Precision Drive Systems

maxon

Modular integrated Robot Joint

High torque and low cogging for excellent performance

如有问题请联系
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202208 V2

Robot Joint Overview

High performance

Compact

Easy to use

Introduction

maxon's compact EC frameless motors combined with an EPOS4 positioning controller delivers a highly dynamic, powerful drive package with field-oriented control (FOC), high efficiency, and maintenance-free components in a high-quality industrial housing. High torque and low cogging effect provide excellent performance. Zero backlash gearhead in combination with a double feedback system allows for excellent positioning movements. To ensure safety during operation a brake system can be added.

Design of the Robot Joint

The compact modular design of the robot joint series is optimal for performance and size. Various options are available such as a hollow shaft, torque sensor, brake and electronics.

Positioning Controller (Optional)

The next generation of positioning controllers offer impressively superior dynamics and outstanding power density. The modular design opens up a wide range of opportunities regarding communication and feedback encoders. The CANopen and EtherCAT field buses, as well as the adjustable digital and analog inputs and outputs, are matched optimally to the various functions and operating modes of the CiA-402 device profile. In addition to the intuitive commissioning software, there are libraries available free of charge for integration into a wide variety of master systems. With the graphic user interface of the EPOS Studio, the configurable drive system automatically searches for ideal control parameters (auto tuning) and is ready for use at the press of a button.

Commissioning

maxon preconfigures the robot joints before shipping. Motor, encoder, and brake parameters are stored on the positioning controller at the factory. For commissioning at the customer site, maxon provides the auto tuning function via the EPOS Studio. This reduces the installation time dramatically.

Gearhead

The customized zero backlash gearhead with its high position accuracy and zero backlash can achieve high precision and optimal position control. Various gearhead ratios can be selected.

Brake (Optional)

The drive can be combined with an optional holding brake; this increases the length of the drive. The brake is active when disconnected from power. It is a holding brake, which is not suitable for deceleration. The brake is controlled by the integrated controller.

Encoders

The Robot Joint series has two integrated encoders. The two different encoder signals can be evaluated simultaneously. This allows for dual-loop control which can be tuned automatically to compensate for mechanical backlash and elasticity.

Torque Sensor (Optional)

The torque sensor can be used to measure torque at the output shaft of the robotic joint.

