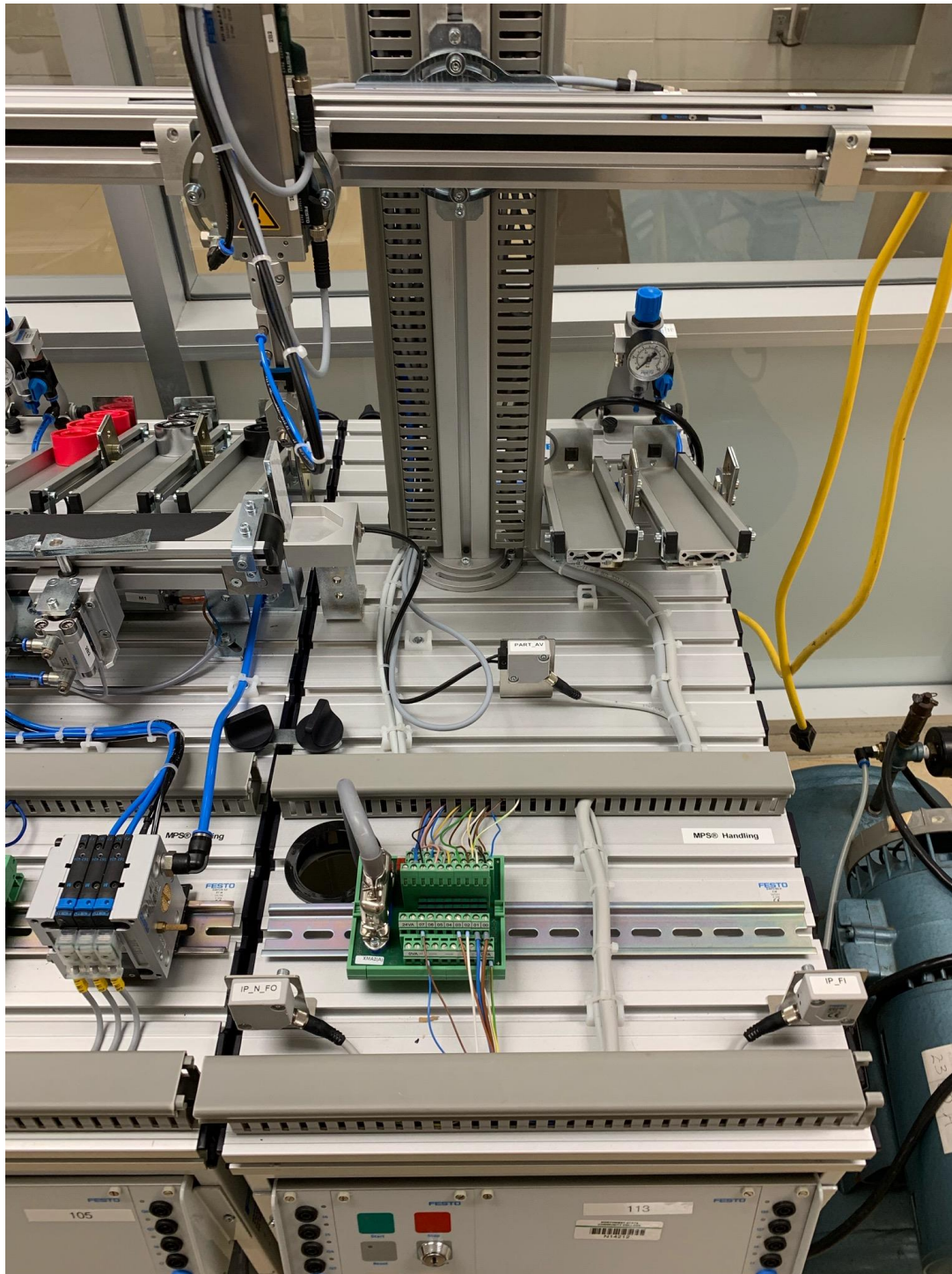


Chapter 28 FESTO

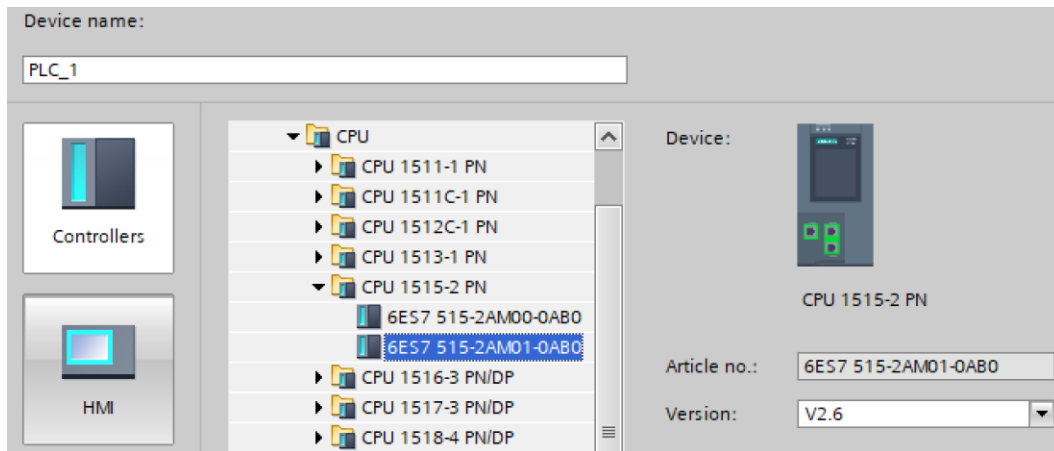
Recent acquisition of a 5 station Festo manufacturing system has given good examples of many concepts previously discussed in the text. Foremost is the state diagram concept. Also, graphic language – state diagram programming is examined. The pictures below give a visual of the stations in the manufacturing system.



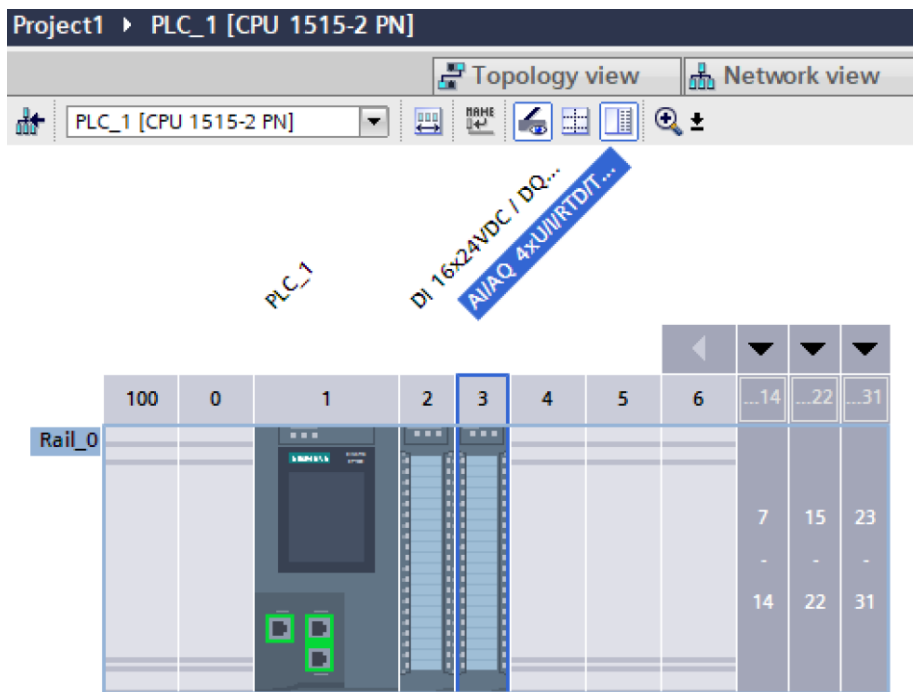
The programs for these sections can be found by downloading the program from the Lab Text Book – Festo Stations 1500 States – Program. The programs are in the list of programs found here. They are:

Device 1 (Left most)	IP: 192.168.1.1	01VE-AS-1500
Device 2 (Second Left)	IP: 192.168.1.1	02PR-AS-1500
Device 3 (Middle)	IP: 192.168.1.1	03BE-AS-1500
Device 4 (Second Right)	IP: 192.168.1.1	09SO-AS-1500
Device 5 (Right most)	IP: 192.168.1.1	04HA-AS-1500

The alternate approach and the one encouraged is to configure the following processor.



Adding digital and analog cards results with the following. Then compile the blank program and download to the processor. This sets up a blank processor with full capability.



