



# Operating Manual

## Control Box

## Revision history

Revision	Date	Comment	Chapter
01	04.04.12	New version	All
02	12.08.13	Drives; Field bus; Data	2.4, 3, 6, 9
03	08.01.19	Company name <b>ToolDrives GmbH&amp;Co.KG</b>	All

## Service

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## 1. About this manual

### 1.1 General

- ▶ This operating manual contains necessary information to safely operate the control box.
- ▶ If this manual is supplied with an amendment (e.g. for special applications), then the information in the amendment is valid. Contradictory specifications in this manual thereby become obsolete.
- ▶ The operator must ensure that this operating manual is read through by all persons assigned to install, operate, or maintain the control box, and that they fully comprehend them.
- ▶ This manual should be stored where it can be easily accessed near the control box.

The original of this manual was created in German, all other language versions are Translations of these instructions.

### 1.2 Safety symbols

The following safety symbols are used to draw your attention to dangers, prohibitions and important information:



**Danger!**

**Danger of personal injury** from dangerous electrical voltage.

Indicates an imminent danger that can result in death or serious injuries if appropriate actions are not taken.



**Danger!**

**Danger of personal injury** from a general source of danger. Indicates an imminent danger that can result in death or serious injuries if appropriate actions are not taken.



**Stop!**

**Risk of property damage.**

Indicates a possible danger that could result in property damage if the corresponding actions are not taken.



**Stop!**

**Suspended loads can fall down.**

Indicates a possible danger that could result in human and property damage if the corresponding actions are not taken.



**Hot surface**

**Risk of burns.**

Indicates possible burns when touched with the bare hand.



**Information**

**Important information.**

Instructions for trouble-free function and useful tip for easy handling.

## 2. Safety

### 2.1 General Information

- ▶ This manual, especially the safety instructions and the rules and regulations valid for the operating site, must be observed by all persons working with the control box.
- ▶ In addition to the safety instructions in this manual, also observe any (legal and otherwise) applicable environmental and accident prevention rules and regulations (e.g. personal safety equipment).

### 2.2 EC - Low Voltage Directive

The control box was built in accordance with directive 2006/95 / EC. The electrical installation must be carried out in accordance with the relevant regulations (e.g. cable cross-sections, protection).

**Compliance with the requirements for an entire system is the responsibility of the manufacturer of the complete system.**

The declaration of conformity can be found in the appendix chap. 9.14.

### 2.3 Dangers

The control box has been developed and built in accordance with the current state of the art and recognized safety regulations. It may only be used and operated in a technically perfect condition.



Read the information about the general safety instructions before starting work (see chapter 2.7 "General safety instructions").

Persons may only carry out work on the control box if they have read and understood this operating manual. Work on an opened control box may be carried out only by an electrician trained by **ToolDrives GmbH&Co.KG**.

### 2.4 Intended use

The control box

- ▶ is designed to be used in industrial systems within closed rooms.
- ▶ is suitable for fixed mounting or installation as well as on machines with moveable axes (maximum acceleration: 1 g; refer also to Chapter 5.2 "Mounting the control box" and 9.1 "Technical specifications").
- ▶ suitable for controlling and monitoring permanently energized synchronous motors of the type Basic Line (Bxxxxxx) and Combi Line (Cxxxxxx), referred to as drives in the following.
- ▶ may be operated exclusively within the performance limits (see Chapter 9.1 "Technical specifications").

- ▶ has to be integrated into the emergency stop system of the assembly of machinery by the manufacturer of the assembly of machinery. In case of an emergency shutdown, power failure, and/or damage to the electrical equipment, the control box has to be:
- ▶ Switched voltage-free immediately.
- ▶ Secured against uncontrolled switching back on.
- ▶ Secured against uncontrolled after-running.

## **2.5 Reasonably foreseeable misuse**

- ▶ Any use that exceeds the maximum permissible values in the technical data, see chapter 9.1 "Technical data", is considered improper and is therefore prohibited.
- ▶ The control box must not be operated in potentially explosive areas.
- ▶ For safe operation: the necessary protective devices must be in place, properly installed and fully functional. They may not be removed, changed, bypassed or rendered ineffective.

## **2.6 Warranty and liability**

Warranty and liability claims for personal injury or property damage are excluded if:

- Failure to observe the instructions for transport and storage;
- ▶ improper use (misuse);
- ▶ improper or not performed maintenance or repair work;
- ▶ Opening the control box by unqualified personnel (see Chapter 2.3 "Personnel");
- ▶ improper assembly / disassembly or improper operation;
- ▶ operation of the control box with defective protective devices;
- ▶ operation of a heavily dirt control box;
- ▶ changes or conversions without the written approval of **ToolDrives GmbH & Co.KG** were executed.



## 2.7 General safety instructions



### **Danger!**

**Faulty electrical connections or unauthorized electrical components lead to serious injuries and even death.**

- Only have all electrical connection work carried out by specialist personnel.
- Replace damaged cables or plugs immediately.



### **Danger!**

**Loose or overloaded screw connections can cause serious injuries or even death and / or substantial property damage.**

- Mount and check all screw connections for fastening the control box. Use matching fastening screws and, if necessary, additionally necessary mounting elements (e.g. dowels) with sufficient strength. Fastening screws and mounting elements are not included in the scope of delivery.



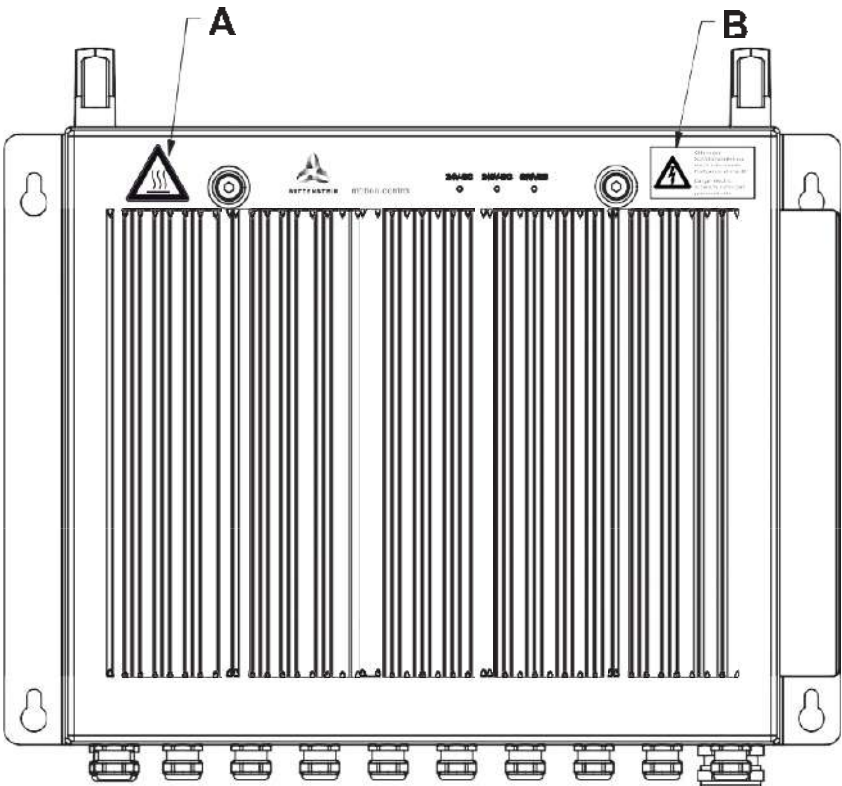


### **Hot surface**

**Hot control box can cause bad burns.**

- Only touch the control box with protective gloves or after a long switch-off time.

## 2.8 Warning and safety signs

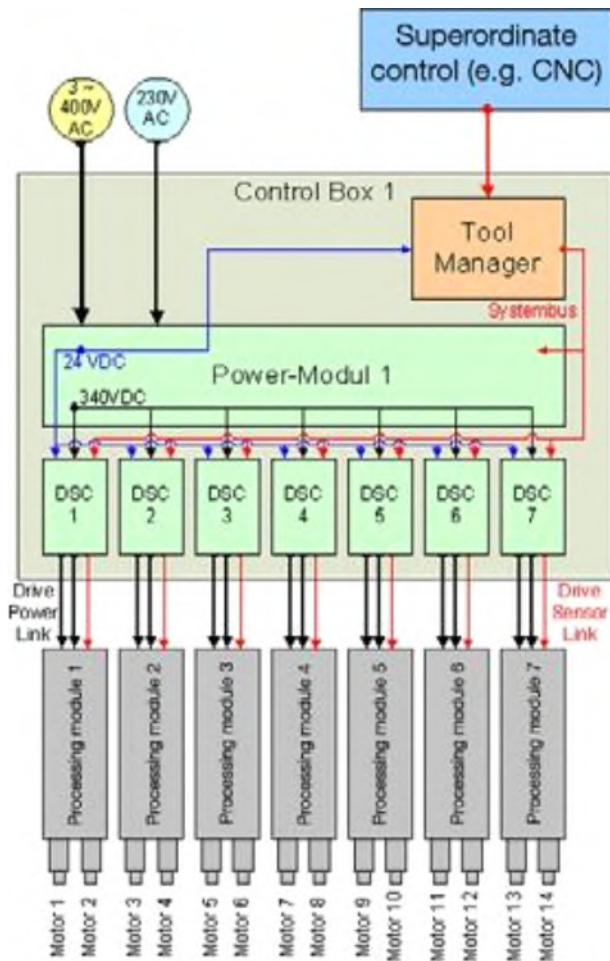
There are warning and safety signs on the control box that warn against hot surfaces and electrical voltage as well as the warning: "Danger electric access to authorized personnel only!" These signs may not be removed. Missing or illegible signs need to be replaced by the operator.

		
	Safety sign	Meaning
A		Warning against hot surface.
B	 <p>Öffnen des Schaltschranks nur durch autorisiertes Fachpersonal erlaubt!            Danger electric access to authorized personnel only!</p>	Warning against electric voltage. Opening the control cabinet is permitted for authorized personnel only.

