MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Reference package for procurement and maintenance review

LTI MOTION

SO84.032.0003.0001.2

SINGLE-AXIS SERVO DRIVE

Used with the applicable ServoOne SO84.032 configuration.

REFERENCE PACKAGE

OFFICIAL DOCUMENT

Selected official manufacturer pages follow this cover.

Source: LTi ServoOne Operation Manual 1100.20B.7-00, April 2014; SO84.032 common ratings and installation.

LTi DRiVES



ServoOne

Operation Manual

Single-Axis System

4 A to 450 A



ServoOne Drives with Ambition

The modular design of ServoOne ensures optimal integration into the machine process. Whether through a high speed field bus communication with the central multi-axis machine control, or through decentralized programmable Motion Control Intelligence in the drive controller, ServoOne will master both tasks brilliantly.

ServoOne Operation Manual Single-Axis System

Id.-No.: 1100.20B.7-00

Status: 04/2014

Valid from firmware status: V2.20-01

The German version is the original version of the operation manual.

Technical alterations reserved

The contents of our documentation have been compiled with greatest care and in compliance with our present status of information.

Nevertheless we would like to point out that this document cannot always be updated parallel to the technical further development of our products.

Information and specifications may be changed at any time. For information on the latest version please refer to http://drives.lt-i.com.

Order Code

The order designation SO8x.xxx.0xxx.xxxx.x informs you about the corresponding variant of the drive controller delivered to you. The significance of the individual characters of the order designation is given in the following order code. You will find a complete order code with all values in the ServoOne system catalogue.

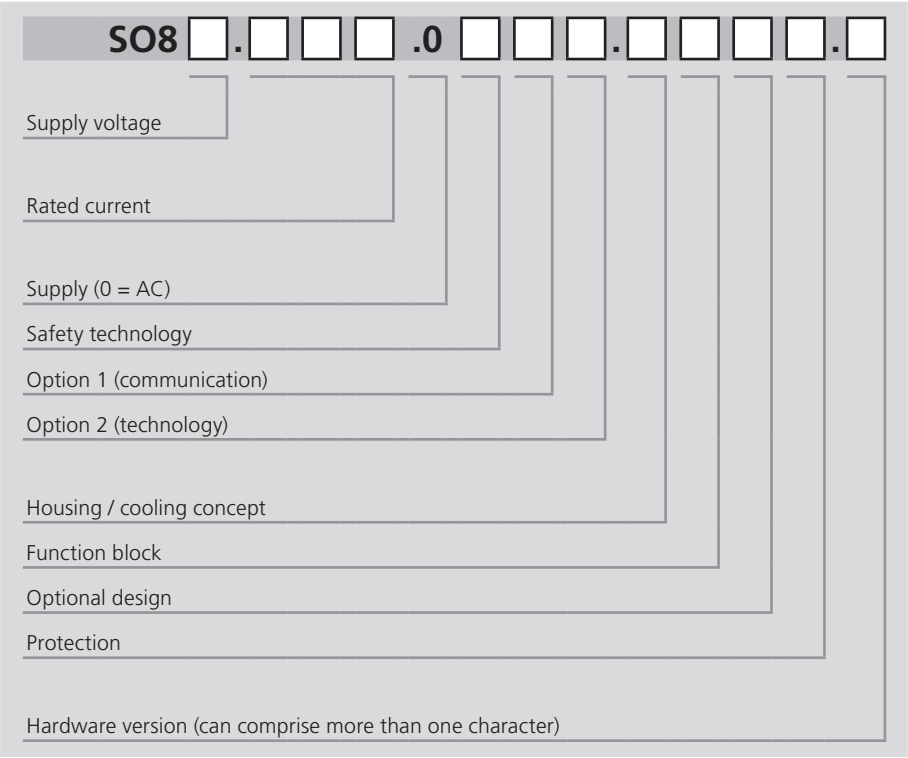


Fig 0.1 Order code ServoOne Single-Axis System

Rating plate

The rating plate on ServoOne drive units informs about the serial number, from which you can read the manufacturing date by using the following key. The location of the rating plate on your ServoOne can be found from page 18 onwards.

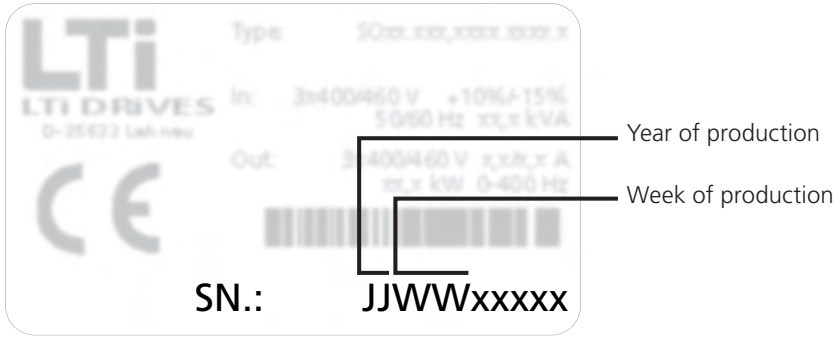


Fig 0.2 Rating plate hardware ServoOne Single-Axis System

Scope of supply

The scope of supply includes:

- ServoOne drive unit
- Terminal accessory pack for control and power terminals (depending on device rated power and variant)
- Set of grommets (on devices with liquid cooling)
- Product DVD

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1 Safety

1.1 Measures for your safety

The following information must be read before initial commissioning to avoid physical injury and/or material damage. The safety regulations must be strictly observed at any time.