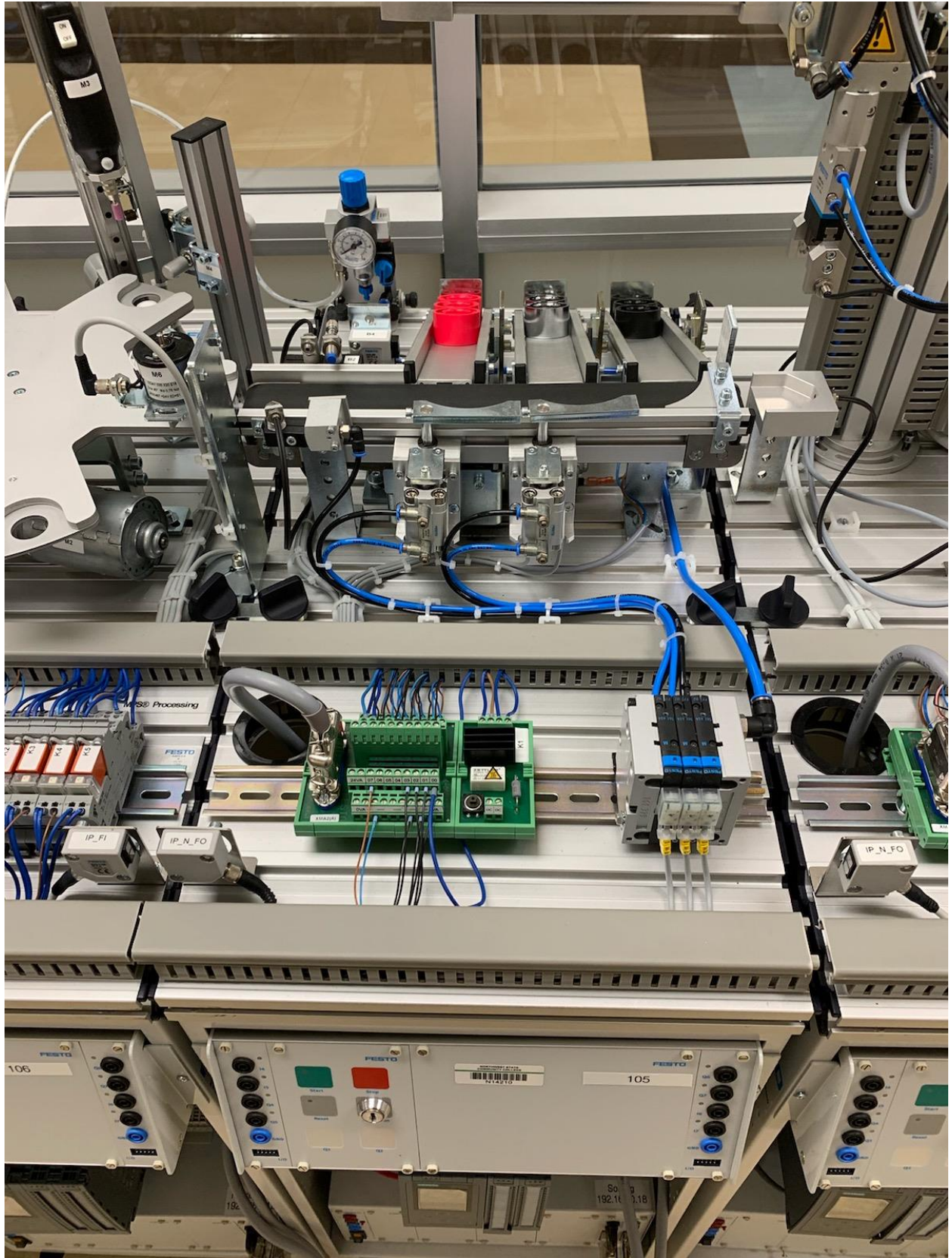
Then look at the Tag list and find the I and Q variables. Then use these variables to turn on the outputs and observe how the inputs function. From there, provide a sequential program to control the section.

PLC tags										
	Name	Tag table	Data type	Address	Retain	Acces...	Writa...	Visibl...	Supervis...	Comment
1	Em_Stop	STEP7 classic symb...	Bool	%I1.5						NOT-AUS entriegelt / Emergency stop unlocked
2	CycleEnd	STEP7 classic symb...	Bool	%M44.3						Zyklusende / Cycle end
3	45step20	STEP7 classic symb...	Bool	%M42.3						Schritt 20 / Step 20
4	45step19	STEP7 classic symb...	Bool	%M42.2						Schritt 19 / Step 19
5	45step10	STEP7 classic symb...	Bool	%M41.1						Schritt 10 / Step 10
6	45step09	STEP7 classic symb...	Bool	%M41.0						Schritt 9 / Step 9
7	45step08	STEP7 classic symb...	Bool	%M40.7						Schritt 8 / Step 8
8	45step07	STEP7 classic symb...	Bool	%M40.6						Schritt 7 / Step 7
9	F_Edge1	STEP7 classic symb...	Bool	%M45.1						Flankenmerker / Edge flag
10	2M1	STEP7 classic symb...	Bool	%Q0.2						Greifer ausfahren / Extend gripper
11	2B2	STEP7 classic symb...	Bool	%I0.5						Greifer eingefahren / Gripper retracted
12	2B1	STEP7 classic symb...	Bool	%I0.4						Greifer ausgefahren / Gripper extended
13	1M2	STEP7 classic symb...	Bool	%Q0.1						Handhabung zu Folgestation / Handling to downstream station
14	45step02	STEP7 classic symb...	Bool	%M40.1						Schritt 2 / Step 2
15	45step01	STEP7 classic symb...	Bool	%M40.0						Schritt 1 / Step 1
16	3M1	STEP7 classic symb...	Bool	%Q0.3						Greifer öffnen / Open gripper
17	3B1	STEP7 classic symb...	Bool	%I0.6						Werkstück ist nicht schwarz / Workpiece is not black
18	Var4	STEP7 classic symb...	Byte	%B42						Variable / variables
19	Var3	STEP7 classic symb...	Byte	%B41						Variable / variables
20	Var2	STEP7 classic symb...	Byte	%B40						Variable / variables
21	Var1	STEP7 classic symb...	Byte	%B44						Variable / variables
22	45step18	STEP7 classic symb...	Bool	%M42.1						Schritt 18 / Step 18
23	45step17	STEP7 classic symb...	Bool	%M42.0						Schritt 17 / Step 17
24	45step16	STEP7 classic symb...	Bool	%M41.7						Schritt 16 / Step 16
25	45step15	STEP7 classic symb...	Bool	%M41.6						Schritt 15 / Step 15
26	45step14	STEP7 classic symb...	Bool	%M41.5						Schritt 14 / Step 14
27	45step13	STEP7 classic symb...	Bool	%M41.4						Schritt 13 / Step 13
28	45step12	STEP7 classic symb...	Bool	%M41.3						Schritt 12 / Step 12
29	45step11	STEP7 classic symb...	Bool	%M41.2						Schritt 11 / Step 11
30	Toggle	STEP7 classic symb...	Bool	%M45.0						Umschalt Bit / Toggle bit
31	T_Blink2	STEP7 classic symb...	Timer	%T44						Blink Timer
32	T_Blink1	STEP7 classic symb...	Timer	%T43						Blink Timer
33	S4	STEP7 classic symb...	Bool	%I1.3						Taster Richten / Reset button
34	S3	STEP7 classic symb...	Bool	%I1.2						Schalter Automatik-Manuell / Automatic-manual switch
35	S2	STEP7 classic symb...	Bool	%I1.1						Taster Stop (Öffner) / Stop button (normally closed)
36	S1	STEP7 classic symb...	Bool	%I1.0						Taster Start / Start button
37	Reset_OK	STEP7 classic symb...	Bool	%M44.2						Richten erfolgreich abgeschlossen / Reset finished
38	RC_Stop	STEP7 classic symb...	Bool	%M132.4						Fernsteuerung Stop / remote control stop
39	RC_Start	STEP7 classic symb...	Bool	%M132.0						Fernsteuerung Start / remote control start
40	RC_Reset	STEP7 classic symb...	Bool	%M132.1						Fernsteuerung Richten / remote control reset
41	45step06	STEP7 classic symb...	Bool	%M40.5						Schritt 6 / Step 6
42	45step05	STEP7 classic symb...	Bool	%M40.4						Schritt 5 / Step 5
43	45step04	STEP7 classic symb...	Bool	%M40.3						Schritt 4 / Step 4
44	45step03	STEP7 classic symb...	Bool	%M40.2						Schritt 3 / Step 3
45	P_Edge	STEP7 classic symb...	Bool	%M44.6						Flankenmerker / Edge flag
46	P2	STEP7 classic symb...	Bool	%Q1.1						Leuchtmelder Grundstellung (Reset) / Reset indicator light
47	P1	STEP7 classic symb...	Bool	%Q1.0						Leuchtmelder Start / Start indicator light
48	IP_N_FO	STEP7 classic symb...	Bool	%Q0.7						Station belegt / station occupied
49	IP_FI	STEP7 classic symb...	Bool	%I0.7						Folgestation frei / Downstream station free
50	F_Start	STEP7 classic symb...	Bool	%M44.0						Start Merker / Start flag
51	F_Mat	STEP7 classic symb...	Bool	%M44.7						Werkstück ist nicht schwarz / Workpiece is not black
52	1M1	STEP7 classic symb...	Bool	%Q0.0						Handhabung zu Vorgängerstation / Handling to upstream station
53	1B3	STEP7 classic symb...	Bool	%I0.3						Handhabung bei Sortierposition / Handling at sorting position
54	1B2	STEP7 classic symb...	Bool	%I0.2						Handhabung bei Folgestation / Handling at downstream station
55	1B1	STEP7 classic symb...	Bool	%I0.1						Handhabung bei Vorgängerstation / Handling at upstream station
56	delay3	STEP7 classic symb...	Timer	%T42						Merker Verzögerungszeit 3 abgelaufen / Flag delay time 3 expired
57	delay2	STEP7 classic symb...	Timer	%T41						Merker Verzögerungszeit 2 abgelaufen / Flag delay time 2 expired
58	delay1	STEP7 classic symb...	Timer	%T40						Merker Verzögerungszeit 1 abgelaufen / Flag delay time 1 expired
59	Var5	STEP7 classic symb...	Byte	%B45						Variable / variables
60	OBStat	STEP7 classic symb...	Byte	%Q80						Ausgangsbyte Station / outputbyte station
61	OBPan	STEP7 classic symb...	Byte	%Q81						Ausgangsbyte Bedienpult / outputbyte panel
62	Init_Pos	STEP7 classic symb...	Bool	%M44.1						Station Handhaben in Grundstellung / Handling station in initial position
63	Init_Bit	STEP7 classic symb...	Bool	%M44.5						Initialisierungsbit / Initialisation bit
64	RCVar	STEP7 classic symb...	Byte	%B132						Remote Variable / remote variables
65	Part_AV	STEP7 classic symb...	Bool	%I0.0						Werkstück vorhanden / Workpiece available
66	RC_Em_Stop	STEP7 classic symb...	Bool	%M132.5						
67	<Add new>									

