

# robotlink<sup>®</sup>

igus.eu...bionic-inspired robot joint...9.2014...



# toolbox

**The roboLink® joint construction kit. Lean automation.**  
 Robotic joints and components made from igus® tribo polymers.

The plastic specialist igus® gives developers, labs, and automation integrators access to a joint construction kit that can be used to construct customised robot systems. The joints are found in a wide range of applications, such as humanoid robots, on handling mechanisms, and in automation tasks. A classic roboLink® articulated arm is extremely light since the draw wire technology allows the drives (motors) to be positioned in a separate drive unit instead of being located on the moving arm.

There are now 7 different joint types that can be combined and linked together in a variety of ways, up to a maximum of 6 degrees of freedom (DOF). Such a 6 axis arm only weighs about 2 kg and can move a useful load of up to 1 kg – depending on geometric configuration.

A roboLink® articulated arm can be driven with optional igus® stepper motors, or if required, can also be driven with other motors and control solutions. Pneumatic drives can also be used.

The "roboLink® D" direct drive joints are a new product range. In this case, the stepper motors are no longer driven by draw wires, but are instead positioned directly on the axis. The familiar igus® slewing rings PRT-01-20 (and -30 and -50) are the basis for this new development.

Enjoy reading and getting ideas.  
 Yours



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igus® – plastics for longer life®



[www.igus.eu](http://www.igus.eu)

Also visit our igus® website [www.igus.eu](http://www.igus.eu), explore other products, technical details, new products, helpful online tools, and benefit from our online product range – any hour of the day.



Our offers are exclusively directed to dealers / resellers. The quoted unit prices in Euros are net prices without VAT. All previous price lists become invalid with the publication of this price list.



**Delivery** free within Germany for orders over EUR 150.00



**Payment** 2% discount within 14 days net within 30 days.

roboLink® Joints and Systems



Rotating joint  
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Pivoting joint  
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Base joint  
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2-axis joint  
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Infinite possibilities  
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roboLink® Components



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3-jaw gripper  
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Complete 6 DOF unit  
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roboLink® Accessories



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Connecting tubes  
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Flange shaft support  
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roboLink® D



Direct drive axis  
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Multi-axis articulated system  
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roboLink® Software

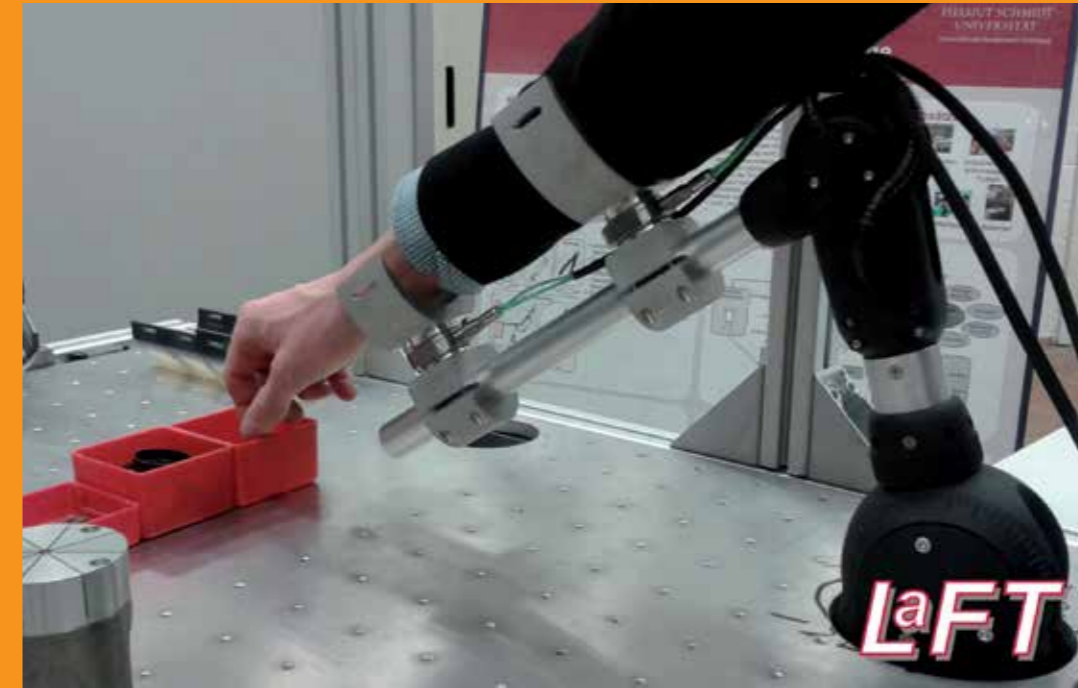
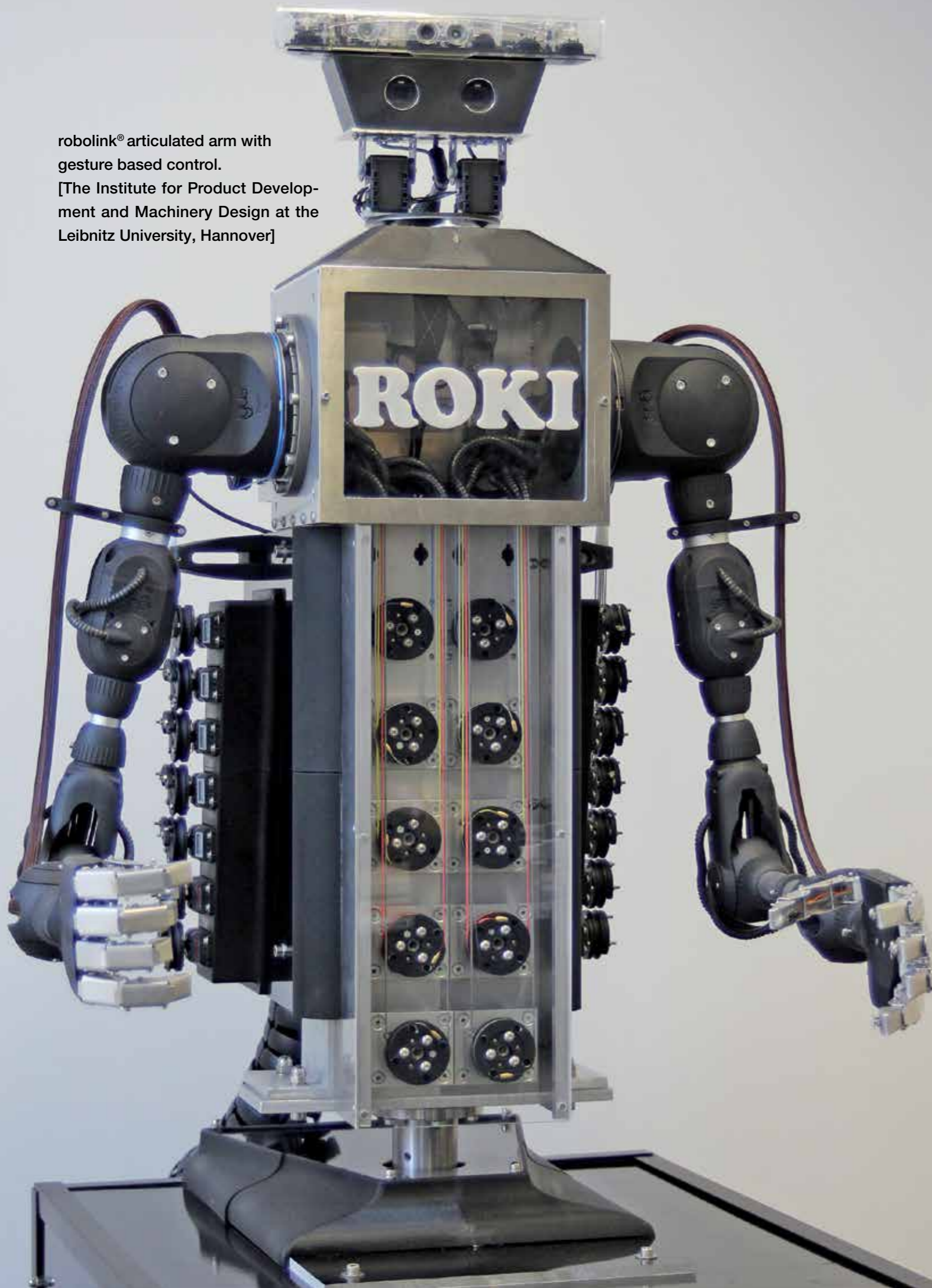


roboLink®-Software "open source"  
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# robolink® application examples

robolink® articulated arm with  
gesture based control.  
[The Institute for Product Develop-  
ment and Machinery Design at the  
Leibnitz University, Hannover]



Manual workstation  
support system with  
human-machine interface  
for the production of the  
Manufacturing Technology  
Lab (LaFT) at Helmut-  
Schmidt University in  
Hamburg



Special design with 4 DOF, 3 joints in series  
[Fraunhofer IFF Magdeburg]



Submerged camera guidance, articulated arm with  
4 DOF, [igus®]



The Technical University at Wroclaw, Poland equipped  
its autonomous robot Flash with 2 robolink articulated  
arms, each with 4 DOF.



"HOBBIT" service robotics project at TU Vienna.  
Project partner Hella Automation, Austria. robolink® arti-  
culated joints on autonomous systems.



## Components kit to make moving robotic systems

A couple of years ago, we established our objective to develop a toolbox of mechanical components for the assembly of moving robotic systems. The first component in this toolbox was a wire driven plastic joint. This component is: lightweight, compact and unlimited.

### LIGHTWEIGHT: joints made of plastic

- Lubrication-free
- Cost-effective
- Long service life
- Standard joint weighs only 345 g

### COMPACT: 2 degrees of freedom in one element

- Pivoting AND rotating
- Freely configurable "arm length" through modular design

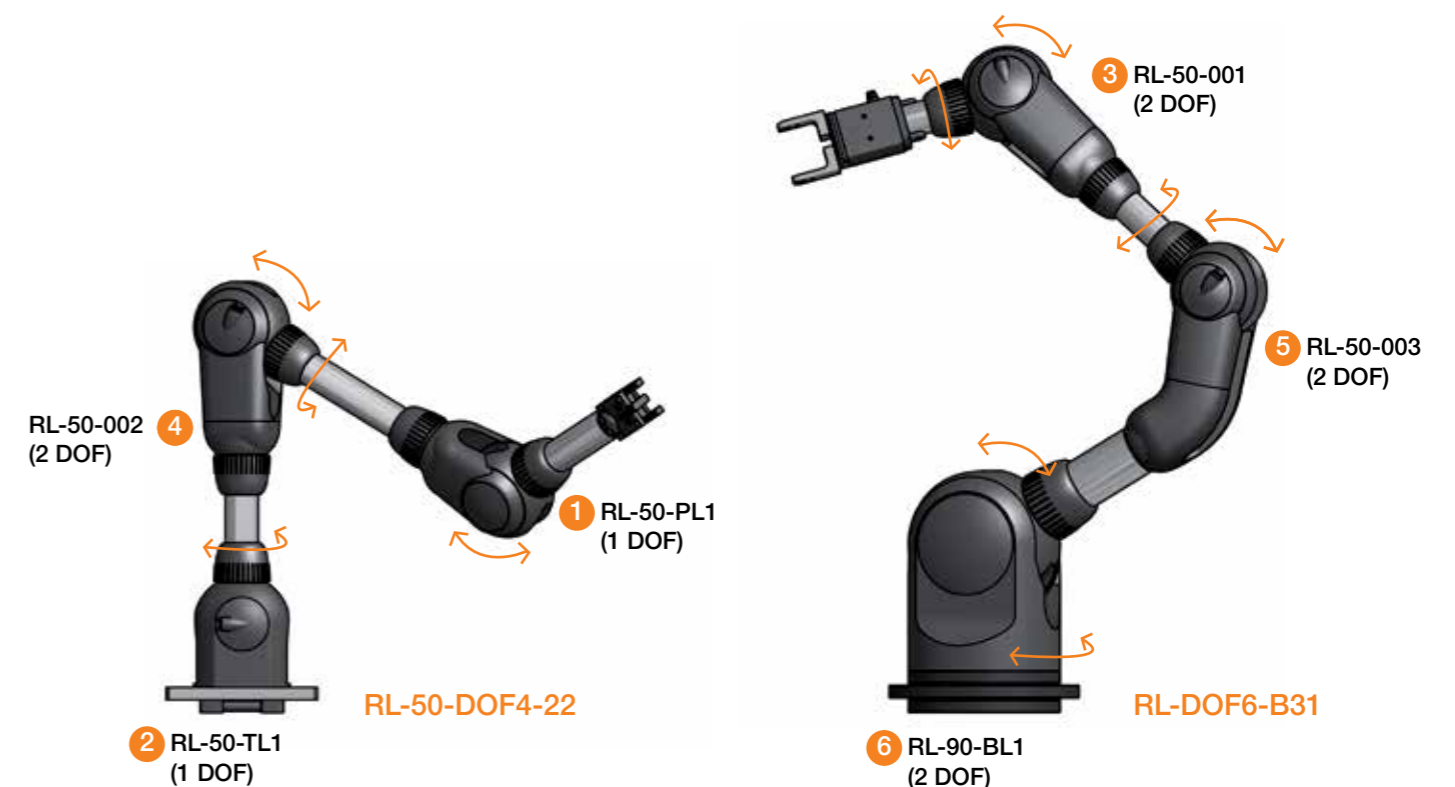
### UNLIMITED: freely selectable drive systems

