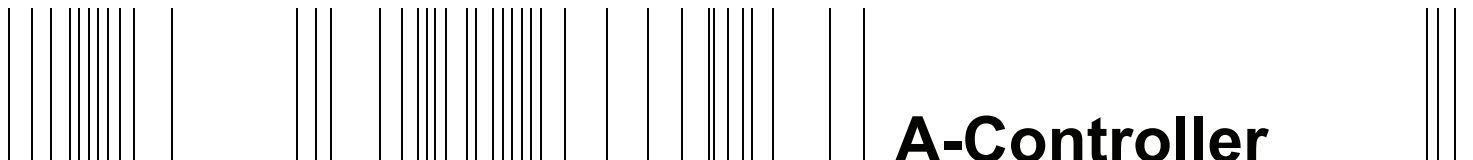


be in motion be in motion



A-Controller

Manual

E	5.96012.02a
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BAUMÜLLER

Title Manual
Product **A-Controller**
Version 5.96012.02a

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ABBREVIATIONS

AC	Alternating current
AM	Asynchronous motor
BB	Ready for use
BEDAS	Operating data store
BUM	Baumotronic Converter Mono Power Unit
BUS	Baumotronic Converter Servo Power Unit
DC	Direct current
DIN	German Standardization Institute (Deutsches Institut für Normung e.V.)
DS	Three-phase current
EMC	Electromagnetic compatibility
FBS	BEDAS missing
FLG	Fault in position encoder signal
FPH	Missing phase
FTO	Fault in tachometer generator signal
HS	Main contactor
HSE	Main contactor ON
HSF	Main contactor enable
IZK	Overcurrent in DC link
LED	Light emitting diode
LT	Power unit
NMX	Maximum RPM exceeded
RS	Controller disable
SGR	Current limit reached
SM	Synchronous motor
T_A	Ambient operating temperature
TBA	Overtemperature of chopper resistor
t_H	Ramp-up/ramp-down time
T_{KK}	Overtemperature of heat sink
T_{MO}	Overtemperature of motor
UVS	Supply voltage too low
U_{ZK}	DC link voltage
VDE	German Association of Electrical Engineers (Verein deutscher Elektrotechniker)

1 SAFETY NOTES

General information

These operating instructions contain the information required for the application as directed of the products described herein. The document is intended for specially trained, skilled personnel who are well-versed in all warnings and maintenance activities.

The units are manufactured using the state-of-the-art technology and are safe in operation. They can be installed safely and commissioned and function without problems if the safety information below is observed.



DANGER

When operating this electrical unit, some parts of the equipment always carry dangerous voltage. Ignoring these safety instructions and warnings may result in death, serious personal injury and/or damage to material assets.

Only qualified personnel who are familiar with the safety information, assembly, operation and maintenance instructions may carry out work on this unit.

Danger information

One the one hand, the information below is for you own personal safety and on the other to prevent damage to the described products or to other connected units.

In the context of the operating instructions and the information on the products themselves, the terms used have the following meanings:



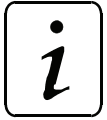
DANGER

This means that **death, severe personal injury or considerable damage to material assets will occur**, unless appropriate safety measures are taken.



WARNING

This means that **death, severe personal injury or considerable damage to material assets may occur**, unless appropriate safety measures are taken.



NOTE

This draws your attention to **important information** about the product, handling of the product or to a particular section of the documentation.

Qualified personnel

In the sense of the safety-relevant information in this document or on the products themselves, qualified personnel are considered to be persons who are familiar with setting up, assembling, commissioning and operating the product and who have qualifications appropriate to their activities.

- Trained or instructed or authorized to commission, ground and mark circuits and equipment in accordance with recognized safety standards.
- Trained or instructed in accordance with recognized safety standards in the care and use of appropriate safety equipment.

Application as directed



WARNING

You may only use the unit/system for the purposes specified in the operating instructions and in conjunction with the third-party equipment and components recommended or authorized by BAUMÜLLER NÜRNBERG GmbH.

For safety reasons, you must not change or add components on/to the unit. The operator must report immediately any changes that occur which adversely affect the safety of the unit/system.

2 TECHNICAL DATA

2.1 General

Closed-loop control

- Closed-loop controller for synchronous motors with brushless tachometer generators, position encoders
- Controller structure designed for current-controlled speed limiting system
- The controller provides:
 - excellent concentricity properties
 - high control dynamic response and rigidity across the entire RPM range
- Inputs:
 - Controller enable
 - Reset
 - Two specified value inputs
 - External current limitation
 - Motor thermal relay
- Outputs:
 - Two relay contacts
 - Ready for use message
 - programmable message: the relay rises either
 - at controller enable
 - at $n = 0$
 - with an overcurrent/earth fault/transistor fault
 - with a missing phase in the feed (BUM 60 only)
 - in the case of intermediate circuit overvoltage or ballast resistor overtemperature (BUM 60 only)
 - in the case of overtemperature of the motor
 - if the position encoder signals are missing
 - in the case of overtemperature of the heatsink
 - in the case of overloading of the 15-V voltage supply
 - if the converter was run at the current limit for longer than 2 s
 - if BEDAS is missing
 - if the tachometer generator signals are missing
 - if the maximum RPM is exceeded (by more than 20%)
- Two analog outputs
 - I_{set} display (10 V, bipolar)
 - n_{act} display (10 V, bipolar)
- Miscellaneous
 - Ambient operating temperature T_A 0 ... +45° C
 - Temperature of coolant (50 mm below bottom edge) T_{coolant} 35° C
 - Storage temperature range -30° C ... +85° C

2.2 Electrical data

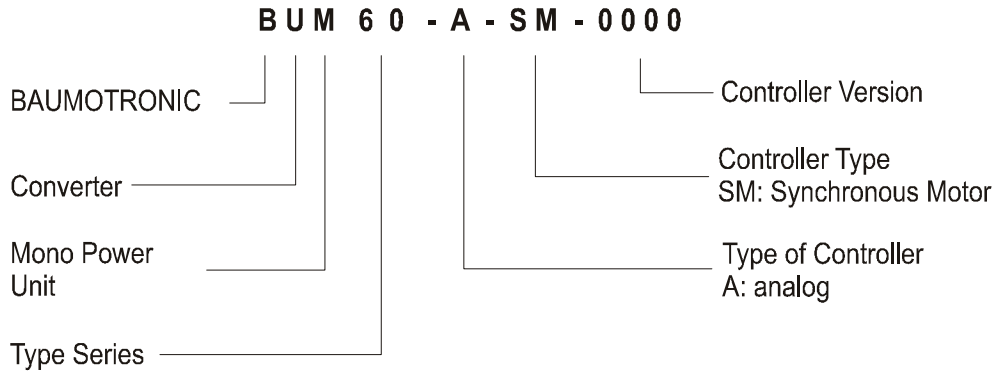
The data of the power unit depends on the basic unit and is described in the relevant documentation.