Tbl- 1: Warning and safety signs on the control box

## Control Box

### 3. Description of the control box



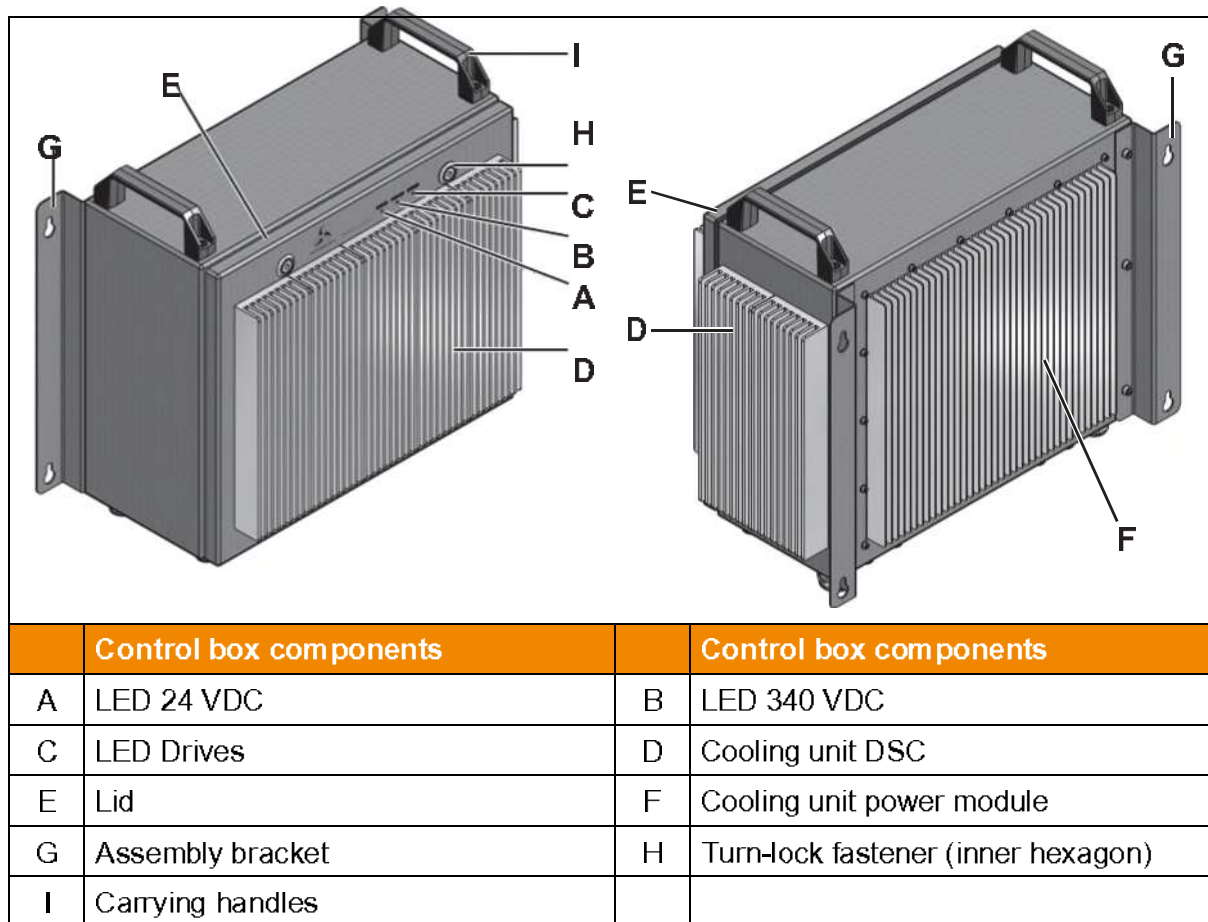
The control box, which is a compact control cabinet unit, combines complex electronic and software components with each other in a small space. Up to 14 drives can be controlled individually by one control box. If more than 14 drives should be employed, the system can be extended by additional control boxes.

The following possibilities are available for controlling the drives (by superordinate controls):

- EtherCAT®
- PROFINET®
- Digital inputs and outputs (digital I/O)

Various configurations are possible for the control box (see Chapter 9.6 "Configuration versions").

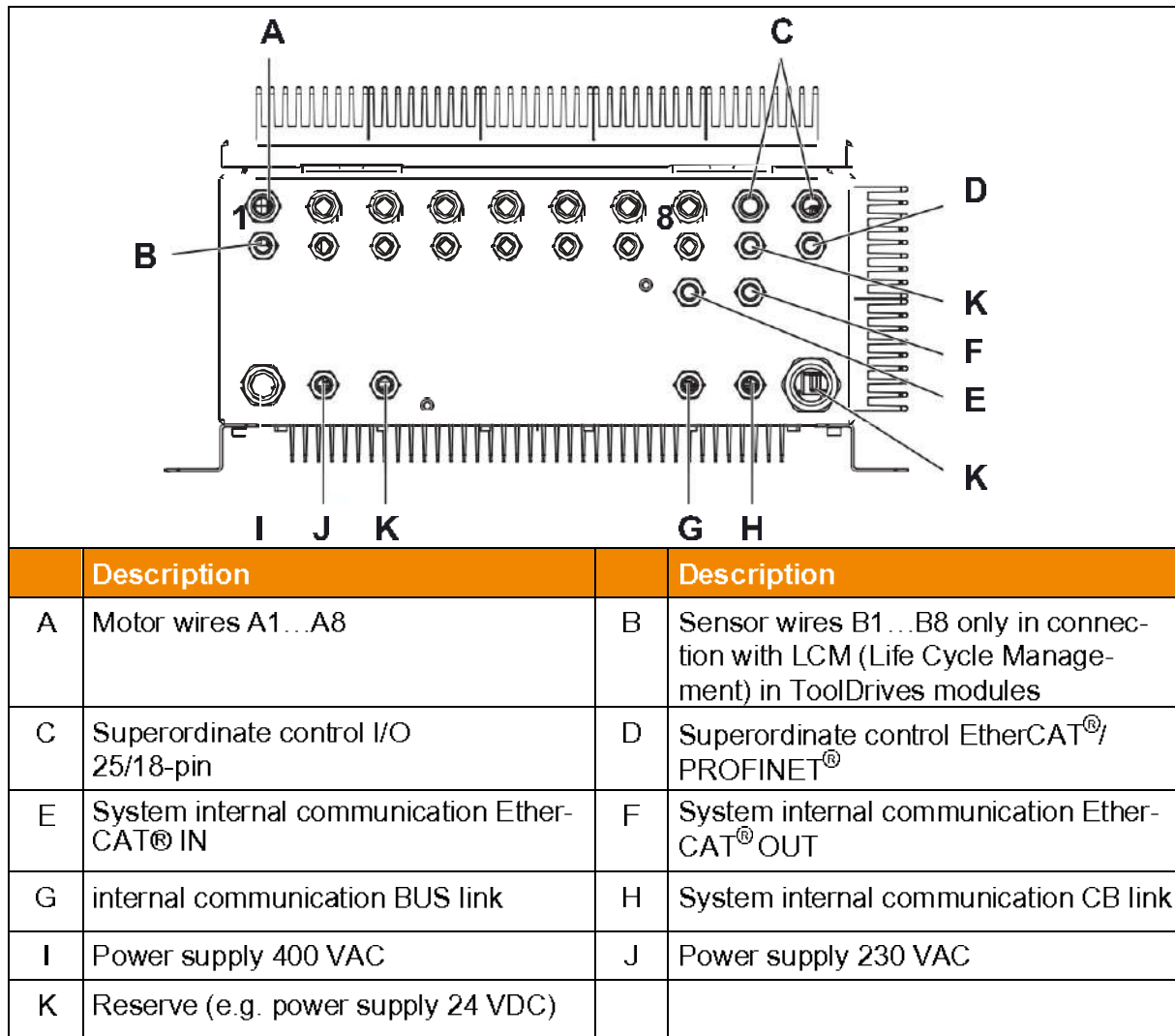
### 3.1 Overview of the control box components



Tbl- 2: Overview of the control box components

## Control Box

### 3.2 Overview of the control box connections



Tbl- 3: Overview of the control box connections

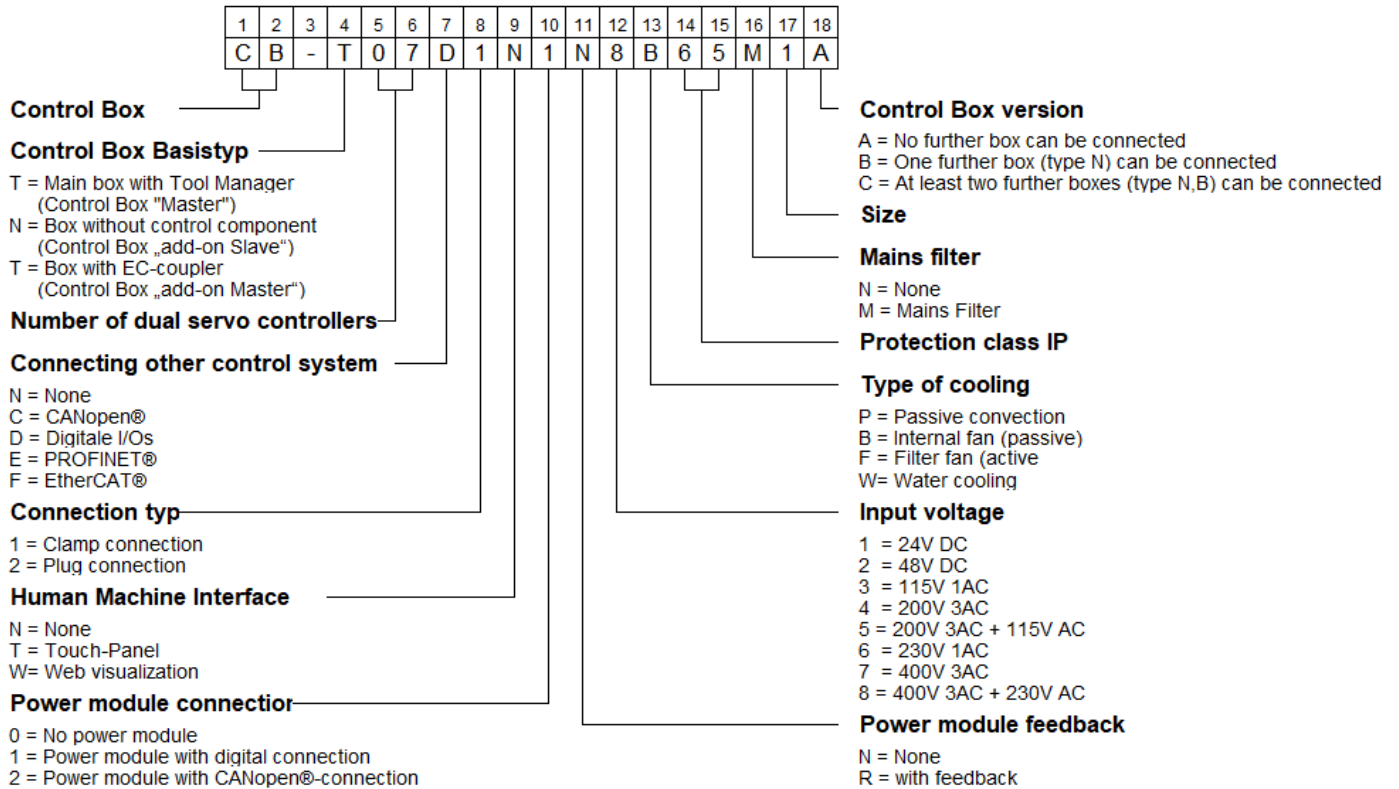
### 3.3 Identification Plate

An identification plate is attached to the control box.

Identification plate		Description	
<div> <p><b>ToolDrives</b> Intelligent services for smart processes D: 59964 Madebach</p> <p>CE</p> <p>A- Type:</p> <p>B- Serial No.: xxxxxxxx AC: 4001xxxx</p> <p>C- Voltage U [V]: 3x400 AC/1x230 AC Current I [A]: 9,1/0,3</p> <p>D- Power P [W]: 6300 Frequency f [Hz]: 50</p> <p>E- Protection class: IP 65</p> <p>F-</p> </div>		A	Type key (see Chapter 3.4 "Type key")
		B	Serial number
		C	Supply voltage
		D	Electric power
		E	Protection class
		F	Manufacturer address
		G	Article code
		H	Current level
		I	Frequency

Tbl- 4: Identification plate

### 3.4 Type code



### 3.5 Scope of delivery

The following are included in the scope of delivery:

- ▶ Control box including supply, motor, and control lines
- ▶ Electrical connection diagram
- ▶ Assembly drawing (mounting dimensions)
- ▶ Operating Manual

## **4. Transport and storage**

### **4.1 Scope of delivery**

Check the completeness of the delivery against the delivery note immediately after delivery. Missing parts or damage must be reported immediately to the carrier, insurance company or **ToolDrives GmbH & Co.KG** in written form.

### **4.2 Packaging**

The control box is delivered packed in cardboard boxes and on a pallet.

Dispose of the packaging materials at the designated disposal points. Observe the applicable national regulations for disposal.