- Connect AND start
- Compact drive unit for a 3 to 6-axis articulated arm
- Drive via wires and stepper motors from igus®
- Alternative drive/control systems easily possible



## Available with angle sensors

Part number	Number of wires		Pivoting angle		Angle of rotation		Weight [g]	Max. Load	
	On-board drive	Optional feed-through	Standard (with stop dog)	Option (*without stop dog)	Standard (with stop dog)	Option (*without stop dog)		Pivoting [Nm]	Rotating [Nm]
1 Pivoting joint RL-50-PL1	2	4	180° (±90°)	210° (±105°)	-	-	235	12	-
2 Pivoting joint RL-50-TL1	2	8	-	-	340° (±170°)	540° (±270°)	245	-	5
3 2-axis joint RL-50-001	4	4	180° (±90°)	210° (±105°)	340° (±170°)	540° (±270°)	345	12	5
4 2-axis joint RL-50-002	4	4	180° (+130°/-50°)	240° (+135°/-105°)	340° (±170°)	540° (±270°)	345	12	5
5 2-axis joint RL-50-003	4	4	180° (+180°/0°)	235° (+180°/-55°)	340° (±170°)	540° (±270°)	400	12	5
6 Base joint RL-90-BL1	4	8	180° (±90°)	190° (±95°)	180° (±90°)	-	1,250	20	10



\* Option without stop dog:

Mechanical stop dogs perform 2 primary functions: Protecting components and wires against overloads in limit positions, and facilitating wire feed-through from other joints through the respective joint. All joints can also be operated without stop dogs, provided...

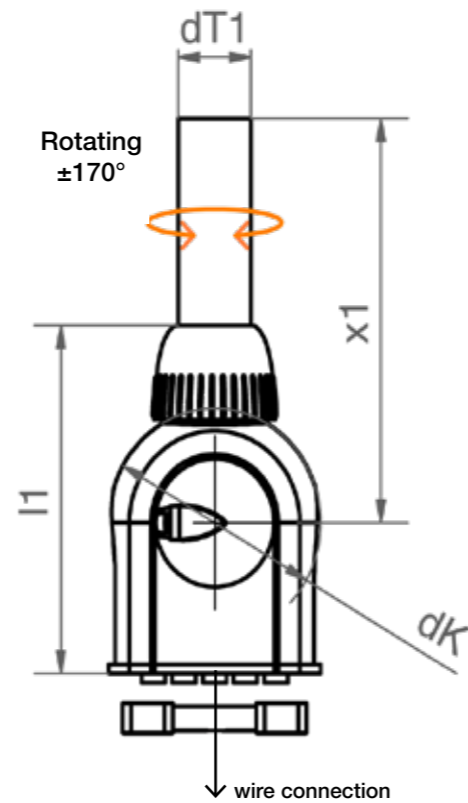
- 1) the limit positions are monitored with software,
- 2) the joint has no rope feed-through (e.g. at the end of a multi-axes articulated arm)

# robolink® Joint | Rotating joint type TL1, 1 DOF\*

1 DOF\* (\*degrees of freedom), only possible as 1st joint in a system, available with angle sensors

## robolink® rotating joint TL1

- **Weight:** 245 g
- **Max. Load:** Rotating 5 Nm
- **Angle of rotation:** 340° (± 170°)
- **Material:** Fine grade polyamide PA 2200, stainless steel screws, Dyneema wires, aluminium HC bearings (alternatively iglidur® J)



### Dimensions [mm]

Part number	Description	x1*	l1	dK	dT1	Prices [€]		
						1-9 Piece	10-24 Piece	25-49 Piece
RL-50-TL1	Pivoting joint	134	125	76	26	350.00	294.00	262.00
RL-50-TL1-E	with angle sensors	134	125	76	26	492.00	413.00	369.00

\* Standard tube length = 100 mm; other lengths available

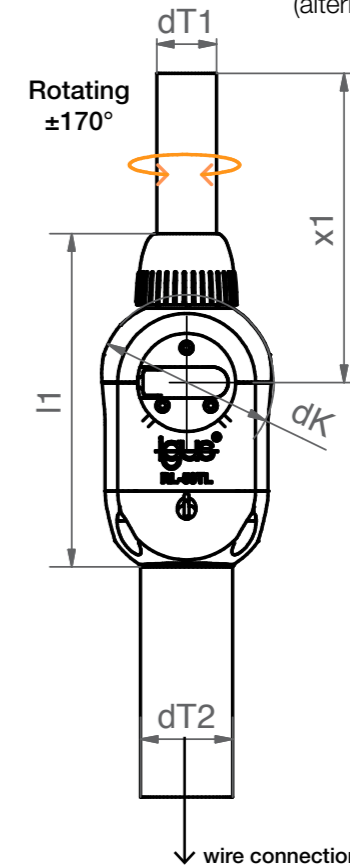
Delivery time from stock

# NEW robolink® Joint | Rotating joint type TL2, 1 DOF\*

1 DOF\* (\*degrees of freedom) for installation as an additional rotating axis after a base joint ("shoulder", 3rd axis), available with angle sensors

## robolink® rotating joint TL1

- **Weight:** 245 g
- **Max. Load:** Rotating 5 Nm
- **Angle of rotation:** 340° (± 170°)
- **Material:** Fine grade polyamide PA 2200, stainless steel screws, Dyneema wires, aluminium HC bearings (alternatively iglidur® J)



### Dimensions [mm]

Part number	Description	x1*	l1	dk	dT1	dT2	Prices [€]		
							1-9 Piece	10-24 Piece	25-49 Piece
RL-50-TL2	Pivoting joint	134	144	76	26	40	350.00	294.00	262.00
RL-50-TL2-E	with angle sensors	134	144	76	26	40	492.00	413.00	369.00

\* Standard tube length = 100 mm; other lengths available

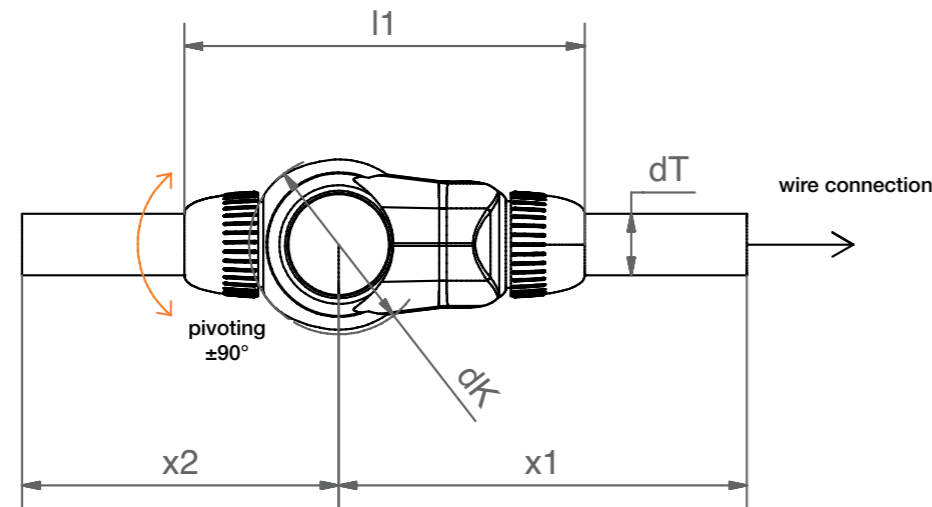
Delivery time from stock

# robolink® Joint | Pivoting joint, 1 DOF\*

1 DOF\* (\*degrees of freedom), available with angle sensors

## robolink® pivoting joint

- **Weight:** 235 g
- **Max. Load:** Pivoting 12 Nm
- **Pivoting angle:** 180° (± 90°)
- **Material:** Fine grade polyamide PA 2200, stainless steel screws, Dyneema wires, aluminium HC bearings (alternatively iglidur® J)



### Dimensions [mm]

Part number	Description	x1*	x2*	l1	dK	dT	Prices [€]		
							1-9 Piece	10-24 Piece	25-49 Piece
RL-50-PL1	Pivoting joint ± 90°	202	134	170	76	26	329.00	276.00	247.00
RL-50-PL1-E	with angle sensors ± 90°	202	134	170	76	26	471.00	395.00	354.00

\* Standard tube length = 100 mm; other lengths available

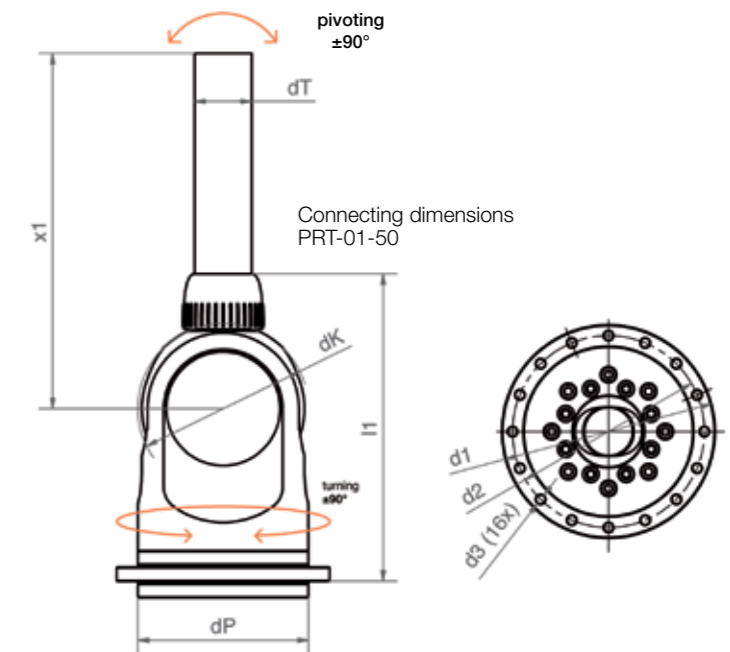
**Delivery time from stock**

# robolink® Joint | Base joint, 2 DOF\*

2 DOF\* (\*degrees of freedom), only possible as 1st joint in a system, available with angle sensors

## robolink® base joint

- Bearing ring rotation on the basis of PRT-01-50 iglidur® J gliding elements rotate on aluminium HC
- **Weight:** 1.250 g
  - **Max. Load:** Pivoting 20 Nm, rotating 10 Nm
  - **Pivoting angle:** 180° (± 90°)
  - **Angle of rotation:** 180° (± 90°)
  - **Material:** Fine grade polyamide PA 2200, stainless steel screws, Dyneema wires, aluminium HC bearings (alternatively iglidur® J)



### Dimensions [mm]

Part number	Description	x1*	l1	dK	dT	dP	d1	d2	d3	Prices [€]		
										1-9 Piece	10-24 Piece	25-49 Piece
RL-90-BL1	Base joint, ± 90°	150	217	120	40	120	150	135	6.6	998.00	838.00	749.00
RL-90-BL1-E	with angle sensors ± 90°	150	217	120	40	120	150	135	6.6	1374.00	1154.00	1031.00