	Read the Operation Manual first! • Follow the safety instructions! • Please observe the user information!
	Electric drives are generally potential danger sources: • Electrical voltages 230 V AC to 680 V DC **Even 30 minutes after switching off the mains supply dangerously high voltages of ≥ 50 V may still be present (capacitor charge). Therefore check for isolation from supply!** • Rotating parts • Hot surfaces
	Protection against magnetic and/or electromagnetic fields during installation and operation. • For persons with pacemakers, metal containing implants and hearing aids etc. access to the following areas is prohibited: – Areas in which drive systems are installed, repaired and operated. – Areas in which motors are assembled, repaired and operated. Motors with permanent magnets are sources of special dangers. NOTE: If there is a necessity to access such areas a decision from a physician is required.
	Your qualification: • In order to prevent personal injury or material damage, only personnel with electrical engineering qualifications may work on the device. • The qualified person must become familiar with the operation manual (see IEC 364, DIN VDE 0100). • Knowledge of national accident prevention regulations (e.g. BGV A3 in Germany)
	During installation follow these instructions: • Always comply with the connection conditions and technical specification. • Comply with the standards for electrical installation, such as wire cross-section, PE-conductor and ground connection. • Do not touch electronic components and contacts (electrostatic discharge may destroy components).

Table 1.1 Notes on safety

Id.-No.: 1100.20B.7-00 Status: 04/2014

Step	Action	Comment
1.	Determine the pin assignment for your device.	Section 3.2 for BG1 to BG4 Section 3.3 for BG5 to BG6a Section 3.4 for BG7
2.	Connect all required input and output units to the control terminals and, if necessary, to the options.	Section 3.8 Section 3.11 and/or 3.12
3.	Connect encoder, motor and, if necessary, the external braking resistor.	Sections 3.13, 3.14 and 3.15
4.	Connect the PE-conductor and the supply voltages.	Sections 3.5 and 3.7
5.	Continue with the commissioning in chapter 4.	

Table 3.1 Electrical installation

3.2 Overview of connections BG1 to BG4

The following shows the layout with the corresponding positions of plugs and terminals. For better orientation we have identified the designations of plugs and terminals with an abbreviation.

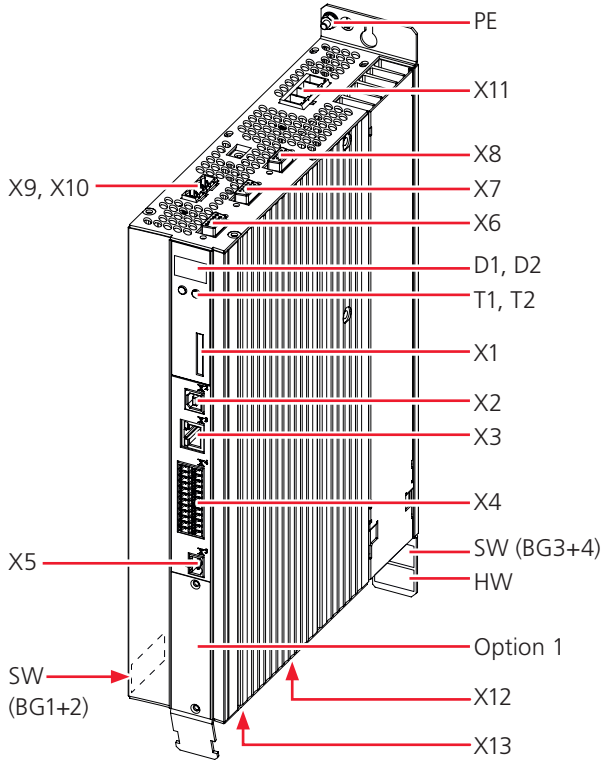


Fig. 3.1 Layout BG1 to BG4 (here: BG1)