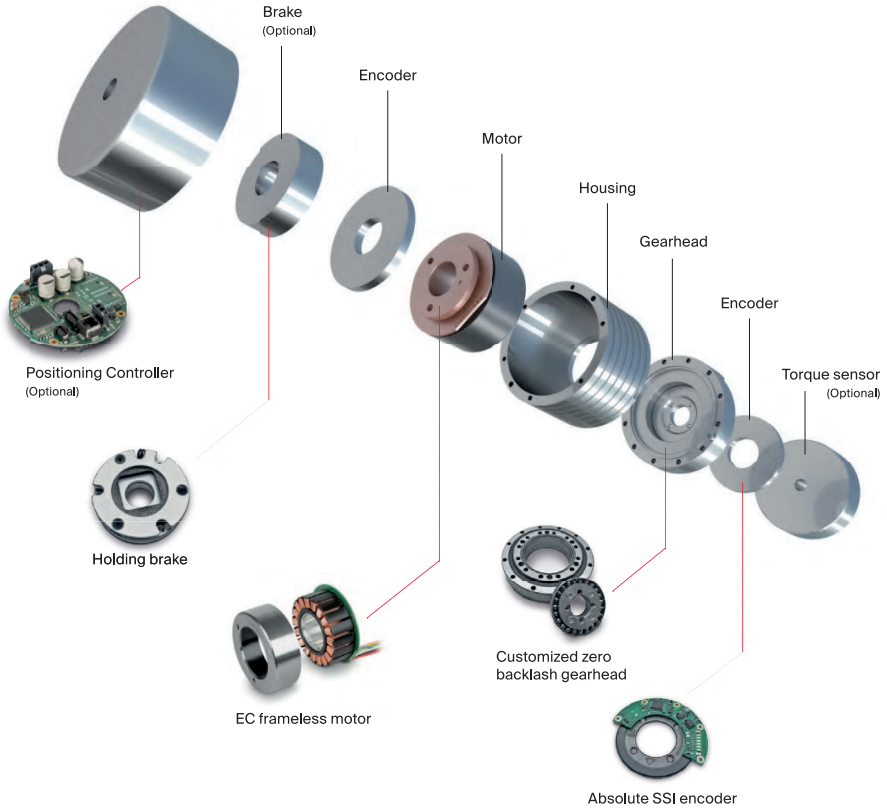
Robot Joint Selection

maxon Robot Joints are integrated systems and can be build according to the customer requirements. The base joints on the following pages are containing motor, gearheads, brake, hollow shaft and double feedback system. An optional position controller and torque sensor can be added. Detailed dimensional drawings based on the selected options are available upon request.

Customizations are available.
For details, contact us at:
maxontech.cn@maxonmotor.com

Product components

- → maxon brushless EC frameless motor
- → Customized zero backlash gearhead
- → Double feedback system
- → Brake
- → Positioning Controller
- → Torque sensor
- → Hollow shaft



High torque and low cogging effect provide excellent performance.

Zero backlash gearhead in combination with a double feedback system allows for excellent positioning movements.

Ordering information

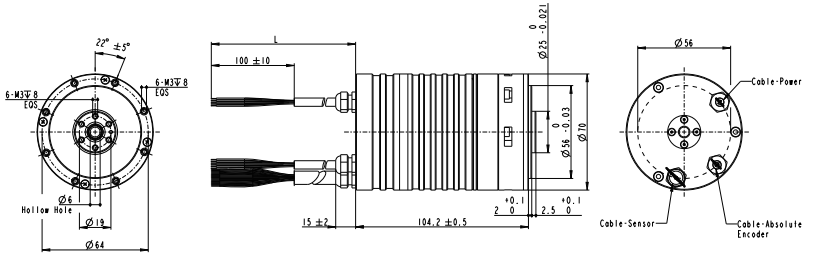
RJ □ - □ - □ - □ - □ - □ - □ - □ - □ - □ - (SP)

- **Customized**
- **Controller:**
  00：None
  CA：CANopen (only for RJ45,RJ60,RJ90)
  EC：EtherCAT (only for RJ45,RJ60,RJ90)
- **Voltage supply:**
  24：24V　48：48V
- **Electrical connection:**
  00：Cable gland
  01：Controller interface (only for RJ45,RJ60,RJ90)
- **Output type:**
  S0：Step Circle fix
- **Hollow size:**
  00：None
  06：6mm (only for RJ45)
  10：10mm (only for RJ60)
  17：17mm (only for RJ90)
  30：30mm (only for RJ110)
- **Brake:**
  00：None　01：Holding brake
- **Absolute encoder:**
  00：None　19S：Single turn
- **Incremental encoder:**
  500 (only for RJ45)
  2048 (only for RJ45,RJ60,RJ90)
  2880 (only for R110)
- **Ratio:**
  51
  81
  101
  121 (only for RJ60, RJ90)
  161 (only for RJ90)
- **Type:**
  4507
  6010
  9016
  9026
  11050

→ **e.g. RJ6010-101-2048-19S-01-10-S0-00-24-CA**

Robot Joint 45　∅70 mm, 70 Watt

Modular Integrated Robotic Joint



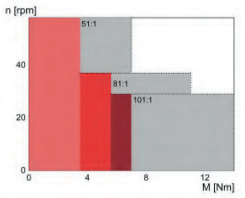
Gear-motor data												
1	Gear Ratio	X:1	51	51	81	81	101	101				
2	Nominal voltage	V	24	48	24	48	24	48				
3	No load speed	rpm	68	49	42	30	34	24				
4	Nominal speed	rpm	58	39	37	24	29	19				
5	Nominal current	A	3.5	1.4	3.5	1.4	3.5	1.4				
6	Maximum current	A	7	2.5	7	2.5	7	2.5				
7	Nominal torque	Nm	3.5	3	5.6	5	7	6.5				
8	Maximum torque	Nm	7	5	11	10	14	13				
9	Torque constant	Nm/A	1.1	2.2	1.7	3.6	2.2	4.6				
10	Thermal time constant winding	s	20	6	20	6	20	6				