### **4.3 Transport**



**Stop!**

**Suspended loads can fall and can cause serious injuries and even death.**

- Do not stand under suspended loads



**Information**

**Hard knocks, for instance because of falling loads or loads being dropped hard, can damage the control box**

- Transport the control box with the necessary care and avoid hard knocks.

Put the control box down carefully Use suitable hoisting equipment.

In case transporting by hoisting equipment is not possible, then the control box has to be carried by two persons and gripped at the intended porting handles.

Refer to Chapter 9.1 "Technical specifications" for the weight specificationsStorage

### **4.4 Storage**

Store the control box in horizontal position (horizontally on mounting brackets) and dry surroundings at a temperature of 5 °C to +60 °C in the original packaging (see also Chapter 9.1 "Technical specifications"). Store the control box for a maximum of 2 years.

For storage logistics, we recommend the "first in first out" method.



## 5. Assembly

Read the general safety instructions before beginning to work (see Chapter 2.7 "General safety instructions").

### 5.1 Preparations

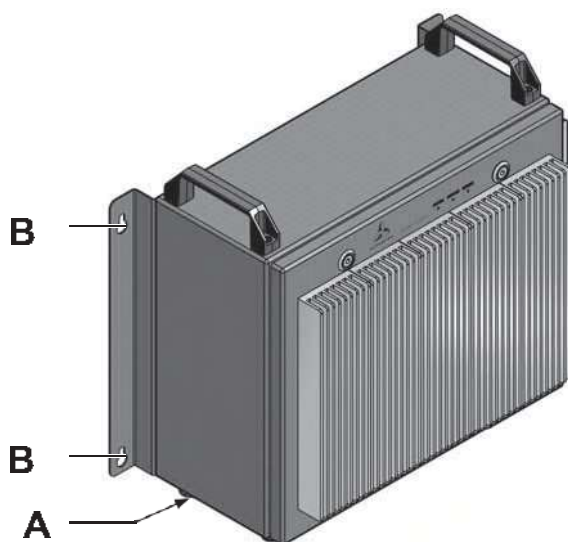


#### Information

**Compressed air can damage the control box's seals**

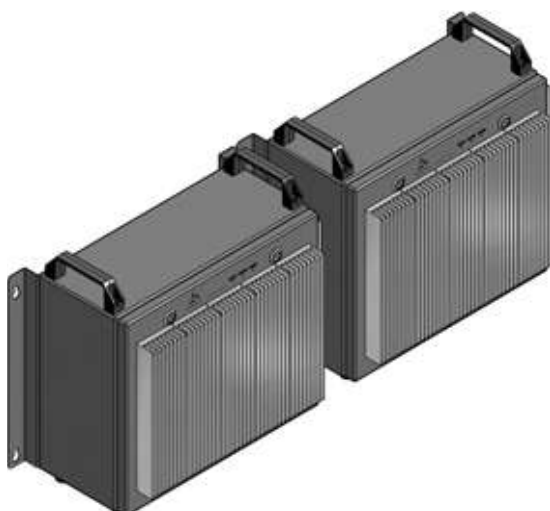
- Do not use compressed air to clean the control box.
- Check the plug connections and cable additionally for damage and impurities

### 5.2 Mounting the control box



- Mount the control box so that the lines (A) for the drives lead away downwards.
- Position the control box at a suitable location that ensures sufficient heat dissipation.
- The housing and the cooling elements of the control box radiate heat. To ensure sufficient convection, a minimum distance of 41 mm must be ensured to the outer contour of the housing.
  - ① Observe the maximum cable lengths (see Chapter 9.1.2 "Cable lengths") during mounting of the control box.
- Fasten the control box with the fastening screws through the through-holes (B).
- 

#### 5.2.1 Mounting additional control boxes



- Mount additional control boxes so that the lines for the drives lead away downwards.
- Position the control box at a suitable location that ensures sufficient heat dissipation.
- Keep a minimum distance of 82 mm when mounting next to each other.
- Keep a minimum distance of 300 mm when mounting under each other.
  - ① Observe the maximum cable lengths (see Chapter 9.1.2 "Cable lengths") during mounting of the control box.



### 5.3 Installing electrical connections



#### **Danger!**

**Electrically live components may result in electric shocks if touched and can cause serious injuries and even death.**

- Observe the five safety rules of electrical engineering before starting electrical installation work:

- 1** Disconnect.
- 2** Ensure that it cannot be switched on again.
- 3** Ensure there is no voltage.
- 4** Ground and short-circuit.
- 5** Cover or close off neighboring, electrified parts.



#### **Danger!**

**Electric operation in moist areas may result in electric shocks and can cause serious injuries and even death.**

- Carry out the electric assembly only in dry areas.



#### **Information**

**The cables of the control boxes need to be laid out in such a way that a minimum bending radius of 10 x outer diameter is observed.**

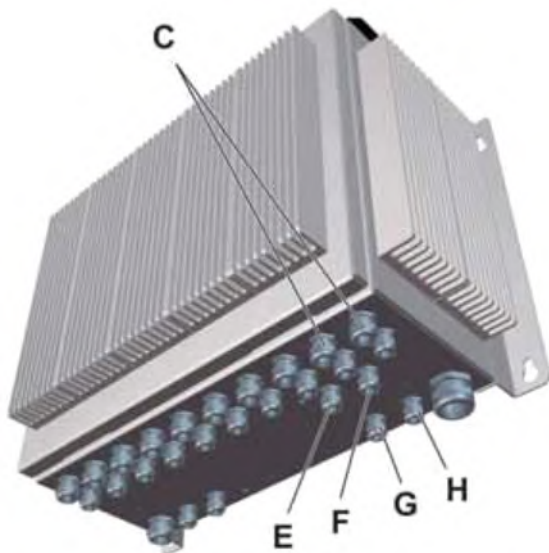
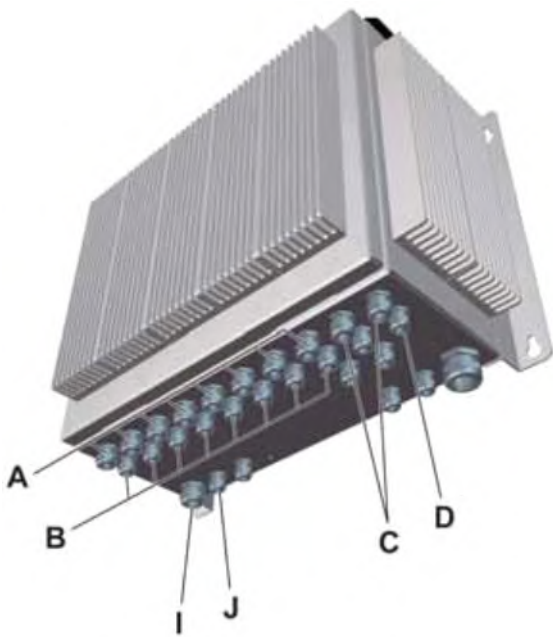
**The cables may be twisted by no more than  $\pm 30^\circ$  over a length of 1 m.**



#### **Information**

**The lines of all control boxes may not be extended.**

- ① Line lengths, refer to Chapter 9.1.2 "Cable lengths", Table "Tbl-9".



- Connect the following connections of the control box with the system:
  - Power supply (I) 3 x 400 VAC/N/PE (switched via emergency stop, see Chapter 2.4 "Intended use").
  - Power supply (J) 230 VAC/N/PE (not switched via emergency stop).
  - Control lines digital (C) or EtherCAT®/PROFINET® Connect (D) to the superordinate control.
  - ⓘ The line allocation can be found in Chapter 9.1.4 "Line allocation (control line, digital I/O)".
  - Connect motor lines (A) to the drives.
- For ToolDrive modules with integrated valve equipment or LCM electronics:
  - Connect sensor lines (B) to the drives.
- Connect the control boxes with each other according to the configuration version:
  - System line CB link (H).
  - System bus BUS link (G).
- For configuration versions with more than 2 control boxes:
  - Connect control boxes with control lines digital I/O (C) or EtherCAT®/PROFINET® (E, F) with each other (see configuration versions in Chapter 9.6 "Configuration versions").
  - ⓘ The line allocation can be found in Chapter 9.1.4 "Line allocation (control line, digital I/O)".

## 6. Startup and operation

- Read the general safety instructions before beginning to work (see Chapter 2.7 "General safety instructions").



### Information

#### **Improper use can cause damage to the control box.**

- The control box may be operated exclusively within the performance limits (see Chapter 9.1 "Technical specifications").
- For other conditions of use, consult our Customer Service department.
- Use the control box only in a clean and dry environment.
- Operate the control box only when it is firmly mounted.
- Check that all plugs are firmly attached.

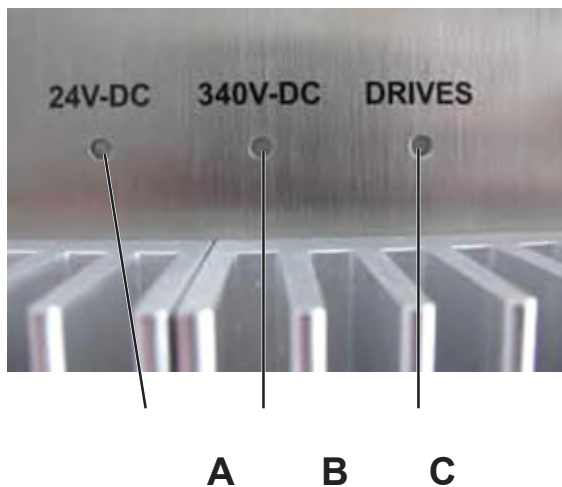


### Information

#### **A speed that is too low can damage the drive and tools.**

- Make sure that the drives [type Basic Line (Bxxxxxx) or Combi Line (Cxxxxxx)] are started before the clamped-in tools cut into the material during forward feed movement.
- Take into account a ramp-up time of the drives of at least 2 seconds when programming the superordinate (CNC) controls.
  - ① Timely starting up of the drives during the movement times saves dwell time before the processing step.

## 6.1 Status LED



The control box is ready for operation when the status LEDs (A - C) light up green.

LED	Display	Function
<b>24 VDC</b>	Off	System off
	Green	Control voltage on
	flashing	Temperature within the control box too high
<b>340 VDC</b>	Off	System off
	Green	Power supply Dual Servo Controller (DSC) on; release for power module given
	Yellow	Power supply Dual Servo Controller (DSC) on; release for power module not given
	Red	Fault in the power module
<b>DRIVES</b>	Off	System off
	Green	All drives without fault
	Red	Fault in at least one drive

Tbl- 5: Status LED, display of the control box's operational states

## 7. Maintenance and disposal

- Read the general safety instructions before beginning to work (see Chapter 2.7 "General safety instructions").



**Gefahr!**

**Improper maintenance work can cause serious injuries as well as damage to the control box.**

- The control box may only be opened by trained electricians.
- Do not clean the control box with compressed air.

### 7.1 Maintenance work

- The control box requires little maintenance, because of its closed design. A regular visual inspection helps prevent damages.

#### 7.1.1 Visual inspection

- Check the control box and all lines for external damage.
- Check whether the identification plate (see Chapter 3.3 "Identification plate") and all safety signs (see Chapter 2.8 "Warning and safety signs") are mounted and legible.

#### 7.1.2 Checking the tightening torques

- Check the tightening torques of the control box's fastening screws (fastening screws are not included in the scope of delivery).

#### 7.1.3 Cleaning

- Clean the outside of the control box using a clean, lint-free cloth. Use a soft brush to clean off the dust and dirt regularly from the cooling units.

### 7.2 Startup after maintenance work

- Clean the outside of the control box.
- Attach all safety devices.

