National Competition 2020 | worldskills Thailand

ข้อกำหนดทางเทคนิค

การแข่งขันฝีมือแรงงานแห่งชาติ ครั้งที่ 28

สาขา : ระบบอัตโนมัติทางอุตสาหกรรม

วันที่ 17 – 19 มีนาคม 2563

ณ สถาบันพัฒนาฝีมือแรงงาน 1 สมุทรปราการ
อำเภอบางเสาธง จังหวัดสมุทรปราการ

National Competition 2020 | worldskills Thailand

ข้อกำหนดทางเทคนิคการแข่งขันฝีมือแรงงานแห่งชาติ ครั้งที่ 28
สาขาระบบอัตโนมัติทางอุตสาหกรรม

****

1. ลักษณะข้อสอบที่ใช้ในการแข่งขัน

เขียนโปรแกรมควบคุมระบบอัตโนมัติทางอุตสาหกรรมและตรวจสอบความถูกต้องของโปรแกรมควบคุมระบบอัตโนมัติทางอุตสาหกรรม

2. เวลาที่ใช้ในการแข่งขัน

จำนวน 6 ชั่วโมง

3. ข้อแนะนำ

3.1 ข้อสอบจะมีการเปลี่ยนแปลงปริมาณ 30% โดยใช้ HMI ในการสั่งงานและแสดงผลชุดแข่งขัน

3.2 ชุดแข่งขันมี 4 ชุด กำหนดการแข่งขันเป็น 3 วัน โดยจับฉลากเข้าแข่งขันวันละ 4 ทีม

3.3 จัดให้มีการแนะนำและทดลองใช้ชุดแข่งขันในวันที่ 17 มีนาคม 2563

3.4 ผู้เข้าแข่งขันต้องเตรียมมัลติมิเตอร์มาใช้ในการแข่งขันเพื่อใช้ตรวจสอบอุปกรณ์

3.5 มีคอมพิวเตอร์ส่วนกลางไว้ให้ในการแข่งขัน

3.6 การตัดสินของกรรมการถือเป็นเด็ดขาด

4. กฎ กติกาในการแข่งขัน

4.1 ในการแข่งขัน ผู้แข่งขันจะต้องมารายงานตัวต่อกรรมการผู้ควบคุมการแข่งขันไม่น้อยกว่า 30 นาที ก่อนเริ่มการแข่งขันทุกวัน เพื่อรับทราบคำแนะนำ คำชี้แจง และข้อปฏิบัติในการแข่งขัน

4.2 ผู้แข่งขันต้องแต่งกายให้เรียบร้อยเหมาะสมกับลักษณะงาน

4.3 ผู้แข่งขันต้องปฏิบัติงานด้วยความปลอดภัยและใช้วัสดุอย่างประหยัด

4.4 ผู้แข่งขันมีเวลาในการปฏิบัติงานทั้งหมด 6 ชั่วโมง โดยผู้เข้าแข่งขันต้องบริหารเวลาด้วยตนเอง ไม่มีการจัดเวลาหยุดพักขณะปฏิบัติงานเว้นเสียจากกรณีอุบัติเหตุ บาดเจ็บ หรือความเจ็บป่วยฉุกเฉิน

4.5 กรณีที่ผู้เข้าแข่งขันใช้เครื่องมือ เครื่องจักร ไม่ถูกต้อง ไม่ปลอดภัย ซึ่งอาจก่อให้เกิดอันตรายต่อตนเองและผู้อื่น กรรมการจะตักเตือนโดยให้พี่เลี้ยงหรือผู้ดูแลเยาวชนร่วมรับทราบและทำการบันทึกการตักเตือนไว้ หากผู้เข้าแข่งขันยังปฏิบัติอีก กรรมการจะเชิญออกจากการแข่งขัน

5. เครื่องมือ วัสดุ อุปกรณ์ที่ใช้ในการแข่งขัน

5.1 วัสดุและอุปกรณ์ที่จัดเตรียมไว้ให้สำหรับผู้แข่งขันต่อหนึ่งคน

ลำดับ	รายการ	คุณลักษณะ	จำนวน	หน่วยนับ	รูปภาพ (ถ้ามี)	หมายเหตุ
1	คอมพิวเตอร์		2	เครื่อง		
2	สายไฟปลั๊กพ่วง	4 ช่อง	2	อัน		
3	ตลับเมตร	ขนาด 3 เมตร	1	อัน		
4	ไขควงชุด	ยี่ห้อสแตนเล่ย์	1	ชุด		
5	ตัวกระจายสัญญาณ	8 พอร์ต	1	ตัว		
6	สายเครือข่ายอีเธอร์เน็ต RJ45 Cat6	5 เมตร	8	เส้น		

5.2 วัสดุและอุปกรณ์ส่วนกลาง ต่อทีม

ลำดับ	รายการ	คุณลักษณะ	จำนวน	หน่วยนับ	รูปภาพ (ถ้ามี)	หมายเหตุ
1	กระดาษ A4		1	รีม		
2	ดินสอ 2B		2	โหล		
3	ยางลบดินสอ		2	โหล		

5.3 วัสดุและอุปกรณ์ที่ผู้เข้าแข่งขันต้องเตรียมมา (หากไม่มีให้ระบุโดยใช้ข้อความว่า -ไม่มี- ให้ชัดเจน)

- มัลติมิเตอร์ 1 ตัว

หมายเหตุ ผู้เข้าแข่งขันรายใดต้องการนำวัสดุและอุปกรณ์นอกเหนือจากรายการที่กำหนดข้างต้น จะต้องเสนอรายการให้คณะกรรมการแข่งขันพิจารณาอนุมัติล่วงหน้าก่อนการแข่งขันไม่น้อยกว่า 30 นาที ทั้งนี้คณะกรรมการแข่งขัน ไม่อนุญาตให้ใช้เครื่องมือใด ๆ ที่ทำให้ผู้เข้าแข่งขันได้เปรียบกว่าผู้เข้าแข่งขันรายอื่น ๆ

6. เกณฑ์การประเมิน (ส่วนนี้จะกำหนดเกณฑ์การประเมินและน้ำหนักคะแนน (Subjective และ Objective) ซึ่งน้ำหนักคะแนนสำหรับทุกเกณฑ์การประเมินจะต้องเป็น 100 คะแนน)

หัวข้อ	รายการ	คะแนน		
		Subjective (ถ้ามี)	Objective	รวม
A	ความปลอดภัย	10		10
B	ผลงานที่ทำสำเร็จและความถูกต้องตามแบบแข่งขัน		86	86
C	เวลา	4		4
	Total =			100