Encoder specifications			
11	**Incremental encoder**		
12	Resolution, counts per turn	CPT	500
13	Number of channels		3
14	Maximum frequency	kHz	100
15	Supply voltage	VDC	5±10%
16	Typical supply current	mA	55
17	Output signal		RS422
18	**Absolute encoder**		
19	Steps per turn		524288
20	Resolution (bit single turn)	bit	19
21	Signal protocol		SSI
22	Data encoding		Binary
23	Clock frequency	MHz	0.5…2
24	Timeout (monoflop time)	µs	20
25	Encoder supply voltage	VDC	5±10%
26	Typical supply current	mA	120
27	Output signal		RS422
28	Setup time after power on	ms	60
29	Absolute accuracy	°	±0.06
30	Repeated accuracy	°	±0.008
Other specifications			
31	Hollow shaft	mm	6
32	Weight	kg	1.25
33	Cable length (L)	mm	1000
34	Maximum radial load (dynamic)	N	490
35	Maximum axial load (dynamic)	N	490
36	Storage temperature	°C	-10…70
37	Operating temperature	°C	-10…40
38	Non-condensing humidity	%	0…75
39	Number of Pole pairs		8

Connection				
	Cable-Power			
40	U	Motor winding 1	AWG20	Red
41	V	Motor winding 2	AWG20	Black
42	W	Motor winding 3	AWG20	White
43	Brake+	Brake power supply+	AWG24	Brown
44	Brake-	Brake power supply-	AWG24	Blue
	Cable-Sensor			
45	V_HALL	Hall power supply+	AWG28	Red/White
46	GND_HALL	Hall sensor ground	AWG28	Black/White
47	H1	Hall sensor 1	AWG28	Yellow
48	H2	Hall sensor 2	AWG28	Brown
49	H3	Hall sensor 3	AWG28	Grey
50	V_ENC	Encoder power supply	AWG28	Red
51	GND_ENC	Encoder ground	AWG28	Black
52	CH A	Channel A	AWG28	Green
53	CH A/	Channel A/	AWG28	Green/Black
54	CH B	Channel B	AWG28	Blue
55	CH B/	Channel B/	AWG28	Blue/Black
56	CH I	Channel I	AWG28	Orange
57	CH I/	Channel I/	AWG28	Orange/Black

Optional		
Brake		
Supply voltage	VDC	24±10%
Duty cycle	%	100
Resistance	Ω	35
Reaction time (coupling)	ms	50
Reaction time (opening)	ms	20
Torque sensor		
Torque range	Nm	-20…+20
Instantaneous torque	Nm	60
Power supply	VDC	5
Output voltage	VDC	2.5±2
Bridge resistance nominal	Ω	350
Sensitivity	V/Nm	0.105
Axial force for crosstalk	N	100
Radial force for crosstalk	N	100
Controller		
Operating voltage	VDC	12…60
Continuous output current	A	8
Maximum output current	A	24
Interface		CANopen or EtherCAT
Cable		
Cable length (L)	mm	500, 1500, 2000

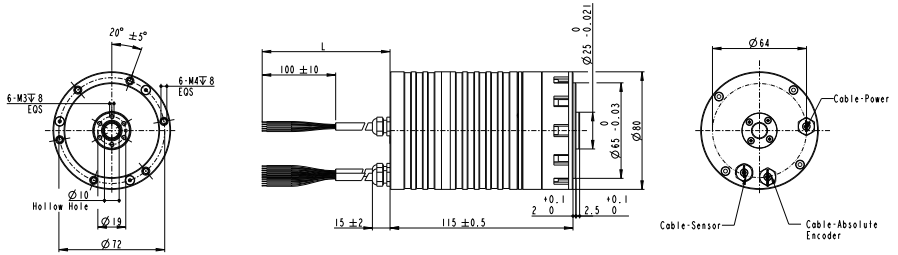
Operating Range



Cable-Magnetic Encoder (Absolute SSI encoder)			
V_ABS	SSI Encoder power supply	AWG28	Red
GND	SSI encoder ground	AWG28	Black
CL+	SSI Clock+	AWG28	Green
CL-	SSI Clock-	AWG28	Yellow
DA+	SSI Data+	AWG28	Brown
DA-	SSI Data-	AWG28	Orange