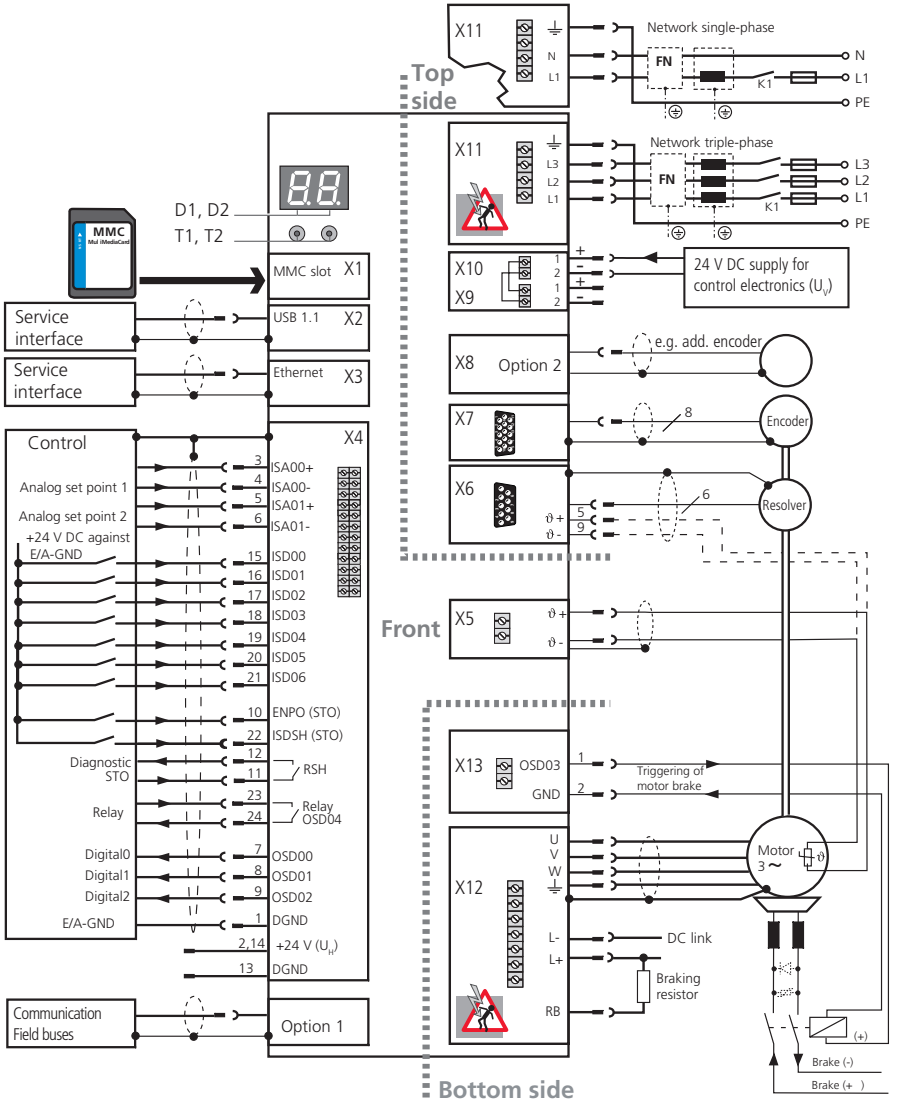


Fig. 3.2 Terminal diagram BG1 to BG4

Number	Designation	Details
D1, D2	7-segment display	page 46
T1, T2	Button	page 46
X1	Slot for MMC-card	page 45
X2	USB 1.1 interface	page 33
X3	Ethernet interface	page 33
X4	Control terminals	page 30
Option 1	Communication	page 33
X11	Connection AC power supply	page 27
PE	Connection PE conductor	page 24
X9, X10	Connection control supply	page 26
X8 (Option 2)	Technology	page 33
X7	Connection high resolution encoder	page 35
X6	Connection resolver	page 35
X5	Connection motor temperature monitoring	page 36
X13	Connection motor brake	page 32
X12	Connection motor, braking resistor and DC link	page 36
HW	Hardware rating plate	page 4
SW	Software rating plate	-

Table 3.2 Legend to terminal diagram BG1 to BG4

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3.5 Connection PE conductor

Step	Action	PE mains connection acc. DIN EN 61800-5-1
1.	Ground each of the drive controllers! Connect terminal ⏚ **in star configuration** and **amply dimensioned** with the PE bar (main ground) in the control cabinet.	The following applies for the PE connection (because leakage current > 3.5 mA): • Mains connection <10 mm² copper: use PE-conductor cross-section min. 10 mm² copper or two cables with the cross-section of the mains cables.
2.	Also connect the PE-conductor terminals of all other components, such as mains choke, filter, etc. in a **star configuration** and **amply dimensioned** with the PE bar (main ground) in the control cabinet.	• Mains connection ≥10 mm² copper: use a PE-conductor cross section complying with the cross-section of the mains cables. Apart from this, you must also consider local and country specific regulations and conditions.

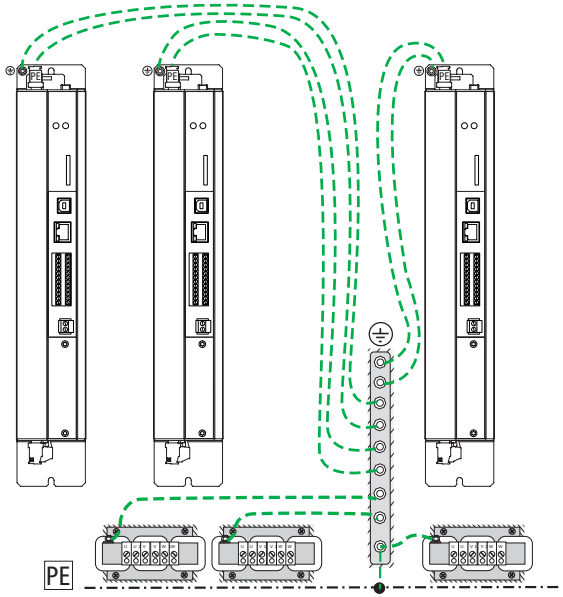


Fig. 3.8 Star configuration layout of PE conductor

3.6 Electrical isolation concept

The control electronics with its logics (µP), the encoder terminals and the inputs and outputs is galvanically isolated from the power section (mains supply/DC link). All control terminals are designed as safety extra-low voltage (SELV/PELV) circuit and must only be operated with SELV or PELV voltages complying with the corresponding specification. This provides reliable protection against electric shock on the control side.