### 7.3 Maintenance schedule

Maintenance work	Before startup	After 500 operating hours or 3 months	Every 3 months	Yearly
Visual inspection	X	X	X	
Checking the tightening torques	X	X		X
Cleaning	X	X	X	

Tbl- 6: Maintenance schedule

## 7.4 Disposal

- Consult our Customer Service department for supplementary information on disassembly and disposal of the control box.



**Gefahr!**



### **Environmental pollution!**

- Replacement parts, operational and auxiliary material have to be disposed of in an environmentally safe manner.
  - Dispose of packaging materials according to regulations.
  - Dispose of the control box at the appropriate disposal stations.
- ① Observe the locally valid regulations for disposals

## 8. Malfunctions



### Information

**A change in operational behavior can indicate existing damage to the control box or result in damage to the control box.**

- Do not put the control box back into operation until the cause of the mal- function has been rectified.

Rectifying of malfunctions may only be done by specially trained technicians.

Fault display	Possible causes of the fault	Troubleshooting
LED 24 VDC flashes green/red	Temperature within the control box too high.	Ensure adequate cooling and heat dissipation.  Check the cooling elements for soiling and clean them if necessary.  Operating parameters (see Chapter 9.1.1 "Control box") must be observed.
LED 340 VDC lights up yellow	Release for power module not given.	Grant release via superordinate control.  Check the control line digital I/O or EtherCAT®-/PROFINET® line.
LED 340 VDC lights up red	Fault in the power module.	Check the 400 V feed line.
LED 340 VDC flashes red	Various (overload etc.).	Attention! Contact Customer Service department.
LED DRIVES lights up red	Fault in at least one drive.	Check the drives and motor lines (wear, fracture, terminals, etc.).

Tbl- 7: Malfunctions

## 9. Appendix

### 9.1 Technical specifications

#### 9.1.1 Control box

Technical specifications of the control box			
Length	mm	562	
Width	mm	290	
Height	mm	493	
Max. weight (without connection line)	kg	35 (depends on the configuration)	
Operational and ambient conditions			
Supply voltage U	V	3 x 400 AC	1 x 230 AC
Nominal current I	A	9,1	0,3
Frequency f	Hz	50	
Output power max. P	W	6300	
Ambient temperature during operation	°C	+5 bis +35	
Ambient temperature during storage	°C	+5 bis +60	
Relative humidity rF	%	< 85, not condensing	
Operating height above sea level	m	≤ 1000	
Operating mode acc. to DIN EN 60034-1 (VDE 0530-1)		S3 - 40%, G 0.5: Simultaneous operation	
Protection class		IP65	
Vibrations (EN 60068-2-6); frequency f	Hz	10 bis 150	
Acceleration	g	1	

Tbl- 8: Technical specifications of the control box

#### 9.1.2 Cable lengths

Cable		Length (depends on the configuration)
Control line (digital I/O)	m	3/5/10/15
EtherCAT®/PROFINET®	m	3/5/10/15
CB-link: Control line CB 1 to CB 2	m	3/5/10
Drive Power Link DPL	m	3/5/10/15
Drive Sensor Link DSL	m	3/5/10/15
BUS-link: System bus CB 1 to CB 2	m	3/5/10

Tbl- 9: Cable lengths



### 9.1.3 Feed lines for control box

Description	Wire number
<b>Feed line 3x1.0 mm<sup>2</sup> Control voltage (no emergency stop) 1 x 230 VAC</b>	
<b>L1</b>	1
<b>N</b>	2
<b>PE</b>	green/yellow
<b>Feed line 5x2.5 mm<sup>2</sup> Load supply (required via emergency stop) 3 x 400 VAC</b>	
<b>L1</b>	1
<b>L2</b>	2
<b>L3</b>	3
<b>N</b>	4
<b>PE</b>	green/yellow

Tbl- 10: Feed lines for control box

### 9.1.4 Line allocation (control line, digital I/O)

Description	Wire color	Abbreviation	Pin
<b>Cable 25-pin</b>			
GND	white	WH	1
RESERVE	brown	BN	2
ON/OFF drive 1	green	GN	3
ON/OFF drive 2	yellow	YE	4
ON/OFF drive 3	gray	GY	5
ON/OFF drive 4	pink	PK	6
ON/OFF drive 5	blue	BL	7
ON/OFF drive 6	red	RD	8
ON/OFF drive 7	black	BK	9
ON/OFF drive 8	violet	VT	10
ON/OFF drive 9	gray-pink	GY-PK	11
ON/OFF drive 10	red-blue	RD-BL	12
ON/OFF drive 11	white-green	WH-GN	13
ON/OFF drive 12	brown-green	BN-GN	14
ON/OFF drive 13	white-yellow	WH-YE	15
ON/OFF drive 14	yellow-brown	YE-BN	16
Release (PM starts voltage regulation for intermediate circuit)	white-gray	WH-GY	17
Fault reset	gray-brown	GY-BN	18
Speed selection BIT 1	white-pink	WH-PK	19

Speed selection BIT 2	pink-brown	PK-BN	20
Speed selection BIT 3	white-blue	WH-BL	21
Speed selection BIT 4	brown-blue	BN-BL	22
READY (PLC program started up, etc.)	white-red	WH-RD	23
Group error	brown-red	BN-RD	24
RESERVE	white-black	WH-BL	25

Tbl- 11: Line allocation, control line 25-pin digital I/O

Description	Wire color	Abbreviation	Pin
<b>Cable 18-pin</b>			
GND	white	WH	1
RESERVE	brown	BN	2
ON/OFF drive 15	green	GN	3
ON/OFF drive 16	yellow	YE	4
ON/OFF drive 17	gray	GY	5
ON/OFF drive 18	pink	PK	6
ON/OFF drive 19	blue	BL	7
ON/OFF drive 20	red	RD	8
ON/OFF drive 21	black	BK	9
ON/OFF drive 22	violet	VT	10
ON/OFF drive 23	gray-pink	GY-PK	11
ON/OFF drive 24	red-blue	RD-BL	12
ON/OFF drive 25	white-green	WH-GN	13
ON/OFF drive 26	brown-green	BN-GN	14
ON/OFF drive 27	white-yellow	WH-YE	15
ON/OFF drive 28	yellow-brown	YE-BN	16
RESERVE	white-gray	WH-GY	17
RESERVE	gray-brown	GY-BN	18

Tbl- 12: Line allocation, control line 18-pin digital I/O

## **9.2 Drive Power Link DPL (motor line)**

- ▶ Drive Power Link DPL (motor line) constructed as: JZ-HF-CY 7x1 mm<sup>2</sup>

### **9.2.1 Setup**

- ▶ Cu wire bare, extra finely stranded according to DIN EN 60228 (VDE 0295) cl. 6 column 4, BS 6360 cl. 6 or IEC 60228 cl. 6
- ▶ Wire insulation, special PVC Z 7225
- ▶ Wire black with white numerals printed on acc. to DIN VDE 0293
- ▶ Earth conductor green-yellow in the outer layer, as of 3 wires
- ▶ Wires stranded in layers, with optimally coordinated lengths of layers
- ▶ Felt winding over each stranding layer
- ▶ PVC interior jacket
- ▶ Screening made of tin-coated Cu wires, wrapping with woven-in synthetic double helix to improve the bending behavior
- ▶ Covering at least 85%
- ▶ Special PVC outer jacket TM2, acc. to DIN VDE 0281 Part 1 or HD 21.1
- ▶ Jacket color gray (RAL 7001)
- ▶ With meter marking

### **9.2.2 Properties**

- ▶ Mostly oil resistant
- ▶ Chemical stability (s. section in Technical specifications)
- ▶ PVC self-extinguishing and flame-retardant acc. to VDE 0482-332-1-2, DIN EN 60332-1-2/ IEC 60332-1
- ▶ The materials used during production are free of silicon and cadmium and free from substances that might impair surface wetting in the coating process
- ▶ Special PVC hose lines, highly flexible, screened
- ▶ In compliance with DIN EN 0281 Part 13

### **9.2.3 Notes**

- ▶ G = with earth conductor GN-YE

### 9.2.4 Technical specifications Drive Power Link

Description	Data
Temperature range	mobile -5 °C to +80 °C, immobile -40 °C to +80 °C
Rated voltage	U0/U 300/500 V
Test voltage	4000 V
Disruptive discharge voltage	min. 8000 V
Insulation resistance	min. 20 MOhm x km
Minimum bending radius	mobile 10 x wire diameter immobile 5 x wire diameter
Radiation resistance	up to 80x106 cJ/kg (up to 80 Mrad)
Weight	about 200 kg/km

Tbl- 13: Technical specifications Drive Power Link

### 9.3 EtherCAT®/PROFINET®

Description	Data
Permitted temperature range	Operation: -40 °C to +70 °C Laying out: -20 °C to +60 °C Transport/Storage: -50 °C to +70 °C
Minimum bending radius	multiple 7.5 x diameter, once 5 x diameter
Weight	about 61 kg/km
Application	Drag chains line, dragging capable for the following requirements: <ul style="list-style-type: none"> <li>- 3 million bending cycles</li> <li>- Bending diameter 200 mm</li> <li>- Movement speed of 4 m/s</li> </ul> Acceleration of 4 m/s <sup>2</sup>

Tbl- 14: EtherCat®/PROFINET®

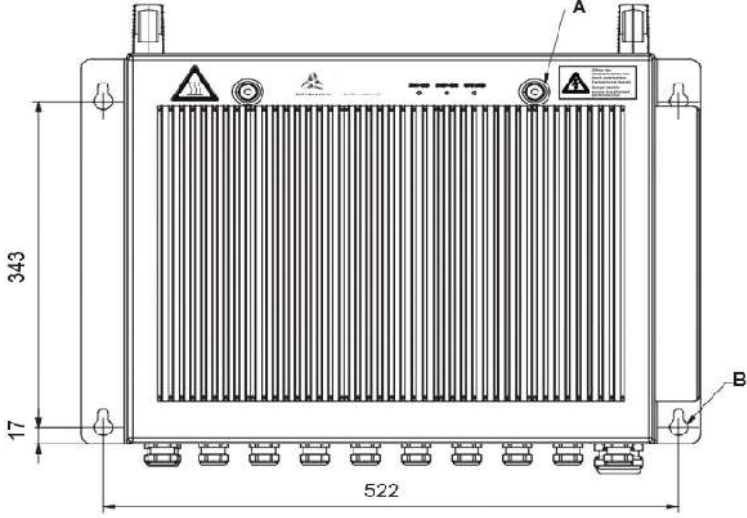
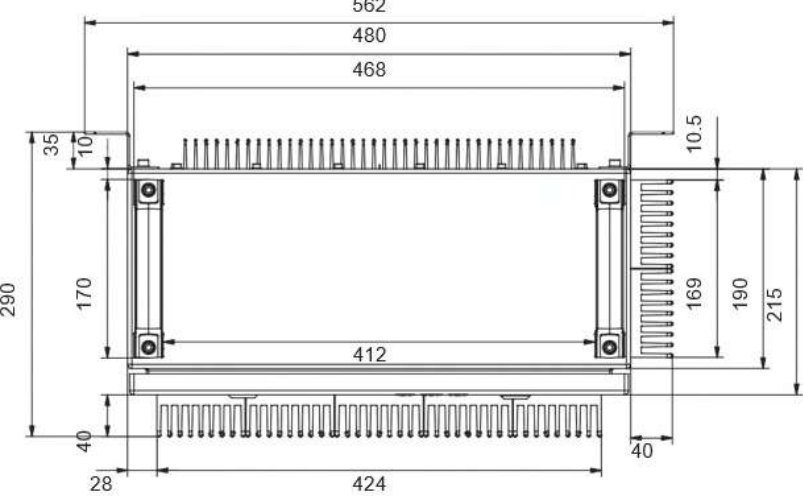
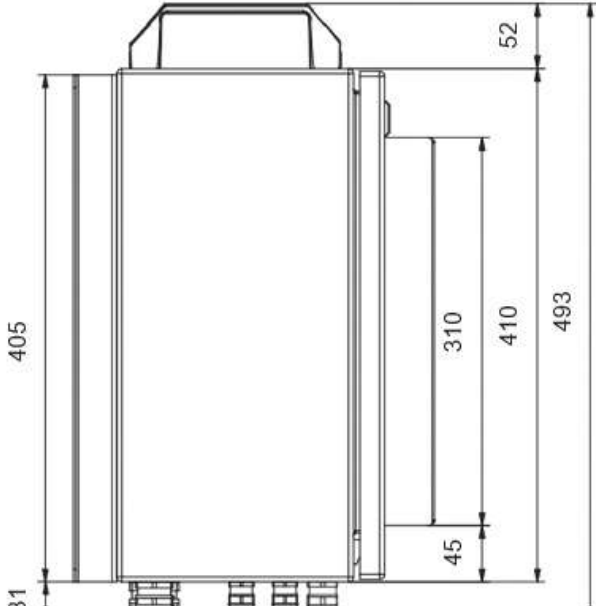
#### 9.4 Feed line for control box