Technical data of the closed-loop controller:

Current set value I_{set} an X8:7	10 V at peak power unit current
Speed set value n_{set} Adaption * n_{set} additional Integrator ramp-up and ramp-down time t_H *	0 ... ±10 V 5 V ... 11.5 V 0 ... ±10 V 9 ms ... 250 ms
Speed actual value at X8:5 n_{ist} $n_{max} \leq 3000 \text{ min}^{-1}$ $n_{max} \geq 3000 \text{ min}^{-1}$	3.3 V / $1000 \text{ min}^{-1} \pm 10 \%$ 1.65 V / $1000 \text{ min}^{-1} \pm 10 \%$
Max. speed n_{max} Speed monitoring at	motor-specific 120 % of n_{max}
External current limitation Standard Variable (Option) Max. current limited for *	0.1 I_S 0 ... 100 % I_S 0.3 / 0.5 / 1 / 2 s
Messages Ready for use Programmable function	X8:3 and 4 X8:1 and 2
Reset	X8:10 and 11
Controller enable RF Controller disable „braked OFF“ Controller disable „unbraked OFF“	undelayed for 200 ms undelayed
Ready for use and programmable function Contacts can be loaded with	24 V / 1 A
Errors displayed via	12 LED

- * Using the operating data store (BEDAS), individual adaptation is possible at the factory to the motor, machine and cooling conditions.
The default settings are printed in **bold type**.

2.3 Type code



NOTE

With the type code:

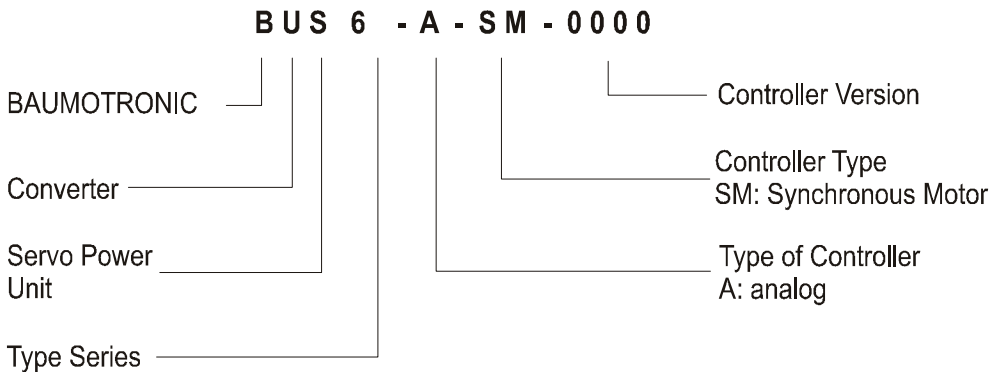
Type code	Mono power unit:	BUM 60 - 30/60-31-B-002-A-0100-L
	with controller:	BUM 60 A - SM - 0100

an unit type exists for 230 V_{AC} supply and analog controller which is fully compatible to the former BUM 25.

Only with this unit type

- the BEDAS and
- the programmable function outputs

are compatible with the last version of the BUM 25.



3 TRANSPORTATION, UNPACKING

The units are packed at the factory in accordance with the order.

You should avoid jarring packages in transit or jolting them, e.g. when setting them down on the ground.

After unpacking the package(s) and checking that the shipment is complete, you can start assembly.

Fibre board, cartridge paper and/or wood are used as packaging materials and they can be disposed of in accordance with local regulations.

Report any damage in transit without delay.



DANGER

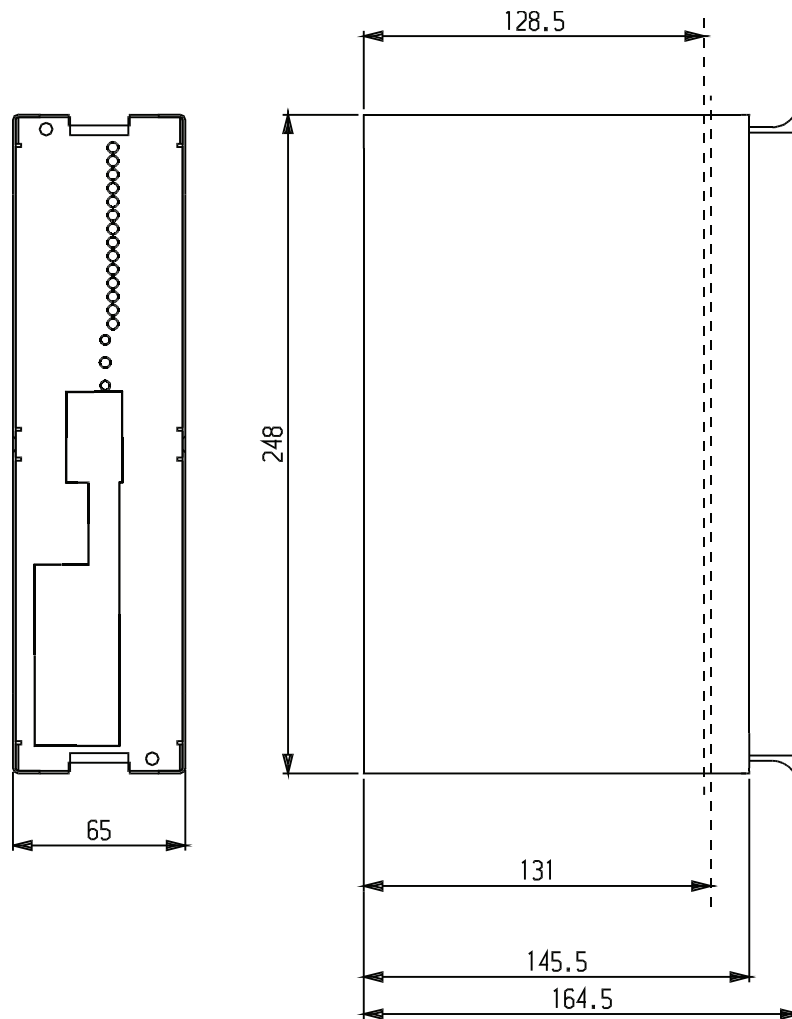
If the unit has been damaged in transit, do not connect it to the mains until appropriate high-voltage testing has been carried out.

Ignoring this information can result in death, severe personal injury, or considerable damage to property

4 ASSEMBLY

4.1 Dimensions

BUS 6 A - SM (cassette version)



Plug-in module depth

- BUS 6 and BUM 62: 128.5 mm
- BUM 63/64: 131.0 mm

You can only determine the total depth in conjunction with the basic unit; you must also take into account the dimensions of the plug-in connectors used (approximately 40 mm).

4.2 Assembly notes



WARNING

The user is responsible for the assembly of the converter power unit, the motor and the other components according to applicable safety standards (e.g. DIN, VDE) and all other relevant national or local regulations regarding conductor dimensions and fusing, grounding, circuit breakers, overcurrent protection etc.

The units are protected from direct contact by being installed in commercially available switching cabinets that meet the minimum protection requirements of preliminary standard EN 50178/VDE 0160/11.94, Section 5.2.4.

BUS 6 A - SM

Plug-in the controller cassette in the designed space of the unit and attach the cassette with its 2 screws.



NOTE

Do not plug-in the cassette when voltage is supplied.

BUS 60 A - SM

The controller is mounted on the unit.

The installation of the units is described in a separate documentation.

5 INSTALLATION

5.1 Danger installation



WARNING

This equipment carries a dangerously high voltage and has dangerous rotating parts (fans). Ignoring the safety and warning information may result in death, severe personal injury or damage to property.

The machine operator is responsible for mounting the power unit, the motor, the transformer and any other equipment in accordance with appropriate safety regulations (e.g. DIN, VDE); equally, you must ensure that all other relevant national and local regulations are met with regard to cable ratings and protection, grounding, disconnectors, overcurrent protection, etc.

The DC link carries a voltage! It is imperative that the provided cover is used

Be particularly careful before touching the drive shaft directly or indirectly with your hands. This is only allowed when the system is deenergized and the drive is stationary.

