Alpha Desktop Robot

ADR - S
Desktop Robot Series



Characteristics

- With combination of high rigid structure design and high funtional robot controller system, constant high speed and high accuracy guaranteed especially, dedicated software for dispensing provides extensive functionality
  ADR Desktop robot series 는 고강성 구조의 설계 기술과 고성능 로봇 컨트롤러의 모션제어의 기술이 결합되어 고속, 고정도의 구현.
- Good performance of three dimentional linear & arc interpolation and precise path movement and various MMI
  3차원의 직선 및 원호 보간, 정밀 Cornering motion 기능, 다양한 MMI 기능
- "ADR-X type" with servo motor & ball screw type and "ADR-S type" with step motor & belt type.
  ADR series 는 "ADR-X" type 의 servo motor & ball screw type 과 "ADR-S" type 의 step motor & belt type 채용으로 사용자에 따라 제품군을 Line-up.

DESKTOP SERIES

Features of New Desk Top Robot

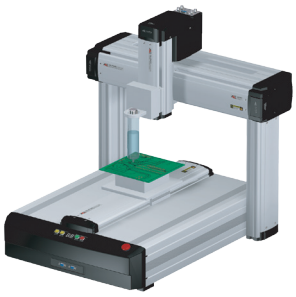
- Extruded type Body with light weight and high rigidity
- Desktop robot with a built in robot controller
- Wide-ranging models from model No. 221(small typed) to model No. 4461 (large typed)
- From affordable models to special typed models
  Servo motor type / Step motor type, Ball screw type / Belt driving type
- High load, high speed, high precise 3 dimensional interpolation and Motion control of accurate cornering
- Dedicated sealing S/W

Robot Controller Hardware Specifications

- RACK Structure - A/S, Easy extention
- Multi DSP System - 3 DSP Applied by function
  Improvement of control and stability
- 32Bit high speed DSP applied - Total 1280MIPS
- New ASIPM applied - Reliability of motor driving improved
- 15KHz high speed switching control - Low noise control
- Great capacity of regenerate resistor - High load inertia driving improved
- ABS / INC encoder applied to all models
- Compact and convenient outer design
- Extensive functions of safe devices
  - Inspection of errors between CPUs
  - All inspection of power supply error
  - BRAKE shortage inspection
  - Inspection of contact error of controller
  - Remote power on/off

Desktop Application

- **Dispensing**
  Coating



- **Vision Inspection**
  Circuit Board Inspection



- **Screw Assembly**
  Driving Screws



- **Soldering**
  Soldering



DESKTOP SERIES

New DeskTop Robot 특장점

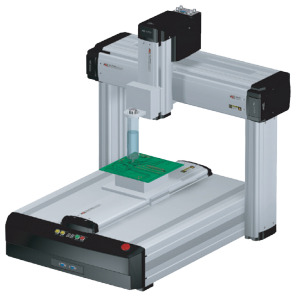
- 경량 고강성 압출형 로봇 Body
- 로봇 컨트롤러 일체형 Desktop 로봇.
- 221부터 4461까지 소형에서 대형모델 까지 다양한 Model Line - up
- 보급형과 고급형 Model Line - up
  서보 모터형 / 스탭 모터형, Ball screw / Belt 구동형
- 고하중, 고속, 고정밀 3차원 보간기능, 정밀 코너링 Motion 제어기능,
- Sealing 전용 S/W

로봇 제어기 HARDWARE Spec

- RACK 구조 - A/S, 증설 용이
- Multi DSP System - 기능별 3개 DSP 적용.
  제어성능, 안정도 향상
- 32Bit 최신 고속 DSP 적용 - Total 1280MIPS
- 최신 ASIPM 적용 - Motor 구동 신뢰성 향상
- 15KHz 고속 switching 제어 - Motor 소음 없이 정숙한 제어 실현
- 대용량 회생저항 사용 - 고관성 부하 구동 능력 향상.
- ABS / INC encoder 모두 적용
- Compact 하며 편리성을 도모한 외관 디자인
- 증설된 안전 장치 및 기능
  - CPU 간에 오동작 감시
  - 모든 전원 이상 감시
  - BRAKE 단선 감시
  - 제어기 접촉 불량 감시
  - Remote power on/off

Desktop Application

- Dispensing
  피막 도포 장비
- Vision Inspection
  검사 측정 장비
- Screw Assembly
  볼트 체결 장비
- Soldering
  용접 설비 장비



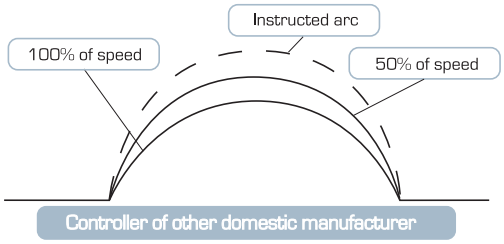



FEATURES OF ALPHA ROBOT

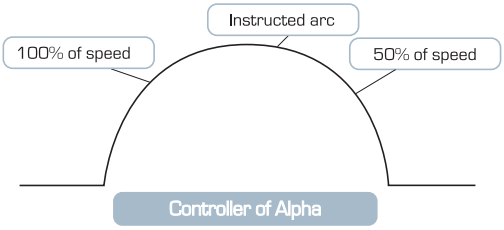
Through all range of speed (up to 100%), uniformed path following error is within 0.5mm (During operation of Linear or arc interpolation)

- Feed forward control with consideration of dynamics shortens time delay
- Feed forward control built in software for speed & current commands

Path following error by changes of speed (Other companies)