You therefore need a separate control supply, compliant with SELV/PELV requirements.

The opposite overview shows the potential supplies for the individual terminals in detail. This concept additionally enhances the operational safety and reliability of the drive controller.

ATTENTION! Terminal X5 (motor PTC) represents a special feature with respect to insulation and isolation. In this respect follow the notes in section 3.14 "Motor connection" from page 36.

SELV = Safety Extra Low Voltage

PELV = Protective Extra Low Voltage

3.7.2 Connection of AC mains supply

Step	Action	Comments
1.	Determine the cable cross-section, depending on maximum current and ambient temperature.	Cable cross-section acc. to local and country specific regulations and conditions.
2.	Wire the drive controller according to its size and type of connection. For cable lengths in excess of 0.3 m use shielded cables!	see Fig. 3.12, Fig. 3.13 or Fig. 3.14
3.	If necessary wire the mains choke, see section 3.7.2	Reduces the voltage distortions (THD) in the net and prolongs the lifetime of the drive controller.
4.	Install a K1 circuit breaker (power circuit breaker, contactor, etc.).	Do **not yet switch** on the AC mains supply!
5.	Use mains fuses (duty class gG, see table 3.7), which will isolate all poles of the drive controller from the mains supply.	For compliance with the equipment safety act acc. toEN 61800-5-1



DANGER CAUSED BY HIGH VOLTAGE! Danger to life! Never wire or disconnect electrical connections while these are live. Always isolate the device from the mains supply before working on it. Even 30 minutes after switching off the mains supply dangerously high voltages ≥ 50 V may still be present (capacitor charge). Therefore check for isolation from supply!



ATTENTION! Should local regulations require the installation of a residual current protective device (RCD), the following applies:
In case of a fault the drive controller is able to generate DC fault currents without zero crossing. Drive controllers therefore must only be operated with residual current protective device (RCDs) type B for AC fault currents, pulsating or smooth DC fault currents, which are suitable for drive controller operation, see IEC 60755. Residual current monitoring devices (RCMs) can additionally be used for monitoring purposes.

Please note:

- Switching the mains power:
  - In case of too frequent switching the unit protects itself by high-resistance isolation from the system. After a rest phase of a few minutes the device is again ready for operation.
- TN network and TT network: Operation is permitted if:
  - with single-phase devices for 1 x 230 V AC the supply network corresponds with the maximum overvoltage category III in accordance with EN 61800-5-1.
  - with triple-phase devices with phase-to-phase voltages 3 x 230 V AC, 3 x 400 V AC, 3 x 460 V AC and 3 x 480 V AC
    1. **the neutral point** of the supply net **is grounded** and
    2. the supply net meets the requirements of the maximum 2. overvoltage category III in accordance with EN 61800-5-1 under a system voltage (external conductor → neutral point) of maximum 277 V.
- IT-network: not permitted!
  - In case of an ground fault the electrical stress is approx. twice as high. Clearances and creepages acc. to EN 61800-5-1 are no longer maintained.
- Connection of the drive controller via a mains choke is mandatory:
  - where the drive controller is used in applications with disturbance variables corresponding with environment class 3, as per EN 61000-2-4 and higher (hostile industrial environment).
  - for compliance with EN 61800-3 or IEC 61800-3, see appendix.
- For further information on current carrying capacity, technical data and environmental conditions please refer to the appendix.



NOTE: Please note that the ServoOne has not been designed for environment class 3. Further measures are mandatory in order to achieve this environment class! For further information please consult your project engineer.

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Drive controller	Device connected load[1] [kVA]		Max. cable cross-section[2] of terminal [mm²]	Specified mains fuse, duty class gG [A]
	With mains choke (4% u_K)	Without mains choke		
SO82.004	1.6	2.2	4	1 x max. 16
SO84.004	2.8	4.0	4	3 x max. 10
SO84.006	4.2	6.0	4	3 x max. 16
SO84.008	5.9	8.3	4	3 x max. 20
SO84.012	8.8	12.5	4	3 x max. 25
SO84.016	11.1	15.0	16	3 x max. 32
SO84.020	13.9	18.7	16	3 x max. 40
SO84.024	16.6	22.5	16	3 x max. 50
SO84.032	22.2	30.0	16	3 x max. 63
	With mains choke (2% u_K)			
SO84.045	31	*For devices of sizes BG5 to BG7 a mains choke is mandatory.*	25	3 x max. 63
SO84.060	42		25	3 x max. 80
SO84.072	50		25	3 x max. 100
SO84.090	62		50	3 x max. 125
SO84.110	76		50	3 x max. 160
SO84.143	99		95	3 x max. 200
SO84.170	118		95	3 x max. 224
SO84.250	173		*Connection via screwed on ring terminal ends.*	3 x max. 300
SO84.325	225			3 x max. 400
SO84.450	310			3 x max. 500

1) *With 3 x 400 V mains voltage*
2) *The minimum cross-section of the power supply cable depends on local regulations and conditions, as well as on the rated AC current of the drive controller.*

Table 3.7 Connected load an mains fuse

NOTE: Before commissioning the value of the connected mains voltage must be set in the drive controller (factory setting = 3 x 400 V AC).

