



# TANGO Desktop Operating Manual

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## Table of Contents

Table of Contents .....	2
1. Product Description .....	3
1.1 Field of Application .....	3
1.2 Intended Use .....	3
2. Safety Instructions .....	3
3. Declaration of Conformity .....	5
3.1 Underlying EU Directives.....	5
3.2 Applied Harmonised Standards.....	5
4. Installation and Initial Operation .....	5
5. Operational Controls, Displays, Connections .....	6
6. Connectors, LEDs, Fuses.....	7
6.1 Motor 1-3: D-Sub 25-Pin Socket .....	7
6.2 Motor 4: Option D-Sub 15-Pin Socket.....	7
6.3 HDI: HD D-Sub 15-Pin Socket.....	8
6.4 RS 232: D-Sub 9-Pin Plug .....	8
6.5 AUX I/O: D-Sub 15-Pin Plug .....	8
6.6 USB: 4-Pin Socket Type B .....	9
6.7 LEDs .....	9
6.8 Fuse.....	9
7. Specifications.....	10
8. Accessories .....	11
8.1 Joystick .....	11
8.2 Trackball .....	13
8.3 Option AUX I/O: Start-up Adapter AUX I/O .....	13
8.4 Encoder Interface .....	14
8.5 TANGO Axis 4 .....	16
9. Maintenance and Service .....	17
9.1 Maintenance .....	17
9.2 Service Adress .....	17
10. Disposal .....	17
11. Warranty .....	17

## 1. Product Description

### 1.1 Field of Application

The controller TANGO Desktop, hereafter named "controller", is a device for driving 2/4 phase stepper motors. It can be operated either in the operation mode "automatic operation" by using an external PC or in the mode "manual operation" by means of a joystick, a track ball or with a ERGODRIVE. 2 limit switch inputs are available per axis, meant for limitation of travel range and for calibrating. Optionally, other digital and analog I/O are available, which have partly been equipped with special functions and are placed in the connector list under AUX I/O. Furthermore, an encoder interface is available for connecting various types of incremental encoders.

### 1.2 Intended Use

2-phase stepping motors only may be connected to the controller, along with those feed equipment items which have been approved by Märzhäuser Sensotech GmbH for operation on this controller. In all other cases, the controller may not be put into operation.

## 2. Safety Instructions

This document includes symbols which warn the user, or provide notes on dangers. It is absolutely necessary that they are followed. These are:



#### Caution

This symbol indicates a danger to the user.



#### Caution

Disconnect the controller from the supply voltage if you carry out changes to the system.



#### Caution

Danger of crushing!



#### Caution

This symbol indicates possible damage to devices and parts.

The controller may not be employed for any other purpose, except for those which are described in this document. The operating instructions of connected peripherals, for example a microscope, are to be considered.



Mortal danger from dangerous voltage. Repair works may only be carried out by qualified specialist staff which is familiar with the controller and only with written permission from Märzhäuser Sensotech GmbH. It is forbidden for any other persons to open, in particular, the cabinet.



In case of incorrect connection of the controller to the mains, the operator can be subject to electric shocks and damage can arise for the controller. Ensure that your mains voltage corresponds to the printed indication on the controller. Only insert the power plug into plug sockets which have a proper protective ground terminal. Ensure that the protection effect is not suspended as a result of e.g. extension cables which do not have any protective ground conductor.



The controller is not equipped with safety devices to counter substances which are corrosive, infectious or radioactive, or which represent a danger to health in any other manner. If you deal with such substances, make sure that all legal prerequisites are met, in particular the national accident-prevention specifications.



In case of connection of non-suitable peripherals or accessories, the operator can be subject to electric shocks, and the controller may become damaged. Only use accessories which have been approved by Märzhäuser Sensotech GmbH for connection to the controller. For example, joystick, ERGODRIVE, trackball, motor cables and so forth are available from Märzhäuser Sensotech GmbH. Märzhäuser Sensotech GmbH does not assume any liability for the consequences of the connection of non-approved accessories.



In case of touching the connectors Motor 1-3 and Motor 4 on the controller, and/or in case of touching the connectors of the connected motor cables, there may be a leakage current when the controller is switched on. Therefore only switch on the controller once you have connected all motor cables to the controller and the target systems.



Ensure that the controller, in connection with your application, corresponds to the applicable safety regulations and to legal provisions. This controller is consistent with DIN EN 61010-1:2011-07 "Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements".



Dangerous movement: In case of connected components, such as e.g. a microscope stage at the controller, there is a crushing danger for the hands. Mechanical parts on the microscope can collide. This can cause damage to these parts. Note that, after switching on the controller, the HDI (joystick, trackball, ERGODRIVE) is active. Ensure that dangerous movements do not occur, either in this operating mode or in any other operating mode.



Remark: The controller can also be configured so that HDI devices are inactive after switching on.



In case of malfunctions, defects or safety defects, switch off all participating devices and disconnect them from the mains, for example by pulling out all power plugs. Secure the participating devices against restart. For repairs, please send the controller to our Customer Service Center.



Controller and peripherals may be operated by trained personnel only. They must be instructed in the dangers which can arise with the operation of the controller and peripherals.