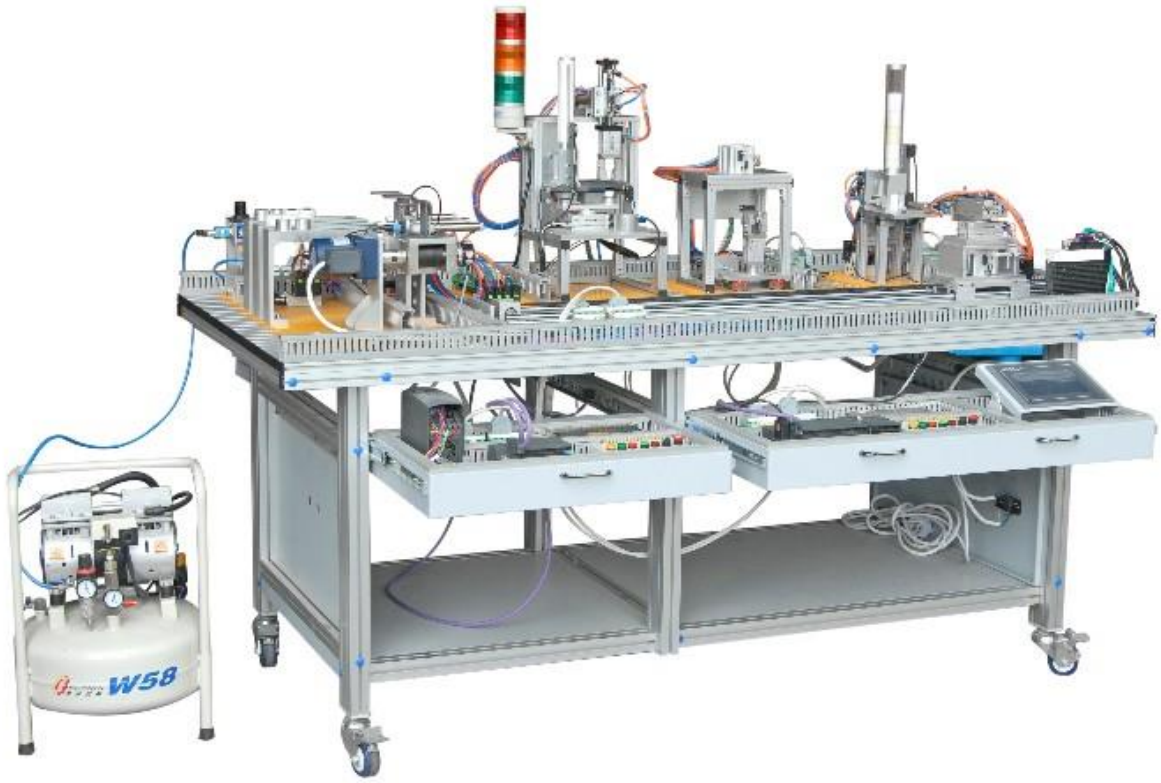
7. รายละเอียดในการให้คะแนน

7.1 หัวข้อ **ความปลอดภัย**	**รวม**	**10**	**คะแนน**
7.2 หัวข้อ **ผลงานที่ทำสำเร็จและความถูกต้องตามแบบแข่งขัน**	**รวม**	**86**	**คะแนน**
7.3 หัวข้อ **เวลา**	**รวม**	**4**	**คะแนน**

(Available Time – Actual Time) x 4/ (Available Time – Fastest Time)

หมายเหตุ กรณีที่ผู้เข้าแข่งขันทำงานไม่เสร็จภายในเวลาที่กำหนด หรือชิ้นงานเสียหาย จะไม่ได้รับการตรวจให้คะแนนชิ้นงาน (ทั้งนี้ขึ้นอยู่กับความเหมาะสมของแต่ละสาขา)

แบบ หรือภาพประกอบ



ใบสั่งงาน

การแข่งขันฝีมือแรงงานแห่งชาติ ครั้งที่ 28

สาขาระบบอัตโนมัติทางอุตสาหกรรม

Skill Area: Industrial Automation

Operation Program Coding and Debugging for YL-335B Automatic Production Line Device (in abbreviation #335)

Please finish the following items before deadline.

1. **Coding and debugging the program for Transfer operation system in #335.**
2. **Coding and debugging the program for Resource provider operation system in #335.**
3. **Coding and debugging the program for Processor operation system in #335.**
4. **Coding and debugging the program for Assembler operation system in #335.**
5. **Coding and debugging the program for Sorter operation system in #335.**
6. **Coding and debugging the program for #335 operation.**
7. **According to the tasks required to complete the servo and inverter parameter settings**

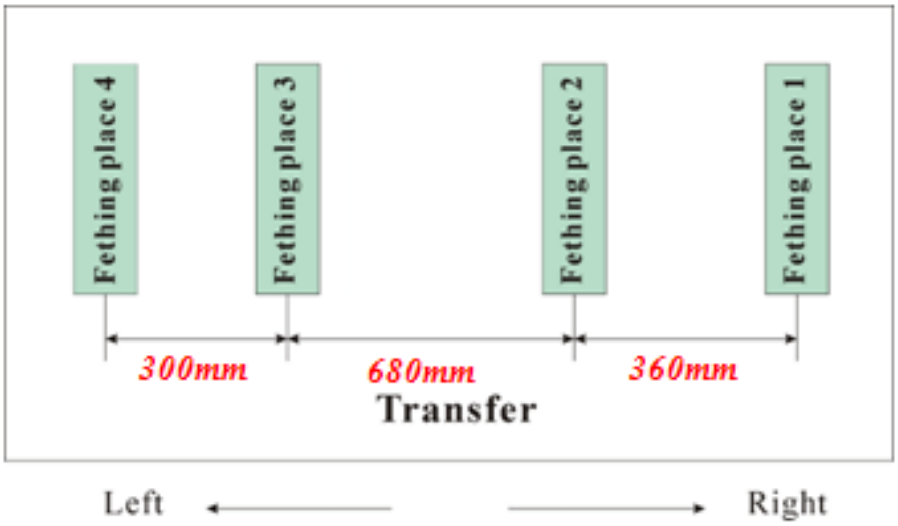
Weighting (points out of total) 100/100

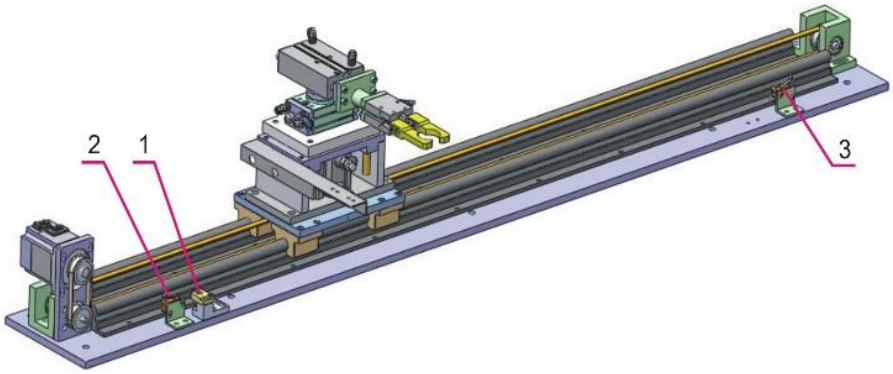
time max 360 min

1. Transfer station control program coding and debugging

Task to be finished

According to #335 Transfer station control program coding and debugging requirements, write the program. Check and verify them via station PLC, make sure the actions satisfy the workpiece transfer requirements.





