MODULAR MULTI-AXIS PROGRAMMABLE MOTION CONTROL SERVODRIVE

DELIVERING ADVANCED MOTION CONTROL
AND FLEXIBILITY FOR CHALLENGING
INDUSTRIAL APPLICATIONS

WHAT MOVES YOUR WORLD

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 performance. And help take your thinking further than you ever thought possible.

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

Higher performance machines can mean a real advantage in productivity and profitability for the plastics and metal forming industries.

The Moog Modular Multi-axis Programmable Motion Control Servodrive—also known as MSD—answers the call for a new generation of servodrives that provides the highest levels of dynamic response, smooth performance and application versatility.

MSD includes modular servodrives powered by a common shared power supply and a motion controller to coordinate the motion across multiple axes.

Meeting your toughest machine challenges

MSD is designed to give machine builders the edge in solving some of the plastics and metal forming industries' toughest challenges. Its user-friendly features, unsurpassed flexibility and high-performance design provide unique advantages including:

- **Higher machine productivity**
  From lowering cycle times in an injection molding machine, to increasing feed rates in a metal forming press, MSD delivers a significant increase in machine output.

- **Improved machine precision**
  More precise motion control results in higher accuracy, virtually no part variations and reduced scrap.

- **Higher machine flexibility**
  The modularity of the MSD 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

- Servodrives from 4-170 A with the option of either the classic AC_{mains} connection or a DC feed with a central feeder unit

- Compact size. Suitable for 300 mm switch cabinet depth, extremely small housing width, for the best possible switch cabinet usage

- Extendable functionality via flexible MSD design

- Tailored software packages with Motion Control functionality for every application

- Support for simultaneous feedback from 3 encoders ensures precise positioning capability extending from resolver to sin/cos single turn and multi turn encoders

- High-speed communication via field bus connection to a wide range of control systems (including EtherCAT, CANopen, PROFIBUS, SERCOS among others)

- Built in PLC as per IEC61131 provides functions adapted to the application with direct access to the drive controller 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 drive controller

3 x 400 - 480 VAC   **Shared DC Bus up to 770 VDC**

Visualisation

Various Communication Interfaces to Host

EtherCAT

Brushless PM AC Motors, Torque Motors, Linear Motors, Asynchronous Motors
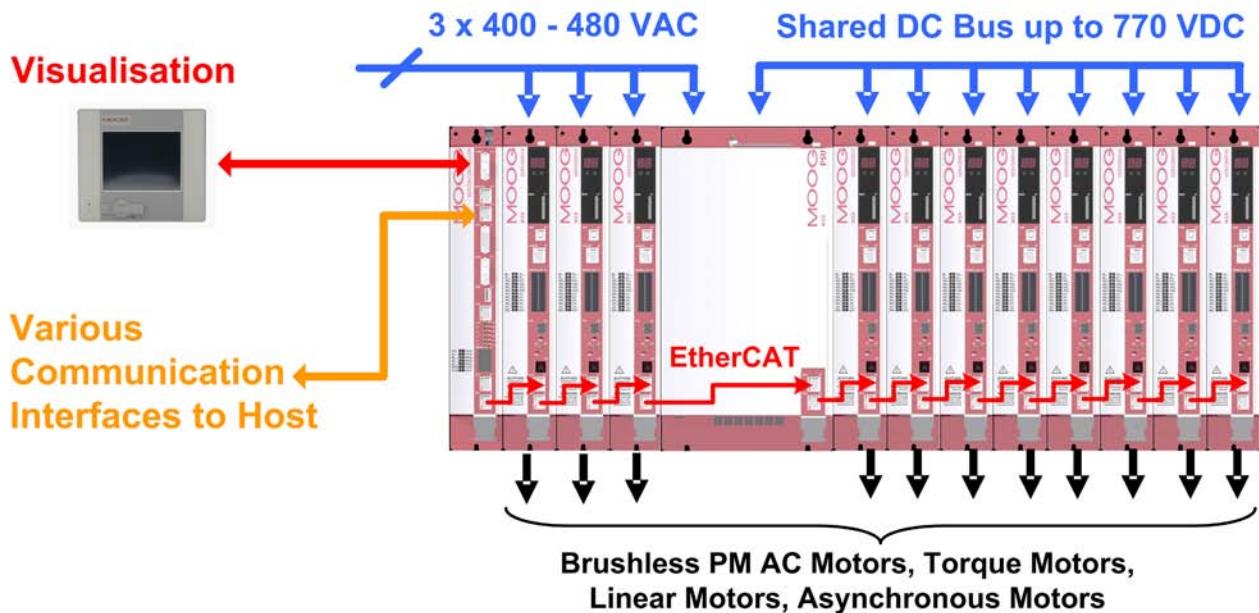
Total flexibility

The MSD is designed to work with a wide spectrum of servomotors—from synchronous and asynchronous to linear and torque motors—while ensuring optimal control. Likewise, its rapid commissioning and control optimization afford consistently high manufacturing quality.

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

Designed for high-performance applications

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

- Fast update rates for current, velocity and position control loops enable you to meet the toughest demands for machine precision

- High speed internal communication via EtherCAT allows for control and coordination across multiple axes

- Comprehensive software package with motion control functionality to suit your needs. The MSD supports IEC 61131 programming as well as programming of custom control loops using MathWorks/C/C++. Thus enabling the creation of application-specific templates for deeper integration with your machines

- Support for multiple communications protocols via field bus connection (SERCOS, EtherCAT, CANopen, PROFIBUS and more) plus the ability to develop custom protocols

- Flexible performance secured by up to three feedback devices like sin/cos single and multi-turn encoders used simultaneously for precise positioning with added ability to support any customized position feedback devices

- Safety is crucial—The MSD is designed to implement safety functions according to EN 61508

- A size for every application—Servodrives from $4\,A_{rms}$ to $170\,A_{rms}$ fan-cooled or even $250\,A_{rms}$ liquid-cooled with AC or DC infeed optional (i.e. with the classic AC_{mains} connection or a DC infeed with central infeed unit). This allows the MSD to be applied across a wide range of machine sizes

- Ease of use exemplified via user-friendly GUI for PC supported parameterization, data programming and firmware exchange via MMC card or USB stick. Your PC may be connected through USB locally, TCP/IP for remote access through factory Ethernet or even via Internet

MSD Motion Controller programmability meets the toughest demands in the target industries.

The MSD Motion Controller is based on a 32-bit, 400 MHz microprocessor. The Motion Controller coordinates and synchronizes axes, and communicates with host computers and other PLCs via multiple fieldbus protocols. With its PLC functionality, it can itself control processes of the machine or parts of it.

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

The MSD Motion controller includes 2 EtherCAT master interfaces for fast real time communication with the Servodrives.

Well proven IEC61131 development environment, Moog Axis Control Software (MACS), with specialized motion libraries is provided to program the MSD Motion controller.

For advanced control, programming of custom control loops an interface to MathWorks/C/C++ is included. This enables the creation of application-specific templates.

Typical applications

- General automation

- Metal forming machines

- Injection and blow-molding machines

- Textile machines such as weaving and knitting machines

- Handling and assembly systems

- Conveying and storage technology

- Packaging and food processing machines

Features

- Highly programmable multi-axis motion controller

- Precisely definable controller structures with cycle times from 100 µs

- Very low jitter (variation of time base) for optimum closed loop accuracy

- Programming with IEC 61131 development environment   MACS (Moog Axis Control Software)

- Integrated PLC functionality

- Hardware functionality can be parameterized via MACS software

- Simple wiring with terminal strips

- Sustained short circuit protection for digital outputs

- No parts subject to wear, no jumpers, no battery or rechargeable battery

- LEDs for status and error display

- EtherCAT Realtime Ethernet interface

- PROFIBUS DP slave as option

Interfaces

+24 volt

License key

Run / Stop / Reset switch

Field bus card (Option)

CAN bus

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

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

Control terminal:
- 4 digital I/O
- 4 programmable LEDs

2 x EtherCAT Master
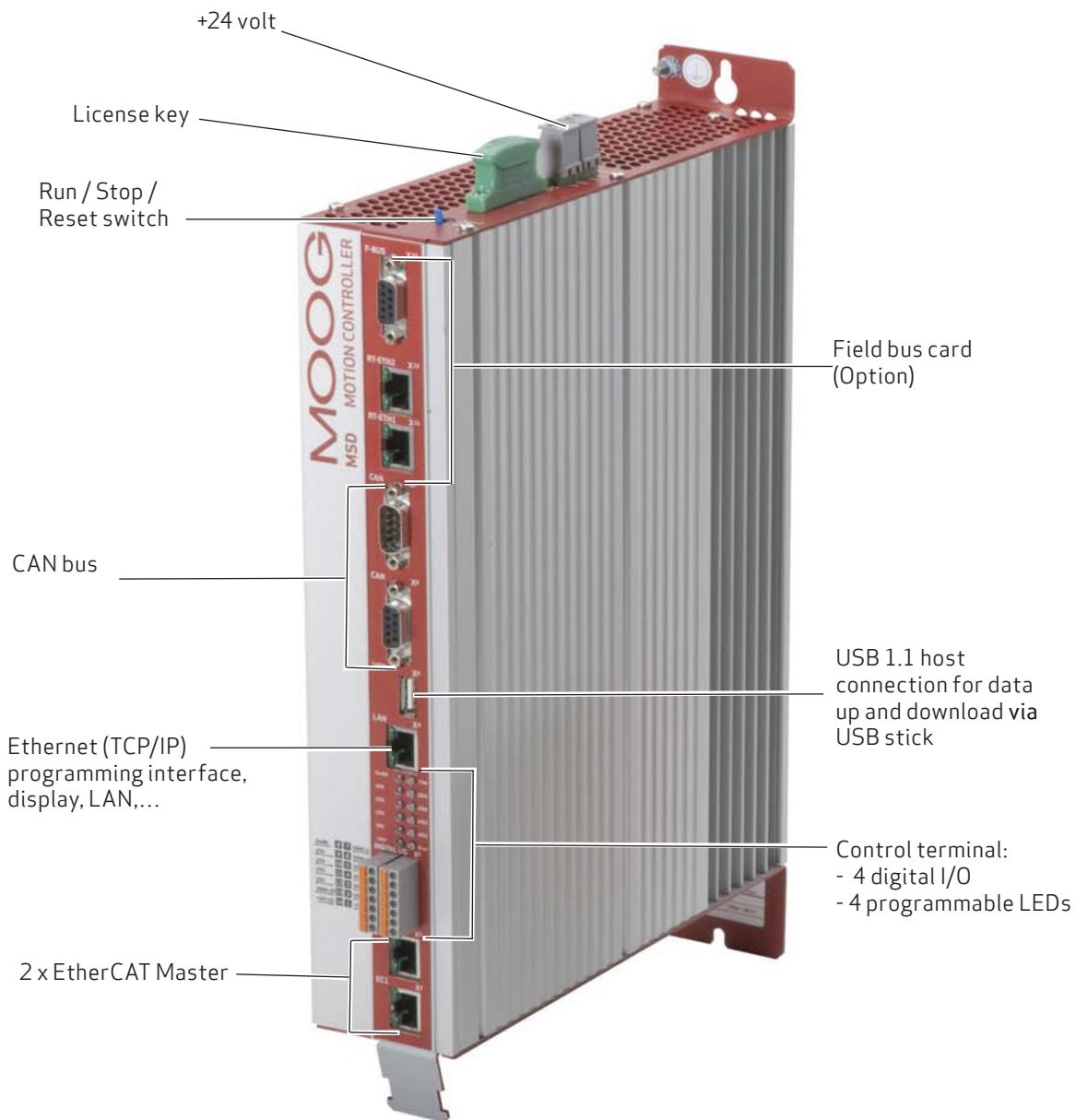
MSD Motion Controller
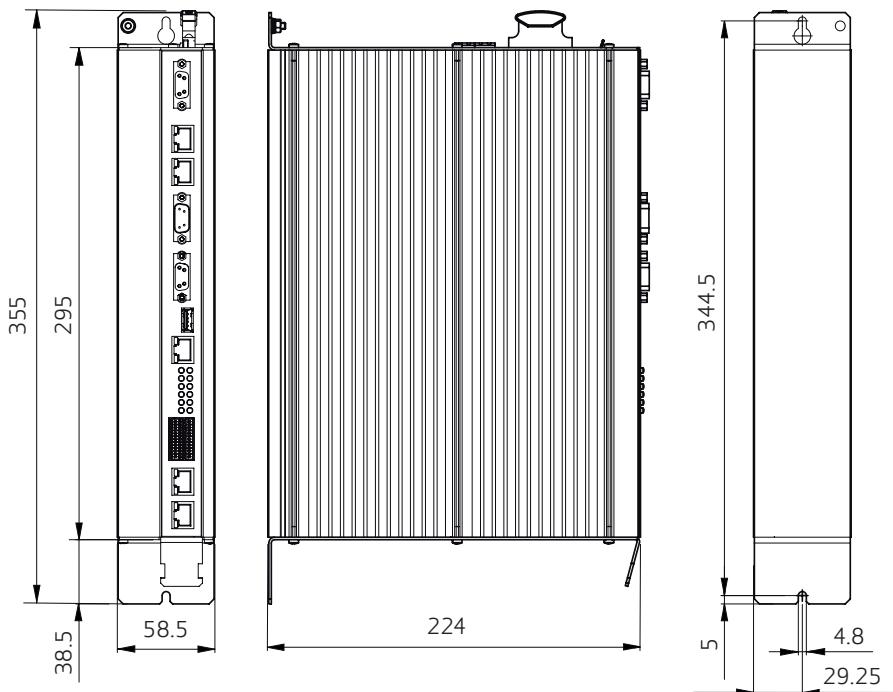
MSD Motion Control Software	Digital Control Module
Processor	PowerPC Processor, 32 bit, RISC architecture with floating point unit
Memory	128 MB RAM, 32 MB Flash EEPROM; data maintenance: typically 10 years

Energy Supply	
Voltage supply of module electronics	24 V DC (18-36 V DC) SELV pursuant to DIN EN 60950-1

Interfaces	
Ethernet (100BaseT)	100 Mbit/s with 8-pole RJ45 connection
EtherCAT	Dual EtherCAT Master Interface, slave in preparation
CAN interfaces	Transmission rate adjustable, 10 kbit/s to 1 Mbit/s CAN: 2 D-Sub »CAN« connectors on the front cover (are connected internally 1:1)
PROFIBUS DP slave (optional)	Transmission rate adjustable up to 12 Mbit/s
USB 1.1 interface	Host interface(s) via USB-A connector

Type	Ordering number
MSD Motion Controller	G391-001-001
MSD Motion Controller as G391-001-001 but additional PROFIBUS DP V1 interface	G391-001-002
MSD Motion Controller as G391-001-001 but additional EtherCAT Slave interface (release planned for 2008)	G391-001-003
MSD Motion Controller as G391-001-001 but additional Second CAN interface (release planned for 2008)	G391-001-004

Moog Axis Control Software

The MACS software (Moog Axis Control Software) offers a state-of-the-art development environment for solving demanding control tasks on the basis of the IEC 61131 standard.