\* Standard tube length = 100 mm; other lengths available

**Delivery time from stock**

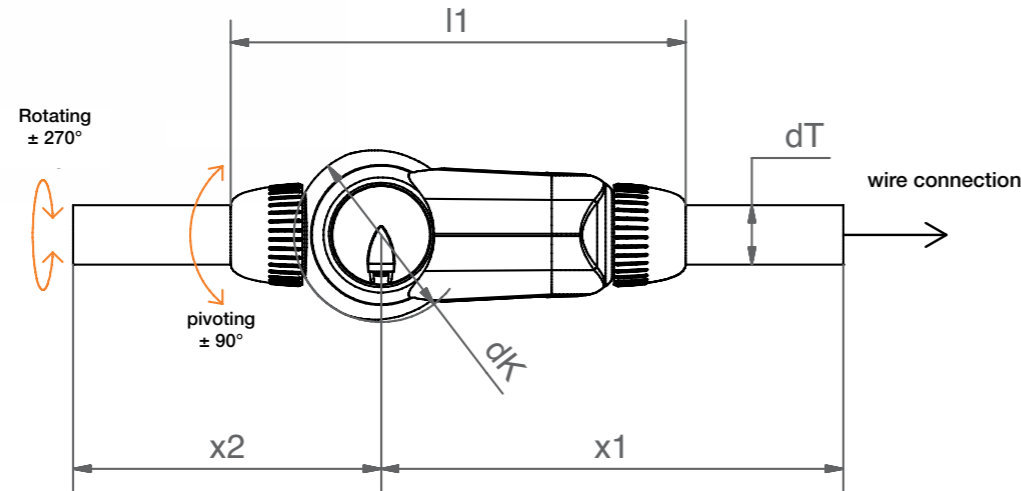
# robolink® Joint | 2-axis joint type 001, 2 DOF\*

2 DOF\* (\*degrees of freedom), available with angle sensors



## robolink® 2-axis joint type 001

- **Weight:** 345 g
- **Max. Load:** Pivoting 12 Nm, rotating 5 Nm
- **Pivoting angle:** 180° (± 90°)
- **Angle of rotation:** 340° (± 170°)
- **Material:** Fine grade polyamide PA 2200, stainless steel screws, Dyneema wires, aluminium HC bearings (alternatively iglidur® J)



### Dimensions [mm]

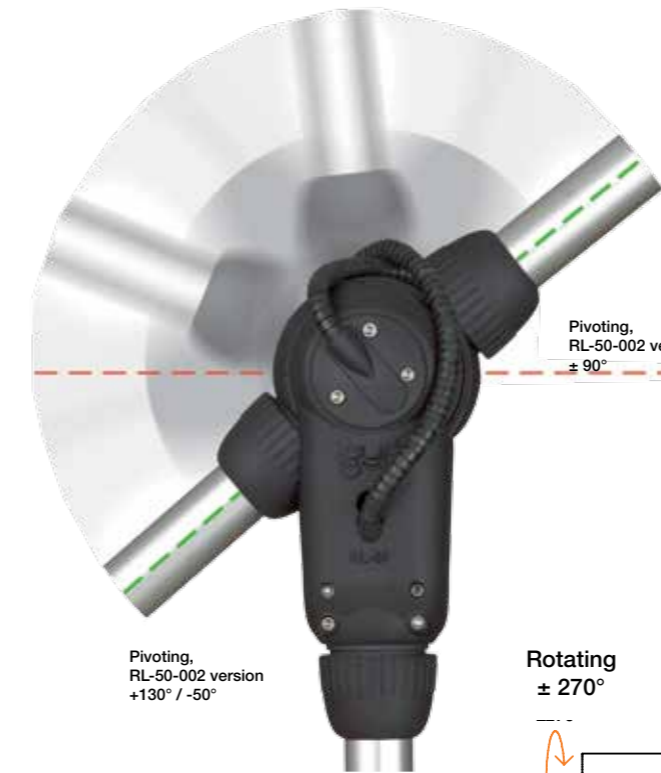
Part number	Description	x1*	x2*	l1	dK	dT	Prices [€]		
							1-9 Piece	10-24 Piece	25-49 Piece
RL-50-001	Rotating and pivoting joint ± 90°	202	134	200	76	26	495.00	416.00	371.00
RL-50-001-E	with angle sensors ± 90°	202	134	200	76	26	871.00	732.00	653.00

\* Standard tube length = 100 mm; other lengths available

**Delivery time**  
from stock

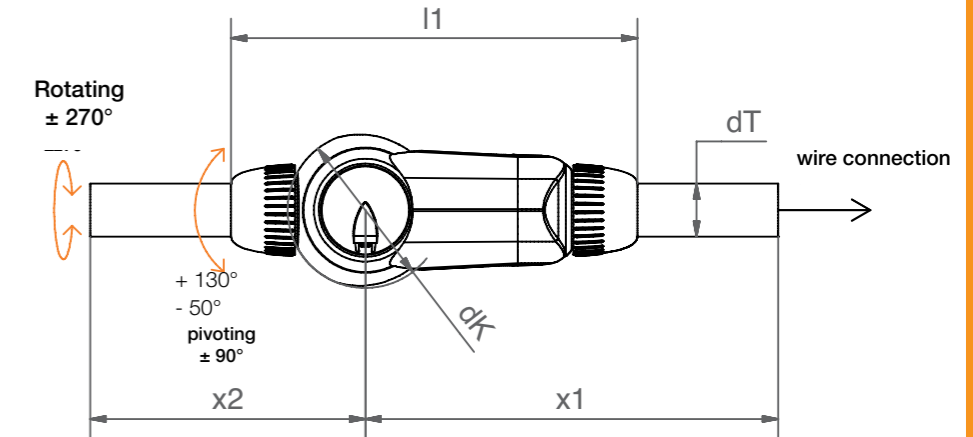
# robolink® Joint | 2-axis joint type 002, 2 DOF\*

2 DOF\* (\*degrees of freedom), available with angle sensors



## robolink® 2-axis joint type 002

- **Weight:** 345 g
- **Max. Load:** Pivoting 12 Nm, rotating 5 Nm
- **Pivoting angle:** 180° (+130°/-50°)
- **Angle of rotation:** 340° (± 170°)
- **Material:** Fine grade polyamide PA 2200, stainless steel screws, Dyneema wires, aluminium HC bearings (alternatively iglidur® J)



### Dimensions [mm]

Part number	Description	x1*	x2*	l1	dK	dT	Prices [€]		
							1-9 Piece	10-24 Piece	25-49 Piece
RL-50-002	Rotating and pivoting joint +130° / -50°	202	134	200	76	26	495.00	416.00	371.00
RL-50-002-E	with angle sensors +130° / -50°	202	134	200	76	26	871.00	732.00	653.00

\* Standard tube length = 100 mm; other lengths available

**Delivery time**  
from stock

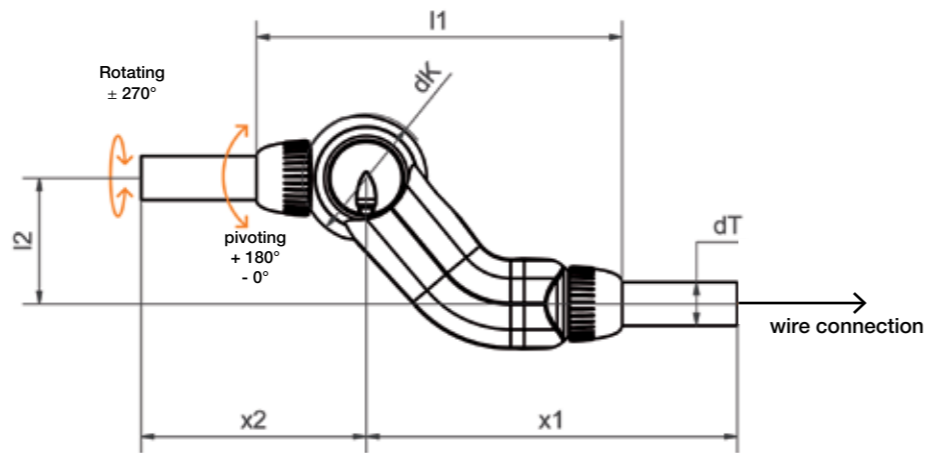


2 DOF\* (\*degrees of freedom), available with angle sensors



### robolink® 2-axis joint type 003

- **Weight:** 400 g
- **Max. Load:** Pivoting 12 Nm, rotating 5 Nm
- **Pivoting angle:** 180° (+180°/0°)
- **Angle of rotation:** 340° (± 170°)
- **Material:** Fine grade polyamide PA 2200, stainless steel screws, Dyneema wires, aluminium HC bearings (alternatively iglidur® J)



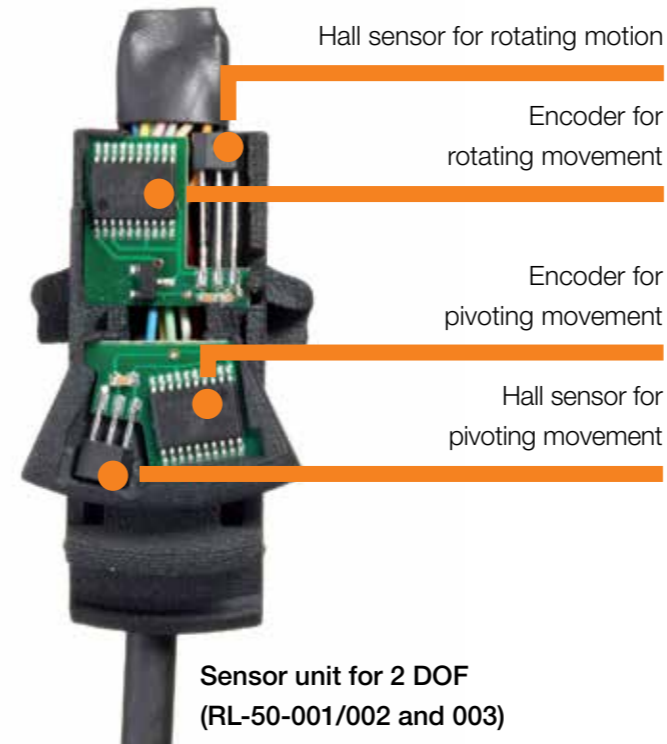
### Dimensions [mm]

Part number	Description	x1*	x2*	l1	l2	dK	dT	Prices [€]		
								1-9 Piece	10-24 Piece	25-49 Piece
RL-50-003	Rotating and pivoting joint +180° / 0°	221	134	218	75	76	26	585.00	492.00	439.00
RL-50-003-E	with angle sensors +180° / 0°	221	134	218	75	76	26	961.00	807.00	749.00

\* Standard tube length = 100 mm; other lengths available

**Delivery time**  
from stock

robolink® angle sensor (optional)



### Standard sensors:

- Magnetic incremental angle sensors
- The sensors have a resolution of 0.07° per axis
- All sensor units are ready to be installed for the respective joints
- Each with 3 m sensor cable (6 leads for each DOF)
- Option: available angle sensors for underwater applications (ES)



Magnetic rings, rotational and pivot axis

### Sensor wiring configuration

Description	Pivoting motion	Rotation
+ 5V	red	red/blue
GND	black	brown
Hall sensor	white	grey
Encoder Index	green	grey/pink
Encoder Channel A	blue	violet
Encoder Channel B	yellow	pink

### Sensor wire

Manufacturer	Cable	Number of conductors	Conductor cross section	Cable diameter
igus®	FIXFLEX FF900.11.282	2 x 6	0.09 mm <sup>2</sup>	3.9 mm

**Delivery time**  
from stock



7 joint variants... unlimited possibilities...

2 DOF:

from 495,-



RL-T1P1-(E)

3 DOF:

from 845,-



RL-P1P1P1-(E)



RL-T101-(E)



RL-B1P1-(E)

5 DOF:

from 1.484,-



RL-T101P1P1-(E)



RL-B101P1-(E)

6 DOF:

from 2.132,-



RL-B10101-(E)



RL-B10301-(E)

...several possible combinations...

