RAON

Robot & Automation on **Humanity**
Creativity
Intelligence

RAONTEC : Company & Product

2018.11.07

RAONTEC INC.
www.raonrobot.com

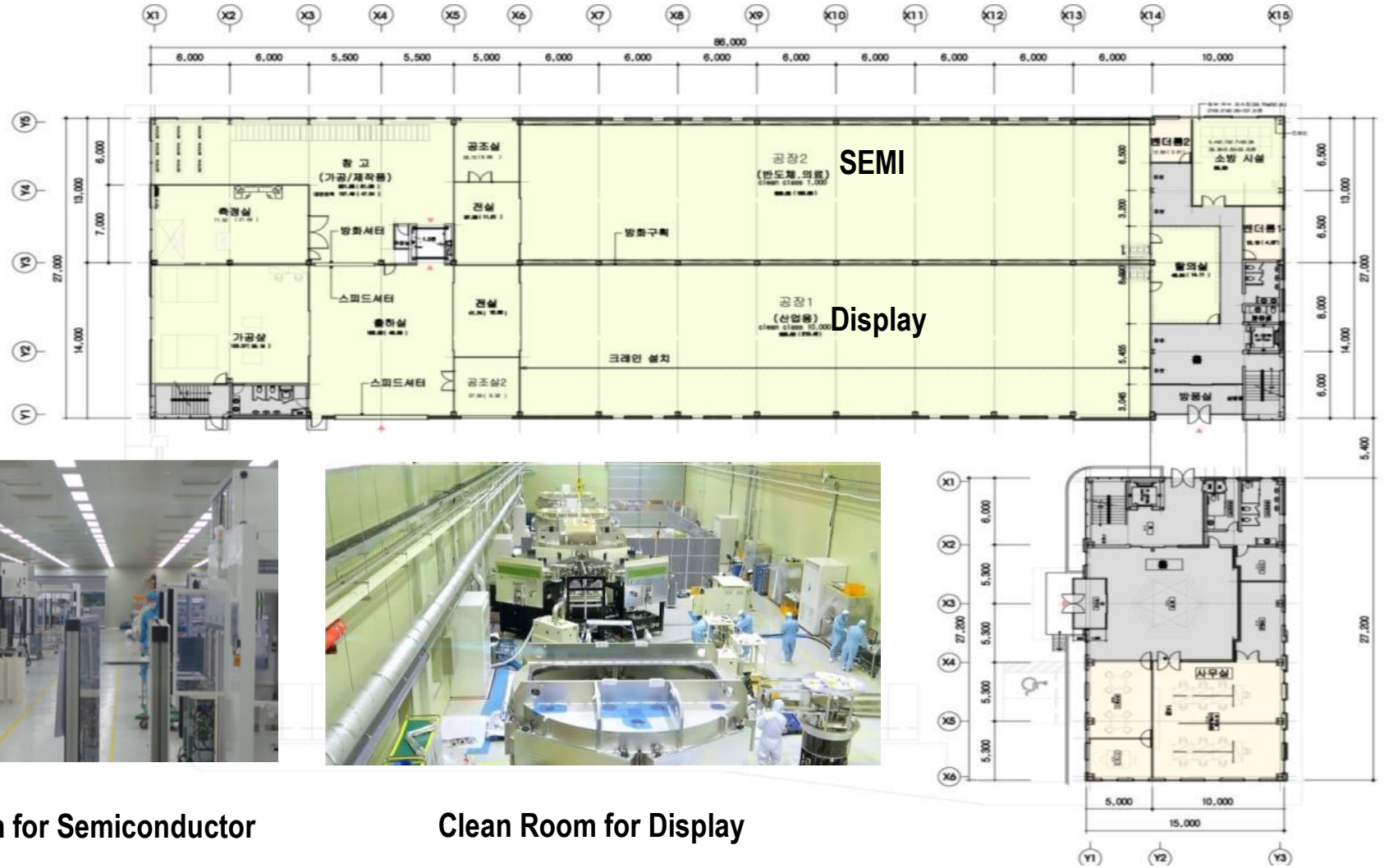
Contents

RAON Robot & Automation on Humanity

- 회 사 명 : ㈜ 라온테크 / Raontec Inc.
- 대표이사 : 김 원 경
- 설립년도 : 2000년 3월 14일
- 코넥스 상장 : 2015년 12월 15일
- 매출 : 287억원 (2017년)
- 사업 분야 :
  ※ 반도체 / 디스플레이[OLED, LCD] / 제약.BIO 로봇
  ※ Automation Tools 및 System
- 주 거래처 : 주성 Eng, TES, 원익IPS, 유진테크
  ICD, SFA, SEMES 외 장비업체
  (Samsung , SDC, LGD , SK Hynix Fab)
- 주요 인증 및 수상
  ※ 벤처기업 인증 및 기업 부설 연구소 설립
  ※ 신기술 인정 KT 획득, ISO 9001 인증
  ※ 이노비즈 인증, CE 인증
  ※ 산업포장 수훈(산업통상자원부)
- 본사 및 공장 : 경기도 수원시 권선구 산업단지
  - 대지 5,445㎡, 건축 : 2,819㎡
- TEL : 031-201-0000 FAX 031-227-1500

1-3. Facility

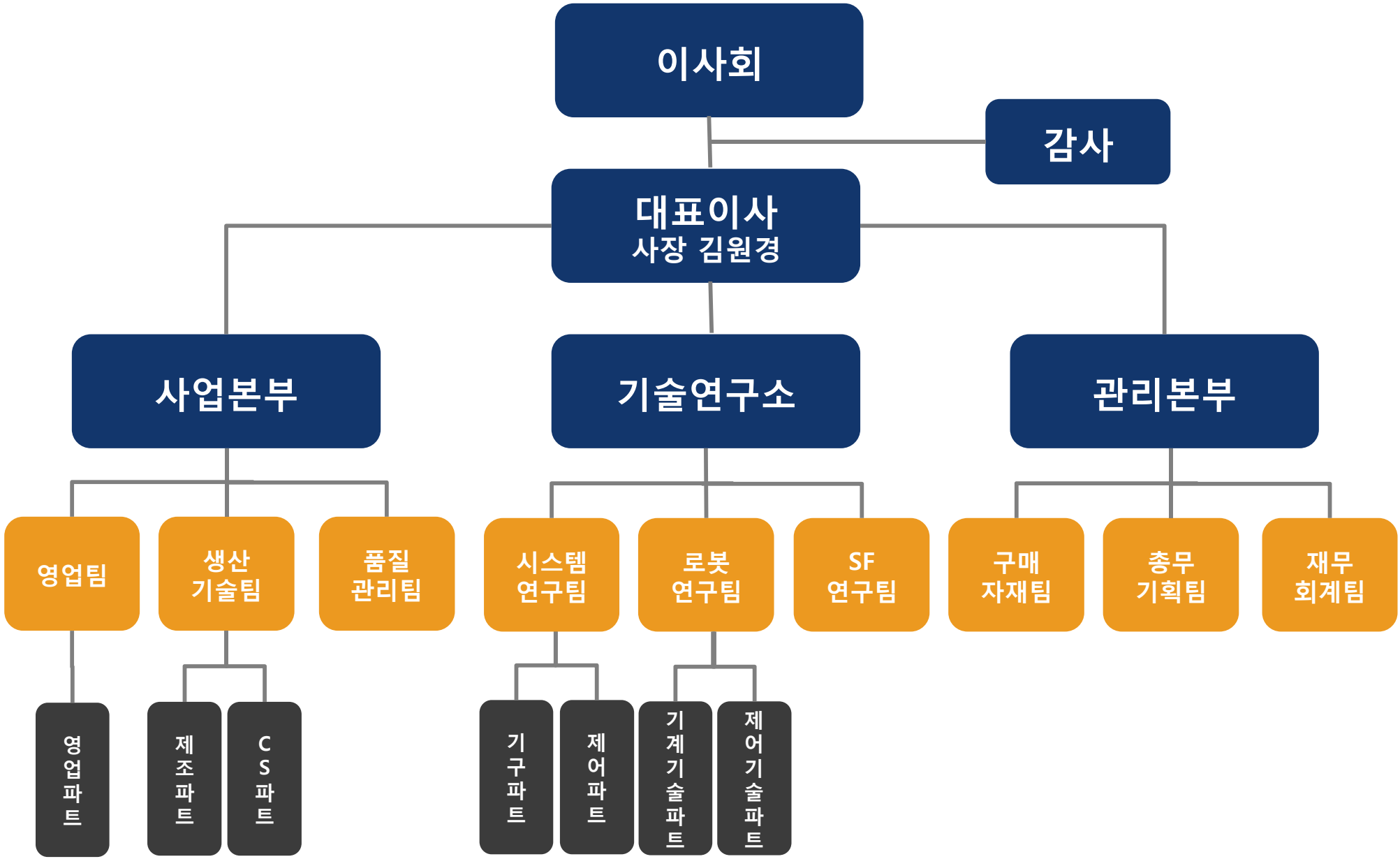
Facility : 5,441 m^2 with 2 stories Semi fab,
1 story Display fab and robot manufacturing fab