MACS includes tools for:

- Programming
- Testing and optimizing
- Debugging
- Documentation
- Visualization
- Configuration

Benefits

- Quick project realization
- Low programming efforts
- One tool for programming, visualizing, documentation
- Compatibility to products of member companies of the CoDeSys Automation Alliance

Feature

- Extensive libraries with Moog function blocks, based on 50 years of experience in electric and motion control solutions
- Highly programmable controller structures
- Maximum flexibility via a complete scope of functions in all IEC 61131 programming languages
- Simultaneous realization of control, regulation and PLC applications in one application program
- Open standard interfaces for communication on machine and process guidance levels
- Motion control functions corresponding to PLCopen standard

Interfaces

Process guidance level:

- OPC server
- DDE interface

Machine level:

- CAN
- CANopen
- Ethernet TCP/IP
- PROFIBUS DP
- EtherCAT

Software Development

- All IEC 61131 programming languages and CFC (Continuous Function Chart)

- Full scope of function in all programming languages, provides maximum flexibility in creation of user programs

- Each module can call other modules regardless of the programming language they have been created in
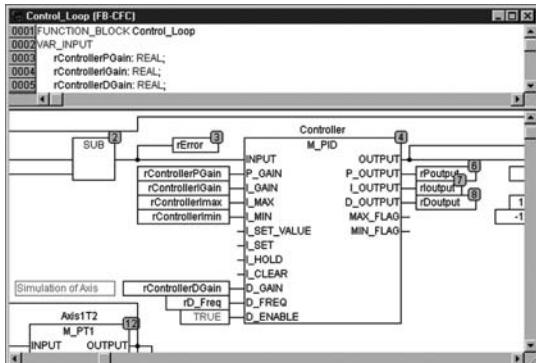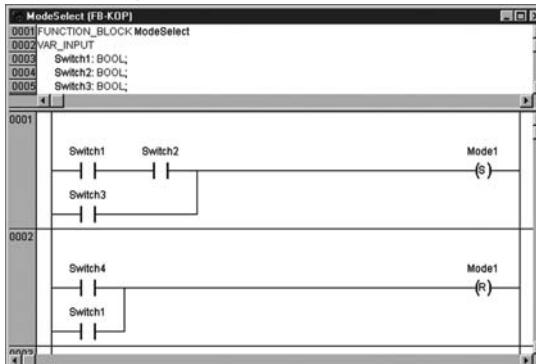
Editors

- Context-sensitive input help

- Automatic formatting

- Context menus in all editors

- Syntax coloring

- Multi-level undo/redo

- Display of the current values of all variables in online operation

Continuous function chart (CFC)

Function block diagram (FBD)

Structured text (ST)
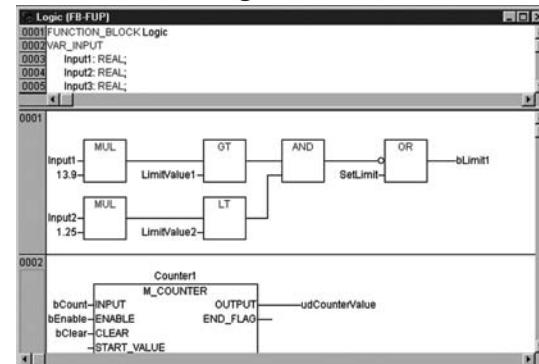
Sequence function chart (SFC)
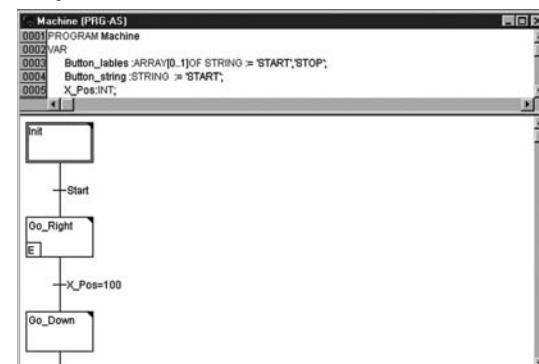
Ladder diagram (LD)

Instruction list (IL)

Visualization

- Commissioning tool

- Creation of visualizations for end users
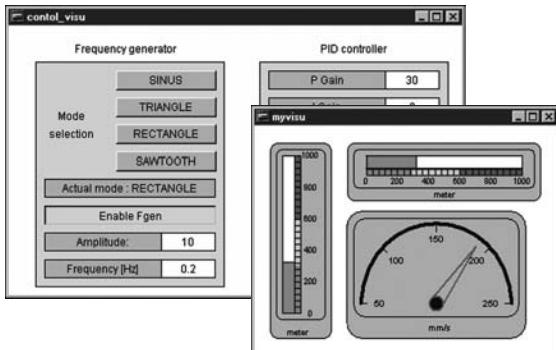
Osciloscope

- Recording of up to 20 channels

- Various triggering possibilities
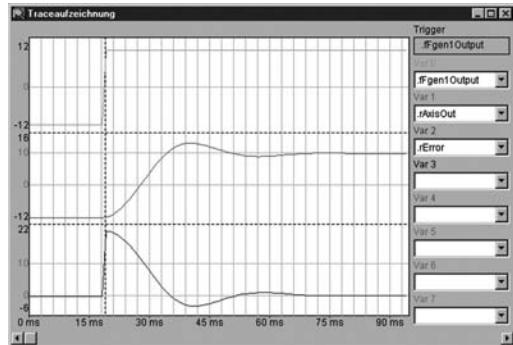
Debugging

- Break points

- Single step/single cycle

- Writing and forcing of variables

- Simulation possible without hardware
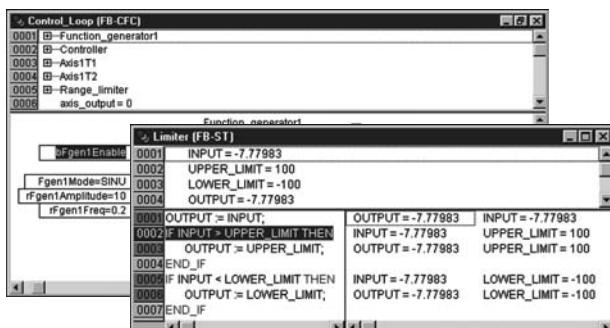
Hardware configuration

- Configuration of all Moog M3000 family modules, like MSD Motion Controller, MSC I and MSC II, on one screen
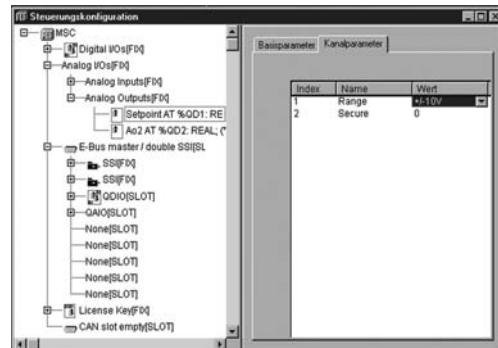
Documentation

- Automatic creation of the project documentation with all components
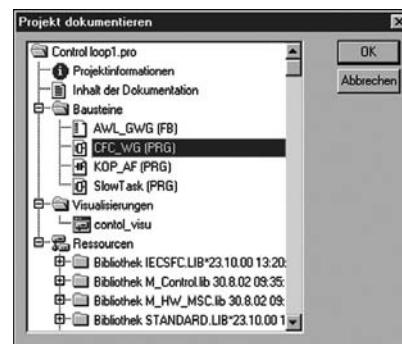
Task configuration

- Enables division of the application program into a number of tasks

- Call of the tasks optionally time-based (cyclic) or event triggered

- Priority and time base of each task adjustable
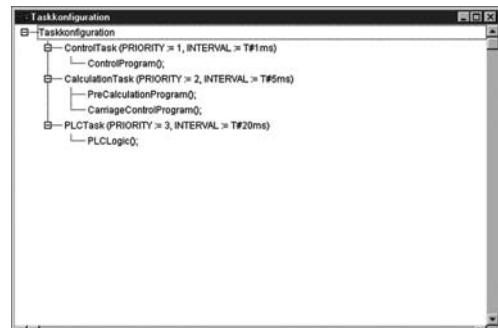
MACS is based on CoDeSys the most modern IEC 61131 programming system. It has been extended in the areas of control technique and motion control by Moog. In this way, even complex automation projects can be managed.

Overview: Scope of function of the Moog Libraries Regulation and Control Technique:

- Controller
  - I, D, PID standard, PID extended

- Filter
  - high-pass, low-pass

- Transmission functions
  - continuous, time discrete

- Non-linear functions
  - dead band, non-linear
  - dual-gain, look-up table

- Simulation of control routes
  - PT1, PT2

- Function generator

- Signal delay

- Counter, timer

PLCopen function blocks

According to the specification „function blocks for motion control" for single and multi-axis applications:

- Absolute and relative positioning

- Speed functions

- Homing

- Cam functions

- Gearbox functions

Communication, Ethernet, CAN

- Initialization

- Transmission and receiving of data

Hardware Related Functions

- Evaluation of status information

- Time evaluation

- Monitoring

Designation	Description	Order number	
MACS **(Moog Axis Control Software)**	Development environment pursuant to IEC 61131 One licence per developer	1 licence: 10 licences:	D138-001-001 D138-001-010
MACS HMI **(Human Machine Interface)**	Visualization version For full-screen display of visualizations which were created with MACS. Without development environment. One licence per machine.	1 licence: 10 licences:	D138-003-001 D138-003-010
Software maintenance contract	Includes support and updates for 1 year	B95 914-001	

License key

One license key is needed per MSD Motion Controller.

The license key contains the runtime license for the MSD Motion Controller. According to the license key used, additional functionality of the MACS software is enabled for usage.

Designation	Scope of Functions	Part number
Controls (Color: Grey)	MACS runtime license for application program • CoDeSys operators and standard IEC 61131 library • MSD Motion Controller hardware library • Moog control technique library • Interface library for CAN bus • Support for OPC and DDE interfaces • Ethernet communication to MACS development environment, EtherCAT interface	D138-002-001
Motion (Color: green)	All functions of "Controls" and additionally: • Motion control library according to PLCopen • Moog motion control function blocks • Library with transfer functions (Z functions) • CANopen and TCP/IP libraries • PROFIBUS DP slave (depending on hardware option)	D138-002-002
System (Color: red)	Program parts and/or complete application programs, produced specifically upon customers request	Is stipulated specific to the order D138-002-xxx
Professional (Color: blue)	Please contact factory	D138-002-003

Designed for the Present and the Future

The MSD Servodrive 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 MSD operates at cycle times of 62.5 µs for current and 125 µs for velocity and position loops.

Currently, 7 mechanical sizes, based on output power, are available, ranging from 4 A_{rms} up to 170 A_{rms}.

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

Typical applications

- General automation

- Metal forming machines

- Injection and blow-molding machines

- Textile machines such as weaving and knitting machines

- Handling and assembly systems

- Conveying and storage technology

- Packaging and food processing machines

Features

- Feed forward structure for higher response time and reduced tracking error

- Compensation of friction torque and cogging torque

- Compensation of mechanic spindles errors for both directions

- Patented method GPOC (Gain Phase Offset Correction) with correlation technique to compensate encoder and resolver errors.
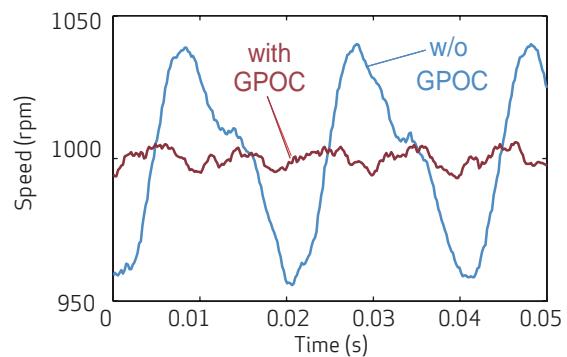
- Servodrives from 4-170 A.
  Supply with the option of either the classic AC_{mains} connection or a DC connection with a central supply unit.

- Evaluation by up to 3 sensors.
  For precise positioning even in systems with backlash and other mechanical errors.

- Built in functional security as per EN 61508, EN 62061, EN ISO 13849-1, IEC 61800-5-2.
  Ensure personnel safety directly in the control unit of the drive.

Interfaces Size 1 - Size 4

AC input

+ 24 V

Status display

2 push buttons

MMC

USB

Ethernet

Control terminals
- 2 analogue inputs
  +/-10V, 12 bit
- Input for safe stand still
  acc. EN954-1
- 8 digital inputs (PLC compatible;
  Low <4,8V, High>15V)
- 3 digital outputs
  (short circuit proof; max. 50 mA)

Motor
Braking resistor
DC link

Motor brake

Option 2: Extensions
- 2nd SinCos-Encoder or EnDat 2.1
- Encoder simulation

High resolution encoder
- SinCos-Encoder
- Serial interfaces e.g.
  SSI and EnDat 2.1
- Serial hiperface

Resolver

Motor-PTC

Option 1: Field bus
- EtherCAT
- SERCOS II
- CAN-Bus
- PROFIBUS DP

Interfaces Size 5

+ 24 V

Motor brake

Option 2: Extensions
- 2nd SinCos-encoder
  or EnDat 2.1
- Encoder simulation

AC input

High resolution encoder
- SinCos-Encoder
- Serial interfaces e.g.
  SSI and EnDat 2.1
- Serial Hiperface

Status display

Resolver

2 push buttons

MMC

USB

Ethernet

Control terminals
- 2 analogue inputs
  +/-10V, 12 bit
- Input for safe stand still
  acc. EN954-1
- 8 digital inputs (PLC compatible;
  Low <4,8V, High>15V)
- 3 digital outputs
  (short circuit proof; max. 50 mA)

Motor-PTC

Option 1: Field bus
- EtherCAT
- SERCOS II
- CAN-Bus
- PROFIBUS DP

Motor
Braking resistor
DC link

Interfaces Size 6A

+ 24 V

AC Input

Status display

2 push buttons

MMC

USB

Ethernet

Control terminals
- 2 analogue inputs
  +/-10V, 12 bit
- Input for safe stand still
  acc. EN954-1
- 8 digital inputs (PLC compatible;
  Low <4,8V, High>15V)
- 3 digital outputs
  (short circuit proof; max. 50 mA)

Motor
Braking resistor
DC link

Motor brake

Option 2: Extensions
- 2nd SinCos-Encoder
  or EnDat 2.1
- Encoder simulation

High resolution encoder
- SinCos-Encoder
- Serial interfaces e.g.
  SSI and EnDat 2.1
- Serial Hiperface

Resolver

Motor-PTC

Option 1: Field bus
- EtherCAT
- SERCOS II
- CAN-Bus
- PROFIBUS DP

Overview Servodrives

The maximum permissible Servodrive output current 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 Servodrives also changes. Refer to the following charts and tables for details on which current load is permissible under specific conditions.