4 DOF:

from 1.134,-



RL-0101-(E)



RL-B103-(E)

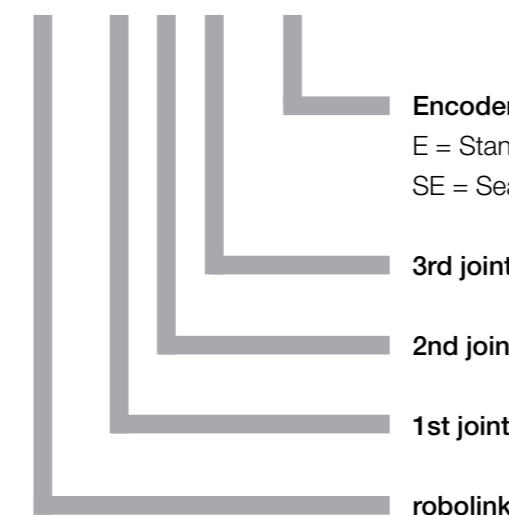


RL-T1P1P1P1-(E)



Ordering key complete system:

RL-T10103 - E



Encoder

E = Standard

SE = Sealed Encoder (underwater application)

3rd joint

2nd joint

1st joint

robolink®

- B1 = Base joint (only as possible as 1st joint)
- T1 = Rotating joint (only as possible as 1st joint)
- T2 = Rotating joint (in an articulated arm)
- P1 = Pivoting joint
- 01 = ± 90°
- 02 = +130° / -50°
- 03 = +180° / 0°



All systems are shipped as standard with aluminum tubes of 100 mm length. The quoted prices and x-dimensions apply to these configurations. Custom lengths or tube materials are possible in mm increments.



Delivery time  
5 days



Prices Price list  
▶ page 34

\* System price in EUR for 1 unit purchases, incl. aluminium tubes and wires (no sensors)

DOF: Degrees of freedom

## 2 and 3-jaw gripper with electric motor



### Properties:

- Simple Plug & Play – compatible with all robolink® systems
- Self-locking drive – continues to grip when powered off
- Replaceable jaws for different applications
- Universal jaws for quick attachment change (RL-50-GRI-02-02-E)
- Light, compact and lubricant-free
- Integrated DC motor with planetary gears

### Technical data [mm]

	2-jaw gripper RL-50-GRI-02-...	3-jaw gripper RL-50-GRI-03-...
Nominal voltage	24V DC	24V DC
Control signal	24V DC	24V DC
Current draw	0.2 A	0.2 A
Control signal	< 10 mA	< 10 mA
DC motor output	3.6 W	3.6 W
Tensioning force	50 N	50 N
Stroke	2 x 20°	3 x 20°
Max. cycles per minute	50	50
Closing / opening time	0.5 s	0.5 s
Fitting	M8x1 – 3pol	M8x1 – 3pol
Protection class	IP42	IP42
Weight	180 g	200 g
Material	PA2200	PA2200

### Electrical connections

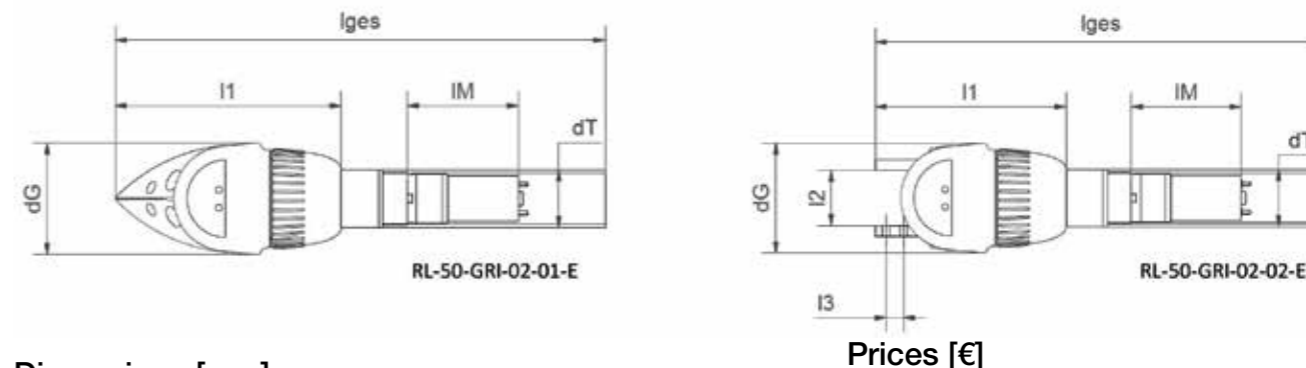
	Function	Colour
1	+24V DC	brown
3	GND	blue
4	+24V DC Signal	black

### Other grippers are possible



Standard adapters (made from PA 2200) are currently available for the following products: FESTO: DHPS-10-A-NC; HGWM-08-Ex-G7; HGWM-12-EX-G7; adaptive gripper. SCHUNK: SGB-32; SGW-40, Gimatic MPPM 1606

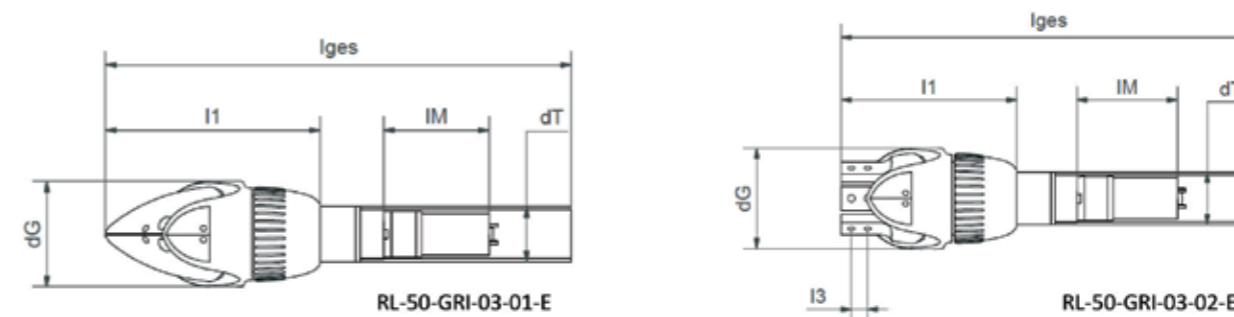
## 2-jaw gripper



### Dimensions [mm]

Ordering number	l1	l2	l3	dG	dT	IM	lges	1-9 Piece	10-24 Piece	25-49 Piece	> 50 Piece
RL-50-GRI-02-01-E	102	-	-	50	26	50	220	374.00	314.16	280.50	on request
RL-50-GRI-02-02-E	87	25	8 (Ø3.4)	50	26	50	205	374.00	314.16	280.50	on request

## NEW: 3-jaw gripper

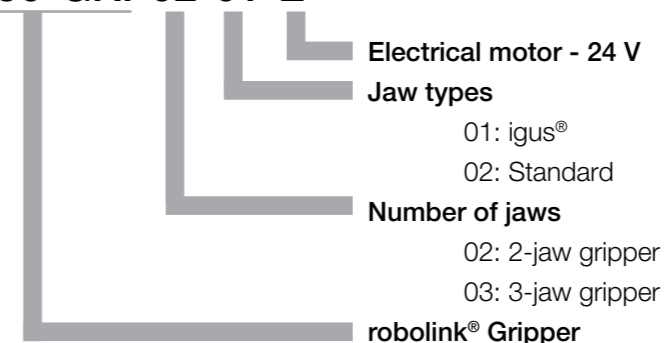


### Dimensions [mm]

Ordering number	l1	l3	dG	dT	IM	lges	1-9 Piece	10-24 Piece	25-49 Piece	> 50 Piece
RL-50-GRI-03-01-E	102	-	50	26	50	220	374.00	314.16	280.50	on request
RL-50-GRI-03-02-E	87	8 (Ø 3.4)	50	2	50	205	374.00	314.16	280.50	on request

### Ordering key complete system:

#### RL-50-GRI-02-01-E



**Delivery time**  
2 days

## Various Stepper motor options



### Motor with stranded wires

Litz motors are the least expensive and the most common stepper motors. The connecting wires for this type directly exit from the housing. They are preferably installed in machines and equipment that have an additional housing or are used in clean environments.



### Motor with connector

The connector interface provides a high IP65 protection level (IP: International Protection). The higher the IP rating, the better the motor is protected from the ingress of dirt and water.



### Motor with connector and encoder

The encoder sends signals from the motor to the motor control. The encoder verifies that the required linear motion has occurred precisely as required. Encoder = increased machine accuracy.



### Motor with plug, encoder and brake

The brake can hold the payload in position when the motor is not under power. This is used as a safety feature during power failures – recommended for vertically mounted systems.

## Installation sizes of NEMA Stepper motors

### NEMA11: Tiny power unit

This motor has very compact dimensions. Even so, heavy loads can be moved with the suitable lead screw pitch. This motor is typically used on small test and analysis equipment and miniature adjustments.

- The holding moment, Mo, is 0.13 Nm
- The connection size is 28 x 28 mm

### NEMA17: Small power unit

This little motor has impressive torque and high RPMs. Reliable operation with fast travel and low loads

- The holding moment, Mo, is 0.5 Nm
- The connection size is 42 x 42 mm

### NEMA23: The most common stepper motor size

Versatile choice due to the high torque and rotational speed. This motor is the best choice for most applications with medium loads.

- The holding moment, Mo, is 2.0 Nm
- The connection size is 56 x 56 mm

### NEMA23XL: Medium sized power units

A development extension of the typical NEMA23 with nearly twice the torque. The assembly dimensions are identical to the NEMA23, allowing many applications

- The holding moment, Mo, is 3.5 Nm
- The connection size is 60 x 60 mm

### NEMA34: Large sized power unit

Applications with higher loads are implemented using the largest installation size. Good for heavy-duty format adjustments or parallel dual axis setups.

- The holding moment, Mo, is 5.9 Nm
- The connection size is 86 x 86 mm

## Technical data

Plate size		28	42	56	60	86
Motor		NEMA11	NEMA17	NEMA23	NEMA23XL	NEMA34
Maximum voltage	[VDC]	60	60	60	60	60
Nominal voltage	[VDC]	24-48	24-48	24-48	24-48	24-48
Nominal current	[A]	1.0	1.8	4.2	4.2	6.4
Holding torque	[Nm]	0.13	0.5	2.0	3.5	5.9
Ratchet torque	[Nm]	0.004	0.022	0.068	0.075	0.210
Step angle	°	1.8	1.8	1.8	1.8	1.8
Resistance / phase	[Ω]	2.30 ±10%	1.75 ±10%	0.5 ±10%	0.65 ±10%	0.33 ±10%
Inductivity/phase	[mH]	1.40 ±20%	3.30 ±20%	1.90 ±20%	3.20 ±20%	3.00 ±20%
Mass moment of inertia - rotor	[kgcm <sup>2</sup> ]	0.02	0.08	0.48	0.84	2.70
Shaft load, axial	[N]	7	7	15	15	65
Shaft load, radial	[N]	20	20	52	63	200

Encoder	
Operating voltage	[VDC] 5
Signals/rotation	[1/min] 500
Zero signal/index	yes
Line driver	RS422 Protocol



Plate size		28 (NEMA11)	42 (NEMA17)	56 (NEMA23)	60 (NEMA23XL)	86 (NEMA34)
Brake						
Operating voltage	[VDC]	-	24 ±10%	24 ±10%	24 ±10%	24 ±10%
Output rating	[W]	-	8	10	10	11
Holding torque	[Nm]	-	0.4	1.0	1.0	2.0
Moment of inertia	[kgcm <sup>2</sup> ]	-	0.01	0.02	0.02	0.07

Mass moment of inertia		28 (NEMA11)	42 (NEMA17)	56 (NEMA23)	60 (NEMA23XL)	86 (NEMA34)
Weight						
Product weight	[kg]	0.25	0.32	1.12	1.56	3.20
With encoder	[kg]	0.27	0.34	1.14	1.58	3.30
With encoder and brake	[kg]	-	0.58	1.36	1.82	3.60

Operating data	
Ambient temperature	[°C] -10 to +50
Max. allowable temp. increase	[°C] 80
Insulation class	B
Air humidity (non condensing)	[%] 85
IP rating – motor housing	IP65 (shaft seal IO52, litz wire motor IP40)
CE conformity	EVM directive

