

SD2x

EXPERT SOLUTIONS PAY OFF.

Product Guide for the Device Family SD2x
Frequency Converters and Servo Amplifiers



"Our frequency converters and servo amplifiers of series SD2x stand out for maximum performance at reduced system costs, low required space and a long service life."

Torsten Blankenburg, CTO at SIEB & MEYER AG

With product series SD2x SIEB & MEYER offers its customers a wide range of serial devices. The portfolio of the innovative frequency converters and servo amplifiers covers a power range of 0.3 to 432 kVA and output frequencies of 0 to 8,000 Hz, which corresponds to a speed of 480,000 rpm. Different control methods and device topologies ensure to find an optimal solution for any application in the product range. Beyond that SIEB & MEYER also offers customized solutions and individually designed devices allowing the best possible integration of frequency converters and servo amplifiers into a complete system.

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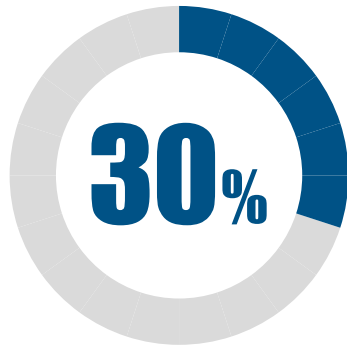
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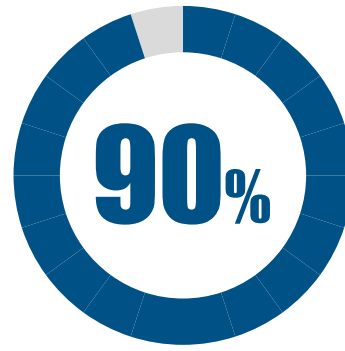
Since its foundation in the year 1962 SIEB & MEYER is successful worldwide in the field of industrial electronics. With 220 employees worldwide today, we develop and manufacture a broad spectrum of CNC and drive technology products. Our core technologies are control systems for mechanical engineering and automation engineering, servo amplifiers for various drive types, frequency converters for high-speed motors and generators. The consistent concentration on our core competences results in our worldwide leading position in the field of CNC controllers for PCB drilling and routing machines. Close cooperation with our customers from the development to a trouble-free operation of our products is the basis of our philosophy of quality.



Up to 30% Less Construction Volume

Naturally, high-speed motors require high rotating field frequencies. Standard frequency converters generally allow maximum rotating field frequencies of a few hundred hertz which inevitably results in a 2-pole motor design. However, 2-pole motors have significant disadvantages with regard to the construction volume and the power density.

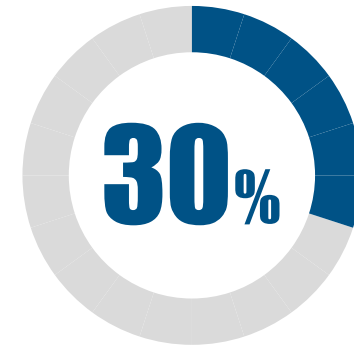
Frequency converters of the SD2x product family are specially designed for the use at rotating field frequencies of up to 8,000 Hz and allow motor designs with more poles. The use of a 4-pole motor instead of a 2-pole motor for example allows the reduction of the construction volume by up to 30%. The weight is reduced and critical bending frequencies can be minimized. This offers new degrees of freedom for optimized motor design.



90% Less Rotor Losses

About 90% of all losses caused by the converter occur in the rotor. These losses result in heat that can damage the motor. Taking into account the small rotor volume as a design-specific factor of high-speed motors, further temperature problems are the outcome. The control techniques applied in the SD2x product family ensure a low level of harmonic frequencies in the motor current. As a result, losses in the frequency converters of series SD2x can be reduced by up to 90% in comparison to competitive products. Heating is reduced correspondingly.

Other advantages of the low motor heating are a longer service life of ball bearings in machine tool spindles and positive effects on the manufacturing quality.



Energy Savings up to 30%

Motion sequences in machine tools are characterized by continuous accelerating and deceleration processes. In terms of energy efficiency power must be supplied and withdrawn from the moving system. The most common solution for handling braking energy is "wasting" the energy. That means the energy is converted into heat and released to the atmosphere without use.

The multi-axes drive system SD2 allows energy exchange between the individual movement axes via a common-DC link and utilizes this potential for energy saving. Depending on the machine structure and motion profile energy savings of up to 30% are possible.



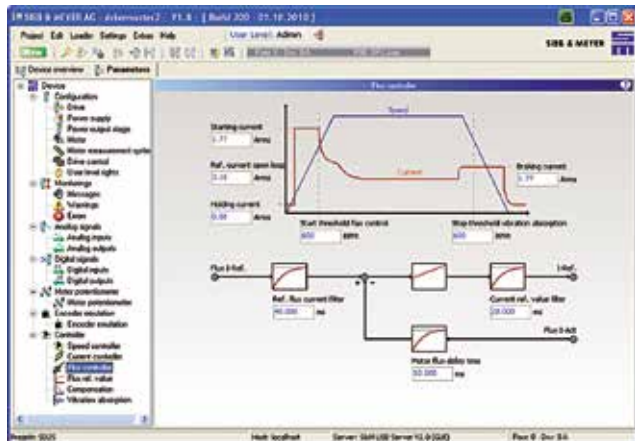
Manufacturing frequency converters requires full attention and a high quality awareness of the staff.

Software

One software for all devices: Firmware and PC software are significant elements for the performance of modern frequency converters and servo amplifiers. Both parts of the software are constantly developed while ensuring highest software stability. This way the SD2x product family already meets the demands of tomorrow.

drivemaster2

The central PC software *drivemaster2* is the core of the complete SD2x product family. The intuitive user interface supports the user in a simple and fast way from parameter setting to diagnosis.

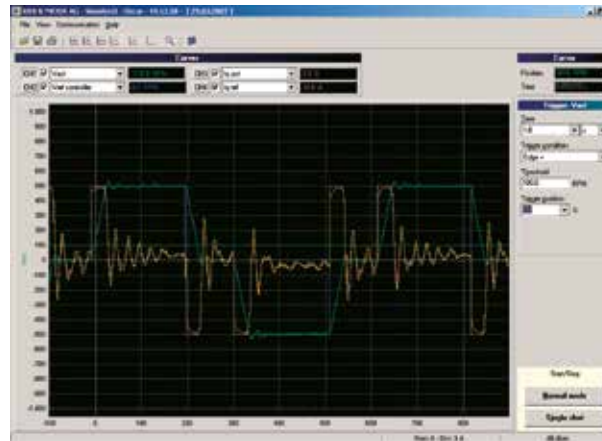


Parameterization

- up to 64 parameter sets
- tree-type structure
- block diagrams
- graphics
- interactive help messages
- comments
- "parameter wizard"

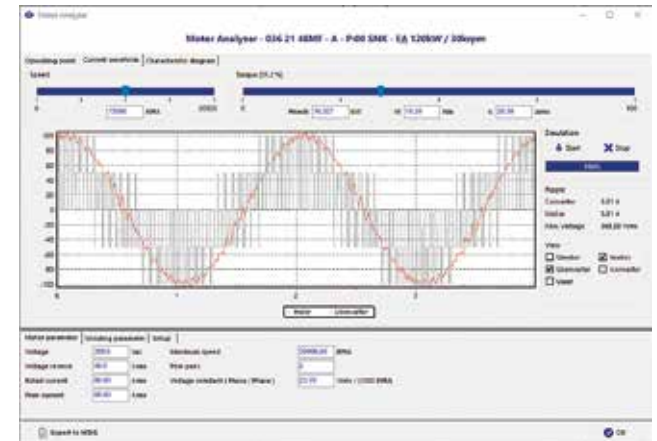
Operation

- without higher-ranking control
- visualized reference and actual values
- error and status messages



Diagnosis

- 4-channel oscilloscope
- zoom functions
- trigger functions
- long-term recording functions
- measurements can be saved
- diagnosis of the inputs and outputs
- bus monitor



Simulation

- asynchronous and synchronous motors
- different loads
- grid conditions
- interference suppression
- control parameters

Drive Functions

With the product family SD2x SIEB & MEYER offers a variety of drive functions allowing optimal operation of synchronous and asynchronous motors with and without speed sensors.

Drive functions for operation without sensors:

SVC

The drive function SVC based on pulse-width modulation (PWM) allows operation of synchronous and asynchronous motors up to 2,000 Hz and 120,000 rpm. The user benefits from the best possible motor performance and low motor heating.

- vector control from about 5 % of the rated speed
- 4-Q operation
- high-dynamic and speed stable

FPAM

Based on the precise EMF measurement the motor is used as a sensor. The drive function FPAM allows operation of high-speed synchronous motors up to 8,000 Hz or 480,000 rpm. Additional motor chokes or LC-filters are not required.