Path following error by changes of speed (Alpha Robotics)

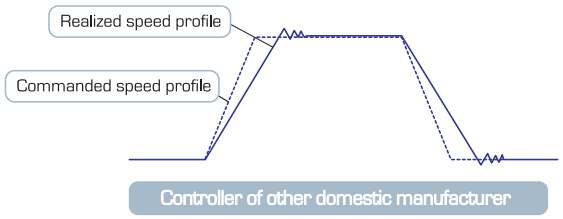


Terms explanation : Dynamics - Indicates load values on the motor changed rapidly by changes of speed and location of moving robots
Feed Forward - Indicates as a method of controlling motors to add certain gain regardless of error values of control loop

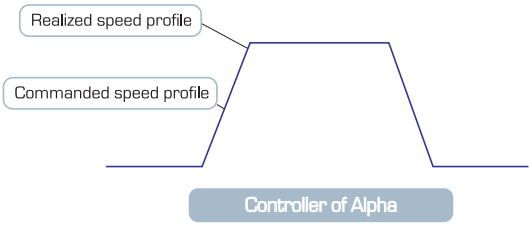
Control of vibration with flexible articulations (axes) by Notch Filter

- Notch Filter as S/W is located in front of Current
- Control of indigenous vibration of a body of robot by Notch Filter

In case of no vibration control



Reason of merit of vibration control

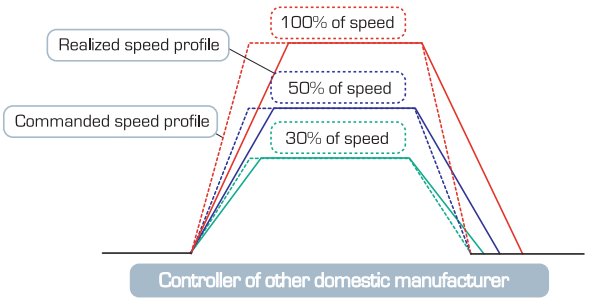


Terms explanation : Notch Filter - Indicates a high technical method to eliminate unstable factors through characteristic analysis of control system

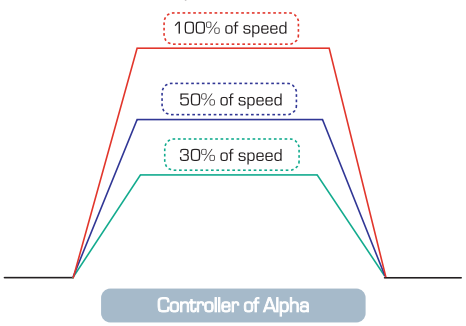
Quick response by Dynamic Feed forward (Shortened cycle time)

- Compensated control of commands of speed and current with consideration of commanded speed, acceleration, and load inertia
- Algorithm of speed and current commands built in function of Feed forward

Reason of late response of controller of other domestic manufacturer



Reason of good point of Feed forward control system with consideration of dynamics

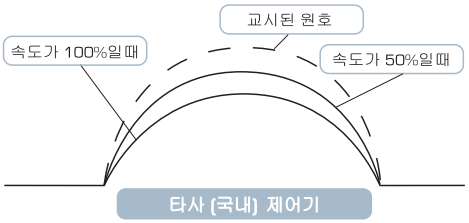


ALPHA ROBOT의 특징

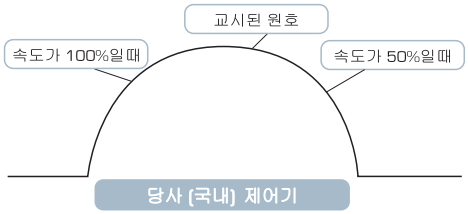
전속도 범위 (up to 100%) 내에서의 양호한 균일 경로 추종정밀도 : 0.5mm 이내 (직선 또는 원호 보간 동작 시)

- 다이나믹스를 고려한 피드포워드 제어로 시스템의 시간지연 감소
- 속도, 전류지령 부분에 피드포워드 제어기능 S/W삽입

속도변동에 따른 경로추종 오차 (타사)



속도변동에 따른 경로추종 오차 (당사)

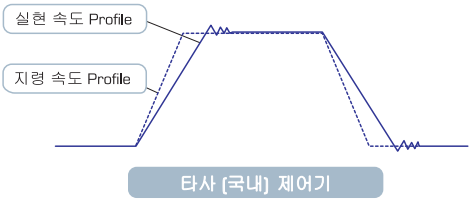


용어 설명 : 운동 다이나믹스 - 로봇은 이동시 가감속과 위치에 따라 모터에 걸리는 부하가 매우 빠르게 변동되는 것을 의미
피드포워드 - 모터를 제어하는 기법으로 제어 loop에 error 값과 관계없이 일정 gain 추가하는 방법

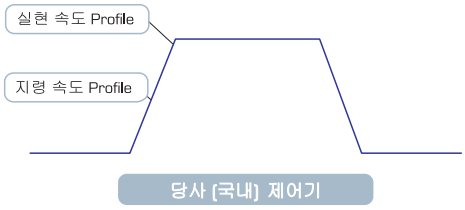
Notch Filter 사용으로 유연한 관절의 진동억제 제어 가능

- 전류 앞단에 S/W적인 노치 필터 삽입
- 노치필터 기능 삽입시 기구부 고유진동 제거가능

진동억제 제어기능이 없는 경우



진동억제 제어기능이 좋은 이유는?

