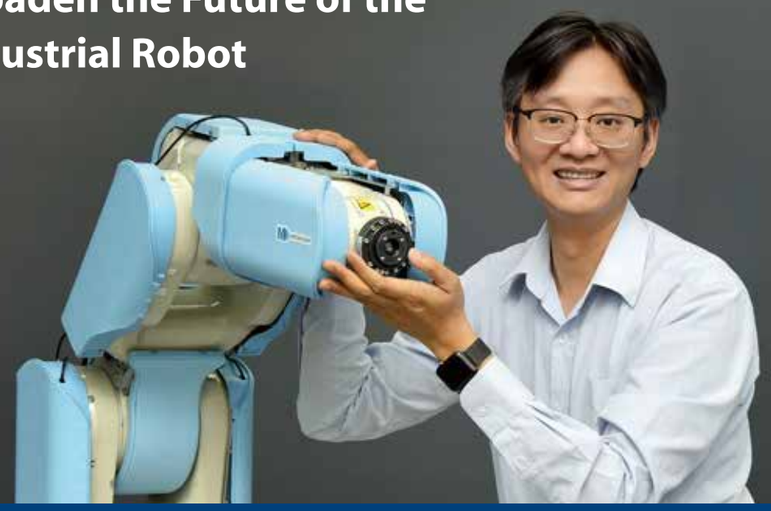
Mechavision 原見精機

Contact Skin

CE

Let Tactile Sensing Technology Broaden the Future of the Industrial Robot



Mechavision Inc.
Chairman Dr. Camus Su

Create a Wonderful World Filled with Human-Robot Collaboration

In the winter of 2009, I received a mission from ITRI: Imagine the world 10 years from now, what kind of technology would be essential for robots? Since I have been working with robots for many years, I believed robots will ultimately be able to leave their confines and become a part of people' s lives. And in everyday life, they must face various interactive scenarios. Thus, along this line of thought, I realized tactile sensing technology would be crucial in their development. At the time, there were already various robot applications using visual sensing and auditory technologies to help people' s daily lives in regards to production, socialization and entertainment. However, in the industrial field, robotic arms were physically isolated from humans to prevent the dangers of their impact on people. In a world where people and robots coexist, interaction is unavoidable, so the idea of developing tactile sensing technology sprouted in my mind. Over the next eight years, through continuous discussions, debates and research, our team developed the world-leading robot tactile sensing technology. We also used our discussions to define the future of tactile sensing technology. Through our heated debates between theory and practice, we hoped to develop the best products for people' s everyday lives and to create a better future.

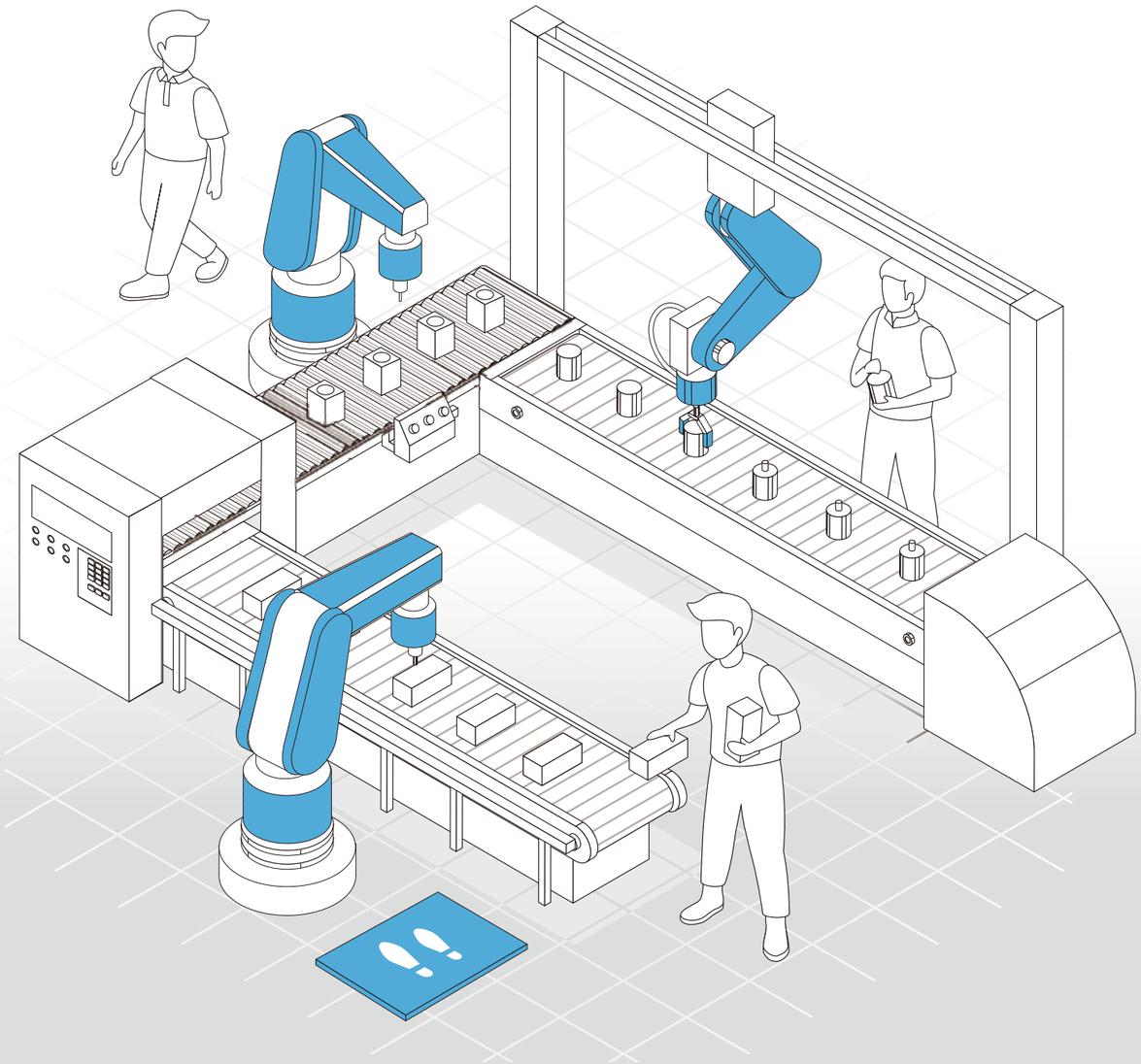
In 2017, in order to welcome this new future, I founded Mechavision Inc. with tactile sensing technology and a R&D team from ITRI. We have since launched a series of products such as "Contact Skin" and "Finger Teach" in cooperation with internationally-known robot companies such as ABB, Epson, Fanuc, Kawasaki, and Mitsubishi Electronic. As we can foresee a future filled with explosive growth in robot application, I believe tactile sensing technology will enhance the level of robot application, opening the door to endless possibilities. Mechavision will continue to focus on developing tactile sensing technology by expanding robot uses in new fields, so to bring positive value to society and thus creating a better world.