- block wave with controlled intermediate DC link
- closed loop control from about 5 % of the rated speed
- high-dynamic and speed stable

V/f-PWM

Based on the V/f curve the drive function allows operation of asynchronous motors up to 3,000 Hz or 180,000 rpm. For parameterization the operator only needs to refer to the data on the motor type plate.

- 4-Q operation
- compensation possibilities for slip, load and R_xI effects
- PWM-based

V/f-PAM

Based on a fundamental wave pulse with controlled DC link the drive function V/f-PAM allows operation of high-speed asynchronous motors up to 8,000 Hz or 480,000 rpm. Additional motor chokes or LC-filters are not required.

- based on V/f curve
- extensive compensation possibilities for slip, load and R_xI effects
- easy parameterization by use of data on motor type plate

HSPWM

Based on a block wave with controlled DC link the drive function HSPWM allows operation of high-speed asynchronous motors up to 8,000 Hz or 480,000 rpm. Additional motor chokes or LC-filters are not required.

- PWM-based
- specifically for applications with frequent partial-loads and periodic load cycles
- for low requirements to dynamics

Drive functions for operation with sensors:

HS-Block

Based on speed detection via Hall sensors the drive function HS-Block allows operation of high-speed synchronous motors up to 6,000 Hz or 360,000 rpm. The evaluation of Hall sensors ensures synchronization to rotating motors.

- block-type motor current commutation via Hall sensor evaluation
- 4-Q operation from speed zero
- PWM-based or block wave with controlled DC link

Servo

The drive function Servo allows high-dynamic and precise speed operation of synchronous and asynchronous motors up to 2,000 Hz or 120,000 rpm as well as operation of linear motors. Together with a higher-ranking position control (CNC) this drive function enables the user to realize high-precision position tasks.

- 4-Q operation from speed zero
- maximum torques from speed zero
- evaluation of various encoder types: Resolver, encoder / linear scale (TTL or Sin/Cos), EnDat, Hiperface, SSI, Hall sensor, linear Hall sensor

Load Indicator

The load indicator is integrated as standard in all devices of series SD2x. The function is used to monitor the torque generating part of the motor current: Once a preset motor load is exceeded the load indicator generates a message. The function is based on a high-precision and dynamic current measurement. Additional expensive measuring sensors as for example acoustic emission sensors may not be required.

LI

The load indicator has different modes with adjustable parameters.

Operators benefit from the easy-to-use oscilloscope function which can also be installed on higher-ranking controls. For evaluation during control processes in the control sequences the load indicator supports different signals on I/O terminals and on serial data connections.

Possible applications:

Tool breakage – Load changes of the motor which result for example due to the contact between the tool and the workpiece can be detected with high sensitivity. If, for example an expected current change does not occur during the machining process, a tool breakage is

likely. The operator can stop the machine immediately and prevent further damage to the machine.

Tool wear – Worn tools require more power and more current. That way a pre-defined tool wear can be detected. If a preset load threshold is reached, a message is generated and the corresponding tool can be replaced quickly. This guarantees a continuous machining quality.

Gap elimination – When the tool touches the workpiece to be machined this is also referred to as "gap elimination" – a process which for example often occurs in grinding and requires immediate reduction of the machining feed rate. This is usually covered by expensive acoustic emission sensors. In many cases the load indicator can take over this function.

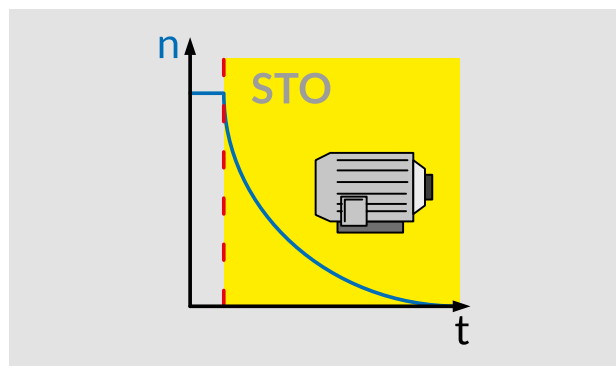
Flexible machining feed rates – Last but not least, feed rates can be flexibly adjusted by using the load indicator. This is particularly helpful for machining work pieces with different material densities (e.g. wood).



The SIEB & MEYER safety functions ensure machine safety without limiting the productivity.

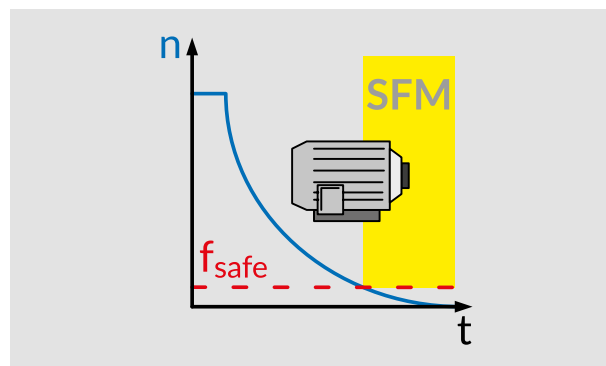
Safety Functions

The product family SD2x is equipped with TÜV-certified functions. These functions help to meet the steadily growing requirements towards the functional safety of machines. Compared to solutions with external safety components the safety functions of the SD2x product family offer enormous advantages as cost savings and easy machine organization.



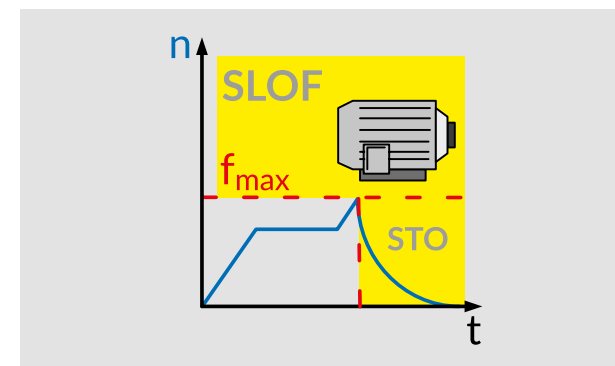
STO

The safety function **Safe Torque Off (STO)** ensures to switch motors to torque-free operation and to prevent restart. Using STO a restart lock of category 4 according to EN 13849-1:2008-12, EN 62061:2008-04 and EN 61508:2002-11; safety level SIL3 can be attained. With the integrated solution the user does not need to use expensive external safety contactors, which contributes to significantly reduced system costs.



SFM

The sensorless safety function **Safe Frequency Monitor (SFM)** allows the termination of a safe frequency/speed (e.g. $< 10\text{Hz}$) of motors/spindles. This way already existing motors/spindles can be used. External safety components or a speed sensor are not needed. The function is certified according to EN 61508:2010; safety level SIL3.



SLOF

The sensorless safety function **Safe Limited Output Frequency (SLOF)** ensures that a preset max. speed is not exceeded. This function is used for example for burst protection or for protection during the setup mode. If the set maximum rotating field frequency is exceeded because of a faulty input or malfunction of the drive, the function STO automatically disables the output stage via internal processes. The function is certified according to EN 61508:2010; safety level SIL3.



"In the eighties I studied electrical engineering. Measuring techniques with 1 % accuracy were already considered as great and control technique was taught with flat irons and simple direct current motors as examples.

Today, we are working with positioning applications in the nanometer range and high-speed applications with speeds up to 600,000 rpm. Making things move and getting best results excite me until today!"

Rolf Gerhardt, head of sales drive electronics at SIEB & MEYER AG

SD2

The Team Player

The drive system SD2 is designed to control synchronous and asynchronous motors with or without a sensor and permits quick and easy adaptation to the individual case of application – whether used with linear motors, rotary motors or motor-driven machining spindles.

This universal drive solution allows realization of high-speed applications up to 360,000 rpm (6,000 Hz). Universal motor encoder interfaces and different connection possibilities to a higher-ranking control allow easy adaptation to changing system requirements – nothing will stand in the way of the optimal realization of multi-axis applications.

As a standard all devices of series SD2 are equipped with "Safe Torque Off" (STO).

The sensorless safety functions "Safe Frequency Monitor" (SFM) and "Safe Limited Output Frequency" (SLOF) are available as option. This is a great benefit to allow compliance with the requirements of the Machinery Directive.



Function · Advantage · Benefit

Multi-axis system

Function: The SD2 single and double drive amplifiers can be supplied by a common power supply unit.

Advantage: The DC voltage coupling allows recovering energy: The energy produced by the braking axes can be used by the driving axes. Depending on the system performance mains supply for up to 12 axis modules can be realized.