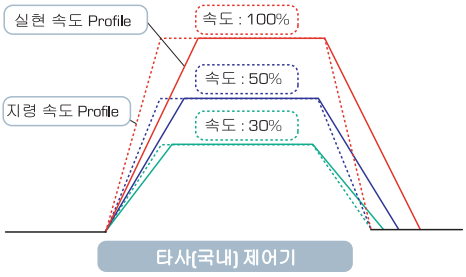


용어 설명 : Notch Filter - 고도의 제어기법으로 제어계의 특성 분석을 통해 제어계를 불안정하게하는 요인들을 제거하는 기법

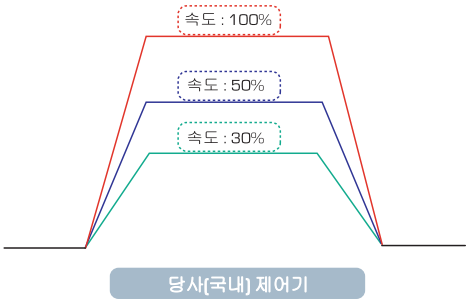
Dynamic Feed - forward 제어를 통한 빠른 응답성 (Cycle time 향상)

- 지령속도, 가속도및 부하관성을 고려하여 속도및 전류지령 보정제어
- 속도지령, 전류지령 알고리즘에 "피드포워드" 기능삽입

타사 제어기가 응답성이 느린 이유는?



Dynamics를 고려한 Feed-forward 제어가 좋은 이유는?



DESKTOP SERIES

Movable without mechanical impact by acceleration or deceleration moving mode in proportion to moving speed

- When motion planning of main controller is designed, mechanical impact generated in acceleration or deceleration of low speed is decreased by setting values of acceleration and deceleration in proportion to moving speeds



Motion planning → Positioning → Speed → Current

Terms explanatio : Motion planning - Indicates a planning to make each part of robot body move to planned positions in 3 dimensional space.

Excellent positioning resolution with full digital control system : Positioning resolution : +/- 1 Encoder Pulse

- In case of Analog
  - Control resolution is low by changes of Offset value according to temperatures
  - Servo Gain regulation is difficult for treatment of variable resistance
- In case of Digital
  - High resolution due to no temperature Offset
  - Easy Servo Gain regulation due to regulation by figures

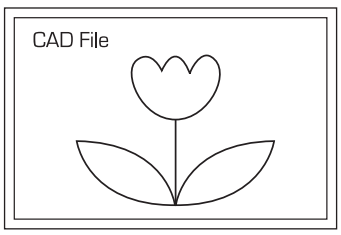


Positioning → Digital commands → Speed → Digital commands → Current

CAM Support

- Without additional robot programming, it's possible to operate with Autocad file

PC CAD File → Save → PC DXF File → Conversion → HOST RBT P.




```
ROBOT PROGRAM
MAIN
JMOV P0
C2MV P2 P3
C2MV P5 P6
CWMV P7 P8
CZMV P9 P10
....
END
```

HOST RBT P. → Transmission → CONT RBT P.

DESKTOP SERIES

이동속도에 비례하는 가·감속도 이동모드로 기계적 충격 없이 이동가능

- 궤적계획 (메인제어기의 모션플래닝) 시 이동속도에 비례되는 가·감속도를 선정하여 저속 가·감속시 발생하는 기계적 충격을 감소 시킴 (종전대비)





용어 설명 : 모션플래닝 - 3차원 공간상에서 로봇이 목적 위치로 이동하기 위해 각 기구부의 운동을 계획하는 것.

Full - digital 제어를 통한 우수한 위치 결정 정밀도: 위치제어 정밀도 : +/- 1Encoder Pulse

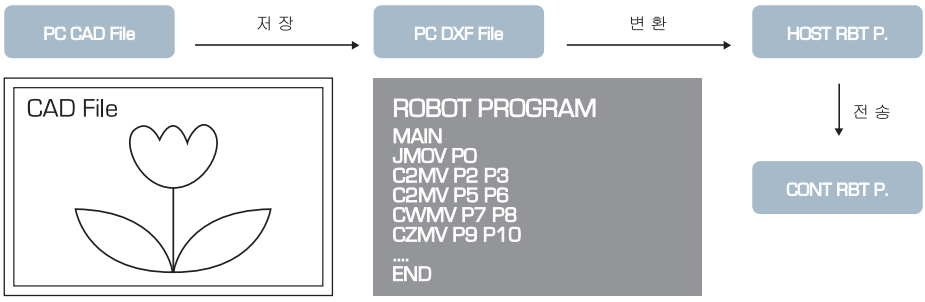
- 아날로그의 경우
  - 온도에 따른 아날로그 옵셋값이 변화되어 제어정밀도 떨어짐.
  - Servo Gain 조정을 가변저항으로 처리하므로 조정 어려움.
- 디지털의 경우
  - 온도 옵셋이 없으므로 정밀도 향상
  - Servo Gain 을 숫자로 조정하여 조정 편리함.





