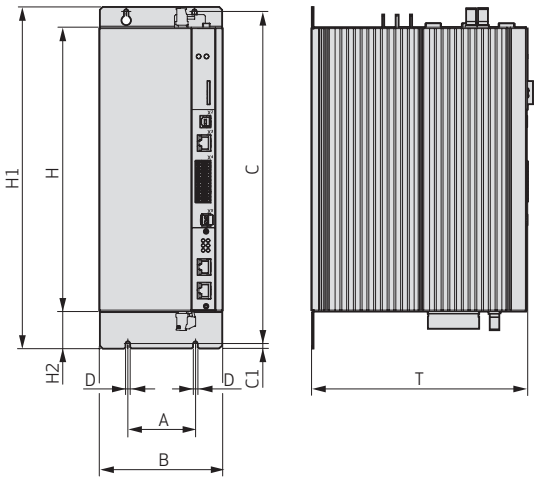
Ordering number	G392-016 Air-cooled	G395-016 Liquid-cooled	G392-020 Air-cooled	G395-020 Liquid-cooled
Output, motor side				
Voltage	3-phase U_{Mains}			
Rated current, effective (I_N)	16 A [1]		20 A [1]	
Peak current	Page 34			
Rotating field frequency	0 to 400 Hz			
Switching frequency of power stage	4/8/12/16 kHz (factory setting 8 kHz at +40 °C (+104 °F) cooling air temperature)			
Input, mains side				
Mains voltage (U_{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 [1]		13.9 kVA [1]	
Current (with mains choke)	17.3 A [1]		21.6 A [1]	
Asymmetry of mains voltage	±3 % maximum			
Frequency	50/60 Hz ±10 %			
Power loss at I_N	330 W [1]		400 W [1]	
DC link				
DC link capacity	1,230 µF			
Braking chopper switch-on-threshold	650 V_{DC} [1]			
Minimum ohmic resistance of an externally installed braking resistor [2]	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 [1]			

1) Data referred to mains voltage 3 x 400 V_{AC} 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

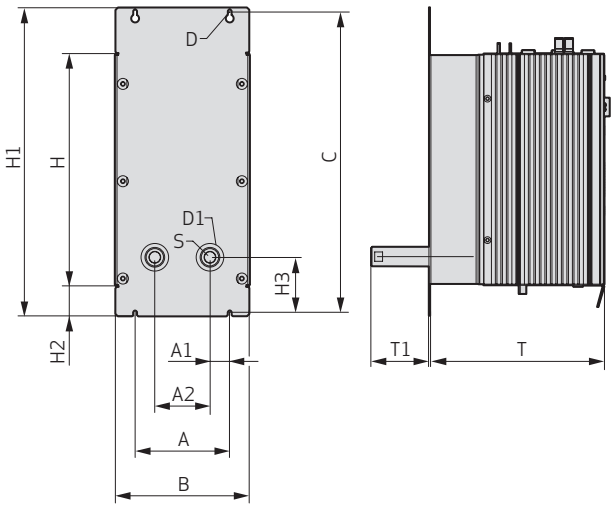
Servo drive	G392-016 Air-cooled	G395-016 Liquid-cooled	G392-020 Air-cooled	G395-020 Liquid-cooled
Cooling method	Air-cooled or liquid-cooled			
Protection	IP20 except terminals (IP00)			
Cooling air temperature	+45 °C (+113 °F) (at 4 kHz power stage switching frequency)			
Weight	6.5 kg (14.33 lb)			
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	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 (1.51/2.95)
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

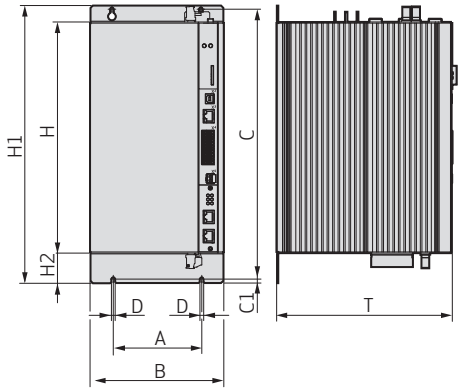
Ordering number	G392-024 Air-cooled	G395-024 Liquid-cooled	G392-032 Air-cooled	G395-032 Liquid-cooled
Output, motor side				
Voltage	3-phase U_{Mains}			
Rated current, effective (I_N)	24 A [1]		32 A [1]	
Peak current	Page 34			
Rotating field frequency	0 to 400 Hz			
Switching frequency of power stage	4/8/12/16 kHz (factory setting 8 kHz at +40 °C (+104 °F) cooling air temperature)			
Input, mains side				
Mains voltage (U_{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 [1]		22.2 kVA [1]	
Current (with mains choke)	26.2 A [1]		34.9 A [1]	
Asymmetry of mains voltage	±3 % maximum			
Frequency	50/60 Hz ±10 %			
Power loss at I_N [1]	475 W [1]		515 W [1]	
DC link				
DC link capacity	2,000 µF			
Braking chopper switch-on-threshold	650 V_{DC} [1]			
Minimum ohmic resistance of an externally installed braking resistor [2]	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 [1]			

1) Data referred to mains voltage 3 x 400 V_{AC} 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

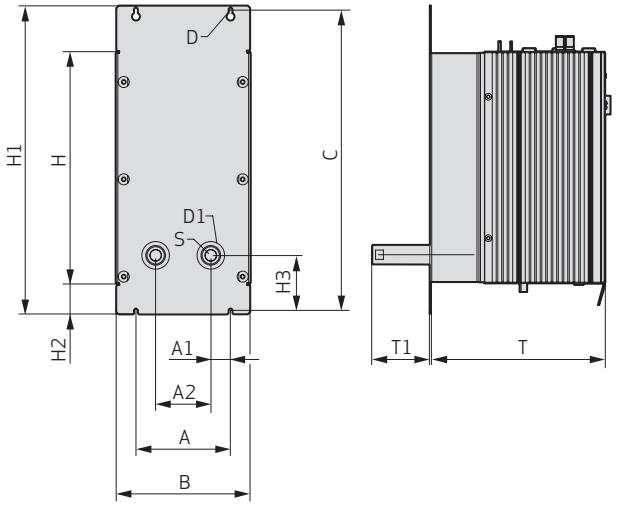
Servo drive	G392-024 Air-cooled	G395-024 Liquid-cooled	G392-032 Air-cooled	G395-032 Liquid-cooled
Cooling method	Air-cooled or liquid-cooled			
Protection	IP20 except terminals (IP00)			
Cooling air temperature	+45 °C (+113 °F) (at 4 kHz power stage switching frequency)			
Weight	7.48 kg (16,49 lb)			
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

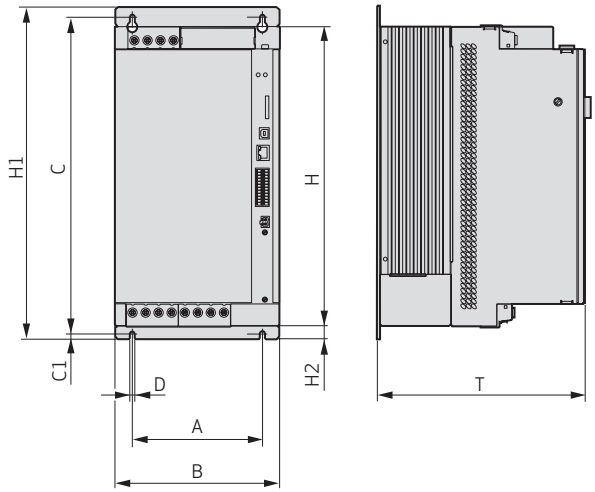
Ordering number	G392-045 Air-cooled	G395-053 Liquid-cooled	G392-060 Air-cooled	G395-070 Liquid-cooled	G392-072 Air-cooled	G395-084 Liquid-cooled
Output, motor side						
Voltage	3-phase U_{Mains}					
Rated current, effective I_N	45 A [1]	53 A [1]	60 A [1]	70 A [1]	72 A [1]	84 A [1]
Peak current	Page 36 (Air cooling) 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)					
Input, mains side						
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 [1]	37 kVA [1]	42 kVA [1]	50 kVA [1]	50 kVA [1]	58 kVA [1]
Current (with mains choke)	45 A [1]	53 A [1]	60 A [1]	70 A [1]	72 A [1]	84 A [1]
Asymmetry of mains voltage	±3 % maximum					
Frequency	50/60 Hz ±10 %					
Power loss at I_N	610 W [1]	690 W [1]	830 W [1]	930 W [1]	1,010 W [1]	1,130 W [1]
DC link						
DC link capacity	430 µF		900 µF			
Braking chopper switch-on-threshold	820 V_{DC}					
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	- [2]	20 Ω	- [2]	10 Ω	- [2]	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_{AC} and 8 kHz switching frequency 2) Not with internal braking resistor available