Benefit: Low wiring and energy costs.

Load Indicator

Function: SD2 offers a high-precision evaluation of the torque generating current by default.

Advantage: The evaluation can be used for tool monitoring. These are for example detection of tool breakage, tool wear, gap eliminator (GAP and crash) and an optimal control of the feed rate during the manufacturing process.

Benefit: Lower system costs, no need for cost-intensive monitoring sensors.

Safety integrated

Function: "Safe Torque Off" (STO) is integrated as standard in the device. The sensorless functions "Safe Frequency Monitor" (SFM) and "Safe Limited Output Frequency" (SLOF) are available as options.

Advantage: No need of external safety components while safety standards are met.

Benefit: Minimization of system costs and higher machine availability.



- 1 Power supply (DC)
- 2 24 V logic supply
- 3 Parameterization and diagnosis
- 4 **Safety integrated "STO"**
Restart lock to meet category 4/PL e according to
EN ISO 13849-1:2015 and EN 61508:2010 SIL3
- 5 6 digital inputs and 4 outputs
- 6 Encoder inputs and outputs (pulse-direction signals)
- 7 Encoder inputs and outputs (measuring system simulation)
- 8 Resolver inputs
- 9 Analog reference interfaces: +/-10 V
- 10 **Universal motor encoder interface**
Resolver, encoder / linear scale (TTL or Sin/Cos), EnDat, Hiperface, SSI,
Hall sensor, linear Hall sensor, magnetoresistive sensor
- 11 Thermal contacts
- 12 2x motor connection for synchronous and asynchronous spindles,
linear motors and rotary motors
- 13 SERVOLINK 4 (optical fiber)
- ! **EtherCAT, PROFIBUS and PROFINET via Gateway** (see page 46)

drivemaster2	SVC	FPAM
V/f-PWM	V/f-PAM	HSPWM
HS-Block	Servo	LI
STO	SFM	SLOF



SD2 with integrated heat sink

Device type	Rated power ¹⁾	Rated current	Peak current/time	Maximum output voltage ¹⁾	Height x width x depth	Weight	Cooling
Single drive amplifier – 325 VDC supply voltage							
0362114DC	3.9 kVA	11.3 Arms	14.1 Arms/5 s	3 x 200 VAC	410 x 70 x 207 mm	5.7 kg	Air
0362114EC	4.8 kVA	14 Arms	28.3 Arms/2 s	3 x 200 VAC	410 x 70 x 207 mm	5.7 kg	Air
0362114IC	8.6 kVA	25 Arms	56.6 Arms/2 s	3 x 200 VAC	410 x 70 x 207 mm	5.7 kg	Air
Single drive amplifier – 560...680 VDC supply voltage							
0362114DF	8 kVA	11.3 Arms	14.1 Arms/5 s	3 x 410 VAC	410 x 70 x 207 mm	5.7 kg	Air
0362114EF	9.9 kVA	14 Arms	28.3 Arms/2 s	3 x 410 VAC	410 x 70 x 207 mm	5.7 kg	Air
0362114IF	9.9 kVA	14 Arms	56.6 Arms/2 s	3 x 410 VAC	410 x 70 x 207 mm	5.7 kg	Air
0362114MF	24.8 kVA	35 Arms	113 Arms/2 s	3 x 410 VAC	410 x 130 x 207 mm	9.3 kg	Air
0362114NF	24.8 kVA	35 Arms	141 Arms/2 s	3 x 410 VAC	410 x 130 x 207 mm	9.3 kg	Air
0362111OF	35.4 kVA	50 Arms	113 Arms/2 s	3 x 410 VAC	410 x 130 x 207 mm	5.9 kg	Water
0362111RF	78 kVA	110 Arms	177 Arms/25 s	3 x 410 VAC	390 x 230 x 144 mm	8.7 kg	Water
0362111SF	141 kVA	200 Arms	245 Arms/25 s	3 x 410 VAC	410 x 230 x 180 mm	11 kg	Water
Double drive amplifier – 325 VDC supply voltage							
0362113DDC	3.5 kVA + 3.5 kVA	10 Arms + 10 Arms	14.1 Arms/5 s + 14.1 Arms/5 s	3 x 200 VAC	410 x 70 x 207 mm	5.7 kg	Air
0362113EEC	3.5 kVA + 3.5 kVA	10 Arms + 10 Arms	28.3 Arms/2 s + 28.3 Arms/2 s	3 x 200 VAC	410 x 70 x 207 mm	5.7 kg	Air
Double drive amplifier – 560...680 VDC supply voltage							
0362113CCF	4.5 kVA + 4.5 kVA	6.4 Arms + 6.4 Arms	7.1 Arms/5 s + 7.1 Arms/5 s	3 x 410 VAC	410 x 70 x 207 mm	5.7 kg	Air
0362113DDF	5 kVA + 5 kVA	7 Arms + 7 Arms	14.1 Arms/5 s + 14.1 Arms/5 s	3 x 410 VAC	410 x 70 x 207 mm	5.7 kg	Air
0362113EEF	5 kVA + 5 kVA	7 Arms + 7 Arms	28.3 Arms/2 s + 28.3 Arms/2 s	3 x 410 VAC	410 x 70 x 207 mm	5.7 kg	Air
Double compact devices – (1)3 x 110...230 VAC mains voltage							
0362131DDC	6.4 kVA	11 Arms + 11 Arms	14 Arms/5 s + 14 Arms/5 s	3 x 200 VAC	410 x 100 x 207 mm	7.5 kg	Air
0362131SSC	6.4 kVA	11 Arms + 11 Arms	42 Arms/1 s + 42 Arms/1 s	3 x 200 VAC	410 x 100 x 207 mm	7.5 kg	Air

1) Rated power and max. output voltage for mains voltage/supply voltage (in bold)

SD2 with integrated heat sink

Device type	Rated power ¹⁾	Rated current	Peak current/time	Maximum output voltage ¹⁾	Height x width x depth	Weight	Cooling
Double compact devices – 3 x 400...480 VAC mains voltage							
0362131DDF	11.2 kVA	7 Arms + 7 Arms	14 Arms/5 s + 14 Arms/5 s	3 x 410 VAC	410 x 100 x 207 mm	7.5 kg	Air
0362131SSF	11.2 kVA	7 Arms + 7 Arms	42 Arms/1 s + 42 Arms/1 s	3 x 410 VAC	410 x 100 x 207 mm	7.5 kg	Air

PS2 power supply unit with integrated heat sink

Device type	Rated power ¹⁾	Height x width x depth	Weight	Cooling
Power supply unit – 3 x 110...480 VAC mains voltage				
0362191F	27 kW	410 x 70 x 207 mm	5.8 kg	Air
0362193F	72 kW	410 x 160 x 207 mm	9.35 kg	Air

1) Rated power and max. output voltage for mains voltage/supply voltage (in bold)

The SD2 multi-axis system: flexible, compact and efficient
In machines with many drive amplifiers the required space in the switch cabinet is in focus. The drive system SD2 allows the integration of up to 12 drive amplifiers, including the power supply unit, with a mounting width of only 490 mm.



SD2 with integrated heat sink and safety functions SFM and SLOF

Device type	Rated power ¹⁾	Rated current	Peak current/time	Maximum output voltage ¹⁾	Height x width x depth	Weight	Cooling
Single drive amplifier – 325 VDC supply voltage							
0362314DC	3.9 kVA	11.3 Arms	14.1 Arms/5 s	3 x 200 VAC	410 x 70 x 209 mm	5.7 kg	Air
0362314EC	4.8 kVA	14 Arms	28.3 Arms/2 s	3 x 200 VAC	410 x 70 x 209 mm	5.7 kg	Air
Single drive amplifier – 560...680 VDC supply voltage							
0362314DF	8 kVA	11.3 Arms	14.1 Arms/5 s	3 x 410 VAC	410 x 70 x 209 mm	5.7 kg	Air
0362314EF	14.2 kVA	20 Arms	28.3 Arms/2 s	3 x 410 VAC	410 x 70 x 209 mm	5.7 kg	Air
0362316IF	20 kVA	28.3 Arms	56.6 Arms/2 s	3 x 410 VAC	410 x 103 x 209 mm	6.5 kg	Air
0362314QF	30 kVA	42 Arms	85 Arms/2 s	3 x 410 VAC	415 x 135 x 218 mm	7.0 kg	Air
Double drive amplifier – 325 VDC supply voltage							
0362313DDC	3.5 kVA + 3.5 kVA	10 Arms + 10 Arms	14 Arms/5 s + 14 Arms/5 s	3 x 200 VAC	410 x 70 x 207 mm	5.7 kg	Air
0362313EEC	3.5 kVA + 3.5 kVA	10 Arms + 10 Arms	28.3 Arms/2 s + 28.3 Arms/2 s	3 x 200 VAC	410 x 70 x 207 mm	5.7 kg	Air
Double drive amplifier – 560...680 VDC supply voltage							
0362313CCF	4.5 kVA + 4.5 kVA	6.4 Arms + 6.4 Arms	7.1 Arms/5 s + 7.1 Arms/5 s	3 x 410 VAC	410 x 70 x 207 mm	5.7 kg	Air
0362313DDF	6.4 kVA + 6.4 kVA	9 Arms + 9 Arms	14 Arms/5 s + 14 Arms/5 s	3 x 410 VAC	410 x 70 x 207 mm	5.7 kg	Air
Single compact devices – (1)3 x 110...230 VAC mains voltage							
0362333EC	2.5 kVA (7.9 kVA ²⁾)	20 Arms	28 Arms/2 s	3 x 200 VAC	410 x 100 x 207 mm	7 kg	Air
Single compact devices – 3 x 400...480 VAC mains voltage							
0362333DF	6 kVA	7 Arms	14 Arms/5 s	3 x 410 VAC	410 x 100 x 207 mm	7 kg	Air