Company Overview

2010	Dr. Camus Su, Chairman of Mechavision Inc., leads a team in researching industrial robot tactile sensing technology at Industrial Technology Research Institute (ITRI).
2015	Succeeds in producing and unveiling Contact Skin on industrial robots.
2017	Participates in the Taiwan Automation Intelligence and Robot Show (TAIROS) and releases Tactile Safety- Contact Skin solution with ITRI. In November, Mechavision Inc. is established in Nangang.
2018	In May, participates in the Taipei Intelligent Machinery & Manufacturing Technology Show (iMTdou) with ITRI. In August, releases "Finger Teach" at the Taipei International Industrial Automation Exhibition with ABB, Epson, Mitsubishi, and FANUC (Century Trading Corporation).
2019	In April, announces Taiwan's first Human-Robot Collaboration (HRC) production line with Qisda and ABB. In August, participates in the Taipei International Industrial Automation Exhibition and TAIROS with ABB, Epson, Century Trading Corporation, Mitsubishi, and Kawasaki Heavy Industries (KHI).

Create a wonderful life of human-robot collaboration

Mechavision



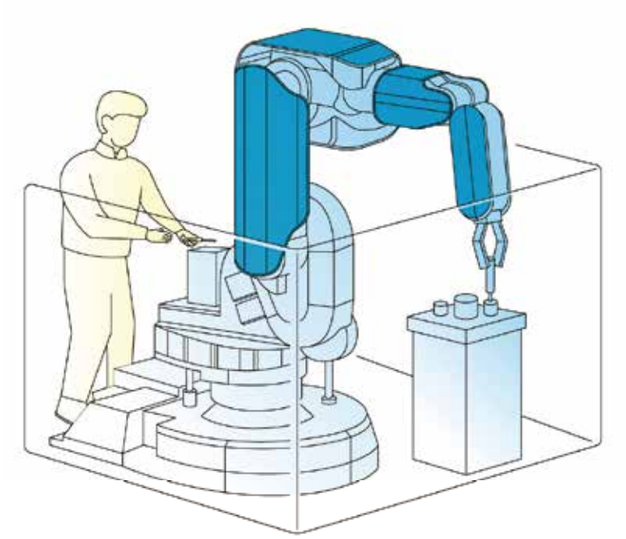
Application

Free Robots from their Confines Achieve Safe and Flexible Smart Manufacturing

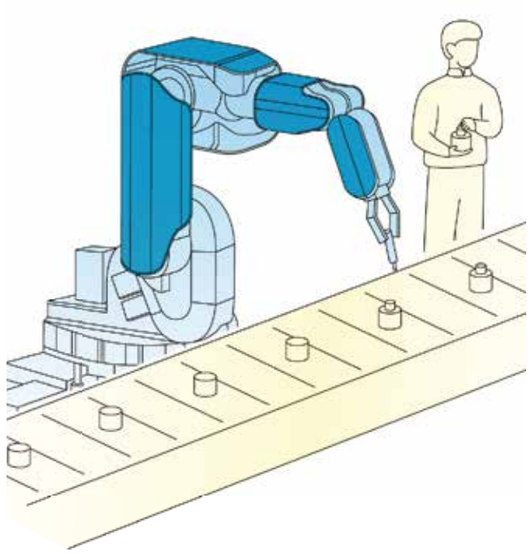
In the smart manufacturing era, the improvement of labor quality and the changes in working environment have given rise to the important role that robots play in production. The traditional production model has also changed from “high volume and small variety” to “small volume and large variety” due to the customer’ s fast-changing needs. According to a report from the International Federation of Robots (IFR), the number of robots supplied to factories worldwide will reach 630,000 units per year until 2021. The trend indicates that the workspaces between people and robots will become closer, and the application level of human-robot collaboration is more extensive. Thus, safety will be the cornerstone of robot application upgrade.

Human-robot collaboration brings improved efficiency to modern factories and drives the development of sensing technology as well. In the past, most of the techniques used torque sensing or specified the speed of robot’ s arm to reduce the impact on the human body. This was just the basic level of protection, which was not a perfect safety standard. Therefore, Mechavision Inc. used tactile sensing technology to develop "Contact Skin" so the surface of the robot’ s arm will feel the sensation of touch. Moreover, we also passed a safety collision test to ensure that the impact to the human body is within an acceptable range. "Contact Skin" also immediately activates a safety emergency stop switch when a collision occurs, which is also compliant with the ISO/TS 15066 standards. We can truly realize safe and flexible smart manufacturing after we install "Contact Skin" on robots.

