Test Project

Task B

Mechatronics

Submitted by:

Fabian Gohlke – FESTO Didactic, Independent Test Project Designer
Michael Linn – FESTO Didactic, Independent Test Project Designer

Felix Alt – FE STO SE, Independent Test Project Validator
Mustafa Ersoy – FESO Didactic SE, Independent Test Project Validator

Content

Introduction to Test Project B 3

Assembly, programming and commissioning of a production line including 3-Magazine Station with Handling Stepper and conveyor belt, SkillsConveyor Station with Module "Assembling" and Lift&Turn 3
Scenario 3
Attention 4
Assembly of IO-Link Device at Magazine 2 5
Assembly of IO-Link Devices – for Handling Stepper at magazine 3 5

HMI Design and Function 6
Page "Home" 6
Page "Order" 6
Page "Value" 6

Your Task 6

Important notes about condition of the evaluation 7
Preparation 7
Function Operation mode and signals 7
Task B, SC-ID B1: Function Quality of production and signals 7
Notes for second (2nd) chance without Expert WP selection (reduced marks) 7
Task B, SC-ID B2: I/O Allocation 7
Task B, SC-ID B3, B4 and B5: HMI Design, PP-Judgement and Workplace management 7
Task B, SC-ID B6: Working Time 7

Mechanical Part 8

Production line layout 8
Assembly of IO-Link Devices 10
Definition of Stack Magazines 10
Different views 10

Electrical part 12

SCS: Details of Module Handling Stepper (actuators and sensors) 12
SCS: Details of Module Handling Stepper (prewired to the Motor controller) 13
Details of Module: Conveyor 300x 40 and wiring allocation mini terminal 15
Details of Module: Conveyor 700x 40 and wiring allocation mini terminal 16
Details of Module: Lift and Turn and wiring allocation Mini-Terminal 17
Details of Module: Assembling and wiring allocation Mini-Terminal 1 and 2 18
Details of Module: Stop&Push and wiring allocation Mini-Terminal 20
SCS: Details of Module Skills Conveyor (more on USB/file server) 21
Front plate 21
Allocation of the prewired front plate 22

Allocation checked with Simulation Box (Station 1 - 3MS) 24
Allocation checked with Simulation Box (Station 2 - SCS) 25

Control Part 27

Initial position 27
HMI Design and Function 28
Page"Home" 28

Page "Order" 28
Page "VALUES" 29
Positions 30
Flow chart Legend and Notes (see flow chart) 30

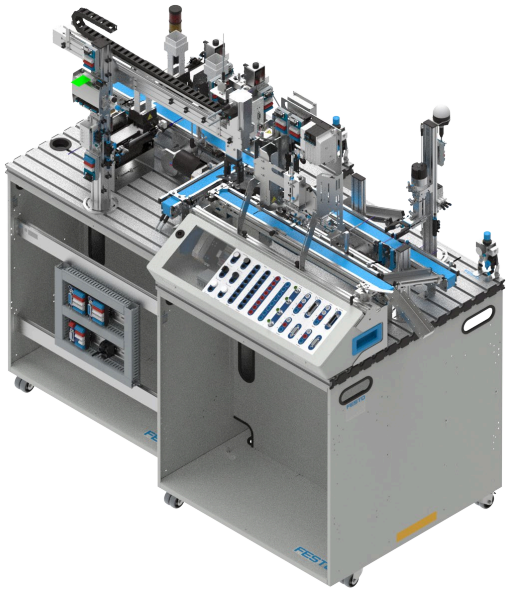
© WorldSkills International

Introduction to Test Project B

Assembly, programming and commissioning of a production line including 3-Magazine Station with Handling Stepper and conveyor belt, SkillsConveyor Station with Module “Assembling” and Lift&Turn

TMAX	INFORMATION
300 min	Also on file server

Scenario



- A customer would like to add a subsystem to his production plant from delivery A (Task A) and adapt his process.
- The workpieces need a cap, get sorted and collected by orders.
- This new subsystem Station 2 consists of:
  - Module SkillsConveyor with one (1) end block, SkillsModule “Assembling”, switch and a Slide
  - Module Conveyor (700 mm) with an optical stopper system
  - Module Lift&Turn with slide
- The existing Station 1 get addional Modules:
  - Module Stop&Push
  - Module Conveyor 300 with a separating slide
  - Module Handling Stepper
- You have to make sure that you can bring the system to the initial position before the evaluation starts from the initial Position. See also “Important notes about condition of the evaluation”