1) Rated power and max. output voltage for mains voltage/supply voltage (in bold)

2) Output at three-phase mains

SD2 for cold-plate mounting

Device type	Rated power ¹⁾	Rated current	Peak current/time	Maximum output voltage ¹⁾	Height x width x depth	Weight	Cooling
Single drive amplifier – 325 VDC supply voltage							
0362111DC	3.8 kVA	11 Arms	14 Arms/5 s	3 x 200 VAC	410 x 70 x 134 mm	3 kg	Cold-plate
0362111EC	4.8 kVA	14 Arms	28 Arms/2 s	3 x 200 VAC	410 x 70 x 134 mm	3 kg	Cold-plate
0362111IC	9.7 kVA	28 Arms	56 Arms/2 s	3 x 200 VAC	410 x 70 x 134 mm	3 kg	Cold-plate
Single drive amplifier – 680 VDC supply voltage							
0362111DF	7.8 kVA	11 Arms	14 Arms/5 s	3 x 410 VAC	410 x 70 x 134 mm	3 kg	Cold-plate
0362111EF	7.8 kVA	11 Arms	28 Arms/2 s	3 x 410 VAC	410 x 70 x 134 mm	3 kg	Cold-plate
0362111IF	11.4 kVA	16 Arms	56 Arms/1 s	3 x 410 VAC	410 x 70 x 134 mm	3 kg	Cold-plate
0362111MF	24.8 kVA	35 Arms	113 Arms/2 s	3 x 410 VAC	410 x 130 x 134 mm	9 kg	Cold-plate
0362111NF	24.8 kVA	35 Arms	141 Arms/2 s	3 x 410 VAC	410 x 130 x 134 mm	9 kg	Cold-plate
Double drive amplifier – 325 VDC supply voltage							
0362110DDC	3.8 kVA + 3.8 kVA	11 Arms + 11 Arms	14 Arms/5 s + 14 Arms/5 s	3 x 200 VAC	410 x 70 x 134 mm	3 kg	Cold-plate
0362110EEC	4.8 kVA + 4.8 kVA	14 Arms + 14 Arms	28 Arms/2 s + 28 Arms/2 s	3 x 200 VAC	410 x 70 x 134 mm	3 kg	Cold-plate
Double drive amplifier – 680 VDC supply voltage							
0362110DDF	7.8 kVA + 7.8 kVA	11 Arms + 11 Arms	14 Arms/5 s + 14 Arms/5 s	3 x 410 VAC	410 x 70 x 134 mm	3 kg	Cold-plate
0362110EEF	7.8 kVA + 7.8 kVA	11 Arms + 11 Arms	28 Arms/3 s + 28 Arms/3 s	3 x 410 VAC	410 x 70 x 134 mm	3 kg	Cold-plate
Double compact devices – (1)3 x 110...230 VAC mains voltage							
0362130DDC	6.4 kVA	11 Arms + 11 Arms	14 Arms/5 s + 14 Arms/5 s	3 x 200 VAC	410 x 100 x 207 mm	7.5 kg	Cold-plate
0362130SSC	6.4 kVA	11 Arms + 11 Arms	42 Arms/1 s + 42 Arms/1 s	3 x 200 VAC	410 x 100 x 207 mm	7.5 kg	Cold-plate
Double compact devices – 3 x 400...480 VAC mains voltage							
0362130DDF	11.2 kVA	7 Arms + 7 Arms	14 Arms/5 s + 14 Arms/5 s	3 x 410 VAC	410 x 100 x 207 mm	7.5 kg	Cold-plate
0362130SSF	11.2 kVA	7 Arms + 7 Arms	42 Arms/1 s + 42 Arms/1 s	3 x 410 VAC	410 x 100 x 207 mm	7.5 kg	Cold-plate

1) Rated power and max. output voltage for mains voltage/supply voltage (in bold)

PS2 power supply unit for cold-plate mounting

Device type	Rated power ¹⁾	Height x width x depth	Weight	Cooling
0362190F	27 kW	410 x 70 x 134 mm	3.1 kg	Cold-plate

1) Rated power and max. output voltage for mains voltage/supply voltage (in bold)



The advantages of SD2, such as its multi-axis capability, safety functions and load indicator, optimally come to us in revolving transfer machines.



Multi-axis press systems benefit from the DC voltage coupling of the drive system SD2. Press systems can be used in high-dynamic applications and ensure energy efficient operation.

SD2S

The All-rounder

SD2S by SIEB & MEYER proves itself as frequency converter as well as servo amplifier. When operated as servo amplifier SD2S can drive linear motors, rotary servo motors and multi-pole torque motors. As frequency converter SD2S allows driving synchronous and asynchronous motors with speeds up to 480,000 rpm. Primary attention is focused on lowest possible motor heating which is one of the most important requirements for the operation of high-speed motors and optimal machining quality. For the operation with a sensor SD2S is able to evaluate all common encoder systems. However, sensorless operation is possible, too.

In both cases SD2S convinces by its high efficiency and compact design which allows a space saving construction of the switch cabinet. Using the *drivemaster2* software, up to 64 parameter sets can be stored in SD2S, allowing flexible operation of different motors. SD2S is connected to the higher-ranking control via analog reference values (+/-10 V), digital I/Os, RS232, USB, CAN bus, PROFIBUS*, PROFINET* or EtherCAT (CoE)**. Alternatively, a CNC control can be connected via the bus system SERVOLINK 4.

*Via Gateway

**CoE = CANopen over EtherCAT



Function · Advantage · Benefit

Extensive drive functions

- Function:** Freely selectable drive functions, selectable drive functions SVC, V/f-PWM, HS-Block, Servo.
- Advantage:** The optimal drive function can be selected depending on the application requirements.
- Benefit:** Best system performance.

Universal motor encoder interface

- Function:** Resolver, encoder / linear scale (TTL or Sin/Cos), EnDat, Hiperface, SSI, Hall sensor, linear Hall sensor, magnetoresistive sensor, NAMUR sensor.
- Advantage:** High flexibility in the choice of the motor encoder interface.
- Benefit:** Low system costs, free choice of the motor manufacturer.

Load Indicator

- Function:** As standard, SD2S offers a highly accurate evaluation of the torque-forming current.
- Advantage:** The evaluation can be used for tool monitoring. These are for example detection of tool breakage, tool wear, gap eliminator (GAP and crash) and an optimal control of the feed rate during the manufacturing process.
- Benefit:** Low system costs, no need of cost-intensive monitoring sensors.