CAM 지원

- AUTO CAD 에서 작업한 FILE로 로봇 운영시 별도의 로봇 Program을 만들지 않고 로봇 운영 가능



FEATURES OF DEDICATED S/W for ALPHA DISPENSING ROBOT

Features of dedicated sealing software

- Easy programming by dedicated sealing control commands
- Possible to set up all conditions with the control commands for sealing
- Able to form patterns through repeated operations of the commands
- Easy operation of sealing for certain area with simple commands
- Function of original locations when tools are exchanged
- Ending treatments of line application with various methods available (Retract)
- Function of disp on/off interval at starting and ending parts
- Operation possible by CAD file (DXF exchange package provided)

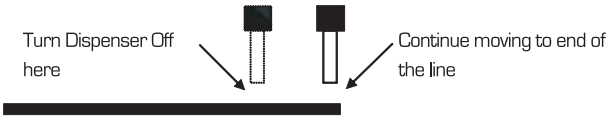
Accurate sealing

- **Tail Length function**

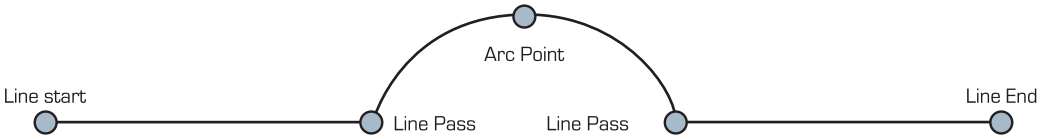
Problem : Making a lump at the ending part of sealing



Solution : Command of dispense off before the ending part in order to eliminate the lump



Dedicated sealing commands



- Easy programming by dedicated sealing commands which was complicated operating programming before (Co-owned commands of international sealing robot manufacturer)
- Functional commands applicable to sealing operation
- Example of above programming of operation

Former commands	Dedicated commands
MAIN Z	Z Clearence
LIFTZ 20	Disp Condition
JMOV P0	Line Start
OUT0=1	Line Passing
DELAY 50	Arc Point
LMOV P1	Line Passing
C2MV P2 P3	Line End
LMOV P4	End Program
OUT 0=0	
DELAY 100	
JOMV P5	
END	

Set up of Sealing Conditions

- **Pnt Dis. Setup -** Set dispensing time and waiting time at the end of dispensing for dots (Dis. Time, Tail Time).
- **Line Dis. Setup -** Set preparatory time of dispensing at the start of line and waiting time at the end of lines (Head Time, Tail Time).
- **Dis. End Setup -** Set the speed and height of the peak at the end of dispensing (H.Speed, L.Speed, L.Length).

ALPHA DISPENSING ROBOT 전용 S/W 특징

실링 전용 소프트웨어의 장점

- 실링 전용 명령어 사용으로 쉬운 프로그램 작성
- 실링을 위한 각종 조건을 명령어를 이용해서 설정 가능
- 툴 교환시 기존 좌표 보정 기능
- 간단한 명령어로 임의의 영역을 실링 가능
- 임의의 도형을 여러 번 반복하여 패턴화 가능
- 다양한 방식의 선도포 끝부분 처리 기능 (Retract)
- 시작, 끝 부분 disp on/off 길이 조정 기능
- CAD에서 작업한 파일로 운전 (DXF 변환패키지 제공)

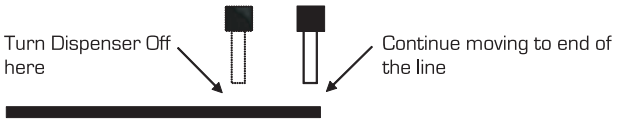
편리한 실링 기능

- Tail Length function

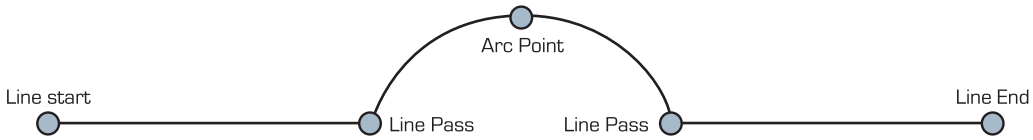
Problem : line의 끝에서 뭉치는 현상발생



Solution : line 종료시점 전에 dispenser off 하여 끝에서 뭉치는 현상 제거



실링 전용 명령어



- 기존 로봇의 난해한 운영 프로그램을 실링 전용 명령어로 간단히 운영 프로그램을 작성 (세계적인 실링 로봇 업체와 명령 공유)
- 실링 작업에 적합한 기능 명령 구현
- 상기의 도형 프로그램 예

기존 명령어	전용명령어	
MAIN Z	Z Clearence	(Z축 높이 지정)
LIFTZ 20	Disp Condition	(실링 토출 대기 등을 지정)
JMOV P0	Line Start	(실링 시작점)
OUT0=1	Line Passing	(실링 중간점. 비정지)
DELAY 50	Arc Point	(원호 보간)
LMOV P1	Line Passing	(실링 중간점. 비정지)
C2MV P2 P3	Line End	(실링 끝점)
LMOV P4	End Program	
OUT 0=0		
DELAY 100		
JOMV P5		
END		

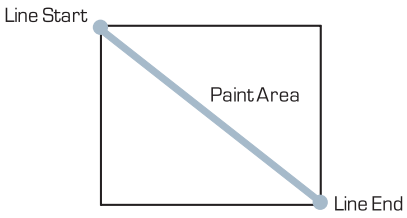
실링 조건 설정

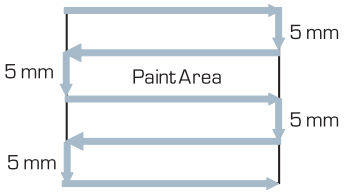
- Pnt Dis. Setup - Dispensing 시간설정 및 말단부 (끝점) 에서의 휴지시간 설정 (Dis 시간, 마무리 시간)
- Line Dis. Setup - 개시부(시작점)에서의 Dispensing 준비시간 과 말단부 (끝점) 에서의 휴지시간 설정 (개시시간, 마무리 시간)
- Dis. End Setup - Dispensing 마무리 단계에서 정점에 이르는 속도와 높이 설정 (H.속도, L 속도, L 길이)