Size 1 Size 2 Size 3 Size 4 Size 5 Size 6

Rated current A_{rms} of Servodrives Size 1-4:

f_T / T_U	Mains voltage	G392-004A Size 1A	G392-004 Size 1	G392-006 Size 1	G392-008 Size 2	G392-012 Size 2	G392-016 Size 3	G392-020 Size 3	G392-024 Size 4	G392-032 Size 4
4 kHz / 45 °C	230 V	4.0 A	--	--	--	--	--	--	--	--
	400 V	--	4.0 A	6.0 A	8.0 A	12.0 A	16.0 A	20.0 A	24.0 A	32.0 A
	460 V	--	4.0 A	6.0 A	8.0 A	12.0 A	16.0 A	20.0 A	24.0 A	32.0 A
	480 V	--	4.0 A	6.0 A	8.0 A	12.0 A	16.0 A	20.0 A	24.0 A	32.0 A
8 kHz / 40 °C	230 V	4.0 A	--	--	--	--	--	--	--	--
	400 V	--	4.0 A	6.0 A	8.0 A	12.0 A	16.0 A	20.0 A	24.0 A	32.0 A
	460 V	--	4.0 A	6.0 A	7.2 A	10.8 A	13.9 A	17.4 A	21.0 A	28.0 A
	480 V	--	4.0 A	6.0 A	6.9 A	10.4 A	13.3 A	16.6 A	20.0 A	26.7 A
12 kHz / 40 °C	230 V	3.7 A	--	--	--	--	--	--	--	--
	400 V	--	3.7 A	5.5 A	6.7 A	10.0 A	11.0 A	13.8 A	15.8 A	21.0 A
	460 V	--	2.9 A	4.4 A	5.3 A	8.0 A	8.8 A	11.0 A	12.4 A	16.5 A
	480 V	--	2.7 A	4.0 A	4.9 A	7.4 A	8.0 A	10.0 A	11.3 A	15.0 A
16 kHz / 40 °C	230 V	2.7 A	--	--	--	--	--	--	--	--
	400 V	--	2.7 A	4.0 A	5.0 A	7.6 A	8.0 A	10.0 A	11.3 A	15.0 A
	460 V	--	1.6 A	2.4 A	3.7 A	5.6 A	5.9 A	7.4 A	9.2 A	12.2 A
	480 V	--	1.3 A	1.9 A	3.3 A	5.0 A	5.2 A	6.5 A	8.4 A	11.2 A

f_T = Power stage switching frequency, T_U = max. cooling air temperature for 10 s

The specified currents refer to a motor cable length of ≤ 10 m

Rated current A_{rms} of Servodrives Size 5-6A:

f_T / T_U	Mains voltage		G392-045 Size 5	G392-060 Size 5	G392-072 Size 5	G392-090 Size 6	G392-110 Size 6	G392-143 Size 6A	G392-170 Size 6A
4 kHz / 45 °C	400 V	I_N	45 A	60 A	72 A	90 A	110 A	143 A	170 A
		I_{MAX} (0Hz)	90 A	120 A	144 A	170 A	170 A	190 A	190 A
		I_{MAX} (>5 Hz)	90 A	120 A	144 A	180 A	220 A	286 A	315 A
	460 V	I_N	42 A	56 A	67 A	83 A	102 A	132 A	157 A
		I_{MAX} (0Hz)	83 A	111 A	133 A	157 A	157 A	176 A	176 A
		I_{MAX} (>5 Hz)	83 A	111 A	133 A	167 A	204 A	265 A	291 A
	480 V	I_N	41 A	54 A	65 A	81 A	99 A	129 A	153 A
		I_{MAX} (0Hz)	81 A	108 A	130 A	153 A	153 A	171 A	171A
		I_{MAX} (>5 Hz)	81 A	108 A	130 A	162 A	198 A	257 A	284 A
8 kHz / 40 °C	400 V	I_N	45 A	60 A	72 A	90 A	110 A	143 A	-- [1]
		I_{MAX} (0Hz)	90 A	120 A	144 A	134 A	134 A	151 A	-- [1]
		I_{MAX} (>5 Hz)	90 A	120 A	144 A	180 A	165 A	215 A	-- [1]
	460 V	I_N	42 A	56 A	67 A	83 A	102 A	132 A	-- [1]
		I_{MAX} (0Hz)	83 A	111 A	133 A	124 A	124 A	140 A	-- [1]
		I_{MAX} (>5 Hz)	83 A	111 A	133 A	167 A	153 A	199 A	-- [1]
	480 V	I_N	41 A	54 A	65 A	81 A	99 A	129 A	-- [1]
		I_{MAX} (0Hz)	81 A	108 A	130 A	121 A	121 A	136 A	-- [1]
		I_{MAX} (>5 Hz)	81 A	108 A	130 A	162 A	149 A	194 A	-- [1]
12 kHz / 40 °C	400 V	I_N	45 A	58 A	58 A	90 A	90 A	115 A	-- [1]
		I_{MAX} (0Hz)	90 A	116 A	116 A	107 A	107 A	121 A	-- [1]
		I_{MAX} (>5 Hz)	90 A	116 A	116 A	144 A	144 A	172 A	-- [1]
	460 V	I_N	42 A	54 A	54 A	83 A	83 A	106 A	-- [1]
		I_{MAX} (0Hz)	83 A	107 A	107 A	99 A	99 A	112 A	-- [1]
		I_{MAX} (>5 Hz)	83 A	107 A	107 A	133 A	133 A	159 A	-- [1]
	480 V	I_N	41 A	52 A	52 A	81 A	81 A	104 A	-- [1]
		I_{MAX} (0Hz)	81 A	104 A	104 A	96 A	96 A	109 A	-- [1]
		I_{MAX} (>5 Hz)	81 A	104 A	104 A	130 A	130 A	155 A	-- [1]
16 kHz / 40 °C	400 V	I_N	42 A	42 A	42 A	72 A	72 A	92 A	-- [1]
		I_{MAX} (0Hz)	84 A	84 A	84 A	86 A	86 A	97 A	-- [1]
		I_{MAX} (>5 Hz)	84 A	84 A	84 A	115 A	115 A	138 A	-- [1]
	460 V	I_N	39 A	39 A	39 A	67 A	67 A	85 A	-- [1]
		I_{MAX} (0Hz)	78 A	78 A	78 A	80 A	80 A	90 A	-- [1]
		I_{MAX} (>5 Hz)	78 A	78 A	78 A	106 A	106 A	128 A	-- [1]
	480 V	I_N	38 A	38 A	38 A	65 A	65 A	83 A	-- [1]
		I_{MAX} (0Hz)	76 A	76 A	76 A	77 A	77 A	87 A	-- [1]
		I_{MAX} (>5 Hz)	76 A	76 A	76 A	104 A	104 A	124 A	-- [1]

f_T = Power stage switching frequency, T_U = max. cooling air temperature
1) Not permissible, please contact factory
2) Double overload for 3 s at an initial load of 70% I_N and double overload for 10 s at a temperature of the heatsink at ≤ 45 °C/4 kHz and ≤ 40 °C/8 kHz
In the frequency range of 0 Hz to 5 Hz the maximum current increases linear
3) Double overload for 30 s (10 s for G392-170) at an initial load of 70 % I_N
The specified currents refer to a motor cable length of ≤ 10 m

Servodrives 4 A to 6 A (Size 1)

Technical data [1]		G392-004A	G392-004	G392-006
Output, motor end				
Voltage		$3 \times U_{Mains}$	$3 \times U_{Mains}$	$3 \times U_{Mains}$
Rated current, effective I_N	4/8 kHz	4 A	4 A	6 A
	12 kHz	3.7 A	3.7 A	5.5 A
	16 kHz	2.7 A	2.7 A	4 A
Peak current for 10 s		$2.0 \times I_N$	$2.0 \times I_N$	$2.0 \times I_N$
Rotating field frequency		0 ... 400 Hz	0 ... 400 Hz	0 ... 400 Hz
Input, mains side				
Mains voltage (U_{Mains})		1 x 230 V -15 % + 10 %	3 x 230 V -15% to 3 x 480 V +10 %	3 x 230 V -15% to 3 x 480 V +10 %
Typical power consumption		1.6 kVA	2.8 kVA	4.2 kVA
Current (with line filter)		9.5 A [2]	4.2 A	6.4 A
Asymmetry of mains voltage		- - [3]	± 3 % max.	± 3 % max.
Frequency		50/60 Hz ±10 %	50/60 Hz ±10 %	50/60 Hz ±10 %
Power loss at 8 kHz, I_N		85 W	96 W	122 W
Braking chopper power electronics				
Maximum power rating of optional internal braking resistor		6 kW at 90 Ω (PTC)	6 kW at 90 Ω (PTC)	6 kW at 90 Ω (PTC)
Minimal ohmic resistance of an externally installed braking resistor		72 Ω	72 Ω	72 Ω

1) All Data referred to 400 V mains voltage, except G392-004A (data referred to 230 V mains voltage)
2) without line choke
3) only one mains voltage, no asymmetric

Mechanics	G392-004A	G392-004	G392-006
Cooling	Forced aircooling	Forced aircooling	Forced aircooling
Mounting	Wall mounting with unobstructed airflow	Wall mounting with unobstructed airflow	Wall mounting with unobstructed airflow
Weight	3.4 kg	3.4 kg	3.4 kg
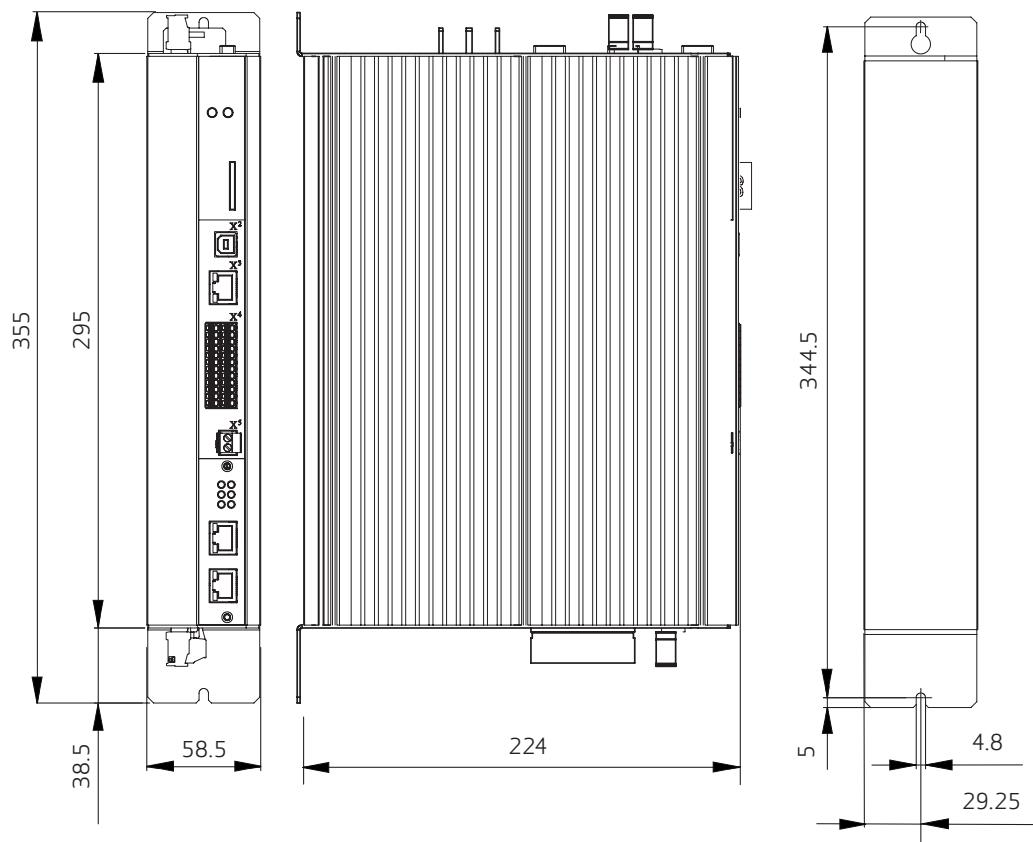
Accessories	G392-004A	G392-004	G392-006
Line choke	CA68926-001	CA55830-001	CA55831-001
Braking resistor	CA59737-001 (35 W) CA59738-001 (150 W) CA59739-001 (300 W) CA59740-001 (1000 W)	CA59737-001 (35 W) CA59738-001 (150 W) CA59739-001 (300 W) CA59740-001 (1000 W)	CA59737-001 (35 W) CA59738-001 (150 W) CA59739-001 (300 W) CA59740-001 (1000 W)
Line filter	- -	CA71184-001	CA71184-001

Servodrives 8 A to 12 A (Size 2)

Technical data [1]		G392-008	G392-012
Output, motor end			
Voltage		$3 \times U_{Mains}$	$3 \times U_{Mains}$
Rated current, effective I_N	4/8 kHz	8 A	12 A
	12 kHz	6.7 A	10 A
	16 kHz	5 A	7.6 A
Peak current for 10 s		$2.0 \times I_N$	$2.0 \times I_N$
Rotating field frequency		0 ... 400 Hz	0 ... 400 Hz
Input, mains side			
Mains voltage (U_{Mains})		3 x 230 V -15% to 3 x 480 V +10 %	3 x 230 V -15% to 3 x 480 V +10 %
Typical power consumption		5.9 kVA	8.8 kVA
Current (with line filter)		8.7 A	13.1 A
Asymmetry of mains voltage		± 3 % max.	± 3 % max.
Frequency		50/60 Hz ±10 %	50/60 Hz ±10 %
Power loss at 8 kHz, I_N		175 W	240 W
Braking chopper power electronics			
Maximum power rating of optional internal braking resistor		6 kW at 90 Ω	6 kW at 90 Ω
Minimal ohmic resistance of an externally installed braking resistor [2]		39 Ω	39 Ω