- 1 USB connection, parameterization, diagnosis and operation
- 2 RS232-/CAN-interface
- 3 2 analog reference value interfaces: $\pm 10\text{ V}$,
2 analog outputs: 0 to 10 V
- 4 **Universal motor encoder interface**
Hall sensor, linear Hall sensor, magnetoresistive sensor,
NAMUR sensor (pulse generator), Sin/Cos encoder
- 5 Motor connection
- 6 Optional: EtherCAT (CoE)
- 7 SERVOLINK 4 via optical fiber PROFIBUS adapter
- 8 Power supply
- 9 9 digital inputs and 5 outputs
- 10 2 TTL encoder inputs and outputs
- 11 **Safety integrated "STO"**
Restart lock to meet category 4/PL e according to
EN ISO 13849-1:2015 and EN 61508:2010 SIL3
- ! **EtherCAT, PROFIBUS and PROFINET via Gateway** (see page 46)

drivemaster2	SVC	FPAM
V/f-PWM	V/f-PAM	HSPWM
HS-Block	Servo	LI
STO	SFM	SLOF

EtherCAT 



SD2S

Device type	Rated power ¹⁾	Rated current	Peak current/time	Maximum output voltage ¹⁾	Height x width x depth	Weight	Cooling
Compact devices – 1 x 50 VAC power supply							
0362X40DA	330 VA	10 Arms	14 Arms/5 s	3 x 45 VAC	249 x 70 x 188 mm	2.5 kg	Air
Compact devices – 1 x 110...230 VAC power supply							
0362X40DC	1.5 kVA	10 Arms	14 Arms/5 s	3 x 200 VAC	249 x 70 x 188 mm	2.5 kg	Air
0362X40EC	1.5 kVA	10 Arms	28 Arms/2 s	3 x 200 VAC	249 x 70 x 188 mm	2.5 kg	Air
Compact devices – (3)1 x 110...230 VAC power supply							
0362X41EC	3.8 kVA (6.9 kVA ²⁾)	20 Arms	28 Arms/5 s	3 x 200 VAC	253 x 104 x 188 mm	3.5 kg	Air
0362X41DC	3.8 kVA (6.9 kVA ²⁾)	20 Arms	56 Arms/2 s	3 x 200 VAC	253 x 104 x 188 mm	3.5 kg	Air
Compact devices – 3 x 200...480 VAC power supply							
0362X40EF	4.3 kVA	7 Arms	28 Arms/5 s	3 x 410 VAC	249 x 70 x 232 mm	3.5 kg	Air
0362X41EF	9.7 kVA	14 Arms	28 Arms/5 s	3 x 410 VAC	253 x 104 x 188 mm	3.5 kg	Air
0362X41IF	9.7 kVA	14 Arms	56 Arms/2 s	3 x 410 VAC	253 x 104 x 188 mm	3.5 kg	Air
0362X49IF³⁾	9.7 kVA	14 Arms	56 Arms/0.4 s	3 x 410 VAC	279 x 90 x 220 mm	3.9 kg	Air
0362X45EF	15.9 kVA	23 Arms	28.3 Arms/5 s	3 x 410 VAC	390 x 181 x 178 mm	7.8 kg	Air
0362X45IF	20.8 kVA	30 Arms	56.6 Arms/2 s	3 x 410 VAC	390 x 181 x 178 mm	7.8 kg	Air
0362X46IF	24.2 kVA	35 Arms	56.6 Arms/5 s	3 x 410 VAC	460 x 190 x 220 mm	13.7 kg	Air
0362X46LF	30.5 kVA	44 Arms	70.7 Arms/5 s	3 x 410 VAC	460 x 190 x 220 mm	13.7 kg	Air
0362X48MF	55.4 kVA	80 Arms	113 Arms/3 s	3 x 410 VAC	429 x 272 x 265 mm	19 kg	Air
0362X48OF	55.4 kVA	80 Arms	113 Arms/3 s	3 x 410 VAC	429 x 200 x 262 mm	15 kg	Water

X = 1: CAN bus

X = 2: EtherCAT and CAN bus

1) Rated power and max. output voltage for mains voltage/supply voltage (in bold)

2) Output at three-phase mains

3) NRTL certified

SD2S light – without interfaces for measuring systems, with CAN bus

Device type	Rated power ¹⁾	Rated current	Peak current/time	Maximum output voltage ¹⁾	Height x width x depth	Weight	Cooling
Compact devices – 1 x 110...230 VAC mains voltage							
0362120DC	1.5 kVA	10 Arms	14 Arms/5 s	3 x 200 VAC	249 x 70 x 188 mm	2.5 kg	Air
0362120EC	1.5 kVA	10 Arms	28 Arms/2 s	3 x 200 VAC	249 x 70 x 188 mm	2.5 kg	Air
Compact devices – (3)1 x 110...230 VAC mains voltage							
0362121EC	3.8 kVA (6.9 kVA ²⁾)	20 Arms	28 Arms/5 s	3 x 200 VAC	253 x 104 x 188 mm	3.5 kg	Air
0362121IC	3.8 kVA (6.9 kVA ²⁾)	20 Arms	56 Arms/2 s	3 x 200 VAC	253 x 104 x 188 mm	3.5 kg	Air
0362129EC	3.8 kVA (6.9 kVA ³⁾)	20 Arms	28 Arms/1 s	3 x 200 VAC	279 x 90 x 220 mm	3.9 kg	Air
Compact devices – 3 x 200...480 VAC mains voltage							
0362121EF	9.7 kVA	14 Arms	28 Arms/5 s	3 x 410 VAC	253 x 104 x 188 mm	3.5 kg	Air
0362121IF	9.7 kVA	14 Arms	56 Arms/2 s	3 x 410 VAC	253 x 104 x 188 mm	3.5 kg	Air

1) Rated power and max. output voltage for mains voltage/supply voltage (in bold)

2) Output at three-phase mains

3) NRTL certified

**The SD2S product family:
powerful, flexible and compact**

A wide performance range of the SD2S product family ensures various application possibilities.





SD2S proves its excellent features for example during the operation of high-speed spindles in the field of internal grinding.



Thanks to its high-precision evaluation of measuring systems SD2S ensures a machining quality in the nanometer range in direct imaging for PCBs.

SD2S-FPAM

The Fast One

Highest speeds, lowest motor heating and best control performance – always in real time: The technical basis is the controlled intermediate DC circuit combined with the established pulse-amplitude modulation (PAM) which allows SD2S doing without additional motor chokes even at high speeds. Based on this technology SIEB & MEYER developed two extremely robust and sensorless control methods: V/f-PAM for asynchronous motors and FPAM for synchronous motors. The usually very special applications in this area require close coordination between the user and SIEB & MEYER. Applications with a large variance of engine types (such as engine test stations) are rather unsuitable.

The existing standard SD2S-FPAM devices are also used as technical basis for customized devices. This way, the customer obtains an optimal solution that is individually adapted to the specific application.



Function · Advantage · Benefit

Output frequencies up to 8,000 Hz

- Function:** Established PAM technology with optimized dynamic characteristics, efficiency and flexibility.
- Advantage:** Virtually no speed limitation combined with optimized control dynamics and excellent system efficiency.
- Benefit:** Low initial costs, possibility to access new applications.

Sensorless control of synchronous and asynchronous motors

- Function:** The control of synchronous motors (FPAM) is based on the accurate EMF measurement in accordance to the rotor position. For asynchronous motors the well-proven drive function V/f-PWM is used.
- Advantage:** Cost-intensive speed sensors are not required. Flexible switching from synchronous to asynchronous motors is possible.
- Benefit:** Cost savings, easy initial operation.

No need of motor chokes or LC-filters

- Function:** The PAM technology allows smallest switching frequencies and reduces the electric stress of the motor as well as interferences (EMC) significantly.
- Advantage:** Additional filter elements or motor chokes are not required.
- Benefit:** Low system costs, easy initial operation.

- 1 USB connection, parameterization, diagnosis and operation
- 2 RS232-/CAN-interface
- 3 2 analog reference value interfaces: $\pm 10\text{ V}$, 2 analog outputs: 0 to 10 V
- 4 **Universal motor encoder interface**
Hall sensor, linear Hall sensor, magnetoresistive sensor, NAMUR sensor (pulse generator), Sin/Cos encoder
- 5 Motor connection
- 6 Optional: EtherCAT (CoE)
- 7 SERVOLINK 4 via optical fiber PROFIBUS adapter
- 8 Power supply
- 9 9 digital inputs and 5 outputs
- 10 2 TTL encoder inputs and outputs
- 11 **Safety integrated "STO"**
Restart lock to meet category 4/PL e according to EN ISO 13849-1:2015 and EN 61508:2010 SIL3
- ! **EtherCAT, PROFIBUS and PROFINET via Gateway** (see page 46)

drivemaster2	SVC	FPAM
V/f-PWM	V/f-PAM	HSPWM
HS-Block	Servo	LI
STO	SFM	SLOF

EtherCAT[®]



SD2S-FPAM

Device type	Rated power ¹⁾	Rated current	Peak current/time	Maximum output voltage ¹⁾	Height x width x depth	Weight	Cooling
Compact devices – 1 x 110... 230 VAC mains voltage							
0362X42DC	1.5 kVA	10 Arms	14 Arms/2 s	3 x 200 VAC	280 x 75 x 230 mm	3 kg	Air
Compact devices – (1)3 x 110... 230 VAC mains voltage							
0362X42EC	3.8 kVA	10 Arms	28 Arms/2 s	3 x 200 VAC	253 x 104 x 188 mm	4 kg	Air
Compact devices – 3 x 200... 480 VAC mains voltage							
0362X44EF	15.9 kVA	23 Arms	28.3 Arms/5 s	3 x 410 VAC	460 x 226 x 201 mm	18.2 kg	Air