Farthest Right

Device 5 (Right most)

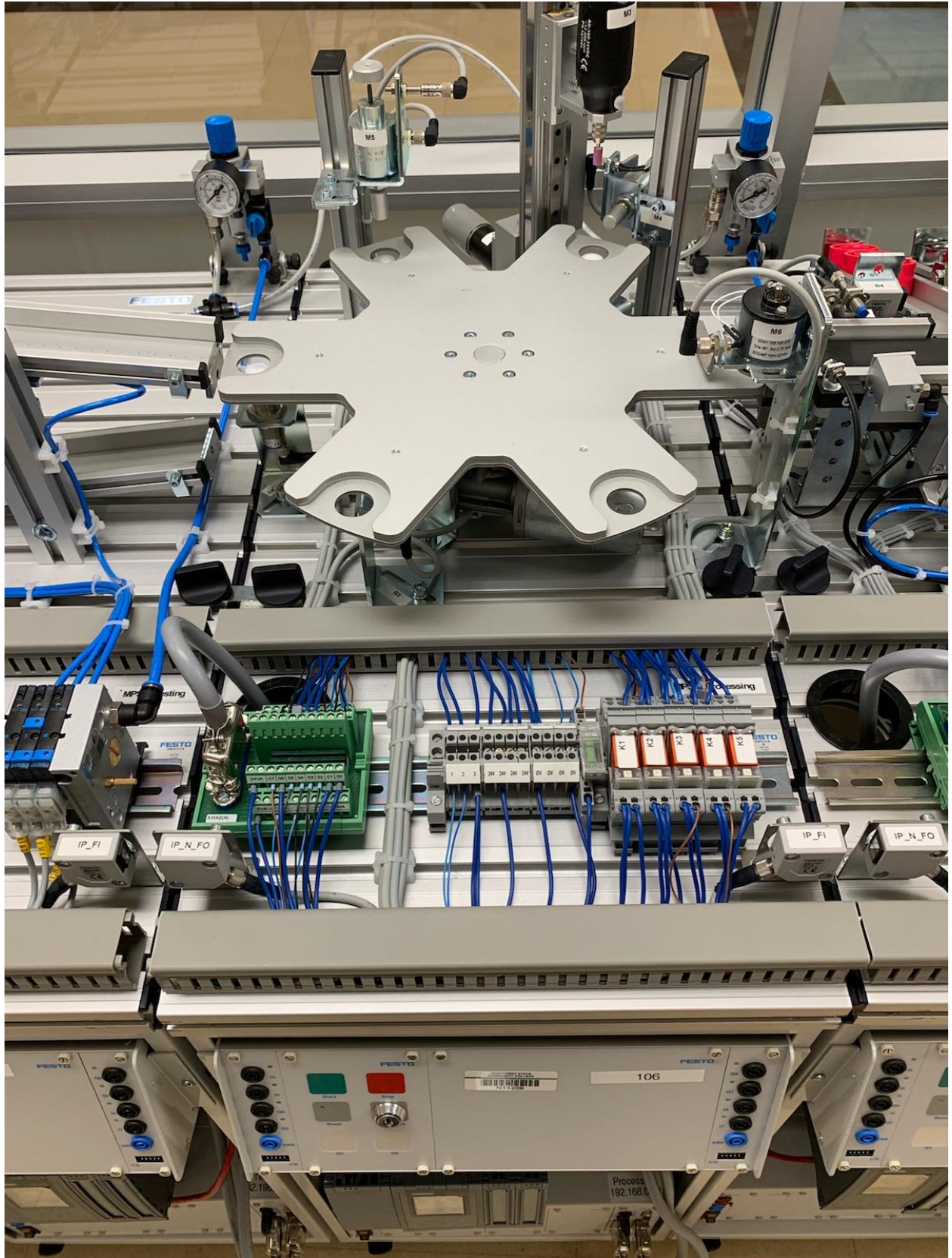
IP: 192.168.1.1 04HA-AS-1500



PLC tags										
Name	Tag table	Data type	Address	Retain	Acces...	Writa...	Visibl...	Supervis...	Comment	
1	Init_Bit	STEP7 classic sy...	Bool	%M7.5					Initialisierungsbit / Initialisation bit	
2	IP_N_FO	STEP7 classic symb...	Bool	%Q0.7					Station belegt / station occupied	
3	F_Start	STEP7 classic symb...	Bool	%M7.4.0					Start Merker / Start flag	
4	Em_Stop	STEP7 classic symb...	Bool	%I1.5					NOT-AUS entriegelt / Emergency stop unlocked	
5	75step15	STEP7 classic symb...	Bool	%M7.1.6					Schritt15 / Step15	
6	75step14	STEP7 classic symb...	Bool	%M7.1.5					Schritt14 / Step14	
7	75step13	STEP7 classic symb...	Bool	%M7.1.4					Schritt13 / Step13	
8	75step12	STEP7 classic symb...	Bool	%M7.1.3					Schritt12 / Step12	
9	Part_AV	STEP7 classic symb...	Bool	%I0.0					Werkstück vorhanden / workpiece available	
10	75step02	STEP7 classic symb...	Bool	%M7.0.1					Schritt2 / Step2	
11	75step01	STEP7 classic symb...	Bool	%M7.0.0					Schritt1 / Step1	
12	3M1	STEP7 classic symb...	Bool	%Q0.3					Stopper einfahren / Retract stopper	
13	2M1	STEP7 classic symb...	Bool	%Q0.2					Weiche 2 ausfahren / Extend switch 2	
14	75step07	STEP7 classic symb...	Bool	%M7.0.6					Schritt7 / Step7	
15	75step06	STEP7 classic symb...	Bool	%M7.0.5					Schritt6 / Step6	
16	75step05	STEP7 classic symb...	Bool	%M7.0.4					Schritt5 / Step5	
17	75step04	STEP7 classic symb...	Bool	%M7.0.3					Schritt4 / Step4	
18	delay1	STEP7 classic symb...	Timer	%T70					Verzögerungszeit 1 abgelaufen / delay time 1 expired	
19	Var5	STEP7 classic symb...	Byte	%MB75					Variable / variables	
20	Var4	STEP7 classic symb...	Byte	%MB72					Variable / variables	
21	Var3	STEP7 classic symb...	Byte	%MB71					Variable / variables	
22	CycleEnd	STEP7 classic symb...	Bool	%M74.3					Zyklusende / cycle end	
23	B4	STEP7 classic symb...	Bool	%I0.3					Rutsche voll / Slide full	
24	B3	STEP7 classic symb...	Bool	%I0.2					Werkstück ist nicht schwarz / Workpiece not black	
25	B2	STEP7 classic symb...	Bool	%I0.1					Werkstück aus Metall / Metallic workpiece	
26	1B1	STEP7 classic symb...	Bool	%I0.4					Weiche 1 einfahren / Switch 1 retracted	
27	75step18	STEP7 classic symb...	Bool	%M72.1					Schritt18 / Step18	
28	75step17	STEP7 classic symb...	Bool	%M72.0					Schritt17 / Step17	
29	75step16	STEP7 classic symb...	Bool	%M71.7					Schritt16 / Step16	
30	Var2	STEP7 classic symb...	Byte	%MB70					Variable / variables	
31	Var1	STEP7 classic symb...	Byte	%MB74					Variable / variables	
32	Toggle	STEP7 classic symb...	Bool	%M74.7					Umschalt Bit / Toggle bit	
33	T_Blink2	STEP7 classic symb...	Timer	%T76					Blink Timer	
34	T_Blink1	STEP7 classic symb...	Timer	%T75					Blink Timer	
35	S4	STEP7 classic symb...	Bool	%I1.3					Taster Richten / Reset button	
36	S3	STEP7 classic symb...	Bool	%I1.2					Schalter Automatik-Manuell / Automatic-manual switch	
37	S2	STEP7 classic symb...	Bool	%I1.1					Taster Stop (Öffner) / Stop button (normally closed)	
38	75step19	STEP7 classic symb...	Bool	%M72.2					Schritt19 / Step19	
39	S1	STEP7 classic symb...	Bool	%I1.0					Taster Start / Start button	
40	Reset_OK	STEP7 classic symb...	Bool	%M74.2					Richten erfolgreich abgeschlossen / Reset finished	
41	RC_Stop	STEP7 classic symb...	Bool	%M132.4					Fernsteuerung Stop / remote control stop	
42	75step11	STEP7 classic symb...	Bool	%M71.2					Schritt11 / Step11	
43	75step10	STEP7 classic symb...	Bool	%M71.1					Schritt10 / Step10	
44	75step09	STEP7 classic symb...	Bool	%M71.0					Schritt9 / Step9	
45	75step08	STEP7 classic symb...	Bool	%M70.7					Schritt8 / Step8	
46	P_Edge1	STEP7 classic symb...	Bool	%M75.0					Flankenmerker / Edge flag	
47	P_Edge	STEP7 classic symb...	Bool	%M75.1					Flankenmerker / Edge flag	
48	OBStat	STEP7 classic symb...	Byte	%Q80					Ausgangsbyte Station / outputbyte station	
49	OBPan	STEP7 classic symb...	Byte	%Q81					Ausgangsbyte Bediendpult / outputbyte panel	
50	K1	STEP7 classic symb...	Bool	%Q0.0					Bandmotor ein / belt motor on	
51	Init_Pos	STEP7 classic symb...	Bool	%M74.1					Station Sortieren in Grundstellung / Sorting station in initial position	
52	2B2	STEP7 classic symb...	Bool	%I0.7					Weiche 2 ausfahren / Switch 2 extended	
53	2B1	STEP7 classic symb...	Bool	%I0.6					Weiche 2 einfahren / Switch 2 retracted	
54	1M1	STEP7 classic symb...	Bool	%Q0.1					Weiche 1 ausfahren / Extend switch 1	
55	1B2	STEP7 classic symb...	Bool	%I0.5					Weiche 1 ausfahren / Switch 1 extended	
56	delay4	STEP7 classic symb...	Timer	%T74					Verzögerungszeit 4 abgelaufen / delay time 4 expired	
57	delay3	STEP7 classic symb...	Timer	%T72					Verzögerungszeit 3 abgelaufen / delay time 3 expired	
58	delay2	STEP7 classic symb...	Timer	%T71					Verzögerungszeit 2 abgelaufen / delay time 2 expired	
59	75step03	STEP7 classic symb...	Bool	%M70.2					Schritt3 / Step3	
60	P3	STEP7 classic symb...	Bool	%Q1.2					Leuchtmelder Rutsche voll / Slide full indicator light	
61	P2	STEP7 classic symb...	Bool	%Q1.1					Leuchtmelder Grundstellung (Reset) / Reset indicator light	
62	P1	STEP7 classic symb...	Bool	%Q1.0					Leuchtmelder Start / Start indicator light	
63	RC_Start	STEP7 classic symb...	Bool	%M132.0					Fernsteuerung Start / remote control start	
64	RC_Reset	STEP7 classic symb...	Bool	%M132.1					Fernsteuerung Richten / remote control reset	
65	RC_Bits	STEP7 classic symb...	Word	%MW132					Fernsteuerungsbits / remote control bit	
66	RCVar	STEP7 classic symb...	Byte	%MB132					Remote Variable / remote variables	
67	RC_Em_Stop	STEP7 classic symb...	Bool	%M132.5						
68	<Add new>									