Danger through penetrating dirt and liquids! The controller has vent holes for cooling. Ensure that no chip cuttings, liquids or other objects can penetrate here. Protect the controller against dirt and dust as far as possible



As a result of a hindered ventilation, the controller can suffer damage. Therefore vent holes may not be covered over. Place the controller on a solid, flat surface. Maintain a separation distance of at least 3 cm to other subjects on all sides. Do not place any objects on the controller.



No connectors may be inserted or disconnected whilst the controller is switched on.



The operation of the controller and the accessories in a potentially explosive environment is prohibited.



Possible damage to the joystick through inappropriate loading or forceful handling!  
Inappropriate loading or forceful handling of the joystick can lead to inaccuracies and damage to the joystick. Protect the joystick against falling, impacts and forcible deflection! Do not store the joystick with the underside facing up!



Ensure that the constant average power input doesn't exceed 100 W as, otherwise, the controller may become too hot. A power input of up to approx. 250 W can be achieved for a short period of time. This capacity may possibly be achieved when all 4 axes are being operated at the same time with 2.5 A motor current and at a high speed.

### 3. Declaration of Conformity

Herewith we declare that the positioning controller TANGO Desktop is not a ready-for-use or ready-for-connection device as mentioned in the "Germany Equipment Safety Act", the "EMC Directive" or in the "Machinery Directive", but a component.

The finally intended mode of operation can only be achieved by integration into the user's construction. The conformity of the user's construction with existing security regulations and/or statutory regulations lies in the user's area of responsibility.

Regulations and recommendations for installation and designated operation are included in this operating manual.

The initial operation of the controller is prohibited until it has been ascertained, that all legal protection and safety requirements have been complied with.

#### 3.1 Underlying EU Directives

EMC Directive:	2004/108/EC	from 15.12.2004
Low Voltage Directive :	2006/95/EC	from 12.12.2006
RoHS Directive:	2011/65/EU	from 08.06.2011
WEEE Directive:	2002/96/EC	from 27.01.2003

#### 3.2 Applied Harmonised Standards

DIN EN 61326-1:2011-04  
 DIN EN 61010-1:2011-07  
 DIN EN 50419:2006-06

### 4. Installation and Initial Operation

- Before beginning with the installation and initial operation first of all please read chapter 2 "Safety Instructions" completely.
- Place the controller on a level and smooth surface.
- Connect the controller to the motors by using the provided motor cables.
- If necessary, connect the joystick, track ball or ERGODRIVE to the connector HDI.
- Connect the interface of the controller via RS 232 or USB interface with the PC. Use provided RS 232 or USB interface cable here for.
- In case of *AUX I/O* option: Check the correct wiring. The motors are without current if AUX I/O, pin PSE, isn't connected to +12V. A start-up adapter (*see chapter 8.3*) is provided.
- In case of *encoder interface* option: Connect the encoders to appropriate sockets of the controller.
- Check whether the power supply voltage that is listed next to the power supply input connector corresponds to your power supply voltage. When conformity has been ensured connect the controller with your supply network by using the provided power cord.
- **Caution when switching on the controller:** Once the controller has been switched on components will be searched for in the HDI. If the joystick is used then the zero point will now be calibrated. The process is finished when the status LED lights up. Make sure that during this period of time the joystick doesn't get shifted. The result would be that the zero point would also be shifted and axes would move when letting go of the joystick!
- Now switch on the controller.
- If necessary, check that used limit switches (polarity, normally open / normally closed, pull-up/pull-down resistor) correspond with the settings of the controller.

- Once the status LED lights up you can carefully proceed operating joystick, ERGODRIVE or track ball to move axes.
- Now check the connection between computer and controller. This is achieved by setting up the right connection parameters (RS232 standard: 57600 Bauds, 11 bits frame, 1 start bit, 8 data bits, 2 stop bits). In case of the USB interface the Baud rate adjusts itself automatically.
- Send (e. g., via the hyperterminal) the command “ver”. The response you receive in return is the version number of the controller.
- Further commands can be found in the list of commands.

### 5. Operational Controls, Displays, Connections

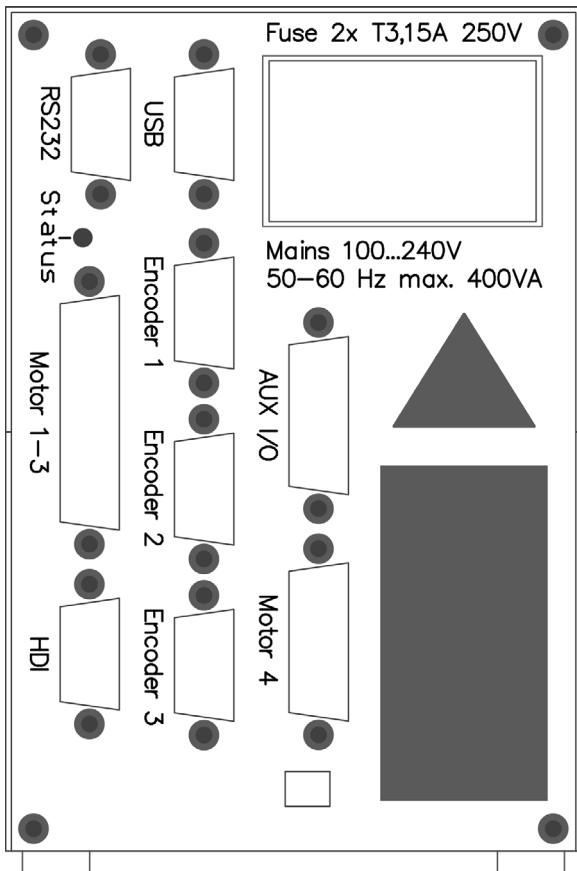


Image 1: Backside

All the controller’s interfaces are situated at the back. The connection’s configuration as well as their technical data is described in the chapter named *Connectors, LEDs, and Fuses*.