Clean Room for Semiconductor

Clean Room for Display

RAON Robot & Automation on Humanity


이사회
감사
대표이사
사장 김원경
사업본부
기술연구소
관리본부
영업팀
생산 기술팀
품질 관리팀
시스템 연구팀
로봇 연구팀
SF 연구팀
구매 자재팀
총무 기획팀
재무 회계팀
영업파트
제조파트
CS파트
기구파트
제어파트
기계기술파트
제어기술파트

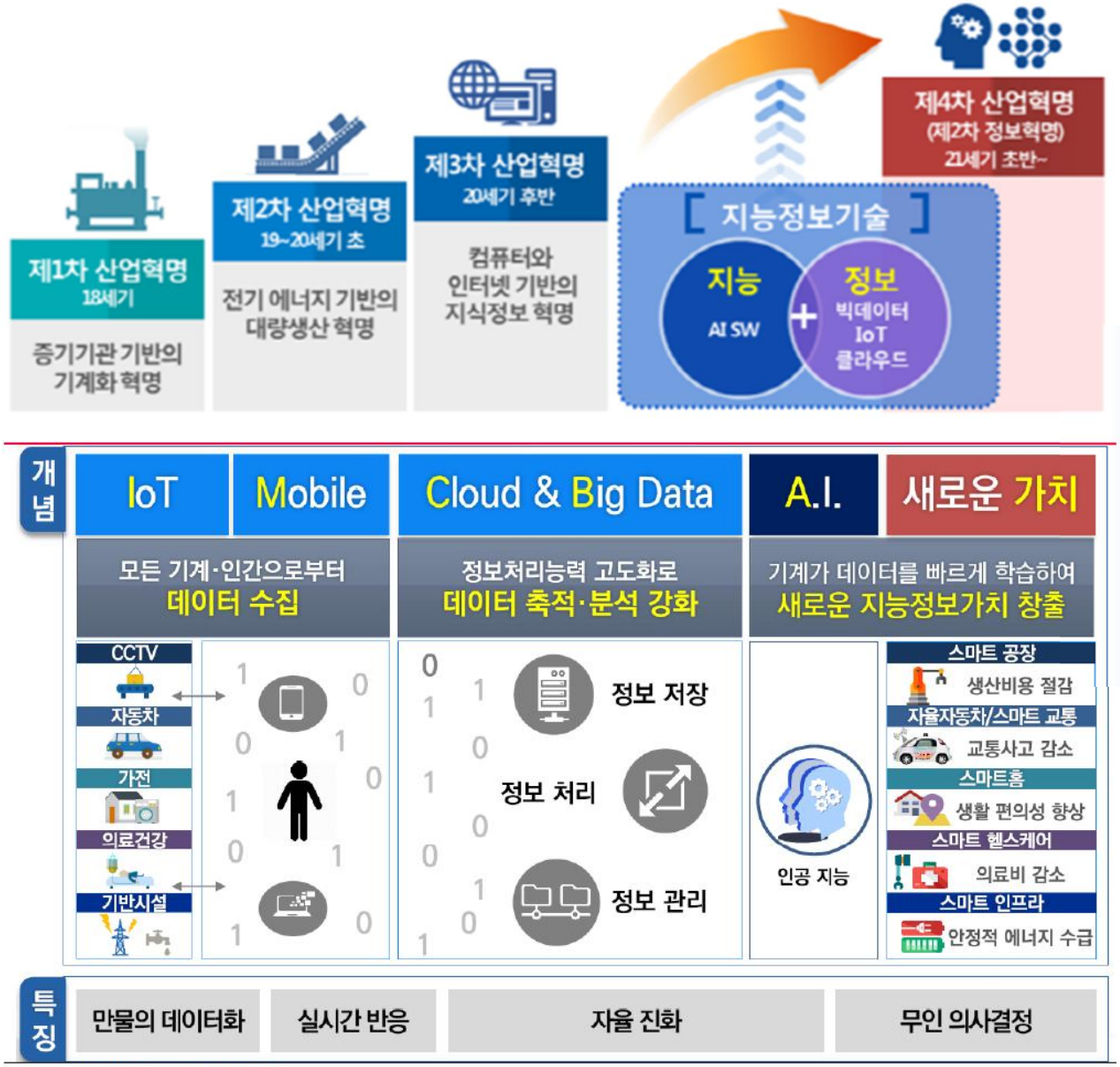
Robot and Automation ON humanity, Creativity, Intelligence

Display : Robot / Automation

반도체 : Robot / Automation

Smart Factory: Robot / Automation

◈ 4차 산업혁명 도래에 따른 반도체, Display 산업 의 호황 과 Robot & Automation 성장



자료: 과학기술정보통신부, 하이투자증권

4차 산업혁명 핵심기술

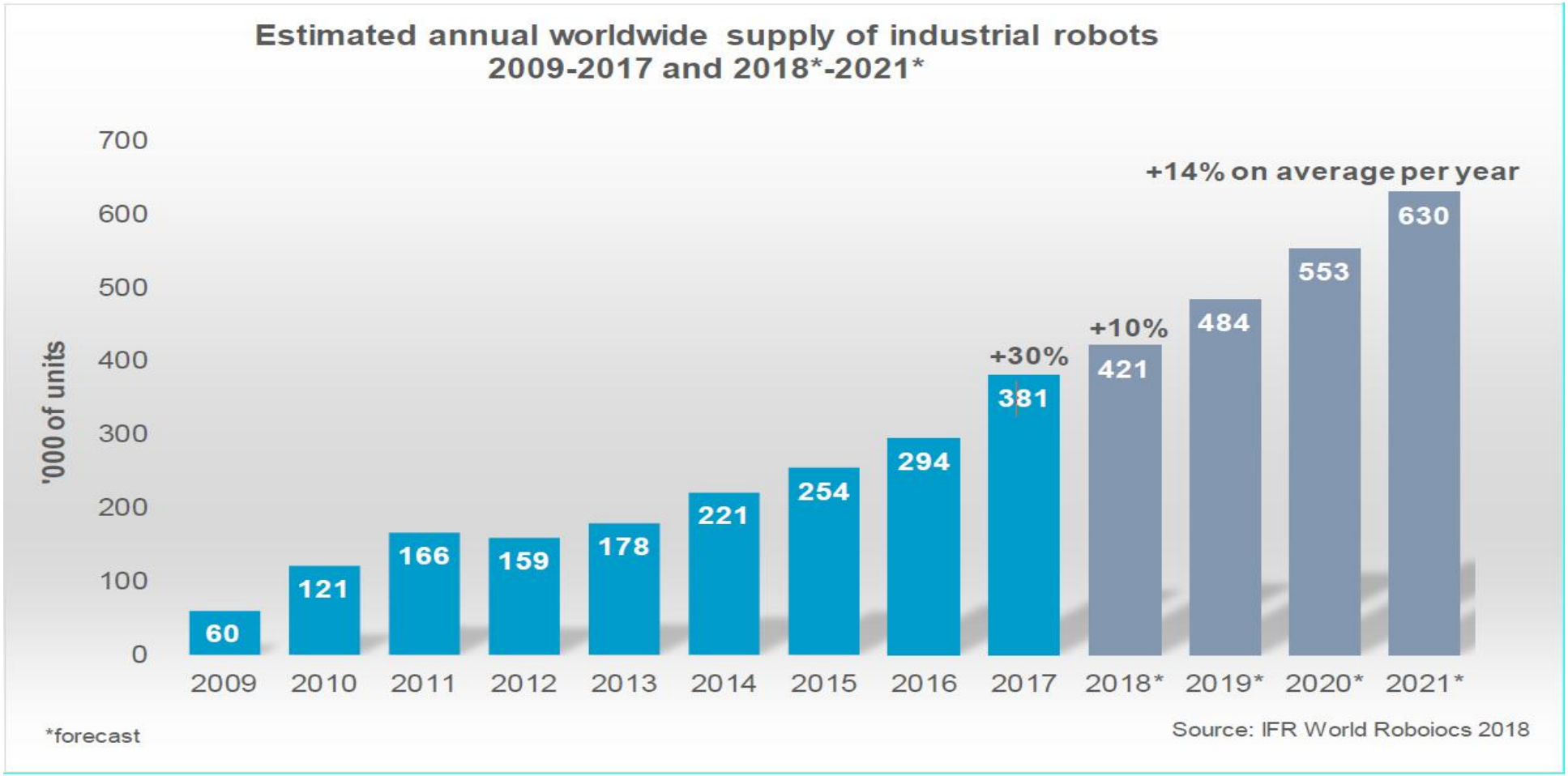
- 사물인터넷 IoT
- Robot
- 3D Printing
- Big Data
- 인공지능 A.I