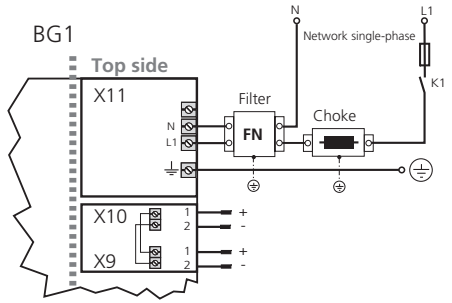


Fig. 3.12 Connection of mains supply 1 x 230 V

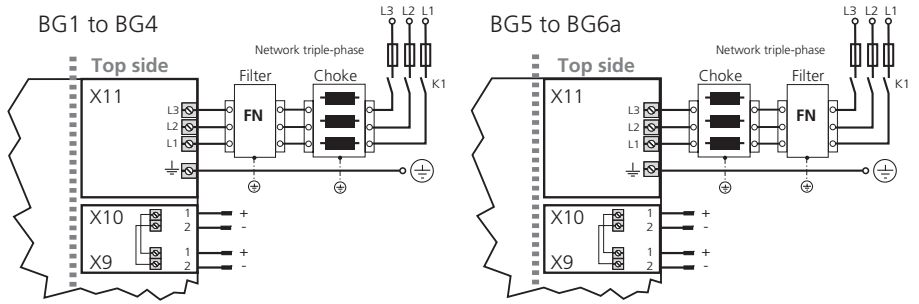


Fig. 3.13 Connection of mains supply 3 x 230/400/460/480 V for BG1 to BG6a

ATTENTION! For devices of sizes BG5 to BG7 a mains choke is mandatory. Due to the different precharging technology in these devices you must make sure that the mains choke is installed between drive controller and mains filter (see Fig. 3.13 and Fig. 3.14).

3.15.2 Design with integrated braking resistor BG1-4

The catalogue only specifies the peak braking power for the drive controller with integrated braking resistor (design SO8x.xxx.xxxx.1xxx, only available up to and including BG4). The permissible permanent braking power must be calculated. It depends on the effective loading of the controller in the corresponding application.

ATTENTION! No additional external braking resistor must be connected to the drive controller SO84.008 to SO84.032 with integrated braking resistor.

In general the drive controller is thermally designed in such a way, that no energy input by the internal braking resistor is permitted during continuous operation with rated AC current and under max. ambient temperature. Thus the controller design with integrated braking resistor only makes sense, if the effective drive controller load is ≤80%, or the braking resistor has been planned for one-time emergency stopping. In case of an emergency stop the heat capacity of the braking resistance can only be utilized for a single braking operation. The permissible energy W_{IBr} can be taken from the following table.

Device	Technology	Rated resistance R_{BR}	Peak braking power P_{PBr}	Pulse energy W_{IBr}	K1
SO82.004	PTC	90 Ω	1690 W [1]	600 Ws	95 W
SO84.004 SO84.006			1690 W [2]		95 W
SO84.008 SO84.012	Wire resistance		4700 W [3] 6170 W [4] 6500 W [5]	6000 Ws	230 W
SO84.016 SO84.020					360 W
SO84.024 SO84.032					480 W

1) Data referred to 1 x 230 V mains voltage (BR switch-on threshold 390 V_{DC})
2) Data referred to 3 x 230 V mains voltage (BR switch-on threshold 390 V_{DC})
3) Data referred to 3 x 400 V mains voltage (BR switch-on threshold 650 V_{DC})
4) Data referred to 3 x 460 V mains voltage (BR switch-on threshold 745 V_{DC})
5) Data referred to 3 x 480 V mains voltage (BR switch-on threshold 765 V_{DC})

Table 3.20 Data of the integrated braking resistor (design SO8x.xxx.xxxx.1xxx)

If the drive is not permanently operated at its power limit, the reduced power dissipation of the drive can be used as braking power.

NOTE: Further calculation assumes that the drive controller is used at max. permissible ambient temperature. This means that any additional energy input from the internal braking resistor caused by low ambient temperature will be neglected.

To calculate the continuous braking power please proceed as follows:

- Calculation of the effective utilization of the drive controller during a cycle T:

$$I_{eff} = \sqrt{\frac{1}{T}\int_0^T i^2\,dt}$$

- Determination of the permissible continuous braking power on basis of unused drive power:

$$P_{DBr} = \left(1 - \frac{I_{eff}}{I_N}\right) \times K1$$

Boundary conditions

- A single braking process must not exceed the maximum pulse energy of the braking resistor.

$$W_{IBr} \geq P_{PBr} \times T_{Br}$$

- The continuous braking power calculated for the device must be greater than the effective braking power of a device cycle.

$$P_{DBr} \geq \frac{1}{T} \times \int_0^T P_{PBr}\,dt_{Br}$$

This results in the minimum permissible cycle time T with calculated continuous braking power:

$$T = \frac{P_{PBr}}{P_{DBr}} \times \int_0^T dt_{Br}$$

The maximum total switch-on time of the braking resistor over a specified cycle time T with calculated continuous braking power results from:

$$T_{BrSum} = \frac{P_{DBr}}{P_{PBr}} \times T$$

3.15.3 Design with integrated braking resistor BG5-7

Drive controllers of sizes 5-7 with liquid cooling can be equipped with an integrated braking resistor as an option. You will find the related technical data in chapter A.2 from page 62.