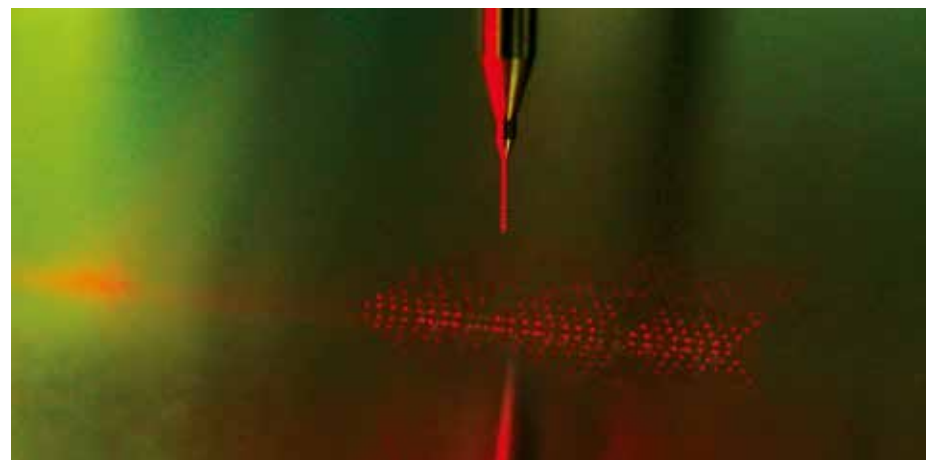
X = 1: CAN bus

X = 2: EtherCAT and CAN bus

1) Rated power and max. output voltage for mains voltage/supply voltage (in bold)



SD2S-FPAM can play its strengths in low-impedance turbo compressors with rotating field frequencies > 2,000 Hz.



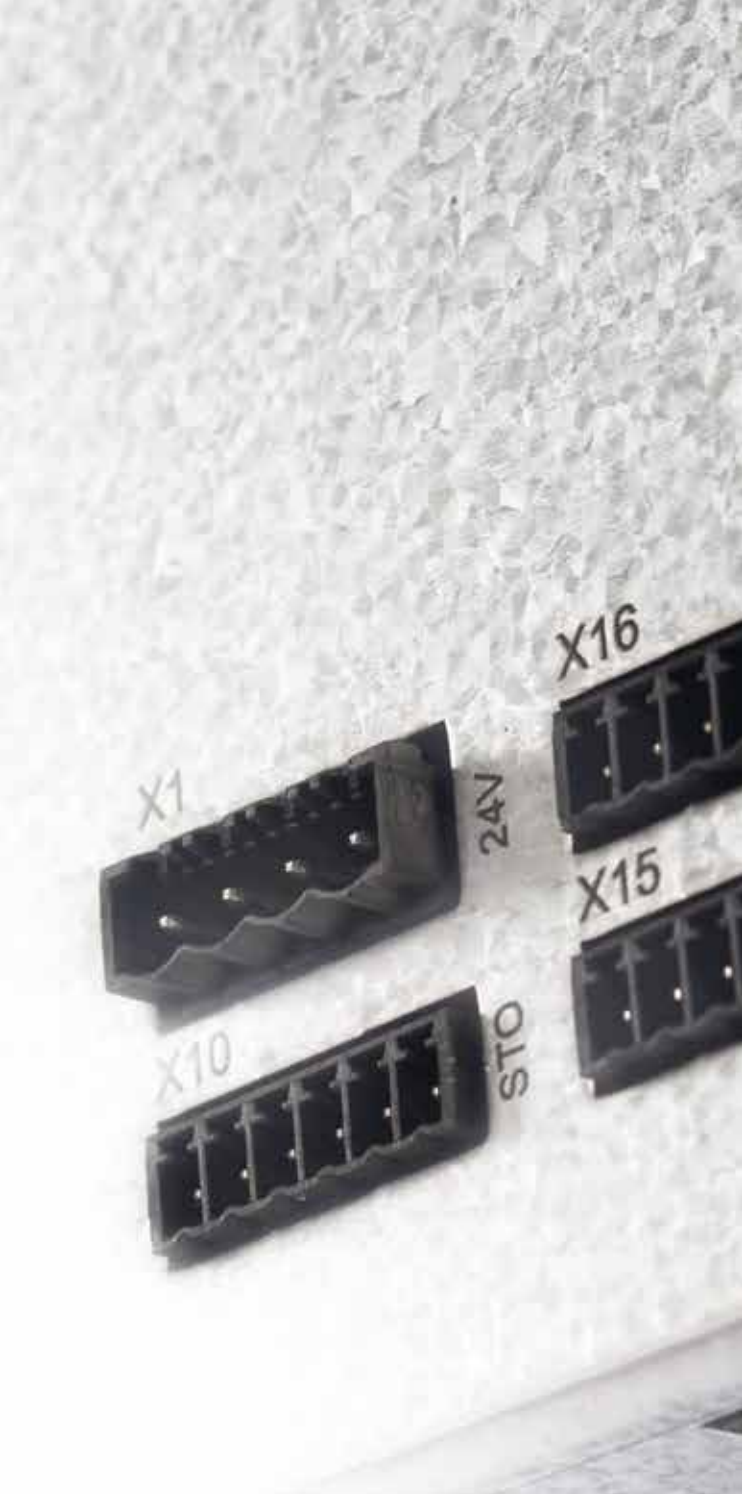
An ideal application for SD2S-FPAM is the operation of PCB drilling spindles with speeds up to 350,000 rpm.

SD2M

The Powerful One

The frequency converters of series SD2M convince by their maximum output, little need for space, reduced system costs and high efficiency. The devices are designed for complex automation tasks in high-speed applications and allow use of synchronous and asynchronous motors. Sensorless applications as well as applications with speed sensor can be realized easily. The high-dynamic vector control combined with highest speeds offers a whole new range of applications.

SIEB & MEYER has developed the frequency converter SD2M using the three-level technology to significantly reduce PWM-related rotor losses. Besides devices for 3-phase mains supply devices with DC supply are provided allowing to operate SD2M with a power supply unit capable of recovering energy. This way applications with a process-related repeated braking operation can take advantage of the benefits of the three-level technology.



Function · Advantage · Benefit

Three-level technology

- Function:** The output stages of SD2M are based on a three-level technology and provide rotating field frequencies up to 2,000 Hz with switching frequencies of 16 kHz.
- Advantage:** Reduced motor losses combined with minimum efforts for motor filters and motor chokes as well as low interfering radiation and insulation stress.
- Benefit:** Low system costs over the whole product life cycle.

Efficiency

- Function:** The devices reach efficiencies of up to 98 %.
- Advantage:** The high efficiency of the devices ensures optimal system efficiencies and reduces cooling requirements.
- Benefit:** Lower energy costs at maximum system output.

DC supply

- Function:** The SD2M devices with DC supply can be operated with active front-end power supply unit.
- Advantage:** Fast acceleration and deceleration processes at high energy efficiency.
- Benefit:** Low energy costs and highest productivity.

- 1 USB connection, parameterization, diagnosis and operation
- 2 RS232-/RS485-/CAN interface
- 3 2 TTL encoder inputs and outputs
- 4 2 analog reference value interfaces: +/-10 V, 2 analog outputs: 0 to 10 V
- 5 **Universal motor encoder interface**
Hall sensor, linear Hall sensor, magnetoresistive sensor, NAMUR sensor (pulse generator), Sin/Cos encoder
- 6 9 digital inputs and 5 outputs
- 7 EtherCAT (CoE)
- 8 **Safety integrated "STO"**
Restart lock to meet category 4/PL e according to EN ISO 13849-1:2015 and EN 61508:2010 SIL3
- 9 Liquid cooling
- 10 Motor connection
- 11 Brake chopper included in the variants with AC voltage supply
- 12 Power supply
- ! **EtherCAT, PROFIBUS and PROFINET via Gateway** (see page 43)