DESKTOP SERIES

Sealing of areas by simple commands

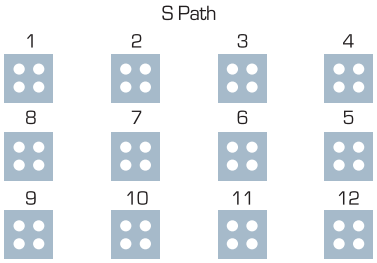
- Brush Area : Cols, Rows, X Off, Y Off, Addr, S Path, Circle, Doughnut

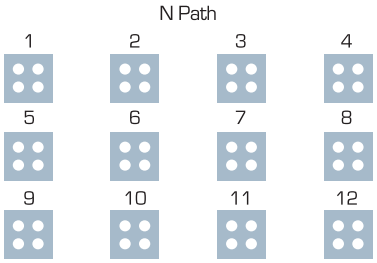




Forming of pattern with simple commands

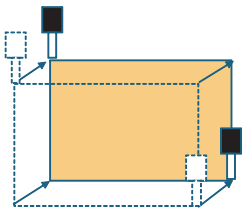
- Step & Repeat X,Y





Function of original location

- When tools are exchanged, input standard two points and then all the coordinates and paths are compensated automatically without inputting all the points and paths again

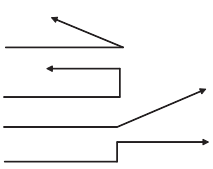


RETRACT

- For soft and accurate ending treatment of line application, tail of solution is on the surface of application

- Operating mode

1. Normal
2. Square
3. Forward
4. Forward Square



CAM Support

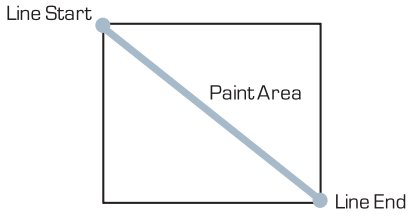
- Without additional robot programming, operation by Autocad file is available

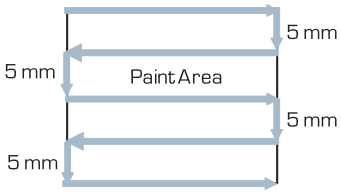
CAM file → Robot Program Conversion → Operation of Robot

DESKTOP SERIES

간단한 명령어로 영역 실링

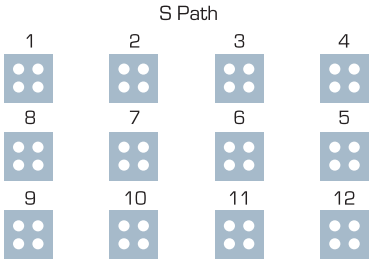
- Brush Area : Cols, Rows, X Off, Y Off, Addr, S Path, Circle, Doughnut

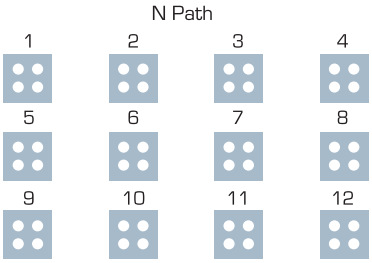




간단한 명령어로 도형 패턴화

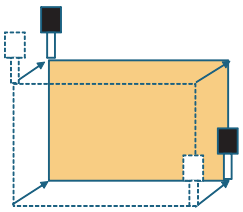
- Step & Repeat X,Y





좌표 보정 기능

- 기존에 사용하던 툴을 형상이 다른 새로운 툴로 교체한 경우
  기존의 저장된 위치를 다시 저장할 필요 없이 두 점의 기준 위치를
  입력하여 전체 좌표를 자동으로 보정.

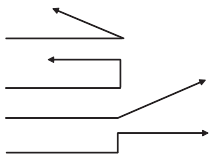


RETRACT

- 선도포의 끝 부분을 부드럽게 처리하기 위하여
  용액의 꼬리 부분을 도포면 위에 올려준다.

- 동작모드

1. Normal
2. Square
3. Forward
4. Forward Square



CAM 지원

- AUTO CAM 에서 작업한 FILE로 로봇 운영시 별도의 로봇 Program을 만들지 않고 로봇 운영 가능.

CAM file → 로봇 Program 자동변환 → 전 류

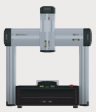
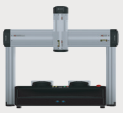
DESKTOP SERIES

ADR SERIES

ADR	-	SX	-	3	-	221	R
1		2		3		4	5





1 SERIES	ADR SERIES ALPHA Desktop Robot	 ADR221	 ADR331	 ADR441	 ADR3351	 ADR4461
2 TYPE	SX Servo Motor Type		SS Step Motor Type			
3 AXIS	2 2 Axis		3 3 Axis		4 4 Axis	
4 SIZE (mm)	220 200×200(XY) 221 200×200×100(XYZ) 330 300×300(XY) 331 300×300×100(XYZ) 440 400×400(XY) 441 400×400×100(XYZ) 3351 300×300×500×100(X_1X_2YZ) 4461 400×400×600×100(X_1X_2YZ)					
5 R AXIS	R R Axis		N None			