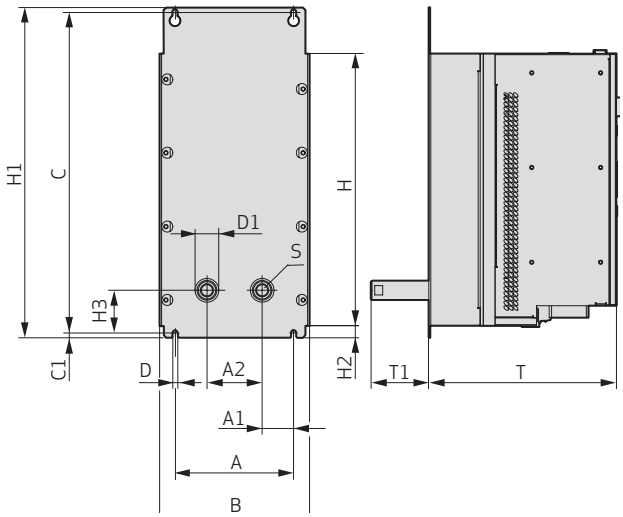
Servo drive	G392-045	G395-053	G392-060	G395-070	G392-072	G395-084
Cooling method	Air-cooled or liquid-cooled					
Protection	IP20 except terminals (IP00)					
Cooling air temperature	+45 °C (+113 °F) (at 4 kHz power stage switching frequency)					
Weight	13 kg/16.5 kg (28.66 lb/36.38 lb)					
Mounting type	Vertical mounting with unhindered 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)	ø 5.6/7 (0.22/0.28)
D1 (hole for pipe socket	ø 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

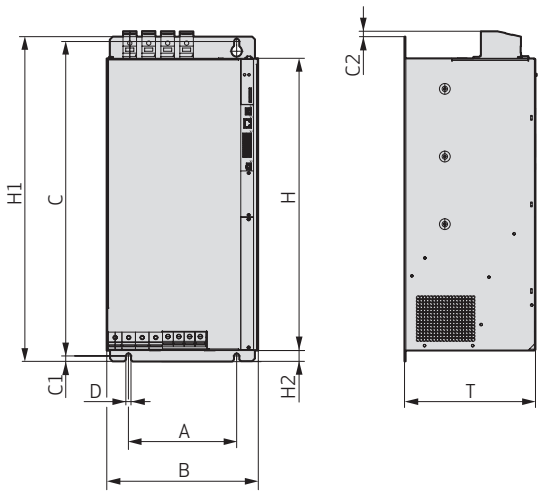
Ordering number	G392-090 Air-cooled	G395-110 Liquid-cooled	G392-110 Air-cooled	G395-143 Liquid-cooled
Output, motor side				
Voltage	3-phase U_{Mains}			
Rated current, effective (I_N)	90 A [1]	110 A [1]	110 A [1]	143 A [1]
Peak current	Page 36 (air-cooled) and page 37 (liquid-cooled)			
Rotating field 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)			
Input, mains side				
Mains voltage (U_{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 [1]	76 kVA [1]	76 kVA [1]	99 kVA [1]
Current (with mains choke)	90 A [1]	110 A [1]	110 A [1]	143 A [1]
Asymmetry of mains voltage	±3 % maximum			
Frequency	50/60 Hz ±10 %			
Power loss at I_N	1,300 W [1]	1,500 W [1]	1,600 W [1]	1,940 W [1]
DC link				
DC link capacity	1,060 µF	2,120 µF	2,120 µF	
Braking chopper switch-on-threshold	820 V_{DC}			
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	- [2]	7.5 Ω	- [2]	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_{AC} and 8 kHz switching frequency 2) Not with internal braking resistor available

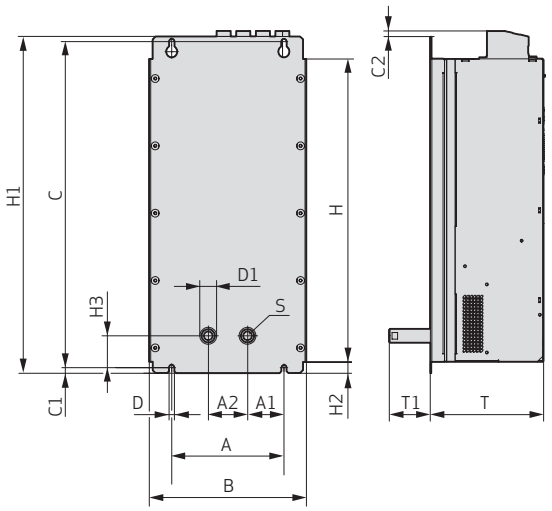
Servo drive	G392-090	G395-110	G392-110	G395-143
Cooling method	Air-cooled or liquid-cooled			
Protection	IP20 except terminals (IP00)			
Cooling air temperature	+45 °C (+113 °F) (at 4 kHz Power stage switching frequency)			
Weight (air/liquid-cooled)	28 kg/31.5 kg (61.73 lb/69.44 lb)			
Mounting type	Vertical mounting with unhindered 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

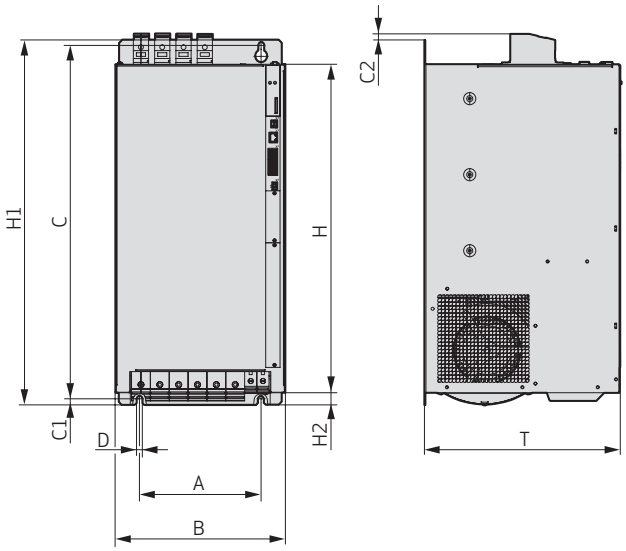
Ordering number	G392-143 Air-cooled	G395-170 Liquid-cooled	G392-170 Air-cooled	G395-210 Liquid-cooled
Output, motor side				
Voltage	3-phase U_{Mains}			
Rated current, effective (I_N)	143 A [1]	170 A [1]	170 A [1]	210 A [1]
Peak current	Page 36 (air-cooled) and Page 37 (liquid-cooled)			
Rotating field 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)			
Input, mains side				
Mains voltage (U_{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 [1]	118 kVA [1]	118 kVA [1]	128 kVA [1]
Current (with mains choke)	143 A [1]	170 A [1]	170 A [1]	185 A [1]
Asymmetry of mains voltage	±3 % maximum			
Frequency	50/60 Hz ±10 %			
Power loss at I_N	2,100 W [1]	2,380 W [1]	2,500 W [1]	2,650 W [1]
DC link				
DC link capacity	3,180 µF	4,240 µF	4,240 µF	
Braking chopper switch-on-threshold	820 V_{DC}			
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	- [2]	5 Ω	- [2]	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_{AC} and 8 kHz switching frequency 2) Not with internal braking resistor available