© WorldSkills International

- The products in 3MS are transported to the left-hand side behind the stopper (max. three (3)) P4, and the products in SCS/Skills Conveyor to the right-hand side slide P13, SCS/Conveyor700 to the left-hand side. As soon as all products are at the target position, they will be taken away.
- It is possible that in the 3MS are products with some bad workpieces, that make a bad cap assembling. This is simulated by an inlay.
- The slide and the switch from Task A have to move to Station 2 SCS
- Products with bad cap assembling are transported to the slide at SCS. The products on the slide will be taken away after each order.
- Products belonging to the order and cap assembled are transported to the slide P16 at Module Lift&Turn via Conveyor700. The products will be removed by hand after each order.
- The following magazine definitions must be observed: see "Definition of Stack Magazines"
- The modules and components must be installed as shown in the pictures.

Attention

- Wrong product includes the wrong workpiece type from a magazine and the wrong orientation of the product.
- Order is "COMPLETE" when the full order is delivered to the slide position P16.
- It is allowed that a workpiece can be processed in Station 1 as soon the Station 1 is free of a workpiece in the process.
- After each order, workpiece behind the stopper or on the slides, are to be taken away manually as shown in the flowchart.
- If a product is wrong, the system has to continue to process workpieces until the order is completed successfully.
- All unused components and documentation in english must be stored in a box at the end of the Competition Day.
- **Note for the assembling of Module Skills Conveyor** (SKC) has to be positioned like seen in the picture. The overlap of the frontside is necessary.
  Module SkillsConveyor assemble in crove 6, Module Conveyor assembled in crove 10. Also, the Module Handling Stepper overlaps the trolley with cables.
  The connection cables of the Module Lift&Turn can overlap the SCS.
- See document "Additional_Information_SKC.pdf".
- **NOTE for the module Skills Conveyor wiring:**
  The wiring of the SKC is directly to the clamps in the Skills Conveyor. There is no Mini-I/O Terminal on the module.
  - The control panel is deactivated. Not to use.
  - The 24V and 0V are bridged at the clamps.
  - Wires coming from outside through the cable entry can be placed outside the cable duct between cable duct and clamps. See picture.

The wiring of the front plate is already done to the clamps. Do a wiring check along the allocation table of the pre-wired front plate of Module SKC (SysLink connector, analogue connector and IO-Link), don't change it.

The analogue signal of clamp 0/1 on Terminal -XG10 (AI) is also wired to the front plate. The measuring of the analogue voltage will be evaluated via the 4mm plugs there.

© WorldSkills International

- **Note for the Modul Assembling on the SkillsConveyor**
  - IO-Link device on Module Assembling is to be connected as follows:
    - Port A: Terminal 1
    - Port B: Terminal 2
  - The Auxilary Power T-Connect should be placed inside the wiring box.
- **Notes about the changes on the IO-Terminals:**
  - Magazines 1 and 2 will be connected to the DA-IO-Link Interface Port A and B at magazine 2. The open connectors can stay on the profile plate. The open wiring at the wiring board has to be take out and prepared like this:  New Modules will be wired to the I/O Terminals
- **NOTE for the Stepper Controller:**
  - Please consider that you may have to use an additional power supply.
  - Please leave the cables in their original length and simply create a loop at the Handling Module
  - Preassembled modules:

MODULE FOR FUNCTION CHECK	CHECKING TIME [MINUTES]
Lift and Turn	60
Assembling	60
Stop&Push/Ejecting	60
Skills Conveyor	60

Assembly of IO-Link Device at Magazine 2

- **NOTE**
- IO-Link device on Module Magazine 2 connect as follows:
  - Port A: mini IO-Terminal Module Magazine 1
  - Port B: mini-IO-Terminal Module Magaine 2
- Connect the IO-Link device with your IO-Link Master
- SimuBox evaluation will be done via the provided C-Interface on the mini IO-Terminal
- You can find the IODD on the file server
- The IO-Link device must be connected and used.
- The IO-Link device is “connected” if the green light is on

Assembly of IO-Link Devices – for Handling Stepper at magazine 3

- **NOTE**
- Connect the IO-Link device on Module Handling Stepper as follows:
  - Port A: mini IO-Terminal Module Handling Stepper Gripper Unit (sensors and actuators)
  - Port B: mini-IO-Terminal Module Handling Stepper Stepper Controller
  - Connect the IO-Link device with your IO-Link Master
  - SimuBox evaluation will be done via the provided C-Interface on the mini IO-Terminal
  - You can find the IODD on the USB-Stick/file server
  - The IO-Link device must be connected and used.
  - The IO-Link device is “connected” if the green light is on

© WorldSkills International

HMI Design and Function

Page “Home”

See also Task A

Page “Order”

See also Task A

Page “Value”

See also Task A

Your Task

Assemble, wire and tube the production line on the profile plate according to this documentation and commission the system.