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3.15.4 Connection of an external braking resistor

DANGER CAUSED BY HIGH VOLTAGE! Danger to life! Terminal L+ (BG1 to BG4) or BR+ (BG5 to BG7) is fixed connected to DC link (>300 V DC). The connection is not fuse protected inside the device. Never wire or disconnect electrical connections while these are live! Always isolate the device from the mains supply before working on it. Even 30 minutes after switching off the mains supply dangerously high voltages of ≥50 V may still be present (capacitor charge). Therefore check for isolation from supply!

ATTENTION!

- Strictly follow the assembly instructions for the braking resistor.
- The temperature sensor (bimetal switch) on the braking resistor must be wired in such a way, that the power stage is deactivated and the connected servo controller is disconnected from the mains supply if the braking resistor overheats.
- The externally installed braking resistor must not be less than the minimum braking resistance permitted and the permitted continuous braking power must not be exceeded, technical data see section A.2 starting with page 62.
- The braking resistor must be connected with a shielded cable.

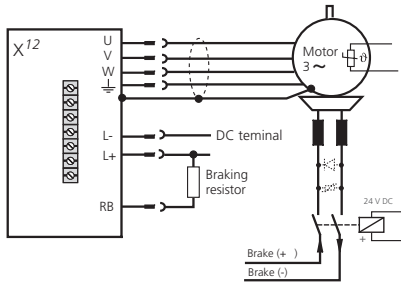
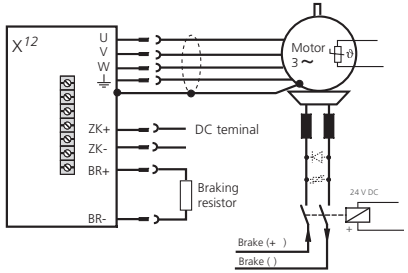
Size BG1 to BG4	Size BG5 to BG7
	

Fig. 3.18 Connection of braking resistor

ATTENTION! No additional external braking resistor must be connected to the drive controller with integrated braking resistor.

Available braking resistors (excerpt)

Ordering designation	Continuous braking power	Resistance[1]	Peak braking power [2]	Degree of protection	Illustration
BR-200.01.540-UR	35 W	200 Ω	2800 W	IP54	 Example: BR-090.01.540-UR
BR-200.02.540-UR	150 W		2800 W	IP54	
BR-200.03.540-UR	300 W		2800 W	IP54	
BR-090.01.540-UR	35 W	90 Ω	6250 W	IP54	
BR-090.02.540-UR	150 W		6250 W	IP54	
BR-090.03.540-UR	300 W		6250 W	IP54	
BR-090.10.650-UR	1000 W		6250 W	IP65	
BR-026.01.540-UR	35 W	26 Ω	21600 W	IP54	
BR-026.02.540-UR	150 W		21600 W	IP54	
BR-026.03.540-UR	300 W		21600 W	IP54	
BR-026.10.650-UR	1000 W		21600 W	IP65	
BR-020.03.540-UR	300 W	20 Ω	27750 W	IP54	
BR-015.03.540-UR	300 W	15 Ω	37000 W	IP54	

1) Tolerance ±10%
2) the maximum possible braking power in dependence on ON-time and cycle time

Table 3.21 Technical data - braking resistors

NOTE: Exact specifications, especially with respect to surface temperature, max. connection voltage and high voltage strength can be found in the ServoOne System Catalogue.

Please consult your projecting engineer for more detailed information on the design of braking resistors.

A Appendix

A.1 Permissible current load for drive controllers

The maximum permissible drive controller output current as well as the peak current are dependent on the mains voltage, the motor cable length, the power stage switching frequency, the design of cooling technology and the ambient temperature. The maximum permissible current carrying capacity of the drive controllers changes with any change in application related conditions.

A.1.1 Current carrying capacity BG1, air cooling, single-phase

Drive controller	Switching frequency of the power stage	Ambient temperature	Rated current	Peak current [A_{eff}]			
			at 230 V_{AC}	with linear increasing rotating field frequency 0 to 5 Hz		for intermittent operation	for time [1]
	[kHz]	[°C]	[A_{eff}]	0 Hz	5 Hz	>5 Hz	[s]
SO82.004 (BG1)	4	45	4.0	8.0	8.0	8.0	10
	8	40	4.0	8.0	8.0	8.0	
	12		3.7	7.4	7.4	7.4	
	16		2.7	5.4	5.4	5.4	

Data apply for a motor cable length ≤10 m
1) Shut-down according to I²t-characteristic

Table A.1 Rated and peak current BG1 (air cooling, single-phase)