drivemaster2	SVC	FPAM
V/f-PWM	V/f-PAM	HSPWM
HS-Block	Servo	LI
STO	SFM	SLOF

EtherCAT 



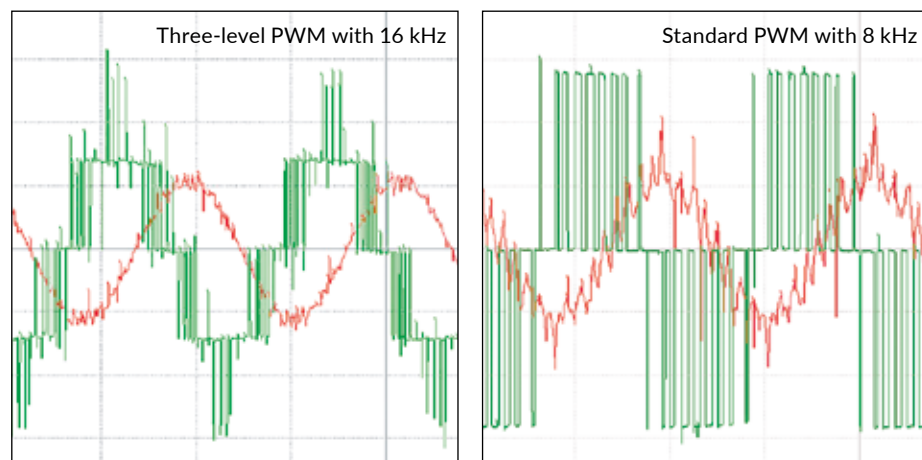
SD2M with 3-phase AC mains voltage

Device type	Rated power ¹⁾	Rated current	Peak current/time	Maximum output voltage ¹⁾	Height x width x depth	Weight	Cooling
Compact devices – 3 x 200...480 VAC mains voltage							
0362280AF	150 kVA	212 Arms	265 Arms/60s	3 x 410 VAC	757 x 392 x 280 mm	55 kg	Water
0362281BF	300 kVA	424 Arms	530 Arms/60s	3 x 410 VAC	1296 x 424 x 359 mm	117 kg	Water

SD2M with DC supply voltage

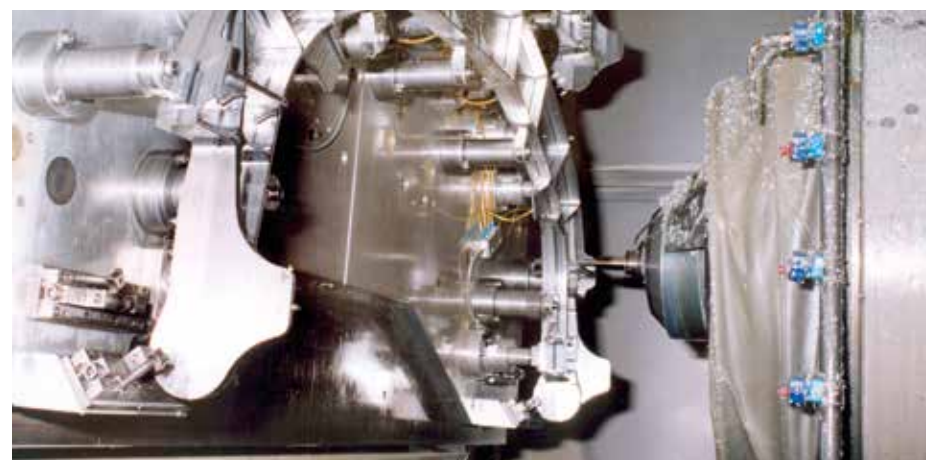
Device type	Rated power ¹⁾	Rated current	Peak current/time	Maximum output voltage ¹⁾	Height x width x depth	Weight	Cooling
DC devices – 300...750 VDC supply voltage							
0362282AF	183 kVA	212 Arms	265 Arms/60s	3 x 500 VAC	757 x 392 x 280 mm	47 kg	Water
0362283BF	432 kVA	500 Arms	530 Arms/60s	3 x 500 VAC	1019 x 424 x 359 mm	90 kg	Water

1) Rated power and max. output voltage for mains voltage/supply voltage (in bold)



The three-level technology plus the higher switching frequency compared to standard converters reduce the harmonic current parts (ripple current) to 25%. Therefore, converter-based motor losses are significantly lower.

Motor current (■) and motor voltage (■) at a rotating field frequency of 900 Hz



Together with SD2M the machining spindles used in volume cutting can provide the maximum machining power to ensure optimal productivity

- 1 USB connection, parameterization, diagnosis and operation
- 2 RS232-/RS485-/CAN interface
- 3 **Universal motor encoder interface**
Hall sensor, linear Hall sensor, magnetoresistive sensor, NAMUR sensor (pulse generator), Sin/Cos encoder
- 4 9 digital inputs and 5 outputs
- 5 Liquid cooling
- 6 Motor connection
- 7 **Safety integrated "STO"**
Restart lock to meet category 4/PL e according to EN ISO 13849-1:2015 and EN 61508:2010 SIL3
- 8 2 TTL encoder inputs and outputs
- 9 2 analog reference value interfaces: ± 10 V, 2 analog outputs: 0 to 10 V
- 10 Power supply

drivemaster2	SVC	FPAM
V/f-PWM	V/f-PAM	HSPWM
HS-Block	Servo	LI
STO	SFM	SLOF



SD2M with 3 phase AC mains voltage without brake chopper

Device type	Rated power ¹⁾	Rated current	Maximum output voltage ¹⁾	Height x width x depth	Weight	Cooling
Compact devices - 3 x 200...480 VAC mains voltage						
0369171AF0200	100 kVA	165 Arms	3 x 410 VAC	685 x 388 x 188 mm	34 kg	Water ^{2) 4)}
0369173AF0200	150 kVA	255 Arms	3 x 410 VAC	771 x 439 x 207 mm	85 kg	Water ^{2) 4)}
0369173BF0200	190 kVA	310 Arms	3 x 410 VAC	771 x 439 x 207 mm	85 kg	Water ^{2) 4)}
0369175AF0100	300 kVA	480 Arms	3 x 410 VAC	1317 x 326 x 498 mm	200 kg	Water ^{3) 4)}
0369175BF0100	396 KVA	630 Arms	3 x 410 VAC	1296 x 424 x 359 mm	200 kg	Water ^{3) 4)}

1) Rated power and max. output voltage for mains voltage/supply voltage (in bold)

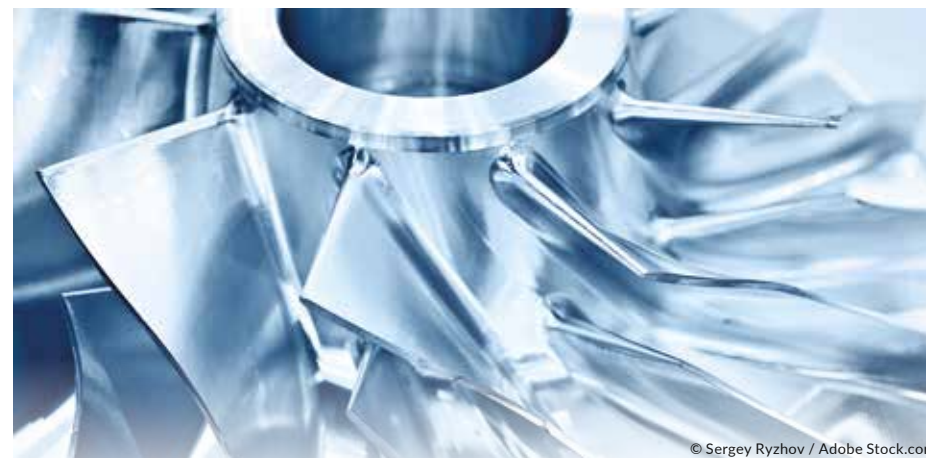
2) Cooling pipes aluminum

3) Cooling pipes copper

4) Air cooled variants and variants with other cooling pipe materials on request



SD2M Turbo is perfectly suited for waste water treatment



SD2M Turbo brings existing and new turbo systems to a new level. Customers benefit from additional functions such as the possibility of supplying active magnetic bearings with the necessary DC voltage via clamp connections. In case of a power failure the process of emergency breaking maintains the DC circuit.

SD2B plus

The Space Marvel

The frequency converter SD2B plus allows sensorless operation of low-voltage asynchronous and synchronous motors with speeds up to 120,000 rpm, as well as control with TTL encoders.

Due to this motors can be operated speed-controlled and torque-controlled even from speed zero.

The safety function "Safe Torque Off" (STO) is integrated as standard in the device to allow low-cost realization of the steadily increasing demands towards machine safety. In addition, the frequency converter is equipped with an internal logic voltage supply so that there is no need for an additional external 24 VDC supply.

The IP20 housing of SD2B plus convinces with its reduced construction height of only 25 mm.

This special compact design allows easy and flexible integration of the device. Besides two TTL encoder inputs and outputs SD2B plus provides five digital inputs and outputs each, analog reference value setting as well as a USB interface for easy parameterization. The serial bus connections CAN and RS232 are integrated as standard and allow realization of all control processes.

Function · Advantage · Benefit

Master-slave operation

- Function:** Synchronization of several SD2B plus via TTL encoder inputs and outputs.
- Advantage:** Autarkic high-precision synchronization of several SD2B plus frequency converters without external control components.
- Benefit:** Lower system costs.