Robot Joint 60 ∅80 mm, 100 Watt

Modular Integrated Robotic Joint



Gear-motor data												
1	Gear Ratio	X:1	51	51	81	81	101	101	121	121		
2	Nominal voltage	V	24	48	24	48	24	48	24	48		
3	No load speed	rpm	69	69	43	43	35	35	29	29		
4	Nominal speed	rpm	59	59	37	37	30	30	25	25		
5	Nominal current	A	5,5	2,8	5,5	2,8	5,5	2,8	5,5	2,8		
6	Maximum current	A	16.5	8.4	16.5	8.4	16.5	8.4	16.5	8.4		
7	Nominal torque	Nm	8.3	9.1	13	14	17	18	20	22		
8	Maximum torque	Nm	25	27	40	43	50	54	60	65		
9	Torque constant	Nm/A	1.8	3.9	2.9	6.2	3.6	7.7	4.3	9.3		
10	Thermal time constant winding	s	12	12	12	12	12	12	12	12		

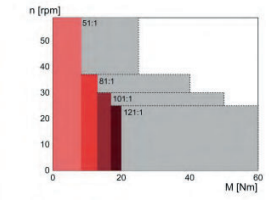
Encoder specifications			
11	**Incremental encoder**		
12	Resolution, counts per turn	CPT	2048
13	Number of channels		3
14	Maximum frequency	kHz	100
15	Supply voltage	VDC	5±10%
16	Typical supply current	mA	55
17	Output signal		RS422
18	**Absolute encoder**		
19	Steps per turn		524288
20	Resolution (bit single turn)	bit	19
21	Signal protocol		SSI
22	Data encoding		Binary
23	Clock frequency	MHz	0.5…2
24	Timeout (monoflop time)	µs	20
25	Encoder supply voltage	VDC	5±10%
26	Typical supply current	mA	120
27	Output signal		RS422
28	Setup time after power on	ms	60
29	Absolute accuracy	°	±0.06
30	Repeated accuracy	°	±0.008

Other specifications			
31	Hollow shaft	mm	10
32	Weight	kg	1,8
33	Cable length (L)	mm	1000
34	Maximum radial load (dynamic)	N	570
35	Maximum axial load (dynamic)	N	570
36	Storage temperature	°C	-10…70
37	Operating temperature	°C	-10…40
38	Non-condensing humidity	%	0…75
39	Number of Pole pairs		7

Optional			
Brake			
Supply voltage		VDC	24±10%
Duty cycle		%	100
Resistance		Ω	35
Reaction time (coupling)		ms	50
Reaction time (opening)		ms	20
Torque sensor			
Torque range		Nm	-100…+100
Instantaneous torque		Nm	300
Power supply		VDC	5
Output voltage		VDC	2.5±2
Bridge resistance nominal		Ω	350
Sensitivity		V/Nm	0.042
Axial force for crosstalk		N	250
Radial force for crosstalk		N	250
Controller			
Operating voltage		VDC	12…60
Continuous output current		A	8
Maximum output current		A	24
Interface			CANopen or EtherCAT
Cable			
Cable length (L)		mm	500, 1500, 2000

Connection				
	Cable-Power			
40	U	Motor winding 1	AWG16	Red
41	V	Motor winding 2	AWG16	Black
42	W	Motor winding 3	AWG16	White
43	Brake+	Brake power supply+	AWG24	Red
44	Brake-	Brake power supply-	AWG24	Black
	Cable-Sensor			
45	V_HALL	Hall sensor power	AWG24	Red/White
46	GND_HALL	Hall sensor ground	AWG24	Black/White
47	H1	Hall sensor 1	AWG24	Yellow
48	H2	Hall sensor 2	AWG24	Brown
49	H3	Hall sensor 3	AWG24	Grey
50	V_ENC	Encoder power supply	AWG24	Red
51	GND_ENC	Encoder ground	AWG24	Black
52	CH A	Channel A	AWG24	Green
53	CH A/	Channel A/	AWG24	Green/Black
54	CH B	Channel B	AWG24	Blue
55	CH B/	Channel B/	AWG24	Blue/Black
56	CH I	Channel Index	AWG24	Orange
57	CH I/	Channel Index/	AWG24	Orange/Black