A.1.2 Current carrying capacity BG1-BG4, air cooling, triple-phase

Drive controller	Switching frequency of the power stage	Ambient temperature	Rated current			Peak current [A_{eff}]			
			at 400 V_{AC}	at 460 V_{AC}	at 480 V_{AC}	with linear increasing rotating field frequency 0 to 5 Hz		for intermittent operation	for time [1]
	[kHz]	[°C]	[A_{eff}]	[A_{eff}]	[A_{eff}]	0 Hz	5 Hz	>5 Hz	[s]
SO84.004 (BG1)	4	45	4.0	4.0	4.0	8.0	8.0	8.0	10
	8	40	4.0	4.0	4.0	8.0	8.0	8.0	
	12		3.7	2.9	2.7	7.4	7.4	7.4	
	16		2.7	1.6	1.3	5.4	5.4	5.4	
SO84.006 (BG1)	4	45	6.0	6.0	6.0	12.0	12.0	12.0	10
	8	40	6.0	6.0	6.0	12.0	12.0	12.0	
	12		5.5	4.4	4.0	11.0	11.0	11.0	
	16		4.0	2.4	1.9	8.0	8.0	8.0	
SO84.008 (BG2)	4	45	8.0	8.0	8.0	16.0	16.0	16.0	10
	8	40	8.0	7.2	6.9	16.0	16.0	16.0	
	12		6.7	5.3	4.9	13.4	13.4	13.4	
	16		5.0	3.7	3.3	10.0	10.0	10.0	
SO84.012 (BG2)	4	45	12.0	12.0	12.0	24.0	24.0	24.0	10
	8	40	12.0	10.8	10.4	24.0	24.0	24.0	
	12		10.0	8.0	7.4	20.0	20.0	20.0	
	16		7.6	5.6	5.0	15.2	15.2	15.2	

Data apply for a motor cable length ≤10 m.
1) Shut-down according to I²t-characteristic

Table A.2 Rated and peak current BG1 to BG4 (air cooling, triple-phase)

Id.-No.: 1100.20B.7-00 Status: 04/2014

A.2.2 SO84.020 to SO84.072, air cooling

Technical data \ Designation	SO84.020	SO84.024	SO84.032	SO84.045	SO84.060	SO84.072
Output motor side [1]						
Voltage	3-phase U_{Netz}					
Rated current effective (I_N)	20 A	24 A	32 A	45 A	60 A	72 A
Peak current	see Table A.2			see Table A.3		
Rotating field frequency	0 ... 400 Hz					
Output stage switching ferquency	4, 8, 12, 16 kHz					
Input mains supply side						
Mains voltage	(3 x 230 V/ 3 x 400 V/ 3 x 460 V/ 3 x 480 V) ±10%					
Device connected load [1] (with mains choke)	13.9 kVA	16.6 kVA	22.2 kVA	31 kVA	42 kVA	50 kVA
Current [1] (with mains choke)	21.6 A	26.2 A	34.9 A	45 A	60 A	72 A
Asymmetry of the mains voltage	±3% max.					
Frequency	50/60 Hz ±10%					

1) Values related to a mains voltage of 3 x 400 V_{eff} (at SO82.004: 1 x 230 Veff) and a switching frequency of 8 kHz
3) Connection of an ext. braking resistor is not permitted for devices with int. braking resistor (version SO8x.xxx.xxxx.1xxx)!

Table A.8 Technical data SO84.020 to SO84.072, air cooling

Technical data \ Designation	SO84.020	SO84.024	SO84.032	SO84.045	SO84.060	SO84.072
Power loss at I_N [1]	400 W	475 W	515 W	610 W	830 W	1010 W
DC link						
Capacity	1230 µF	2000 µF		430 µF	900 µF	
Brake chopper switch-on treshold [1]	650 V DC [1]			820 V DC		
Minimum ohmic resistance of an externally installed braking resistor [3]	20 Ω [3]	12 Ω [3]		18 Ω		13 Ω
Brake chopper continuous power with external braking resistor [1]	21 kW [1]	35 kW [1]		37 kW		52 kW
Peak brake chopper chopper with external braking resistor [1]	21 kW [1]	35 kW [1]		37 kW		52 kW
Optional: internal braking resistor	90 Ω			-		
Brake chopper continuous power mit internem Bremswiderstand	see section 3.15.2			-		
Peak brake chopper chopper with internal braking resistor	see section 3.15.2			-		

1) Values related to a mains voltage of 3 x 400 V_{eff} (at SO82.004: 1 x 230 Veff) and a switching frequency of 8 kHz
3) Connection of an ext. braking resistor is not permitted for devices with int. braking resistor (version SO8x.xxx.xxxx.1xxx)!

Table A.8 Technical data SO84.020 to SO84.072, air cooling

NOTE: For further information on brake chopper switch-on threshold please refer to chapter 3.15.