Schematic diagram of the delivery position for #335 Transfer station

1. Original position 2. Right limit run-length switch 3. Left limit run-length switch

Initial position of mechanical arm and paw for #335 Transfer station:

- **Mechanical arm should on the Original position (Original Sensor 1-1 is ON)**
- **Mechanical paw on the lowest position (Sensor 1-2 is ON)**
- **Mechanical paw with the move back state (Sensor 1-7 is ON)**
- **Mechanical paw with open state (Sensor 1-8 is OFF)**

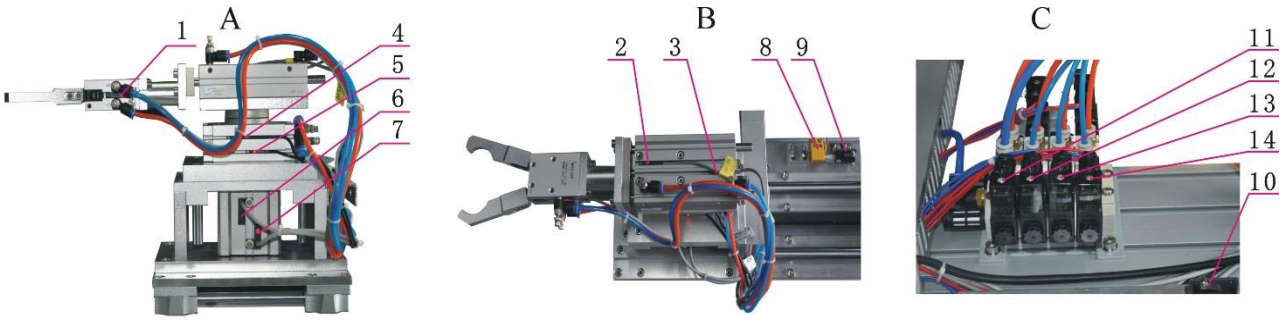


Figure **1 #335 Transfer station control system components installing position**

1.Sensor 1-8	2.Sensor 1-6	3.Sensor 1-7	4.Sensor 1-5
5.Sensor 1-4	6.Sensor 1-3	7.Sensor 1-2	8.Sensor 1-1
9.Right limit run-length switch	10.Left limit run-length switch		11.Electromagnetic Valve 1-1
12.Electromagnetic valve 1-2	13.Electromagnetic Valve 1-3		14.Electromagnetic Valve 1-4

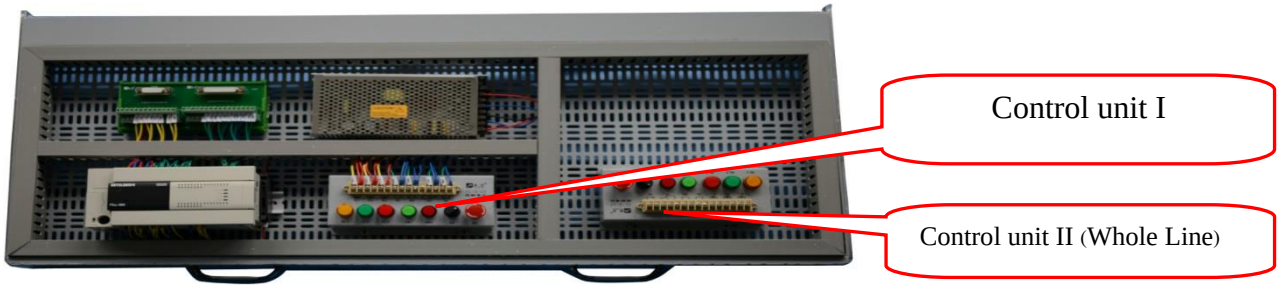
- **Mechanical paw in turn right state (Sensor 1-5 is ON)**

Transfer station PLC I/O signal

Table 1 Transfer station PLC I/O signals

Input signals					
ID	**Input**	**Symbol**	**Symbol Description**	**Signal Description**	**Source of Signal**
1	X000	SC1	Sensor 1-1	Mechanical arm original position	Device side（H01687）
2	X001	K1	Right limit run-length switch	Mechanical arm right limit position	
3	X002	K2	Left limit run-length switch	Mechanical arm left limit position	
4	X003	1B1	Sensor 1-2	Air cylinder 1-1 move back	
5	X004	1B2	Sensor 1-3	Air cylinder 1-1 move out	
6	X005	2B1	Sensor 1-4	Air cylinder 1-2 turn left	
7	X006	2B2	Sensor 1-5	Air cylinder 1-2 turn right	
8	X007	3B1	Sensor 1-6	Air cylinder 1-3 move out	
9	X010	3B2	Sensor 1-7	Air cylinder 1-3 move back	
10	X011	4B	Sensor 1-8	Mechanical paw hold tight	
11	X012		Servo Alarm	Servo Alarm	
12	X017	SB1	Start button	Device starts	Control unit (Whole line)
13	X020	QS	Emergency button	Device stops in urgent	
14	X021	SB2	Stop button	Device stops properly	
15	X022	SA	Working mode	Working mode switch	
16	X024	SB2	Stop button	Device stops properly	Control unit
17	X025	SB1	Start button	Device starts	
18	X026	QS	Emergency button	Device stops in urgent	
19	X027	SA	Working mode	Working mode switch	

Output signals					
ID	**Output**	**Symbol**	**Symbol Description**	**Signal Description**	**Source of Signal**
1	Y000		Pulse	Input pulse signal to servo	Device side（H01650）
2	Y002		Direction	Change driver direction of servo	
3	Y003	1Y	Electromagnetic valve 1-1	Air cylinder 1-1 move out, mechanical paw up	
4	Y004	2Y1	Electromagnetic valve 1-2-1	Air cylinder 1-2 turn left	
5	Y005	2Y2	Electromagnetic valve 1-2-2	Air cylinder 1-2 turn right	
6	Y006	3Y	Electromagnetic valve1-3	Air cylinder 1-3 move out, mechanical paw move out	
7	Y007	4Y1	Electromagnetic valve 1-4-1	Air cylinder 1-4 move back, mechanical paw hold tight workpiece	
8	Y010	4Y2	Electromagnetic valve 1-4-2	Air cylinder 1-4 move out, mechanical paw put down workpiece	
9	Y015	HL1	Yellow lamp	ON	Control unit
10	Y016	HL2	Green lamp	ON	
11	Y017	HL3	Red lamp	ON	



(1) Single station testing requirements of transport station

Mode choice, various operations and status indication are provided by local control unit module. Switch SA of control unit module II is used for test pattern selection (SA disconnected state).

Single station testing including manipulator device running smoothing and running veracity of straight line running mechanism, test item select by transfer switch SA of control unit I. Select the former, the light HL1 of control unit module I normally on. Select the second, the HL2 normally on.

① Manipulator device running smoothing testing(SA=OFF): the button SB1, SB2, QS of control unit module I jog control the manipulator left, right movement and speed switch respectively. when button QS at reset status, given running speed 60mm/s; press QS, given speed 200mm/s. press SB1 and SB2 at the same time for 2 seconds, manipulator search for zero. During the running process, once left limit or right limit, manipulator should stop at once, and control unit module I light HL3 normally on.

Note: high-low speed switch require that can act during the manipulator device running.