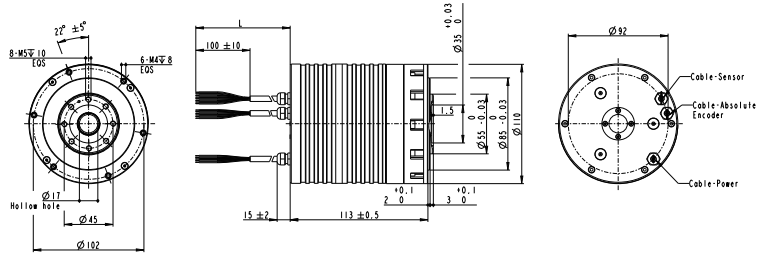
Operating Range



Cable-Absolute encoder			
V_ABS	SSI encoder power	AWG28	Red
GND	SSI encoder ground	AWG28	Black
CL+	SSI Clock+	AWG28	Green
CL-	SSI Clock-	AWG28	Yellow
DA+	SSI Data+	AWG28	Brown
DA-	SSI Data-	AWG28	Orange

Robot Joint 90 ∅110 mm, 160 Watt

Modular Integrated Robotic Joint



Gear-motor data												
1	Gear Ratio	X:1	51	51	81	81	101	101	121	121	161	161
2	Nominal voltage	V	24	48	24	48	24	48	24	48	24	48
3	No load speed	rpm	49	49	31	31	25	25	21	21	16	16
4	Nominal speed	rpm	39	39	25	25	20	20	17	17	12	12
5	Nominal current	A	6	4	6	4	6	4	6	4	6	4
6	Maximum current	A	19	12	19	12	19	12	19	12	19	12
7	Nominal torque	Nm	13	13	21	20	26	26	31	31	41	41
8	Maximum torque	Nm	39	39	62	61	77	77	93	92	123	122
9	Torque constant	Nm/A	2.4	3.8	3.9	6	4.8	7.5	5.8	9	7.7	11.9
10	Thermal time constant winding	s	20	20	20	20	20	20	20	20	20	20

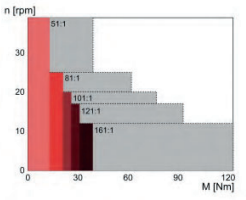
Encoder specifications			
11	**Incremental encoder**		
12	Resolution, counts per turn	CPT	2048
13	Number of channels		3
14	Maximum frequency	kHz	100
15	Supply voltage	VDC	5±10%
16	Typical supply current	mA	55
17	Output signal		RS422
18	**Absolute encoder**		
19	Steps per turn		524288
20	Resolution (bit single turn)	bit	19
21	Signal protocol		SSI
22	Data encoding		Binary
23	Clock frequency	MHz	0.5…2
24	Timeout (monoflop time)	µs	20
25	Encoder supply voltage	VDC	5±10%
26	Typical supply current	mA	120
27	Output signal		RS422
28	Setup time after power on	ms	60
29	Absolute accuracy	°	±0.06
30	Repeated accuracy	°	±0.008

Other specifications			
31	Hollow shaft	mm	17
32	Weight	kg	3
33	Cable length (L)	mm	1000
34	Maximum radial load (dynamic)	N	1400
35	Maximum axial load (dynamic)	N	1400
36	Storage temperature	°C	-10…70
37	Operating temperature	°C	-10…40
38	Non-condensing humidity	%	0…75
39	Number of Pole pairs		11