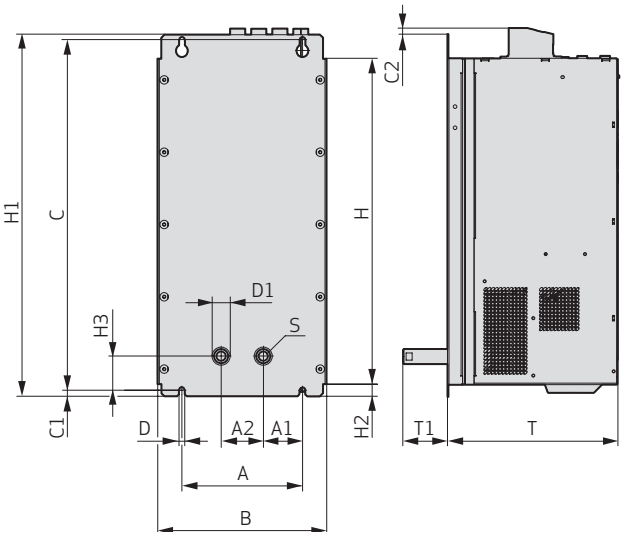
Servo drive	G392-143	G395-170	G392-170	G395-210
Cooling method	Air-cooled or liquid-cooled			
Protection	IP20 except terminals (IP00)			
Cooling air temperature	+45°C (+113 °F) (at 4 kHz power stage switching frequency)			
Weight (air/liquid-cooled)	32 kg/41.1 kg (70.55 lb/90.61 lb)			
Mounting type	Vertical mounting with unhindered 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

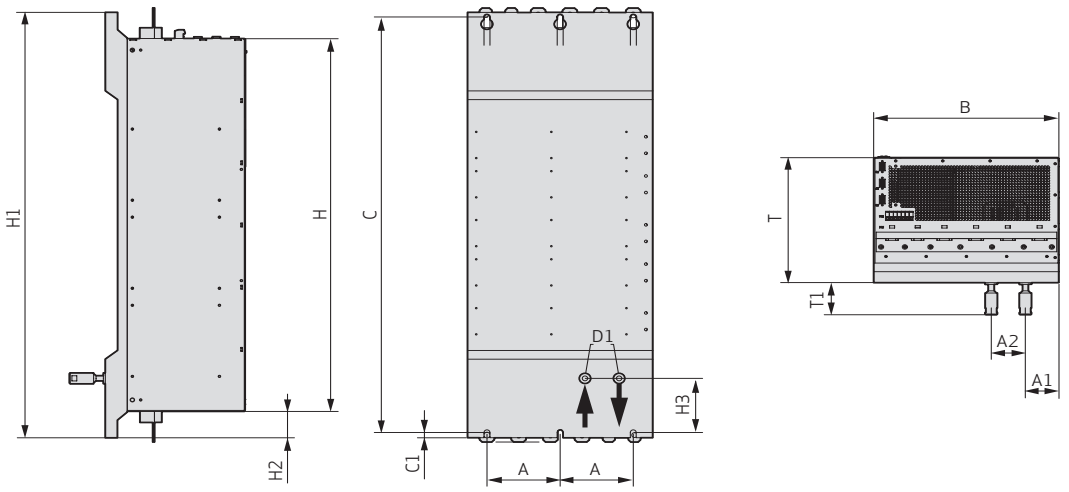
Ordering number	**G395-250**	**G395-325**	**G395-450**
Output, motor side			
Voltage	3-phase U_{Mains}		
Rated current, effective (I_N)	250 A [1)]	325 A [1)]	450 A [1)]
Peak current	Page 38		
Rotating field frequency	0 to 400 Hz		
Switching frequency of power stage	2, 4 kHz (factory setting 2 kHz at +40 °C (+104 °F))		
Input, mains side			
Mains voltage (U_{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 [1)]	225 kVA [1)]	310 kVA [1)]
Current (with mains choke)	250 A [1)]	325 A [1)]	450 A [1)]
Asymmetry of mains voltage	±3 % maximum		
Frequency	50/60 Hz ±10 %		
Power loss at I_N	3,960 W [1)]	4,800 W [1)]	6,750 W [1)]
DC link			
DC link capacity	3,600 µF	5,400 µF	7,200 µF
Braking chopper switch-on-threshold	820 V_{DC}		
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_{AC} 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	ø 12 (0.47)
D1 (hole for pipe socket)	ø 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 [1] CB09935-001 [1]	CB09935-001 [1] CB09936-001 [1]

1) Depends on the effective power

OVERVIEW

Type	Page	Compact version Sizes C2 to C4	Standard version Sizes 1 to 7
Fieldbus module for EtherCAT	53	•	•
Fieldbus module for CANopen	54	•	•
Fieldbus module for Profibus-DP	55	•	•
Fieldbus module for SERCOS II	56	•	•
Fieldbus module for CANopen plus 2 analog outputs	57	–	•
Fieldbus module for SERCOS III	58	•	•
Fieldbus module for VARAN	59	–	•
Fieldbus module for Profinet IRT	60	–	•

Note: The communication modules 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 Fielbus system. It is considered 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	≥125 µs
Synchronization jitter	≤1 µs (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 ±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.

Type	**Profibus**
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

Note: Only available built-in ex factory

SERCOS II

Short description

Communications interface for Profibus-DP.

Type	SERCOS II
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

Note: Only available built-in ex factory
SERCOS III is also available as communication module. For details see page 58

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 ±20 % (as per. IEC 61131-2)

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

Order code	G39x	-	xxx	-	5xx	-	xxx

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

Note: Only available built-in ex factory
SERCOS II is also available as communication module. For details see page 56

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 µs to 65 ms (multiples of 125 µs 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 µs to 65 ms (multiples of 500 µs programmable)
Network topology	Line
Connection	RJ45 shielded
Cable type	CAT5

Order code	G39x	-	xxx	-	8xx	-	xxx

Note: Only available built-in ex factory

OVERVIEW

Technology module

Type	Page	Compact version Sizes C2 to C4	Standard version Sizes 1 to 7
Interface for Second Sin/Cos encoder	62	•	•
Interface for TTL encoder simulation/TTL master encoder	63	•	•
Interface for TwinSync communication	64	–	•
Interface for TTL encoder with commutation signals	65	•	–
Interface for SSI encoder simulation	66	–	•

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_{ss} + 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

Note: Only available built-in ex factory

TwinSync connecting

CB36987	-	xxx	-	yyy [1]

- TwinSync connection
- Connector type
- Cable length (m)

Technical data	**CB36987-xxx-yyy [1]**
Connections	2 x SUB-D 9-pin mole
Cross-section	4 x 2 x 0.25 mm² + 2 x 0.50 mm² (4 x 2 x 0.0004 in² + 2 x 0.0008 in²)