② Running veracity testing of straight line running mechanism (SA=ON):

a: When electricity and gas source of the equipment is switched on, if each cylinder meet the requirement of initial position, and servo at zero, so the "normal working" indicator light HL1 is normally on, means the equipment is already. Otherwise, the indicator light flashes at a frequency of 1Hz.

b： If equipment not ready, press SB2 button of control unit I to reset, let each cylinder at initial position, servo return to zero.

c : If equipment is ready, put one workpiece at discharging platform of feeding station, press SB1, system start, "system running" light HL2 normally on.

d: Transport station catch manipulator device should act the operation of catch the workpiece of feeding station. Finished the action, servo motor drives the manipulator device move to front of assembly platform of assembly station at the speed of not less than 300mm/s, put the workpiece at the assembly platform.

e: Press SB1 button again, manipulator device should catch back the work piece, then transport from assembly station to process station, arrived at front of process platform, put the work piece at the process platform. Manipulator device running speed requirement be same with d.

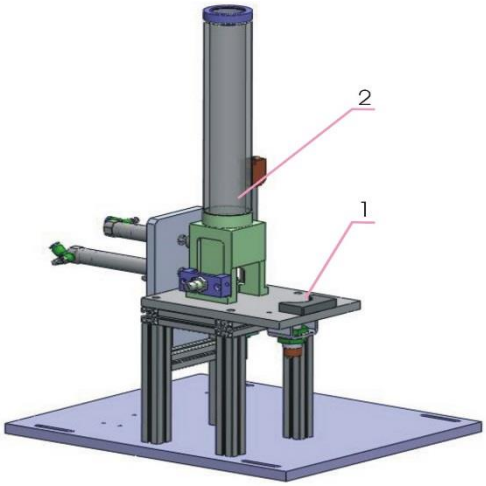
f: Press SB1 button again, manipulator device should catch back the work piece. When finished, manipulator arm counterclockwise 90.

g: manipulator device finished the operation of put down the workpiece and retraction in place, manipulator arm should clockwise rotation 90, then servo motor drives the manipulator device back to origin at the high speed of not less than 400mm/S, then stop.

2. Resource provider station control program coding and debugging

Task should be finished.

According to #335 Resource provider station control program coding and debugging requirements, write the program. Check and verify them via station PLC, make sure the actions satisfy the workpiece providing requirements.



Schematic diagram of the feeding position for #335 Resource provider station

1. Fetching place 1 2. Store space the workpiece

Resource provider station air cylinder and store space initial position:

- **The number of workpiece in store space satisfies the requirement (Sensors 2-7 and 2-6 are ON)**
- **Air cylinder 2-1 is with "move back" position (Sensor 2-2 is ON)**
- **Air cylinder 2-2 is with "move back" position (Sensor 2-4 is ON)**
- **No workpiece on Fetching place 1 (Sensor 2-5 is OFF)**

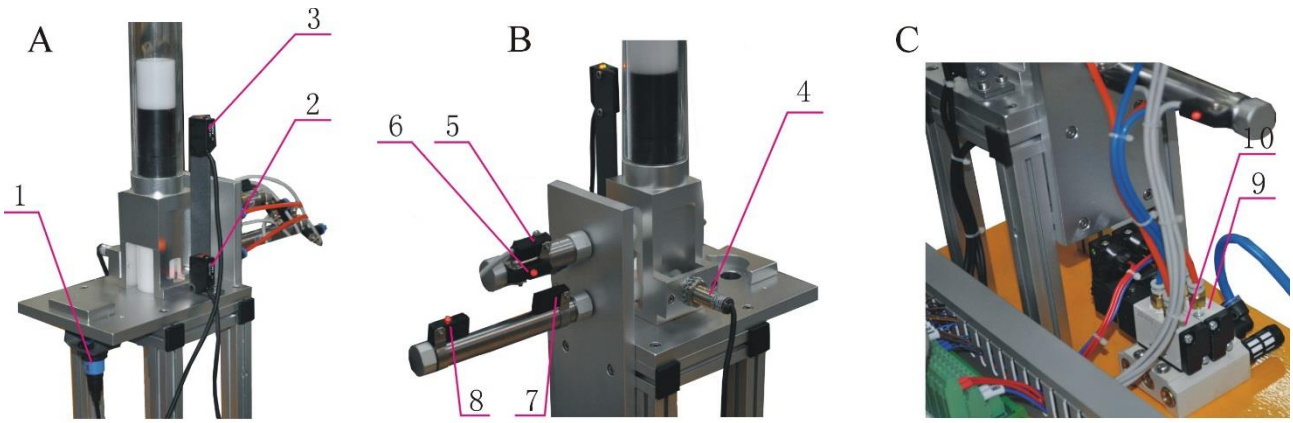


Figure 2 #335 Resource provider station control system components installing position

1.Sensor 2-5	2.Sensor 2-7	3.Sensor 2-6	4.Sensor 2-8	5.Sensor 2-1	6.Sensor 2-2
7.Sensor 2-3	8.Sensor 2-4	9. Electromagnetic valve 2-1		10. Electromagnetic valve 2-2	

Resource provider station PLC I/O signal:

Table 2 Resource provider station PLC I/O signals

Input signals					
ID	**Input**	**Symbol**	**Symbol Description**	**Signal Description**	**Source of Signal**
1	X000	1B1	Sensor 2-1	Air cylinder 2-1 move out	Device side（H01687）
2	X001	1B2	Sensor 2-2	Air cylinder 2-1 move back	
3	X002	2B1	Sensor 2-3	Air cylinder 2-2 move out	
4	X003	2B2	Sensor 2-4	Air cylinder 2-2 move back	
5	X004	SC1	Sensor 2-5	Workpiece on fetching place 1	
6	X005	SC2	Sensor 2-6	The number of workpiece in Store space satisfies requirement	
7	X006	SC3	Sensor 2-7	Workpiece in store space	
8	X007	SC4	Sensor 2-8	Workpiece is metal	
9	X015	SB2	Stop button	Device stops properly	Control unit
10	X013	SB1	Start button	Device starts	
11	X014	QS	Emergency button	Device stops in urgent	
12	X015	SA	Working mode	Working mode switch	

Output signals					
ID	**Output**	**Symbol**	**Symbol Description**	**Signal Description**	**Source of Signal**
1	Y000	1Y	Electromagnetic valve 2-1	Air cylinder 2-1 move out, push the workpiece in store space	Device side（H01650）
2	Y001	2Y	Electromagnetic valve 2-2	Air cylinder 2-2 move out, push out the workpiece in store space	
3	Y007	HL1	Yellow lamp	ON	Control unit
4	Y010	HL2	Green lamp	ON	
5	Y011	HL3	Red lamp	ON	

(1) single station testing requirements of feeding station

Mode choice, various operations and status indication are provided by local control unit module. Switch SA is used for test pattern selection (SA disconnected state).

①When electricity and gas source of the equipment is switched on, to meet the requirement of initial position, so the “normal” indicator light HL1 is on, means the equipment is already. Otherwise, the indicator light flashes at a frequency of 1Hz.

②If the equipment is already, work unit be standby condition. press SB1 button, it should act the operation of push the workpiece to discharge platform. Take out the workpiece manually, press the SB1 again, it push the workpiece again. During the acting process, press stop button SB2, work unit finish this cycle then stop.