Integrated logic voltage supply

- Function:** SD2B plus uses the DC mains supply to generate its 24 V logic supply.
- Advantage:** No need for second DC power supply for the 24 V logic supply.
- Benefit:** Optimization of the required space and reduction of system costs.

Parameterization via USB

- Function:** Logic voltage supply via USB interface.
- Advantage:** Parameterization of SD2B plus without connected voltage supply is possible via the USB interface, which allows pre-configuration of devices outside the machine.
- Benefit:** Lower system costs.

- 1 USB connection, parameterization, diagnosis and operation
- 2 Analog reference interface: ± 10 V
- 3 **Safety integrated "STO"**
Restart lock to meet category 4/PL e according to EN ISO 13849-1:2015 and EN 61508:2010 SIL3
- 4 5 digital inputs and 5 outputs
- 5 RS232-/CAN interface
- 6 2 TTL encoder inputs and outputs
- 7 2 TTL encoder inputs and outputs / BISS-Renishaw
- 8 Motor connection
- 9 DC supply
- 10 SERVOLINK



drivemaster2	SVC	FPAM
V/f-PWM	V/f-PAM	HSPWM
HS-Block	Servo	LI
STO	SFM	SLOF

SD2B/SD2B plus

Device type	Rated power ¹⁾	Rated current	Peak current/time	Maximum output voltage ¹⁾	Height x width x depth	Weight	Cooling
Board device (SD2B) – 1 x 24...80 VDC supply voltage							
0362170DB	660 VA	7 Arms	10 Arms/10 s	3 x 55 VAC	142 x 111 x 54 mm	0.5 kg	Air
Device with housing (SD2B plus) – 1 x 24...48 VDC supply voltage							
0362171DA1	740 VA ²⁾	13 Arms	15,8 Arms/10 s	3 x 33 VAC	165 x 120 x 25 mm	0,55 kg	Luft
Device with housing (SD2B plus) – 1 x 24...80 VDC supply voltage							
0362171DB1	940 VA ²⁾	10 Arms	12 Arms/10 s	3 x 55 VAC	165 x 120 x 25 mm	0.55 kg	Air

1) Rated power and max. output voltage for mains voltage/supply voltage (in bold)

2) NRTL/CSA certified



In dental CAD/CAM milling machines SD2B plus ensures optimal operation of low-volt manufacturing spindles and allows space-saving integration into the machine.



SD2B plus is ideal for operating low-volt spindles for example in the watch industry.

"We implement many special solutions for our customers. Of course, these solutions require more intensive customer service than off-the-shelf products. For an extensive advice of our customers we attach great importance to the advisory skills of our service technicians."

Elmar Zeman, development manager drive technology at SIEB & MEYER AG

High-quality Accessories for Optimum Performance

Specific demands of different applications often require the use of additional components as line filters/line chokes, fieldbus interfaces or motor chokes. To ensure the perfect interaction of the frequency converters and servo amplifiers with these additional components SIEB & MEYER offers appropriate high-quality accessories.

Line filter



Gateway



Mains choke



Sinusoidal filter/motor choke



Plug-on operating unit



Built-in operating unit



Customer Satisfaction is Our Top Priority

Support

For SIEB & MEYER, the Lueneburg based experts in drive technology, customer service has top priority: The high-qualified service technicians have long years of experience in customer support in the field of standard and special-purpose machine building. This ensures deep expertise in versatile, even unusual application fields – a great benefit in particular for application-specific projects.

Besides assisting customers on site, SIEB & MEYER service staff also supports the customers via telephone, e-mail or Team Viewer. Each customer has a contact person he can call directly – nobody has to take a detour via a hotline.

For customer service in particular not only the question how you can help a customer is of main importance, but also when you can help him: For that reason, fast reaction times are a matter of course for SIEB & MEYER – whenever needed, we provide quick and hassle-free support to our customers.

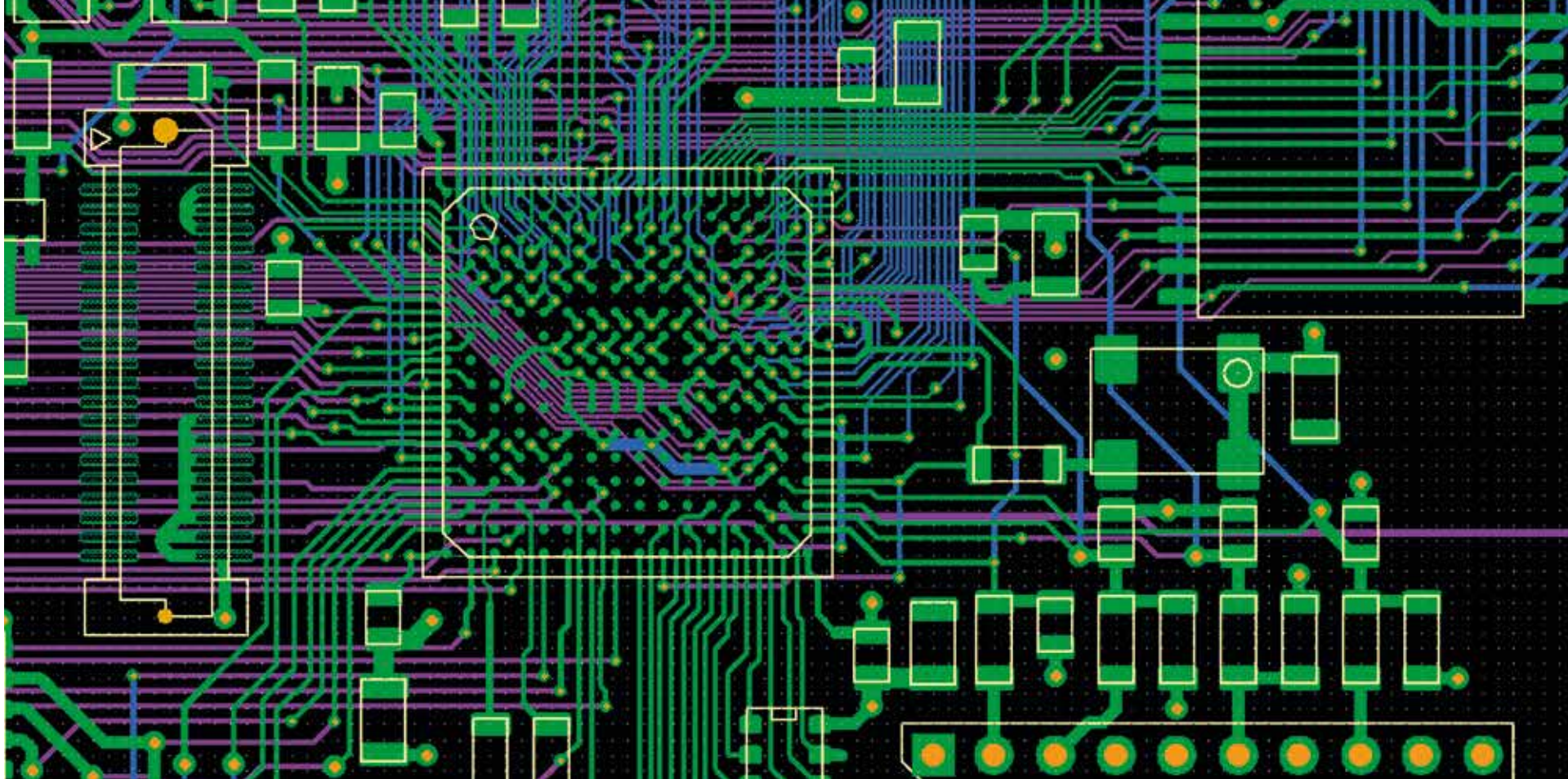
Customized Solutions

SIEB & MEYER also provides customized solutions in the field of high-speed frequency converters and servo amplifiers. The range of services is far reaching and includes simple hardware adaptations, such as special housing shapes or interfaces, as well as completely redesigned devices and functions.

From joint planning to serial production of the specific solution – SIEB & MEYER offers everything from one source. We have all experts needed in-house – e.g. in the fields of power electronics, control technology, PC and embedded programming, PCB layout, EMC and mechanical construction.

In order to accomplish the development targets timely and safely we use professional simulation and design tools amongst others. All products are manufactured in the modern production facilities at SIEB & MEYER – with high quality and in flexible product quantities: Anything is possible from the prototype to serial production of several thousand devices or assemblies per year.





Modern software tools for PCB design and for simulation ensure the quality of all SIEB & MEYER products.

3D design tools allow tailor-made mechanical realization in particular for the development of customized device designs.

Your notes

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