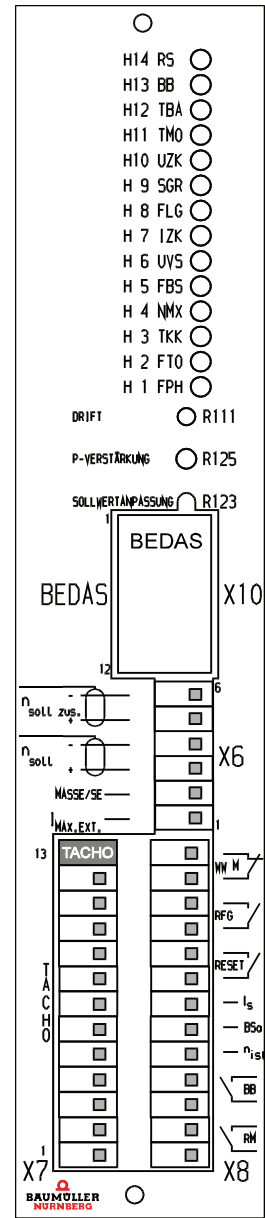
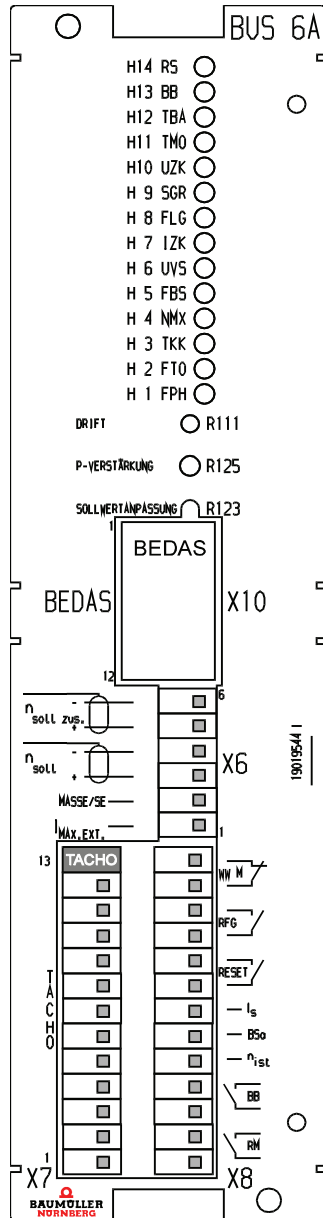
Safety devices must never be deactivated.

Relatively high leakage to ground occurs in the converter and the motor, i.e. the drive may be incompatible with current-operated e.l.c.b.s (corresponding to provisional standard EN 50178:1994 Section 5.2.11.2).

You may only use variable-speed drives in applications that correspond to valid EN specifications.

5.2 Checks before installation

- Make a note of the type and number of the unit and of the motor
- Check the connections using the connection diagram
- Connect the plugs on the device:



5.3 Display

LED display element

- H14 RS ○
- H13 BB ○
- H12 TBA ○
- H11 TMO ○
- H10 UZK ○
- H 9 SGR ○
- H 8 FLG ○
- H 7 IZK ○
- H 6 UVS ○
- H 5 FBS ○
- H 4 NMX ○
- H 3 TKK ○
- H 2 FTO ○
- H 1 FPH ○

LED	Color	Function
H14 RS	yellow	Controller disable
H13 BB	green	Ready for use
H12 TBA	red	Overtemperature of ballast resistor *
H11 TMO	red	Overtemperature of motor
H10 UZK	red	Overvoltage in DC link
H9 SGR	red	Current limit reached
H8 FLG	red	Position encoder signal error
H7 IZK	red	Overcurrent in DC link
H6 UVS	red	Supply voltage too low
H5 FBS	red	BEDAS missing
H4 NMX	red	Maximum speed reached
H3 TKK	red	Overtemperature of heat sink
H2 FTO	red	Tachometer generator signal error
H1 FPH	red	Phase missing *

* Monitored in BUM 60 only

Connection information

X6	1	External current limitation: wire bridge on X6:2 reduces current to 10% of I_{max} ; On request, variable current limitation (0 ... +10 V = 0 ... 100% of current)
	2	Frame ground to NC/PLC earth: at least 4 mm ²
	3, 4	Speed specified value $n_{set} = 0 \dots 10$ V on differential amplifier; Polarity specified in the plan applies to counter-clockwise-rotating motor shaft
	5, 6	Additional specified value, same differential amplifier as before, does not run via integrator

X7		Connect brushless tachometer generator via a cable set; for line lengths, refer to accessories. For assignments of terminals 1-12, refer to connection diagram. At initial commissioning, use an original cable.
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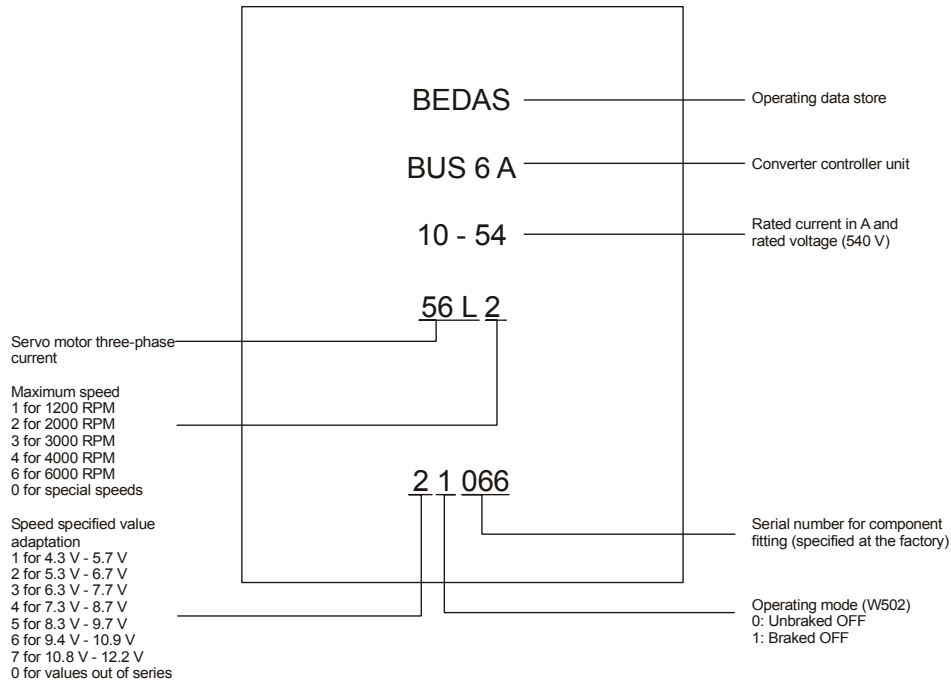
X8	1, 2	Relay for programmable message	
		BUM 60 A - SM - 0100 Message overvoltage DC link contact open in the event of a message contacts 24 V / 1 A	all other BUM 60 A-Controller contact closed in the event of a message contacts 24 V / 1 A
	3, 4	Ready for use relay; contact closed on ready for use, can be loaded with 24 V/1 A; relay opens approximately 2 s after switch-on and closes immediately after Mains OFF. Error is indicated via the operating display if the relay drops in operation.	
	5, 6	Display of actual RPM value 0 ... approx. 10 V, bipolar; instrument for speed display $R_i > 5$ k	
	6	Reference potential BSa	
	7, 6	Current specified value for display of the current or the torque; output 0 ... 10 V corresponds to 0 ... peak output current, output bipolar, can be loaded with 2 mA max.	
	8, 9	Reset, error messages are cleared on activation of the contact or, if not available, automatically on switching on again. No reset until the error has been removed!	
	10, 11	Close the contact for controller enable; in the case of a controller disable (contact open), the system disables the controllers at once, the drive coasts to a stop (==> unbraked OFF). Alternative: when the contact opens, the system automatically brakes the drive to zero speed, braking is interrupted after 200 ms and the controller is disabled (==> braked OFF). For braked OFF, you must fit wire bridge W502 in BEDAS. In the case of drives with high levels of external inertia, it is better to slow the drive down to zero speed using the RPM specified value and to disable the controller at zero speed. In the event of a power failure, the system does not automatically brake drives to zero speed, but rather, they coast to a stop instead.	
	12, 13	Connection for the motor thermal relay; when the bimetal contact in the motor opens, the system carries out controller disable and an unbraked OFF. This protects the motor from overloading.	