Second Right

Device 4 (Second Right) IP: 192.168.1.1 09SO-AS-1500

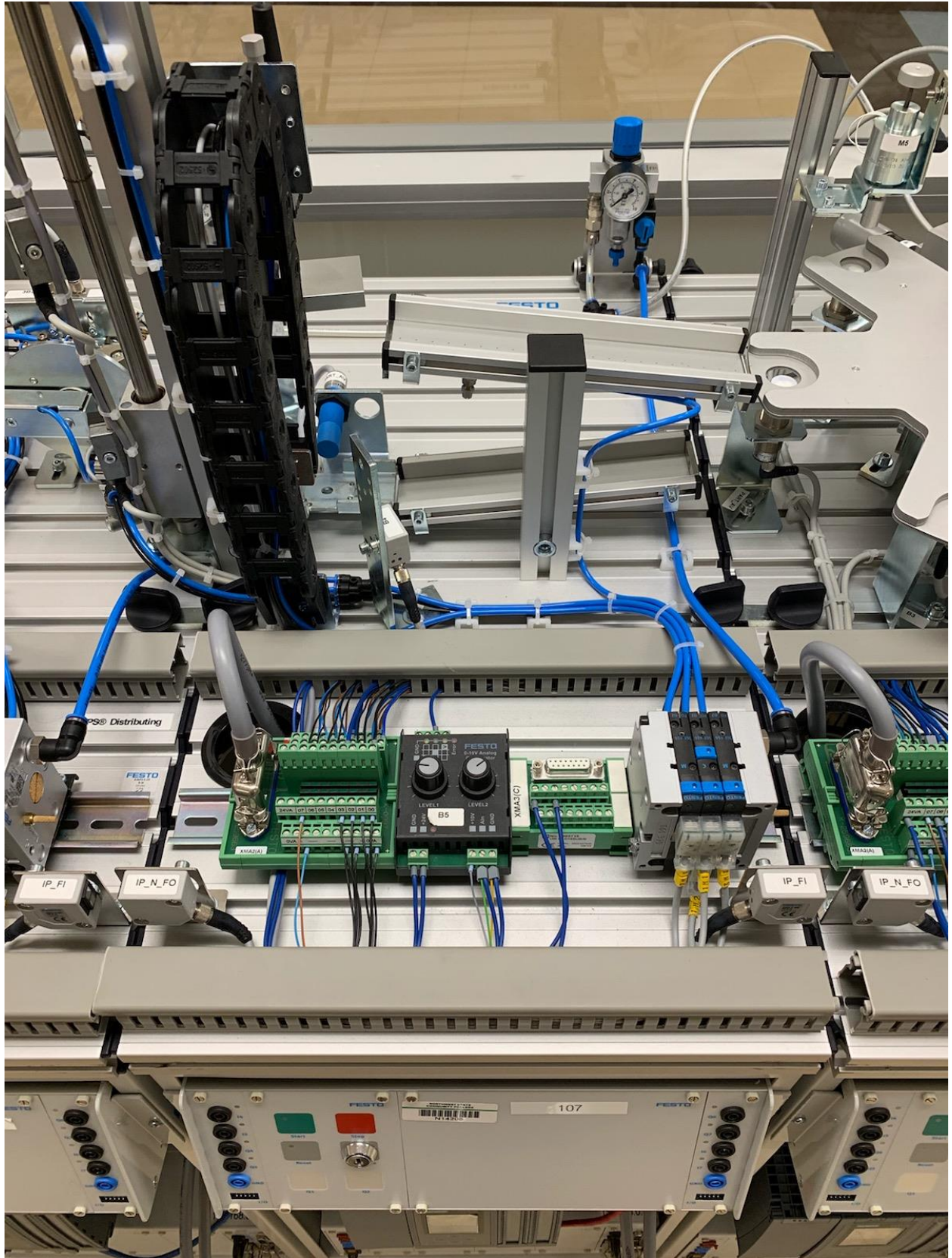


PLC tags										
	Name	Tag table	Data type	Address	Retain	Acces...	Writa...	Visibl...	Supervis...	Comment
1	B4	STEP7 classic sy...	Bool	%I0.6						Bohrlochprüfung in Ordnung / Checking drill hole o.k.
2	B3	STEP7 classic symb...	Bool	%I0.5						Rundschtaltisch positioniert / Indexing table positioned
3	B2	STEP7 classic symb...	Bool	%I0.1						Werkstück bei Bohrvorrichtung / Workpiece at drilling unit
4	B1	STEP7 classic symb...	Bool	%I0.2						Werkstück bei Prüfvorrichtung / Workpiece at checking unit
5	35step30	STEP7 classic symb...	Bool	%M3.5						Schritt 30 / Step 30
6	35step27	STEP7 classic symb...	Bool	%M3.2						Schritt 27 / Step 27
7	35step26	STEP7 classic symb...	Bool	%M3.1						Schritt 26 / Step 26
8	35step25	STEP7 classic symb...	Bool	%M3.0						Schritt 25 / Step 25
9	35step24	STEP7 classic symb...	Bool	%M2.7						Schritt 24 / Step 24
10	35step23	STEP7 classic symb...	Bool	%M2.6						Schritt 23 / Step 23
11	K2	STEP7 classic symb...	Bool	%Q0.1						Rundschtaltisch Motor an / Indexing table motor on
12	K1	STEP7 classic symb...	Bool	%Q0.0						Bohrmaschine Motor an / Drilling unit motor on
13	T_Blink1	STEP7 classic symb...	Timer	%T38						Blink Timer
14	S4	STEP7 classic symb...	Bool	%I1.3						Taster Richten / Reset button
15	S3	STEP7 classic symb...	Bool	%I1.2						Schalter Automatik-Manuell / Automatic-manual switch
16	35step12	STEP7 classic symb...	Bool	%M1.3						Schritt 12 / Step 12
17	35step11	STEP7 classic symb...	Bool	%M1.2						Schritt 11 / Step 11
18	35step10	STEP7 classic symb...	Bool	%M1.1						Schritt 10 / Step 10
19	35step09	STEP7 classic symb...	Bool	%M1.0						Schritt 9 / Step 9
20	35step08	STEP7 classic symb...	Bool	%M0.7						Schritt 8 / Step 8
21	35step17	STEP7 classic symb...	Bool	%M2.0						Schritt 17 / Step 17
22	35step16	STEP7 classic symb...	Bool	%M1.7						Schritt 16 / Step 16
23	35step15	STEP7 classic symb...	Bool	%M1.6						Schritt 15 / Step 15
24	35step14	STEP7 classic symb...	Bool	%M1.5						Schritt 14 / Step 14
25	35step13	STEP7 classic symb...	Bool	%M1.4						Schritt 13 / Step 13
26	delay8	STEP7 classic symb...	Timer	%T37						Verzögerungszeit 7 abgelaufen / delay time 7 expired
27	delay7	STEP7 classic symb...	Timer	%T36						Verzögerungszeit 7 abgelaufen / delay time 7 expired
28	35step29	STEP7 classic symb...	Bool	%M3.4						Schritt 29 / Step 29
29	P_Edge2	STEP7 classic symb...	Bool	%M3.4.4						Flankenmerker / Edge flag
30	P_Edge1	STEP7 classic symb...	Bool	%M3.5.0						Flankenmerker / Edge flag
31	P_Edge	STEP7 classic symb...	Bool	%M3.4.6						Flankenmerker / Edge flag
32	35step02	STEP7 classic symb...	Bool	%M3.0.1						Schritt 2 / Step 2
33	35step01	STEP7 classic symb...	Bool	%M3.0.0						Schritt 1 / Step 1
34	1B2	STEP7 classic symb...	Bool	%I0.4						Bohrmaschine unten / Drilling unit in lower position
35	1B1	STEP7 classic symb...	Bool	%I0.3						Bohrmaschine oben / Drilling unit in upper position
36	35step28	STEP7 classic symb...	Bool	%M3.3						Schritt 28 / Step 28
37	delay6	STEP7 classic symb...	Timer	%T35						Verzögerungszeit 6 abgelaufen / delay time 6 expired
38	delay5	STEP7 classic symb...	Timer	%T34						Verzögerungszeit 5 abgelaufen / delay time 5 expired
39	delay4	STEP7 classic symb...	Timer	%T33						Verzögerungszeit 4 abgelaufen / delay time 4 expired
40	delay3	STEP7 classic symb...	Timer	%T32						Verzögerungszeit 3 abgelaufen / delay time 3 expired
41	delay2	STEP7 classic symb...	Timer	%T31						Verzögerungszeit 2 abgelaufen / delay time 2 expired
42	delay1	STEP7 classic symb...	Timer	%T30						Verzögerungszeit 1 abgelaufen / delay time 1 expired
43	Var5	STEP7 classic symb...	Byte	%M35						Variable / variables
44	Var4	STEP7 classic symb...	Byte	%M32						Variable / variables