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

Note: Only available built-in ex factory

SSI ENCODER SIMULATION

Short description

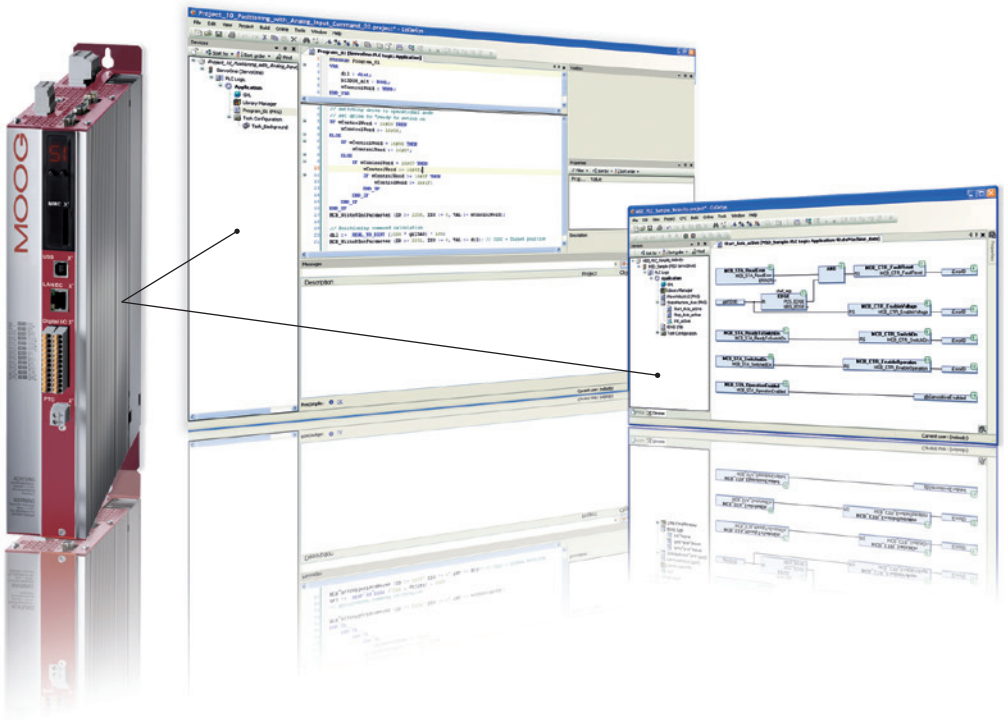
This option permits SSI encoder simulation for output of position information. The length and the protocol for SSI data transfer can be flexibly parameterized. Synchronization of the control cycle to the external SSI clock signal is possible as an option.

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

Note: Only available built-in ex factory

OVERVIEW



Type	Page	Compact Version Sizes C2 to C4	Standard Version Sizes 1 to 7
MSD PLC function package for programming in IEC 61131	68	•	•

MSD PLC FUNCTION PACKAGE FOR PROGRAMMING IN IEC 61131

Short description

The MSD PLC, programmable in IEC 61131, shares the microcontroller platform of the PSA 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	• Continuous Function Chart • Ladder Diagram • Function Block Diagram • Structured Text • Instruction List • Sequential Function Chart
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
PC User Software Moog DriveAdministrator	Full version	70
Selection of motor cables	C08336-xxx-yyy CB05708-xxx-yyy C08733-xxx-yyy B47916-xxx-yyy CA98676-xxx-yyy	71
Selection of encoder cables	C08335-011-yyy CA58876-002-yyy CA58877-002-yyy	72
Mains chokes	CA68926-001 CA55830-001 to CA55843-001 CA96898-001 to CA96900-001 CB09045-001	74
Braking resistors	CB09047-001 to CB09049-001 CA59737-001 to CA59744-001 CB36901-001 to CB36904-001 CB09050-001 CB53860-001	78
Mains filters - Sizes C2 to C4	CB09937-001 to CB09940-001 CB09942-001	82
Mains filters - Sizes 1 to 7	CA71184-001 to CA71190-001 CB09932-001 to CB09936-001	85
NTC Adapter	CA72290-001	89
Liquid cooling connection set	CB37132-001	90
Spare connector kits	CA65115-001 CA70545-001 to CA70548-001	91

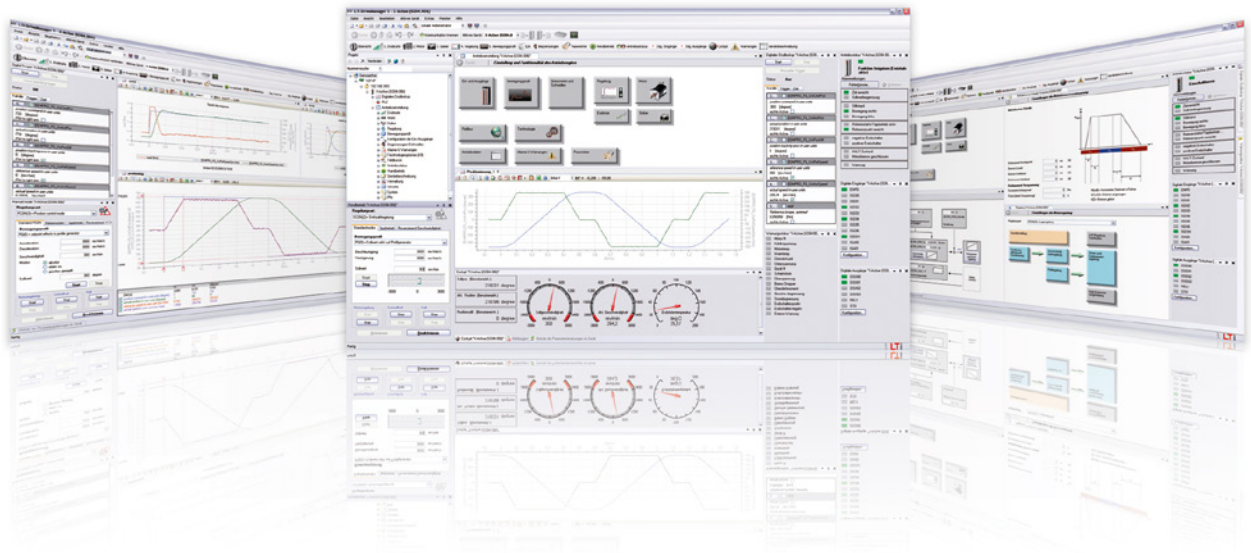
PC USER SOFTWARE Moog DriveAdministrator

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 dri ves
	Operator control and diagnosis with cockpit, 6-channel oscilloscope, and others
	Fast serial commissioning with a configurable commissioning file (containing firmware, parameters, MSD PLC program)
	Project management

Parameterization Software



SELECTION OF MOTOR CABLES

Ordering code

C08336	-	xxx	-	yyy [1]

- Ready made-up motor cable
- Configuration option
- Cable length (m)

Technical data	**C08336-xxx-yyy [1] [2]**		**CB05708-xxx-yyy [1] [2]**		**C08733-xxx-yyy [1] [2]**		**B47916-xxx-yyy [1] [2]**		**CA98676-xxx-yyy [1] [2]**	
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^2 + 2 x 1 mm^2 (4 x 0.0024 in^2 + 2 x 0.0016 in^2)		4 x 4 mm^2 + 2 x 1,5 mm^2 (4 x 0.0062 in^2 + 2 x 0.0023 in^2)		4 x 6 mm^2 + 2 x 1 mm^2 (4 x 0.0093 in^2 + 2 x 0.0015 in^2)		4 x 10 mm^2 + 2 x 1.5 mm^2 (4 x 0.0155 in^2 + 2 x 0.0023 in^2)		4 x 16 mm^2 + 2 x 1.5 mm^2 (4 x 0.0248 in^2 + 2 x 0.0023 in^2)	
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

CO8335	-	011	-	yyy [1]

- Ready made-up encoder cable
  - Resolver cable
  - Encoder cable SSI, EnDat
  - Encoder cable Hiperface®
- Version
- Cable length (m)

Technical data	**CO8335-011-yyy [1]**	**CA58876-002-yyy [1]**	**CA58877-002-yyy [1]**
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

	CO8335-011-yyy [1]	**CA58876-002-yyy** [1]	**CA58877-002-yyy** [1]
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 [1]	3 x 460 V, -25 % +10 %, 50/60 Hz [1]
Overload factor	1.8 x I_N for 40 s	2.0 x I_N 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_K 4 % (corresponding to 9.2 V at 230 V)	U_K 4 % (corresponding to 9.2 V at 400 V) applies to mains chokes with I_N = 4.0 A to 32 A [2] U_K 2 % (corresponding to 4.6 V at 400 V) applies to mains chokes with I_N = 45 A to 450 A [3]
Permissible contamination	P2 as per EN 61558-1	
Thermal configuration	$I_{eff} \leq I_N$	
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