- ▶ Feed line 3x1.0 mm<sup>2</sup> Control voltage (no emergency stop) 1 x 230 VAC (max. 30 m)
  - ÖLFLEX® FD CLASSIC 810 3G1; diameter 7,1 mm
- ▶ d line 5x2.5 mm<sup>2</sup> Load supply (required via emergency stop) 3 x 400 VAC (max. 30 m)
  - ÖLFLEX® FD CLASSIC 810 5G2,5; Diameter 11.8 mm
- ▶ Technical specification (ÖLFLEX® FD CLASSIC 810)
  - Low-adhesion surface
  - Flame-retardant acc. to DIN EN 60332-1-2 (VDE 0482-332-1-2)
  - Can be used in humid or wet rooms
  - Designed for up to 5 million alternating bending cycles in the cable drag chain
  - Outdoors not without UV protection and only taking the temperature range into account

Description	Data
Wire ID code	Black with white numerals acc. to DIN VDE 0293
In compliance with	Wire acc. to VDE 0245/0281 Jacket acc. to VDE 0245/0281
Insulation volume resistivity	> 20 GOhm x cm
Wire structure	Extra finely stranded acc. to VDE 0295, class 6/IEC 60228 Cl.6
Minimum bending radius	For flexible utilization: 7.5 x outer diameter permanently installed: 4 x outer diameter
Rated voltage	U0/U: 300/500 V
Test voltage	4000 V
Earth conductor	G = with earth conductor GN-YE X = without earth conductor
Temperature range	Mobile: 0 °C to +70 °C Immobile: -40 °C to +70 °C

Tbl- 15: Feed line for control box

9.5 Dimensions / Mounting dimensions for control box

Figure (example with 7 DSC)	View
 <p>Frontal view 2 x turn-lock fastener (A) 4 x fastening screw (B)</p>	
 <p>Top view</p>	
 <p>Side view (from left)</p>	








Tbl- 16: Dimensions (mm) control box

## 9.6 Configuration versions

### 9.6.1 Display of the block diagrams

Abbreviation	Description
<b>CB</b>	Control box
<b>CNC</b>	Superordinate control (CNC machine)
<b>PLC</b>	Programmable Logic Controller
<b>DPL</b>	Drive Power Link (motor line)
<b>DSL</b>	Drive Sensor Link (sensor line)

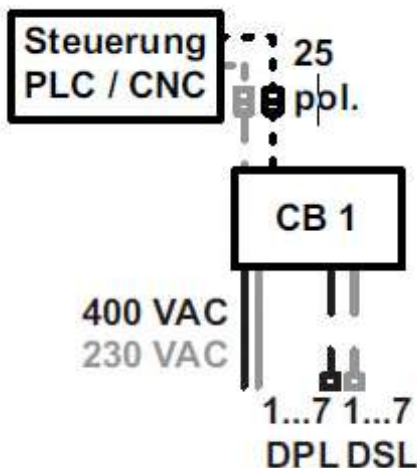
Tbl- 17: Abbreviations for block diagram

Line type	Description
	400 VAC power supply
	230 VAC power supply
	EtherCAT® line ("EC-link")
	Fieldbus (EtherCAT® or PROFINET®) from superordinate control*
	Control line (D I/O) from superordinate control*
	Drive Power Link ("DPL"), connection to the drive
	Drive Sensor Link ("DSL"), connection to the drive
* alternative	
** only with modules with LCM	

Tbl- 18: Line types block diagram

### 9.6.2 Configuration version: Single control box

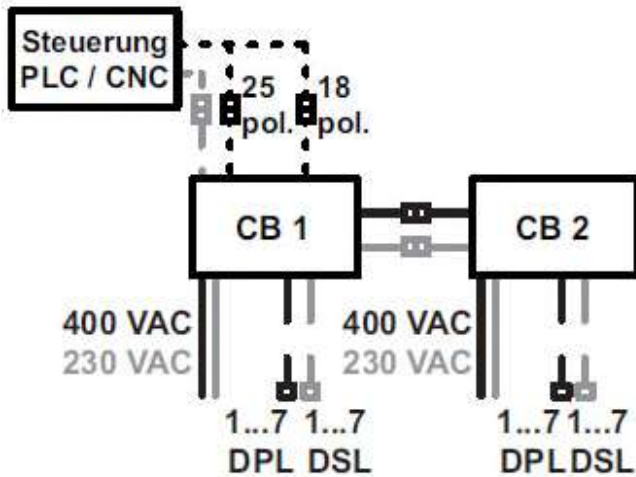
① Description of the abbreviations and line types see Chapter 9.6.1 "Display of the block diagrams".



- **Only when connecting via network line (EtherCAT® or PROFINET®):** Connect Control Box 1 with the network line (plug socket, variable lengths) to the superordinate control. A short network line with plug is on the control box.
- **Only when connecting via digital I/O:** Connect control box 1 with the 25-pin control line (D I/O, plug socket, variable lengths) to the superordinate control. Wire the superordinate control directly (pin assignment, see Chapter 9.1.4 "Line allocation (control line, digital I/O)").

### 9.6.3 Configuration version: Two control boxes

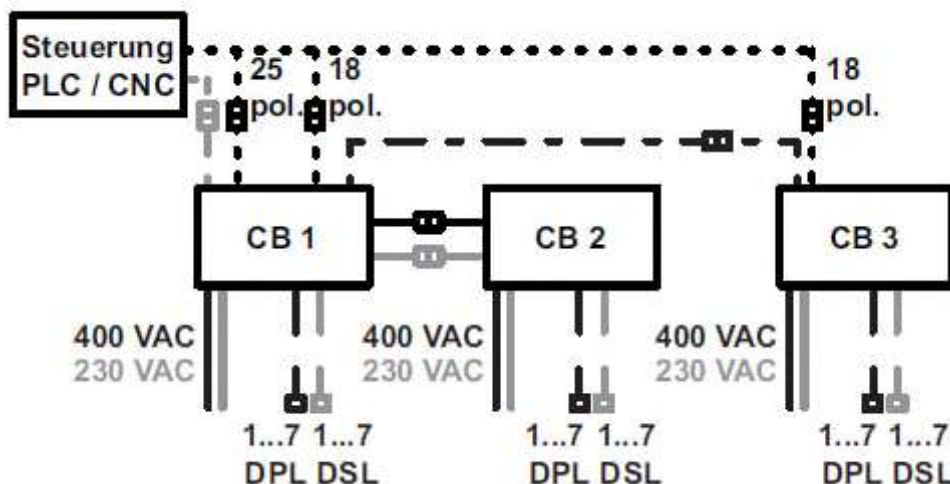
① Description of the abbreviations and line types see Chapter 9.6.1 "Display of the block diagrams".



- **Only when connecting via network line (EtherCAT® or PROFINET®):** Connect Control Box 1 with the network line (plug socket, variable lengths) to the superordinate control. A short network line with plug is on the control box.
- **Only when connecting via digital I/O:** Connect control box 1 with the 25-pin and 18-pin control lines (D I/O, plug socket, variable lengths) to the superordinate control. Wire the superordinate control directly (pin assignment, see Chapter 9.1.4 "Line allocation (control line, digital I/O)").
- Connect the control boxes 1 with 2 using the BUS-link line and the CB-link line (plug socket).

### 9.6.4 Configuration version: Three control boxes

① Description of the abbreviations and line types see Chapter 9.6.1 "Display of the block diagrams".



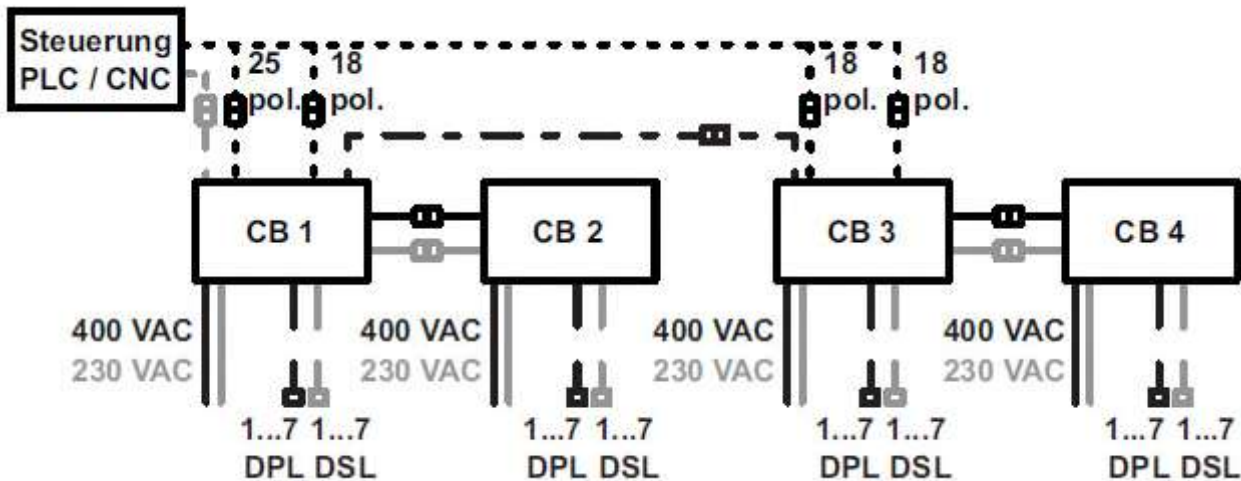
- **Only when connecting via network line (EtherCAT® or PROFINET®):** Connect Control Box 1 with the network line (plug socket, variable lengths) to the superordinate control. A short network line with plug is on the control box.
- **Only when connecting via digital I/O:** Connect control box 1 with the 25-pin and the 18-pin control line (D I/O, plug socket, variable lengths) as well as control box 3 with the 18-pin control line (D I/O, plug socket, variable lengths) to the superordinate control. Wire the superordinate control directly (pin assignment, see Chapter 9.1.4 "Line allocation (control line, digital I/O)").



- Connect the control boxes 1 with 2 using the BUS-link line and the CB-link line (plug socket).
- Connect the control boxes 1 with 3 using the EC-link line (plug/socket).