1) All data referred to 400 V mains voltage.
2) Connection of an external braking resistor is not allowed by devices with internal braking resistor. (Version G392-xxxxxxx-xx2)

Mechanics	G392-008	G392-012
Cooling	Forced aircooling	Forced aircooling
Mounting	Wall mounting with unobstructed airflow	Wall mounting with unobstructed airflow
Weight	4.9 kg	4.9 kg
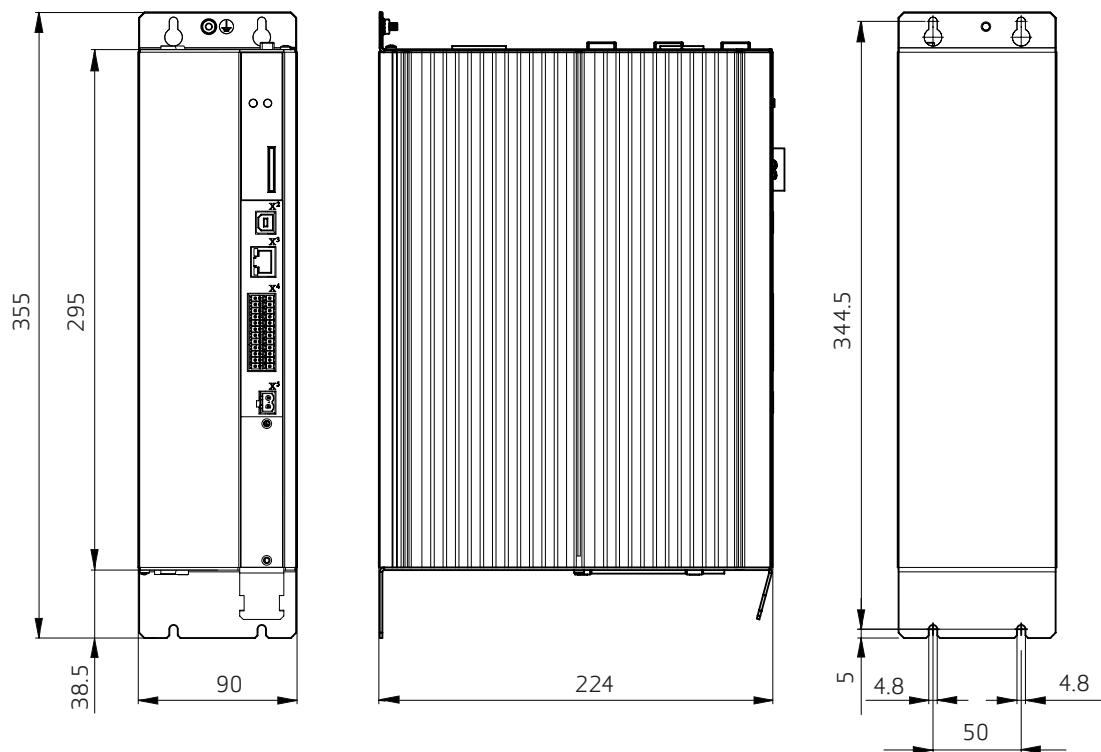
| Accessories	G392-008	G392-012
Line choke	CA55832-001	CA55833-001
Braking resistor	CA59737-001 (35 W) CA59738-001 (150 W) CA59739-001 (300 W) CA59740-001 (1000 W)	CA59737-001 (35 W) CA59738-001 (150 W) CA59739-001 (300 W) CA59740-001 (1000 W)
Line filter	CA71185-001	CA71185-001

Servodrives 16 A to 20 A (Size 3)

Technical data [1]		G392-016	G392-020
Output, motor end			
Voltage		$3 \times U_{Mains}$	$3 \times U_{Mains}$
Rated current, effective I_N	4/8 kHz	16 A	20 A
	12 kHz	11 A	13.8 A
	16 kHz	8 A	10 A
Peak current for 10 s		$2.0 \times I_N$	$2.0 \times I_N$
Rotating field frequency		0 ... 400 Hz	0 ... 400 Hz
Input, mains side			
Mains voltage (U_{Mains})		3 x 230 V -15% to 3 x 400/480 V +10 %	3 x 230 V -15% to 3 x 400/480 V +10 %
Typical power consumption		11.1 kVA	13.9 kVA
Current (with line filter)		17.3 A	21.6 A
Asymmetry of mains voltage		± 3 % max.	± 3 % max.
Frequency		50/60 Hz ±10 %	50/60 Hz ±10 %
Power loss at 8 kHz, I_N		330 W	400 W
Braking chopper power electronics			
Maximum power rating of optional internal braking resistor		6 kW at 90 Ω	6 kW at 90 Ω
Minimal ohmic resistance of an externally installed braking resistor [2]		20 Ω	20 Ω

1) All data referred to 400 V mains voltage.
2) Connection of an external braking resistor is not allowed by devices with internal braking resistor. (Version G392-xxxxxxx-xx2)

Mechanics	G392-016	G392-020
Cooling	Forced aircooling	Forced aircooling
Mounting	Wall mounting with unobstructed airflow	Wall mounting with unobstructed airflow
Weight	6.5 kg	6.5 kg
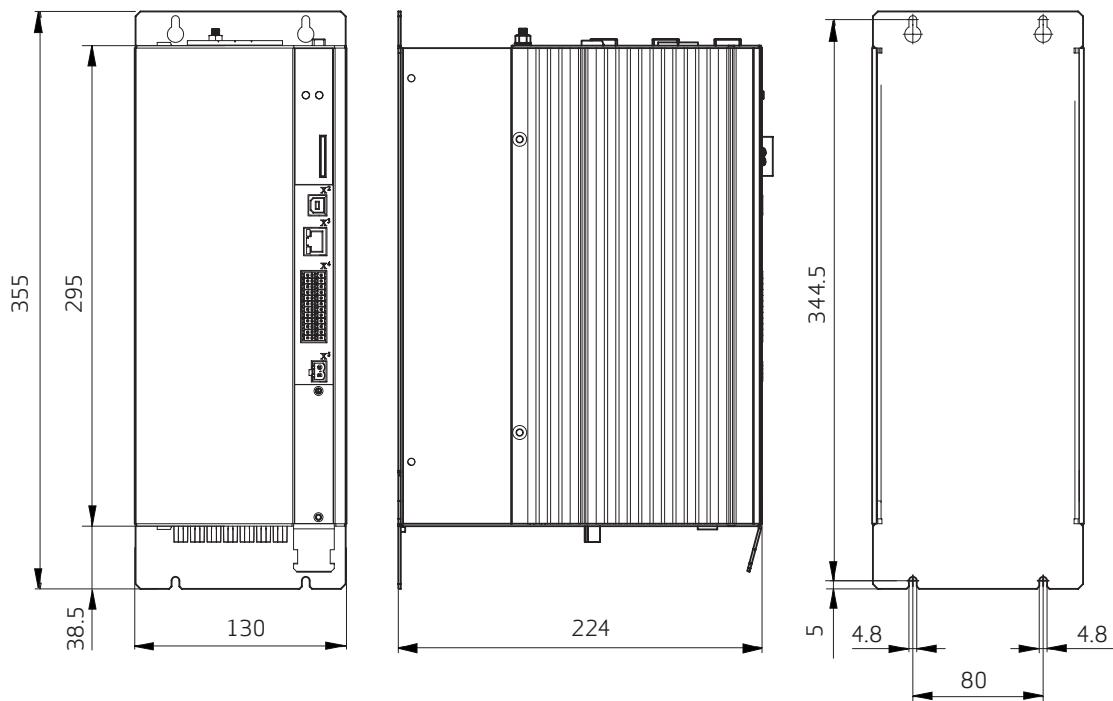
| Accessories	G392-016	G392-020
Line choke	CA55834-001	CA55835-001
Braking resistor	CA59741-001 (35 W) CA59742-001 (150 W) CA59743-001 (300 W) CA59744-001 (1000 W)	CA59741-001 (35 W) CA59742-001 (150 W) CA59743-001 (300 W) CA59744-001 (1000 W)
Line filter	CA71185-001	CA71186-001

Servodrives 24 A to 32 A (Size 4)

Technical data [1]		G392-024	G392-032
Output, motor end			
Voltage		$3 \times U_{Mains}$	$3 \times U_{Mains}$
Rated current, effective I_N	4/8 kHz	24 A	32 A
	12 kHz	15.8 A	21 A
	16 kHz	11.3 A	15 A
Peak current for 10 s		$2.0 \times I_N$	$2.0 \times I_N$
Rotating field frequency		0 ... 400 Hz	0 ... 400 Hz
Input, mains side			
Mains voltage (U_{Mains})		3×230 V -15% to $3 \times 400/480$ V +10%	3×230 V -15% to $3 \times 400/480$ V +10%
Typical power consumption		16.6 kVA	22.2 kVA
Current (with line filter)		26.2 A	34.9 A
Asymmetry of mains voltage		± 3 % max.	± 3 % max.
Frequency		50/60 Hz ±10 %	50/60 Hz ±10 %
Power loss at 8 kHz, I_N		475 W	515 W
Braking chopper power electronics			
Maximum power rating of optional internal braking resistor		6 kW at 90 Ω	6 kW at 90 Ω
Minimal ohmic resistance of an externally installed braking resistor [2]		12 Ω	12 Ω

1) All data referred to 400 V mains voltage.
2) Connection of an external braking resistor is not allowed by devices with internal braking resistor. (Version G392-xxxxxxx-xx2)

Mechanics	G392-024	G392-032
Cooling	Forced aircooling	Forced aircooling
Mounting	Wall mounting with unobstructed airflow	Wall mounting with unobstructed airflow
Weight	7.5 kg	7.5 kg
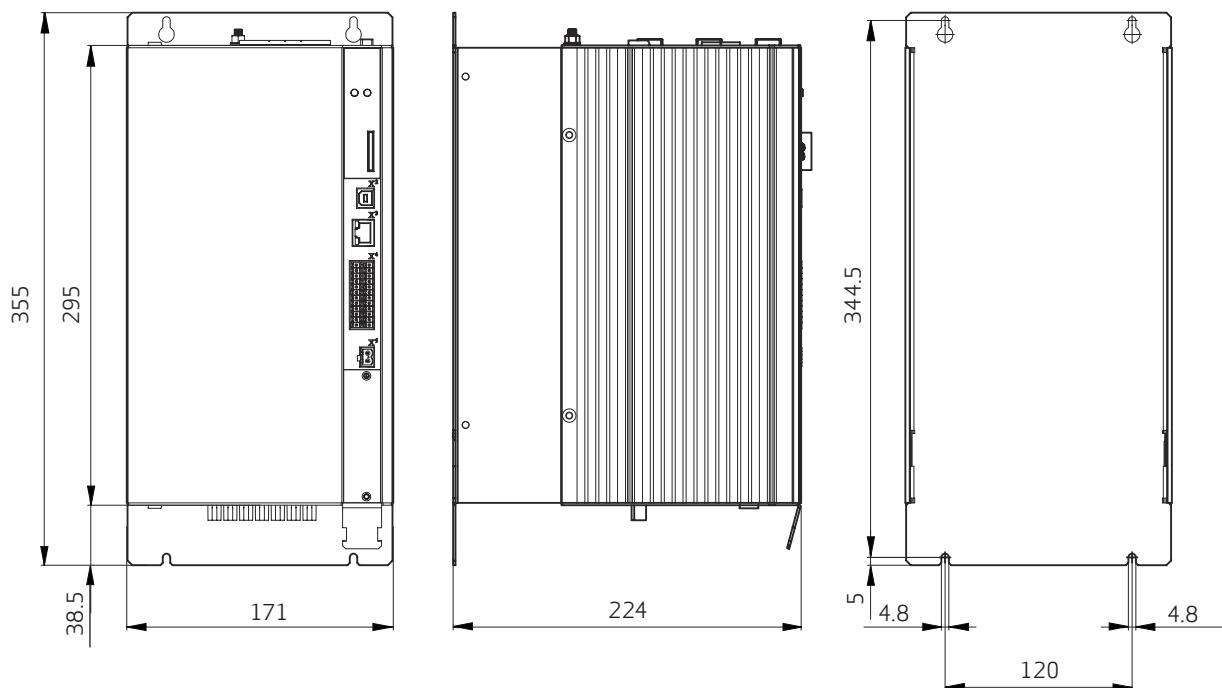
| Accessories	G392-024	G392-032
Line choke	CA55835-001	CA55836-001
Braking resistor	CA59741-001 (35 W) CA59742-001 (150 W) CA59743-001 (300 W) CA59744-001 (1000 W)	CA59741-001 (35 W) CA59742-001 (150 W) CA59743-001 (300 W) CA59744-001 (1000 W)
Line filter	CA71186-001	CA71186-001

Servodrives 45 A to 72 A (Size 5)

Technical data [1]		G392-045	G392-060	G392-072
Output, motor end				
Voltage		$3 \times U_{Mains}$	$3 \times U_{Mains}$	$3 \times U_{Mains}$
Rated current, effective I_N	4/8 kHz	45 A	60 A	72 A
	12 kHz	45 A	58 A	58 A
	16 kHz	42 A	42 A	42 A
Peak current for 3 s with a pre-load of 70% of the rated current I_N		$2 \times I_N$	$2 \times I_N$	$2 \times I_N$
Rotating field frequency		0 ... 400 Hz	0 ... 400 Hz	0 ... 400 Hz
Input, mains side				
Mains voltage (U_{Mains})		$3 \times 400/480$ V -25%+10 %	$3 \times 400/480$ V -25%+10 %	$3 \times 400/480$ V -25%+10%
Typical power consumption		31 kVA	42 kVA	50 kVA
Current (with line filter)		45 A	61 A	72 A
Asymmetry of mains voltage		± 3 % max.	± 3 % max	± 3 % max
Frequency		50/60 Hz ±10 %	50/60 Hz ±10 %	50/60 Hz ±10 %
Power loss at 8 kHz, I_N		610 W	830 W	1010 W
Braking chopper power electronics				
Minimal ohmic resistance of an externally installed braking resistor		18 Ω	18 Ω	13 Ω

1) All data referred to 400 V mains voltage.