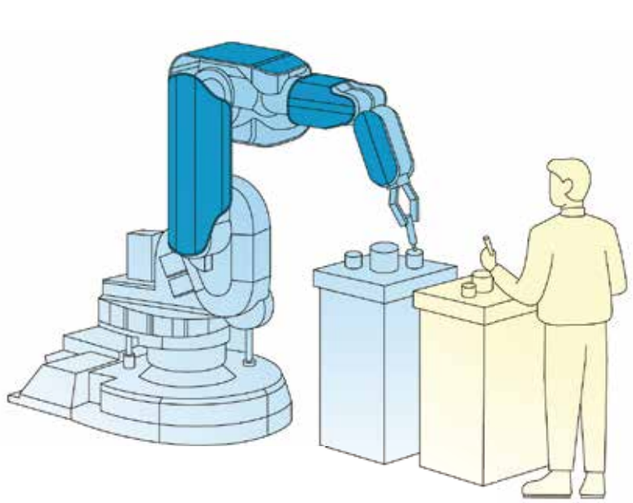
1 | Maintenance



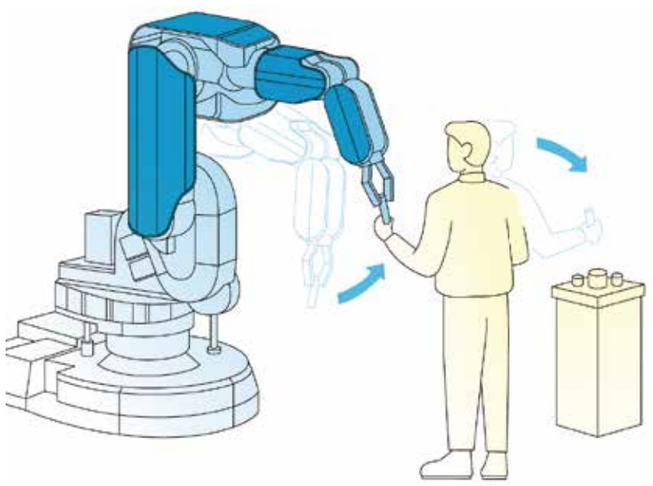
2 | Streamlined Assembly Line Human-Robot Cooperation



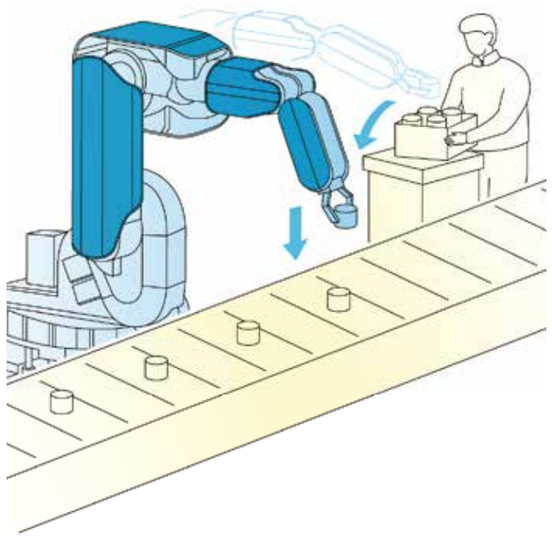
3 | Independent Human-Robot Operation in the Same Field



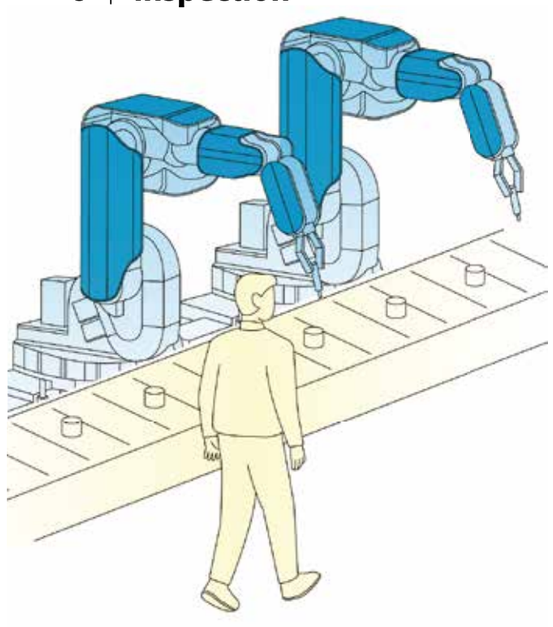
4 | Human-Robot Collaborative Interactions



5 | Parts Feeding



6 | Inspection



Robot’ s workspace Worker’ s workspace

Features

Safety Standard : Compliance with **CE | UL**

Safety Level **ISO 13849: Cat.3** (Double circuit line design) **PL d** (PFHd: $<10^{-6}$ / Hour) / **Collaborative Robot ISO / TS 15066 : Impact Test Report**

Easy to Assemble

Contact Skin can immediately upgrade the production line and improve its flexibility