RAON BIZ

- 반도체용 Robot & Automation
- Display 용 Robot & Automation
- Smart 공장용 Robot & Automation

◈ 글로벌 산업용 로봇시장 2021년까지 연평균 14% 증가 전망

- 2017년 산업용로봇 381,000대 공급(YoY 30% 증가), 2021년 630,000대 공급 전망
- 글로벌 생산 체계가 실물 공장을 가상현상과 연결하는 'Industry 4.0'로 전환, 제조업용 로봇 수요 급증
- 생산시설 현대화.자동화, 에너지 효율화.신소재 활용, 라이프 사이클 단축, 품질개선 노력 등으로 로봇 수요 급증



Global industrial robot sales doubled within five years (2013-2017)

◈ 2018년 세계 반도체 업계의 시설 투자 규모 $1,020억(약 113조원)로 YoY 9% 증가 전망

- 삼성전자, SK하이닉스 메모리 반도체 업체들이 전체 시설투자의 53%를 차지(DRAM 시장 72%, 낸드 시장 50% 점유)
- SK하이닉스 M15(청주)에 16조원 M16(이천)에 15조원, 삼성전자 중국 시안 공장 2라인에 7조5천억원 투자 계획
- 2022년 까지 SSD 시장이 연 평균 12.2% 고공 성장 예상

◈ memory semiconductor Major companies Fab production plan

Division		2018년	2019년	2020년	2021년	Remarks
Samsung Electronics	SCS2(Xian, china)		20K	60K	70K	NAND
	P1-2(pyeongtaek)	20K				
	P1-3(pyeongtaek)	60K	40K			DRAM
	P2L(pyeongtaek)			50K	70K	NAND, DRAM
	S5L		10K	10K		Foundry
Skhynix	M14 P2(icheon)	40K	30K	30K		DRAM
	M15P1(cheongju)	15K	30K	35K		NAND
	M15P2(cheongju)			20K	60K	NAND
	M16(icheon)				20K	DRAM
	CF2(Wuxi, China)		40K	30K		DRAM

◈ 업계의 공급과잉 심화되나 OLED가 신 성장동력으로 시장 성장을 견인할 전망

- 삼성디스플레이 중소형 OLED에 집중하여 6세대 설비 증설을 지속할 전망
- 엘지디스플레이 대형 OLED에 집중하여 8세대 이상 W-OLED 설비 증설 및 파주 P10공장(10.5세대)을 OLED 설비로 전환 추진
- 중국 BOE를 필두로 GVO(Visionox).EDO.Tianma 등 업체들이 중소형OLED에 적극 투자

【국내업체 중소형 OLED CAPA 현황 및 전망 (단위 : 1,000장/월) 】

업체	공장	세대	타입	'17.4Q	'18.4Q	'19.4Q	'20.4Q
삼성 디스플레이	아산 A1	4G	R/F	55	55	55	55
	아산 A2	5.5G	R/F	181	189	189	189
	아산 A3	6G	Flexible	125	135	135	135
	아산 A4	6G	Flexible		30	30	30
	아산 A5	6G	Flexible			15	90
삼성디스플레이 소계 (6세대 전환 기준)				266	311	326	401
LG 디스플레이	파주 E2	4G	Flexible	22	22	22	22
	구미 E5	6G	Flexible	13	16	24	24
	파주 E6	6G	Flexible		20	30	30
LG디스플레이 소계 (6세대 전환 기준)				18	41	59	59
6세대 전환 기준 Total				284	352	385	460

【중국업체 중소형 OLED CAPA 현황 및 전망 (단위 : 1,000장/월) 】

업체	공장	세대	타입	'17.4Q	'18.4Q	'19.4Q	'20.4Q
BOE	청두 B7	6G	R/F	2	36	48	48
	멘양 B11	6G	Flexible			27	48
EDO	상하이1	4G	Rigid	18	22.5	22.5	22.5
	상하이2	6G	R/F			16	30
GVO (Visionox)	쿤샨	5.5G	R/F	9	15	15	15
	구안	6G	R/F			15	30
Tianma	상하이	5.5G	Rigid	8	8	8	8
	우한	6G	R/F	10	25	30	30
Truly	후이조우	4G	Rigid	15	15	15	15
Royole	선전	5.5G	Flexible		1	13	15
CSOT	우한 T4	6G	R/F			6	30
6세대 전환 기준 Total (중국)				32	87	176	252

【LG디스플레이 대형 WOLED CAPA 현황 및 전망 (단위 : 1,000장/월) 】

업체	공장	세대	타입	'17.4Q	'18.4Q	'19.4Q	'20.4Q
LG 디스플레이	파주 E3	8G	WOLED	10	10	10	10
	파주 E4	8G	WOLED	47	62	86	86
	中 광저우 3	8G	WOLED			55	55
	파주 P10	10.5G	WOLED				45

RAON Provides at full-customized design solution.

Semiconductor

EFEM

BackBone

ATM

Vaccum

Display

8G Glass Handling

Vacuum Cluster Tool

Smart Factory

DeltaFly

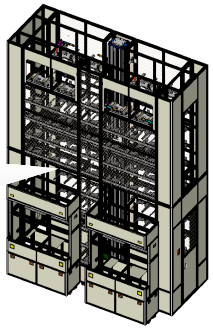
협동로봇

Industrial Robot

년도	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Semi Product	✓ WTR		Reticle STK		EFEM	Hand Solution	Vacuum Robot	Backbone : Single	Vacuum : Quad		Backbone : Twin	Successfully Mass production	
Display & Solar Cell		CST Stocker		8G Cassette		6G Glass Robot		Pan Robot		6G & 8G Vacuum Robot	Cluster Tool	Successfully Mass production	
Smart Factory									Paint Robot	DeltaFly Lineup	Delta Automation	Export China	

Wafer Handling Products Overview

Stocker Robot



ATM Robot

Vacuum Robot

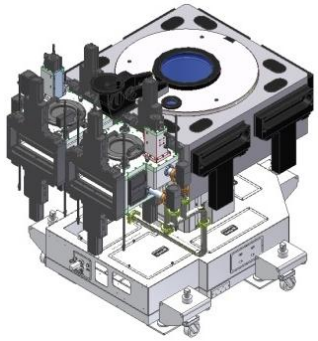
Vacuum Robot

Platform
EFEM & Backbone

Wafer Handling
Robot & Automation

EFEM

Backbone

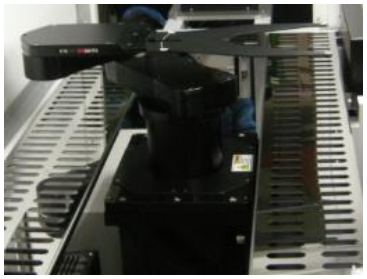


Twin Backbone

❖ Solution in Atmospheric Environment

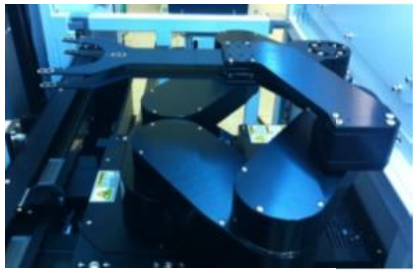
❖ Robots for Atmospheric Application

- Passive Grip, Edge Grip, Vacuum , Multi Blade Robot .
- RAONTECH Robot self design, manufacture