Mechanics	G392-045	G392-060	G392-072
Cooling	Forced aircooling	Forced aircooling	Forced aircooling
Mounting	Wall mounting with unob-structed airflow	Wall mounting with unob-structed airflow	Wall mounting with unob-structed airflow
Weight	13 kg	13 kg	13 kg
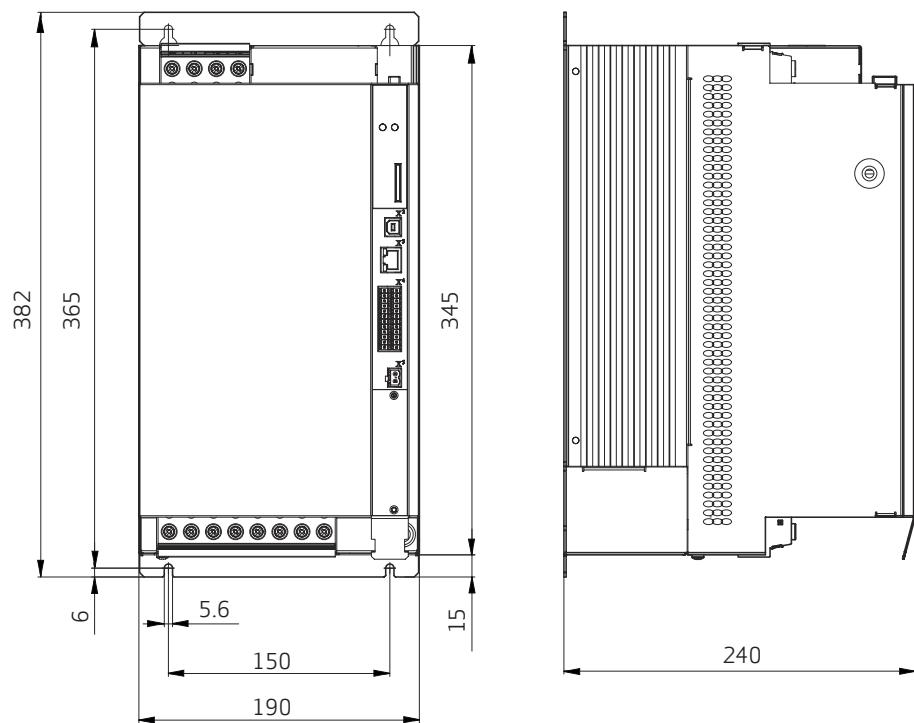
Accessories	G392-045	G392-060	G392-072
Line choke	CA68937-001	CA55838-001	CA55839-001
Braking resistor	CA59741-001 (35 W) CA59742-001 (150 W) CA59743-001 (300 W) CA59744-001 (1000 W)	CA59741-001 (35 W) CA59742-001 (150 W) CA59743-001 (300 W) CA59744-001 (1000 W)	CA59741-001 (35 W) CA59742-001 (150 W) CA59743-001 (300 W) CA59744-001 (1000 W)
Line filter	CA71187-001	CA71187-001	CA71188-001

Servodrives 90 A to 170 A (Size 6, 6A)

| Technical data [1]		G392-090	G392-110	G392-143	G392-170
Output, motor end					
Voltage		$3 \times U_{Mains}$	$3 \times U_{Mains}$	$3 \times U_{Mains}$	$3 \times U_{Mains}$
Rated current, effective I_N	4 kHz	90 A	110 A	143 A	170 A
	8 kHz	90 A	110 A	143 A	--[3]
	12 kHz	90 A	90 A	115 A	--[3]
	16 kHz	72 A	72 A	92 A	--[3]
Peak current for 3 s with a pre-load of 70% of the rated current I_N [2]	I_{MAX} (0Hz)	134 A	134 A	151 A	--[3]
	I_{MAX} (>5 Hz)	180 A	165 A	215 A	--[3]
Rotating field frequency		0 ... 400 Hz	0 ... 400 Hz	0 ... 400 Hz	0 ... 400 Hz
Input, mains side					
Mains voltage (U_{Mains})		3 x 400/480 V -25%+10 %	3 x 400/480 V -25%+10 %	3 x 400/480 V -25%+10 %	3 x 400/480 V -25%+10 %
Typical power consumption		62 kVA	76 kVA	99 kVA	118 kVA
Current (with line filter)		90 A	110 A	143 A	170 A
Asymmetry of		± 3 % max.	± 3 % max.	± 3 % max.	± 3 % max.
Frequency		50/60 Hz ±10 %	50/60 Hz ±10 %	50/60 Hz ±10 %	50/60 Hz ±10 %
Power loss at 8 kHz, I_N		1300 W	1600 W	2100 W	2500 W
Braking chopper power electronics					
Minimal ohmic resistance of an externally installed braking resistor		12 Ω	10 Ω	8.5 Ω	6.5 Ω

1) All data referred to 400 V mains voltage
2) All data referred to 8kHz/40°C
3) Frequency not permissible, please contact factory

Mechanics	G392-090	G392-110	G392-143	G392-170
Cooling	Forced aircooling	Forced aircooling	Forced aircooling	Forced aircooling
Mounting	Wall mounting with unobstructed airflow	Wall mounting with unobstructed airflow	Wall mounting with unobstructed airflow	Wall mounting with unobstructed airflow
Weight	28 kg	28 kg	32 kg	32 kg

SIZE 6 (G392-090 / G392-110)
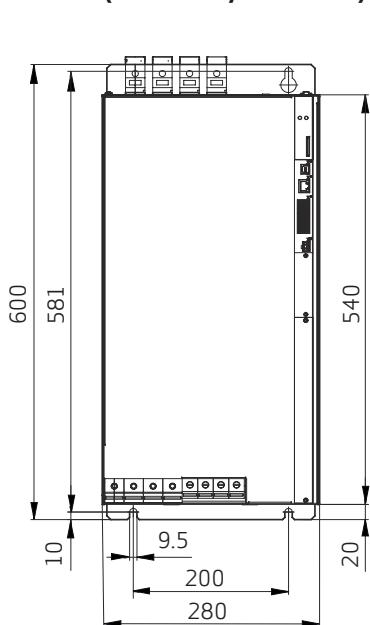
SIZE 6A (G392-143 / G392-170)
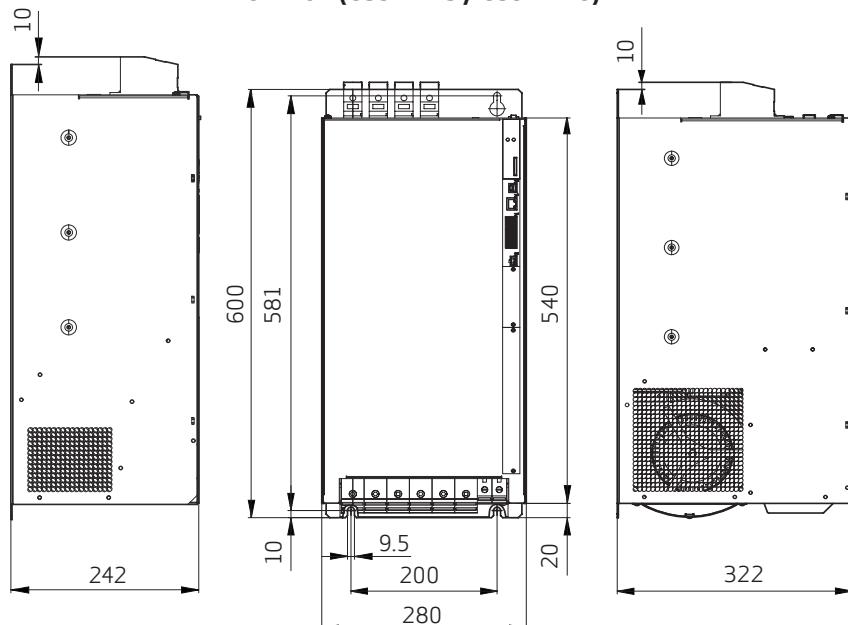
Accessories	G392-090	G392-110	G392-143	G392-170
Line choke	CA55840-001	CA55841-001	CA55842-001	CA55843-001
Braking resistor	CA59741-001 (35 W) CA59742-001 (150 W) CA59743-001 (300 W) CA59744-001 (1000 W)	CA59741-001 (35 W) CA59742-001 (150 W) CA59743-001 (300 W) CA59744-001 (1000 W)	CA59741-001 (35 W) CA59742-001 (150 W) CA59743-001 (300 W) CA59744-001 (1000 W)	CA59741-001 (35 W) CA59742-001 (150 W) CA59743-001 (300 W) CA59744-001 (1000 W)
Line filter	CA71188-001	CA71189-001	CA71189-001	CA71190-001

Option cards
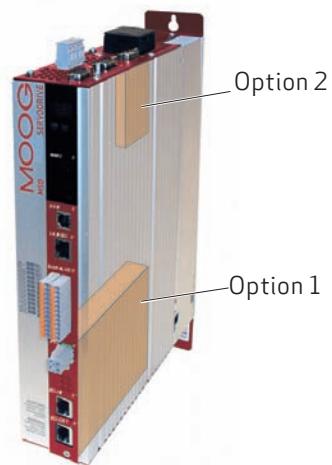
Option 2

Option 1

Content [1]	Type	Page
Option 1: Field bus		
EtherCAT	Field bus module for EtherCAT	32
CANopen	Field bus module for CANopen	33
PROFIBUS	Field bus module for PROFIBUS DPV1	34
SERCOS II	Field bus module for SERCOS II	35
CANopen + 2 analogue outputs	Field bus module for CANopen plus analogue outputs	36
Option 2: Sensors		
Sin/Cos-/ EnDat 2.1-encoder	Encoder option EnDat 2.1	37
Encoder simulation / TTL-encoder	Additional TTL-encoder input/output	39

1) The design variants can only be ordered together with the drive controller. They are delivered works mounted.

Option 1: EtherCAT

Overview

EtherCAT is an Ethernet based, real-time capable, synchronous field bus system. It is one of the fastest real-time Ethernet solutions for automation systems.

Technical data	Option 1 EtherCAT
Standard	IEC/PAS 62407 (since 2005)
Transfer rate	up to 100 Mbit/s
Transmission medium	standardized Ethernet in accordance with IEEE 802.3
Cycle time (min)	125 µs (8 kHz)
Synchronisation jitter	≤ 1 µs (distributed clocks)
Communication profile	CoE (DS301)
Device profile	DS402
Network topology	sLine, tree or star possible
Connection	RJ45 (shielded)
Cable type	CAT5 or higher

Order code	G392	-	xxx	x	**1**xx	-	xxx

The design variants can only be ordered together with the drive controller. They are delivered works mounted.

Option 1: CANopen

Overview

Communications interface CANopen, for floating equipment electronics

Technical data	Option 1 CANopen
Standard	ISO 11898
Communication	CiA/DS301
Device profile	CiA/DS402
Transfer rate/ line length	20 kbit/s up to 1000 m 1 Mbit/s up to 40 m
Cable connection	2 x Phoenix contact connectors (type FMC 1.5/5-ST-3,5 - GY) 5-pin (as per CiA/ DR303)
Voltage supply ext.	+ 24 V (± 6 V)

Order code	G392	-	xxx	x	**2**xx	-	xxx

The design variants can only be ordered together with the drive controller. They are delivered works mounted.

Option 1: PROFIBUS

Overview

Communications interface for PROFIBUS DPV1

Technical data	Option 1 PROFIBUS
Standard	EN50170
Communication	Directive 2.084
Device profile	PROFIBUS
Transfer rate/ line length	9.6 kbit/s up to 1200 m 12 Mbit/s up to 100 m
Cable connection	PROFIBUS D SUB 9-pin plug

Order code	G392	-	xxx	x	**3**xx	-	xxx

The design variants can only be ordered together with the drive controller. They are delivered works mounted.

Option 1: SERCOS II

Overview

The interface corresponds to the international standard IEC 61491/ EN61491 for SERCOS interfaces, and ensures optimal interaction of digital drives and control systems from differing manufacturers.

Technical data	Option 1 SERCOS II
Application note	AN17.2 (dated 2003-02-11)
Transfer rate	2/4/8 and 16 Mbit/s
Connections	1 Transmitter, 1 Receiver, fibre optic cables conform to the SERCOS interface specification (version 2.2 Nov. 2001)

Order code	G392	-	xxx	x	**4**xx	-	xxx

The design variants can only be ordered together with the drive controller. They are delivered works mounted.

Option 1: CANopen + 2 analogue outputs

Overview

Communications interface CANopen, for floating equipment electronics

Technical data	Option 1 CANopen + 2 analogue outputs
Standard	ISO 11898
Communication	CiA/DS301
Device profile	CiA/DS402
Transfer rate/ line length	20 kbit/s up to 1000 m, 1 Mbit/s up to 40 m
Cable connection for CAN	2 x Phoenix contact connectors (type FMC 1.5/5-ST-3,5 - GY) 5-pin (as per CiA/ DR303)
Voltage supply ext.	+ 24 V (± 6 V)
Analogue output channels	2
Voltage range	± 10 V differential
Permissible current load	max. 3 mA, short circuit
Output	+/- 10 V, 12 bit resolution
Precision	± 0.1% or ±19.5 mV
Cycle time	125 µs
Cable connection for analogue outputs	2x Phoenic contact connectors (type FMC1.5/2:ST- 3,5- GY) 4-pin for analog outputs
Order code	G392 - xxx x **5**xx - xxx

The design variants can only be ordered together with the drive controller. They are delivered works mounted.

Option 2: 2nd encoder

Overview

This option allows the use of a second sin/cos-encoders in the axis control simultaneously. The operation with only one sin/cos-encoder (incl. EnDat 2.1 / Hyperface-encoder) is standard (plug-in X7).

EnDat 2.1 is an interface protocol developed by the company Heidenhain for the transmission of the absolute position of the sin/cos-encoder.

Technical data	Option 2 2nd encoder input
Voltage supply	5 V ± 5 % / 150 mA (controlled via sensor cables)
Protocol of the RS422 interface	EnDat 2.1 (Heidenhain order code EnDat 01)
Signal shape of the track signals	Sine/Cosine, 1 V_{ss}
Cable length	50 m max.

Order code	G392	-	xxx	x	x**1**x	-	xxx

The design variants can only be ordered together with the drive controller. They are delivered works mounted.

Option 2: Encoder simulation / TTL-Encoder

Overview

This option card provides an input for a TTL-encoder output as well as an input for a TTL-encoder to the drive. The output is used in applications where the superimposed control system closes the position loop and expects an encoder feedback.

The output is galvanic isolated and the output resolution can be selected in steps of 2^n. A standard TTL-encoder can be connected to this option and could be used as a master set point.