DESKTOP SERIES

Specification of Desktop Robots

ADR - SS (Stepping motor)									
Model		220(R)	221(R)	330(R)	331(R)	440(R)	441(R)	3351	4461
Range of operation	X axis	200mm	200mm	300mm	300mm	400mm	400mm	300mm	400mm
	Y axis	200mm	200mm	300mm	300mm	400mm	400mm	500mm	600mm
	Z axis	-	100mm	-	100mm	-	100mm	100mm	100mm
	R/(W) axis	300deg	300deg	300deg	300deg	300deg	300deg	-	-
Speed	PTP X, Y	500mm/s	500mm/s	500mm/s	500mm/s	500mm/s	500mm/s	500mm/s	500mm/s
	PTP Z	-	200mm/s	-	200mm/s	-	200mm/s	200mm/s	200mm/s
	PTP R/(W)	360 degree/s	360 degree/s	360 degree/s	360 degree/s	360 degree/s	360 degree/s	-	
	CP X, Y, (Z)	0.1.-500mm/s (0.1.-200mm/s)							
Repeatability accuracy (MAX)	X, Y axis	± 0.05mm	± 0.05mm	± 0.05mm	± 0.05mm	± 0.05mm	± 0.05mm	± 0.05mm	± 0.05mm
	Z axis	-	± 0.02mm	-	± 0.02mm	-	± 0.02mm	± 0.02mm	± 0.02mm
	R(W) axis ※1	± 0.22°	± 0.22°	± 0.22°	± 0.22°	± 0.22°	± 0.22°	-	
Position Command Resolution (All)		0.001mm	0.001mm	0.001mm	0.001mm	0.001mm	0.001mm	0.001mm	0.001mm
Portable weight	Work	10kg	10kg	10kg	10kg	10kg	10kg	10kg	10kg
	Tool	(2Kg)	5Kg (2Kg)	(2Kg)	5Kg (2Kg)	(2Kg)	5Kg (2Kg)	5Kg	5Kg
Number of controllable axis (R)		2 Axis (3 Axis)	3 Axis (4 Axis)	2 Axis (3 Axis)	3 Axis (4 Axis)	2 Axis (3 Axis)	3 Axis (4 Axis)	4 Axis	4 Axis
Motion Program Language		Dispensor Language (Dispense Line / DOT / Arc / Circl, Various Brush Area, Step & Repeat, Line Dispense Setup, Point Dispense Setup, Dispense End Setup, Z Clearance, Retract, Auto Purge, Round, PALLET, Mathematic calculation, Cycle Counter, etc)							
PLC Program Language		30 instruction sets							
Programming method		T - Box , PC							
Operating method		T - Box, PC, Front-panel, I/O							
Drive method		Micro stepping motor							
Control method		PTP and CP (2D/3D Line,circle)							
External interface		RS232-C 2ch							
User input / output		System I/O (IN : 4, OUT : 5), User I/O (IN : 16, OUT : 15)							
CPU Performance		Main : 32bit ,1200MFLOFS, Servo : 16Bit, 40MIPS * 2							
PLC function		10 programs, 1000 steps/PGM							
Program capacity		100 programs, 1000 steps/PGM							
Data memory capacity		20,000 step / 20,000 points							
Program Storage		512KB Battery Backup SRAM							

※1:R axis : Without Gear

DESKTOP SERIES

Specification of Desktop Robots

ADR - SX (AC Servo motor)							
Model		330(R)	331(R)	440(R)	441(R)	3351	4461
Range of operation	X axis	300mm	300mm	400mm	400mm	300mm	400mm
	Y axis	300mm	300mm	400mm	400mm	500mm	600mm
	Z axis		100mm		100mm	100mm	100mm
	R/(W) axis	300deg	300deg	300deg	300deg		
Speed	PTP X, Y ※2	1000mm/s	1000mm/s	1000mm/s	1000mm/s	1000mm/s	10 00mm/s
	PTP Z		500mm/s		500mm/s	500mm/s	500mm/s
	PTP R/(W)	360 degree/s	360 degree/s	360 degree/s	360 degree/s		
	CP X,Y, (Z)	500mm/s	500mm/s	500mm/s	500mm/s	500mm/s	500mm/s
Repeatability accuracy (MAX)	X, Y, Z axis	± 0.02mm	± 0.02mm	± 0.02mm	± 0.02mm	± 0.02mm	± 0.02mm
	R(W) axis※1	± 0.11°	± 0.11°	± 0.11°	± 0.11°		
Repeatability accuracy	All axis	0.001mm	0.001mm	0.001mm	0.001mm	0.001mm	0.001mm
Portable weight	Work X, W	7kg	7kg	7kg	7kg	7kg	7kg
	Tool Z (R)	(4kg)	7kg (4kg)	(4kg)	7kg (4kg)	7kg	7kg
Number of controllable axis (R)		2 Axis (3 Axis)	3 Axis (4 Axis)	2 Axis (3 Axis)	3 Axis (4 Axis)	4 Axis	4 Axis
Motion Program Language		Dispensor Language (Dispense Line / DOT / Arc / Circl, Various Brush Area, Step & Repeat Line Dispense Setup, Point Dispense Setup, Dispense End Setup, Z Clearance, Retract, Auto Purge, Round, PALLET, Mathematic calculation,Cycle Counter, etc)					
PLC Program Language		30 instruction sets					
Drive method		AC servo Motor					
Control method		PTP and CP (2D/3D Line,circle)					
External interface		RS232-C 2ch					
User input /output		System I/O (IN : 4, OUT : 5), User I/O (IN : 16, OUT : 15)					
Extension (Option) User input /output		IN : 16, OUT : 15					
CPU Performance		Main : 32bit, 1200MFLOFS, Servo : 16Bit, 40MIPS * 2					
PLC function		10 programs, 1000 steps/PGM					
Program capacity		100 programs, 1000 steps/PGM					
Data memory capacity		20,000 step / 20,000 points					
Program Storage		512KB Battery Backup SRAM					

※1 : R axis : With gear
※2 : Configure to order the ball screw lead 10

ADR series

* With combination of high rigid structure design and high funtional robot controller system, constant high speed and high accuracy guaranteed Especially, dedicated software for dispensing provides extensive functionality
* Good performance of three dimentional linear & arc interpolation and precise path movement and various MMI
* "ADR-X type" with Servo motor & Ball screw type and "ADR-S type" with Step motor & Belt type.