45	Var3	STEP7 classic symb...	Byte	%M31						Variable / variables
46	Var2	STEP7 classic symb...	Byte	%M30						Variable / variables
47	Var1	STEP7 classic symb...	Byte	%M34						Variable / variables
48	Toggle	STEP7 classic symb...	Bool	%M3.7						Umschalt Bit / Toggle bit
49	T_Blink2	STEP7 classic symb...	Timer	%T39						Blink Timer
50	P3	STEP7 classic symb...	Bool	%Q1.2						Leuchtmelder Werkstück schlecht / Workpiece not ok indicator light
51	P2	STEP7 classic symb...	Bool	%Q1.1						Leuchtmelder Grundstellung (Reset) / Reset indicator light
52	P1	STEP7 classic symb...	Bool	%Q1.0						Leuchtmelder Start / Start indicator light
53	OBStat	STEP7 classic symb...	Byte	%Q0						Ausgangsbyte Station / outputbyte station
54	OBPan	STEP7 classic symb...	Byte	%Q1						Ausgangsbyte Bedienpult / outputbyte panel
55	35step22	STEP7 classic symb...	Bool	%M2.5						Schritt 22 / Step 22
56	35step21	STEP7 classic symb...	Bool	%M2.4						Schritt 21 / Step 21
57	35step20	STEP7 classic symb...	Bool	%M2.3						Schritt 20 / Step 20
58	35step19	STEP7 classic symb...	Bool	%M2.2						Schritt 19 / Step 19
59	35step18	STEP7 classic symb...	Bool	%M2.1						Schritt 18 / Step 18
60	S2	STEP7 classic symb...	Bool	%I1						Taster Stop (Offner) / Stop button (normally closed)
61	S1	STEP7 classic symb...	Bool	%I0						Taster Start / Start button
62	Reset_OK	STEP7 classic symb...	Bool	%M3.2						Richten erfolgreich abgeschlossen / Reset finished
63	RC_Stop	STEP7 classic symb...	Bool	%M13.4						Fernsteuerung Stop / remote control stop
64	RC_Start	STEP7 classic symb...	Bool	%M13.0						Fernsteuerung Start / remote control start
65	Em_Stop	STEP7 classic symb...	Bool	%I1.5						NOT-AUS entriegelt / Emergency stop unlocked
66	CycleEnd	STEP7 classic symb...	Bool	%M3.3						Zyklus Ende / Cycle end
67	Bad_P_Pos3	STEP7 classic symb...	Int	%MW40						Schlechtteil bei Übergabestelle / bad workpiece at interchange point
68	Bad_P_Pos2	STEP7 classic symb...	Int	%MW38						Schlechtteil bei Bohrmach. / bad workpiece at drilling machine
69	Bad_P_Pos1	STEP7 classic symb...	Int	%MW36						Schlechtteil bei Bohrlochpr. / bad workpiece at checking drill hole
70	35step07	STEP7 classic symb...	Bool	%M0.6						Schritt 7 / Step 7
71	35step06	STEP7 classic symb...	Bool	%M0.5						Schritt 6 / Step 6
72	35step05	STEP7 classic symb...	Bool	%M0.4						Schritt 5 / Step 5
73	35step04	STEP7 classic symb...	Bool	%M0.3						Schritt 4 / Step 4
74	35step03	STEP7 classic symb...	Bool	%M0.2						Schritt 3 / Step 3
75	RC_Reset	STEP7 classic symb...	Bool	%M13.2						Fernsteuerung Richten / remote control reset
76	RCVar	STEP7 classic symb...	Byte	%M132						Remote Variable / remote variables
77	Part_AV	STEP7 classic symb...	Bool	%I0						Werkstück vorhanden / Workpiece available
78	Init_Pos	STEP7 classic symb...	Bool	%M3.1						Station Bearbeiten in Grundstellung / Processing station in initial position
79	Init_Bit	STEP7 classic symb...	Bool	%M3.5						Initialisierungsbit / Initialisation bit
80	IP_N_FO	STEP7 classic symb...	Bool	%Q0.7						Station belegt / station occupied
81	IP_FI	STEP7 classic symb...	Bool	%I0.7						Folgestation frei / Downstream station free
82	F_Start	STEP7 classic symb...	Bool	%M3.4.0						Start Merker / Start flag
83	M6	STEP7 classic symb...	Bool	%Q0.6						Werkstück auswerfen / Push out workpiece
84	M5	STEP7 classic symb...	Bool	%Q0.5						Werkstück prüfen / Proofing workpiece
85	M4	STEP7 classic symb...	Bool	%Q0.4						Werkstück spannen / Fixing workpiece
86	K4	STEP7 classic symb...	Bool	%Q0.3						Bohrmaschine nach oben / Raise drilling unit
87	K3	STEP7 classic symb...	Bool	%Q0.2						Bohrmaschine nach unten / Lower drilling unit
88	RC_Em_Stop	STEP7 classic symb...	Bool	%M13.5						
89	<Add new>									

Middle

Device 3 (Middle)