(2) emergency stop operation

When press QS, feeding station should stop immediately, meanwhile “emergency stop” lamp HL3 is normal ON, after reset QS, “emergency stop” lamp HL3 OFF. Each cylinder returns to original state automatically. After reset finished, press start button SB1 to restart test.

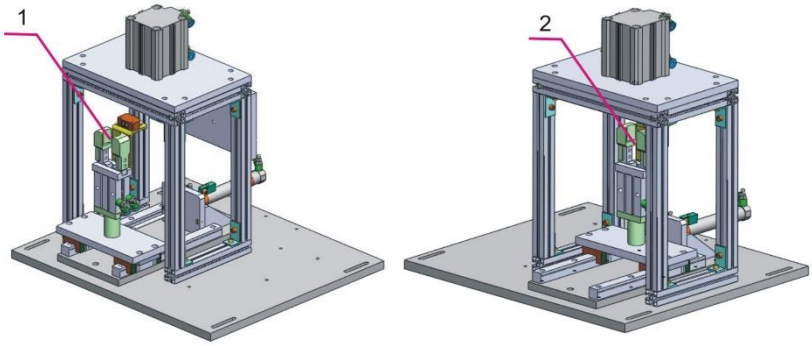
(3) workpiece feeding status

During the running process, if workpieces not enough, working unit continues to work, but “normal work” light HL2 flashes at a frequency of 1Hz. If silo no workpiece, light HL1 and HL2 flashes at a frequency of 2Hz. The equipment finished this operation then stop. Unless supply enough workpiece to silo, workstation not restart.

3. Processor station control program coding and debugging

Task should be finished.

According to #335 processor station control program coding and debugging requirements, write the program. Check and verify them via station PLC, make sure the actions satisfy the workpiece processing requirements.



Schematic diagram of the processing position for #335 Processor station

processor station air cylinder initial position:

- **No workpiece on Fetching place 2 (Sensor 3-1 is OFF)**
- **Mechanical paw open (Sensor 3-2 is OFF)**
- **Mechanical paw moves to Fetching place 2 (Sensor 3-3 is ON)**
- **Air cylinder 3-3 with "move back" position (Sensor 3-5 is ON)**

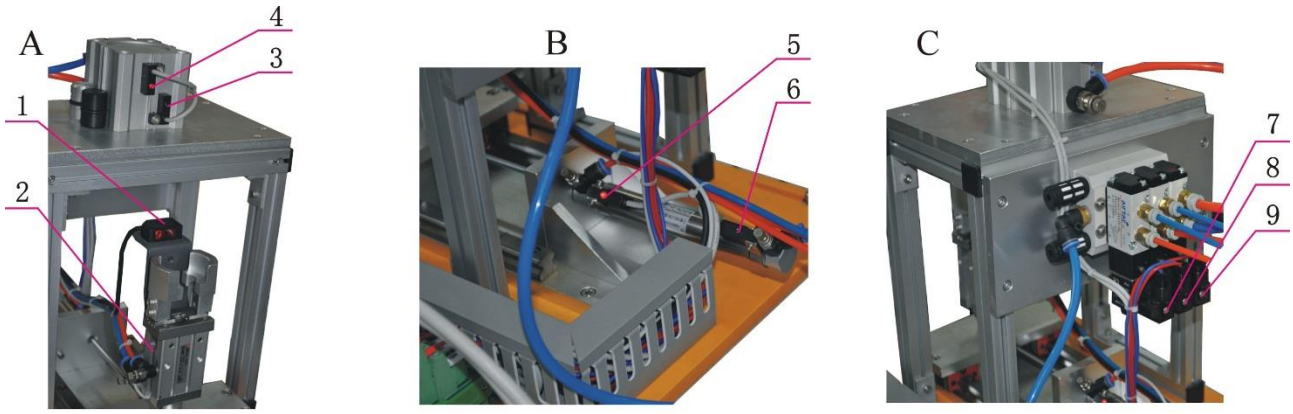


Figure 3 #335 Processor station control system components installing position

1.Sensor 3-1 2.Sensor 3-2 3.Sensor 3-6 4.Sensor 3-5 5.Sensor 3-3 6.Sensor 3-4

7. Electromagnetic valve 3-3 8. Electromagnetic valve3-2 9. Electromagnetic valve3-1

Processor station PLC I/O signal

Table 3 Processor station PLC I/O signals

Input signals					
ID	**Input**	**Symbol**	**Symbol Description**	**Signal Description**	**Source of Signal**
1	X000	SC1	Sensor 3-1	There is a workpiece on fetching place 2	Device side（H01687）
2	X001	1B	Sensor 3-2	Mechanical paw hold tight	
3	X002	2B1	Sensor 3-3	Air cylinder 3-2 move out	
4	X003	2B2	Sensor 3-4	Air cylinder 3-2 move back	
5	X004	3B1	Sensor 3-5	Air cylinder 3-3 move back	
6	X005	3B2	Sensor 3-6	Air cylinder 3-3 move out	
7	X012	SB2	Stop button	Device stops properly	Control unit
8	X013	SB1	Start button	Device starts	
9	X014	QS	Emergency button	Device stops in urgent	
10	X015	SA	Working mode	Working mode switch	

Output signals					
ID	**Output**	**Symbol**	**Symbol Description**	**Signal Description**	**Source of Signal**
1	Y000	1Y	Electromagnetic valve 3-1	Air cylinder 3-1 move back, mechanical paw hold workpiece tight	Device side（H01650）
2	Y002	2Y	Electromagnetic valve 3-2	Air cylinder 3-2 move back, mechanical paw return back to the processing place	
3	Y003	3Y	Electromagnetic valve 3-3	Air cylinder 3-3 move out to process the workpiece	
4	Y007	HL1	Yellow lamp	ON	Control unit
5	Y010	HL2	Green lamp	ON	
6	Y011	HL3	Red lamp	ON	

(1) Requirements on the test of Processing Unit

Mode selection, various operations and status indications are supplied by the local control unit. Switch SA is used to select the test mode (SA is disconnected).

① When electric power is ON, air source is connected, and it is on the original position for start, then the "Normal working" indicator light HL1 will be normal ON, to show that the equipment is ready. Otherwise, the indicator light will twinkle in 1Hz frequency.

②When the equipment is ready, push button SB1 and it will start, “Run” indicator light HL2 will be normal ON. When the workpiece to be processed is fed to the processing unit and is detected, the equipment will clamp the workpiece, transfer for punching in the processing area, when punching is over, it will go back and wait for the next workpiece for processing. If there is no stop signal input, when any new workpiece is fed to the processing unit, the processing unit will start the new working cycle.

③ During the running process, push stop button SB2, the processing unit will stop after it finishes work in the current work cycle, and the indicator light HL2 will be OFF.

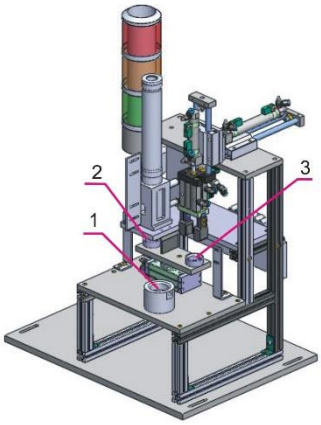
(2) Emergency stop operation

When press QS, the processing unit will stop immediately, same time, HL3 will be normal ON, when QS is reset, HL3 will be OFF, and each cylinder will recover to the initial status. After resetting finished, push button SB1 to restart test.