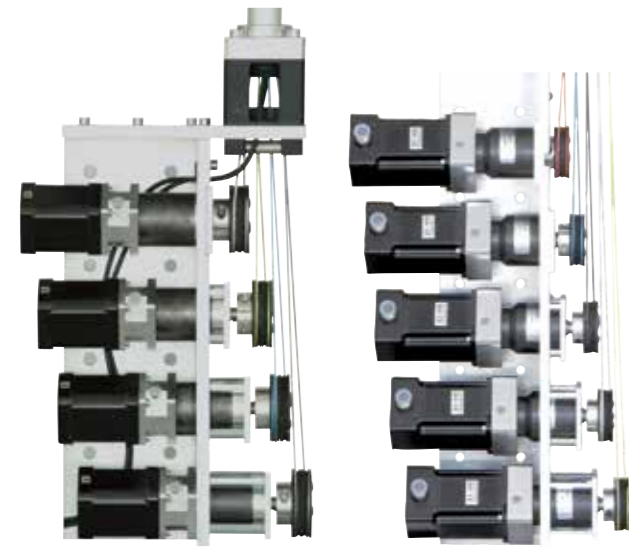


## Drive module



Technical data		Prices [€]
Part number	Description	per piece
RL-AEM1-17L	NEMA17, strand	415.40
RL-AEM1-17	NEMA17, connector	477.70
RL-AEM1-23L	NEMA23, strand	467.00
RL-AEM1-23	NEMA23, connector	515.20

## roboLink® drive units for all articulated arms



- Freely configurable arm length through modular design
- Stepper motor driven
- Alternative drive/control systems easily possible

Pict. 1

Pict. 2

### Dimensions [mm]

Description	3 DOF		4 DOF		5 DOF	
	Part number	Prices [€]	Part number	Prices [€]	Part number	Prices [€]
NEMA17, strand	RL-DU1317L	from 1,647.24	RL-DU1417L	from 2,119.43	RL-DU1517L	from 2,634.10
NEMA17, connector	RL-DU1317	from 1,834.14	RL-DU1417	from 2,368.63	RL-DU1517	from 2,945.60
NEMA23, strand	RL-DU1323L	from 1,863.39	RL-DU1423L	from 2,393.60	RL-DU1523L	from 2,970.10
NEMA23, connector	RL-DU1323	from 2,007.99	RL-DU1423	from 2,586.40	RL-DU1523	from 3,211.10

More information about igus® stepper motors  
▶ from page 20

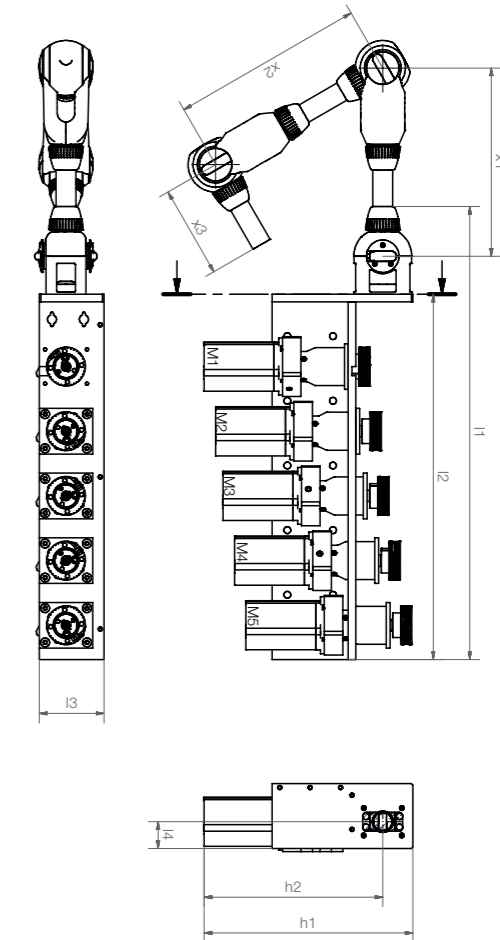
**Delivery time** Drive module: from stock  
Drive unit: 5 days

## Example: 5 DOF arm with NEMA 23 drive unit



### roboLink® drive unit with 5 DOF articulated arm

- Freely configurable arm length through modular design
- Stepper motor driven
- Alternative drive/control systems easily possible



### Dimensions [mm]

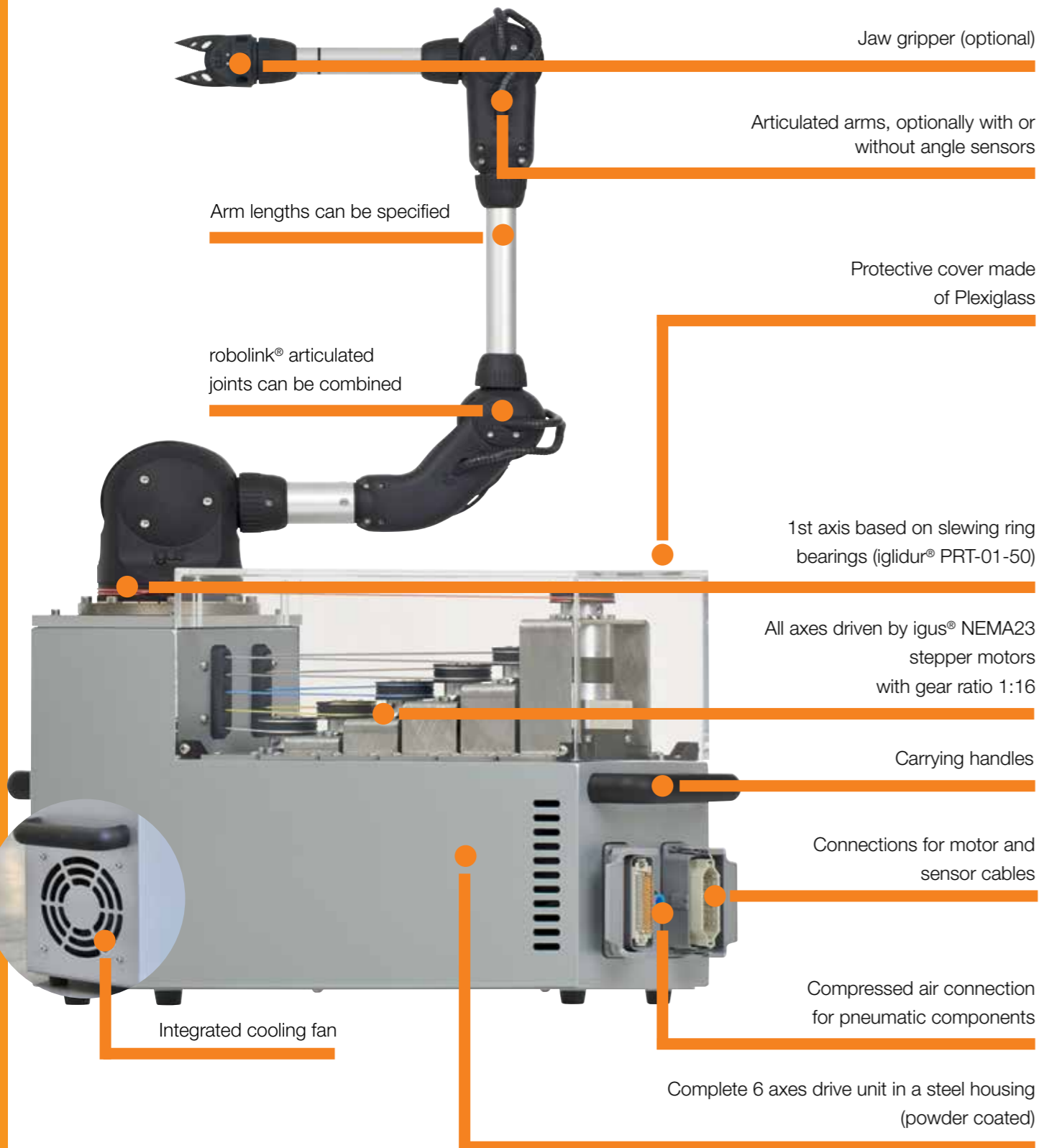
Part number	for Motor	dT	h1	h2	l1	l2	l3	l4	Prices [€]
									1 piece
RL-T10201-DU1517	NEMA 17	26	240	197,5	530	410	75	32.5	from 4,118.10
RL-T10201-E-DU1517	NEMA 17	26	240	197,5	530	410	75	32.5	from 5,012.10
RL-T10201-DU1523	NEMA 23	26	275	235	600	480	85	35	from 4,454.10
RL-T10201-E-DU1523	NEMA 23	26	275	235	600	480	85	35	from 5,348.10

More information about igus® stepper motors  
▶ from page 20

**Delivery time** 5-10 days

# NEW robolink® Components | Drive unit

## 6 DOF drive unit



**Cables:**  
Motor and sensor cables available from stock

**Connector:**  
2 versions available:  
Socket/plug and socket/open



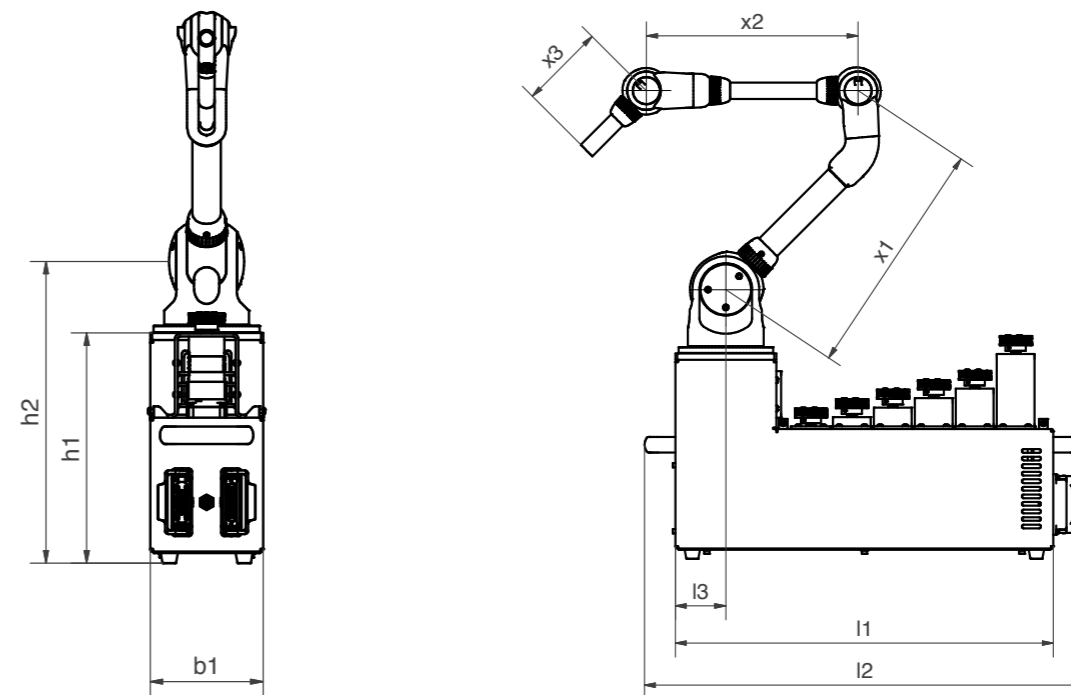
**i** More information about igus® stepper motors ► from page 20

# NEW robolink® Components | Drive unit

## Cables

	Motor cable socket/plug	Motor cable socket/open	Sensor cable socket/plug	Sensor cable socket/open
<b>Part number</b>	RL-CB13-CAB-MOT-01	RL-CB13-CAB-MOT-02	RL-CB13-CAB-SENS-01	RL-CB13-CAB-SENS-02
<b>Cable type</b>	3 m	3 m	3 m	3 m
<b>Number of cables / cross section</b>	igus® CF130.05.25.UL	igus® CF130.05.25.UL	igus® CF2.01.48	igus® CF2.01.48
<b>Connector Housing</b>	25 x 0,5 mm <sup>2</sup>	25 x 0,5 mm <sup>2</sup>	48 x 0,15 mm <sup>2</sup>	48 x 0,15 mm <sup>2</sup>
<b>Connector</b>	Harting Han 16 A	Harting Han 16 A	Harting Han 16 A	Harting Han 16 A
<b>Free cable end</b>	Harting Han 25 D	Harting Han 25 D	D-Sub 50 pol	D-Sub 50 pol
<b>Socket</b>	Harting Han 25 D	Free cable end	D-Sub 50 pol	Free cable end
<b>Price in € / piece</b>	130.31	101.50	202.37	170.91

## 6 DOF drive unit



### Dimensions [mm]

Part number	Description	b1	h1	h2	l1	l2	l3	Standard arm leghth			1 piece
								x1*	x2*	x3*	
RL-B10201-DU3623L	without angle sensors	160	326	427	600	698	80	280	236	134	from 5,846.40
RL-B10201-E-DU3623L	with angle sensors	160	326	427	600	698	80	280	236	134	from 6,992.40

\* Standard tube length = 100 mm; other lengths available

### Prices [€]



**Delivery time**  
Cables: from stock  
Complete drive unit: 5 - 10 days

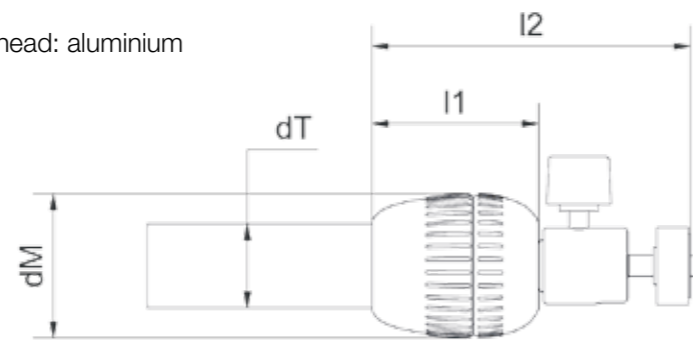
Camera adapter with or without ball head



Universal adapter for cameras on roboLink® arms

With standard ball and socket joint to connect with camera thread 1/4" UNC, with cable feedthrough for camera cable or power supply. Cables can be fed through the articulated arm.