Optional			
Brake			
Supply voltage		VDC	24±10%
Duty cycle		%	100
Resistance		Ω	35
Reaction time (coupling)		ms	50
Reaction time (opening)		ms	20
Torque sensor			
Torque range		Nm	-150…+150
Instantaneous torque		Nm	450
Power supply		VDC	5
Output voltage		VDC	2.5±2
Bridge resistance nominal		Ω	350
Sensitivity		V/Nm	0.042
Axial force for crosstalk		N	250
Radial force for crosstalk		N	250
Controller			
Operating voltage		VDC	12…60
Continuous output current		A	12
Maximum output current		A	36
Interface			CANopen or EtherCAT
Cable			
Cable length (L)		mm	500, 1500, 2000

Connection				
	Cable-Power			
40	U	Motor winding 1	AWG16	Red
41	V	Motor winding 2	AWG16	Black
42	W	Motor winding 3	AWG16	White
43	Brake+	Brake power supply+	AWG24	Red
44	Brake-	Brake power supply-	AWG24	Black
	Cable-Sensor			
45	V_HALL	Hall sensor power	AWG24	Red/White
46	GND_HALL	Hall sensor ground	AWG24	Black/White
47	H1	Hall sensor 1	AWG24	Yellow
48	H2	Hall sensor 2	AWG24	Brown
49	H3	Hall sensor 3	AWG24	Grey
50	V_ENC	Encoder power supply	AWG24	Red
51	GND_ENC	Encoder ground	AWG24	Black
52	CH A	Channel A	AWG24	Green
53	CH A/	Channel A/	AWG24	Green/Black
54	CH B	Channel B	AWG24	Blue
55	CH B/	Channel B/	AWG24	Blue/Black
56	CH I	Channel Index	AWG24	Orange
57	CH I/	Channel Index/	AWG24	Orange/Black

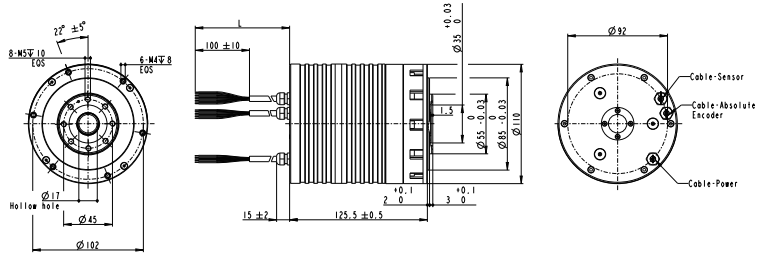
Operating Range



Cable-Magnetic Encoder (Absolute SSI encoder)			
V_ABS	SSI encoder power	AWG28	Red
GND	SSI encoder ground	AWG28	Black
CL+	SSI Clock+	AWG28	Green
CL-	SSI Clock-	AWG28	Yellow
DA+	SSI Data+	AWG28	Brown
DA-	SSI Data-	AWG28	Orange

Robot Joint 90 ∅110 mm, 260 Watt

Modular Integrated Robotic Joint



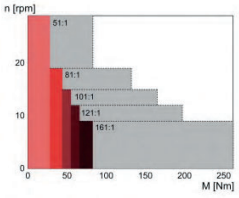
Gear-motor data												
1	Gear Ratio	X:1	51	51	81	81	101	101	121	121	161	161
2	Nominal voltage	V	24	48	24	48	24	48	24	48	24	48
3	No load speed	rpm	31	31	20	20	16	16	13	13	10	10
4	Nominal speed	rpm	29	29	19	19	15	15	12	12	9	9
5	Nominal current	A	12	4.1	12	4.1	12	4.1	12	4.1	12	4.1
6	Maximum current	A	36	12.3	36	12.3	36	12.3	36	12.3	36	12.3
7	Nominal torque	Nm	28	27	44	44	55	54	66	65	87	87
8	Maximum torque	Nm	83	82	132	131	165	163	197	195	262	260
9	Torque constant	Nm/A	2.8	8	4.4	12.8	5.5	15.9	6.6	19	8.7	25.3
10	Thermal time constant winding	s	18	18	18	18	18	18	18	18	18	18