X10		Slot for the operating data store, BEDAS; the device to motor assignment is indicated on the BEDAS. For further information, refer to the Technical Data.
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5.5 Operating data store BEDAS

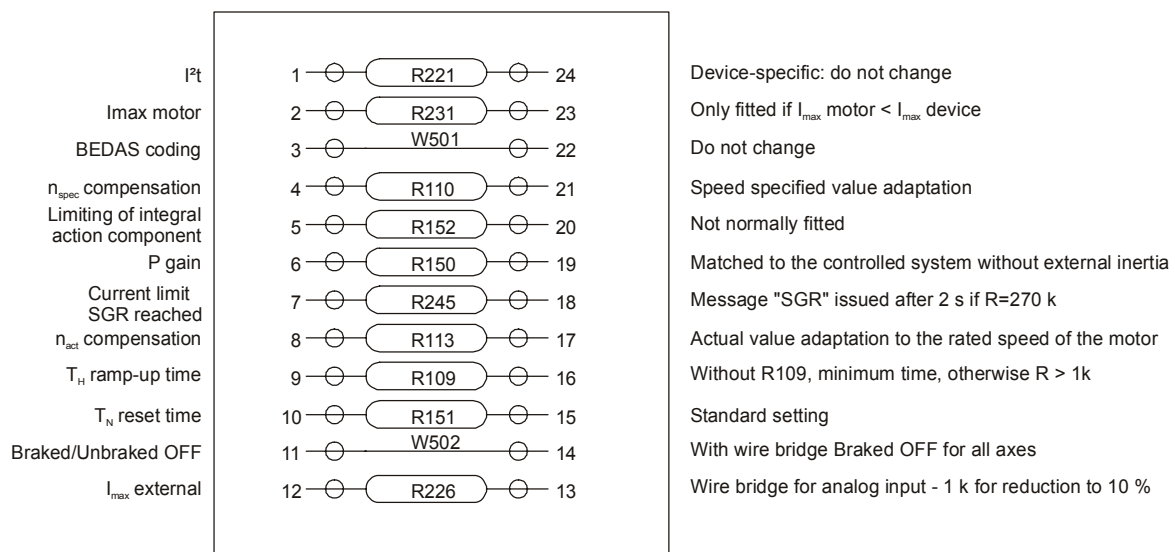
You plug this component into location X10 on the controller. BEDAS contains all the circuitry necessary for adapting the power unit to the respective three-phase current motor. The great advantage is the ease of handling at commissioning and maintenance. The marking on the device clearly defines the assignment to the three-phase current servo motor and to the power unit.

Marking



Fitting the operating data store

(this may only be changed by specialist personnel after consulting with the manufacturer)





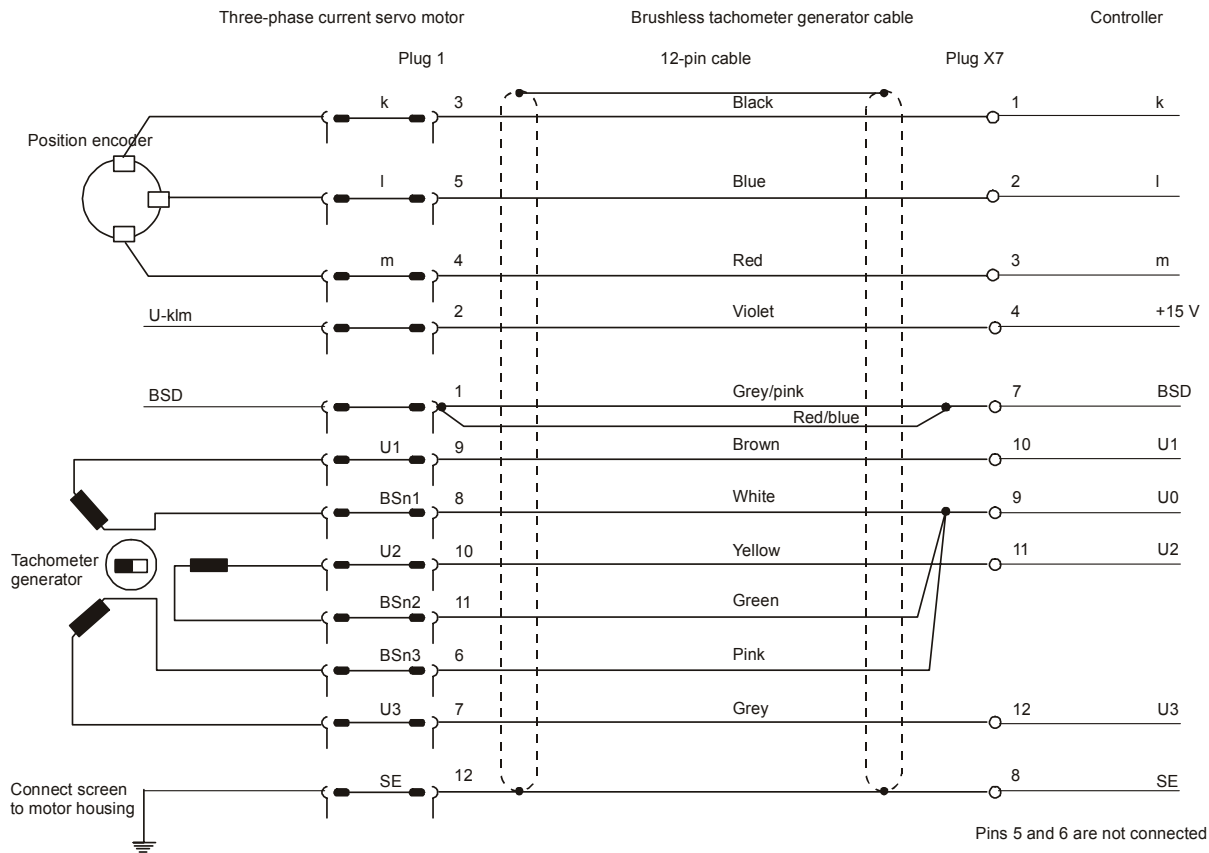
NOTE

Unit type	BUM 60 A - SM - 0100	all other A-Controller
BEDAS	The BEDAS code (W501) can be printed with the values of the BUM 25 (27 kΩ) BEDAS code.	The BEDAS code (W501) must be printed with the value 22,1 kΩ.

Order information:

- Motor type and version
- Length and works number of tachometer generator cable
- Specified RPM speed for max. speed
- Ramp-up time of integrator for specified value step-change
- Braked OFF or Unbraked OFF with controller disable
- Switched or analog current limit

5.6 Brushless tachometer generator cable



Connect the sub-unit terminal to socket X7 on the controller. If necessary, unscrew the sub-unit terminal before laying the cable.