- Weight with ball head: 100 g
- Weight without ball head: 50 g
- Material: Fine grade polyamide PA2200, ball head: aluminium

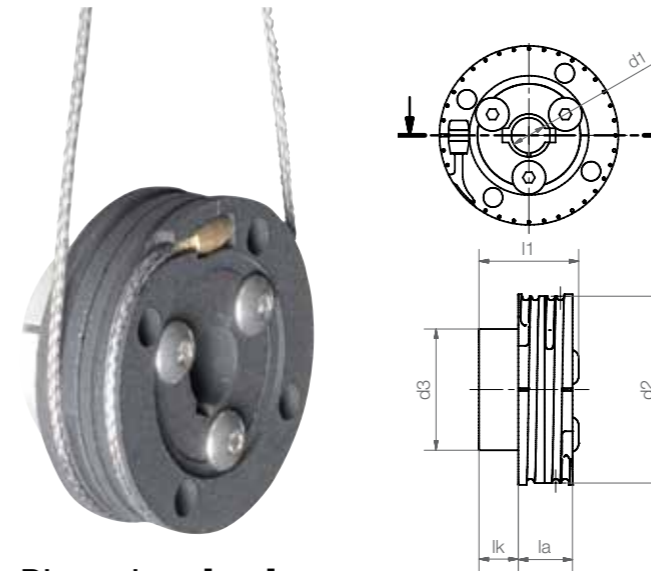


Dimensions [mm]

Part number	Description	l1	l2	dT	dM	Prices [€]		
						1-9 piece	10-24 piece	25-49 piece
RL-50-CAD01	with ball head	51.5	98.5	26	45	123.60	103.82	92.70
RL-50-CAD02	without ball head	51.5	98.5	26	45	69.20	58.13	51.90

Delivery time from stock

Drive systems for roboLink®



Tensile roboLink® drive wheel

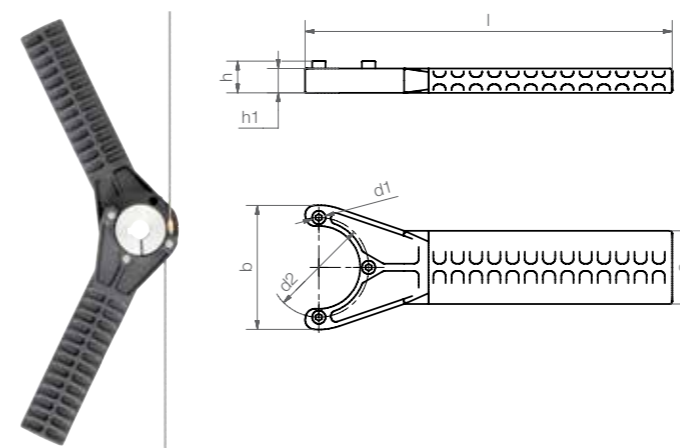
- Split design
- Easy-tensioning of the drive wires
- Releasing and clamping with hexagon socket
- Can be used with optional igus® clamping tool

Dimensions [mm]

Part number	d1	d2	d3	l1	lA	lK	Prices [€]			
							1-9 piece	10-24 piece	25-50 piece	> 50 piece
RL-ZA011-0250-05	5	50	32	26.7	14.5	11	68.85	57.38	45.90	
RL-ZA011-0250-06	6	50	32	26.7	14.5	11	68.85	57.38	45.90	
RL-ZA011-0250-08	8	50	32	26.7	14.5	11	68.85	57.38	45.90	
RL-ZA011-0250-08PFN*	8	50	32	26.7	14.5	11	68.85	57.38	45.90	on request
RL-ZA011-0250-10	10	50	32	26.7	14.5	11	68.85	57.38	45.90	
RL-ZA011-0250-10PFN*	10	50	32	26.7	14.5	11	68.85	57.38	45.90	
RL-ZA011-0250-12	12	50	32	26.7	14.5	11	68.85	57.38	45.90	
RL-ZA011-0250-12PFN*	12	50	32	26.7	14.5	11	68.85	57.38	45.90	

\* with feather key groove DIN 6885

Clamping tool



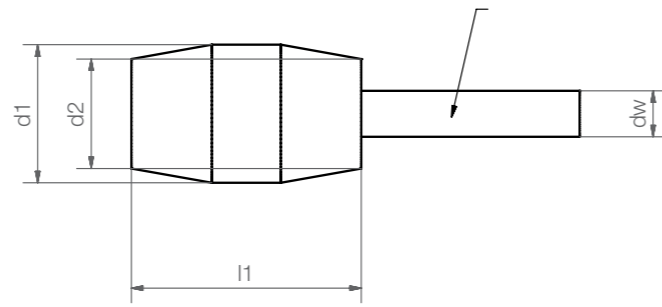
- Easy rope tensioning
- For split drive wheel RL-ZA011-0250
- Material: PA2200 / VA

Dimensions [mm]

Part number	l	h	h1	a	b	d1	d2	Prices [€]			
								1-9 piece	10-24 piece	25-50 piece	> 50 piece
RL-ZA011-0250-CLMPT	150.6	13	10	30	51	5.5	41	58.80	48.75	39.20	on request



Draw-wire technology for robolink®



robolink® wire end bottom

- Material: brass

1) Wire end

Part number	d1 [mm]	d2 [mm]	dw [mm]	l1 [mm]	Prices [€]			
					1-9 piece	10-24 piece	25-50 piece	> 50 piece
RL-SD02-SN01	6	4.8	2.0	10	2.95	2.50	2.00	on request

2) Dyneema wire

Part number	Colour	Prices [€]	
		Prices for 1 piece	
		€/m	
RL-SD02-01*	carbon-grey	0.80	

\* -xxx = length in mm, max. 10,000 mm (other lengths and colours on request)

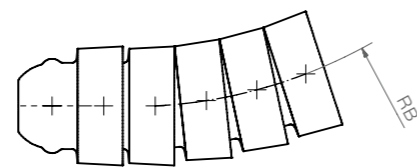
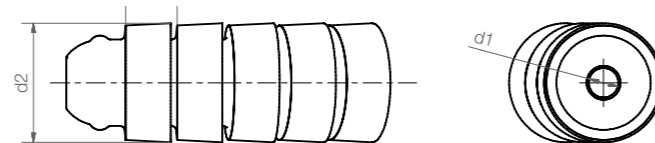
Drive systems for robolink®



robolink® bowden cable

Tear-resistant drive rope (3800 N) with Dyneema® rope

- Outer draw segments (RN54)
- High flexibility
- High axial load capacity
- Bending radius: 33 mm
- Weather-resistant



Dimensions [mm]

Part number	d1	d2	l1	RB	Price [€]
					1 €/m
RL-SD02-BZ01*	2.0	8	3.5	33	62.50

\* -xxx = length in mm, without wire



Tubes made of aluminium, GFRP or CFRP



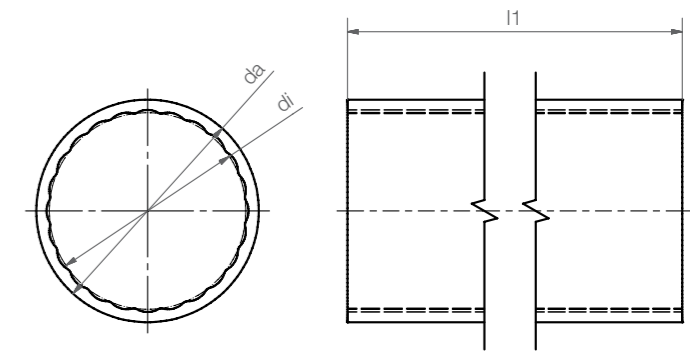
robolink® connecting tubes d26

- Length as required
- Inner contour (anti-twist device)
- Feedthrough of ropes and pneumatic hoses, cables
- Corrosion-resistant
- Light weight
- Stable

Dimensions [mm]

Part number	da	di	Weight [g/m]	Prices [€]
				1 €/m
RL-TAL-26-xxx*	26	23	270	42.00
RL-TGF-26-xxx*	26	23	200	228.00
RL-TCF-26-xxx*	26	23	170	378.00

\* -xxx = length (l1) in mm, max. 1,000 mm (other lengths on request)

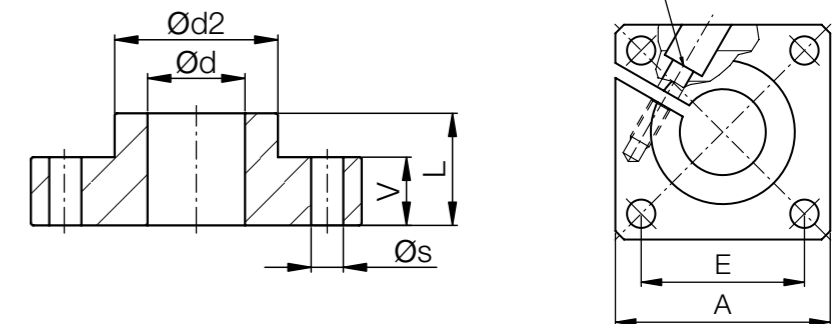


Mounting technology for robolink®



robolink® flange shaft support

- Material: Aluminium
- Connection to drive housing



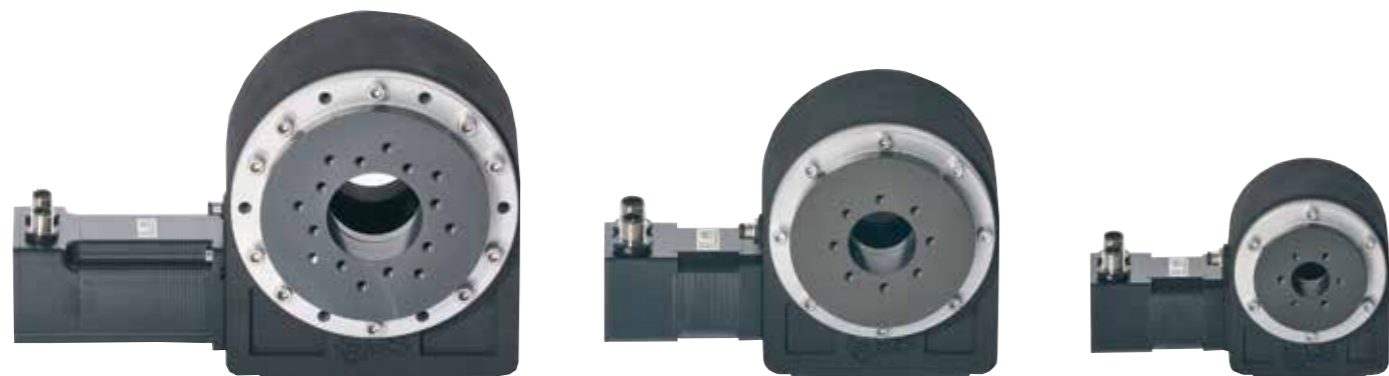
Dimensions [mm]

Part number	Ø d	A	L	Ø d2	E	Ø s	V	SW	Weight [g]	Prices [€]			
										1-9 piece	10-24 piece	25-49 piece	> 50 piece
RL-TWAF-26	26	60	25	42.0	42 ± 0.15	6.6	16	5	150	30.71	28.50	27.14	on request



## robolink® D joints

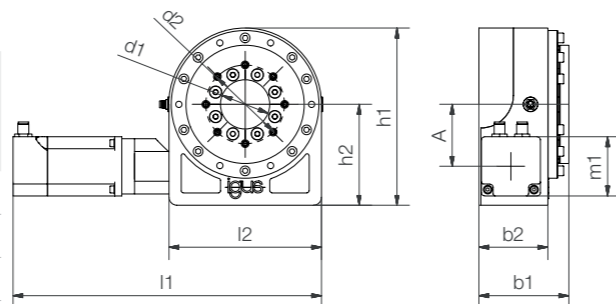
robolink® D articulated joints are motor-driven slewing ring bearings (iglidur® PRT) in a plastic housing. The main component is a worm gear. The center hole remains free for feeding cables etc through. The articulated joints can be ordered with or without motor. We currently offer igus® stepper motors as standard. Other motors will be available in future. The robolink® D articulated joints are available in 3 sizes.