The following connections are optional:

- Encoder 1, Encoder 2, Encoder 3:  
Encoder interfaces axis 1...3
- AUX I/O: See connector description
- Motor 4

The Status LEDs on the front panel and at the back have the same function:

- LED off: Controller not ready
- LED on: Controller ready
- LED blinks approx. 1 x/sec.: Boot loader active
- LED blinks approx. 3 x/sec.: Output stages are switched off due to error or PSE
- LED blinks approx. 6 x/sec.: Status not OK, e. g., false command

## 6. Connectors, LEDs, Fuses

### 6.1 Motor 1-3: D-Sub 25-Pin Socket

Pin	Label	Function
1	MOT1PH1+	Motor 1, Phase 1+
2	MOT1PH1-	Motor 1, Phase 1-
3	MOT1PH2+	Motor 1, Phase 2+
4	MOT1PH2-	Motor 1, Phase 2-
5	MOT2PH1+	Motor 2, Phase 1+
6	MOT2PH1-	Motor 2, Phase 1-
7	MOT2PH2+	Motor 2, Phase 2+
8	MOT2PH2-	Motor 2, Phase 2-
9	END10	Limit switch axis 1, zeropoint )*
10	END1END	Limit switch axis 1, endpoint )*
11	ETS A	Electronic Identification Plate A
12	ETS B	Electronic Identification Plate B
13	N.C.	Not connected
14	MOT3PH1+	Motor 3, Phase 1+
15	MOT3PH1-	Motor 3, Phase 1-
16	MOT3PH2+	Motor 3, Phase 2+
17	MOT3PH2-	Motor 3, Phase 2-
18	END20	Limit switch axis 2, zeropoint )*
19	END2END	Limit switch axis 2, endpoint )*
20	END30	Limit switch axis 3, zeropoint )*
21	END3END	Limit switch axis 3, endpoint )*
22	+5VEXT2	+5 V )**
23	N.C.	Not connected
24	GND	GND
25	GND	GND
Casing		GND

)\* TTL-Input, 1 kOhm pull-up/pull-down resistor, software selectable, low-pass filter 1 kOhm, 100 nF

)\*\* +5VEXT2: Max. current is 500 mA.

### 6.2 Motor 4: Option D-Sub 15-Pin Socket

Pin	Label	Function
1,9	MOT4PH1-	Motor 1, Phase 1-
2,10	MOT4PH1+	Motor 1, Phase 1+
3,11	MOT4PH2+	Motor 1, Phase 2 +
4,12	MOT4PH2-	Motor 1, Phase 2 -
5	END4END	Limit switch Axis 4, Endpoint )*
6	END40	Limit switch axis 4, zeropoint )*
7	+5VEXT2	+5 V )**
8	GND	GND
13	N.C.	Not connected
14	N.C.	Not connected
15	N.C.	Not connected
Casing		Shield, GND

)\* TTL-Input, 1 kOhm pull-up/pull-down resistor, software selectable, low-pass filter 1 kOhm, 100 nF

)\*\* +5VEXT2: Max. current is 500 mA.

### 6.3 HDI: HD D-Sub 15-Pin Socket

HDI = Human Device Interface (Joystick, Trackball, ERGODRIVE)

Pin	Label	Description*)	Function Joystick	Function Trackball	Function ERGODRIVE
1	IN1A	AN, FI 1 kOhm, 10 nF	Axis 1	/	Axis 1, A+
2	IN2A	AN, FI 1 kOhm, 10 nF	Axis 2	/	Axis 1, B+
3	IN3A	AN, FI 1 kOhm, 10 nF	Axis 3	/	Axis 2, A+
4	IN4A	AN, FI 1 kOhm, 10 nF	Axis 4 / Key F1	Middle Key: Resolution up	Axis 2, B+
5	SPEED	AN, FI 1 kOhm, 100 nF	Key F3	Left Key: Resolution down	Keys
6	IN1B	AN, FI 1 kOhm, 10 nF	/	Axis 1, Quadrature 1	Axis 1, A-
7	IN2B	AN, FI 1 kOhm, 10 nF	/	Axis 1, Quadrature 2	Axis 1, B-
8	IN3B	AN, FI 1 kOhm, 10 nF	/	Axis 2, Quadrature 1	Axis 2, A-
9	IN4B	AN, FI 1 kOhm, 10 nF	/	Axis 2, Quadrature 2	Axis 2, B-
10	HDI_ID	AN, PU, FI 1 kOhm, 100 nF	Autom. Identification	Autom. Identification	Autom. Identification
11	SNAP_SHOT1	TTL, PU, FI 1 kOhm, 10 nF, HDI_TXD	Key F2	Snap-Shot	Axis 3, A (TTL)
12	AX_SEL	TTL, PU, FI 1 kOhm, 10 nF, HDI_RXD	Key F4	Right Key	Axis 3, B (TTL)
13	HDI_ON	5V-CMOS OUT, RI = 1 kOhm	LED Device active	/	Digital VCC
14	+5VEXT1	5 V, max. 50 mA	+5 Vref	+5 V	+5 V (analog VCC)
15	GND	GND	AGND	GND	GND
Casing		GND	Shield (GND)	Shield (GND)	Shield (GND)