### 9.6.5 Configuration version: Four control boxes

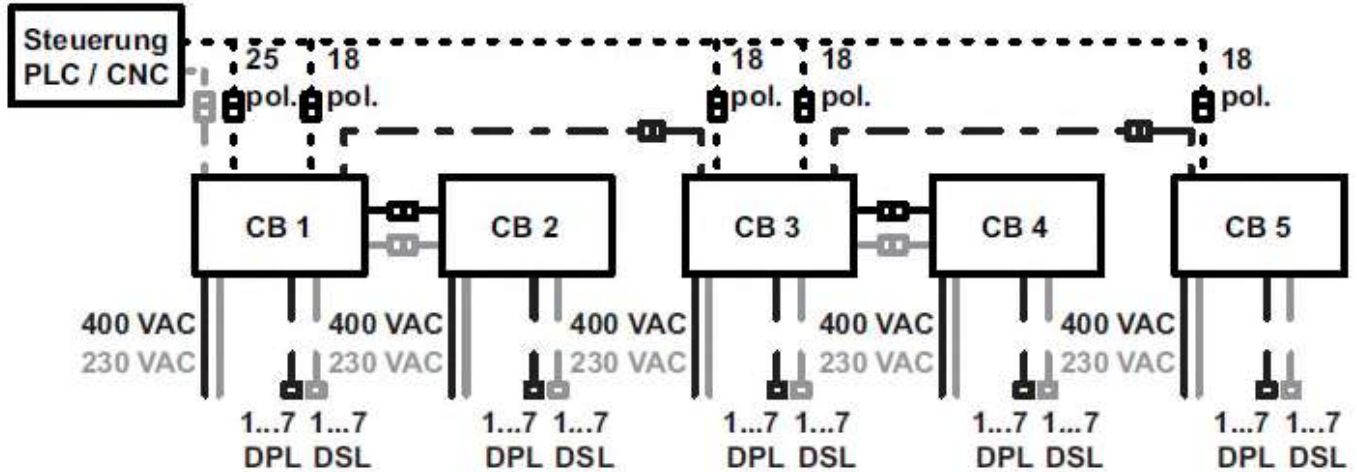
① Description of the abbreviations and line types see Chapter 9.6.1 "Display of the block diagrams".



- **Only when connecting via network line (EtherCAT® or PROFINET®):** Connect Control Box 1 with the network line (plug socket, variable lengths) to the superordinate control. A short network line with plug is on the control box.
- **Only when connecting via digital I/O:** Connect control box 1 with the 25-pin and the 18-pin control line (D I/O, plug socket, variable lengths) as well as control box 3 with two 18-pin control lines (D I/O, plug socket, variable lengths) to the superordinate control. Wire the superordinate control directly (pin assignment, see Chapter 9.1.4 "Line allocation (control line, digital I/O)").
- Connect the control boxes 1 with 2 as well as 3 with 4 using BUS-link lines and CB-link lines (plug socket).
- Connect the control boxes 1 with 3 using the EC-link line (plug/socket).

### 9.6.6 Configuration version: Five control boxes

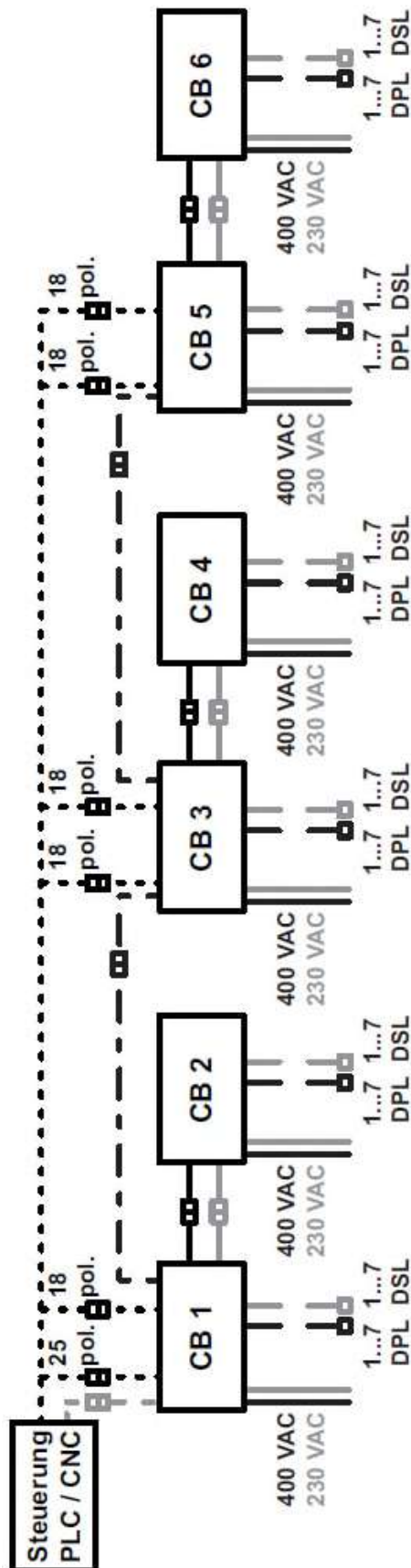
① Description of the abbreviations and line types see Chapter 9.6.1 "Display of the block diagrams".



- **Only when connecting via network line (EtherCAT® or PROFINET®):** Connect Control Box 1 with the network line (plug socket, variable lengths) to the superordinate control. A short network line with plug is on the control box.
- **Only when connecting via digital I/O:** Connect control box 1 with the 25-pin and the 18-pin control line (D I/O, plug socket, variable lengths), control box 3 with two 18-pin control lines (D I/O, plug socket, variable lengths), as well as control box 5 with the 18-pin control line (D I/O, plug socket, variable lengths) to the superordinate control. Wire the superordinate control directly (pin assignment, see Chapter 9.1.4 "Line allocation (control line, digital I/O)").
- Connect the control boxes 1 with 2 as well as 3 with 4 using BUS-link lines and CB-link lines (plug socket).
- Connect the control boxes 1 with 3 as well as 3 with 5 using EC-link lines (plug/socket).

### 9.6.7 Configuration version: Six control boxes

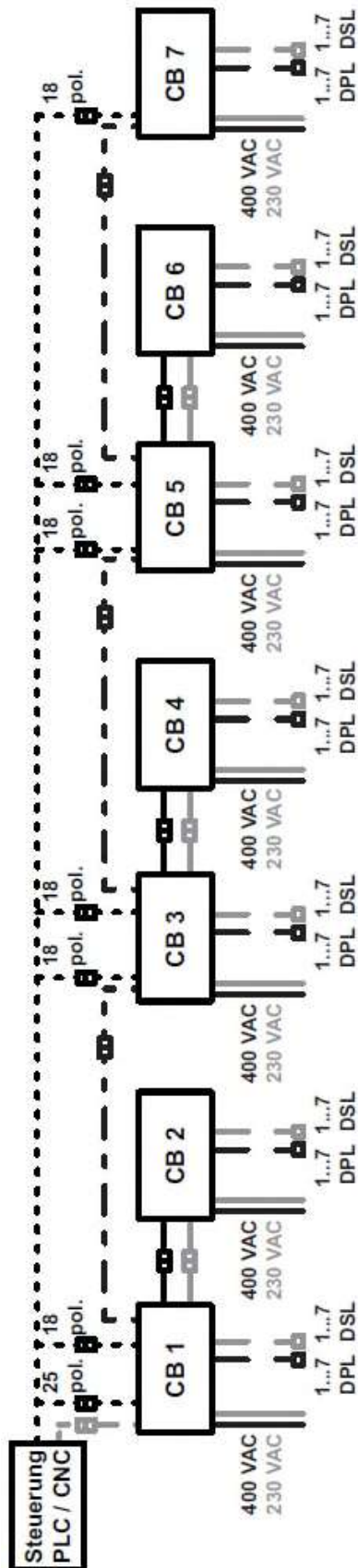
① Description of the abbreviations and line types see Chapter 9.6.1 "Display of the block diagrams".



- **Only when connecting via network line (EtherCAT® or PROFINET®):** Connect Control Box 1 with the network line (plug socket, variable lengths) to the superordinate control. A short network line with plug is on the control box.
- **Only when connecting via digital I/O:** Connect control box 1 with the 25-pin and the 18-pin control line (D I/O, plug socket, variable lengths) as well as control boxes 3 and 5 with two 18-pin control lines (D I/O, plug socket, variable lengths) to the superordinate control. Wire the superordinate control directly (pin assignment, see Chapter 9.1.4 "Line allocation (control line, digital I/O)").
- Connect the control boxes 1 with 2, 3 with 4, as well as 5 with 6 using BUS-link lines and CB-link lines (plug socket).
- Connect the control boxes 1 with 3 as well as 3 with 5 using EC-link lines (plug/socket).

### 9.6.8 Configuration version: Seven control boxes

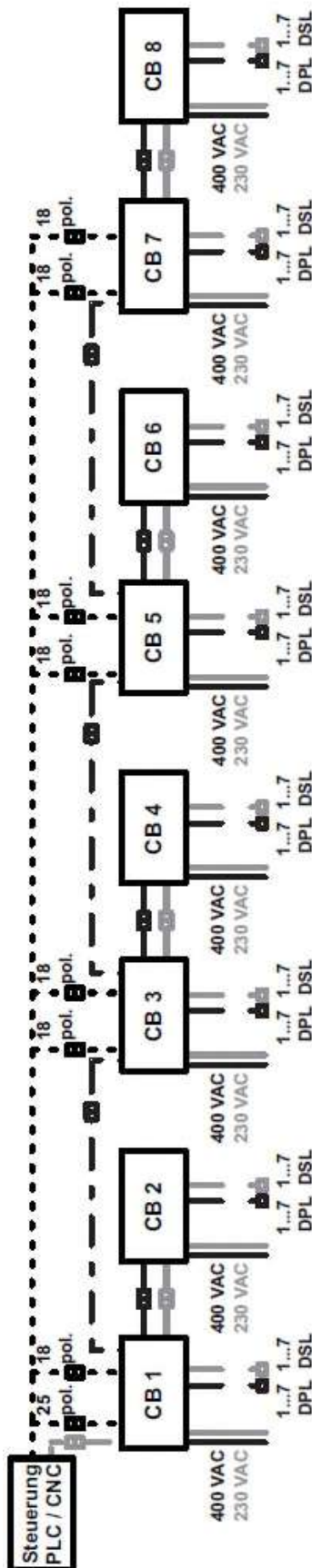
① Description of the abbreviations and line types see Chapter 9.6.1 "Display of the block diagrams".



- **Only when connecting via network line (EtherCAT® or PROFINET®):** Connect Control Box 1 with the network line (plug socket, variable lengths) to the superordinate control. A short network line with plug is on the control box.
- **Only when connecting via digital I/O:** Connect control box 1 with the 25-pin and the 18-pin control line (D I/O, plug socket, variable lengths), control boxes 3, 5, and 7 with two 18-pin control lines (D I/O, plug socket, variable lengths) to the superordinate control. Wire the superordinate control directly (pin assignment, see Chapter 9.1.4 "Line allocation (control line, digital I/O)").
- Connect the control boxes 1 with 2, 3 with 4, as well as 5 with 6 using BUS-link lines and CB-link lines (plug socket).
- Connect the control boxes 1 with 3, 3 with 5, as well as 5 with 7 using EC-link lines (plug/socket).

### 9.6.9 Configuration version: Eight control boxes

① Description of the abbreviations and line types see Chapter 9.6.1 "Display of the block diagrams".