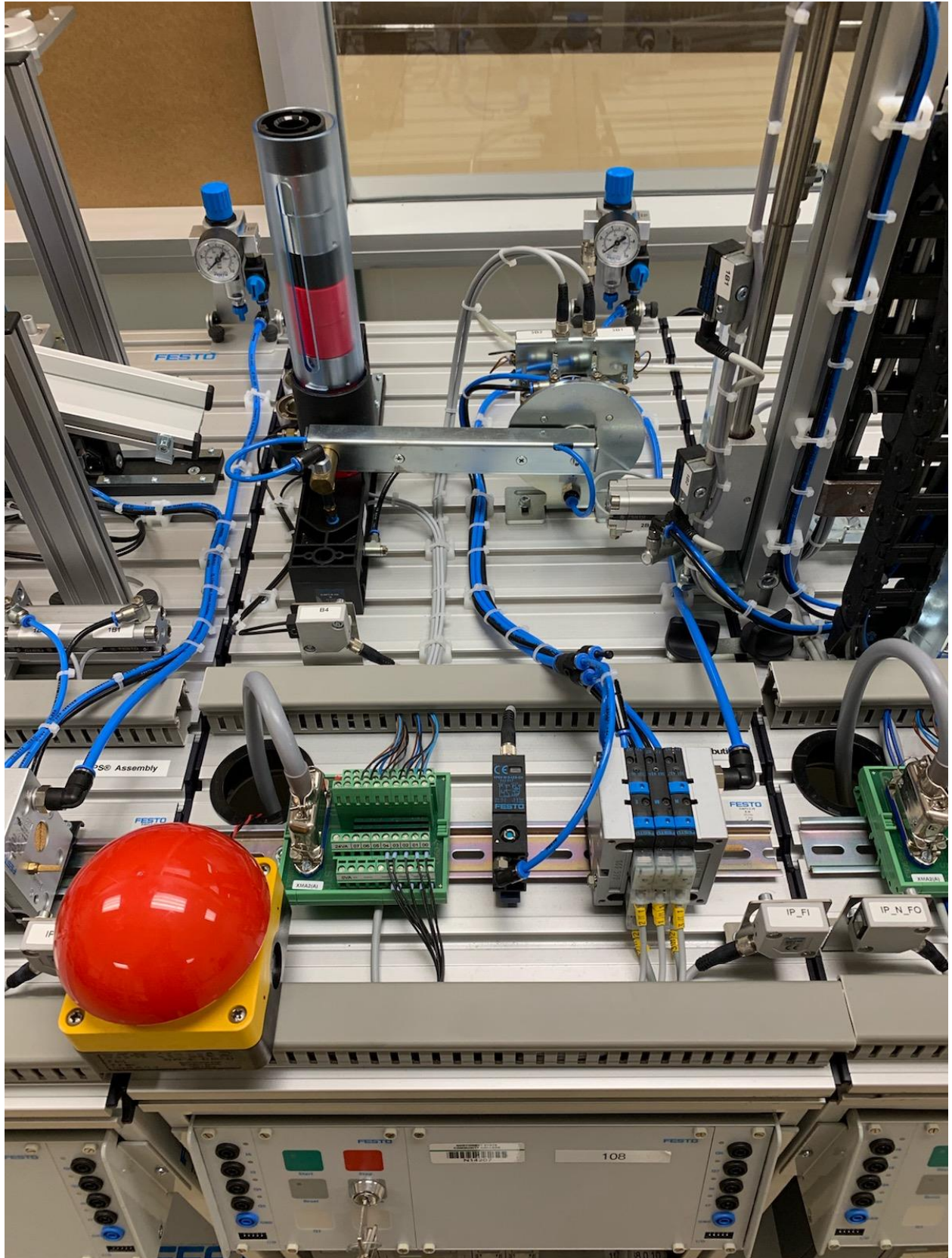
IP: 192.168.1.1 03BE-AS-1500



PLC tags										
Name	Tag table	Data type	Address	Retain	Acces...	Writa...	Visibl...	Supervis...	Comment	
1	OB5stat	STEP7 classic sy...	Byte	%QB0					Ausgangsbyte Station / outputbyte station	
2	OBPan	STEP7 classic symb...	Byte	%QB1					Ausgangsbyte Bedienpult / outputbyte panel	
3	Init_Pos	STEP7 classic symb...	Bool	%M2.1					Station Prüfen in Grundstellung / Testing station in initial position	
4	Init_Bit	STEP7 classic symb...	Bool	%M2.4.5					Initialisierungsbit / Initialisation bit	
5	3M1	STEP7 classic symb...	Bool	%Q0.3					Luftkissenrutsche an / air slide on	
6	25step19	STEP7 classic symb...	Bool	%M2.2					Schritt 19 / Step 19	
7	25step18	STEP7 classic symb...	Bool	%M2.1					Schritt 18 / Step 18	
8	25step17	STEP7 classic symb...	Bool	%M2.0					Schritt 17 / Step 17	
9	RC_Stop	STEP7 classic symb...	Bool	%M132.4					Fernsteuerung Stop / remote control stop	
10	RC_Start	STEP7 classic symb...	Bool	%M132.0					Fernsteuerung Start / remote control start	
11	RC_Reset	STEP7 classic symb...	Bool	%M132.1					Fernsteuerung Richten / remote control reset	
12	RCVar	STEP7 classic symb...	Byte	%MB132					Remote Variable / remote variables	
13	25step05	STEP7 classic symb...	Bool	%M20.4					Schritt 5 / Step 5	
14	25step04	STEP7 classic symb...	Bool	%M20.3					Schritt 4 / Step 4	
15	25step03	STEP7 classic symb...	Bool	%M20.2					Schritt 3 / Step 3	
16	25step02	STEP7 classic symb...	Bool	%M20.1					Schritt 2 / Step 2	
17	25step12	STEP7 classic symb...	Bool	%M21.3					Schritt 12 / Step 12	
18	25step11	STEP7 classic symb...	Bool	%M21.2					Schritt 11 / Step 11	
19	25step10	STEP7 classic symb...	Bool	%M21.1					Schritt 10 / Step 10	
20	25step09	STEP7 classic symb...	Bool	%M21.0					Schritt 9 / Step 9	
21	delay6	STEP7 classic symb...	Timer	%T25					Verzögerungszeit 6 abgelaufen / delay time 6 expired	
22	delay5	STEP7 classic symb...	Timer	%T24					Verzögerungszeit 5 abgelaufen / delay time 5 expired	
23	delay4	STEP7 classic symb...	Timer	%T23					Verzögerungszeit 4 abgelaufen / delay time 4 expired	
24	delay3	STEP7 classic symb...	Timer	%T22					Verzögerungszeit 3 abgelaufen / delay time 3 expired	
25	IP_IN_FO	STEP7 classic symb...	Bool	%Q0.7					Station belegt / station occupied	
26	IP_FI	STEP7 classic symb...	Bool	%I0.7					Folgestation frei / Downstream station free	
27	F_Start	STEP7 classic symb...	Bool	%M24.0					Start Merker / Start flag	
28	Em_Stop	STEP7 classic symb...	Bool	%I1.5					NOT-AUS entriegelt / Emergency stop unlocked	
29	1M1	STEP7 classic symb...	Bool	%Q0.0					Hebezyylinder nach unten / Lower lifting cylinder	
30	1B2	STEP7 classic symb...	Bool	%I0.5					Hebezyylinder unten / Lifting cylinder lowered	
31	1B1	STEP7 classic symb...	Bool	%I0.4					Hebezyylinder oben / Lifting cylinder raised	
32	B2	STEP7 classic symb...	Bool	%I0.1					Werkstück nicht schwarz / not black workpiece	
33	delay2	STEP7 classic symb...	Timer	%T21					Verzögerungszeit 2 abgelaufen / delay time 2 expired	
34	delay1	STEP7 classic symb...	Timer	%T20					Verzögerungszeit 1 abgelaufen / delay time 1 expired	
35	Var5	STEP7 classic symb...	Byte	%MB25					Variable / variables	
36	Var4	STEP7 classic symb...	Byte	%MB22					Variable / variables	
37	Var3	STEP7 classic symb...	Byte	%MB21					Variable / variables	
38	Var2	STEP7 classic symb...	Byte	%MB20					Variable / variables	
39	Var1	STEP7 classic symb...	Byte	%MB24					Variable / variables	
40	Toggle	STEP7 classic symb...	Bool	%M24.7					Umschalt Bit / Toggle bit	
41	T_Blink2	STEP7 classic symb...	Timer	%T27					Blink Timer	
42	T_Blink1	STEP7 classic symb...	Timer	%T28					Blink Timer	
43	CycleEnd	STEP7 classic symb...	Bool	%M24.3					Zyklus Ende / Cycle end	
44	B5	STEP7 classic symb...	Bool	%I0.3					Werkstückhöhe korrekt / Workpiece height correct	
45	B4	STEP7 classic symb...	Bool	%I0.2					Sicherheitslichtschranke / Safety light barrier	
46	S4	STEP7 classic symb...	Bool	%I1.3					Taster Richten / Reset button	
47	25step16	STEP7 classic symb...	Bool	%M21.7					Schritt 16 / Step 16	
48	25step15	STEP7 classic symb...	Bool	%M21.6					Schritt 15 / Step 15	
49	25step14	STEP7 classic symb...	Bool	%M21.5					Schritt 14 / Step 14	
50	25step13	STEP7 classic symb...	Bool	%M21.4					Schritt 13 / Step 13	
51	Part_AV	STEP7 classic symb...	Bool	%I0.0					Werkstück vorhanden / Workpiece available	
52	P3	STEP7 classic symb...	Bool	%Q1.3					Leuchtmelder Material / Indicator light material 1: 0=bk 1=rd 1=s	
53	P2	STEP7 classic symb...	Bool	%Q1.1					Leuchtmelder Grundstellung (Reset) / Reset indicator light	
54	P1	STEP7 classic symb...	Bool	%Q1.0					Leuchtmelder Start / Start indicator light	
55	25step01	STEP7 classic symb...	Bool	%M20.0					Schritt 1 / Step 1	
56	2M1	STEP7 classic symb...	Bool	%Q0.2					Auswerfzylinder nach vorn / Extend ejecting cylinder	
57	2B1	STEP7 classic symb...	Bool	%I0.6					Auswerfzylinder eingefahren / Ejecting cylinder retracted	
58	1M2	STEP7 classic symb...	Bool	%Q0.1					Hebezyylinder nach oben / Raise lifting cylinder	
59	P_Edge1	STEP7 classic symb...	Bool	%M25.0					Flankenmerker / Edge flag	
60	delay7	STEP7 classic symb...	Timer	%T26					Verzögerungszeit 7 abgelaufen / delay time 7 expired	
61	25step08	STEP7 classic symb...	Bool	%M20.7					Schritt 8 / Step 8	
62	25step07	STEP7 classic symb...	Bool	%M20.6					Schritt 7 / Step 7	
63	25step06	STEP7 classic symb...	Bool	%M20.5					Schritt 6 / Step 6	
64	P_Edge	STEP7 classic symb...	Bool	%M24.6					Flankenmerker / Edge flag	
65	S3	STEP7 classic symb...	Bool	%I1.2					Schalter Automatik-Manuell / Automatic-manual switch	
66	S2	STEP7 classic symb...	Bool	%I1.1					Taster Stop (Öffner) / Stop button (normally closed)	
67	S1	STEP7 classic symb...	Bool	%I1.0					Taster Start / Start button	
68	Reset_OK	STEP7 classic symb...	Bool	%M24.2					Richten erfolgreich abgeschlossen / Reset finished	
69	RC_Em_Stop	STEP7 classic symb...	Bool	%M132.5					Remote Control Emergency Stop	