Technical data	Option 2 TTL-Encoder simulation
Output	Impulse signals A and R, RS422 level
Isolation for output	Opto coupler, no external supply voltage necessary
Maximum output frequency	1 MHz
Input	A, B and R signals RS422 level
Voltage supply for encoder	5 V, 150 mA
Maximum input frequency	500 kHz
Output resolution	64, 128, 256 .. 65536
Cable length	50 m max.

Order code	G392	-	xxx	x	x**2**x	-	xxx

The design variants can only be ordered together with the drive controller. They are delivered works mounted.

Intelligent and centralized solution for modular drives system.

Active front-end power supply units with sinusoidal regeneration, PSU-AR, are complementary parts of the MSD Servodrive family.

The PSU-AR is available in two power sizes (P_{nom}/P_{max}): 50/94 kW and 110/160 kW with 10 s overload capability. The power electronics switching frequency for the best ratio of size/efficiency is set to 4 kHz and synchronized with the motor axis modules.

Details on voltage-power (current) relations:

AC Input Mains [V_{rms}]	Size5 / Size 6A			
	P_{nom} [kW]	P_{max} [kW]	Idc_{nom} [A]	Idc_{max} [A]
200	24.7/55.4	46.9/79.8	32.1/71.9	60.9/103.6
400	49.5/110.7	93.8/159.6	64.3/143.8	121.8/207.2
480	49.5/110.7	93.8/159.6	64.3/143.8	121.8/207.2

The 400 V_{rms} is the AC_{mains} nominal input voltage. The DC bus voltage can be stabilized at maximum 770 V.

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

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

Typical applications

- General automation

- Metal forming machines

- Injection and blow-molding machines

- Textile machines such as weaving and knitting machines

- Handling and assembly systems

- Conveying and storage technology

- Packaging and food processing machines

Features

- Enabling the best electric motor utilization all over the world through the DC-bus voltage boost and stabilization (the AC_{mains} in range of 200 V to 480 V +/- 10 %, 50 Hz & 60 Hz).

- Running with TN, TT and IT networks.

- Single DC supply for multiple axes through a short-circuit protected bus streamlines cabling and reduces footprint.

- Improving efficiency of a process through the power factor control.

- Returning energy to the AC_{mains} allows for low energy consumption.

- Regulating and controlling AC_{mains} disturbances (blackouts, under/over-voltage, spikes, etc.).

- Effective communication with the rest of the motion control system.

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

Interfaces (Preliminary version)

AC input

+ 24 Volt

DC bus

+ 24 Volt

USB

Ethernet

Control terminal

EtherCAT
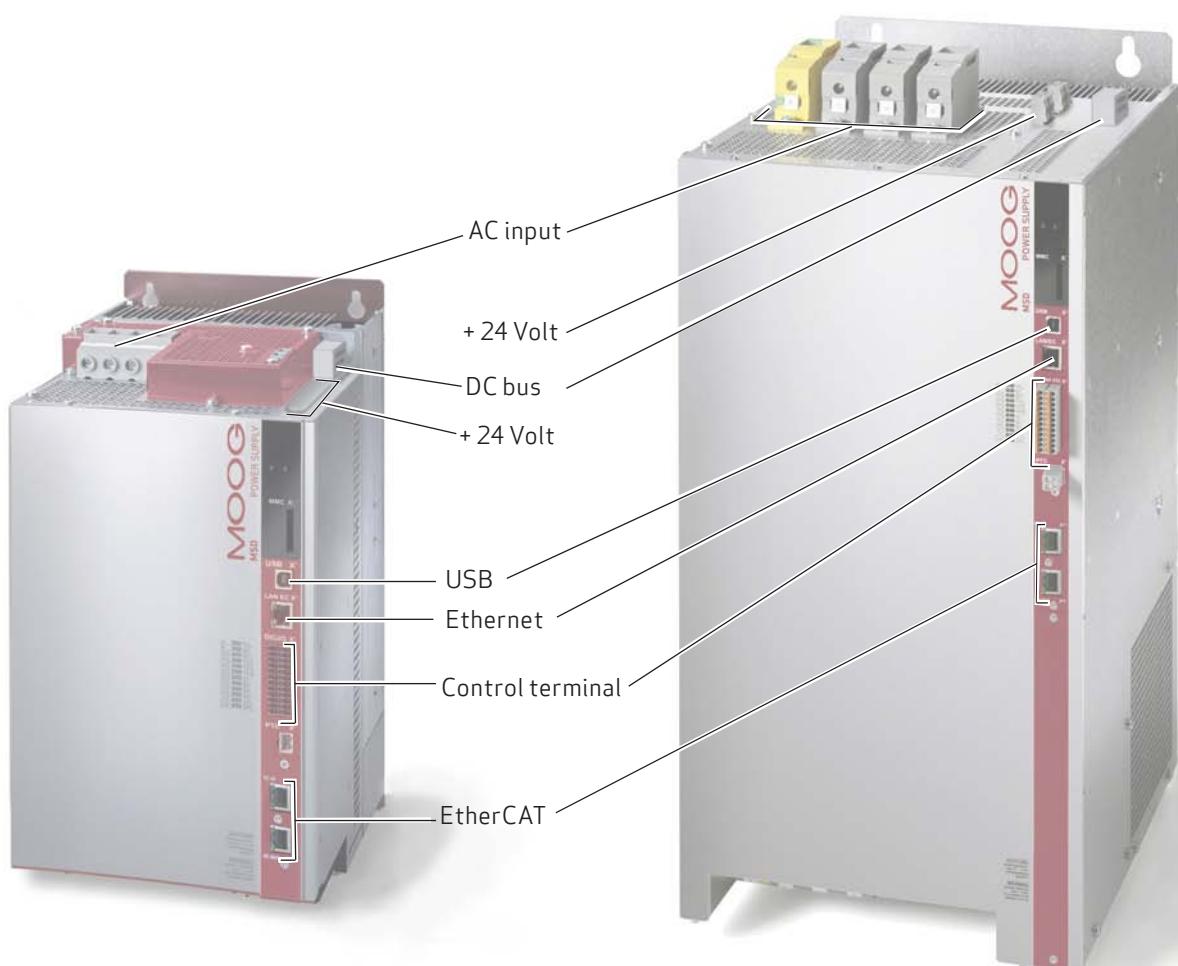
Supplementary components
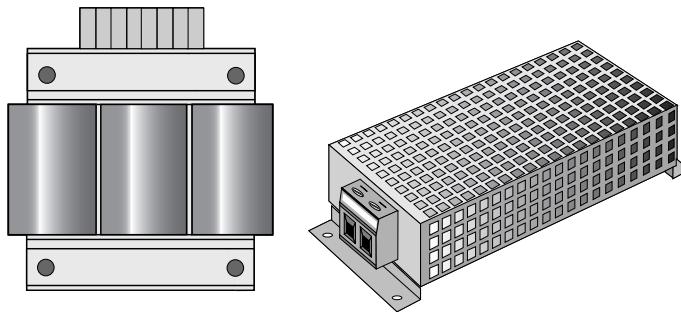
Content	Order designation	Page
Line chokes	CA68926-001 , CA55830-001 ... **CA55843-001**	43
Braking resistors	CA59737-001 ... **CA59744-001**	46
Line filters	CA71184-001 ... CA71190-001	49
Cables		52
Spare connector kits		53

Line chokes

Ambient conditions	CA68926-001	CA55830-001 - CA55843-001
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	-25 ° C to +45 ° C, with power reduction to 60 °C (1.3 % / °C)	-25 ° C to +45 ° C, with power reduction to 60 °C (1.3 % / °C)
Mounting height	1000 m , with power reduction up to 2000 m (6 % / 1000 m)	1000 m, with power reduction up to 2000 m (6 % / 1000 m)
Relative air humidity	15 ... 95 %, condensation not permitted	15 ... 95 %, condensation not permitted
Storage temperature	-25 °C to +70 °C	-25 °C to +70 °C
Protection	IP00	IP00
Short-circuit protection	U_K 4 % (corresponding to 9.2 V at 230 V)	U_K 4 % (corresponding to 9.2 V at 400 V) for 4.0 A to 32 A drives U_K 2 % (corresponding to 4.6 V at 400 V) for 45 A to 170 A drives
Permissible contamination	P2 to EN 61558-1	P2 to EN 61558-1
Thermal configuration	$I_{eff} \leq I_N$	$I_{eff} \leq I_N$
UL Recognition	Version CA558..-001 has UL Recognition for the USA and Canadian markets	Version CA558..-001 has UL Recognition for the USA and Canadian markets

1) At mains frequency 60 Hz the power loss increases by approx. 5 - 10 %.

One-phase line choke

| Order designation	Suitable for Servodrives	Rated current [A]	Power loss tot. [W]	Inductance [mH]	Weight [kg]	Connection [mm]
CA68926-001	G392-004A	14	16	2.1	1.5	4

CA68926-001
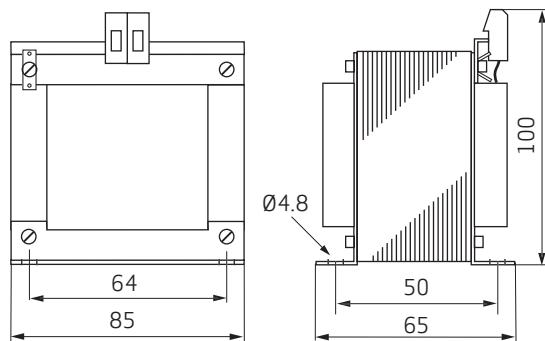
Three-phase line chokes

| Order designation	Suitable for Servodrives	Rated current [A]	Power loss tot. [W]	Inductance [mH]	Weight [kg]	Connection [mm]
CA55830-001	G392-004	4.2	20	7	2.5	4
CA55831-001	G392-006	6	25	4.88	2.5	4
CA55832-001	G392-008	8	25	3.66	2.5	4
CA55833-001	G392-012	14	45	2.09	4.0	4
CA55834-001	G392-016	17	45	1.72	4.0	4
CA55835-001	G392-020 G392-024	24	50	1.22	5.0	16
CA55836-001	G392-032	32	70	0.92	6.0	16
CA55837-001	G392-045	45	60	0.33	5.0	16
CA55838-001	G392-060	60	70	0.25	7.0	16
CA55839-001	G392-072	72	80	0.20	10	16
CA55840-001	G392-090	90	120	0.16	13	35
CA55841-001	G392-110	110	140	0.13	15	35
CA55842-001	G392-143	143	160	0.10	25	70
CA55843-001	G392-170	170	170	0.09	25	70

Three-phase line chokes

Di-men-sion	CA55 830 -001	CA55 831 -001	CA55 832 -001	CA55 833 -001	CA55 834 -001	CA55 835 -001	CA55 836 -001	CA55 837 -001	CA55 838 -001	CA55 839 -001	CA55 840 -001	CA55 841 -001	CA55 842 -001	CA55 843 -001
B	125	125	125	155	155	155	190	155	190	190	230	230	240	240
H	130	130	130	160	160	170	200	170	200	240	300	300	330	330
T	75	75	75	80	80	120	110	120	120	110	160	180	200	200
A	100	100	100	130	130	130	170	130	170	170	180	180	190	190
C	55	55	55	59	59	72	58	72	68	78	98	122	125	125
D Ø	5	5	5	8	8	8	8	8	8	8	8	8	11	11

CA55830-001 to CA55838-001
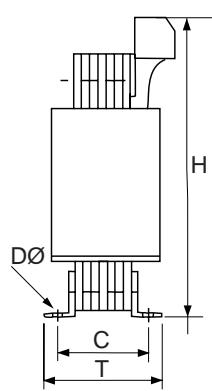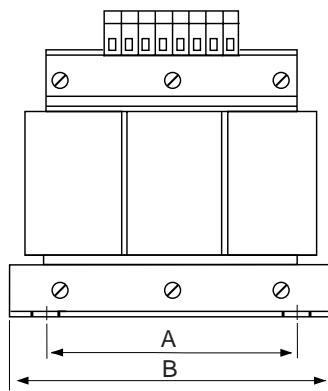
CA55839-001 to CA55843-001
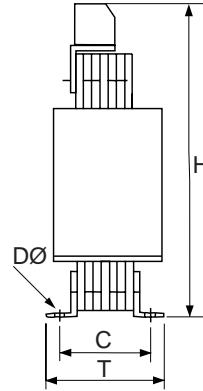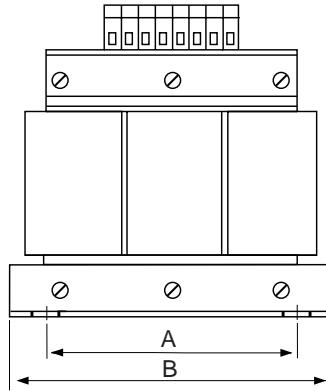
Braking resistors
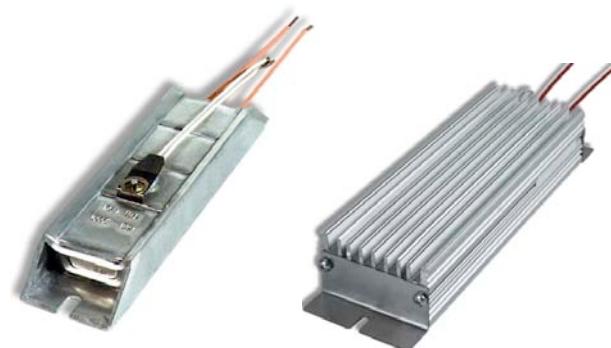
CA59737-001 **CA59738-001**

| Technical data	Type A1	Type A2	Type A3	Type A4
Surface temperature	› 250 °C	› 250 °C	› 250 °C	› 250 °C
Touch protection	No	No	No	No
Voltage	max. 970 V DC	max. 970 V DC	max. 970 V DC	max. 970 V DC
High-voltage strength	4000 V DC	4000 V DC	4000 V DC	4000 V DC
Temperature monitoring	Yes, with bimetallic protector (breaking capacity 0.5 A/ 230 V)	Yes, with bimetallic protector (breaking capacity 0.5 A/ 230 V)	Yes, with bimetallic protector (breaking capacity 0.5 A/ 230 V)	Yes, with bimetallic protector (breaking capacity 0.5 A/ 230 V)
Acceptance tests	CE compliant; UL Recognition	CE compliant; UL Recognition	CE compliant; UL Recognition	CE compliant; UL Recognition
Connection	1 m long PTFE-insula-ted litz wire	1 m long PTFE-insula-ted litz wire	1 m long PTFE-insula-ted litz wire	Connection cabinet with PG screw fittings