Encoder specifications			
11	**Incremental encoder**		
12	Resolution, counts per turn	CPT	2048
13	Number of channels		3
14	Maximum frequency	kHz	100
15	Supply voltage	VDC	5±10%
16	Typical supply current	mA	55
17	Output signal		RS422
18	**Absolute encoder**		
19	Steps per turn		524288
20	Resolution (bit single turn)	bit	19
21	Signal protocol		SSI
22	Data encoding		Binary
23	Clock frequency	MHz	0.5…2
24	Timeout (monoflop time)	µs	20
25	Encoder supply voltage	VDC	5±10%
26	Typical supply current	mA	120
27	Output signal		RS422
28	Setup time after power on	ms	60
29	Absolute accuracy	°	±0.06
30	Repeated accuracy	°	±0.008

Other specifications			
31	Hollow shaft	mm	17
32	Weight	kg	3.4
33	Cable length (L)	mm	1000
34	Maximum radial load (dynamic)	N	1400
35	Maximum axial load (dynamic)	N	1400
36	Storage temperature	°C	-10…70
37	Operating temperature	°C	-10…40
38	Non-condensing humidity	%	0…75
39	Number of Pole pairs		11

Optional		
Brake		
Supply voltage	VDC	24±10%
Duty cycle	%	100
Resistance	Ω	35
Reaction time (coupling)	ms	50
Reaction time (opening)	ms	20
Torque sensor		
Torque range	Nm	-200…+200
Instantaneous torque	Nm	600
Power supply	VDC	5
Output voltage	VDC	2.5±2
Bridge resistance nominal	Ω	350
Sensitivity	V/Nm	0.042
Axial force for crosstalk	N	250
Radial force for crosstalk	N	250
Controller		
Operating voltage	VDC	12…60
Continuous output current	A	12
Maximum output current	A	36
Interface		CANopen or EtherCAT
Cable		
Cable length (L)	mm	500, 1500, 2000

Operating Range



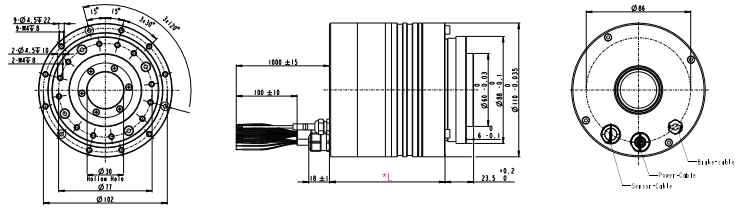
Connection				
	Cable-Power			
40	U	Motor winding 1	AWG16	Red
41	V	Motor winding 2	AWG16	Black
42	W	Motor winding 3	AWG16	White
43	Brake+	Brake power supply+	AWG24	Red
44	Brake-	Brake power supply-	AWG24	Black
	Cable-Sensor			
45	V_HALL	Hall sensor power	AWG24	Red/White
46	GND_HALL	Hall sensor ground	AWG24	Black/White
47	H1	Hall sensor 1	AWG24	Yellow
48	H2	Hall sensor 2	AWG24	Brown
49	H3	Hall sensor 3	AWG24	Grey
50	V_ENC	Encoder power supply	AWG24	Red
51	GND_ENC	Encoder ground	AWG24	Black
52	CH A	Channel A	AWG24	Green
53	CH A/	Channel A/	AWG24	Green/Black
54	CH B	Channel B	AWG24	Blue
55	CH B/	Channel B/	AWG24	Blue/Black
56	CH I	Channel Index	AWG24	Orange
57	CH I/	Channel Index/	AWG24	Orange/Black

Cable-Magnetic Encoder (Absolute SSI encoder)			
V_ABS	SSI encoder power	AWG28	Red
GND	SSI encoder ground	AWG28	Black
CL+	SSI Clock+	AWG28	Green
CL-	SSI Clock-	AWG28	Yellow
DA+	SSI Data+	AWG28	Brown
DA-	SSI Data-	AWG28	Orange