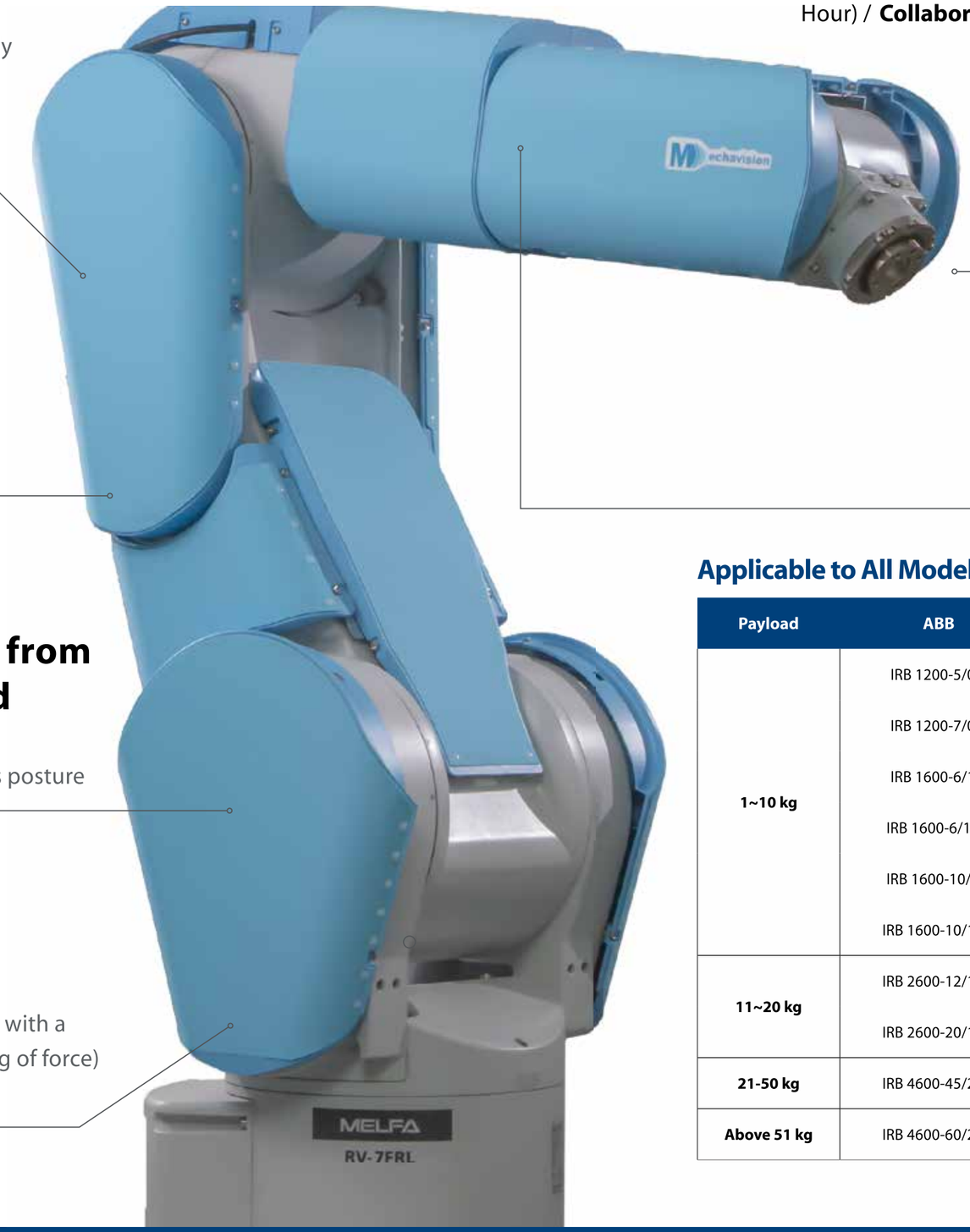
Material Independent

Contact Skin sensing ability is not affected by different materials and nonconductors

Unaffected by the Environment

Contact Skin sensor is ground vibration-proof

Collaborative Scenario of All Kinds of Industrial Robot



No Interference from Torque or Payload

Contact Skin sensitivity is not affected by the robot's posture

High Sensitivity

Contact Skin stops the robot with a light touch (approximate 1 kg of force) to ensure worker safety.

Applicable to All Models

Payload	ABB	Epson	Faunc	Kawasaki	Mitsubishi Electric
1~10 kg	IRB 1200-5/0.9 IRB 1200-7/0.7 IRB 1600-6/1.2 IRB 1600-6/1.45 IRB 1600-10/1.2 IRB 1600-10/1.45	C4-A901 (C4L) VT6-A90S VT6-A90SR VT6-A90SW LS3-401S	LR Mate 200iD/7L LR Mate 200iD/7LC LR Mate 200iD LR Mate 200iD/7C LR Mate 200iD/7WP LR Mate 200iD/7H	RS007L	RV-7FRL(M)(C)
11~20 kg	IRB 2600-12/1.65 IRB 2600-20/1.65		M-10iA/12 M-20iA		
21-50 kg	IRB 4600-45/2.05				
Above 51 kg	IRB 4600-60/2.05				

ISO / TS 15066 Collision Measurement Certification

Due to Heightened Safety Awareness of Human-Robot Collaboration, Businesses Should Prepare to Improve their Competitive Advantage

Digitimes / Tim Liu

We often hear about companies that have declared their equipment as meeting ISO-10218 standards. However, is it ISO 10218-1 or ISO 10218-2? Is it the robot itself or whole system integration?

In general, robots could be regarded as only a control unit which cannot achieve complete automated actions. According to the current safety regulations, the robot simply needs to meet ISO 10218-1 standards. However, when robots were combined with peripheral systems, we should meet ISO 10218-2 instead in order to evaluate the overall operating system. Moreover, if we are facing a human-robot collaboration scenario, we must refer to the collision test stated in ISO/TS 15066, to meet the safety requirements of the complete mechanical system.

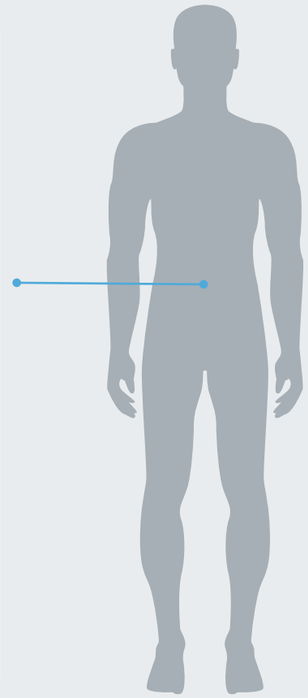
The contents of ISO/TS 15066 enable a more specific security direction when planning a collaborative environment. For instance, ISO/TS 15066 not only clearly explains the possibility of collision, the type of collision, but also how to reduce the risk of collision; such as passively increasing the contact area, using buffer materials, or actively controlling power, strength, and speed. In terms of the safety of the human-robot collaboration environment, if a company set the preparation for ISO/TS 15066 as their top priority, it will ensure the best results.

If we followed the regulations mentioned above, we will be more assured of employees' working in a safe environment. And for those companies using robots for the first time, clear requirements will help them better understand how to build the safest environment rather than explore on their own or problem-solve after accidents occur.

As mentioned above, ISO regulation is not a "single article" to comply with. Intricate derivative clauses and reference provisions are mixed in each main article. Companies can meet the safety regulations more effectively through servicing companies which provide security assessment and certification counseling.

Compliance with ISO/TS 15066 Biomechanical Limit Test of Humans during a Collision Limits of the human body (below the head) is based on the impact force on the abdomen 110N.

Body region		Specific body area	Quasi-Static Contact		Transient Contact	
			Maximum permissible pressure Ps[N/c ㎡]	Maximum permissible force[N]	Maximum permissible pressure Ps[N/c ㎡]	Maximum permissible force[N]
Skull and forehead	1	Middle of forehead	130	130	130	130
	2	Temple	110		110	
Face	3	Masticatory muscle	110	65	110	65
Neck	4	Neck muscle	140	150	280	300
	5	Seventh neck muscle	210		420	
Back and shoulders	6	Shoulder joint	160	210	320	420
	7	Fifth lumbar vertebra	210		420	
Chest	8	Sternum	120	140	240	280
	9	Pectoral muscle	170		340	
Abdomen	10	Abdominal muscle	140	110	280	220
Pelvis	11	Pelvic bone	210	180	420	360
Upper arms and elbow joints	12	Deltoid muscle	190	150	380	300
	13	Humerus	220		440	
Lower arms and wrist joints	14	Radial bone	190	160	380	320
	15	Forearm muscle	180		360	
	16	Arm nerve	180		360	
Hands and fingers	17	Forefinger pad D	300	140	600	280
	18	Forefinger pad ND	270		540	
	19	Forefinger end joint D	280		560	
	20	Forefinger end joint ND	220		440	
	21	Thenar eminance	200		400	
	22	Palm D	260		520	
	23	Palm ND	260		520	
	24	Back of the hand D	200		400	
	25	Back of the hand ND	190		380	
Thighs and knees	26	Thigh muscle	250	220	500	440
	27	Kneecap	220		440	
Lower legs	28	Middle of shin	220	130	440	260
	29	Calf muscle	210		420	