TYPE A1
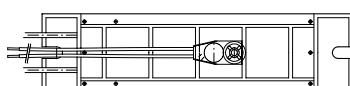
TYPE A2
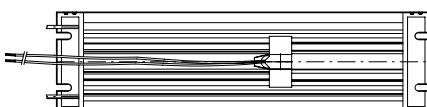
TYPE A3
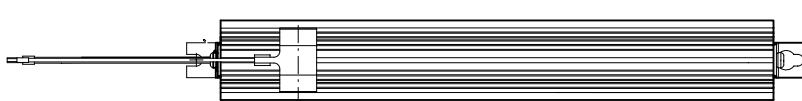
TYPE A4
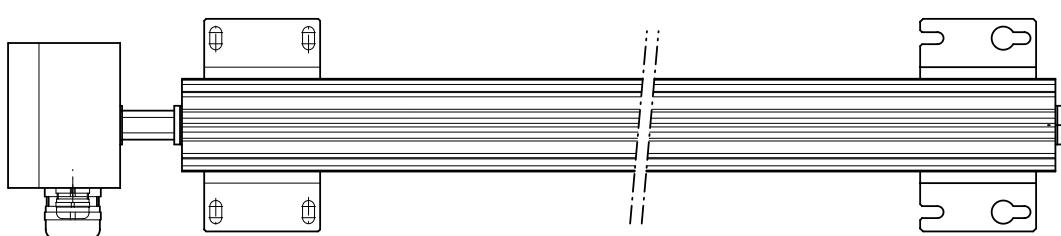
Order designation	Continuous braking power [W]	Resistance [W ±10 %]	Peak braking power [W] 750 VDC	Protection	Dimensions
CA59737-001	35	90	6250 W	IP54	A1
CA59738-001	150	90	6250 W	IP54	A2
CA59739-001	300	90	6250 W	IP54	A3
CA59740-001	1000	90	6250 W	IP65	A4
CA59741-001	35	26	21600 W	IP54	A1
CA59742-001	150	26	21600 W	IP54	A2
CA59743-001	300	26	21600 W	IP54	A3
CA59744-001	1000	26	21600 W	IP65	A4

Type A1
CA59737-001 and CA59741-001
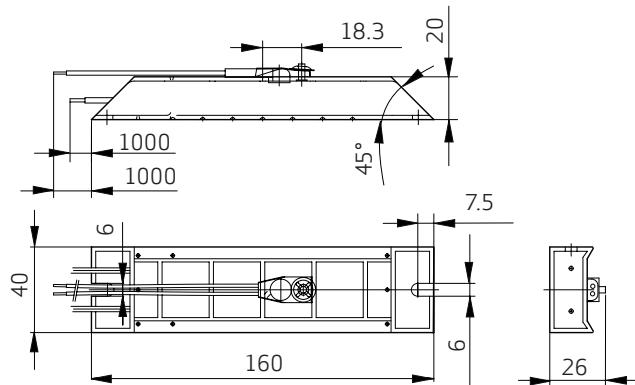
Type A2
CA59738-001 and CA59742-001
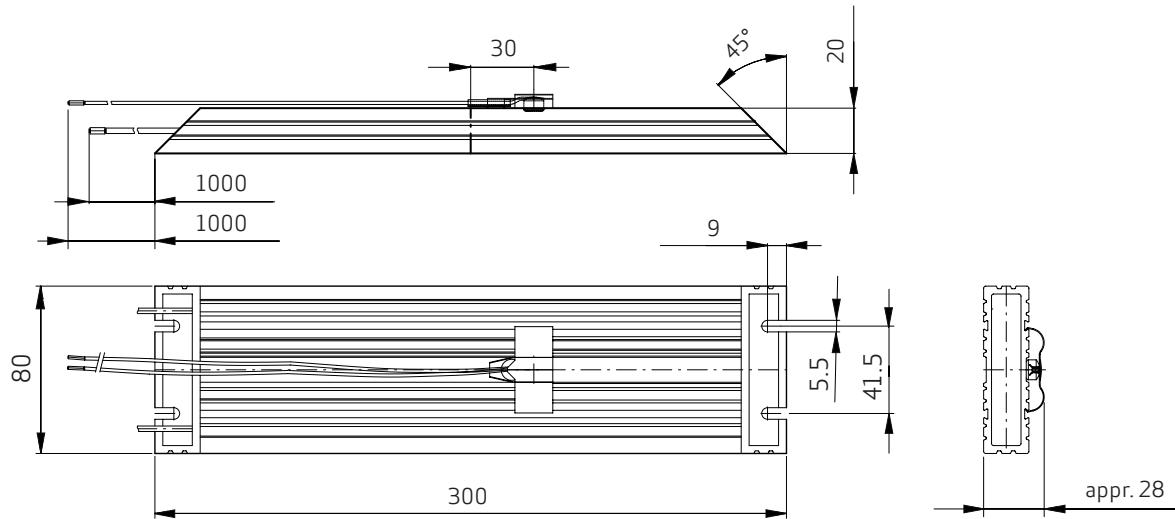
Type A3
CA59739-001 and CA59743-001
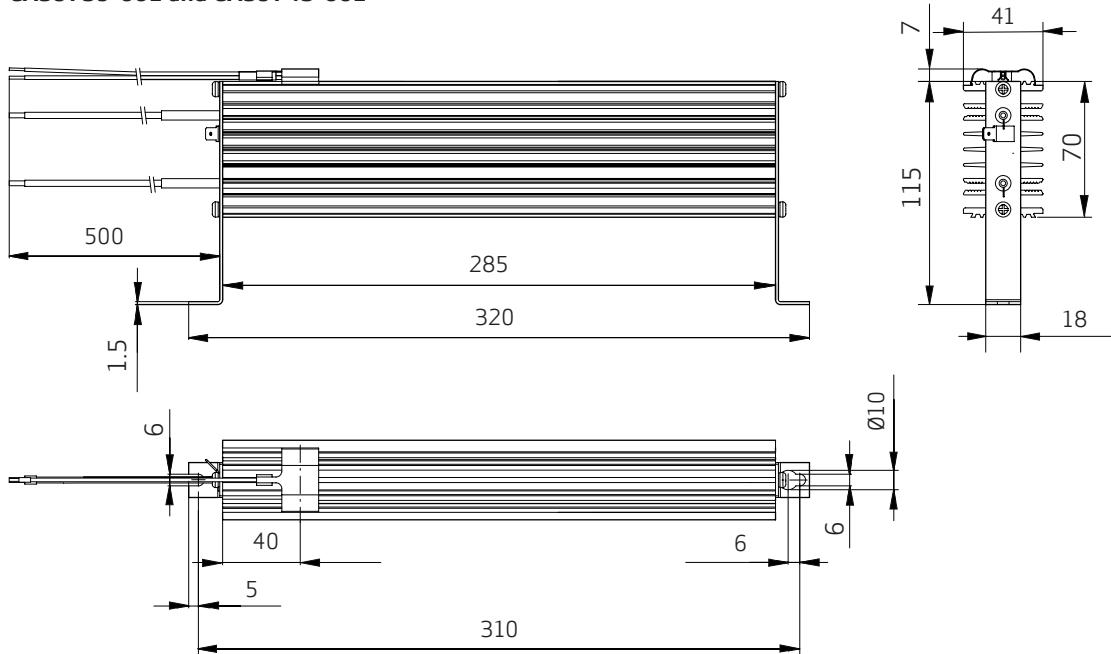
Type A4
CA59739-001 and CA59743-001
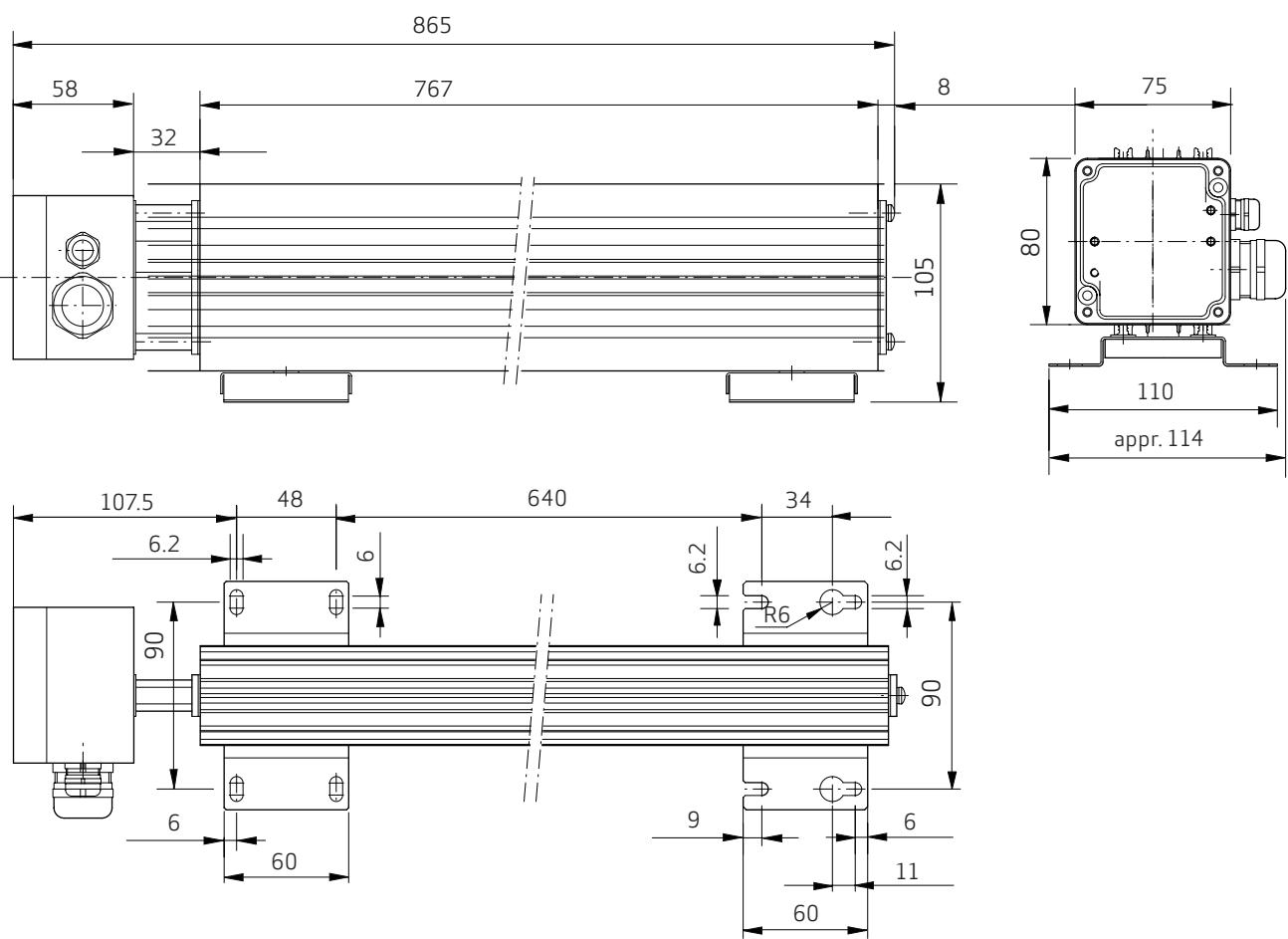
Line filters

Ambient conditions	CA71184 - CA71190
Rated voltage	3 x 480 V, +10 %, 50/60 Hz
Overload	2x for 10 s, repeatable for 30 min.
Ambient temperature	-25 ° C to +40 ° C, with power reduction to 60 °C (1.3 % / °C)
Mounting height	1000 m , with power reduction up to 4000 m (6 % / 1000 m)
Relative air humidity	15 ... 85 %, condensation not permitted
Storage temperature	-25 °C bis +70 °C / -40 °C bis +85 °C
Protection	IP00
Permissible contamination	P2 to EN 61558-1
Acceptance tests	CE compliant, UL-recognition
Radio shielding accordant EN61800-3 - living quarter	Motor cable length up to 100 m permitted
Radio shielding accordant EN61800-3 - industrial sector	Motor cable length up to 150 m permitted

Three-phase line filters

Order designation	Suitable for Servodrives	Type	Rated current [A]	Power loss tot. [W]	Touch current [mA]	Weight [kg]	Connection [mm²]
CA71184 -001	G392-004 G392-006	A 1	7	5	5.3	1.3	0.2 ... 4.0 PE bolt M5
CA71185 -001	G392-008 G392-012 G392-016	A 1	16	16	7.5	2.2	0.2 ... 4.0 PE bolt M5
CA71186 -001	G392-020 G392-024 G392-032	A 1	35	34	6.4	3.4	0.2 ... 6.0 PE bolt M5
CA71187 -001	G392-045 G392-060	A 1	63	30	4	5	0.5 ... 16 PE bolt M6
CA71188 -001	G392-072 G392-090	A 2	100	45	5	6	16 ... 50 PE bolt M8
CA71189 -001	G392-110 G392-143	A 2	150	55	7	6.8	16 ... 50 PE bolt M8
CA71190 -001	G392-170	A 3	180	15	7.2	7	Current bar/drilling 3 x 25/11 PE bolt M10

Three-phase line filters

Order designation	Type	A	B	C	D	E	F	G	H	I	K	L	MØ
CA71184-001	A1	175	55	75	165	45	155	177	--	--	--	--	4.5
CA71185-001	A1	255	55	110	245	30	235	257	--	--	--	--	4.5
CA71186-001	A1	270	55	110	255	30	240	271	--	--	--	--	5.5
CA71187-001	A1	280	62	180	270	40	240	305	--	--	--	--	7
CA71188-001	A2	290	75	200	270	45	250	336	--	--	--	--	7
CA71189-001	A2	320	90	220	300	60	280	380	--	--	--	--	7
CA71190-001	A3	310	200	120	180	180	160	410	45	86	30	91	8.5