\*) AN = analog input 0...5 V, TTL = TTL-Input, PU = pull-up resistor 4.7 kOhm → +5 V, FI = low-pass filter

### 6.4 RS 232: D-Sub 9-Pin Plug

Pin	Label
1	/
2	RXD
3	TXD
4	/
5	GND
6	/
7	RTS
8	CTS
9	Not connected / Option: +5VEXT2 )*

\*) Option: Pin 9 (RI) internally connectable to +5VEXT2. Max. load of +5VEXT2 is 500 mA.

### 6.5 AUX I/O: D-Sub 15-Pin Plug

Pin	Label	Description ) <sup>1</sup>	Function
1	TAKT_IN	TTL, PU, FI 1 kOhm, 1 nF	Pulse input for pulse/direction mode of one axis
2	V/R_IN	TTL, PU, FI 1 kOhm, 1 nF ) <sup>3</sup>	Direction input for pulse/direction mode of one axis
3	STOP-	TTL, PU, FI 1 kOhm, 10 nF ) <sup>3</sup>	TTL low = All axes stop
4	SNAP_SHOT2-	TTL, PU, FI 1 kOhm, 10 nF ) <sup>3</sup>	Trigger input for saving the current position.
5	TAKT_OUT	HCMOS - Output 5V ) <sup>3</sup>	Pulse output for pulse/direction mode of one external axis.
6	V/R_OUT	HCMOS - Output 5V ) <sup>3</sup>	Direction output for pulse/direction mode of one external axis.
7	SHUTTER_OUT	HCMOS - Output 5V ) <sup>3</sup>	For driving an external shutter controller.
8	TRIGGER_OUT	HCMOS - Output 5V ) <sup>3</sup>	Position synchronized trigger output
9	ANIN0	AN, FI 1 kOhm, 100 nF	0...5 V analog input
10	ANOUT0	Analog Out	Ua = 0...10 V, RI = 100 Ohm
11	ANOUT1	Analog Out	Ua = 0...10 V, RI = 100 Ohm
12	PSE	Power Stage Enable	When connected to +12 V: Power stages are enabled. When open or connected to GND: Power stages are off. ) <sup>2</sup>
13	+12V	+12 V	I <sub>max.</sub> = 500 mA + 200 mA for Pin 12 (PSE)
14	+5VEXT2	5 V )**	+5VEXT2: Max. current is 500 mA.
15	GND	GND	
Casing		GND	Shield

)<sup>1</sup> AN = analog input 0...5 V, TTL = TTL-input, PU = pull-up resistor 4.7 kOhm → +5 V, FI = low-pass filter



<sup>2</sup> Short-term power rating: 12 V V/3.5 A (< 30  $\mu$ s), after 60  $\mu$ s fading away to max. 200 mA

<sup>3</sup> Other functions on request; for application software the inputs can be read and the outputs written.

HCMOS output level 5 V: U<sub>out</sub> > 3.7 V @ I<sub>out</sub> = -6 mA; low level: U<sub>out</sub> < 0.4 V @ I<sub>out</sub> = 6 mA

## 6.6 USB: 4-Pin Socket Type B

Pin	Label
1	VCC) <sup>1</sup>
2	USBDM
3	USBDP
4	GND
Casing	Shield

<sup>1</sup> Only 100 nF  $\rightarrow$  GND. Current consumption = 0 mA.

## 6.7 LEDs

The controller has one green status LED on the front panel and one at the back. The functions of both LEDs are identical.

- a) LED off: Controller not ready
- b) LED on: Controller ready
- c) LED blinks approx. 1 x/sec.: Boot loader active
- d) LED blinks approx. 3 x/sec.: Output stages are switched off
- e) LED blinks approx. 6 x/sec.: Status not OK, e. g., false command

Ref. c): A software update can be loaded by using the boot loader in the controller. During this period of time the controller must remain switched on!

Ref. d): The output stages may be switched off for one of the following reasons:

- The over current shut down of the output stage has responded (= error).
- An operating voltage is beyond its specification (= error).
- With the PSE input in connector AUX I/O the output stages have been deactivated.
- The ambient temperature is too high.

## 6.8 Fuse

2 fuses are accessible. They are situated in the device-connector combined element at the back of the controller. Only install fuses, which have the same value and the same tripping characteristic as listed at the back of the controller. The dimensions of the fuses are 5 x 20 mm.