* ADR Desktop Robot series는 고강성 구조의 설계 기술과 고성능 로봇 켄트롤러의 모션제어 기술이 결합되어 고속, 고정도를 구현. 특히 DISPENSING 전용 소프트웨어 채용으로 탁월한 성능을 발휘.
* 3차원 직선 및 원호 보간, 정밀 Cornering Motion 기능, 다양한 MMI 기능.
* ADR series는 "ADR-X" TYPE의 Servo motor & Ball screw type 과 "ADR-S" TYPE의 Step motor & Belt type 채용으로 사용자에 따라 제품군을 Line-up.

The features of ADR series

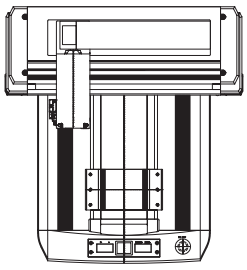
1) Wide variations
   a. Ball screw type drive method with servo motor
   b. Ball screw type drive method at Z axis with step motor
   c. From small sized type, 200 X 200 (X+Y) to large sized type, 400 X 600 X 600 (X1+X2+Y)
   d. From popular type to specialized type
2) High rigid structure
   Minimum vibration during operation and transferring due to the sturcture
3) High speed and precision
   High speed and precision achieved through punctional motion controller, servo motor, and ball screw
4) axes combination (X+Y) available
5) Absolute encoder available

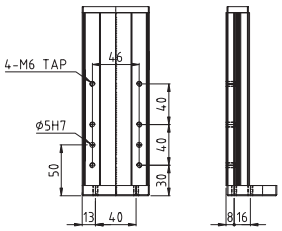
ADR series Desktop Robot의 특징

1) 다양한 제품군
   a. Sevor motor type에 Ball screw 구동형
   b. Step motor type에 Belt 구동형 (Z축 Ball screw)
   c. 소형 200 X 200 (X+Y)에서 대형 제품 400 X 600 X 600 (X1+X2+Y) 대응가능
   d. 보급형에서 고급형의 제품 대응가능
2) 고강성 구조
   이송 및 작업시의 충격에 의한 흔들림을 최소화
3) 고속 및 고정도 실현
   고성능 모션 컨트롤러 및 Servo motor 와 Ball screw를 적용하여 고속 및 고정도 실현
4) 2축 (X+Y) 조합으로도 가능
5) Absolute Encoder 사용가능