### Technical data

Part number	Based on	Worm gear ratio	igus®-stepper motor* (optional)
RL-D-20-001	PRT-01-20	38:1	NEMA17 with encoder
RL-D-30-001	PRT-01-30	50:1	NEMA17 with encoder
RL-D-50-001	PRT-01-50	48:1	NEMA23XL with encoder

\* More information about igus® stepper motors ► from page 20



### Articulated joints without motor - Dimensions [mm]

Part number	d1	d2	h1	h2	l2	b1	b2	A	weight [g]	1 piece
RL-D-20-001	20	31	103	60	86	66,5	50	31	380	397,50
RL-D-30-001	30	42,5	128	75	106	69	50	40	600	496,00
RL-D-50-001	50	80	178	100	156	91	70	63	1720	895,00

### Prices [€]

### Articulated joints with igus® stepper motors and encoder and INI-Kit – Dimensions [mm]

Part number	d1	d2	h1	h2	l1	l2	b1	b2	A	weight [g]	1 piece
RL-D-20-001-MOT17-E	20	31	103	60	195	86	66,5	50	31	950	671,00
RL-D-30-001-MOT17-E	30	42,5	128	75	215	106	69	50	40	1170	773,00
RL-D-50-001-MOT23XL-E	50	80	178	100	314	156	91	70	63	3490	1277,00

### Prices [€]



**Delivery time**  
Single joint: 5 days  
Articulated arm: 5 - 10 days



**More information about iglidur® PRT slewing ring bearings**  
► [www.igus.eu/prt](http://www.igus.eu/prt)

## Articulated arm with direct drive



robolink® D joints (available in 3 sizes)

Low weight and low costs: igus®-triflex® R e-chain® (TRL.30.050.0)

All axes driven by igus® NEMA23XL or NEMA17 stepper motors

Based on slewing ring bearings (iglidur® PRT) in a plastic housing with integrated worm gear

Arm lengths can be specified



It's possible to use the individual articulated joints as a construction kit to make an articulated arm with up to 6 degrees of freedom. In addition to the individual articulated joints, different connection elements (made of plastic) and connection tubes (made of aluminium) are also available. The pictures show two possible combinations (4 and 6 DOF).

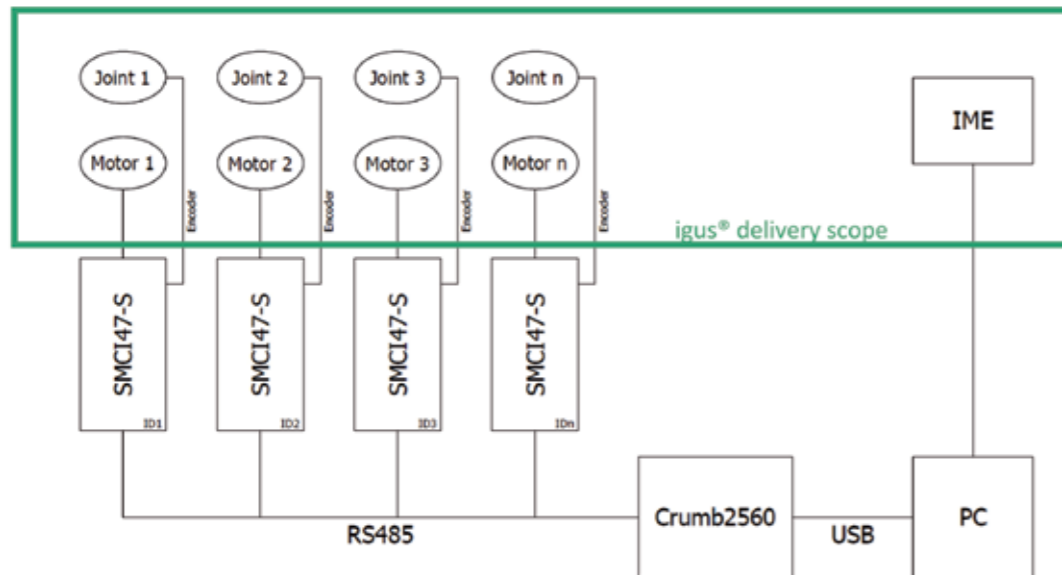




**Open source software for the roboLink® joint construction kit**

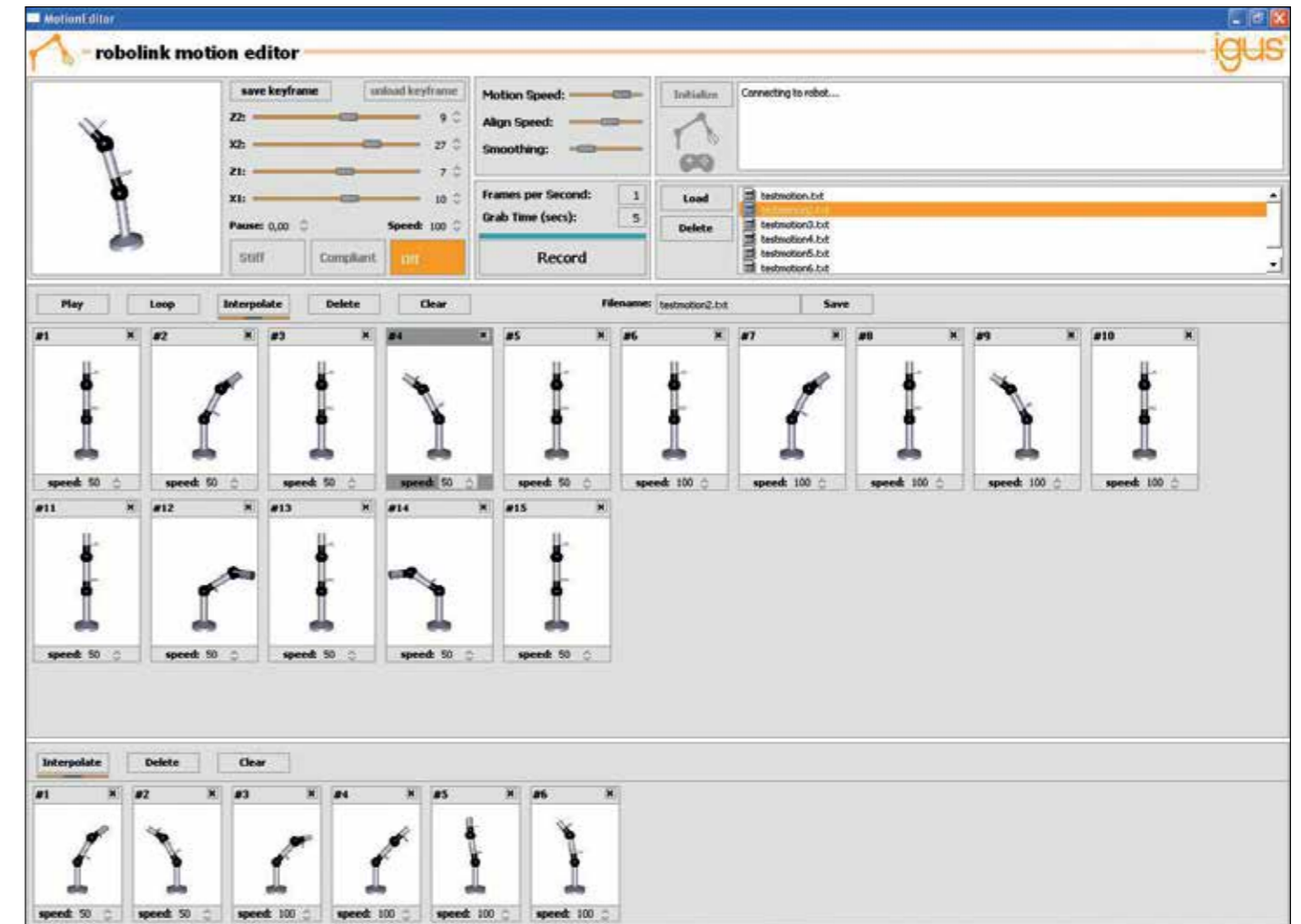
You can use our roboLink® construction kit to freely and easily, freely and individually implement your ideas and concepts, be it with 1, 2, 3, 4, 5 or 6 axes.

- Free of charge
- Intuitive programming
- For all versions of articulated arms, 1-6 DOF
- Simple control software



**Hardware configuration:**

Stepper motor control - NANOTEC SMCI47-S2, memory-chip Crumb2560 ATmega USB module.



**roboLink® software for programming articulated arms: IME (igus® motion editor)**

For controlling roboLinkR articulated arms there are a large number of possibilities. igusR stepper motors are usually controlled using stepper motor cards. Additionally a higher level control is required to coordinate the axes. igus® has developed easy, intuitive control software, which allows the programming of articulated arms (1-6 DOF).

Simple control software: Free of charge, open source:

► [www.igus.eu/roboLink/software](http://www.igus.eu/roboLink/software)



More information about software also online in roboLink® BLOG

► [www.igus.eu/roboLink/blog](http://www.igus.eu/roboLink/blog)



## System examples without angle sensor Prices [€]

DOF	Part number	Components	1-9 Piece	10-24 Piece	25-49 Piece	> 50 Piece
2	RL-T1P1	TL1 - PL1	679.00	571.00	510.00	on request
3	RL-P1P1P1	PL1 - PL1 - PL1	1,275.00	1,071.00	957.00	on request
3	RL-T101	TL1 -001	845.00	710.00	634.00	on request
3	RL-B1P1	BL1 - PL1	1,327.00	1,115.00	995.00	on request
4	RL-0101	001 - 001	1,134.00	953.00	851.00	on request
4	RL-B103	BL1 - 003	1,583.00	1,330.00	1,187.00	on request
4	RL-T1P1P1P1	TL1 - PL1 - PL1 - PL1	1,625.00	1,365.00	1,219.00	on request
5	RL-T101P1P1	TL1 - 001 - PL1 - PL1	1,791.00	1,505.00	1,344.00	on request
5	RL-B101P1	BL1 - 001 - PL1	1,956.00	1,643.00	1,467.00	on request
6	RL-B10101	BL1 - 001 - 001	2,122.00	1,782.00	1,592.00	on request
6	RL-B10301	BL1 - 003 - 001	2,212.00	1,858.00	1,659.00	on request

## System examples with angle sensor Prices [€]

DOF	Part number	Components	1-9 Piece	10-24 Piece	25-49 Piece	> 50 Piece
2	RL-T1P1-E	TL1 - PL1	963.00	809.00	723.00	on request
3	RL-P1P1P1-E	PL1 - PL1 - PL1	1,701.00	1,429.00	1,276.00	on request
3	RL-T101-E	TL1 - 001	1,363.00	1,145.00	1,023.00	on request
3	RL-B1P1-E	BL1 - PL1	1,845.00	1,550.00	1,384.00	on request
4	RL-0101-E	001 - 001	1,886.00	1,585.00	1,415.00	on request
4	RL-B103-E	BL1 - 003	2,305.00	1,936.00	1,729.00	on request
4	RRL-T1P1P1P1-E	TL1 - PL1 - PL1 - PL1	2,193.00	1,843.00	1,645.00	on request
5	RL-T101P1P1-E	TL1 - 001 - PL1 - PL1	2,593.00	2,179.00	1,945.00	on request
5	RL-B101P1-E	BL1 - 001 - PL1	2,851.00	2,395.00	2,138.00	on request
6	RL-B10101-E	BL1 - 001 - 001	3,250.00	2,730.00	2,438.00	on request
6	RL-B10301-E	BL1 - 003 - 001	3,340.00	2,806.00	2,505.00	on request

 Other robolink® systems prices on request. Please call us.