Your task is complete when:

1. The Station has been assembled mechanically, wired correctly, connected and its correct operation is guaranteed (based on evaluation using the simulation box).
   Function and wiring of the I/O Terminal for the station have to be checked using simulation box.
   Preparation: Connect the simulation box to the I/O Terminal (Output 0-7: signal 1 or 0); (Input 0-7: signal 1 or 0)
2. Correct execution of the program with PLC activation (based on evaluation with PLC) is guaranteed. See also “Important notes about condition of the evaluation”
3. The system meets the specifications (in accordance with the Standard and Assessment Guide for Judgement in Professional Practice, HMI design).

The system will be sent to the customer as soon as you are finished. You will have no opportunity to make improvements afterwards. Hardware problems during the evaluation phase can be solved during the next task.

© WorldSkills International

Important notes about condition of the evaluation

Preparation

- Connect the PLC board with the I/O terminals, switch key to the position AUTO (HMI), start the PLC, no programming cable and no communication between PC and PLC, valve for air is opened. Magazines, conveyor and slides are empty.
  You will get time to check that before the evaluation!

Function Operation mode and signals

The assessment team will not place workpieces in the system for an initial run.

The initial run is your responsibility. The evaluation team will be only evaluating the result after the initial run.

Task B, SC-ID B1: Function Quality of production and signals

- Start from the required initial position.
- Put at least four (4) Workpieces into Magazine 1, Magazine 2, Magazine 3* and on the SKC Slide* (will never get empty)
- Put minimum four (4) caps in the magazine of the Module Assembling
- Minimum Process required for the assessment:
  - During the evaluation at least one (1) order must have been executed and delivered to the selected position.
  - Reduced Lamp function (see Flow chart)
- Attention: When the function stops with one product in the station, the evaluation is finished. (no manual help allowed)
- (Second (2nd) chance possible)

Notes for second (2nd) chance without Expert WP selection (reduced marks)

- Start from the initial position.
- For the first (1st) order Competitor selects three (3) types of workpieces for the evaluation and puts them into **one (1)** magazine (first (1st) upside down, second (2nd) wrong colour, third (3rd) correct). And on the slide with the separator (first (1st) correct colour and orientation but with cap assembling simulation ring, second (2nd) correct. Select only one (1) WP to produce.
- Attention: When the function stops with one (1) product in the station, the evaluation is finished. (no manual help allowed)

Task B, SC-ID B2: I/O Allocation

Based on the allocation lists and the required place of the I/O – Terminals (IO-Boards, IO-Interfaces and Modules)

Task B, SC-ID B3, B4 and B5: HMI Design, PP-Judgement and Workplace management

Based on the SAG document

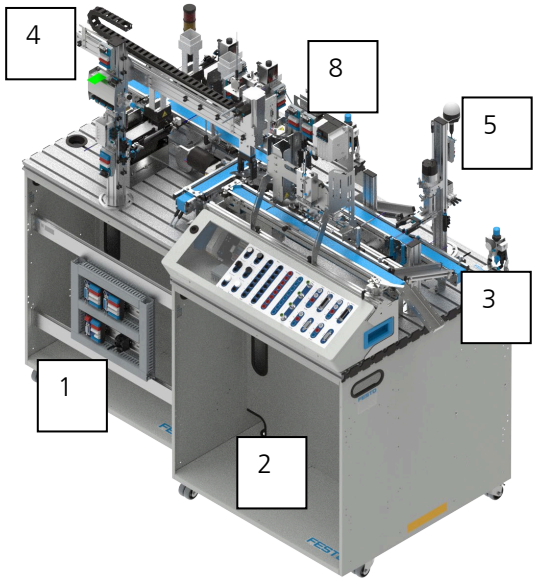
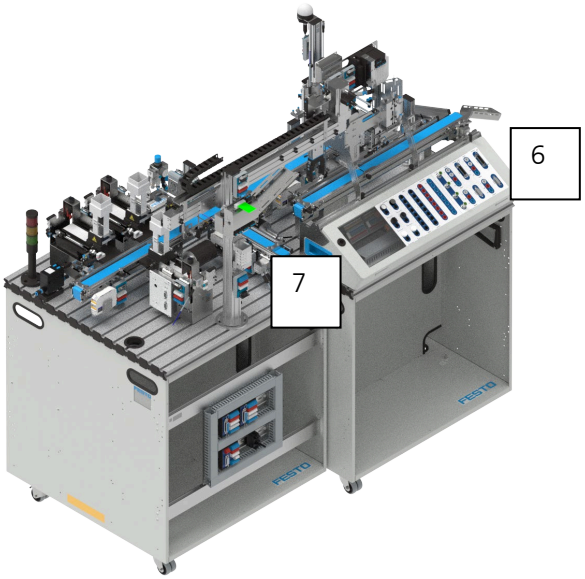
Task B, SC-ID B6: Working Time