Type A1
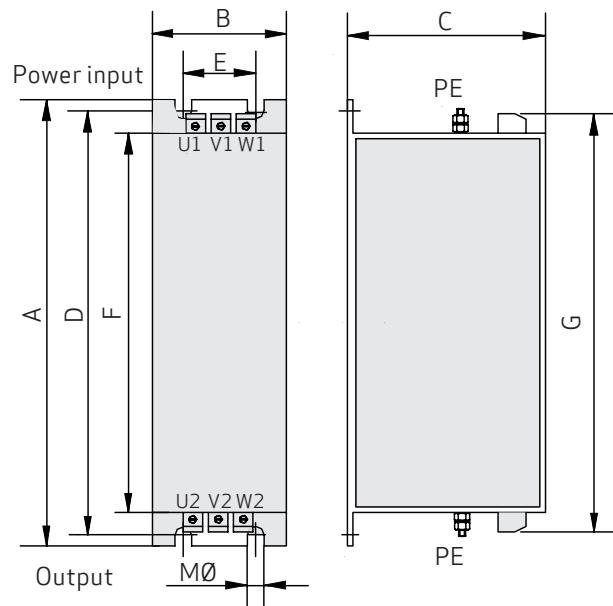
Type A2
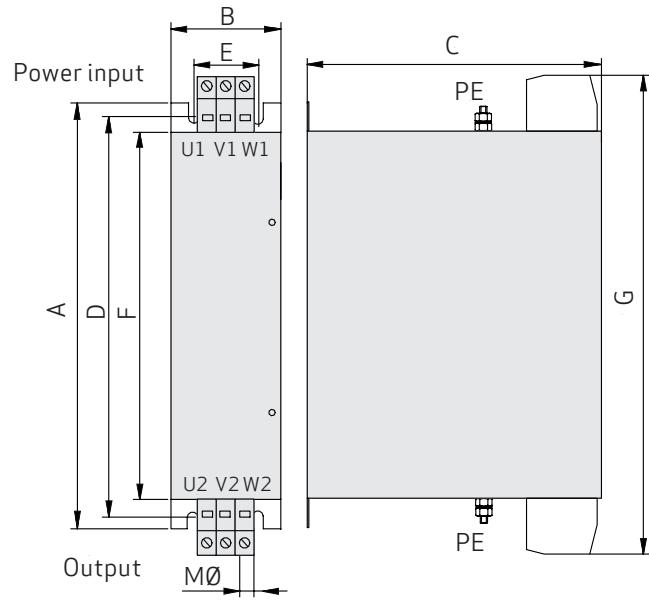
Type A3
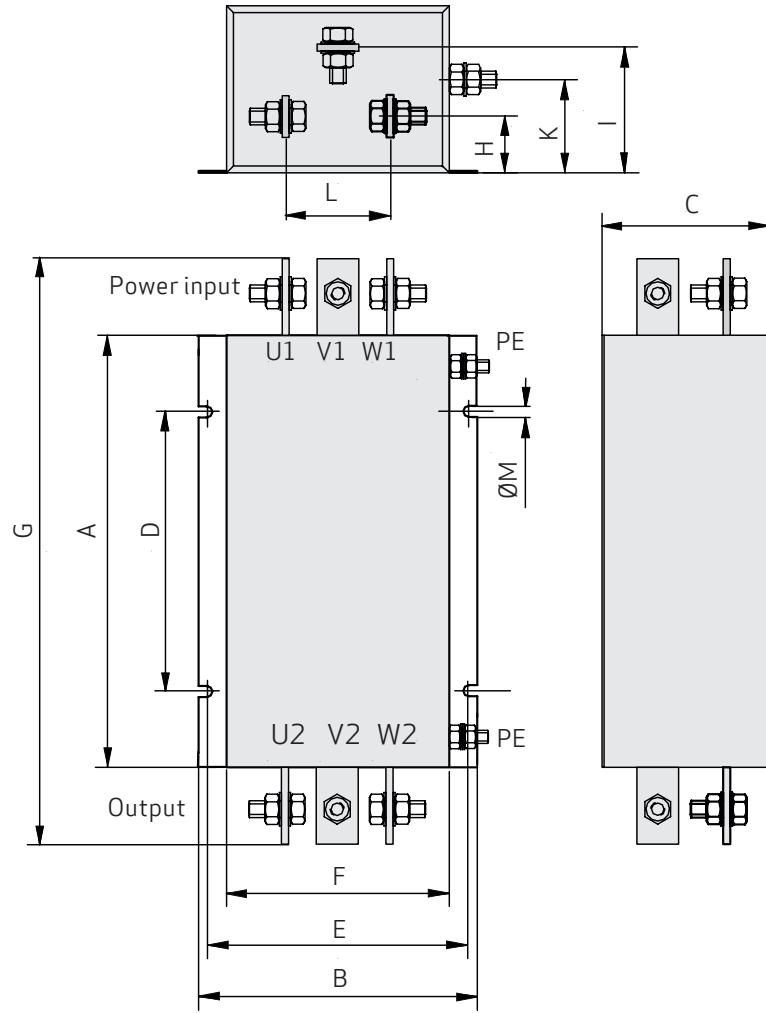
Cables

Cables	Model number	Description	Notes
Pre-assembled power cable [1]	C08336-001-xxx	$4 \times 1.5 \ mm^2 + 2 \times 1 \ mm^2$	for motor model series Fastact G421, G422, G423 and G424, as well as Fastact G462, G463, G464 and G465
Pre-assembled power cable [1]	B47915-001-xxx	$4 \times 2.5 \ mm^2 + 2 \times 1 \ mm^2$	for motor model series Fastact G425
Pre-assembled power cable [1]	C08733-001-xxx	$4 \times 6.0 \ mm^2 + 2 \times 1 \ mm^2$	for motor model series Fastact G466
Pre-assembled power cable [1]	B47916-001-xxx	$4 \times 10 \ mm^2 + 2 \times 1 \ mm^2$	for motor model series Fastact G426 and G428
Not pre-assembled power cable	B47890-001	$4 \times 1.5 \ mm^2 + 2 \times 1 \ mm^2$	for motor model series Fastact T/F, Fastact W and Fastact H
Not pre-assembled power cable	B47903-001	$4 \times 2.5 \ mm^2 + 2 \times 1 \ mm^2$	for motor model series Fastact T/F, Fastact W and Fastact H
Not pre-assembled power cable	C08731-001	$4 \times 6.0 \ mm^2 + 2 \times 1 \ mm^2$	for motor model series Fastact T/F, Fastact W and Fastact H
Not pre-assembled power cable	B47904-001	$4 \times 10 \ mm^2 + 2 \times 1 \ mm^2$	for motor model series Fastact T/F, Fastact W and Fastact H
Pre-assembled signal cable [1]	C08335-011-xxx		for motors with resolver
Pre-assembled signal cable [1]	CA58877-002-xxx		for motors with Stegmann encoder
Pre-assembled signal cable [1]	CA58876-002-xxx		for motors with Heidenhain encoder

1) „xxx" means length in meters. Standard lengths are: 5 m , 10 m , 15 m, 20 m, 50 m. Further lengths on request.

Spare connector kits

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

Moog Part number	Moog Part number	Description	Notes
MCTR connector kit	CA65115-001	2 x FMC 1,5/7-ST-3,5GY 2 x MSTB 2,5/2-ST GY	Mating connectors for the MSD Motion controller X3, X9 and X10
Servodrive control	CA70545-001	4 x MVSTBR 2,5/2-ST GY 1 x MVSTBR 2,5/3-ST GY 2 x FMC 1,5/12-ST-3,5 GY	Mating connectors X4, X5, X9, X10, X13, X20 for the MSD Servodrives
Servodrive power Size 1/2	CA70546-001	1 x PC4HV/4-ST-7,62GY 1 x PC5/7-STF-SH-7,62GY	Mating connectors for the power connectors X11, X12 of the Servodrives Size 1 and Size 2
Servodrive power Size 3/4	CA70547-001	1 x PC16/4-STF-10,16GY 1 x IPC16/7-STF-SH-10,16GY	Mating connectors for the power connectors X11, X12 of the Servodrives Size 3 and Size 4
Servodrive CAN	CA70548-001	2 x FMC 1,5/5-ST-3,5GY 2 x FMC 1,5/2-ST-3,5GY	Mating connectors for the CAN interface X32 and additional analogue output signals X33, on the CAN Field bus option

General technical specification

CE mark

The Servodrives[1] meet the requirements of the Low Voltage Directive DIN EN 50178 and the product norm EN 61800-3 (EMC).

The Servodrives[1] thus meet the requirements for installation into a machine or system as per the Machinery Directive 98/37/EG.

The Servodrives[1] are accordingly CE marked. The CE mark on the type plate indicates conformity with the above Directives.

UL approbation (in preparation)

For the entire G392-0xx Servodrives[1] series cUL approbation has been granted. The cUL approbation is equivalent to UL and CSA approbation.

EMC acceptance tests

All G392-0xx have an aluminium housing with an anodised surface to reduce interference (in accordance with EN 61800-3, environment classes 1 and 2).

So that the interference output associated with the cabling is limited to the permitted level, all G392-0xx Servodrives (Size 1 to Size 5) are fitted with built-in line filters. This ensures compliance with the EMC product standard DIN EN 61800-3:

- Public low voltage system:

- Living areas up to 10 meters motor cable length

- Industrial low voltage system:

- Industrial areas up to 25 meters motor cable

- In addition, line filters are available for all servo controllers (see the „supplementary components" section).

Characteristic		MSD System
Protection		IP 20
Temperature range	during operation[2]	-10 ...45 ° C with power reduction up to bis 55 ° C
Temperature range	during storage[2]	-25 ... +55 °C
Temperature range	during transit[2]	-25 ... +70 °C
Relative humidity during operation[2]		15 ... 85 %, condensation not permitted
Mechanical strength to IEC 68-2-6	in stationary use	Vibration: 0.075 mm in frequency range 10 ... 58 Hz Shock: 9.8 m/s^2 in frequency range >58 ... 500 Hz
Mechanical strength to IEC 68-2-6	in transit	Vibration: 3.5 mm in frequency range 5 ... 9 Hz Shock: 9.8 m/s^2 in frequency range >9 ... 500 Hz
Protection	Device	IP20 (NEMA 1) terminals excepted [3]
Machine safety		in accordance with BGV A3
Mounting height		Up to 1000 m above MSL, above 1000 m above MSL with reduced power, max. 2000 m above above MSL

1) Also applies to user and communication modules
2) Further information on this subject can be found in the Engineering Guide
3) The connection terminals comply with IP00

As the world leader in motion control technologies, Moog offers a full range of service and support designed to ensure maximum productivity on a daily basis.

Moog Authentic Repair® and Moog **Maintenance Services** offer the quality, quick turnaround, expertise of trained technicians and global consistency of services you need to keep your equipment operating as it should. Our expert technicians are there to optimize your machine performance, minimize downtime and ensure the smooth commission of all Moog products.

**Moog Maintenance Services
for the global support:**

- Repairing your product to like-new performance through Moog Authentic Repair Services

- Diagnosing and identifying sources of malfunctions in your motion control system

- Regular maintenance visits, pre-visits prior to scheduled downtime and scheduled repairs

- Machine or system start-up, commissioning and reinstallation services

- Field replacements, retrofits or product repair

- Upgrade recommendations and collaborative engineering to change product parameters

- Access to electronic and print resources, including service manuals, drawings, software and other online resources to solve problems and minimize on-site visits

With facilities in more than 28 countries worldwide, Moog is committed to provide prompt, expert service on a local level.

**Visit us today**

For more information on Moog Authentic Repair and Maintenance Services, visit **www.moog.com/industrial**. Use the web site's global locator to find the Moog office nearest you for application engineering, repair or field services.

MSD Power Supply Unit   G396 - ☐☐☐ - 0 0 1 - 0 0 1

Rated power	
050	50 kW
110	110 kW

001	Regenerative

Variant sequential numbering

MSD Motion Controller   G391 - 0 0 1 - ☐☐☐

Field bus Options:	
001	None
002	PROFIBUS DP
003	EtherCAT slave
004	CAN second

Future Options:	
005	PROFINET
006	Powerlink
007	CC-Link
008	SERCOS III
009	Fire Wire
010	VARAN
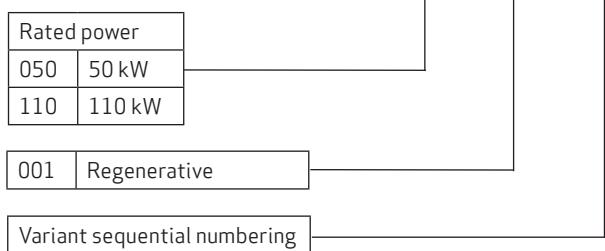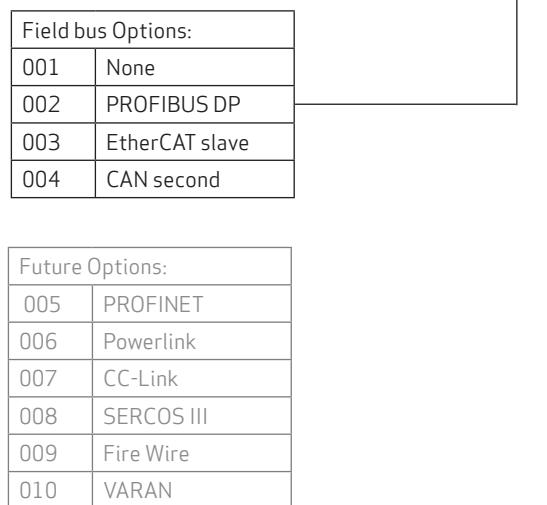
MSD Servodrive   **G392 -** ☐☐☐ ☐☐☐ **-** ☐☐☐

Rated current:	
004	4A Size 1
006	6A Size 1
008	8A Size 2
012	12A Size 2
016	16A Size 3
020	20A Size 3
024	24A Size 4
032	32A Size 4
045	45A Size 5
060	60A Size 5
072	72A Size 5
090	90A Size 6
110	110A Size 6
143	143A Size 6 A
170	170A Size 6 A

Supply voltage:	
-	3x 230 V – 480 V
A [1]	1x 230 V

Variant sequential numbering	
001	Standard
002 [2]	Internal braking resistor

Option 3: Safety	
0	Normal
1	Safety

Option 2: Sensors	
0	None
1	2nd Encoder
2	Encoder simulation

Option 1: Field bus	
0	None
1	EtherCAT
2	CANopen
3	PROFIBUS DP
4	SERCOS II
5	CANopen + 2 analogue outputs

1) supply voltage 1 x 230 V only available for G392-004A
2) internal braking resistor available for size 1 to size 4

TAKE A CLOSER LOOK.

Moog solutions are only a click away. Visit our Web site for more
information and the Moog facility nearest you.

MOOG

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

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

Austria
+43 664 144 65 80
info.austria@moog.com

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

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

Finland
+358 9 2517 2730
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 4120 8799
info.india@moog.com

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

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

Japan
+81 463 55 3767
info.japan@moog.com

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

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

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

Norway
+47 64 94 19 48
info.norway@moog.com

Russia
+7 31713 1811
info.russia@moog.com

Singapore
+65 6773 6238
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

United Kingdom
+44 1684 29 6600
info.uk@moog.com

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

www.moog.com/industrial

WHAT MOVES YOUR WORLD

MOOG