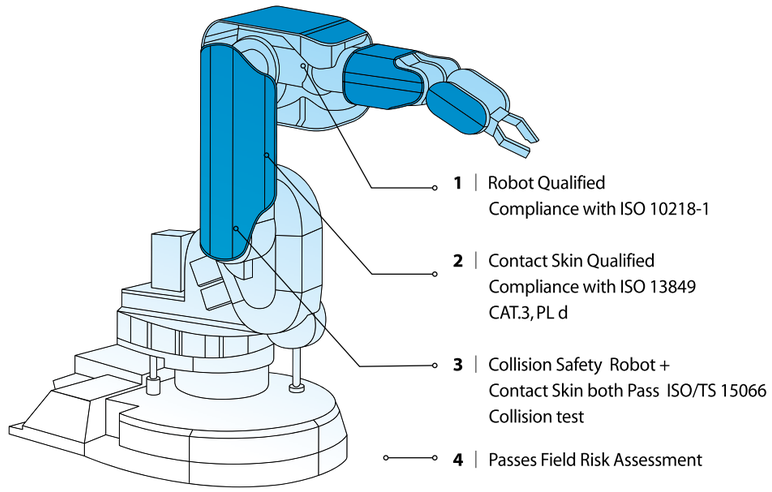
Source : ISO/TS 15066 : 2016(en)

Compliant with German Social Accident Insurance (DGUV) Certified by PILZ Collision System PRMS: Standard for Human-Robot Collaboration (HRC)

As there are now more human-robot collaborative applications, there is heightened awareness of their safety. Hence, a complete safety certification system will be vital. Mechavision uses the German PILZ robot measurement system PRMS (system approved by DGUV), to evaluate and test "Contact Skin" in accordance with the specifications of ISO/TS 15066. By using the collision measurement set PRMS, those industrial robots armed with "Contact Skin" are now able to determine the power and force that occur in possible collisions, so that factories can ensure efficient production as well as safety.

Source : Pilz GmbH & Co. KG

How to Achieve a Completely Safe Human-Robot Collaborative Workspace



PILZ Collision Measurement Report

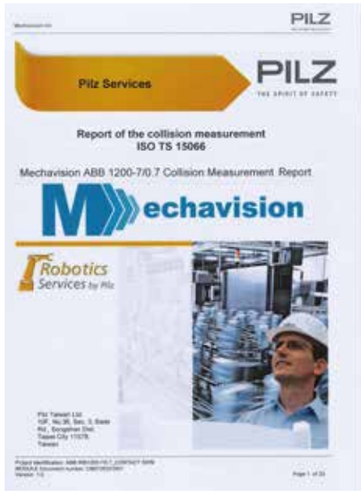


ABB
AT0201_Standard

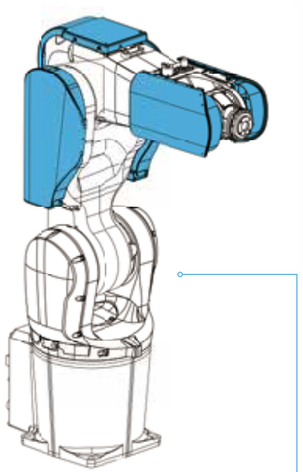


ABB
AT0201_Plus

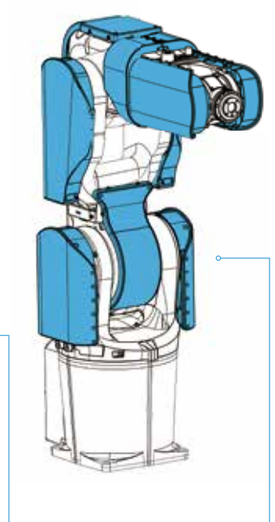


ABB
AT0202_Standard

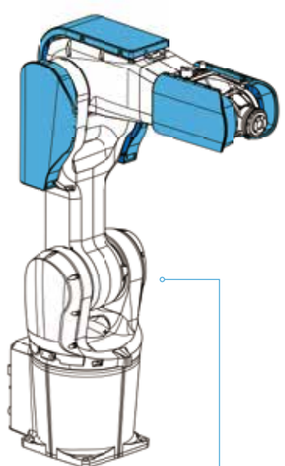


ABB
AT0202_Plus

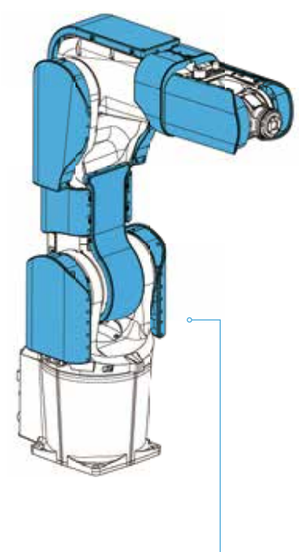


ABB
KT0202_General

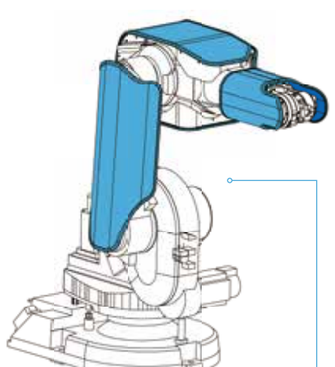


ABB
KT0205_General

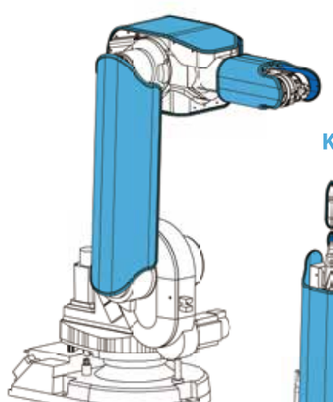


ABB
KT0203_General

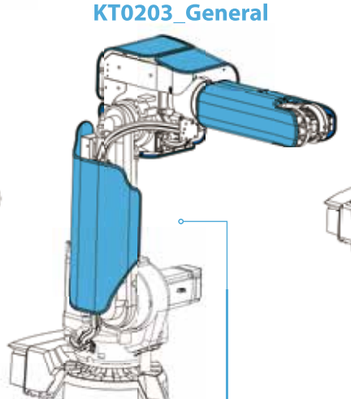
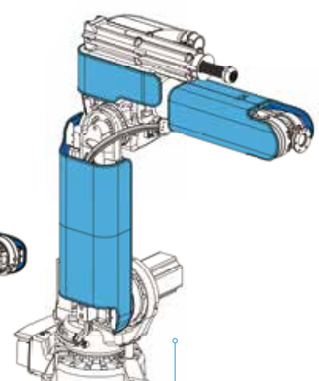