Passive Grip

Edge Grip



Vacuum Grip

SCARA Dual (Y 사 & Raon)

❖ Automation Product Line Up – SmartFab ™

- Full Line Up : 2~4 Port EFEM (Standard Module in Semiconductor Fab)
- LPM, Aligner, Robot etc. All Sub Module apply to product

✓ 2 Port SF200

✓ 3 Port SF300

✓ 4 Port SF400

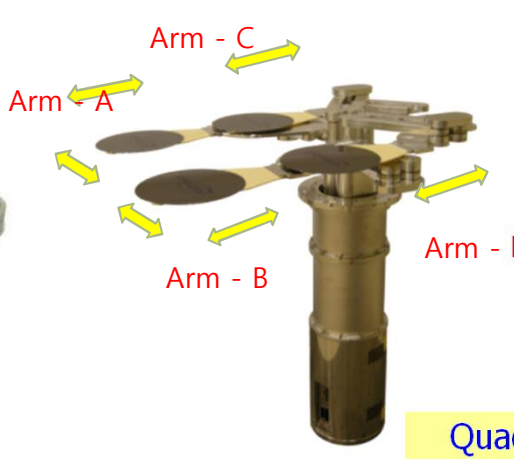
❖ Solution in Vacuum Environment

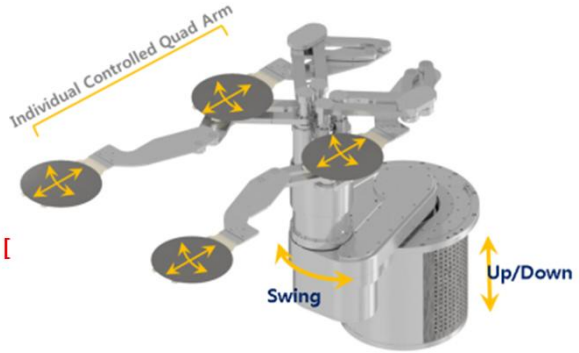
❖ Robots for Vacuum Environment – VACTRA™

- Compact Arm, Single Arm, Dual Arm, Quad Arm Vacuum Robot
- Parallel Link Arm Structure → No Belt, Reliable & Particle Free
- RAONTEC Robot self design, Manufacture

Compact Vacuum Robot

Dual Arm Robot

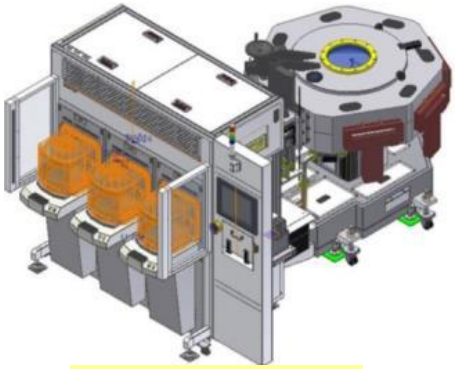




Quad Arm Robot

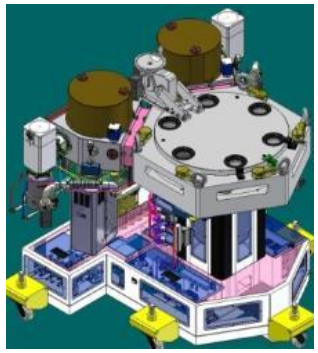
❖ Automation Tools : Customizing & Application Engineering of Backbone

- Stack Load Lock, Batch Load Lock, Elevation L/L, Twin Backbone ..

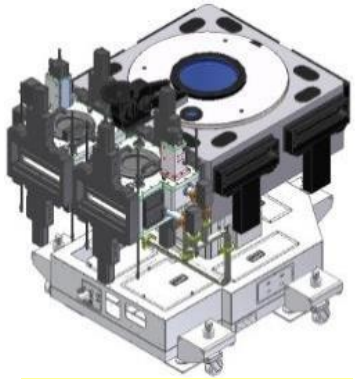


✓ Stack Type L/L

✓ Batch Type L/L



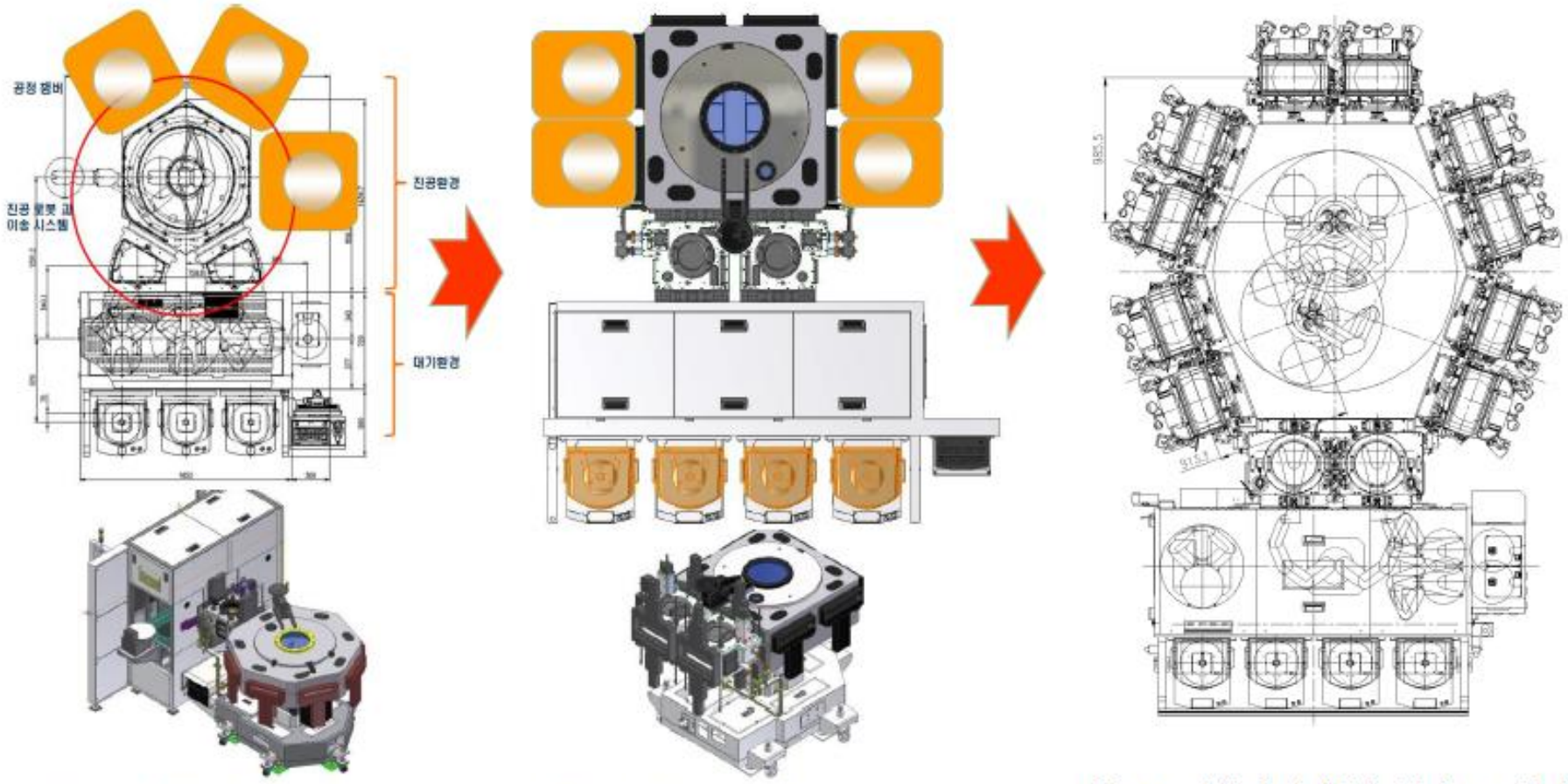
✓ Single or Elevation L/L



✓ Twin Backbone

❖ Platform Solution & Line Up

- High Throughput : Single Cluster Type → Dual Wafer Transfer Robot & Transfer Module
- Small Foot Print : Save Valuable Space
- More Process Chamber : From 6 Process Chamber → Up to 12 Chamber with One Robot