# General Conditions of Sale and Delivery of igus® GmbH (hereinafter called igus) as of March 2003

### I. Scope

The following conditions apply only to dealers, if the contract concerns the operation of their commercial enterprise, legal persons under public law and public special funds.

### II. Application

Orders only become binding with the acceptance of the order by igus. Alterations and additions must be made in writing. All offers are without engagement in so far as they are not described as firm offers. In the case of continuous business relations, these conditions also apply to future transactions which do not refer explicitly to them in so far as the conditions have been received by the customer for an earlier order accepted by igus. If the customer has differing conditions of purchase these obligate igus only if they have been explicitly accepted by igus. Should individual conditions be or become ineffective, the other conditions remain unaffected by this.

### III. Prices

The prices are ex works exclusive of freight, customs duty, ancillary import charges and packaging plus the respectively prevailing value added tax, in so far as nothing else has been agreed upon. igus is not bound to previous prices in the case of new orders (= follow-up orders).

### IV. Obligation to Deliver and Obligation to Take Delivery

Terms of delivery begin after the following have been received: all documents necessary for carrying out the order, the advance payment and the on-time supply of materials, in so far as these were agreed upon. If, through no fault of igus, it becomes impossible to ship the goods, the delivery deadline is regarded as having been met when notification is given that the goods are ready to be shipped. If an agreed delivery deadline is not met due to the fault of igus, the customer is, in so far as igus has not acted in a grossly negligent or wilful manner, entitled after expiry of an adequate period of grace and under exclusion of further claims to demand compensation for delayed performance or to cancel the contract if the customer has indicated the rejection of the performance in writing when fixing the period of grace. The compensation for delayed performance is limited to a maximum of 5% of that part of the delivery which has not been carried out according to the contract. In the case of blanket orders without an agreement regarding the term, size of the manufacturing lot and appointed times to take delivery, igus can, at the latest three months after the order has been accepted, demand that these are fixed in a binding manner. If the customer does not meet this demand within three weeks, igus is entitled to fix a two-week period of grace and to cancel the contract after this period has expired or to refuse to deliver and to claim damages. If the customer does not fulfil his obligation to take delivery, igus is, without affecting other rights, not bound to the provisions concerning the self-help sale but can sell the delivery item by private contract after having notified the customer. For igus to take back a delivery item out of good will, the item must be returned in good order and condition, in its original packaging and must be delivered with freight prepaid after a date has been appointed. igus is entitled to charge a reasonable amount for the costs it incurs through taking back the item. Acts of God entitle igus to postpone delivery by the length of the hindrance and a reasonable start-up period or, due to the part of the contract not yet fulfilled, to cancel the contract in part or completely. Strikes, lockouts or unforeseeable circumstances, e.g. plant interruptions, which make it impossible for igus, despite reasonable efforts, to deliver on time, are equivalent to acts of God; igus must furnish proof in such cases. This also applies when the above-named hindrances occur during a delayed performance or occur to a subcontractor. The customer can call upon igus to declare within two weeks whether it wishes to cancel the contract or deliver within a reasonable period of grace. If igus does not provide this declaration, the customer can cancel the part of the contract which has not been fulfilled. igus will notify the customer without delay if an act of God occurs. It must keep the disturbances caused to the customer to a minimum.

### V. Packaging, Shipment, Passage of Risk

In so far as nothing else has been agreed upon, igus selects packaging, type of shipment and shipping route according to its own best judgment. The risk passes to the customer when the delivery item leaves the igus factory, even with a freight prepaid delivery. If there is delay in shipping the item and the customer is responsible for this delay, the risk passes to the customer when he is notified that the item is ready for shipping. At the written request of the customer, the goods can be insured at the customer's cost against damage during storage, damage through breakage, damage during transport and damage due to fire.

### VI. Reservation of Ownership

The deliveries remain the property of igus until all claims which igus has on the customer have been satisfied, including when the purchase price for specifically designated claims has been paid; in the case of a current account, the reservation of ownership of the deliveries (conditional goods) acts as cover for igus's invoice balance. If igus sets up a liability under a bill of exchange in connection with the payment of the purchase price, the reservation of ownership does not terminate until the bill of exchange has been paid by the customer as drawee. Working or processing of the goods by the customer is carried out under exclusion of the acquisition of ownership under § 950 German Civil Code (Bürgerliches Gesetzbuch, BGB); igus becomes, in accordance with the relationship of the net invoice value of its goods to the net invoice value of the worked or processed goods, co-owner of the item which has come into being in this way and which serves as conditional goods to safeguard igus's claims. If the item is processed, combined or mixed with other goods which do not belong to igus, the provisions of §§ 947, 948 German Civil Code apply with the result that igus's share of the co-ownership of the new item is now regarded as conditional goods according to these provisions. The customer is only permitted to resell the conditional goods in normal business on the condition that he also agrees upon a reservation of ownership with his customers in accordance with the above provisions. The customer is not entitled to dispose of the conditional goods in any other way, particularly through pledging or the transfer of ownership as security. If the goods have been resold the customer herewith assigns to igus all debt claims and other claims on his customers which result from the resale and all ancillary rights until such time as all igus's claims have been satisfied. On igus's demand, the customer is obliged to give igus all information and documents which are necessary to assert igus's rights over the customer's customers. If the conditional goods are resold after processing, in accordance with the above provisions, together with other goods which do not belong to igus, the purchase money claim, in accordance with the above provision, is assigned to igus only to the extent of the invoice value of igus's conditional goods. If the value of the securities existing for igus exceed igus's total claims by more than 10%, igus is, on the customer's demand, obliged to release securities at igus's option to this extent. Attachments and seizures of the conditional goods by a third party must be reported to igus without delay. Action costs resulting from this are carried by the customer in every case in so far as they are not to be carried by a third party. If igus, in accordance with the above provisions, makes use of its reservation of ownership by taking back the conditional goods, igus is entitled to sell the goods by private contract. The conditional goods are taken back at the price of the proceeds gained, at the most, however, at the price of the agreed delivery prices. Further claims to damages, particularly lost profits, remain unaffected.

### VII. Warranty and Liability for Defects

The reference samples are binding for the quality and specification of the products; at the request of the customer, these reference samples can be presented by igus for testing. The warranty of certain qualities of the delivery item and for the performances of moulds must be made in writing in the order acceptance. The reference to standard technical specifications serves to describe the performance. If igus has advised the customer outside the contractual performance, it is liable for the operability and suitability of the delivery item only with explicit written assurance of this. The state of technology at the time the order is accepted is decisive. Complaints must be made in writing without delay, at the latest two weeks after receipt of the delivery. In the case of hidden defects, complaints must be made immediately after such defects have been ascertained. In both cases all claims due to defects lapse, in so far as nothing else has been agreed upon, twelve months after passage of risk. Insofar as the law, under §§ 438 paragraph 1 no. 2 German Civil Code, 479 paragraph 1 German Civil Code, 634 paragraph 1 no. 2 German Civil Code, makes longer periods of limitation mandatory, these longer periods apply. In the case of justified complaints – whereby the reference samples released in writing by the customer are binding for the quality and specification – igus is obliged to supplement its performance. If igus does not fulfil these obligations within a reasonable period, or if a repeated attempt to rectify the defects fails, the customer is entitled to demand reduction of purchase price or to rescind the contract. Further claims, in particular claims for reimbursement of expenses or damages due to harm caused by a defect or consequential harm caused by a defect, only exist with regard to the regulations under VIII. At igus's request replaced parts must be sent back to igus postage not prepaid. The customer's own reworking or improper use of the goods result in the loss of all claims for defects. The customer is entitled to rework the goods and demand compensation for reasonable costs only to prevent unreasonably high damage or when there is a delay by igus in rectifying the defects, and then only after igus has been notified. Wear and tear through use in conformity with the contract do not result in warranty claims. Claims under a right of recourse, in accordance with §§ 478, 479 German Civil Code, only exist insofar as the consumer was justified in availing himself of these claims and only to the extent laid down in the law. Such claims do not, however, exist in the case of liberal settlements agreed upon with igus. A prerequisite for the existence of claims under a right of recourse is that the person entitled to recourse observes his own obligations, in particular the requirement to give notice of defects.

### VIII. General Limitations of Liability

In all cases in which igus is obliged, by way of derogation from the above provisions, to pay damages on account of contractual or legal subject-matters, igus is only liable in so far as it, its managerial employees or assistants can be charged with having acted wilfully or with gross negligence or with having injured life, body or health. The liability without fault under the Law pertaining to Product Liability and liability for the performance of a guarantee of quality remain unaffected. Liability for culpable violation of essential contractual duties also remains unaffected; however, liability in this respect is limited to the foreseeable, typical damages except for the cases named on p. 1. The above regulations do not result in the burden of proof being changed to the disadvantage of the customer.

### IX. Terms of Payment

All payments are to be made exclusively to igus. In so far as nothing else has been agreed upon, the purchase price for deliveries or other performances must be paid with a 2% cash discount within 14 days or without discount within 30 days of the invoice date. A prerequisite for the granting of a cash discount is that all undisputed invoices payable on an earlier date have been settled. No cash discount is granted for payments with bills of exchange. If the agreed payment date is exceeded, interest will be charged at eight percentage points above the respective base interest rate in so far as igus does not prove that it must pay a higher interest rate. The right to refuse checks or bills of exchange is reserved. Checks and eligible bills are only accepted on account of performance, all costs connected with these are carried by the customer. The customer can only offset debt or assert a right of retention when his claims have been found to be undisputed or legally effective. If terms of payment are not observed or circumstances arise which justify serious doubts about the credit worthiness of the customer, all igus's claims on the customer become immediately payable. igus is furthermore entitled to demand advance payments for outstanding deliveries and, after a suitable period of grace, to cancel the contract or demand damages for failure of performance, and also to prohibit the customer from reselling the goods and, at the customer's cost, to take back goods which have not yet been paid for.

### X. Sampling

The costs for one-time sampling do not contain the costs for test and machining equipment or changes caused to be made by the customer. Costs for further sampling which are igus's responsibility, are carried by igus. In so far as nothing else has been agreed upon, igus is and remains owner of the moulds manufactured for the customer by igus itself or by a third party commissioned by igus. Moulds are only used for the customer's orders if the customer fulfils his obligations to pay and to take delivery. igus is obliged to replace these moulds at no cost only if this is necessary to fulfil an output quantity which the customer has been assured.

### XI. Supply of Materials

If materials are delivered by the customer they must be delivered on time in good order and condition at the customer's cost and risk and with a reasonable quantity bonus of at least 5%. If these prerequisites are not met the delivery time is extended by a reasonable amount. Except in the case of acts of God, the customer carries the additional costs which arise, including those incurred through manufacturing interruptions.

### XII. Industrial Property Rights

If igus has to deliver based on drawings, models, samples or using parts supplied by the customer, the customer is responsible for ensuring that the industrial property rights of third parties are not contravened by this. The customer must indemnify igus against claims of third parties and compensate damages which have occurred. If igus is prohibited from manufacturing or delivering by a third party with reference to a protective right belonging to this third party, igus is entitled, without examining the legal status, to stop the work. Drawings and samples given to igus which have not led to an order, will be sent back on request; otherwise igus is entitled to destroy them three months after the offer has been submitted. igus is entitled to copyrights and, if applicable, industrial property rights regarding models, moulds, equipment, designs and drawings drawn up by igus or by a third party under commission to igus.

### XIII. Place of Fulfilment and Place of Jurisdiction

igus's registered office is the place of fulfilment. The place of jurisdiction may be, at igus's option, igus's registered office or the customer's registered office; this also applies to legal proceedings regarding legal documents, bills of exchange and checks. Only German law is applicable. UN Sales Law is excluded.

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