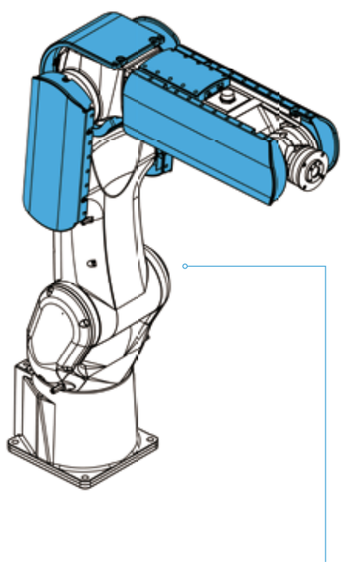
ABB
KT0207



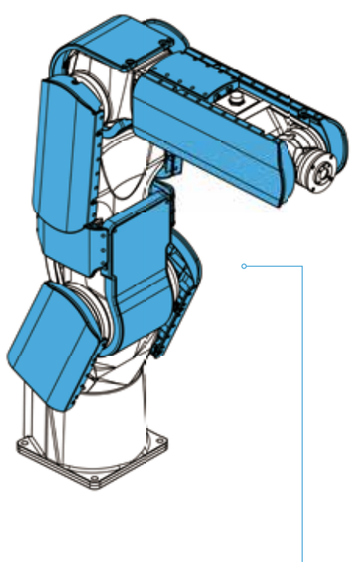
Skin Model	AT0201_Standard	AT0201_Plus	AT0202_Standard	AT0202_Plus
Robot Brand	**ABB**	**ABB**	**ABB**	**ABB**
Series	1200	1200	1200	1200
Robot Model	IRB 1200-7/0.7	IRB 1200-7/0.7	IRB 1200-5/0.9	IRB 1200-5/0.9
Robot Payload	7	7	5	5
Robot Reach(m)	0.7	0.7	0.9	0.9
Skin Coverage	J3 ~J5	J1~J5	J3 ~J5	J1~J5
Skin + Robot Work Range				
J1	±170°	±170°	±170°	±170°
J2	+135° ~-100°	+115° ~-95°	+135° ~-100°	+125° ~-98°
J3	+67° ~-185°	+60° ~-185°	+70° ~-188°	+65° ~-188°
J4	±270°	±270°	±270°	±270°
J5	+130° ~-115°	+130° ~-115°	+130° ~-115°	+130° ~-115°
J6	±400°	±400°	±400°	±400°
Skin Electrical Spec.				
Power	24V DC	24V DC	24V DC	24V DC
Output	NC (Normal Closed)	NC (Normal Closed)	NC (Normal Closed)	NC (Normal Closed)
IP Level	54	54	54	54

Skin Model	KT0202_General	KT0205_General	KT0203_General	KT0207
Robot Brand	**ABB**	**ABB**	**ABB**	**ABB**
Series	1600	1600	2600	4600
Robot Model	IRB 1600-X/1.2	IRB 1600-X/1.45	IRB 2600-X/1.65	IRB 4600-X/2.05
Robot Payload	6/10	6/10	12/20	45/60
Robot Reach(m)	1.2	1.45	1.65	2.05
Skin Coverage	J2 ~J5	J2 ~J5	J2 ~J5	J2 ~J5
Skin + Robot Work Range				
J1	±180°	±180°	±180°	±180°
J2	+136° ~-58°	+150° ~-90°	+155° ~-95°	+150° ~ -90°
J3	+55° ~-225°	+55° ~-245°	+75° ~-180°	+75° ~-95°
J4	±200°	±200°	±400°	±400°
J5	±115°	±120°	±120°	±115°
J6	±400°	±460°	±400°	±400°
Skin Electrical Spec.				
Power	24V DC	24V DC	24V DC	24V DC
Output	NC (Normal Closed)	NC (Normal Closed)	NC (Normal Closed)	NC (Normal Closed)
IP Level	54	54	54	54