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A.3 Connections for motor cable

Characteristic	BG1 + BG2	BG3 + BG4	BG5	BG6 + BG6a	
				90 - 110 A	143 - 170 A
Connectivity for cables (flexible with ferrules)	0.25 - 4 mm² (AWG 24 - AWG 10) *)	0.75 - 16 mm² (AWG 18 - AWG 6)	max. 25 mm² (AWG 4)	35 - 95 mm² (AWG 2 - AWG 4/0)	50 - 150 mm² (AWG 3 - AWG 5/0)
Tightening torque (Nm)	0.7 - 0.8	1.7 - 1.8	2.5 - 4.5	15 - 20	25 - 30
recommended crimping tool	Phoenix CRIMPFOX 6	Phoenix CRIMPFOX 6 or 16 S	Phoenix CRIMPFOX or similar	-	-

*) Suitable for ferrules without plastic sleeve up to 6 mm²

Table A.13 Technical data terminals for motor cable BG1 to BG6a

Characteristic	BG7
Screws for ring terminal end	ZK-, ZK+, RB-, RB+: M10 L1-3, U, V, W: M12
Tightening torque (Nm)	Screws M10: 20-25 Screws M12: 25-30

Table A.14 Technical data for connecting bars for motor cable BG7

A.4 Current demand of control supply

Housing variant	Size	max. starting current	Continuous current
Wall mounting	BG1 - BG4	6 A	2 A
	BG5	7 A	2.5 A
	BG6 - BG6a	10 A	0 A (10 A) [1]
Liquid cooling	BG3 - BG4	6 A	2 A
	BG5	7 A	2 A
	BG6 - BG6a	8 A	0 A (2 A) [1]
	BG7	4 A	2 A

1) *The value in brackets is valid as long as the voltage supply for the power section is switched off. Once the power section is supplied with voltage, an internal high-voltage switch-mode power supply will take over the supply for the control unit..*

Table A.15 Current demand of control supply

A.5 Ambient conditions

Ambient conditions	ServoOne
Degree of protection	IP20 except the terminals (IP00)
Accident prevention instructions	according to local regulations (in Germany e.g. BGV A3)
Mounting height	up to 1000 m above sea level, higher than 1000 m above sea level with reduced power 1% per 100 m, max. 2000 m above sea level
Pollution severity	2
Type of installation	Built-in unit, only for vertical installation in a control cabinet with min. degree of protection IP4x, when using the safety function STO min. IP54.

Table A.16 Ambient conditions ServoOne

Climatic conditions			ServoOne
during transport	acc. to EN 61800-2, IEC 60721-3-2 class 2K3[1]		
	Temperature		-25 °C to +70 °C
	Relative air humidity		95% at max. +40 °C
during storage	acc. to EN 61800-2, IEC 60721-3-1 class 1K3 and 1K4[2]		
	Temperature		-25 °C to +55 °C
	Relative air humidity		5 to 95%
during operation	acc. to EN 61800-2, IEC 60721-3-3 class 3K3[3]		
	Temperature	Air cooling	**BG1** -10 °C to +45 °C (4 kHz) -10 °C to +40 °C (8, 12, 16 kHz) **BG2 to BG4** -10 °C to +45 °C (4 kHz), up to 55 °C with power reduction (5% per °C) -10 °C to +40 °C (8, 12, 16 kHz), up to 55 °C with power reduction (4% per °C) **BG5 to BG6a** -10 °C to +45 °C (4 kHz) -10 °C to +40 °C (8, 12, 16 kHz), above up to 55 °C wit power reduction (2% per °C)
		Liquid cooling	**BG3 and BG4** -10 °C to +45 °C (4 kHz), up to 55 °C with power reduction (5% per °C) -10 °C to +40 °C (8, 12, 16 kHz), up to 55 °C with power reduction (4% per °C) **BG5 to BG6a** -10 °C to +45 °C (4, 8, 12, 16 kHz), up to 55 °C with power reduction (2% per °C) **BG7** -10 °C to +40 °C (2, 4 kHz), up to 55 °C with power reduction (2% per °C)
	Relative air humidity		5 to 85% without Condensation

1) The absolute air humidity is limited to max. 60 g/m³. This means e.g. at 70 °C, that the relative humidity must only be max. 40%.

2) The absolute air humidity is limited to max. 29 g/m³. The maximum values for temperature and relative air humidity specified in the table must not occur at the same time.

3) The absolute air humidity is limited to max. 25 g/m³. This means, that the maximum values for temperature and relative air humidity specified in the table must not occur at the same time.

Table A.17 Climatic conditions ServoOne

Mechanical conditions	ServoOne		
Vibration limit during transport	acc. to EN 61800-2, IEC 60721-3-2 class 2M1		
	Frequency [Hz]	**Amplitude [mm]**	**Acceleration [m/s²]**
	2 ≤ f < 9	3.5	not applicable
	9 ≤ f < 200	not applicable	10
	200 ≤ f < 500	not applicable	15
Shock limit during transport	acc. to EN 61800-2, IEC 60721-2-2 class 2M1		
	Dropping height of packed device max. 0.25 m		
Vibration limits of system[1]	acc. to EN 61800-2, IEC 60721-3-3 class 3M1		
	Frequency [Hz]	**Amplitude [mm]**	**Acceleration [m/s²]**
	2 ≤ f < 9	0.3	not applicable
	9 ≤ f < 200	not applicable	1

1) Note: The devices are solely intended for stationary use.

Table A.18 Mechanical conditions ServoOne



ATTENTION!

- **Control cabinet min. IP54 for STO**
  According to EN ISO 13849-2 the control cabinet must have degree of protection IP54 or higher when using the safety function STO (Safe Torque OFF).
- **No continuous vibrations!**
  The drive controllers must not be installed in areas where they would be permanently exposed to vibrations.

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