4. Assembler station control program coding and debugging

Task should be finished.

According to #335 Assembler station control program coding and debugging requirements, write the program, check and verify them via station PLC, make sure the actions satisfy the workpiece assembly requirements.



Schematic diagram of the workpiece placement for #335 Assembler station

1. **Fetching place 3** 2. **Left fetching place** 3. **Right fetching place**

Assembler station air cylinder initial position:

- **No workpiece on Fetching place 3 (Sensor 4-5 is OFF)**
- **The number of the small workpiece in Store space satisfied (Sensor 4-1 and 4-2 is ON)**
- **Air cylinder 4-3 is on "turn right" state (Sensor 4-11 is ON)**
- **Mechanical paw is on the highest position (Sensor 4-14 is ON)**
- **Mechanical paw is on "move back" position (Sensor 4-15 is ON)**
- **Mechanical paw is on "open" state (Sensor 4-12 is OFF)**
- **Air cylinder 4-1 is on "move out" position (Sensor 4-8 is ON)**
- **Air cylinder 4-2 is on "move back" position (Sensor 4-7 is ON)**

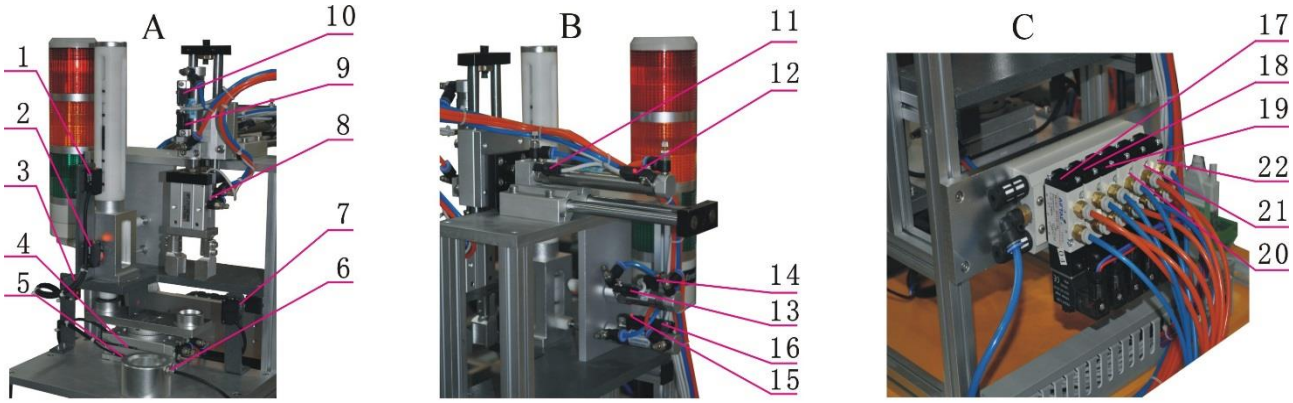


Figure 4 #335 Assembler station control system components installing position

1.Sensor 4-1	2.Sensor 4-2	3.Sensor 4-3	4.Sensor 4-11	5.Sensor 4-10	6.Sensor4-5
7.Sensor 4-4	8.Sensor 4-12	9.Sensor 4-13	10.Sensor 4-14	11.Sensor 4-16	12.Sensor4-15
13.Sensor 4-6	14.Sensor 4-7	15.Sensor 4-8	16.Sensor 4-9		
17. Electromagnetic valve 4-4		18. Electromagnetic valve 4-3		19. Electromagnetic valve 4-5	
20. Electromagnetic valve 4-6		21. Electromagnetic valve 4-1		22. Electromagnetic valve 4-2	

Assembler station PLC I/O signal

Table 4 Assembler station PLC I/O signals

Input signals					
ID	**Input**	**Symbol**	**Symbol Description**	**Signal Description**	**Source of Signal**
1	X000	SC1	Sensor4-1	The number of the small workpiece in store space is satisfied	Device side（H01687）
2	X001	SC2	Sensor 4-2	Small workpiece in store space	
3	X002	SC3	Sensor 4-3	Small workpiece on the Left fetching place	
4	X003	SC4	Sensor 4-4	Small workpiece on the Right fetching place	
5	X004	SC5	Sensor 4-5	Workpiece on the Fetching place 3	
6	X005	1B1	Sensor 4-6	Air cylinder 4-2 move out	
7	X006	1B2	Sensor 4-7	Air cylinder 4-2 move back	
8	X007	2B1	Sensor 4-8	Air cylinder 4-1 move out	
9	X010	2B2	Sensor 4-9	Air cylinder 4-1 move back	
10	X011	3B1	Sensor 4-10	Air cylinder 4-3 turn left	
11	X012	3B2	Sensor 4-11	Air cylinder 4-3 turn right	
12	X013	4B	Sensor 4-12	Mechanical paw hold tight	
13	X014	5B1	Sensor 4-13	Air cylinder 4-5 move out	
14	X015	5B2	Sensor 4-14	Air cylinder 4-5 move back	
15	X016	6B1	Sensor 4-15	Air cylinder 4-6 move back	
16	X017	6B2	Sensor 4-16	Air cylinder 4-6 move out	
17	X024	SB2	Stop button	Device stops properly	Control unit
18	X025	SB1	Start button	Device starts	
19	X026	QS	Emergency button	Device stops in urgent	
20	X027	SA	Working mode	Working mode switch	

Output signals					
ID	**Output**	**Symbol**	**Symbol Description**	**Signal Description**	**Source of Signal**
1	Y000	1Y	Electromagnetic valve 4-1	Air cylinder 4-1 move back, put down the small workpiece	Device side（H01650）
2	Y001	2Y	Electromagnetic valve 4-2	Air cylinder 4-2 move out, push the small workpiece in store space	
3	Y002	3Y	Electromagnetic valve 4-3	Air cylinder 4-3 move back, the small workpiece on the Right fetching place turn left	
4	Y003	4Y	Electromagnetic valve 4-4	Air cylinder 4-4 move back, mechanical paw hold the small workpiece tight	
5	Y004	5Y	Electromagnetic valve 4-5	Air cylinder 4-5 move out, mechanical paw move down	
6	Y005	6Y	Electromagnetic valve 4-6	Air cylinder 4-6 move out, mechanical paw move out	
7	Y006	HL4	Red alarm lamp	ON	
8	Y007	HL5	Orange alarm lamp	ON	
9	Y010	HL6	Green alarm lamp	ON	
10	Y015	HL1	Yellow lamp	ON	Control unit
11	Y016	HL2	Green lamp	ON	
12	Y017	HL3	Red lamp	ON	

(1) Requirements on the test of Assembly Unit

Mode selection, various operations and status indications are supplied by the local control unit. Switch SA is used to select the test mode (SA is disconnected).

①When electric power is ON, air source is connected, and it is on the original position for start, then the "Normal"indicator light HL1 will be ON, to show that the equipment is ready. Otherwise, the indicator light will twinkle in 1Hz frequency.

② When the equipment is ready, push start button, the assembly unit will start, “Run” indicator light HL2 will be ON. When there is no column component on the left tray of the rotary table, it will start drop the workpiece, if there are components on the left tray, and no component on the right tray, the right tray will revert.