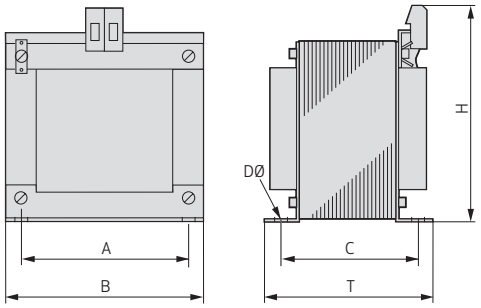
Note: For recommended combinations of controllers and mains chokes refer to the relevant controller catalog page

MAINS CHOKES

Single-phase mains chokes

Ordering number	Rated current [A]	U_k [%]	Power loss tot. [W]	Inductance [mH]	Weight [kg (lb)]	Connection [mm² (in²)]
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

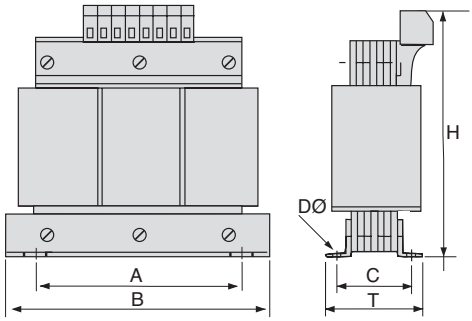
Ordering number	Rated current [A]	U_k [%]	Power loss tot. [W]	Inductance [mH]	Weight [kg (lb)]	Connection [mm² (in²)]
CA55830-001	4.2	4	20	7	2.5 (5.51)	4 (0.006)
CA55831-001	6	4	25	4.88	2.5 (5.51)	4 (0.006)
CA55832-001	8	4	25	3.66	2.5 (5.51)	4 (0.006)
CA55833-001	14	4	45	2.09	4 (8.82)	4 (0.006)
CA55834-001	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 x M10

MAINS CHOKES

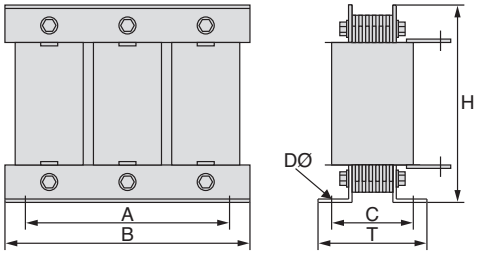
Three-phase mains chokes

Dimensional drawings

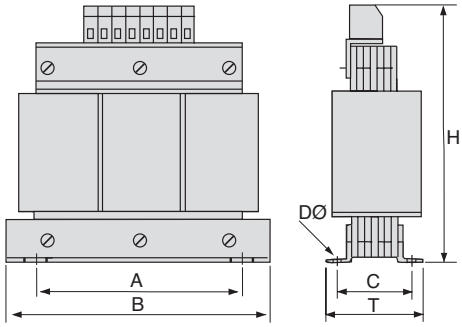
CA55830-001 to CA55838-001



CA96898-001 to CA96900-001, CB09045-001



CA55839-001 to CA55843-001

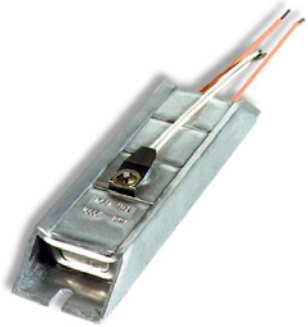


Dimensions [mm(in)]	CA68930-001	CA55831-001	CA55832-001	CA55833-001	CA55834-001	CA55835-001
B (width)	125 (4.92)			155 (6.10)		
H (height)	130 (5.12)			160 (6.30)	160 (6.30)	170 (6.69)
T (depth)	75 (2.95)			80 (3.15)	80 (3.15)	120 (4.72)
A	100 (3.94)			130 (5.12)		
C	55 (2.17)			59 (2.32)	59 (2.32)	72 (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_{DC}				
High-voltage strength	4,000 V_{DC}				
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)	

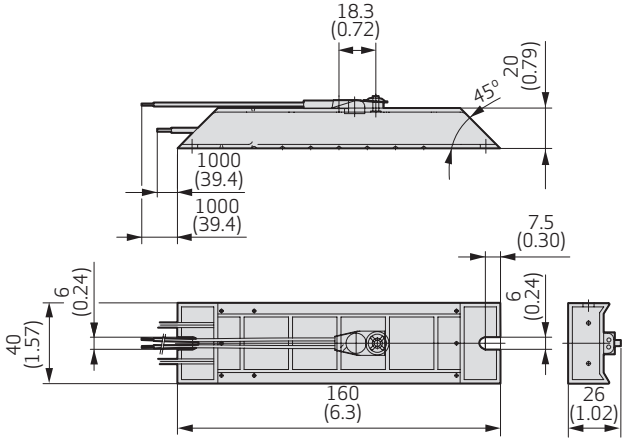
Note: For recommended combinations of drives and braking resistors refer to the relevant drives catalog page

BRAKING RESISTORS

Ordering number	Continuous power [1]	Resistance	Peak power [W]			Protection	Connection		Dia-gram
							Resistance	Bimetallic protector	
	[W]	Ω ±10 %	390 V_{DC}	650 V_{DC}	750 V_{DC}				
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

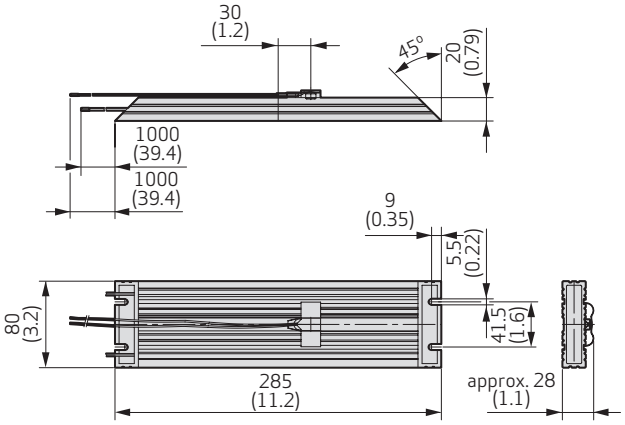
1) At cycle times of maximum 150 s the required rated continuous power can be calculated according to the following formula: Rated continuous power (W) = maximum pulse duration (s) x peak power (W) / cycle time (s)