Second left

Device 2 (Second Left) IP: 192.168.1.1 02PR-AS-1500



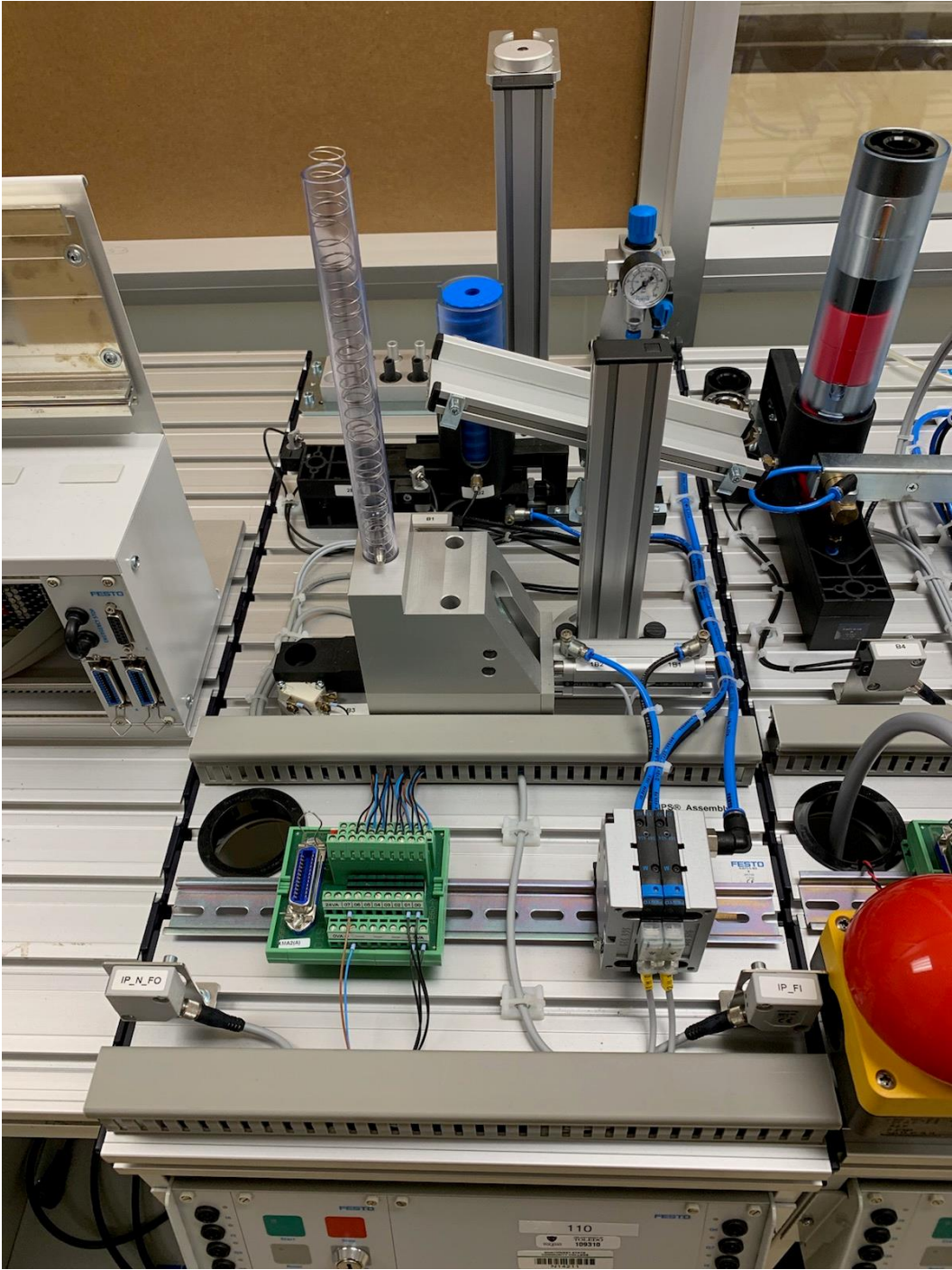
PLC tags										
	Name	Tag table	Data type	Address	Retain	Acces...	Writa...	Visibl...	Supervis...	Comment
1	2M2	STEP7 classic sy...	Bool	%Q0.2						Abwurfimpuls ein / Ejection impulse on
2	2M1	STEP7 classic symb...	Bool	%Q0.1						Vakuum ein / Vacuum on
3	2B1	STEP7 classic symb...	Bool	%Q0.3						Werkstück angesaugt / Workpiece gripped
4	1Step03	STEP7 classic symb...	Bool	%M10.2						Schritt 3 / Step 3
5	1Step02	STEP7 classic symb...	Bool	%M10.1						Schritt 2 / Step 2
6	1Step01	STEP7 classic symb...	Bool	%M10.0						Schritt 1 / Step 1
7	P_Edge1	STEP7 classic symb...	Bool	%M15.0						Flankenmerker / Edge flag
8	P_Edge	STEP7 classic symb...	Bool	%M14.6						Flankenmerker / edgeflag
9	1Step12	STEP7 classic symb...	Bool	%M11.3						Schritt 12 / Step 12
10	1Step11	STEP7 classic symb...	Bool	%M11.2						Schritt 11 / Step 11
11	1Step10	STEP7 classic symb...	Bool	%M11.1						Schritt 10 / Step 10
12	IP_FI	STEP7 classic symb...	Bool	%Q0.7						Folgestation frei / Downstream station free
13	F_Start	STEP7 classic symb...	Bool	%M14.0						Start Merker / Start flag
14	Em_Stop	STEP7 classic symb...	Bool	%I1.5						NOTAUS entriegelt / Emergency stop unlocked
15	Init_Pos	STEP7 classic symb...	Bool	%M14.1						Station Verteilen in Grundstellung / Distributing station in initial position
16	Init_Bit	STEP7 classic symb...	Bool	%M14.5						Initialisierungsbit / Initialisation bit
17	Var4	STEP7 classic symb...	Byte	%MB15						Variable / variables
18	1Step16	STEP7 classic symb...	Bool	%M11.7						Schritt 16 / Step 16
19	1Step15	STEP7 classic symb...	Bool	%M11.6						Schritt 15 / Step 15
20	1Step14	STEP7 classic symb...	Bool	%M11.5						Schritt 14 / Step 14
21	1Step06	STEP7 classic symb...	Bool	%M10.5						Schritt 6 / Step 6
22	1Step05	STEP7 classic symb...	Bool	%M10.4						Schritt 5 / Step 5
23	1Step04	STEP7 classic symb...	Bool	%M10.3						Schritt 4 / Step 4
24	Var3	STEP7 classic symb...	Byte	%MB11						Variable / variables
25	Var2	STEP7 classic symb...	Byte	%MB10						Variable / variables
26	Var1	STEP7 classic symb...	Byte	%MB14						Variable / variables
27	Toggle	STEP7 classic symb...	Bool	%M14.7						Umschalt Bit / Toggle bit
28	T_Blink2	STEP7 classic symb...	Timer	%T11						Blink Timer
29	T_Blink1	STEP7 classic symb...	Timer	%T10						Blink Timer
30	S4	STEP7 classic symb...	Bool	%I1.3						Taster Richten / Reset button
31	S3	STEP7 classic symb...	Bool	%I1.2						Schalter Automatik-Manuell / Automatic-manual switch
32	S2	STEP7 classic symb...	Bool	%I1.1						Taster Stop (Öffner) / Stop button (normally closed)
33	S1	STEP7 classic symb...	Bool	%I1.0						Taster Start / Start button
34	Reset_OK	STEP7 classic symb...	Bool	%M14.2						Richten erfolgreich abgeschlossen / Reset finished
35	RC_Stop	STEP7 classic symb...	Bool	%M132.4						Fernsteuerung Stop / remote control stop
36	RC_Start	STEP7 classic symb...	Bool	%M132.0						Fernsteuerung Start / remote control start
37	RC_Reset	STEP7 classic symb...	Bool	%M132.1						Fernsteuerung Richten / remote control reset
38	1Step13	STEP7 classic symb...	Bool	%M11.4						Schritt 13 / Step 13
39	RCVar	STEP7 classic symb...	Byte	%MB132						Remote Variable / remote variables
40	1M1	STEP7 classic symb...	Bool	%Q0.0						Auschiebbyl. Werkstück ausschieben/ Ejecting cylinder push out workpi.
41	1B2	STEP7 classic symb...	Bool	%I0.1						Auschiebbyl. ausgefahren / Ejecting cylinder extended
42	1B1	STEP7 classic symb...	Bool	%I0.2						Auschiebbyl. eingefahren / Ejecting cylinder retracted
43	P3	STEP7 classic symb...	Bool	%Q1.2						Leuchtmelder Magazin leer / Magazine empty indicator light
44	P2	STEP7 classic symb...	Bool	%Q1.1						Leuchtmelder Grundstellung (Reset) / Reset indicator light
45	3M1	STEP7 classic symb...	Bool	%Q0.3						Schwenkzyl. zu Magazin / Swivel drive to magazine
46	3B2	STEP7 classic symb...	Bool	%I0.5						Schwenkzyl. in Pos. Folgestation / Swivel drive in pos. downstream stat.
47	3B1	STEP7 classic symb...	Bool	%I0.4						Schwenkzyl. in Pos. Magazin / Swivel drive in pos. magazine
48	1Step09	STEP7 classic symb...	Bool	%M11.0						Schritt 9 / Step 9
49	1Step08	STEP7 classic symb...	Bool	%M10.7						Schritt 8 / Step 8
50	1Step07	STEP7 classic symb...	Bool	%M10.6						Schritt 7 / Step 7
51	P1	STEP7 classic symb...	Bool	%Q1.0						Leuchtmelder Start / Start indicator light
52	OB5stat	STEP7 classic symb...	Byte	%QB0						Ausgangsbyte Station / outputbyte station
53	OBPan	STEP7 classic symb...	Byte	%QB1						Ausgangsbyte Bedienpult / outputbyte panel
54	CycleEnd	STEP7 classic symb...	Bool	%M14.3						Zyklusende / CycleEnd
55	B4	STEP7 classic symb...	Bool	%I0.6						Sensor Magazin leer / Sensor magazine empty
56	3M2	STEP7 classic symb...	Bool	%Q0.4						Schwenkzyl. zu Folgestation / Swivel drive to downstream station
57	RC_Em_Stop	STEP7 classic symb...	Bool	%M132.5						Remote Control Emergency Stop
58	Ext_Em_Stop	STEP7 classic symb...	Bool	%I1.6						External Emergency Stop
59	Em_Stop_Act	STEP7 classic symb...	Bool	%M133.0						Emergency Stop Activated
60	<Add new>									