Cluster Type Platform

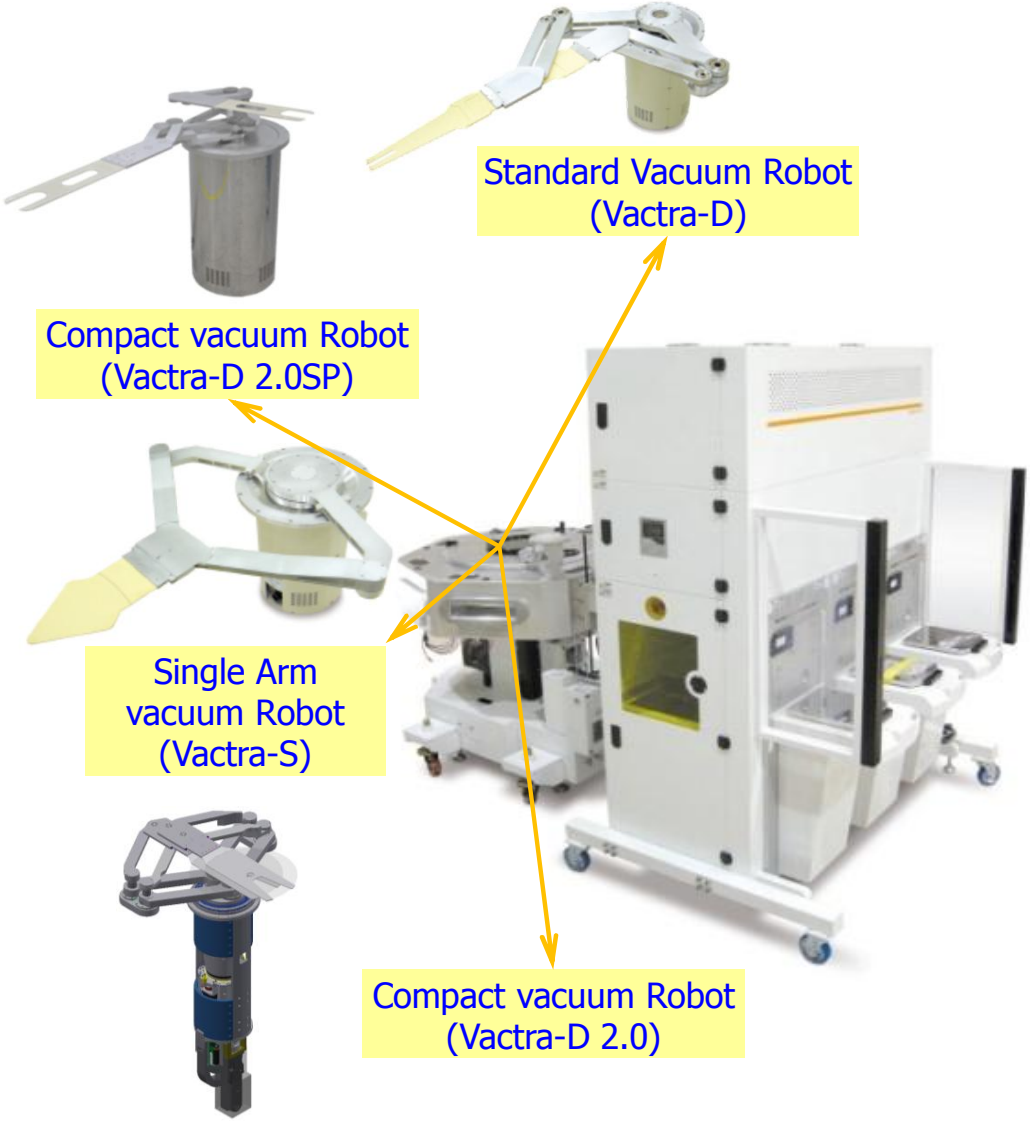
Twin Type Platform

Next : High MPH / More PM

❖ Platform solution of RAONTEC

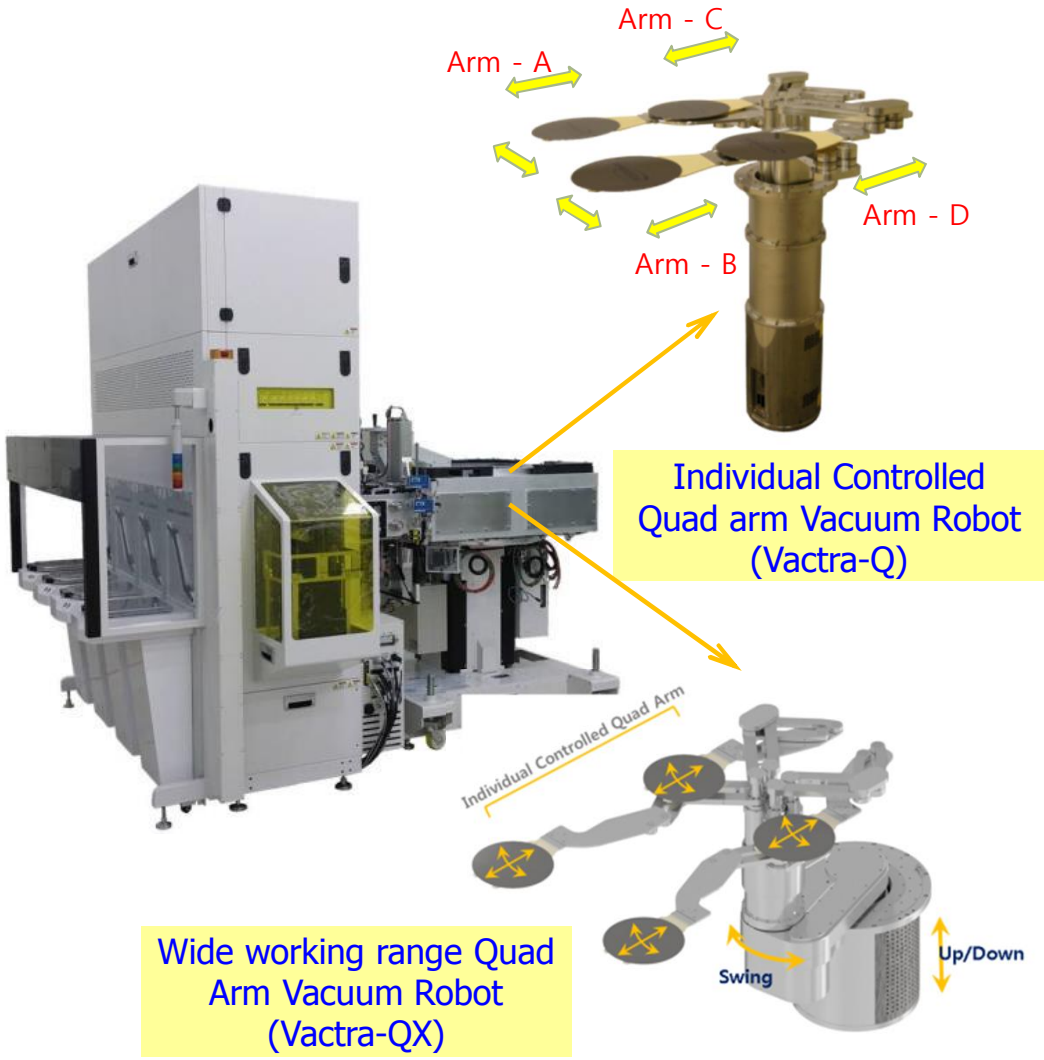
❖ Cluster Type : Vacuum Robot & Backbone

→ Compact / Standard / Customized Model



❖ Twin Type : Vacuum Robot & Backbone

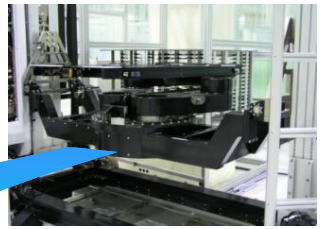
→ Individual Controlled Robot & Backbone