- **Only when connecting via network line (EtherCAT® or PROFINET®):** Connect Control Box 1 with the network line (plug socket, variable lengths) to the superordinate control. A short network line with plug is on the control box.
- **Only when connecting via digital I/O:** Connect control box 1 with the 25-pin and the 18-pin control line (D I/O, plug socket, variable lengths), control boxes 3, 5, and 7 with two 18-pin control lines (D I/O, plug socket, variable lengths) to the superordinate control. Wire the superordinate control directly (pin assignment, see Chapter 9.1.4 "Line allocation (control line, digital I/O)").
- Connect the control boxes 1 with 2, 3 with 4, 5 with 6, as well as 7 with 8 using BUS-link lines and CB-link lines (plug socket).
- Connect the control boxes 1 with 3, 3 with 5, as well as 5 with 7 using EC-link lines (plug/socket).

## 9.7 Digital control system

Via the digital I/O interface, the ToolDrives system can be controlled with binary control signals that conform to the EN 61131 specification.

Description	Data
Rated voltage	24 VDC (-15 %/+20 %)
Signal voltage "0"	-3...+5 V (EN 61131-2, type 1/3)
Signal voltage "1"	+15...+30 V (EN 61131-2, type 3)
Input current	3 mA type. (EN 61131-2, type 3)
Input filter	3.0 ms type.
Potential separation	500 V

Tbl- 19: Specifications of the control signals

### 9.7.1 Overview of the control lines

An individual control line is led out for each control box. The control line for the first control box is 25-pin, the other control lines (for the control boxes 2 up to 8) are assembled 18-pin. The control lines to the even-numbered control boxes (no. 2, 4, 6, 8) are fed out thereby via the respectively preceding control box (no. 1, 3, 5, 7). This results in the following configuration for the complete assembly with eight control boxes.

Control box no.	Control lines
1	25-pin + 18-pin
2	None
3	2 × 18-pin
4	None
5	2 × 18-pin
6	None
7	2 × 18-pin
8	None

Tbl- 20: Overview of the control lines



## 9.7.2 Digital signal inputs

Signal direction: Control ToolDrives system

The ToolDrives system receives the following general control signals via the 25-pin line that is fed out of the first control box.

Signal name	Wire color	Function
Release	white-gray	"0": The intermediate voltage for the DSC is blocked "1": The intermediate voltage for the DSC is released
Error reset	gray- brown	Sequence "0-1-0": All current faults are reset if possible
Speed specification 1	white-pink	Specification of a fixed speed, bit 1
Speed specification 2	pink-brown	Specification of a fixed speed, bit 2
Speed specification 3	white-red	Specification of a fixed speed, bit 3
Speed specification 4	brown-red	Specification of a fixed speed, bit 4

Tbl- 21: Digital signal inputs

The speed of the drives depends on the four signals for the speed specification as well as the tool holder that is used.

All processing modules within a system should be equipped with the same tool holder. In case different tool holders are desired, then this is realizable only after consultation and approval by **ToolDrives GmbH&Co.KG**.

The following table shows the speeds in relation to the signals for the speed specification and the configured speed range. When selecting the speed, the permitted speeds of the tools and the tool holder needs to be taken into account! The speed specification is taken over during standstill and also during operation of the processing modules, e.g. the speed of the drives can be changed during running operation. A speed change during running operation is taken over after a time of about 50 to 75 milliseconds.

Speed specification					Speed in min <sup>-1</sup> depending on the speed range		
Stage	Bit 4	Bit 3	Bit 2	Bit 1	Speed range 3,000 - 9,000 (e.g. Weldon)	Speed range 3,000 - 12,000 (e.g. quick-action chuck Weldon, high-speed Weldon)	Speed range 3,000 - 18,000 (e.g. collet chuck ER 11/16)
1	0	0	0	0	3,000	3,000	3,000
2	0	0	0	1	3,400	3,600	4,000
3	0	0	1	0	3,800	4,200	5,000
4	0	0	1	1	4,200	4,800	6,000
5	0	1	0	0	4,600	5,400	7,000
6	0	1	0	1	5,000	6,000	8,000
7	0	1	1	0	5,400	6,600	9,000
8	0	1	1	1	5,800	7,200	10,000

9	1	0	0	0	6,200	7,800	11,000
10	1	0	0	1	6,600	8,400	12,000
11	1	0	1	0	7,000	9,000	13,000
12	1	0	1	1	7,400	9,600	14,000
13	1	1	0	0	7,800	10,200	15,000
14	1	1	0	1	8,200	10,800	16,000
15	1	1	1	0	8,600	11,400	17,000
16	1	1	1	1	9,000	12,000	18,000

Tbl- 22: Speed specification



To control the drives, the ToolDrives system receives for each control box the following control signals via the 25-pin as well as (for two or more control boxes) 18-pin lines.

Signal name	Wire color	Function
Drive 1	green	"0": Do not extend drive 1 (rotates at idle speed) "1": Extend drive 1 and accelerate to set speed
Drive 2	yellow	"0": Do not extend drive 2 (rotates at idle speed) "1": Extend drive 2 and accelerate to set speed
Drive 3	gray	"0": Do not extend drive 3 (rotates at idle speed) "1": Extend drive 3 and accelerate to set speed
Drive 4	pink	"0": Do not extend drive 4 (rotates at idle speed) "1": Extend drive 4 and accelerate to set speed
Drive 5	blue	"0": Do not extend drive 5 (rotates at idle speed) "1": Extend drive 5 and accelerate to set speed
Drive 6	red	"0": Do not extend drive 6 (rotates at idle speed) "1": Extend drive 6 and accelerate to set speed
Drive 7	black	"0": Do not extend drive 7 (rotates at idle speed) "1": Extend drive 7 and accelerate to set speed
Drive 8	violet	"0": Do not extend drive 8 (rotates at idle speed) "1": Extend drive 8 and accelerate to set speed
Drive 9	gray-pink	"0": Do not extend drive 9 (rotates at idle speed) "1": Extend drive 9 and accelerate to set speed
Drive 10	red-blue	"0": Do not extend drive 10 (rotates at idle speed) "1": Extend drive 10 and accelerate to set speed
Drive 11	white-green	"0": Do not extend drive 11 (rotates at idle speed) "1": Extend drive 11 and accelerate to set speed
Drive 12	brown-green	"0": Do not extend drive 12 (rotates at idle speed) "1": Extend drive 12 and accelerate to set speed
Drive 13	white-yellow	"0": Do not extend drive 13 (rotates at idle speed) "1": Extend drive 13 and accelerate to set speed
Drive 14	yellow-brown	"0": Do not extend drive 14 (rotates at idle speed) "1": Extend drive 14 and accelerate to set speed

Tbl- 23: Control signals



## 9.8.2 System data to be received

Sending direction: ToolDrives system → superordinate control

dwConnectExternalBus\_Global\_OUT

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
bySpeed_Max								bySpeed_Min																						bCommon_Error	bReady

Bit no.	Type	Name	Description
0	Bit	bReady	System ready
1	Bit	bCommon_Error	Group error (DSC and/or control boxes)
2 - 15		Spare	Reserved
16 - 23	U8	bySpeed_Min	Minimum drive speed in $100 \text{ min}^{-1}$
24 - 31	U8	bySpeed_Max	Maximum drive speed in $100 \text{ min}^{-1}$

Tbl- 27: Description system data to be received

The minimum drive speed of the processing modules is generally  $3,000 \text{ min}^{-1}$ , i.e. the value *bySpeedMin* is 30. The maximum drive speed depends on the tool holder and the processing modules:

Tool holder	BVXXX-XX-000: max. speed [ $\text{min}^{-1}$ ]	BVXXX-XX-050: max. speed [ $\text{min}^{-1}$ ]	Value by-Speed_Max
Weldon	9,000	-	90 / -
Quick-action chuck (Weldon)	12,000	-	120 / -
High-speed Weldon	12,000	12,000	120 / 120
Collet chuck ER 11	14,000	-	140 / -
Collet chuck ER 16	-	17.000	- / 170

Tbl- 28: Speed of the processing modules

## 9.9 Data of the control box

### 9.9.1 Data to be sent

Sending direction: Superordinate control ToolDrives system

arrConnectExternalBus\_Controlbox\_IN

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
															bResetError_CB

Bit no.	Type	Name	Description
0	Bit	bResetError_CB	Reset fault of the control box (in particular of the power module).
1 - 15		Spare	Reserved

Tbl- 29: Description control box data to be sent

### 9.9.2 Data to be received

Sending direction: ToolDrives system → superordinate control

arrConnectExternalBus\_Controlbox\_OUT

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
byErrorCode_CB [not defined]														bError_CANMaster	bError_ControlBox

Bit no.	Type	Name	Description
0	Bit	bError_ControlBox	Fault occurred in the control box (power module).
1	Bit	bError_CANMaster	Fault of the CAN Master occurred (only for control boxes no. 1, 3, 5, and 7).
2 - 7		Spare	Reserved
8 - 15	U8	byErrorCode_CB	Error code of the control box.

Tbl- 30: Description control box data to be received

## 9.10 Drive-related data

### 9.10.1 Data to be sent

Sending direction: Superordinate control ToolDrives system

dwINData\_Axis\_1

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
										bBohrenAktiv	bUseldleSpeed	bResetDSC Node	bAxis Out	bAxis ResetError	bAxis Start	iAxis_Speed															

dwINData\_Axis\_2

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
										bBohrenAktiv	bUseldleSpeed	bResetLCM Node	bAxis Out	bAxis ResetError	bAxis Start	iAxis_Speed															

Bit no.	Type	Name	Description
0 - 15	I16	iAxis_Speed	Set speed of the drive in min <sup>-1</sup>
16	Bit	bAxis_Start	1: Starting the drive 0: Stopping the drives (refer to bit 20)
17	Bit	bAxis_ResetError	Reset faults of the drive.
18	Bit	bAxis_Out	0: Do not extend drive axis 1: Extend drive axis (switch digital output) *
19	Bit	bResetDSC_Node	Reset motor control. Bit only in <i>dwINData_Axis_1</i> , valid for both axes. **
19	Bit	bResetLCM_Node	Reset LCM function
20	Bit	bUseldleSpeed	0: Bit16 = 0 switches the drive off 1: Bit16 = 0 brakes the drive to idle speed
21	Bit	bBohrenAktiv	With this bit, the superordinate control informs the ToolDrives system about a running drilling process (drill brake detection).
22 - 31		Spare	Reserved
* Only for processing modules with integrated valve equipment			
** Only with processing modules with LCM			

Tbl- 31: Drive related sending data



20	Bit	bDSC_Node_Error	The CAN bus connection to the motor control is defective. The bit is set only in <i>dwOUTData_Axis_1</i> and is valid for both axes.
21	Bit	bVelocityOK	The axis has reached the range of the set speed.
22	Bit	bBohrerbruchErkannt	After the drilling procedure has been completed (see bit 21 sending data), a drill brake has been detected. *
23	Bit	bKolbenOben	Top piston end position detected. **
24	Bit	bKolbenUnten	Bottom piston end position detected. **
25 - 31		Spare	Reserved
* Only for enabled option "drill brake detection". ** Only with processing modules with LCM and integrated end position detection.			

Tbl- 32: Drive related receiving data

The control words *dwOUTData\_Axis\_1* and *dwOUTData\_Axis\_2* are assigned to a processing module with two independent drives.

In case the set speed *iAxis\_Speed* (see 9.10.1 "Data to be sent") lies outside the permitted speed range, the following fault treatment is valid:

- If the drive is at standstill:

If an impermissible speed value is specified, then the error bit *bSpeed\_Value\_Error* is set promptly. The drive cannot be started now; setting the start bits *bAxis\_Start* will be ignored. If a permissible speed value is specified afterwards in this status, then the drive is started immediately (with a set start bit) and the error bit is removed.