Farthest Left

Device 1 (Left most)

IP: 192.168.1.1 01VE-AS-1500

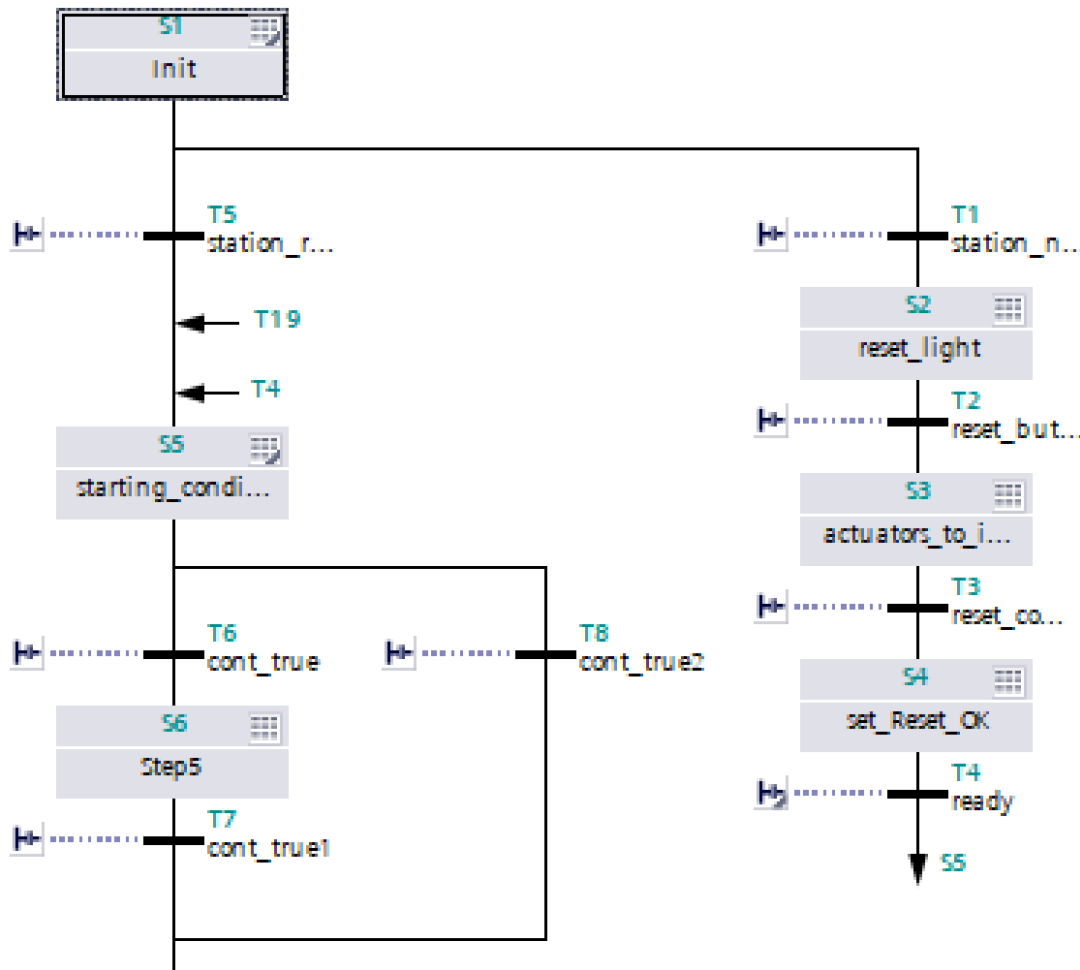
This station is a stand-alone assembly block with a number of hopper feeders ready to present various parts to the robot for assembly. The parts may vary somewhat but typically are fed to the robot which performs an assembly before feeding the part into the five station manufacturing system.

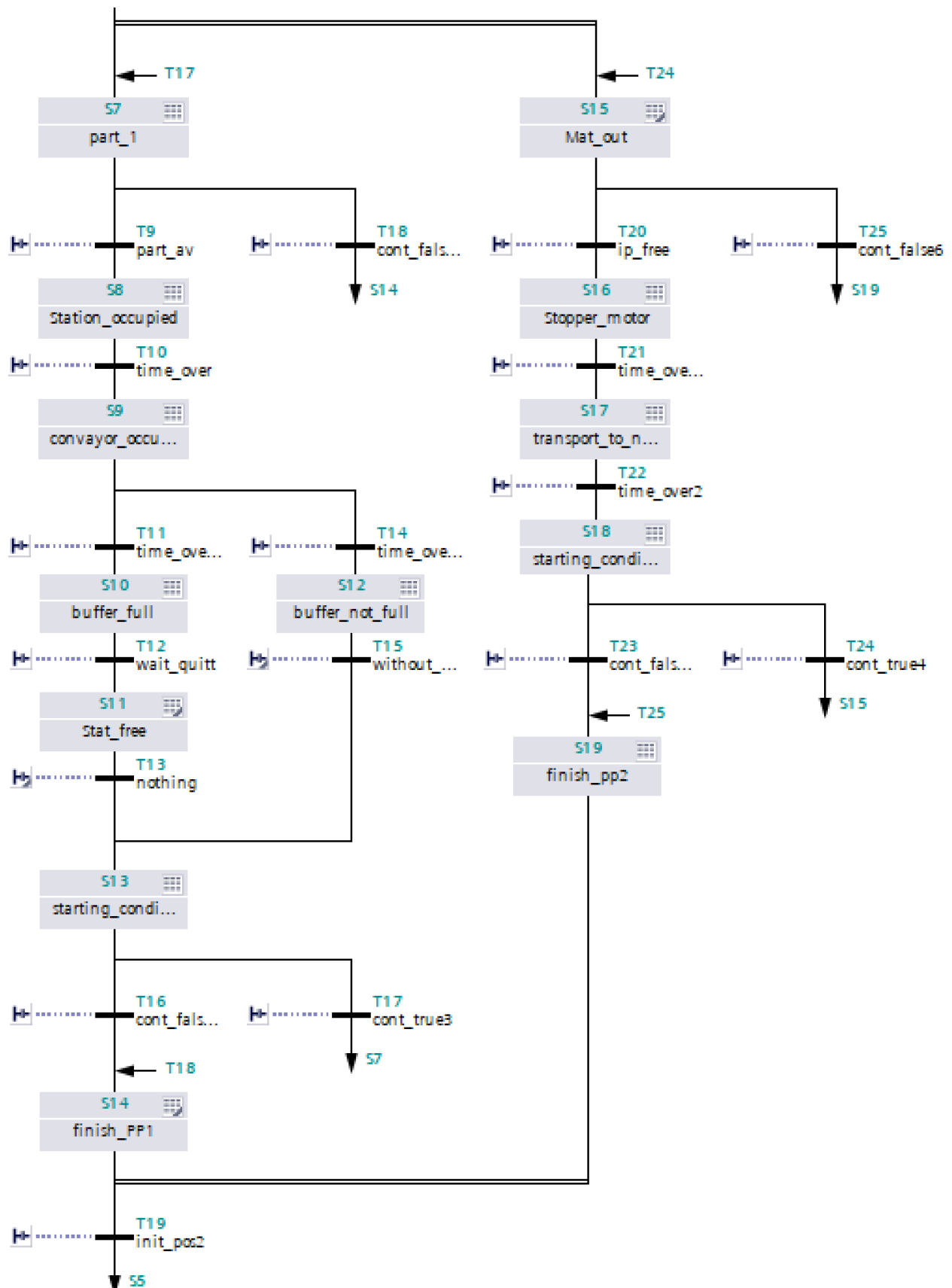


To write the control program for one of these sections, first develop an accurate I/O list. Turn on and off each of the digital outputs and observe what happens. Does something move? Does something change? List the inputs that change for each of the outputs.

Then write a sequential program using preferably LAD to control this section of the line. Do not consider linkage with other sections. Just control the section of the line under control of the PLC you are programming. Create a start mechanism to introduce a part and move it through your section. Demo the completed program for credit.

The following is an example of Sequential Function Chart, an alternative to LAD. You may choose to use it instead of LAD. See extra credit for using SFC.





Turn on and off all outputs. Observe the function and write it in the attached table. Also include the Signal Assignment (turns on/turns off with coil on).

Output Definition Table

Actuator	Function/State	Signal Assignment

Then, observe the input(s) that are changed when the output is turned on/off. This table is developed next.

Input Definition Table

Sensor	Function/State	Signal Assignment

Now, write the program to introduce a part and move through the various stations of your section. Consider your choice of language:

- Ladder
- FBD
- SFC

Each has advantages. The examples of Ch. 11 give starter ideas for Ladder. FBD can be used in similar fashion. SFC is new and should be considered.

You may want to try all three and compare your results.



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