## 7. Specifications

Performance Motor Controller	
Number of Axes	Up to 4
Type of Motor	Stepper motor 2/4 phases, e. g. 100, 200 or 400 full steps/revolution
Microstep Resolution	819,200 steps/revolution (@ motor with 200 steps/revolution)
Power Stage	Automatic adaptation to a wide range of stepper motors
Max. Phase Current	1,25/2,5/3,75 A, depends on order
Motor Current	0.03 A up to max. phase current, selectable per software
Current Reduction after Movement	0...100 % of selected motor current
Current Reduction Delay	Selectable from 0...65,000 ms
Motor Voltage	48 V AC effective max.; 48 V DC max.
Mode of Movement	Simultaneous vector drive of 1 to 4 axes or/and single axis movement is possible; even at the same time
Max. Amount of Vectors/s with PC	250 vectors per second (depends on used PC and software)
Speed Range	0.000001...70 revolutions/s
Acceleration/Deceleration	0.0001...20 m/s <sup>2</sup> programmable with one parameter per axis
Position Range	Max. +/-2,6 m
Command Set	LSTEP or Venus-1 (others on request)

Processing System	
Processor	ADSP BF536: 32 bit, 400 MIPS DSP
Processor Clock Speed	396 MHz
Processor MMACS	Up to 792 MMACS
Flash Memory	8 Mbit for programme storage
EEPROM	256 kBit for configuration data
SDRAM	16 Mbyte for extended system processing
Fast DSP RAM	100 kByte for fast data / instruction processing
Reset	Via hardware or software command

Safety Functions	
Voltage Monitor Logic	Supervises 3.3 V and 5 V supply, takes reset on low voltage
Voltage Monitor Power Stage	Switches power stage off in case of PSE (+12 V, AUX I/O connector) or motor voltage (readable via software) are out of range
Short Circuit Protection Motor	Phase to phase and phase to ground, power stage switches off within typical 1 µs, resetable via software
Overcurrent Protection for External Devices	Protection for +12V, +5Vext1 and +5Vext2 is self resetting after removing overload
Hardware Limit Switch Input	2 per axis, TTL-level, NO or NC, switching either to 0 V or +5 V, software selectable pull-up or pull-down resistors for each input
Software Limits for Movement	User-definable within range of +/-2,6 m
Software Stop	Stops the movement
Power Stage Enable <sup>1)</sup>	When connected to +12V: Power stages are enabled. When open or connected to GND: Power stages are off.
Stop Input <sup>1)</sup>	Stops the movement of all axes

<sup>1)</sup>= Only with option AUX I/O

Communication Interface	
RS232	To connect the controller with the PC. Standard baud rate: 57.6 kBaud Max. baud rate: 115.2 kBaud
USB	To connect the controller with the PC. USB 2.0 compatible.

I/O: Human Device Interface	
Human Device Interface (HDI)	For connecting joystick, ERGODRIVE or trackball, all with automatic device identification (Plug & Play)

I/O: Special Functions (only with option AUX I/O)	
Takt, V/R Out	Pulse and direction signal for driving e. g. an external axis controller
Takt, V/R In	Pulse and direction signal from e. g. an external auto focus unit for driving e. g. the Z-axis
Trigger Out	Position synchronized trigger output for e. g. video camera
Shutter Out	Signal for driving e.g. a shutter unit
Snapshot	Position capture: Stores the actual position value. Value can be read afterwards.
Stop	Stops the movement.
PSE	Power Stage Enable. When connected to +12V: Power stages are enabled. When open or connected to GND: Power stages are off.
Analog Out	2 independent outputs 0...10 V. E. g. for controlling microscope illumination. Resolution: 14 bit, precision analog to the +5 V supply (reference).
Analog In	Input 0...5 V, e. g. for temperature measurement
TTL In	Up to 3 TTL user readable inputs
TTL Out	Up to 3 TTL user writeable outputs

Optional Modules	
Encoder Interface	Up to 3 encoders: 1Vpp, MR/analog 5Vpp, TTL (RS-422), depends on order. Analog resolution is 14 bit. TTL (RS-422) up to 30 MHz.

Power Requirements (without additional cards)	
Voltage	100...240 V AC
Frequency	50...60 Hz
Power	Max. 400 VA
Inrush Current	Max. 30 A

Environment	
Form factor	L x W x H = 238 x 103,5 x 160 mm (without connectors)
Operating temperature	+5...40 °C ambient, protect against direct sun exposure
Cooling	Normal convection (refer to Safety Regulations)
Humidity	RH = 85 % max., non condensing
Weight without cables	Approx. 2.5 kg
Installation altitude	Max. 2000 m
Protection class	IP20

## 8. Accessories

### 8.1 Joystick

**Product description:**

The joystick of Märzhäuser Sensotech GmbH, in combination with the controller, serves for the manual moving of motorized microscope and measuring stages. According to purchase order, one of the following 4 design implementations is included in the scope of delivery of the control:



Image 2: 2-Axes Joystick  
Art.-No.: 00-76-200-0820



Image 3: 3-Axes Joystick  
Art.-No.: 00-76-300-0820



Image 4: 3-Axes Joystick with Multi-Function Wheel  
Art.-No.: 00-76-300-0821



Image 5: 4-Axes Joystick with Multi-Function Wheel  
Art.-No.: 00-76-400-0820

**Operating elements and LED:**

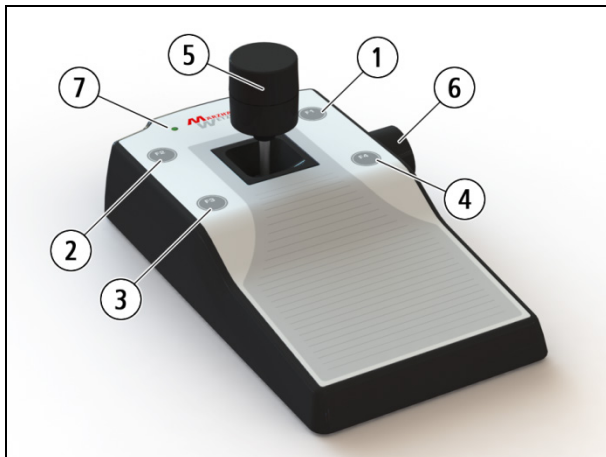


Image 6: Operating elements and LED (display shows 4-Axis Joystick with Multi-Function Wheel)

- 1 F1-key
- 2 F2-key
- 3 F3-key
- 4 F4-key
- 5 Joystick with rotary potentiometer  
*(rotary potentiometer available only with 3-Axis Joystick and 4-Axis Joystick with Multi-Function Wheel)*
- 6 Multi-function wheel  
*(available only with 3-Axis Joystick with Multi-Function Wheel and 4-Axis Joystick with Multi-Function Wheel)*
- 7 Status-LED

The deflection of the joystick and the rotary potentiometer is proportional to speed (e.g. small deflection – low speed, large deflection - high speed).

The rotation of the multi-function wheel is path synchronic (e.g. one rotation of the multi-function wheel – 1 mm change in the position of the scanning stage).

**Scope of functions:**

When delivered, the controls of the joystick are configured as follows:

Operating element	Assigned function/axis
F1-/F2-/F3-/F4-key	No allocation
Joystick	X-axis (axis 1) / Y-axis (axis 2)
Rotary potentiometer	Z-axis (axis 3)
Multi-function wheel	Z-axis (axis 3)

**Configurabilities:**

The joystick can be configured to be multi-purpose with the aid of SwitchBoard, or by means of a corresponding programming of the controller. The states of joystick, rotary potentiometer, multi-function wheel and function keys can be scanned over the software interface, or evaluated by the controller.

Configuration options for the joystick (excerpt):

- Free and precise programming of the maximum travel speeds per axis (mm/s)
- Allocation of different speed characteristics per axis
- Inversion of the travel direction for joysticks, rotary potentiometer and multi-function wheel
- Exchange of the allocation of joystick deflection and axes to be driven (X/Y)
- Blocking of axes
- Programming of the path to be traveled per rotation of the multi-function wheel
- Allocation of the multi-function wheel to any axis
- Control of the LED lighting LED 100 by joystick or multi-function wheel

According to configuration, the function keys F1-F4 enable rapid access to different functions (excerpt):

- Switchover of the joystick characteristics
- Allocation of the rotary potentiometer to a 4<sup>th</sup> axis
- Change of velocity
- Saving and driving to coordinates (SnapShot function)
- Activation of the LED 100 lighting control
- Activation of the speed-proportional joystick functionality for the multi-function wheel (e.g. for fast setting-adjustment of the assigned axes using the function keys)

You can find detailed information on the configuration of the joystick in the following documents:

- *Description of TANGO instruction set*
- *Bedienungsanleitung SwitchBoard*

**Technical Data:**

	2-Axes-Joystick	3-Axes-Joystick	3-Axes-Joystick with Multi-Function Wheel	4-Axes-Joystick with Multi-Function Wheel
<b>Art.-No.</b>	00-76-200-0820	00-76-300-0820	00-76-300-0821	00-76-400-0820
<b>Controllable axes</b>	2	3	3	4
<b>Dimensions</b>	229 x 122 x 90 mm	229 x 122 x 96 mm	229 x 139 x 90 mm	229 x 139 x 96 mm
<b>Interface</b>	HD D-Sub 15-pin socket (connection <i>HDI</i> to the controller)			
<b>Material</b>	Membrane keyboard (control panel), ABS-plastic with haptic coating (housing), stainless steel (housing bottom)			
<b>Weight</b>	Approx. 1 kg			

## 8.2 Trackball



Image 7: Trackball

The trackball shown in the illustration above may only be used with the TANGO controller. The trackball is used to operate the controller's axes manually. It has the operational controls *Ball* and *Keys* LEFT, RIGHT, and CENTRE.

### Ball:

The following assignment of turning direction to moved axis is pre-set:

- X-Direction: Axis 1
- Y-Direction: Axis 2

The following can be achieved by software command:

1. The assignment of the motor turning direction to ball direction can be inverted per axis.
2. Each axis can be locked individually.
3. The maximum speed per axis can be pre-set.

### Keys:

- Key LEFT: The resolution becomes finer. The travelling range per ball turn decreases.
- Key CENTRE: The resolution becomes coarser. The travelling range per ball turn increases.
- Key RIGHT: Can be interrogated by the user via interface or can be evaluated by the controller (special function assignment on request).

## 8.3 Option AUX I/O: Start-up Adapter AUX I/O



This adapter will be provided in case of the option AUX I/O. It connects Pin 12 (PSE) with Pin 13 (+12V) on the AUX I/O socket.