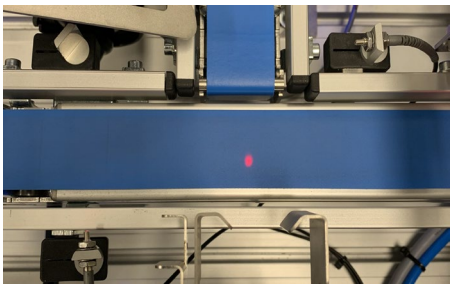
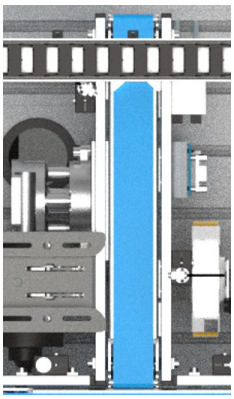
Time evaluation (only if 100% of points is achieved for PLC with WP selection by Experts and simulation box function and at least 66,67% points each for judgement in professional practice and HMI design)

© WorldSkills International

Mechanical Part

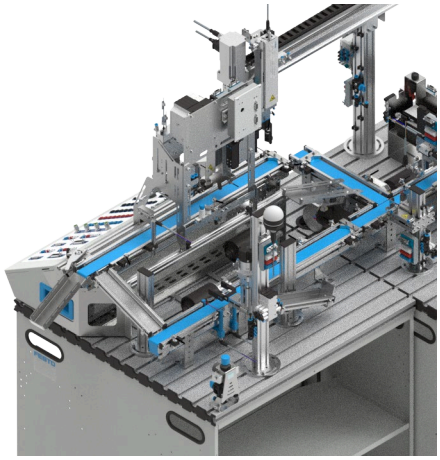
Production line layout

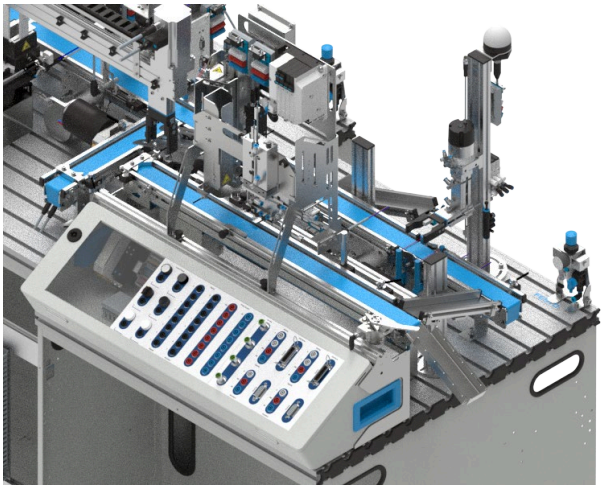
SYSTEM LAYOUT VIEW FROM RIGHT HAND SIDE	SYSTEM LAYOUT VIEW FROM LEFT HAND SIDE
	
1. 3-Magazine Station (3MS)	2. Skills Conveyor Station (SCS)
3. Module Conveyor 700mm	4. Module Handling Stepper
5. Module Lift&Turn	6. Module Skills Conveyor (SKC)
7. Module Conveyor 300mm	8. Module Assembling