Flat Panel Handling Products Overview

Cassette Transfer

Stocker Robot



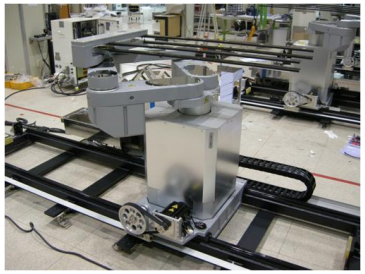
FPD Glass Handling Robot

Glass Transfer
Mask Transfer
Robot

Vacuum Robot
Glass / Mask

8th G Vacuum Robot

Vacuum Cluster Tool



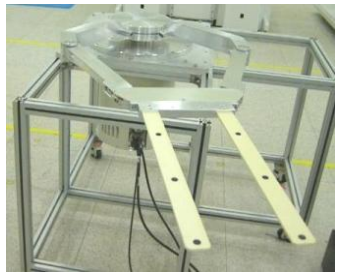
Glass Handling

OLED Mask Handling

❖ Vacuum Robot Solution

❖ Vacuum Robot Lineup – VACTRA™

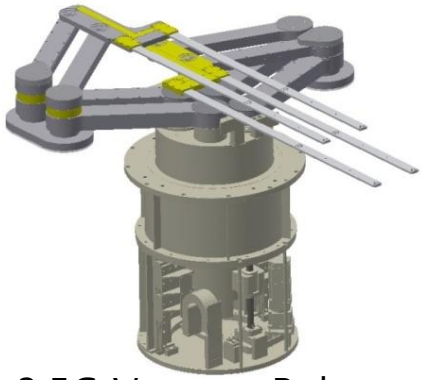
- Single Arm, Dual Arm Vacuum Robot form 2G → 8G
- Parallel Link & Link-Slider Arm Structure → No Belt, Reliable & Particle Free
- 라온테크 Robot 자체 설계, 생산



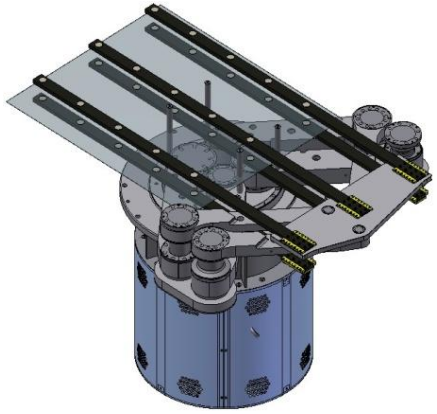
2G Vacuum Robot

6G Vacuum Link

8G Vacuum Link-Slider



3.5G Vacuum Robot



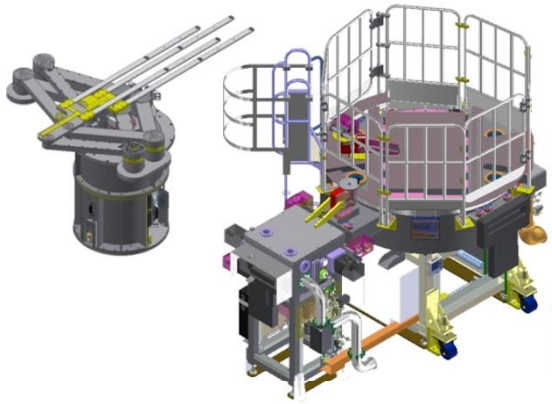
5G~6G Vacuum Robot

6G Vacuum

❖ Vacuum Transfer System for Display Panel

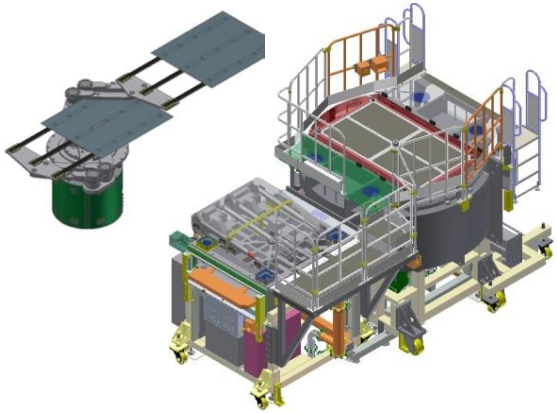
- ❖ Vacuum Transfer System : Provide Customized Vacuum Transfer Solution for OLED
- ❖ Glass & Mask Transfer Automation Solution from 2G to 6G in Vacuum Environment
- ❖ Load Lock, Transfer Chamber, Buffer Chamber and so on

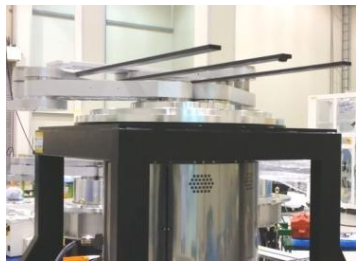
- 3 G~4G Transfer Chamber
: 3G~4G Vacuum Robot apply



4G TM Platform

- 5G Transfer Chamber
: 5G Vacuum Robot apply



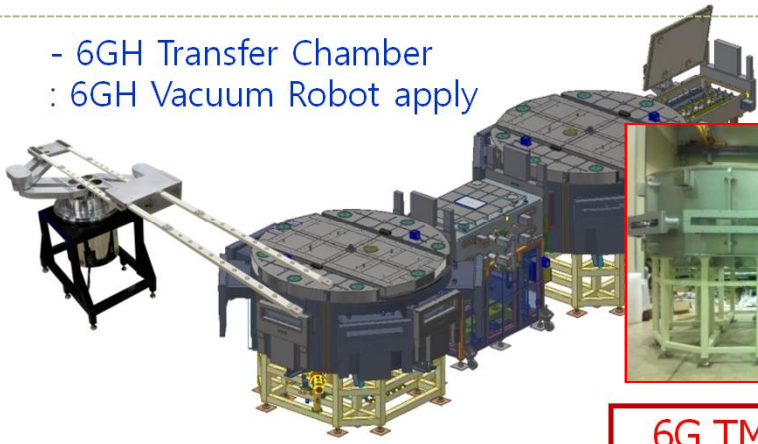


5G TM Platform

- 5.5 G Transfer Chamber
: 5.5G Vacuum Robot apply

5.5G TM Platform

- 6GH Transfer Chamber
: 6GH Vacuum Robot apply



6G TM Platform

5

Food/Cosmetic/Pharmaceutical
Handling Products Overview

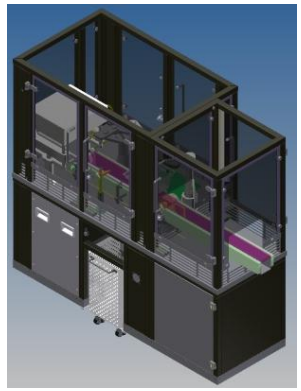
Material Handling in General Industries.

Delta Robot

Incasing Automation

Delta Robot Packaging

Bio Handling Robot



Pharmaceutical Automation

Articulated Robot

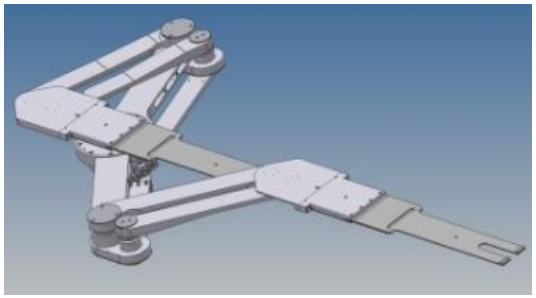
Medical & Bio Automation

Industrial Robot

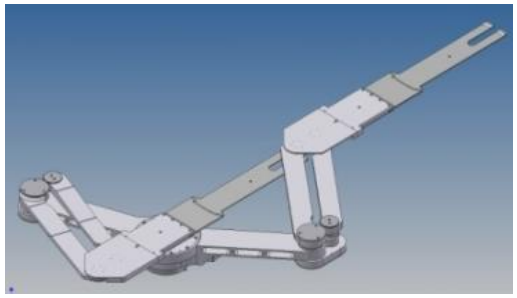
❖ Link Mechanism in Vacuum Environment

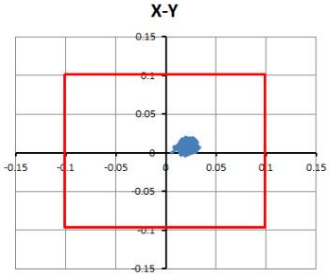
❖ Vacuum robots for cluster type
: Link Type Dual Arm Robot