Dimensional braking resistors, A1

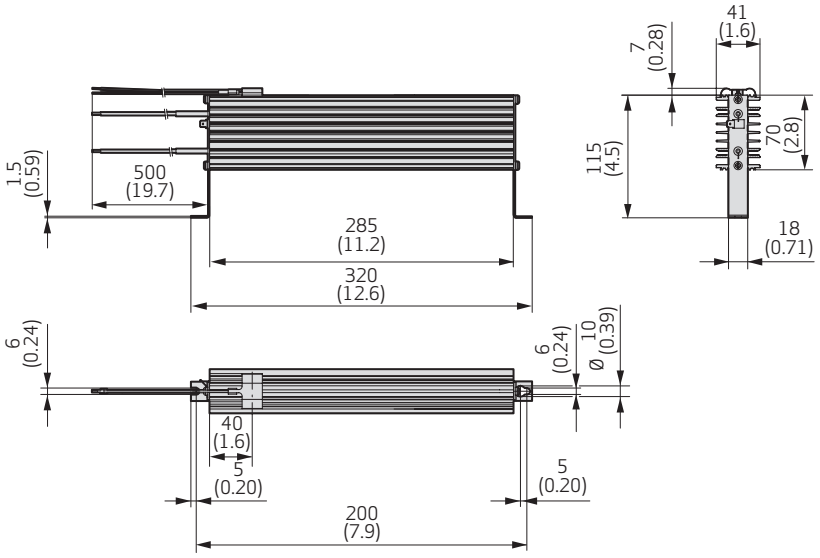


BRAKING RESISTORS

Dimensional braking resistors, A2

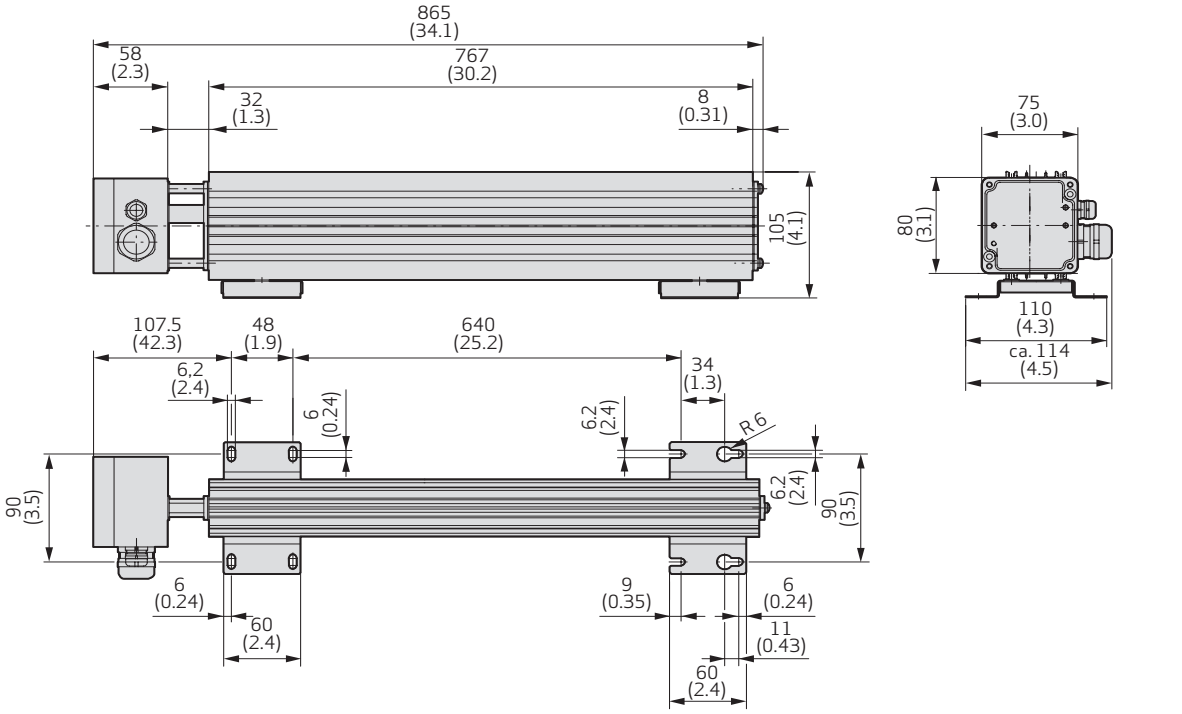


Dimensional braking resistors, A3

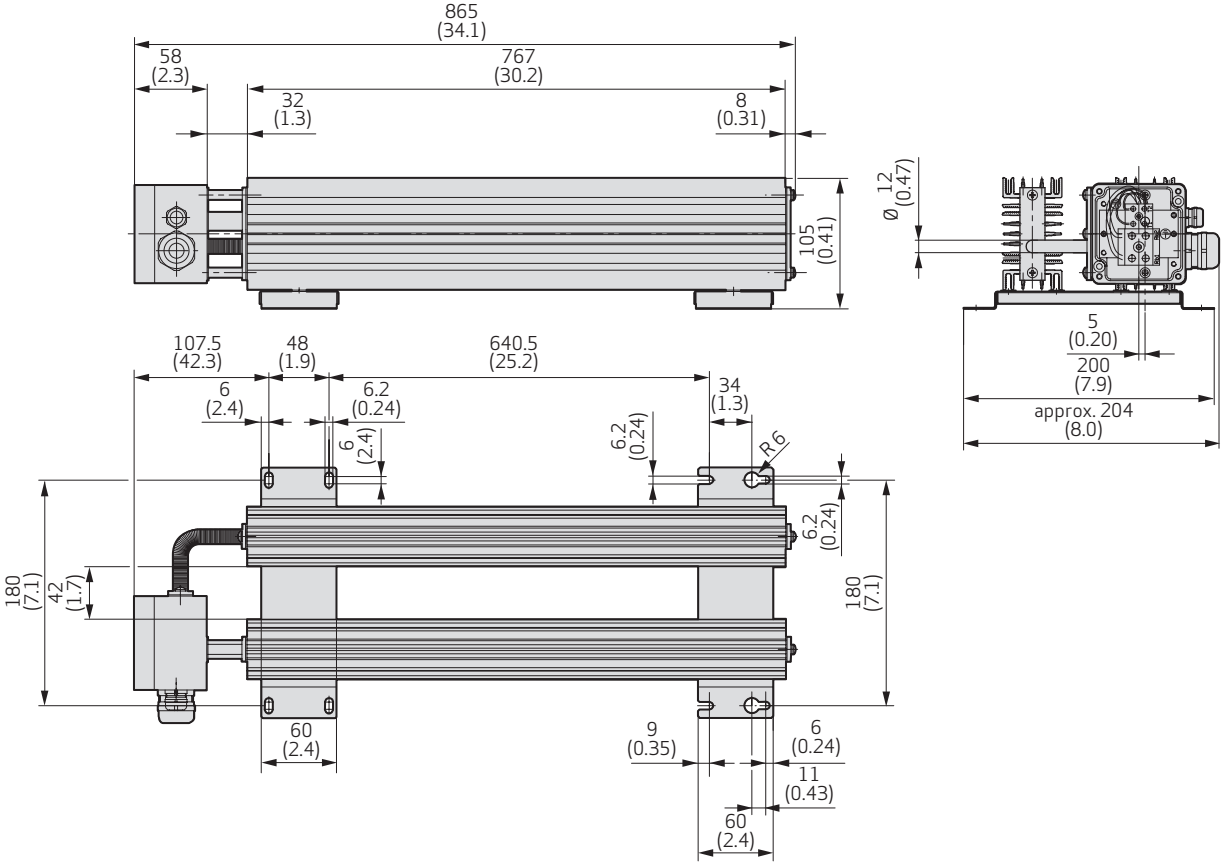


BRAKING RESISTORS

Dimensional braking resistors, A4



Dimensional braking resistors, A5



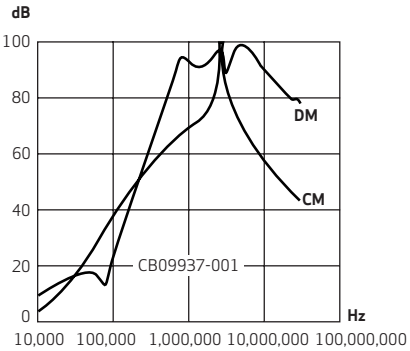
MAINS FILTERS - SIZES C2, C3, C4

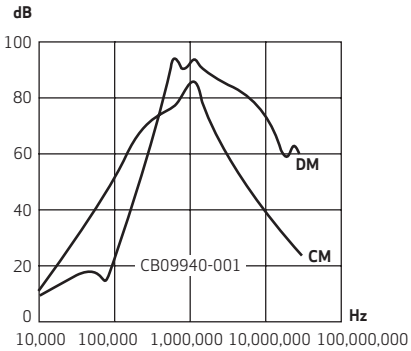
CB09939-001

Ambient conditions	CB09937-001 to CB09939-001	CB09940-001 and CB09942-001
Rated voltage	1 x 230 V_{AC} +10 % at 50/60 Hz	3 x 480 V_{AC} +10 % at 50/60 Hz
Overload	2 for 10 s, repeatable after 6 min [1]	
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 metallically 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 1)	Touch current 2) [mA]		Weight
		[A]	[W]	[mA]	N	F	[kg (lb)]
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 1)	Touch current 2) [mA]		Weight
		[A]	[W]	[mA]	N	F	[kg (lb)]
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