ONE SENSOR – TWO POSITIONS	TOP VIEW CONVEYOR 300
	

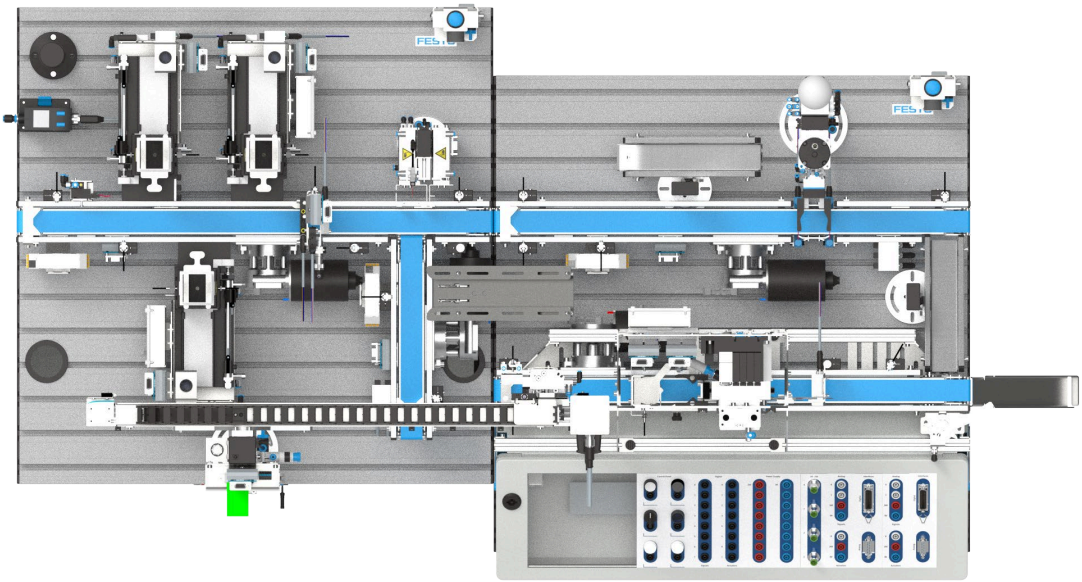
© WorldSkills International

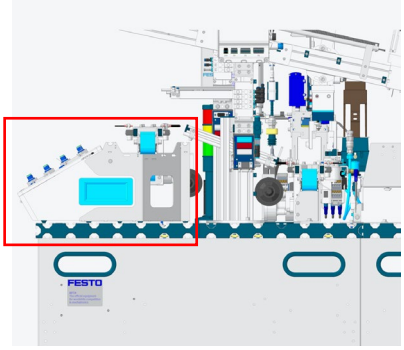
DETAILS OF SKILLSCONVEYOR STATION (SCS)





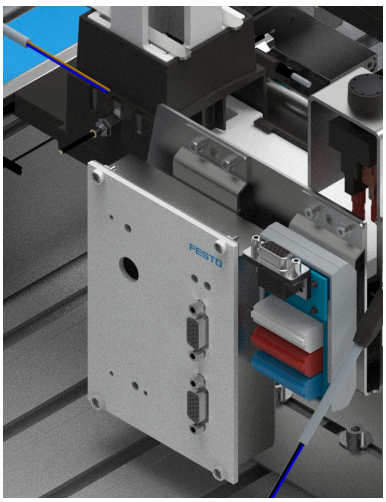
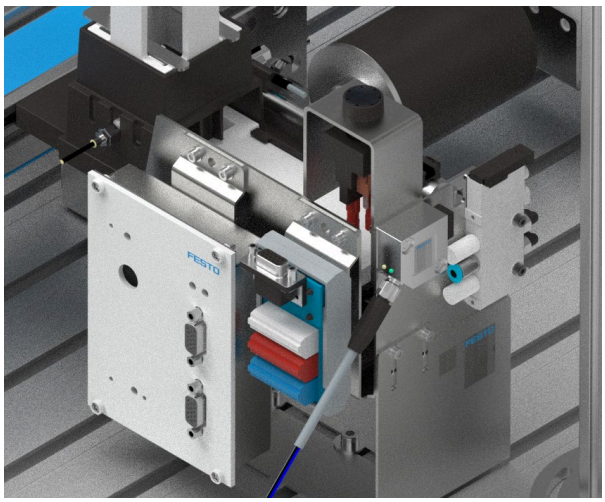
SYSTEM LAYOUT – TOP VIEW