③If there is a column component on the right tray of the rotary table, and there is a workpiece on the assembly table, the mechanical claw for assembly will claw the column component and put it into the array of workpieces to be assembled.

④When assembly is finished, the mechanical claw shall return to its original position, waiting

for the next assembly cycle.

⑤If you push stop button SB2 when it is running, the supply unit will stop supplying immediately, when all conditions for assembly are fine, the assembly unit will stop when it finishes work in the current assembly cycle.

⑵ Emergency stop operation

When you push QS, the assembly unit will stop immediately, at the same time, HL3 will be ON, when QS is reset, “Emergency stop” HL3 will be OFF, and each cylinder will recover to the initial status. After resetting, push button SB1 to restart test.

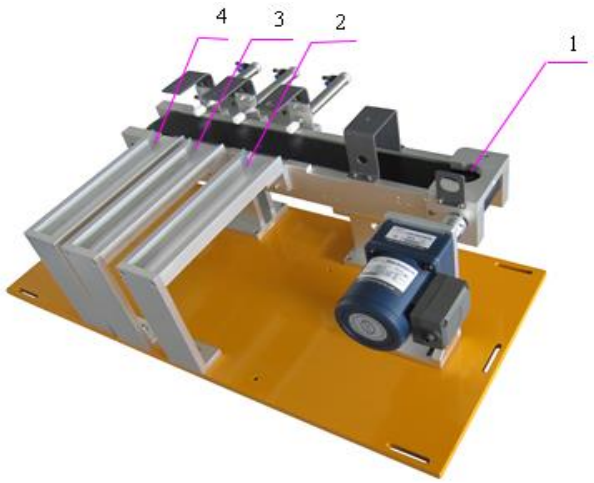
(3) Supply status indication

In running, when “Component shortage” alarming is ON, the indicator light HL3 will twinkle in 1Hz frequency, HL1 and HL2 will be ON; in running, when “No component” alarming is ON, the indicator light HL3 will twinkle, ON for 1s and OFF for 0.5s, HL2 will be OFF, HL1 will be ON, the unit will stop when it finishes work in the current work cycle. Unless sufficient workpieces are added into the storehouse, the unit will not restart.

5. Sorter station control program coding and debugging

Task should be finished.

According to #335 Sorter station control program coding and debugging requirements, write the program. Check and verify them via station PLC, make sure the actions satisfy the workpiece sorting requirements.



Schematic diagram of the sorting position for #335 Sorter station
1. Fetching place 4 2. Stocker #1 3. Stocker #2 4. Stocker #3

Sorter station air cylinder and store space initial position:

- **No workpiece on Fetching place 4 (Sensor 5-1 is OFF)**
- **Air cylinder 5-1 on "move back" position (Sensor 5-5 is OFF)**
- **Air cylinder 5-2 on "move back" position (Sensor 5-6 is OFF)**
- **Air cylinder 5-3 on "move back" position (Sensor 5-7 is OFF)**
- **AC induction motor stop**

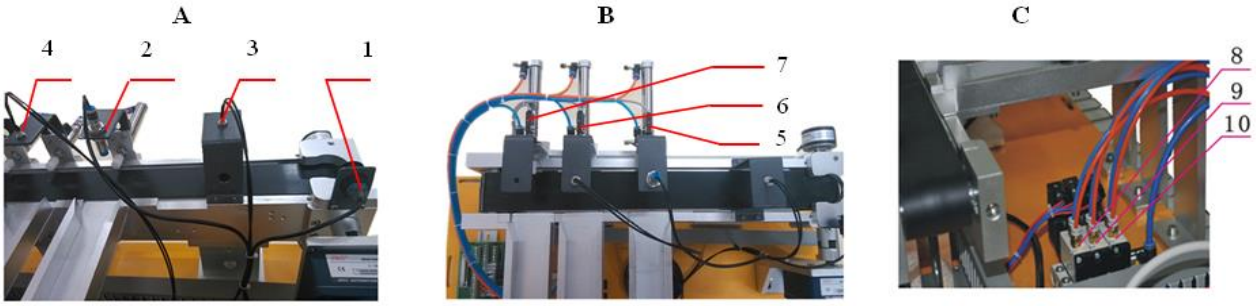


Figure 5 #335 Sorter station control system components installing position

1.Sensor 5-1 2.Sensor 5-2 3.Sensor 5-3 4.Sensor 5-4 5.Sensor 5-5
6.Sensor 5-6 7.Sensor 5-7 8.Electromagnetic valve 5-3
9.Electromagnetic valve 5-2 10.Electromagnetic valve 5-1

Sorter station PLC I/O signal

Table 5 Sorter station PLC I/O signals

Input signals						
ID	**Input**	**Symbol**	**Symbol Description**		**Signal Description**	**Source of Signal**
1	X000		B Terminal	Revolve encoder	Input pulse signal to X000	Device side（H01687）
2	X001		A Terminal		Input pulse signal to X001	
3	X002		Z Terminal		N/A	
4	X003	SC1	Sensor 5-1		Workpiece on Fetching place 4	
5	X004	SC2	Sensor 5-2		It is metal workpiece	
6	X005	SC3	Sensor 5-3		The workpiece is not black	
7	X006	SC4	Sensor 5-4		N/A	
8	X007	1B	Sensor 5-5		Air cylinder 5-1 move out	
9	X010	2B	Sensor 5-6		Air cylinder 5-2 move out	
10	X011	3B	Sensor 5-7		Air cylinder 5-3 move out	
11	X012	SB2	Stop button		Device stops properly	Control unit
12	X013	SB1	Start button		Device starts	
13	X014	QS	Emergency button		Device stops in urgent	
14	X015	SA	Working mode		Working mode switch	

Output signals					
ID	**Output**	**Symbol**	**Symbol Description**	**Signal Description**	**Source of Signal**
1	Y000	STF	Frequency converter	Forward revolve	FR-E700
2	Y001	RH		High speed	
3	Y004	1Y	Electromagnetic valve 5-1	Air cylinder 5-1 move out, push the workpiece into stocker#1	Device side（H01650）
4	Y005	2Y	Electromagnetic valve 5-2	Air cylinder 5-2 move out, push the workpiece into stocker#2	
5	Y006	3Y	Electromagnetic valve 5-3	Air cylinder 5-3 move out, push the workpiece into stocker#3	
10	Y007	HL1	Yellow lamp	ON	Control unit
11	Y010	HL2	Green lamp	ON	
12	Y011	HL3	Red lamp	ON	

(1) Requirements on the test of Distribution Unit

Mode selection, various operations and status indications are supplied by the local control unit. Switch SA is used to select the test mode (SA is disconnected). There are 3 types of workpieces, shown in diagram 6.

① When electric power is ON, air source is connected, and it is on the original position for start, then the "Normal"indicator light HL1 will be ON, to show that the equipment is ready.Otherwise, the indicator light will twinkle in 1Hz frequency.

②When the equipment is ready, push start button SB1, the system will start, “Run” indicator light HL2 will be ON. When the assembled workpiece is dropped manually onto the transfer belt, the frequency converter will start, to actuate the transmission motor to feed the workpiece to the distribution area in **30Hz** frequency.