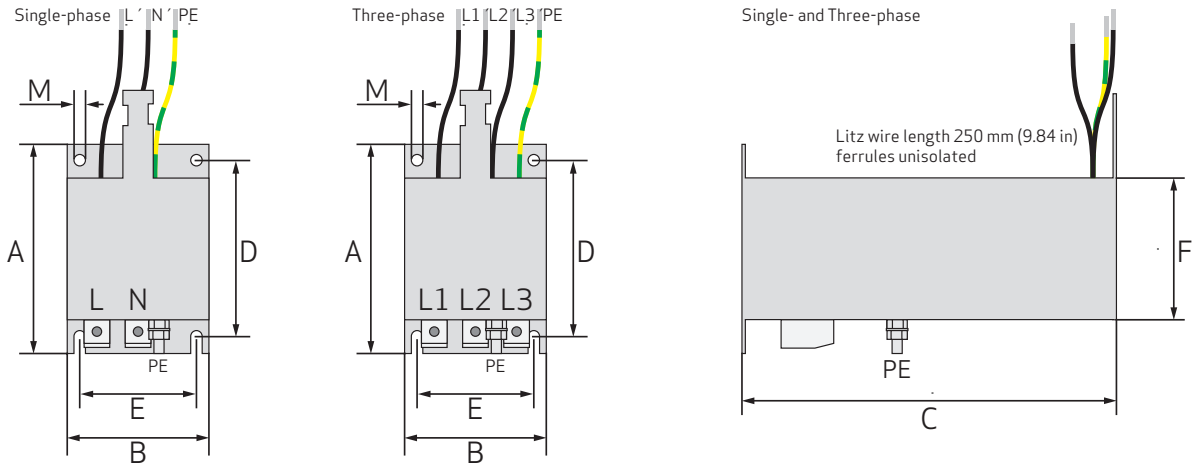
Single-phase mains filters

Ordering number	Dimensions [mm (in)]							PE	Input		Output Wire cross section
	A	B	C	D	E	F	M		Clamping area [mm² (in²)]	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 [mm² (in²)]	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

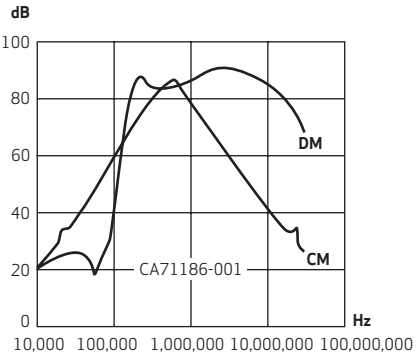


MAINS FILTERS - SIZES 1 TO 7

CA71190-001

Ambient conditions	**CB09937-001 to CB09939-001**
Rated voltage	3 x 480 V_{AC} +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	Overload [1]	Power loss	Leakage current [2]	Touch current [3] [mA]		Weight
	[A]	[A]	[W]	[mA]	N	F	[kg (lb)]
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 metallically 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	Overload [4]	Power loss	Leakage current [5]	Touch current [6] [mA]		Weight
	[A]	[A]	[W]	[mA]	N	F	[kg (lb)]
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)

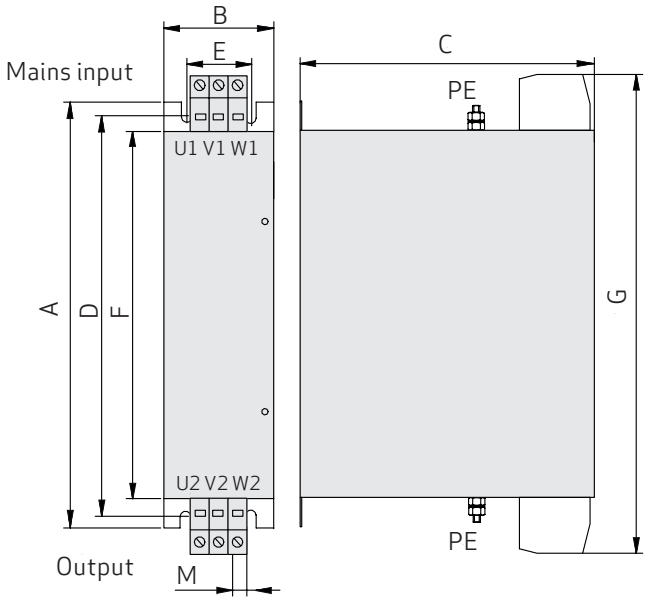
4) For 60 s, repeatable after 30 min; precondition: Mains filter Type of installation vertically on metallically bright base plate
5) Effective value of leakage current to EN 60939 (2009) at 50 Hz and rated voltage with 2 % asymmetry. The leakage current may increase further due to the suppressed device
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 [mm² (in²)]	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)	ø 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)	ø 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)	ø 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)	ø 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)	ø 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)	ø 7.0 (0.28)	M8	16 to 50 (0.0248 to 0.0775)	15 to 20