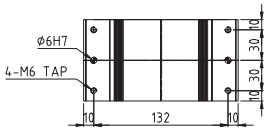
ADR-SS-221



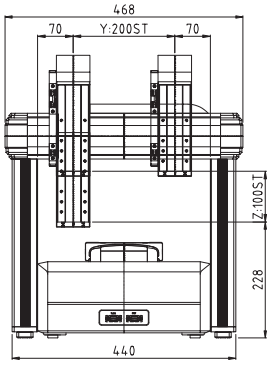


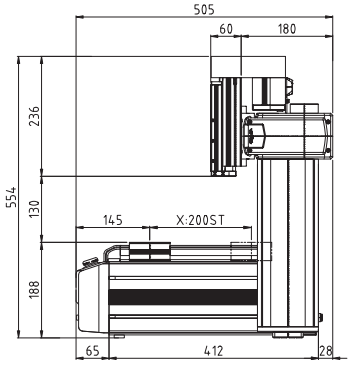


Z-Axis Table



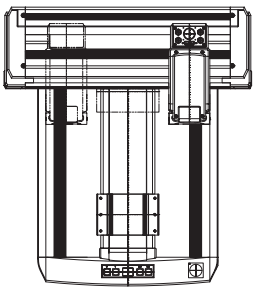
X-Axis Table

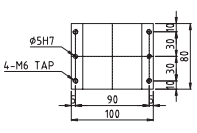




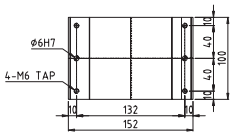
ADR-SX, SS-331



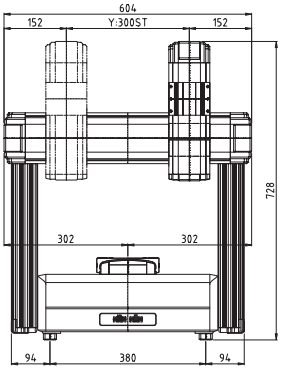


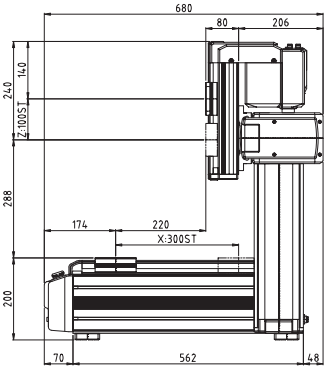


Z-Axis Table



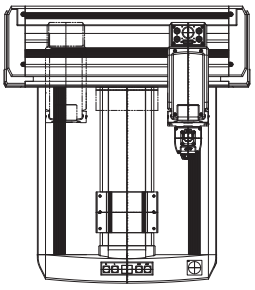
X-Axis Table

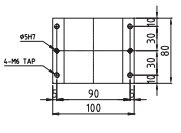




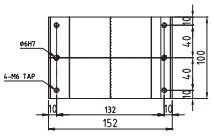
ADR-SX, SS-331R



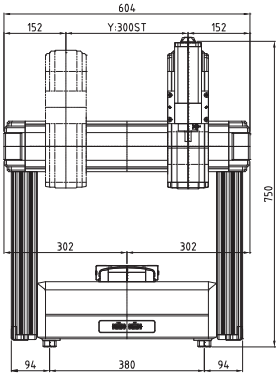


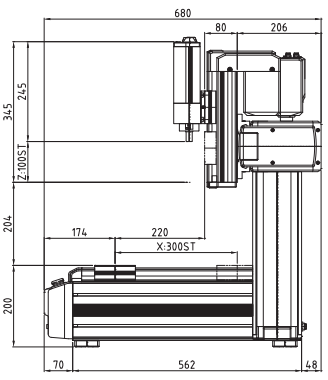


Z-Axis Table

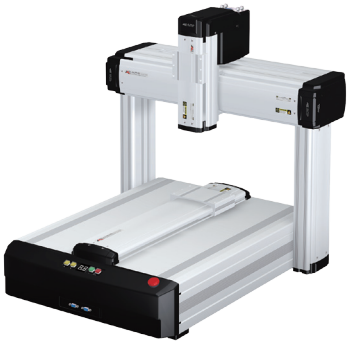


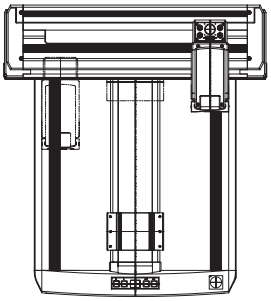
X-Axis Table

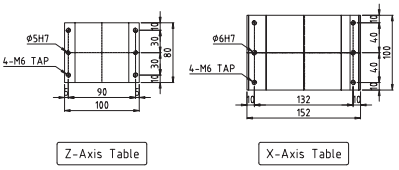


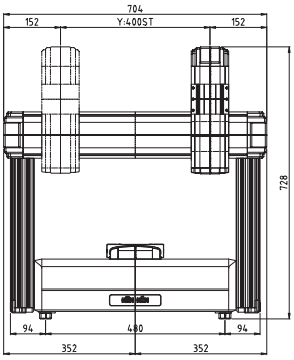


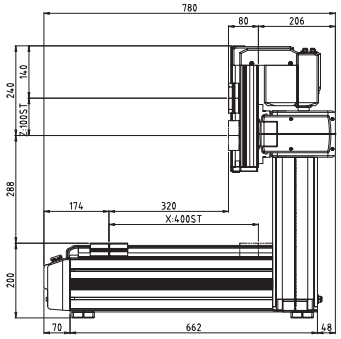
ADR-SX,SS-441





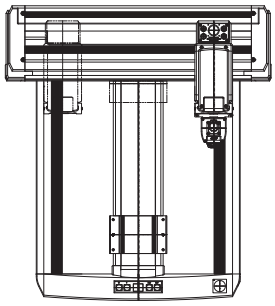


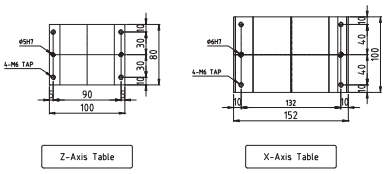


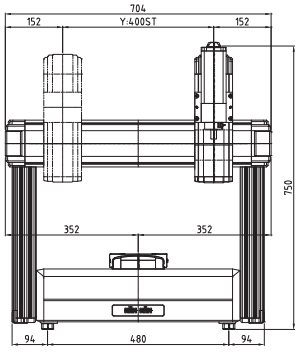


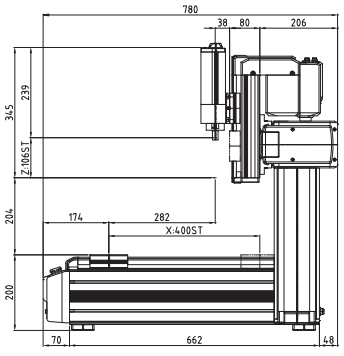
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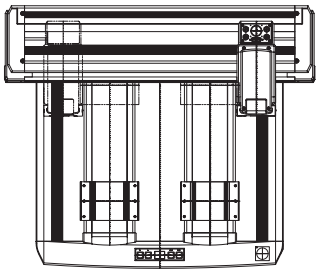


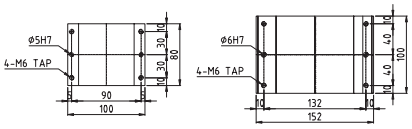


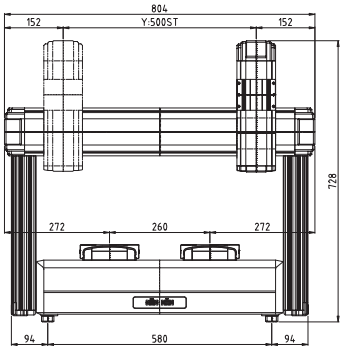


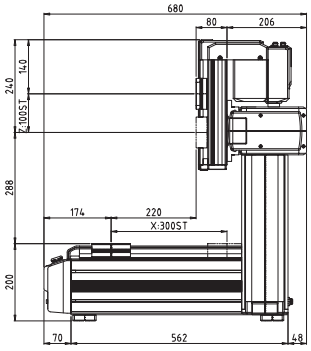
ADR-SX,SS-3351











ADR-SX,SS-4461