- With running drive:

If the drive is already running with a permissible speed and an impermissible speed value is specified after that, then the drive continues rotating at the current speed. If an impermissible speed value is ignored and the error bit *bSpeed\_Value\_Error* is set. If a valid speed is specified after that, then this new speed is taken over for the drive and the error bit is reset.

**Exception:**

For drives that are marked as "not installed" (*bAxis\_Installed* = 0), the error bit *bSpeed\_Value\_Error* is generally not set.

- If a valid speed is specified again after an impermissible speed, then the error bit *bSpeed\_Value\_Error* is reset immediately. No command for resetting the fault is necessary.

## 9.11 Modes of operation

### 9.11.1 Fault displays

Error code	Fault	Description
<b>Error "Common"</b>		
0x0000	ERROR_RESET	Fault was reset.
0x3210	UDC_HIGH	The intermediate voltage is too high or the limit value is set wrong.
0x3220	UDC_LOW	The intermediate voltage is too low or the limit value is set wrong.
0x5530	EEPROM	Content of the EEPROM is nonconforming, reading failed. → Restart electronics. If the fault continues, save parameter again in EEPROM.
0x7400	LOAD_TIMER	DSP load too high.
0x8100	COMMUNICATION_GENERIC	Communication fault, e.g. heartbeat. Check the configuration (sending and receiving configuration does not correspond to the actual communication. Check CAN cables.
0x8200	PROTOCOL_GENERIC	Protocol fault. Master sends "wrong" telegrams or telegrams are corrupted due to EMC influences.
<b>Error "Axis 1" / Error "Axis 2"</b>		
0x2310	OVERCURRENT	Overcurrent fault ( $I \times t$ )
0x2320	SHORT_CIRCUIT	Short circuit fault
0x2380	CURRENT_OFFSET	Current offset fault
0x2381	CTRL_SATURATION	Regulator limit reached, i.e. possibly no motor connected or maximum speed or load point reached.
0x2382	SUM_OF_CURRENTS	Sum of currents fault
0x4310	OVERTEMP_MOTOR	Over temperature motor model or limit value set wrong.
0x4320	OVERTEMP_PA	Over temperature output stage or limit value set wrong.
0x7180	OVERVELOCITY	Over speed or limit value set wrong.
0x7381	SENSORLESS	Speed deviation is too great during sensorless operation.
0x7382	SENSORLESS_STARTUP	Sensorless startup sequence failed. If this happens several times, the regulators are not parameterized optimally for the application.

Tbl- 33: Error codes DSC



Error code	Fault	Description
0x0001xxxx	Error NMT	DSC not connected / Fault CAN master
0x0002xxxx	Write / Read SDO	DSC not connected or access to non-existing objects or wrong parameters.
0x0004xxxx	Reset CAN master	Fault CAN master / Wrong parameterization
0x0008xxxx	Write all (only File Handling)	Parameter file not found.
0x0010xxxx	ADS Net ID / Device ID	Fault CAN master.
0x0020xxxx	EEPROM Device	Parameters could not be deleted or saved.
0x0040xxxx	EEPROM File Handling	Parameter file not found.

Tbl- 34: Error code manager on the configuration window

xxxx --> ADS Error Code, see Beckhoff Information System

The error codes of the configuration window are OR-linked, i.e. several can be displayed. A current fault should therefore always be acknowledged to generate a new meaningful fault message. If several faults are displayed at the same time, the ADS Error Code cannot be evaluated anymore!

## 9.12 Interfaces

c = Number of control boxes: 1 ... 8

m = Number of processing modules or dual servo controllers: 1 ... 56 n = Number of drives: 1 ... 112

### 9.12.1 Digital control (I/O)

Inputs and outputs as seen from the control box.

Signal	Description
1 x output	System ready
1 x output	Output group error
1 x input	Release of the intermediate voltage for the Dual Servo Controllers
1 x input	Reset all faults
n x input	Rotating and extending, speed specification the same for all spindles
4 x input	Specification of the speed from 16 preprogrammed speeds

Tbl- 35: Inputs and outputs as seen from the control box

### 9.12.2 EtherCAT® Fieldbus

Inputs as seen from the control box (see also Chapter 9.8 "Control via fieldbus (EtherCAT® or PROFINET®)").

The inputs are specified as in Table "Tbl-36" and switched to the fieldbus.

Input signal	Signal length
dwConnectExternalBus_Global_IN	32 bit
arrConnectExternalBus_Controlbox_IN ControlBox 1	16 bit
arrConnectExternalBus_Controlbox_IN ControlBox 2	16 bit
arrConnectExternalBus_Controlbox_IN ControlBox 8	16 bit
dwINData_Axis_1 module 1	32 bit
dwINData_Axis_2 module 1	32 bit
dwINData_Axis_1 module 52	32 bit
dwINData_Axis_2 module 52	32 bit

Tbl- 36: Input signals EtherCAT® Fieldbus

Outputs as seen from the control box (see also Chapter 9.8 "Control via fieldbus (EtherCAT® or PROFINET®)").

The outputs are specified as in Table "Tbl-37" and switched to the fieldbus.

Output signal	Signal length
dwConnectExternalBus_Global_OUT	32 bit
arrConnectExternalBus_Controlbox_OUT ControlBox 1	16 bit
arrConnectExternalBus_Controlbox_OUT ControlBox 2	16 bit
arrConnectExternalBus_Controlbox_OUT ControlBox 8	16 bit
dwOUTData_Axis_1 module 1	32 bit
dwIOUTData_Axis_2 module 1	32 bit
dwOUTData_Axis_1 module 52	32 bit
dwOUTData_Axis_2 module 52	32 bit

Tbl- 37: Output signals EtherCAT® Fieldbus

### 9.12.3 PROFINET® Fieldbus

The station name of the ToolDrives system is "tooldrivesXXX", whereby XXX stands for a number between 1 and 255. The pre-setting for the station name is "tooldrives001".

The inputs and outputs of the ToolDrives system are switched in 32-bit wide signals on the fieldbus.

Inputs as seen from the control box (see also Chapter 9.8 "Control via fieldbus (EtherCAT® or PROFINET®)").

Input signal	
dwConnectExternalBus_Global_IN	
arrConnectExternalBus_Controlbox_IN Box 2	arrConnectExternalBus_Controlbox_IN Box 1
arrConnectExternalBus_Controlbox_IN Box 4	arrConnectExternalBus_Controlbox_IN Box 3
arrConnectExternalBus_Controlbox_IN Box 8	arrConnectExternalBus_Controlbox_IN Box 7
dwINData_Axis_1 module 1	
dwINData_Axis_2 module 1	
dwINData_Axis_1 module 52	
dwINData_Axis_2 module 52	

Tbl- 38: Input signals PROFINET® Fieldbus

Outputs as seen from the control box (see also Chapter 9.8 "Control via fieldbus (EtherCAT® or PROFINET®)").

Output signal	
dwConnectExternalBus_Global_OUT	
arrConnectExternalBus_Controlbox_OUT Box 2	arrConnectExternalBus_Controlbox_OUT Box 1
arrConnectExternalBus_Controlbox_OUT Box 4	arrConnectExternalBus_Controlbox_OUT Box 3
arrConnectExternalBus_Controlbox_OUT Box 8	arrConnectExternalBus_Controlbox_OUT Box 7
dwOUTData_Axis_1 module 1	
dwOUTData_Axis_2 module 1	
dwOUTData_Axis_1 module 52	
dwOUTData_Axis_2 module 52	

Tbl- 39: Output signals PROFINET® Fieldbus

## 9.13 Terms and Abbreviations

ToolDrives system		
Term	Abbreviation	Description
<b>Decentral automation platform</b>		
Control box "Master"	CB-T	
Control box "add-on Master"	CB-B	
Control box "add-on Slave"	CB-N	
<b>Processing modules</b>		
Basic Line Basic Line Bxxxxxx		Module Basic Line BV032-01-000 Module Basic Line BV032-02-000 Module Basic Line BV032-02-050 - with external valves - with integrated valve equipment Module
Combi Line		Module Combi Line Cxxxxxx
<b>Life Cycle Management LCM</b>		
Condition Monitoring	CM	Software in the tool
Life Cycle Management Electronics		Hardware in the processing module
Dual Servo Controller	DSC	Double axis regulator
Tool manager	TM	
Power module	PM	
Drive Sensor Link	DSL	
Drive Power Link	DPL	
EC-link		EtherCAT <sup>®</sup> line (control box 1/3, 3/5, 5/7)
BUS-link		CAN bus (control box 1/2, 3/4, 5/6, 7/8)
CB-link		Control line (control box 1/2, 3/4, 5/6, 7/8)
CNC-link		Integrating "Master" control box to superordinate control
EtherCAT <sup>®</sup> coupler		Component in "add-on Master" control box for connecting to "Master" control box
EtherCAT <sup>®</sup> bridge		Component in "Master" control box as communication interface to the superordinate control
EtherCAT <sup>®</sup> extension		Component in "Master" control box for connecting and additional "add-on Master"
CANopen <sup>®</sup> Master		Component in "Master" and "add-on Master" control box for the internal fieldbus communication

## 9.14 Declaration of conformity

**EG-Konformitätserklärung**

Wir **Wittenstein motion control GmbH**  
**Geschäftsfeld tool drives**

Anschrift **Walter-Wittenstein-Straße 1**  
**D-97999 Igersheim / Germany**  
**Tel: +49(0)7931 - 493-0**  
**Fax: +49(0)7931 - 493-10915**  
**e-mail: info-tooldrives@wittenstein.de**

erklären hiermit in alleiniger Verantwortung, dass das bezeichnete Produkt im Originalzustand

Bezeichnung: **Control Box**

Typ: **CB-T07D1N1N8B65M1A**  
**CB-X ...**

mit den Anforderungen der folgenden gültigen EG-Richtlinie

<b>2006/95/EG</b>	<b>Niederspannungsrichtlinie</b>
<b>2004/108/EG</b>	<b>EMV-Richtlinie</b>
<b>2011/65/EU</b>	<b>Richtlinie zur Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten</b>

übereinstimmt und somit die Anforderungen erfüllt. Die Gültigkeit der EG-Konformitätserklärung erlischt bei Verwendung von Ersatzteilen, die nicht von WITTENSTEIN motion control GmbH Geschäftsfeld tool drives zugelassen sind. Control Boxen der oben genannten Baureihe tragen das CE-Zeichen.

Folgende harmonisierte Normen wurden angewandt:

<b>DIN EN 60664-1</b>	<b>Isulationskoordination für elektrische Betriebsmittel in Niederspannungsanlagen – Teil 1: Grundsätze, Anforderungen und Prüfungen</b>
<b>DIN EN 60529:1991 + A1:2000</b>	<b>Schutzarten durch Gehäuse (IP-Code)</b>
<b>DIN EN 60068-2-6:2008</b>	<b>Umgebungseinflüsse Teil 2-6: Prüfverfahren - Prüfung Fc: Schwingungen (sinusförmig)</b>
<b>DIN EN 60068-2-78:2001 (2002-09)</b>	<b>Umgebungseinflüsse Teil 2-78: Prüfungen; Prüfung Cab: Feuchte Wärme, konstant</b>



motion control

**DIN EN ISO 13732-1:  
2008-12**

**Ergonomie der thermischen Umgebung – Bewertungsverfahren  
für menschliche Reaktionen bei Kontakt mit heißen  
Oberflächen – Teil 1: Heiße Oberflächen**

Igersheim, 27.03.2012

Ort und Datum der Ausstellung

A handwritten signature in blue ink, appearing to read 'Bernd Schimpf', written over a horizontal line.

Dr. Bernd Schimpf  
Geschäftsführer  
WITTENSTEIN motion control GmbH  
Bereich Industrie und tool drives

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