Assume that the weight of the finished workpiece respectively: white core finished workpiece 20g, black core finished workpiece 30g, metal core finished workpiece 40g and finished goods sorting specification for total weight 100g, the finished workpiece capacity of station 1 and station 2 is not more than 4 workpieces. The principle for distribution:

a, finished workpiece distribute to station1 preferential, then station2

b, the workpiece not match station 1 and 2 distribute condition, should push into station 3.

c, when station 1 and 2 both satisfy the sorting specification for total weight 100g, the sorting system stop.

When the workpieces are pushed out of the slide slot, the work cycle of the unit is over. Only when the workpieces are pushed out of the slide slot, it can drop workpieces to the transfer belt again, to start the next work cycle. Press stop button SB2, it will stop when it finishes the current distribution cycle, and the indicator light HL2 will be OFF.

(2) **Emergency stop operation**

When press QS, the distribution unit will stop immediately, at same time, “Emergency stop” indicator light HL3 will be ON, when QS is reset, “Emergency stop” HL3 will be OFF. Each cylinder will recover to the initial status automatically. Then the remaining workpieces on the belt shall be take out manually. After resetting, push start button SB1 to restart test.

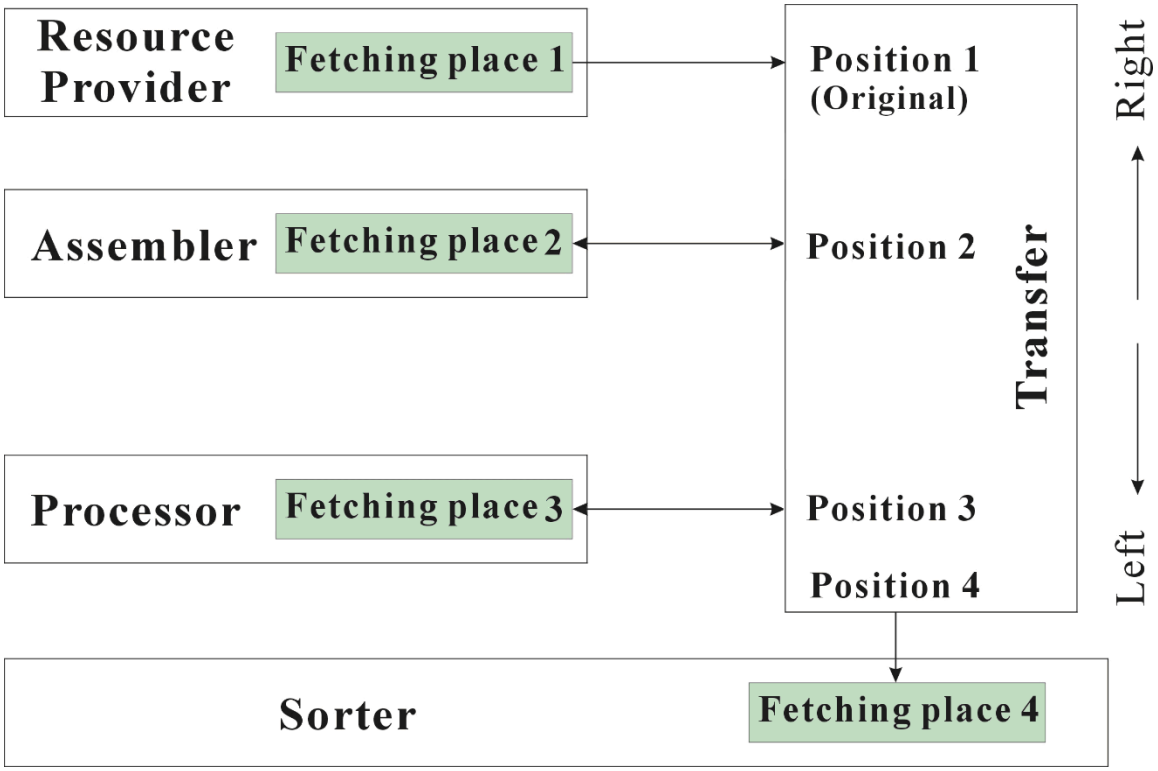
diagram 6 **Workpiece type**

Plastic (metal) plastic (white) plastic (black)

6. Coding and debugging the program for #335 operation

Tasks should be finished.

According to #335 The overall control program coding and debugging requirements, write the program. Check and verify them via PLC of all stations, make sure the actions satisfy the requirements of #335 operation.



Schematic diagram of the overall position for #335 system

(1) Whole system running requirement:

Whole line mode, transfer station as the main station, commands of start and stop , emergency stop , reset is given by control unit module II , status signal of operation , stop , alarm is indicated by warning light which installed in assembly unit .

Transfer switch SA of control unit module of all stations is in power on, the trainer can be in whole online mode. Transfer station PLC program should check all stations first whether is in original state when in online mode.

If the original state of any one station is not satisfied, the green warning light which installed in assembly unit flashes at a frequency of 2Hz, red and yellow lights both off. If cylinder is not in original state, servo is not searching zero completing at the origin, press SB2 to reset, the speed of search zero of manipulator without specific requirement, please set by yourself.

If all station is in original state, green warning light will be on, which allow to start the system. Press SB1, system starting, green and yellow warning light will be on, indication light HL1 of local control unit module of all substation will be on, means system runs in online mode. System running in normal condition, all substation technique operation process is same as single station, but the main command operation is from main station system. Manipulator return from each station to transport workpiece has following request: the speed of manipulator from sorting station to origin position not less than 400 mm/s, other condition operation speed is not less than 300 mm/s.

Complete machine operating technique process as follows: if the loading area of feeding unit has working piece, the manipulator of transfer station transports the working piece to assembly station to assemble, after assembling transport to processing unit for stamping, after stamping transport to sorting unit to sort and store. Only the sorting station finish one sorting operation, and transfer the manipulator to the origin, one operating period of the system stops. The feeding unit only carry one time pushing operation in it.

(2) Stop operation in normal

Press control unit module I button SB1 of main station under online operation, one operation period is over, then each unit stop operating.

(3) Abnormal operation status test

(1) Supplying status warning signal of working piece

If there's alarm signal of "not enough working piece" or "no working piece" from feeding station or assembly station, the system operates as follows:

① **Frequency flicker of the red light in 1Hz of alarm signal warning light if "not enough working piece", green and yellow light keep on. The system keeps on working.**

② **Red light display in 1 second , off in 0.5 second flicker , if there's " no working piece" ; yellow light is off , green light keeps on** .

If the alarm signal of “no working piece” from feeding station, and feeding station already pushing working piece, system will go on operating till complete unfinished operation in one period. When operation period is over, system will stop operation, the system can’t start unless the alarm signal “no working piece” disappear.

If the alarm signal of “no working piece” from assembly station, and rotation table of assembly station drops down small column parts, system keeps on operating till complete unfinished work in one working period. When operation period is over, system will stop operation, the system can’t start unless the alarm signal “no working piece” disappear.

(2) Transportation station emergency stop and reset

If meet fault, need to stop emergently in system running (press emergency button), the transport station will stop immediately. After resetting, it will continue operation from the breakpoint before emergency stop.