Dimensional drawings

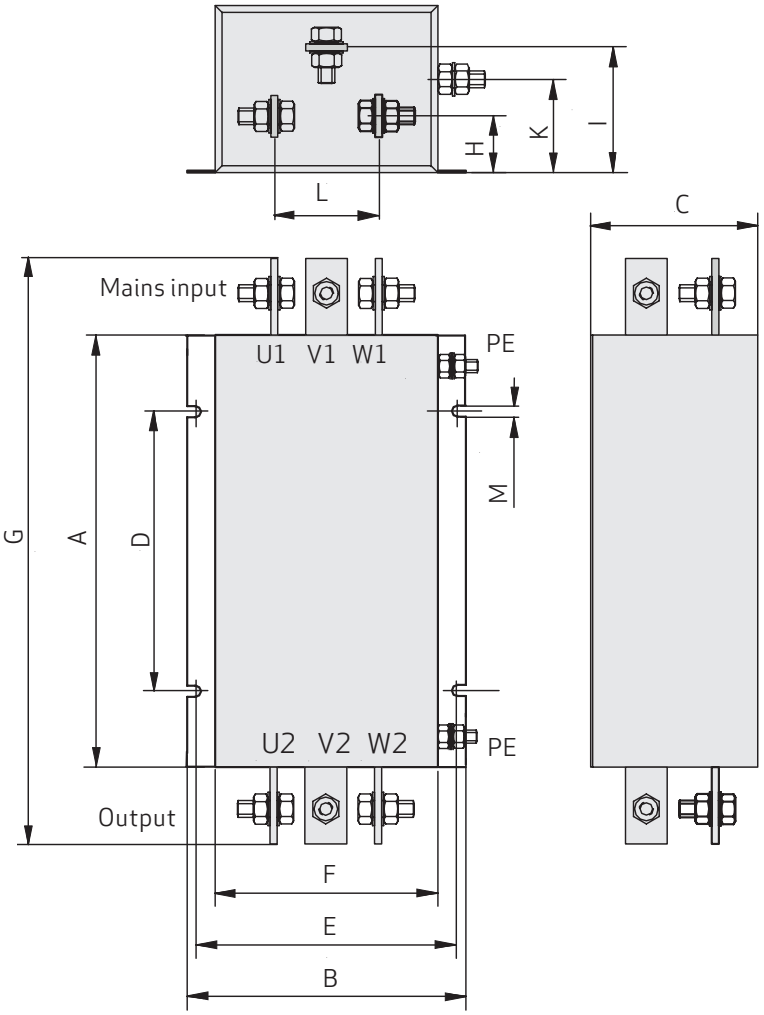


MAINS FILTERS - SIZES 1 TO 7

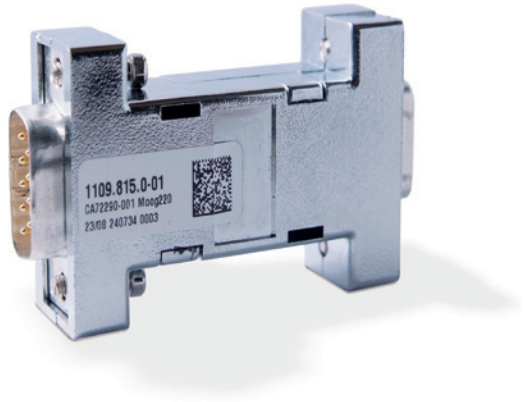
Three-phase mains filters

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

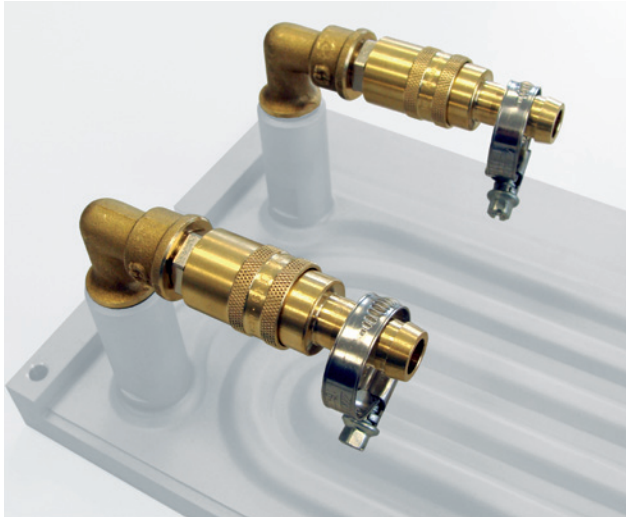


CA72290 -001

Short description

The NTC Adapter is used for motors with a 220 k Ω 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 d rive devices

SPARE CONNECTOR KITS

Short description

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^{3} - 7 pole 1 x mating connector for x^{9} - 2 pole 1 x mating connector for x^{10} - 2 pole
Servo drive control connector kit (G392/G395 Size1 to Size4)	CA70545-001	2 x mating connector for x^{4} - 12 pole 1 x mating connector for x^{5} - 2 pole 1 x mating connector for x^{9} - 2 pole 1 x mating connector for x^{10} - 2 pole 1 x mating connector for x^{13} - 2 pole
Servo drive power connector kit (G392/G395 Size1 + Size2 with 400 V)	CA70546-001	1 x mating connector for x^{11} - 4 pole 1 x mating connector for x^{12} - 7 pole
Servo drive power connector kit (G392/G395 Size1 + Size2 with 230 V)	CB59705-001	1 x mating connector for x^{11} - 4 pole 1 x mating connector for x^{12} - 7 pole
Servo drive power connector kit (G392/G395 Size3 + Size4 with 400 V)	CA70547-001	1 x mating connector for x^{11} - 4 pole 1 x mating connector for x^{12} - 7 pole
Servo drive control connector kit (G392/G395 Size5 to Size7)	CB59706-001	2 x mating connector for x^{4} - 12 pole 1 x mating connector for x^{5} - 2 pole 1 x mating connector for x^{9} - 2 pole 1 x mating connector for x^{10} - 2 pole 1 x mating connector for x^{20} - 3 pole
Servo drive control connector kit (G392 Size7)	CB59708-001	2 x mating connector for x^{4} - 12 pole 1 x mating connector for x^{5} - 2 pole
Servo drive shield clamps (G392/G395 Size1 to Size4)	CB59709-001	
Servo drive connector kit CANopen (G392/G395)	CB59710-001	2 x mating connector for x^{32} - 5 pole
Servo drive connector kit CANopen + 2 analog outputs (G392/G395)	CA70548-001	2 x mating connector for x^{32} - 5 pole 1 x mating connector for x^{33} - 2 pole 1 x mating connector for x^{33} - 2 pole
Servo drive Compact control connector kit (C2 to C4)	CB40512-001	2 x mating connector for x^{4} - 12 pole 1 x mating connector for x^{5} - 2 pole 1 x mating connector for x^{13} - 2 pole 1 x mating connector for x^{13} - 2 pole
Servo drive Compact power connector kit (C2 + C3)	CB40513-001	1 x mating connector for x^{1} - 7 pole 1 x mating connector for x^{2} - 2 pole 1 x mating connector for x^{3} - 4 pole
Servo drive Compact power connector kit (C4)	CB40515-001	1 x mating connector for x^{1} - 7 pole 1 x mating connector for x^{2} - 2 pole 1 x mating connector for x^{3} - 4 pole
Servo drive Compact screaning clamps	CB40514-001	

ABOUT MOOG

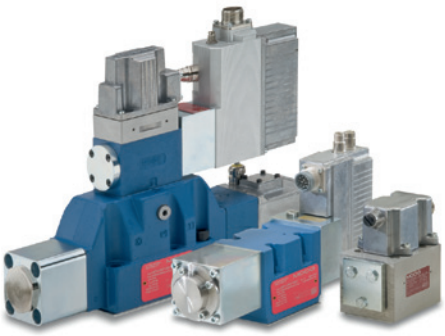
Moog Inc. is a worldwide designer, manufacturer and integrator of precision control components and systems. Moog's Industrial Group designs and manufactures high performance motion control solutions combining electric, hydraulic, and hybrid technologies with expert consultative support in a range of 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 2.47billion.

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.

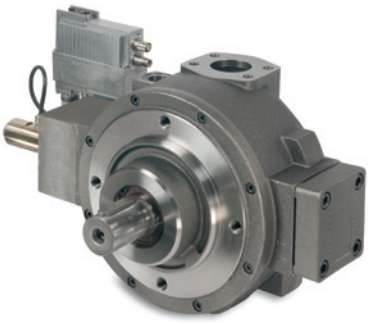
Moog experts work in close collaboration with machine builders and application engineers to design motion control systems for greater productivity, higher reliability, superior connectivity, less costly maintenance and more effective operations. Our regional presence, industry knowledge and design flexibility 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.

Servo Drives

Servo Motors



Servo Valves



Radial Piston Pumps

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

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

MOOG GLOBAL SUPPORT®

TAKE A CLOSER LOOK.

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.

Argentinia
+54 11 4326 5916
info.argentina@moog.com

Australia
+61 3 9561 6044
info.australia@moog.com

Brazil
+55 11 3572 0400
info.brazil@moog.com

Canada
+1 716 652 2000
info.canada@moog.com

China
+86 21 2893 1600
info.china@moog.com

Finland
+358 10 422 1840
info.finland@moog.com

France
+33 1 4560 7000
info.france@moog.com

Germany
+49 7031 622 0
info.germany@moog.com

Hong Kong
+852 2 635 3200
info.hongkong@moog.com

India
+91 80 4057 6666
info.india@moog.com

Ireland
+353 21 451 9000
info.ireland@moog.com

Italy
+39 0332 421 111
info.italy@moog.com

Japan
+81 46 355 3767
info.japan@moog.com

Korea
+82 31 764 6711
info.korea@moog.com

Luxembourg
+352 40 46 401
info.luxembourg@moog.com

Netherlands
+31 252 462 000
info.thenetherlands@moog.com

Norway
+47 6494 1948
info.norway@moog.com

Russia
+7 8 31 713 1811
info.russia@moog.com

Singapore
+65 677 36238
info.singapore@moog.com

South Africa
+27 12 653 6768
info.southafrica@moog.com

Spain
+34 902 133 240
info.spain@moog.com

Sweden
+46 31 680 060
info.sweden@moog.com

Switzerland
+41 71 394 5010
info.switzerland@moog.com

Turkey
+90 216 663 6020
info.turkey@moog.com

United Kingdom
+44 168 429 6600
info.uk@moog.com

USA
+1 716 652 2000
info.usa@moog.com

www.moog.com/industrial

Programmable Single-axis Servo Drives
Ritter/Rev. A, April 2013, Id. CDL38448-en