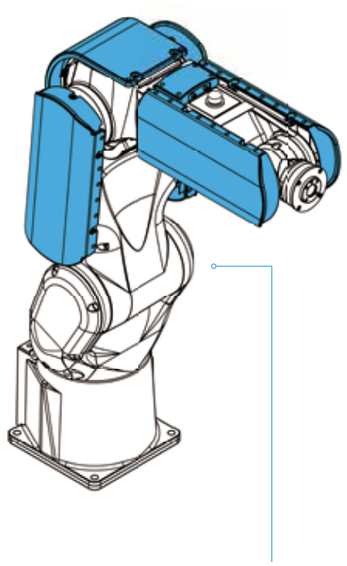
Fanuc
AT0301_Standard



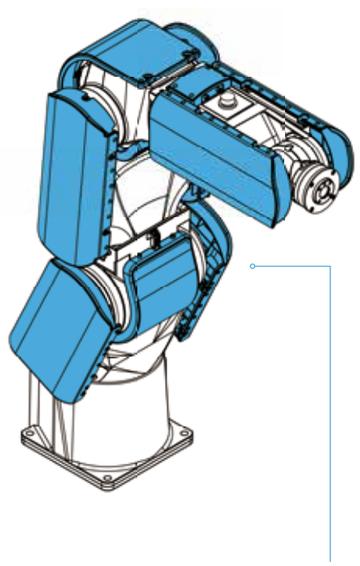
Fanuc
AT0301_Plus



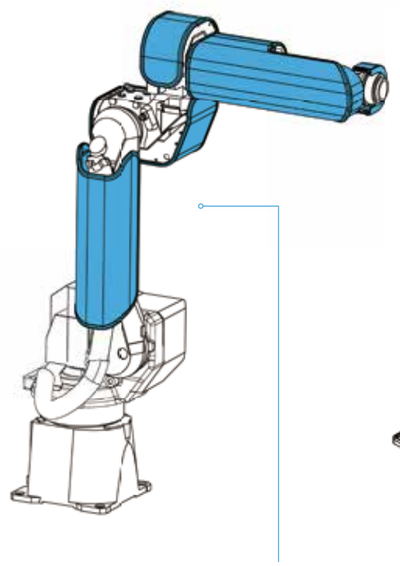
Fanuc
AT0303_Standard



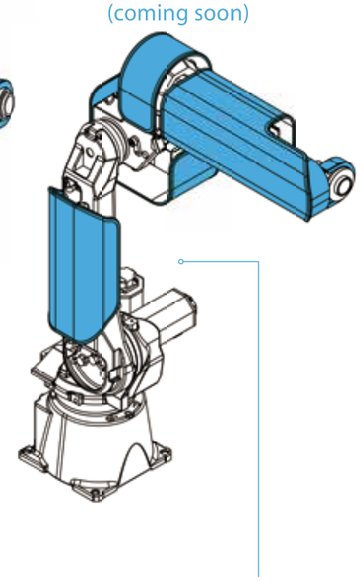
Fanuc
AT0303_Plus



Fanuc
KT0304_Standard



Fanuc
KT0364_Standard
(coming soon)



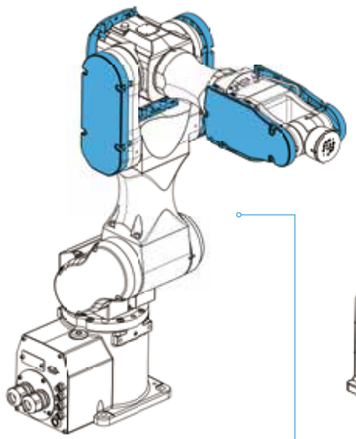
Skin Model	AT0301_Standard	AT0301_Plus	AT0303_Standard
Robot Brand	**Fanuc**	**Fanuc**	**Fanuc**
Series	LR Mate 200iD	LR Mate 200iD	LR Mate 200iD
Robot Model	7L, /7LC	7L, /7LC	200iD, / 7C, /7WP, /7H
Robot Payload	7	7	7
Robot Reach(m)	0.911	0.911	0.717
Skin Coverage	J3 ~J5	J1 ~J5	J3 ~J5
Skin+Robot Work Range			
J1	±180°	±180°	±180°
J2	+145° ~-100°	+130° ~-78°	+145° ~-100°
J3	+199° ~-57°	+190° ~-57°	+199° ~-57°
J4	±190°	±190°	±190°
J5	±125°	±125°	±125°
J6	±360°	±360°	±360° *
Skin Electrical Spec.			
Power	24V DC	24V DC	24V DC
Output	NC (Normal Closed)	NC (Normal Closed)	NC (Normal Closed)
IP Level	54	54	54

*Note: Model 7H does not have J6 Axis

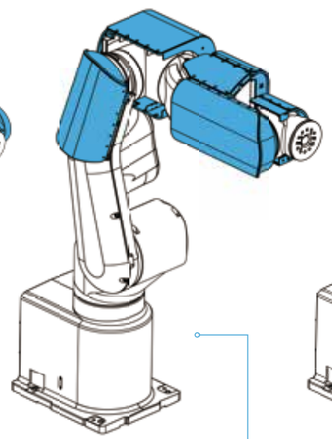
Skin Model	AT0303_Plus	KT0304_Standard	KT0364_Standard
Robot Brand	**Fanuc**	**Fanuc**	**Fanuc**
Series	LR Mate 200iD	M-10iA	M-20iA
Robot Model	200iD, / 7C, /7WP, /7H	M-10iA/12	M-20iA
Robot Payload	7	12	20
Robot Reach(m)	0.717	1.42	1.811
Skin Coverage	J1~J5	J2 ~J5	J2 ~J5
Skin+Robot Work Range			
J1	±180°	±190°	±170°
J2	+126° ~-77°	+160° ~ -90°	+160/-80°
J3	+199° ~-57°	-90° ~ +200°	±229°
J4	±190°	±190°	±200°
J5	±125°	±140°	±180°
J6	±360° *	±360°	±450°
Skin Electrical Spec.			
Power	24V DC	24V DC	24V DC
Output	NC (Normal Closed)	NC (Normal Closed)	NC (Normal Closed)
IP Level	54	54	54

*Note: Model 7H does not have J6 Axis

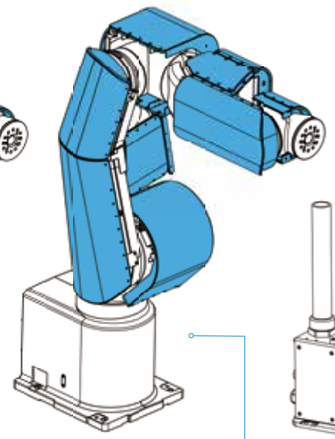
Epson
AT0101



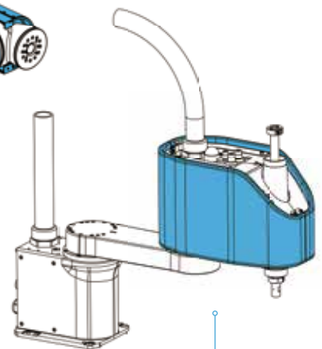
Epson
AT0104-Standard



Epson
AT0104-Plus



Epson
DT0105-Standard



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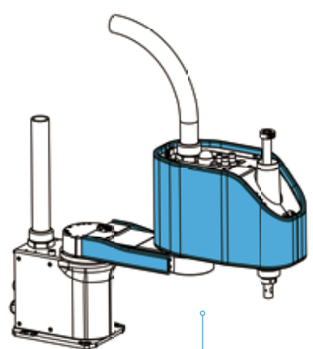
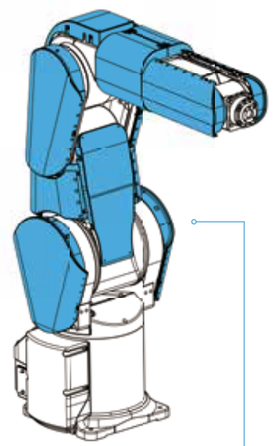
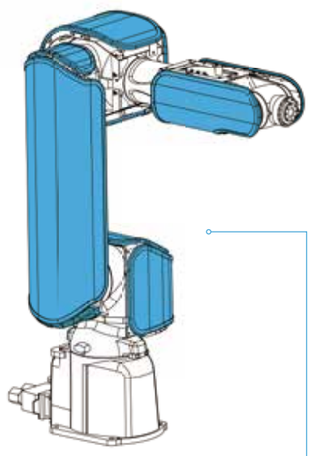
DT0105-Plus