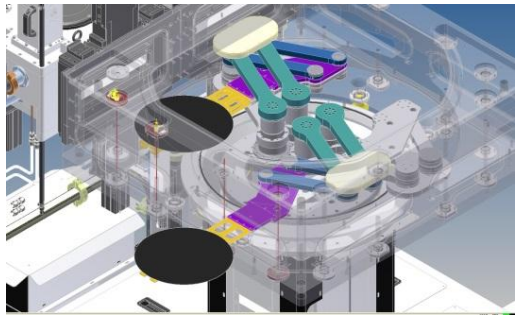
❖ Reliable Mechanism
- Reliable parallel **link Arm → Patent**
- No belt mechanism
- High speed arm [reach Time < 1 Sec]
- Field proven robot arm structure

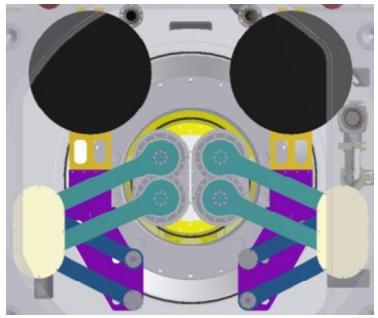


❖ 4 bar link driven robot arm **(Belt free)**
- Drive arm by bearing and gear :
- Secured reliability through long run test

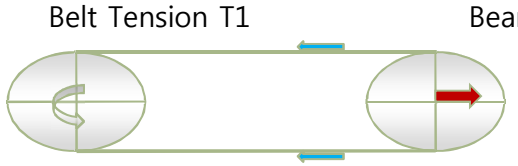




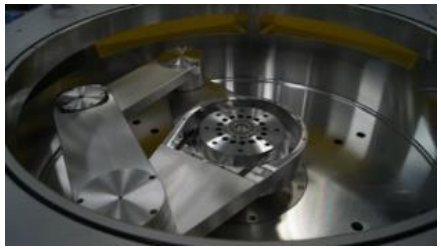


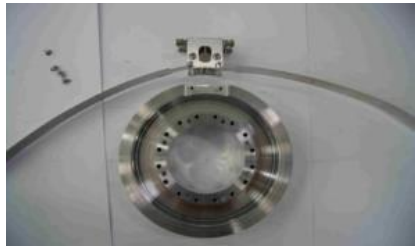


❖ Belt driven robot arm : **Case of competitor**
- Operation by bearing, pulley and belt
- Belt tension deviation issue by ambient temperature
- Misalign of arm resulted from calibration tension change
- Belt damage and bearing overload due to heat expansion



Pulley & Bearing



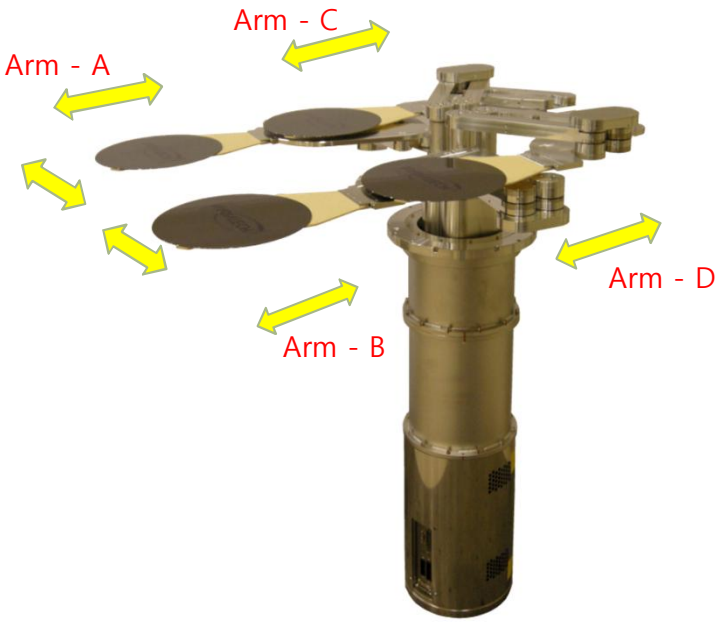


❖ Vacuum Robots for Twin chamber(Quad arm robot)

: Individually controllable quad arm robot (**each arm control available**)

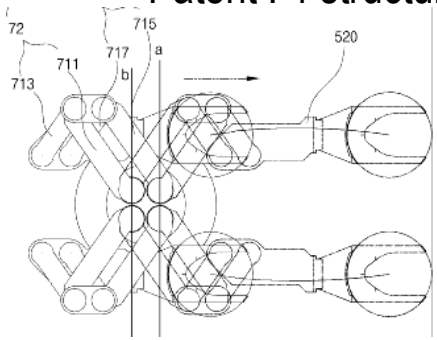
❖ Individual Control

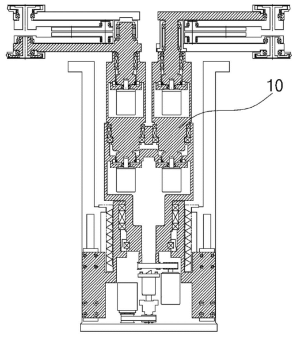
- Robot Body Up & Down + Rotation + AWC(Wafer Centering) Axis
- Arm Set (4 Arm) : Individual Extend and Retract
- Excellent reliability,
- Ease Teaching,
- Fast AWC Time & Tact Time

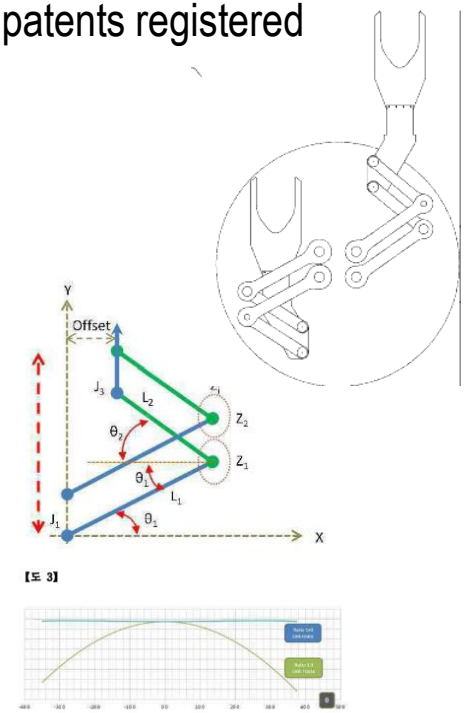


Quad (4) Arm Vacuum Robot

Patent : 4 structural patents registered

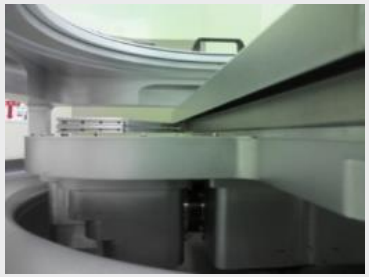
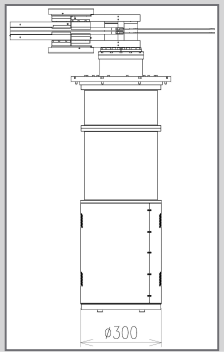
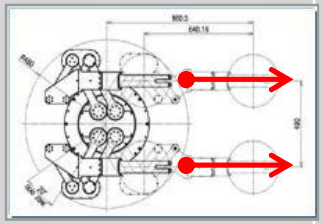
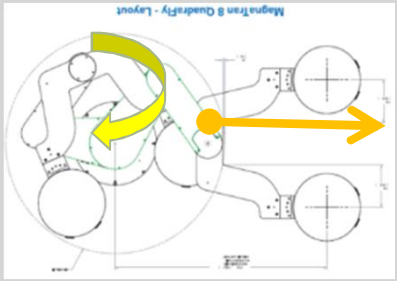
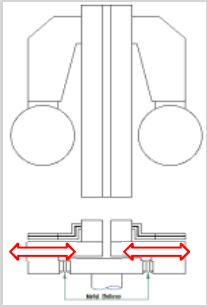