If plugged, the power stages may be activated.

If Pin 12 is unconnected or connected to ground, the power stages are off.

Image 8: Start-up adapter AUX I/O

## 8.4 Encoder Interface

### Generally:

Terminating resistor 120 Ohm for Axis:

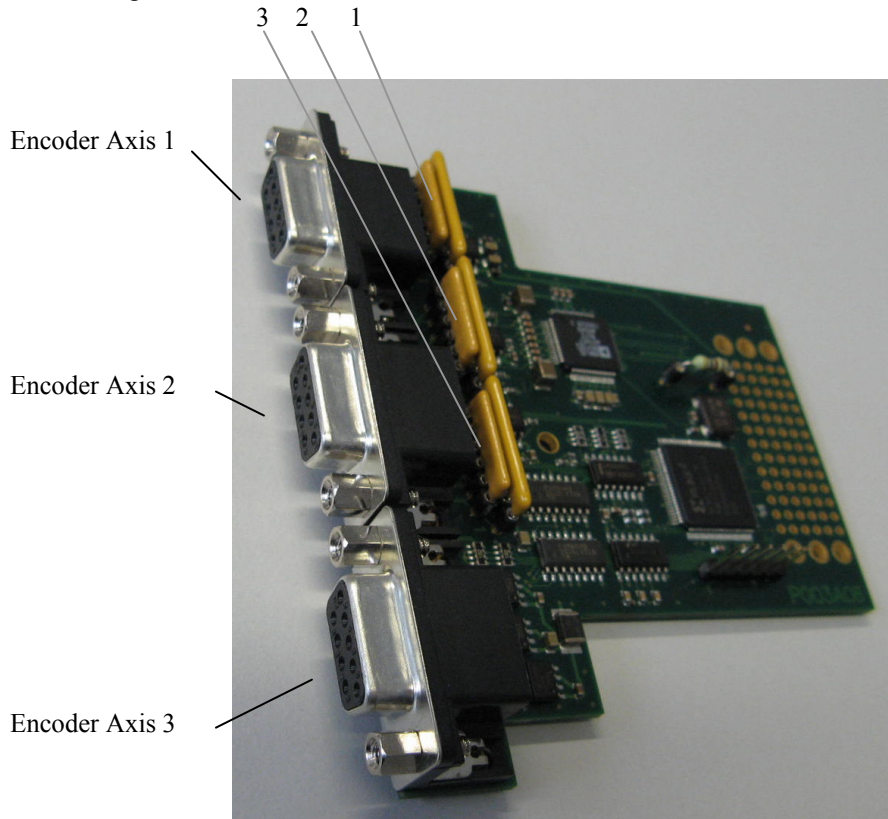


Image 9: PCB encoder interface

The encoder interface may be used exclusively for the controllers TANGO Desktop, TANGO PCI-E and TANGO PCI-S. The mechanical design varies depending upon installation situation. The interface will be delivered installed on the TANGO controller.

The encoder interface is useable for the following incremental encoder types:

- TTL (RS-422) quadrature interface
- 1Vpp interface
- MR/analog 5Vpp interface
- TTL (non differential) interface: Please contact vendor!

The type of interface is factory made and is to be indicated with the order.

### 8.4.1 Encoder 1-3: D-Sub 9-Pin Sockets

Pin	Label	Function
1	-U1	Phase 1 (sine), negative input
2	GND	GND
3	-U2	Phase 2 (cosine), negative input
4	NAS )*	Error signal
5	-U0	Reference signal, negative input
6	+U1	Phase 1 (sine), positive input
7	+5V	Supply voltage
8	+U2	Phase 2 (Cosine), positive input
9	+U0	Reference signal, positive input
Casing		GND, for connecting the shield

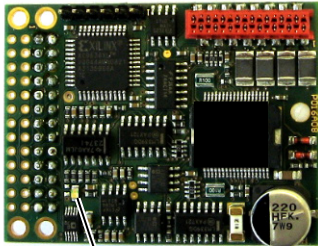
)\* Input is inactive on delivery

### 8.4.2 Technical Data

Nr.	Parameter	1Vpp	MR/analog 5Vpp	TTL (RS-422)	Comment
1	Input Voltage of Position Signal	0.6...1.2 Vpp	1.5...5 Vpp	> +/-0.2 V	Difference signals have be to in the DC voltage range 0...5 V
2	Reference Voltage	> +/- 50 mV	> +/- 50 mV	> +/- 50 mV	Common mode voltage range 0...5 V
3	NAS-Signal )*	TTL	TTL	TTL	„H“ = measure system ok „L“ = error, 1 kOhm → GND low-pass filter 1 kOhm/1nF
4	Bandwidth Position Signal	Approx. 250 kHz	Approx. 250 kHz	32 ns edge distance	At very high frequency, the MR/analog 5Vpp and 1Vpp signals will be counted like the TTL (RS-422) signals.
5	Max. Frequency for the Position Signal during Reference Move	6 kHz	6 kHz	> 40 μs edge distance	The reference signal will be synchronized with the positioning signal.
6	Max. reachable Interpolation Factor	51,400-fold	51,400-fold	4-fold	Per signal period
6	Interpolation Factor at max. Voltage of Position Signal	29,100- fold	32,700- fold	4- fold	Per signal period, based on worst case of signal angle.
7	Interpolation Factor at min. Voltage of Position Signal	14,500- fold	9,800- fold	4- fold	Per signal period, based on worst case of signal angle.
8	Input Resistance	120 Ohm	120 Ohm	120 Ohm	Input resistance may be changed on request. Please contact vendor.
9	Supply Current +5 V				Max. 0.5 A per encoder. Amount of all currents is 1 A max.