Mitsubishi Electric
AT0602

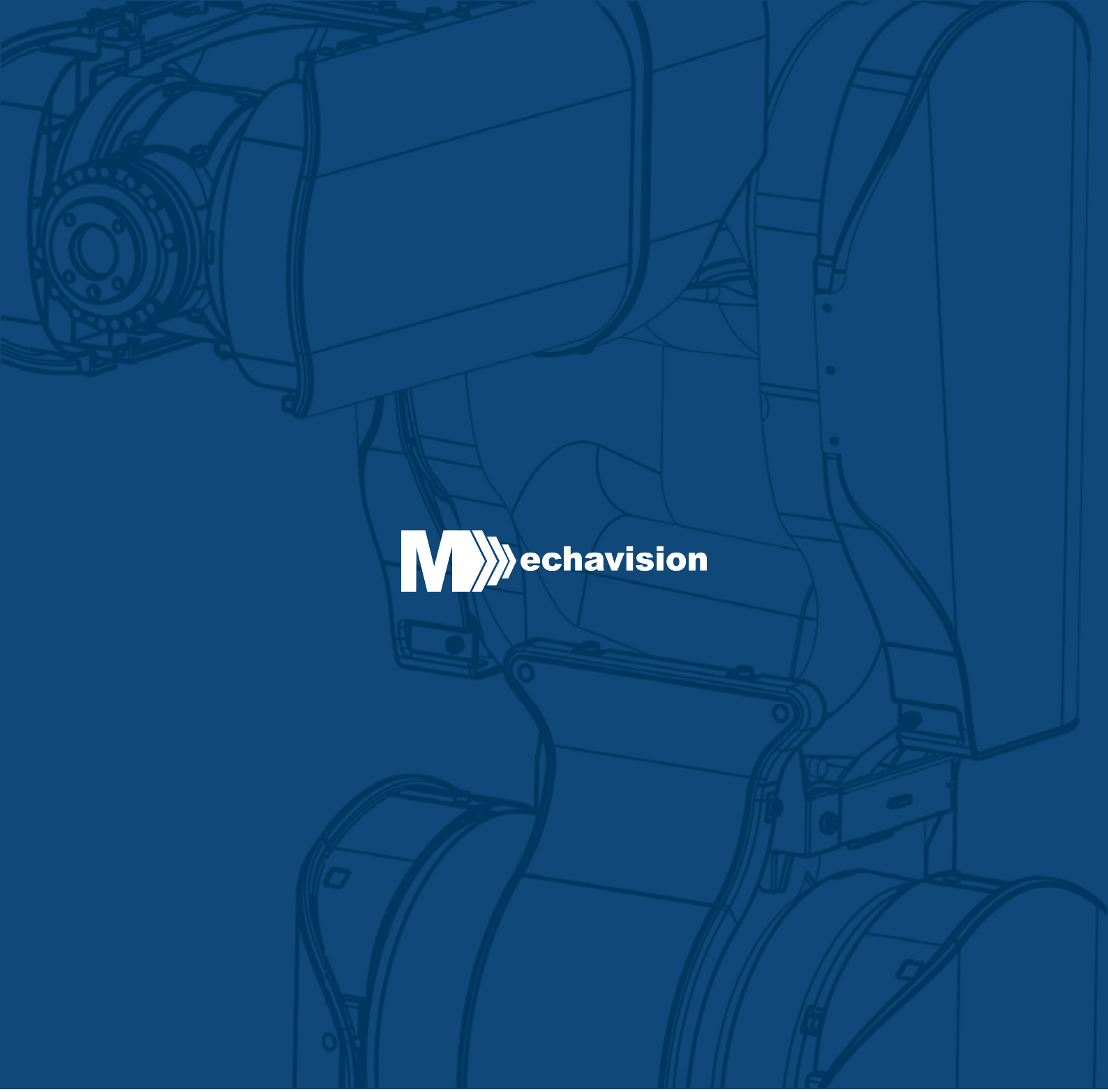


Kawasaki
AT0701



Skin Model	AT0101	AT0104-Standard	AT0104-Plus	DT0105-Standard
Robot Brand	**Epson**	**Epson**	**Epson**	**Epson**
Series	C	VT	VT	LS
Robot Model	C4-A901(C4L)	VT6-A90S, /A90SR, / A90SW	VT6-A90S, /A90SR, / A90SW	LS3-401S
Robot Payload	4	6	6	3
Robot Reach(m)	0.9	0.9	0.9	0.4
Skin Coverage	J3 ~J5	J3~J5	J1~J5	J2
Skin+Robot Work Range				
J1	±170°	±170° /± 30°	±170° /± 30°	± 132°
J2	+65° ~-160°	-160° ~ + 65°	-160° ~ + 65°	± 141°
J3	+225° ~-51°	-51° ~ + 190°	-51° ~ + 190°	150mm
J4	±200°	± 200°	± 200°	± 360°
J5	±135°	± 125°	± 125°	x
J6	±360°	± 360°	± 360°	x
Skin Electrical Spec.				
Power	24V DC	24V DC	24V DC	24V DC
Output	NC (Normal Closed)	NC (Normal Closed)	NC (Normal Closed)	NC (Normal Closed)
IP Level	54	54	54	54

Skin Model	DT0105-Plus	AT0602	AT0701
Robot Brand	**Epson**	**Mitsubishi Electric**	**Kawasaki**
Series	LS	RV-FR	R
Robot Model	LS3-401S	RV-7FRL(M)(C)	RS007L
Robot Payload	3	7	7
Robot Reach(m)	0.4	0.908	0.93
Skin Coverage	J1~J2	J1~J5	J1 ~J5
Skin+Robot Work Range			
J1	± 125°	±240°	±180°
J2	± 141°	+115° ~-100°	+135°
J3	150mm	+157° ~0°	±157°
J4	± 360°	±200°	±200°
J5	x	±120°	±125°
J6	x	±360°	±360°
Skin Electrical Spec.			
Power	24V DC	24V DC	24V DC
Output	NC (Normal Closed)	NC (Normal Closed)	NC (Normal Closed)
IP Level	54	54	54



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