Robot Joint 110 ∅110 mm, 500 Watt

NEW

Modular Integrated Robotic Joint



*L: without brake 70mm; with brake 95mm

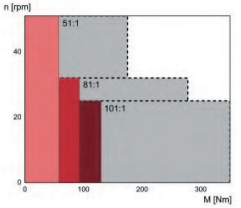
Gear-motor data					
1	Gear Ratio	X:1	51	81	101
2	Nominal voltage	V	24	24	24
3	No load speed	rpm	66	41	33
4	Nominal speed	rpm	51	32	25
5	Nominal current	A	23	23	23
6	Maximum current	A	70	70	70
7	Nominal torque	Nm	58	93	130
8	Maximum torque	Nm	175	278	350
9	Torque constant	Nm/A	2.5	4.0	5.6
10	Thermal time constant winding	s	5.4	5.4	5.4

Encoder specifications			
11	**Incremental encoder**		
12	Resolution, counts per turn	CPT	2880
13	Number of channels		2
14	Maximum frequency	kHz	1200
15	Supply voltage	VDC	5±10%
16	Typical supply current	mA	50
17	Output signal		RS422
18	**Absolute encoder**		
19	Steps per turn		524288
20	Resolution (bit single turn)	bit	19
21	Signal protocol		SSI
22	Data encoding		Binary
23	Clock frequency	MHz	0.5…2
24	Timeout (monoflop time)	µs	20
25	Encoder supply voltage	VDC	5±10%
26	Typical supply current	mA	120
27	Output signal		RS422
28	Setup time after power on	ms	60
29	Absolute accuracy	°	±0.06
30	Repeated accuracy	°	±0.008

Other specifications			
31	Hollow shaft	mm	30
32	Weight	max. kg	3.7
33	Cable length (L)	mm	1000
34	Maximum radial load (dynamic)	N	1600
35	Maximum axial load (dynamic)	N	1600
36	Storage temperature	°C	0…+50
37	Operating temperature	°C	+5…+40
38	Non-condensing humidity	%	0…75
39	Number of Pole pairs		21

Optional		
Brake		
Supply voltage	VDC	24±10%
Duty cycle	%	33
Resistance	Ω	13
Reaction time (coupling)	ms	55
Reaction time (opening)	ms	35
Torque sensor		
Torque range	Nm	TBD
Maximum torque	Nm	TBD
Power supply	VDC	TBD
Output voltage	VDC	TBD
Bridge resistance nominal	Ω	TBD
Sensitivity	V/Nm	TBD
Axial force for crosstalk	N	TBD
Radial force for crosstalk	N	TBD
Controller		
Operating voltage	VDC	TBD
Continuous output current	A	TBD
Maximum output current	A	TBD
Interface		TBD
Cable		
Cable length (L)	mm	500, 1500, 2000
Cable outlet		Radia
Absolute encoder	interface	BISS-C 17bits,19bits

Operating Range



Connection				
	Cable-Power			
40	U	Motor winding 1	AWG14	TBD
41	V	Motor winding 2	AWG14	TBD
42	W	Motor winding 3	AWG14	TBD
	Cable-Sensor			
43	V_HALL	Hall sensor power	AWG24	TBD
44	GND_HALL	Hall sensor ground	AWG24	TBD
45	H1	Hall sensor 1	AWG24	TBD
46	H2	Hall sensor 2	AWG24	TBD
47	H3	Hall sensor 3	AWG24	TBD
48	V_ENC	Encoder power supply	AWG24	TBD
49	GND_ENC	Encoder ground	AWG24	TBD
50	CH A	Channel A	AWG24	TBD
51	CH A/	Channel A/	AWG24	TBD
52	CH B	Channel B	AWG24	TBD
53	CH B/	Channel B/	AWG24	TBD
54	V_ABS	SSI encoder power	AWG24	TBD
55	GND	SSI encoder ground	AWG24	TBD
56	CL+	SSI Clock+	AWG24	TBD
57	CL-	SSI Clock-	AWG24	TBD
58	DA+	SSI Data+	AWG24	TBD
59	DA-	SSI Data-	AWG24	TBD
	Cable-Brake			
	Brake+	Brake power supply+	AWG22	TBD
	Brake-	Brake power supply-	AWG22	TBD