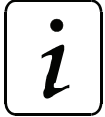
Two different versions of the cable are supplied that are precut and have integrated Interconnectron PLD 171 circular plugs. You must only use original manufacturer parts that guarantee contact protection, tension relief, protection levels and permanent contact.

Precut cables with connectors

Length	Article number: Standard	Article number: Power chain
2 m	113 580	
3 m	113 146	197 362
5 m	102 124	194 122
7 m	194 152	
8 m	110 620	195 502
10 m	102 125	195 503
15 m	102 126	195 504
20 m	110 433	195 505
25 m	110 844	195 506
30 m	112 220	198 666
35 m	113 579	
44 m	197 419	
50 m	112 155	
60 m	112 759	
65 m	197 048	
75 m	197 049	
100 m	188 349	

5.7 Accessories

	Works number
• Sub-unit terminal X6 6-pin RM 5	1900 9063
• Sub-unit terminal X7 12-pin RM 5	1900 9064
• Sub-unit terminal X8 13-pin RM 5	1901 7560



NOTE

A set of sub-unit terminals for X6 and X8 are supplied already fitted.

Sub-unit terminal X7 is supplied with the brushless tachometer generator cable.

6 COMMISSIONING

6.1 Danger information



WARNING

This equipment carries a dangerously high voltage and, depending on the version, may have dangerous rotating parts (fans). Ignoring the safety and warning information may result in death, severe personal injury or damage to property.

You are responsible for mounting the power converter, the motor, the commutating reactor and any other equipment in accordance with appropriate safety regulations (e.g. DIN, VDE); equally, you must ensure that all other relevant national and local regulations are met with regard to cable ratings and protection, grounding, disconnecters, overcurrent protection, etc.

The most important factors for protecting people are the DIN/VDE protective measures and safety regulations. If there are no protective earth connections on the equipment, commutating reactor or the motor, personal injuries are inevitable, since the surfaces may carry dangerously high voltages.

The power converter's power cables are energized!

The mains unit and the field connector of the power converter carry a dangerous voltage even when the main contactor has dropped.

During operation, the principles on which the power converter and the motor work lead to leakage currents to earth that are dissipated via the specified protective earths and may result in a current-operated e.l.c.b on the input side blowing prematurely.

In the case of a short-circuit to frame or to ground, a direct proportion may arise in the leakage current that makes triggering a higher level current-operated e.l.c.b either more difficult or totally impossible.

Make the PE connection in accordance with DIN EN 60204/VDE 0113 Part 1/06.93; Section 8.2.2 taking into account provisional standard EN 50178/ VDE 0160/11.94, Sections 5.3.2.1 and 8.3.4.4.

Before carrying out commissioning, check whether the plastic covers over the power stage connections are in place.



WARNING

If an error occurs, the drive is deenergized and then coasts unbraked to a standstill. You should consider this situation particularly with motion and lifting drives.

Faulty drive response

During initial commissioning, faulty or uncontrolled motion of the driven machine elements is always possible. At this stage, you should therefore proceed with particular care.

Before switching on the drive, you must carefully check the functions of all the higher level safety equipment to prevent injury to people.

Take particular care when directly or indirectly touching the drive shaft with your hand. This is only allowed when the shaft is stationary and the power converter is deenergized. Any exposed parts of the machine, such as the shafts, fans, etc., must be covered during operation.

Contact protection in accordance with paragraph 4 Section 4 VBG 4

Protection against direct contact comprises all the measures against danger that can result from touching the active parts of electrical equipment.

You must therefore protect the active parts from being touched by means of insulation, the construction and arrangement of the equipment or permanently mounted guards. The guards in question are standard covers, barriers and procedures that guarantee that people cannot touch active parts that are carrying power.

Switching cabinets must have an emergency off facility to switch off any voltages that could be dangerous. This does not include equipment which, if switched off, would cause an even more dangerous situation. The emergency off releasing element must be arranged in such a way that it can be reached quickly in case of danger. In the case of work that is considerably more dangerous than usual, another person must be present.

The machine minder must ensure that unauthorized people do not work at the machine.



WARNING

The machine minder must report immediately any changes that occur at the machine which adversely affect safety.

When dismantling safety equipment during commissioning, repair and maintenance work, you must ensure that the machine is taken out of commission in accordance with applicable regulations. You must remount and check safety equipment immediately after completing commissioning, repair and maintenance work.

This list of measures required for safe power unit operation is not complete. If you should need further information or if special problems arise please contact BAUMÜLLER NÜRNBERG or a sales agency. Please observe the warnings in Chapter 1 of these operating instructions.



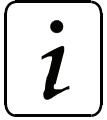
NOTE

Before touching the modules, the operator must release any electrostatic charge to protect electronic components from high voltages generated through electrostatic charge, by simply touching a conductive, grounded object immediately before, for example.



This label is placed in a visible location on units with electrostatically susceptible components and / or modules.

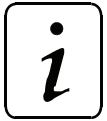
6.2 Initial commissioning of the drive system



NOTE

Did you observe the following points before carrying out initial commissioning?:

- made a note of the type and number of the devices and the motor
- checked the connections on the basis of the connection diagram, in particular correct connection of the motor winding



NOTE

At the factory, we carefully checked the drive and optimized it using the operating data store. Changes may be made to the operating data store only after consulting with the manufacturer.



DANGER

During initial commissioning, faulty or uncontrolled motion of the driven machine elements is always possible. Before carrying out commissioning, you should therefore carefully check that all safety equipment is functioning properly to rule out any chance of injury to people. Commissioning of the drive should be carried out by authorized specialists who should assist the engineer in commissioning the machine.

1. Check the assignment of the motor and the BEDAS and the power unit;
2. Check connections on the basis of the connection suggestion.
Carry out VDE protective measures!
Connect the following:
 - Battery box with settable RPM specified value (e.g. 0 ... 1.5 V) at terminals X6:3 and 4; polarity dependent on the required direction of rotation; refer to diagram (temporarily disconnect the existing connections for controller enable and RPM specified value);
 - Voltmeter for checking the intermediate circuit voltage for the duration of commissioning;
 - Push button for controller enable between terminals X8:10 and 11;
 - 24 V for the holding brake in the motor (e.g. type DSG.....)
3. Motor checks
 - Sequence of main connections
 - Brushless tachometer generator cable is OK
 - Connection of temperature monitoring
 - Holding brake, if present
 - PE connection
 - Motor fixed to flange
 - Shaft rotates easily

- Check plug-in connection on motor
4. Limit the current to 10% of the peak device current, I_{max} (approximately 6 A) by connecting terminal X6:1 to 2.
 5. Unscrew connections L1, L2 and L3.
 6. Check the mains voltage by connecting the voltmeter and switching it on.
 7. Reconnect L1, L2, L3 on the basic unit.
 8. Switch on the system.
Check the operating display.
(see display)
 9. Check whether the fan is working.
 10. Check the intermediate circuit voltage.
Switch off the system and wait until the DC link has discharged.
 11. Release the holding brake if fitted.
Specify at terminals X6:3 and 4 the minimum RPM specified value of approximately 100 mV.
 12. Switch on the system and briefly press the push button for controller enable:
 - Yellow LED for controller disable goes out.
 - Motor turns.
 - Power transmission runs without disturbances.
 - Direction of rotation OK
 - Speed controller functioning (even motor running dependent on the specified value).
 - Switch off the system!
Correct the direction of rotation by replacing both specified value cables.
 13. Carry out coarse setting of the speed using a manual tachometer or frequency f of the position encoder signal at terminal X7:1 to X7:7 actual speed value $n_{act} = (f * 60)/3$
Match the speed, using the specified value adaptation potentiometer, e.g. to an RPM specified value of 500 mV.
 14. Run in the drive while taking into account the final position or the maximum speed.
 15. Check emergency stop.
 16. Cancel current limitation by disconnecting X6:1 from 2.
 17. Switch on again at RPM specified value $n_{set} = 0$, carry out drift compensation using the Drift.
 18. Using potentiometer P gain, increase the P gain as a proportion of external torque to motor torque to just below the stability limit. You know that this limit has been reached when the specified current value, IS, on terminal X8:7 starts oscillating. From this point onwards, turn the potentiometer down slightly (to the left);
Note
Increasing the P gain in an uncontrolled manner does not improve the dynamics of the drive at all; in continuous operation, the oscillations of the current specified value can lead to thermal overload of the motor.
 19. Switch off the system!
Remove the push buttons for controller enable and the battery box and make connections to the controller instead.
 20. Carry out fine compensation of the RPM by means of the screen display, contouring error, manual tachometer or similar and correct the drift compensation;