)\* Input is inactive on delivery

### 8.5 TANGO Axis 4



LED1

Image 10: TANGO Axis 4

**Pinning motor connector (15-Pin D-Sub Socket):**

Pin	Function	Comment
1, 9	MOT1PH1+	Motor, Phase 1-
2, 10	MOT1PH1-	Motor, Phase 1+
3, 11	MOT1PH2+	Motor, Phase 2+
4, 12	MOT1PH2-	Motor, Phase 2-
5	ENDEND	Limit switch endpoint )*
6	END0	Limit switch zeropoint )*
7	+5VEXT	+5 V, max. 500 mA
8	GND	GND
13, 14, 15	N.C..	Not connected

) \* TTL input, 1 kOhm pull-up/pull-down resistor, software selectable, low-pass filter 1 kOhm, 100 nF

LED1: Is on when power stage is active.

The module TANGO Axis 4 is designed to drive a 2 or 4-phase stepper motor. 2 limit switches may be connected to the module. The module must be used exclusively for TANGO Desktop, TANGO PCI-E and TANGO PCI-S. The mechanical design varies depending upon installation situation. The interface will be delivered installed on the TANGO controller.

**Note:** The PSE pin at the AUX-IO connector of the TANGO controller (to switch off the power stage) switches off the power stage of the TANGO Achse 4 via software. There is no switching off via hardware like it is at axes 1-3 of TANGO Desktop.

**Technical Data:**

Performance Motor Controller	
Type of Motor	Stepper motor 2/4 phases, e. g. 100, 200 or 400 full steps/revolution
Microstep Resolution	819,200 steps/revolution (@ motor with 200 steps/revolution)
Power Stage	Automatic adaptation to a wide range of stepper motors
Max. Phase Current	1.0 A
Motor Current	0.03...1 A, selectable per software
Current Reduction after Movement	0...100 % of selected motor current
Current Reduction Delay	Selectable from 0...65,000 ms
Motor Voltage	48 V <sub>eff</sub> AC max.; 48 V DC max. depends on power supply

Power Requirements	
Motor Voltage	11.4...50 V DC <sup>1)</sup>
+12 V (+/- 5%)	Approx. 10 mA
+5 V (+/- 5%)	Approx. 15 mA
+3,3 V (+/-5%)	Approx. 30 mA

<sup>1)</sup> Current depends on type of motor, motor current, DC voltage, revolutions per second, etc. An estimation is: I<sub>max.</sub> = ca. 1/3 x motor current. Individual measurements are needed.

Environment	
Form factor	L x W = 57 x 44 mm (without cable)
Operating temperature	+5...70 °C ambient
Cooling	Normal convection
Humidity	RH = 85 % max., non condensing

Safety Functions	
Voltage Monitor Power Stage	Switches power stage off at low voltage
Short Circuit Protection Power Stage	Phase to phase and phase to ground, power stage switches off within typical 5 µs, resetable via software
Overcurrent Protection for External Devices	+5VEXT is self resetting after removing overload
Hardware Limit Switch Input	2, TTL level, NO or NC, switching either to 0 V or +5 V, software selectable pull-up or pull-down resistors for each input



## 9. Maintenance and Service

### 9.1 Maintenance

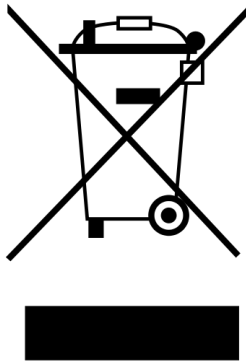
The positioning controller is free of maintenance. Clean the cover with a soft, slightly moist, cloth. Avoid direct contact with liquids or solvents.

### 9.2 Service Address

Should any problem or malfunction appear during operation, please check all external connections first (voltage supply, cabling, etc.). If the malfunction or problem can't be solved, please return the controller to the following service address together with a brief description of the error:

Märzhäuser Wetzlar GmbH & Co. KG  
Customer Service Center  
In der Murch 15  
D-35579 Wetzlar  
Email: [service@marzhauser.com](mailto:service@marzhauser.com)  
Tel.: +49 (0) 6441 / 9116-36

## 10. Disposal



Don't dispose electronic equipment to the normal waste.

The controller should be returned to the manufacturer free of charge for purpose of disposal. Please send the indicator to the address mentioned in chapter 9.2.

The positioning controller is registered with the registration number DE 25271278.

## 11. Warranty

Märzhäuser Sensotech GmbH grants a warranty of 24 months for the controller.

Within this warranty, Märzhäuser Sensotech GmbH will repair or replace your instrument, if in any way it is defective in material or workmanship.

Other claims of guarantee or claims of damage in result of defectives, are excluded from this warranty.

This warranty doesn't cover any defectives, which result from abnormal use or incorrect handling. Changes or interventions without our approval, void this warranty.