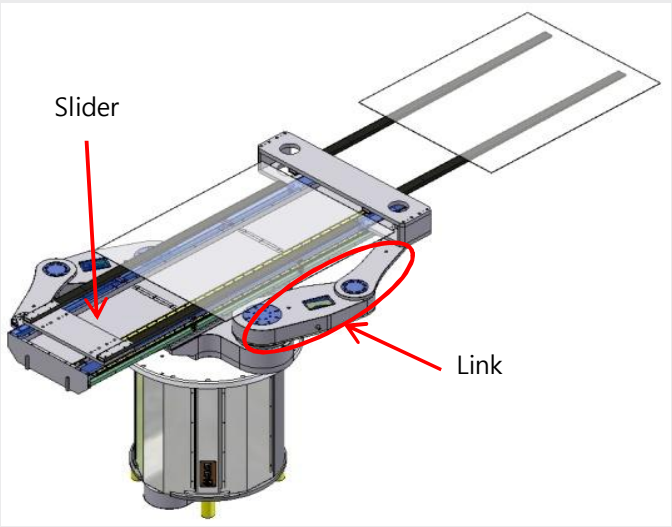


❖ Individual Controlled Quad

❖ Comparison with Competitor

	Raontec	B company	
Model	Vactra-Q		
	7 axis 	4 axis 	8 axis 
Feature	- Small Body (Φ300) - Linear Motion of Link Arm - Individual Ferro Magnet Seal - Simple Adjustment Axis  	- Dual arm quad hand robot - 4 Axis Robot - Simple - Another arm should be rotated when arm extension 	- Large Body , Large Arm Set - Linear Motion (LM Guide Type) - Large Adjustment Axis 
Strong/ weak points	* Adoptable at high temp/vacuum * Small size, Arm straight movement	• Adoptable at high temp • Difficult to teach and adjust left/right wafer • Slow Swap time using Auto Wafer Centering * Inaccurate Wafer Centering	* Weakness on particle generation due to use of LM guide in the vacuum chamber * Weak at hot temp * Difficult to maintenance due to big and heavy
MPH Accuracy Price	125 % AWC : 0.1 TIR △	100 % AWC : 0.2 TIR ○	114 % AWC : 0.2 TIR X

❖ Vacuum Robots for OLED VTS
: Link Type / Link-Slider Dual Arm

	4절 Link 구조	Link-Slider 구조
적용 분야	2G~6G Glass 및 Mask 이송용 저 가반하중 대응 진공 로봇	6G Mask 이송, 8G / 11G Glass 및 Mask 이송 등 고 가반하중 대응 진공로봇
구조	  	
특징	* 4절 Link 구조 (belt 등 사용 않음) - Particle 발생 요소 없음 - 고온에서도 안정적인 정밀도 유지 - 장기간 사용 시에도 우수한 반복 정밀도 유지 * Ferro Seal 적용 - 저진공 및 고진공에 적합	* Link Slider 구조 (진공 내 belt 사용 않음) - Particle 발생 요소 없으며, 장기간 반복정밀도 유지 - 고 가반하중에도 처짐 성능 우수 * Ferro Seal 적용 - 저진공 및 고진공에 적합
비고	T사, I사 장비에 적용 ➔ LGD, SDC 에 공급	I사 장비에 적용 ➔ 삼성전자에 공급

❖ Delta Robot

- Fast Pick & Place within 0.4sec
- Compact & High stiffness Structure
- Vision interface & Conveyor Tracking
- Application field : Food , Medical & Bio Manufacturing
- Work Range : Φ500 ~ Φ1,800mm

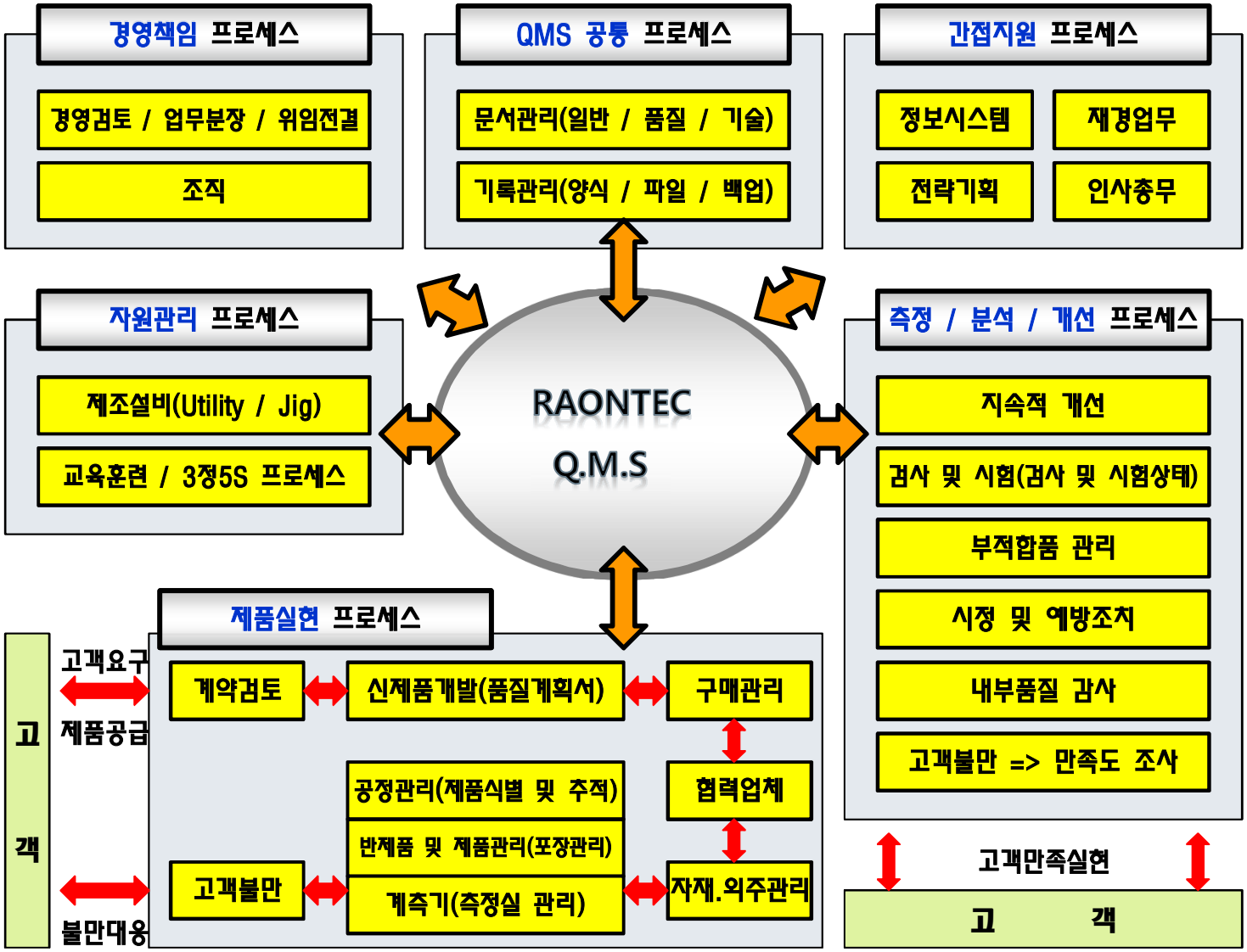
❖ Collaboration Robot - 4차 산업혁명 로봇

- Impedance Control
- Small & Compact Structure
- Integrated Driving Component Module
- Small Size & Medium Size Robot ,
  - ✓ Reach 600mm, Payload 3kg
  - ✓ Reach 850mm, Payload 5kg
- Controller Embedded in Robot Base
- 6 ~ 7Axis
- Self Diagnose Function
- EtherCat Motion Controller

Reach 600mm
Payload 3kg

Reach 850mm
Payload 5kg

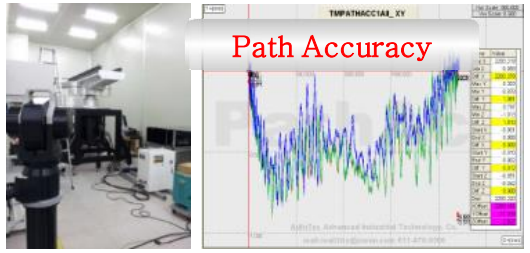
❖ Quality Management System



ISO Certification

CE Certification

Clean Room (Class 1000)



3 D Laser Performance Test

T H A N K S

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RAON Robot & Automation on Humanity