Correct the direction of rotation by reversing the connections for the RPM specified value if necessary.



DANGER

With a higher-level position controller, positive feedback can lead to the drive rotating at maximum speed. Additional measures must be taken to prevent positive feedback.

21. Check the dynamic response:

- Acceleration to rapid traverse (with/without load)
- Braking to $n = 0$ (check ballast, braking time)
- Position control
- Emergency stop

In each case, record the speed actual value n_{act} (terminal X8:5) and the current specific value I_S at X8:7.

Even at extreme loading, the elasticity of the intermediate circuit voltage may only be 10%.

22. Does the torque curve $M_L(I_S)$ correspond to the intended operating mode load?

23. The holding brake releases and brakes at the right time.

24. After one hour of continuous operation:

- Measure the temperatures of the switching cabinet and the motor with a probe!
- Temperature on flange $< 65\text{ °C}$
- Incoming air on converter $< 35\text{ °C}$ (with cabinet closed)
- Mains failure/braking/emergency stop
- Limit switch
- Start/stop operation

Commissioning of the BUS 6 A/BUM 60 A is completed.

7 MAINTENANCE



WARNING

The equipment carries a dangerously high voltage and has dangerous rotating parts (fans). Ignoring the safety and warning information may result in death, severe personal injury or damage to property.

You may only carry out maintenance when the unit is deenergized.

Do not begin work on the power stage and the intermediate circuit until you have made sure that the unit is not carrying potential or a voltage (remanent charge).

When dismantling safety devices during commissioning, repair and maintenance work, you must ensure that the machine is taken out of commission exactly as specified. You must remount and check safety equipment immediately after completing commissioning, repair and maintenance work.

After carrying out any work involving intervention in the machine – regardless of whether this involves the motor, the actual value acquisition or the power converter – the owner must carry out acceptance testing and document it chronologically in the machine log. Failure to do this may result in the owner being faced with consequences relating to liability legislation.

Do not start work on the power unit, intermediate circuit until you have made sure that the unit is not carrying potential or a voltage (remanent charge).

7.1 Maintenance information

The units supplied are maintenance-free.

Prohibition of unauthorized modifications

For safety reasons, unauthorized additions or modifications to the drive are not allowed.

7.2 Troubleshooting

Operation display			Cause	Remedy
1	FPH	red	Phase missing in feed *	<ul style="list-style-type: none"> – Replace the defective fuse – Check the mains connecting cable
2	FTO	red	Tachometer generator signal error	<ul style="list-style-type: none"> – Temporarily replace the defective tachometer generator cable and repair the breakage (soldered or plug-in contact).
			Missing tachometer generator voltage U1, U2 or U3	<ul style="list-style-type: none"> – Measure the resistance of the tachometer generator on the metal plug: U1 between 8 and 9 U2 between 10 and 11 U3 between 6 and 7 (R = 47 Ω or 23.5 Ω) Completely replace the motor
3	TKK	red	Over temperature of heat-sink	<ul style="list-style-type: none"> – Power transistors are overloaded – Fan has broken down – Ambient temperature is too high – Heat concentration in the cabinet
4	NMX	red	Maximum speed exceeded	<ul style="list-style-type: none"> – Specified RPM value is too high – Actual RPM value adapted wrongly
5	FBS	red	Missing BEDAS	<ul style="list-style-type: none"> – Plug BEDAS into location X10 on the associated device such that pins 1 and 24 on the device are at the top
6	UVS	red	Supply voltage is too low	<ul style="list-style-type: none"> – Intermediate circuit voltage drops to $U < 200\text{ V}$ – With error in switching power supply, replace device and retain BEDAS
7	IZK	red	Overcurrent in current circuit	<ul style="list-style-type: none"> – Short-circuit of motor lines – Interturn fault in motor – Earth fault in motor
8	FLG	red	Position encoder error	<ul style="list-style-type: none"> – Temporarily replace the defective tachometer generator cable repair the breakage (soldered or plug-in contact). – Completely replace the motor
9	SGR	red	Current limit reached	<ul style="list-style-type: none"> – Monitoring time for current limit set on BEDAS exceeded – Monitoring time too short – Motor blocked – Motor lines interchanged – Load torque too high – Motor lines not connected – Current limiting activated – Tachometer generator or position encoder interchanged – Brake blocked
10	UZK	red	Overvoltage in intermediate circuit	<ul style="list-style-type: none"> – Connection voltage too high – Discharging of intermediate circuit via the ballast circuit does not function – Braking power $> P_{\max}$ ballast – Ballast resistor blown – Wire bridge for ballast missing – External ballast resistor not connected
11	TMO	red	Overtemperature of motor (thermal relay must be connected) *	<ul style="list-style-type: none"> – Effective power on the shaft is greater than the motor's full-load power – Improve the cooling conditions, i.e. lower the temperature and improve cooling on the flange – Fan on the motor has broken down – BEDAS fitted wrongly

Operation display			Cause	Remedy
12	TBA	red	Overtemperature choke resistor	<ul style="list-style-type: none"> – Effective power on the shaft is greater than the motor's full-load power – Improve the cooling conditions, i.e. lower the temperature and improve cooling on the flange – Fan on the motor has broken down – BEDAS fitted wrongly
13	BB	green	Ready for use	– no error
14	RS	yellow	Controller disable	– no error

* only with BUM 60



NOTE

If no error message is pending but ready for use, BB, is not lit up, the basic unit is not ready for use.

7.3 Disposal

For the most part, the equipment consists of the following components and materials:

Component	Material
Various spacers, housing of current converter and unit fan, etc.	Plastic
PCBs on which all the open- and closed-loop electronics are mounted	Base material: Epoxy-resin fiberglass woven material, copper-coated on both sides and plated-through, various electronic components such as condensers, resistors, relays, semi-conductors, etc.

For technical reasons, electronic components might need to contain dangerous materials, so you should not open them.

If the components are used correctly, there is no danger to human beings or to the environment.

In case of fire, dangerous compounds may result or hazardous materials may be released.

You must dispose of or recycle equipment or components according to national regulations as well as any applicable local or regional ordinances.

8 APPENDIX

8.1 Manufacturer Declaration

HERSTELLERERKLÄRUNG IN SINNE DER EG-MASCHINENRICHTLINIE 89/392/EWG, ANHANG IIB

Manufacturer Declaration in Accordance with the EC-Machine Guidelines 89/392/EEC, Appendix II B

Hiermit erklären wir, daß es sich bei dieser Lieferung um die nachfolgend bezeichnete Maschinenkomponente handelt und daß ihre Inbetriebnahme solange untersagt ist, bis festgestellt wurde, daß die Maschine, in die diese Komponente eingebaut ist, den Bestimmungen der EG-Maschinenrichtlinie 89/392/EWG, Anhang II B entspricht.

We herewith declare that this delivery includes the following specified machine component and that its putting into operation is prohibited until the declaration is made that the machine, in which this component is built in, complies with the regulations of the EC-machine guideline 89/392/EWG, appendix II B.

Bezeichnung der Maschinenkomponente:
Specification of the machine component:

Typenbezeichnung:
Type:

Regler


BUS 6 A - SM

BUM 60 A - SM

Nürnberg, den 11.02.2005

Hersteller-Unterschrift:

Signature of the Manufacturer:



16.02.2005

Andreas Baumüller
Geschäftsführer
Head of division



11.2.2005

Dr. Peter Heidrich
Entwicklungsleiter
Head of development

8.2 General Conditions of Sale and Delivery

1. Obligation and Conclusion of Contract

- a) Deliveries of goods and provision of services shall be effected exclusively based on these trading conditions. They are an essential component of the contracts for delivery and shall be considered as having been accepted by the placing of an order. In the case of constant business relations, they also apply for the future contracts.
- b) Agreements diverging from the contract and verbal collateral agreements shall only be binding if they have been confirmed in writing by Baumüller Nürnberg GmbH (hereinafter referred to as Baumüller). Diverging trading conditions on the behalf of the purchaser shall be without obligation, even where these have not been expressly objected to. These General Conditions of Sale and Delivery shall be considered as having been accepted by the purchaser at the latest when the delivery is accepted.
- c) In as far as deliveries of goods are subject to separate external obligations in accordance with the Law Concerning Foreign Trade and Payments with respect to the Federal Office for Economics, the purchaser has to observe the relevant conditions at his/her own responsibility.

2. Price and Offers

Offers are subject to confirmation, not binding and apply subject to material supply possibilities. Supplements and amendments require written confirmation. Prices are ex works and are subject to confirmation. Invoicing takes place in accordance with the prices valid on the date of delivery.

3. Extent of Delivery and Delivery Time

- a) Specified delivery periods/dates are without obligation, in as far as nothing else to the contrary has been expressly agreed upon in writing. Delivery periods do not commence until the purchaser has fulfilled all duties of co-operation, in particular regarding details of performance. In the event that the agreed deposits for orders are delayed, then the delivery time shall be extended accordingly.
- b) The purchaser is entitled, in particular in the event of a delay in delivery of longer than 3 months, to set an appropriate period of grace and after its expiry, to withdraw from the order. Claims to compensation due to non-fulfilment or delay shall be excluded, in as far as Baumüller is not responsible for intent or gross negligence.
- c) Baumüller is entitled at any time to effect partial deliveries and partial services, as well as to invoice these accordingly.

4. Delivery Problems

- a) Delays/preventions in the delivery of goods or the provision of services due to force majeure entitle Baumüller to delay the production and delivery by the duration of the obstruction plus an appropriate period of time or to withdraw in part or in whole from the order.
- b) Industrial disputes or other circumstances which substantially impede or render impossible the delivery, such as, in particular, disturbances in the operating processes, problems in procuring materials, official directives also apply as force majeure, irrespective of whether they arise with regard to Baumüller or suppliers.
- c) In these cases, Items 4 a), b), the purchaser shall have no claim to compensation due to non-fulfilment or delay of the delivery.

5. Packaging

Items for sale and delivery items are packaged and transport insurance policies are taken out according to the

instructions of and at a cost to the purchaser. Upon demand, the packaging material has to be returned without delay, free of freight charges and expenses.

6. Dispatch and Passing of Risk

Deliveries shall be made ex works. The dispatch shall be effected at a cost to and at the risk of the recipient of the service/the purchaser. The risk passes to the recipient of the delivery/purchaser as soon as the delivery items leave the works. This shall apply at the latest, from the transfer of the delivery items to the person carrying out the transport, forwarding agent or carrier.

7. Warranty

- a) The period of warranty amounts to 12 months from the day of dispatch.

In the event that a delivery item is defective, Baumüller shall deliver an additional replacement or make a subsequent improvement at its own choice. Multiple subsequent improvements are permissible. Other warranty claims on the behalf of the purchaser, in particular also due to direct or indirect consequential damage are excluded. The precondition for any warranty is the normal contractual use of the delivery items. In the event of the utilization of warranty services, the motor, the replacement part or the device has to be sent in free of freight charges, packaging costs or customs duties after prior co-ordination with Baumüller. Baumüller is exempted from any warranty if the party ordering returns the goods complained about without prior co-ordination or contrary to agreement. Warranty claims expire one month after rejection of a defect on which notice is given, in as far as the purchaser remains silent in this respect.

8. Notification of Defects

- a) The purchaser shall examine the subject matter of the contract and delivery items immediately and give notice of any defects without delay, however, no later than 7 days after receipt of the delivery. In case of non-obvious defects notice has to be given in writing without delay after their discovery, however, no later than 6 months from the point of delivery. In the event that the purchaser does not give notice of any defects in writing within this period of time, then the subject matter of the contract shall be considered as having been approved.
- b) The purchaser shall allow Baumüller a suitable inspection of defects of which notice is given and shall place all necessary/requested technical information, in particular, inspection records and test reports at Baumüller's disposal. In the event that the purchaser fails to do so, then the delivery items shall be considered as not having been complained about and as being approved. In the event that the purchaser alters the delivery items, then he/she shall lose his/her warranty claims.
- c) In the event of an established material defect or performance defect, Baumüller can eliminate the defect or supply a replacement. The purchaser can demand rescission or a reduction after the expiry of an appropriately set period of grace. Further claims on the behalf of the purchaser, in particular to the reimbursement of dismantling costs or installation costs are excluded. The same applies to damages which do not affect the delivery item itself.
- d) Natural wear and tear and damage which arises after the transferral of risk, in particular also due to incorrect or negligent handling, excessive demands or other unsuitable use not in conformity with the contract are excluded from

the warranty. The same applies in particular for defects which are attributable to atmospheric discharges, over-voltages and chemical influences.

- e) If no case of warranty is in existence or in the event that this subsequently turns out to be the case, the purchaser shall remunerate the utilization or the use of an item or of a right, as well as services provided and expenses to an appropriate amount. Baumüller is entitled to a right of control as referred to in §§ 315 ff. BGB [German Civil Code].

9. Liability

Contractual or legal claims on the behalf of the purchaser against Baumüller are limited to intent and gross negligence. This does not apply in as far as claims from the ProdHaftG [Product Liability Act] have been enforced. Baumüller shall only be held liable to the amount of the damage foreseeable in accordance with the purpose of the contract. Material damage which exceeds the value of a delivery/service is not foreseeable in this sense. The liability is limited in terms of amount to the remuneration contractually owed.

10. Payments

- a) Invoices are payable at the time agreed in the contract, at the latest within 30 days after the invoice date, in cash and without deductions. The purchaser can only offset with claims which are final and absolute or undisputed. The same applies to the exercising of rights of retention.
- b) In the event of a delay in payment on the behalf of the purchaser, interest to the rate of 4 % above the respective minimum lending rate of the German Federal Bank, however at least 10 % has to be paid, without separate proof being required.
- c) Failure to comply with the terms of payment or circumstances which endanger the credit worthiness of the purchaser result in all claims immediately becoming due. In these cases, deliveries shall only be made against payment in advance.
- d) Cash payments, bank transfers or cheque and bill payments shall not be considered as payment/fulfilment of the obligation before the amount due for payment has been irrevocably received by Baumüller or credited to Baumüller's account.
- e) Payments have to be made directly to Baumüller. The field staff are not entitled to accept payments or to issue extensions or waivers without separate written authority.

11. Reservation of Ownership

- a) The ownership of delivery items remains reserved up to the fulfilment of all existing claims against the purchaser from the business relation. Any bundling with other items shall be effected by the purchaser for Baumüller. Then, the entire product shall be considered as reserved goods.
- b) The purchaser is entitled to sell the reserved goods in orderly business transactions. All claims to which the purchaser is entitled from this sale or other legal grounds shall be assigned by him/her in advance to Baumüller. Baumüller shall accept the assignment. In the event that the reserved goods are bundled or sold with other items standing in the possession of third parties, then the assignment shall only apply to the amount of the invoice value of the reserved goods. The purchaser is authorised to collect these assigned claims. Upon request, he/she has to make notice of the assignment to the debtor.
- c) The purchaser shall inform Baumüller without delay of impending and enforced access on the behalf of third parties to the reserved goods or to the assigned claims. The purchaser shall bear the costs incurred by this.

- d) The authorization on the behalf of the purchaser to dispose of the reserved goods and to collect assigned claims expires in the event that the terms of payment are not complied with, in particular, also in the case of bill and cheque protests. In this case, Baumüller is entitled to take possession of the reserved goods. The purchaser bears the costs incurred by this. The taking back of goods shall only represent a withdrawal from the contract when this is expressly stated.

- e) In the event that the value of the securities granted exceeds the secured claims in terms of amount by more than 20 %, then Baumüller shall renounce the securities exceeding this value.

12. Drawings and Documentation

Baumüller is entitled to the exclusive property right and copyright to cost estimates, drawings and all other documentation. These documents may not be made accessible to third parties without prior written consent. In the event that a contract is not concluded, not implemented or otherwise ended, then all documents have to be returned immediately and unsolicited. There shall be no right to retention to these documents.

13. Copyright (in particular Software / Licence)

- a) Baumüller is exclusively entitled to all rights to the software/edited versions, in particular property rights and copyrights to the relinquished software, in particular for the controlling of machines, systems and installations.
- b) Baumüller grants the purchaser/buyer the non-exclusive, non-transferable right to use the relinquished software in the framework of the contractual purpose at the contractually intended location/on the places in existence at the time of purchase (single licence). The software shall only be used on the associated purchased contractual item. Any use extending beyond this is prohibited. In the event of a use extending beyond this, Baumüller shall have the rights referred to in Items 13 c), 13 d).
- c) It is prohibited to make copies of the relinquished software, whether in whole or in part, in as far as the making of copies of the machine-readable material in the framework of the required data backup or as copies for internal company use has not separately been agreed upon with prior written consent from Baumüller. Processing of the relinquished software, in particular by means of alteration, translation or by bundling with other programs shall only be permitted after prior written consent from Baumüller. Protection notices from Baumüller on/in the software may not be removed and also have to be adopted onto copies and edited versions. Copies produced contrary to this condition shall come under the possession and copyright of Baumüller. Baumüller can prohibit the use of such copies and elect to demand the immediate surrender or complete destruction with proof of this destruction.
- d) The buyer is not permitted to extend the licence in terms of location/work places/machines/machine types or to grant rights of utilization or grant sub-licences. The extension of the licence shall be permitted by Baumüller exclusively against a separate remuneration which has to be agreed upon in writing.

14. Applicable Law

The law of the Federal Republic of Germany is authoritative for all rights and obligations from and in connection with this contract. The regulations of the UN Sales Convention (CISG) are excluded.

15. Place of Performance and Place of Jurisdiction

The place of performance for delivery and payment is the seat of Baumüller. The place of jurisdiction for all dispu-

tes from and in connection with this contract, in particular also for cheque and bill liabilities is the seat of Baumüller.

16. Miscellaneous

In the event that individual or several conditions of these Conditions of Sale and Delivery should be or become ineffective in part or in whole, then the validity of the remaining conditions shall remain unaffected by this. The parties shall complement/replace the ineffective or incomplete condition with an appropriate regulation which most extensively corresponds to the economic purpose of the contractually desired regulation. The same applies for the case of the presence of a gap in the regulations.

For the case that acceptance and installation are also agreed upon, then the following conditions, Items 17 and 18 shall also apply:

17. Acceptance

- a) The inspection of the delivery items ready for acceptance shall take place in the Baumüller works. The purchaser shall bear the costs of this inspection. In the event that the purchaser fails to perform the inspection, then the delivery items shall be considered as having been delivered in conformity with the contract when they leave the works.
- b) The purchaser is obliged to take delivery of goods and services from Baumüller without delay. Immaterial defects do not entitle the purchaser to refuse the acceptance.
- c) In the event that the purchaser does not declare within 7 days after notification of the readiness for acceptance on the behalf of Baumüller or after receipt of the contractual service in writing and with exact, examinable specification of reasons that he/she refuses the acceptance, then the acceptance shall be considered as having been declared and the orderly performance of the contract as having been ascertained.
- d) The agreed service shall be considered as having been accepted when the item delivered has been put into operation by the purchaser himself/herself or upon his/her instructions by third parties beyond the functional test re-

quired to carry out the acceptance. This also applies in the event that the purchaser refuses the functional test/the acceptance without sufficient cause.

- e) Experts to be designated by both parties shall take part in the acceptance inspection. The result of the functional test shall be entered in a record to be signed by the purchaser in consideration of the technical specifications.

18. Erection and Installation

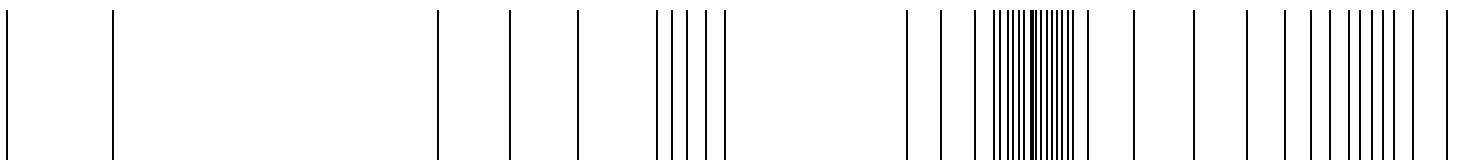
Erection and installation shall only be effected in the case of express agreement at the following further conditions:

- a) The purchaser makes required workers and material available at his/her own expense.
- b) Before the commencement of installation works the purchaser shall make available unsolicited all required specifications, in particular concerning the location of power lines which have been laid such that they are hidden and similar installations, as well as the required static specifications.
- c) Before the commencement of the erection/installation, the delivery items required for the commencement of works have to be on site and all preliminary works progressed to the extent that the erection/installation can immediately begin and be completely carried out without interruption.
- d) In the event that the erection, installation or putting into operation is delayed due to circumstances for which Baumüller is not responsible, then the purchaser shall bear the costs for idle time and journeys required on the behalf of the installation personnel.
- e) The installation personnel working time has to be certified weekly by the purchaser. The purchaser shall present to the installation personnel a written certification regarding the ending of the erection/installation without delay.
- f) Baumüller shall not be held liable for the installation personnel works, in as far as the works are not connected to the delivery and the erection or installation.
- g) Trial runs on systems not supplied by Baumüller shall not be carried out by the installation personnel.

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be in motion



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