© WorldSkills International

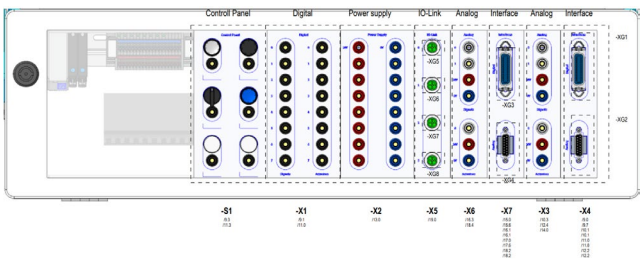
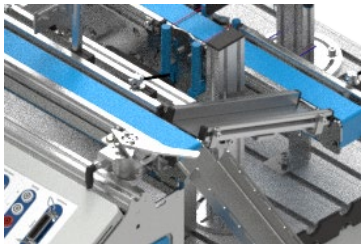
Assembly of IO-Link Devices

PLACE OF ASSEMBLING OF IO-LINK DEVICE AT MAGAZINE 2	PLACE OF ASSEMBLING OF IO-LINK DEVICES – FOR HANDLING STEPPER AT MAG. 3
	

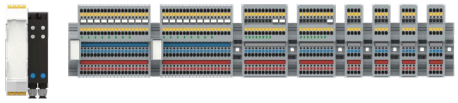
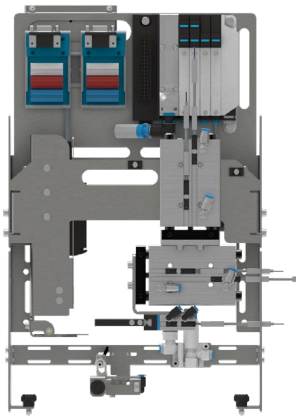
Definition of Stack Magazines

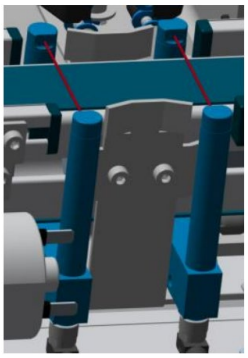
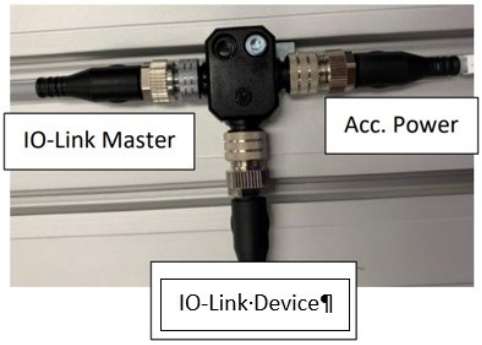
MODULE: MAGAZINE IN 3MS	BLACK	RED	SILVER
Back - left hand side (1)	X		
Back - right hand side (2)		X	
Front - single other side of Mag1 and Mag2(3)			X

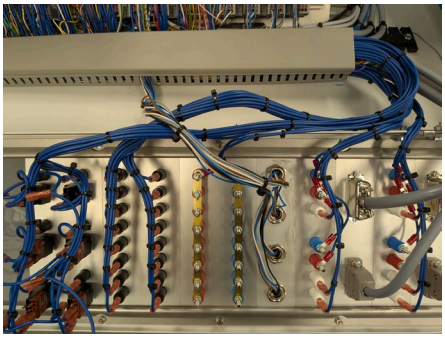
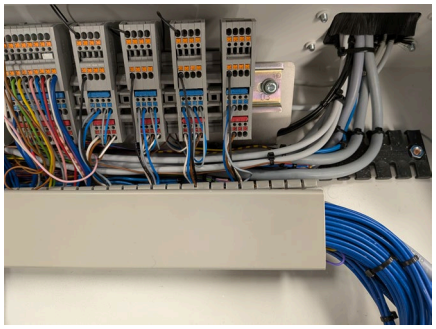
Different views

SKC FRONTSIDE	IO-LINK LAMP@MODUL LIFT&TURN	SEPARATOR AND SLIDE IN SCS
		

© WorldSkills International

SKC: CABLE RESERVE WIRES BEHIND SKC	SKC INSIDE	MODULE “DISTRIBUTION&ASSEMBLING“
		

LIGHT BARRIER SET	AUXILARY POWER T-CONNECT	ERROR HIGHT SIMULATION INLAY
		

BACK PANEL PRE-WIRED ==> DON’T CHANGE IT	CABLE DUCT AND WIRING FROM OUTSIDE
	

Electrical part

Add and Connect the Stepper Controler along the general information from C-6M!

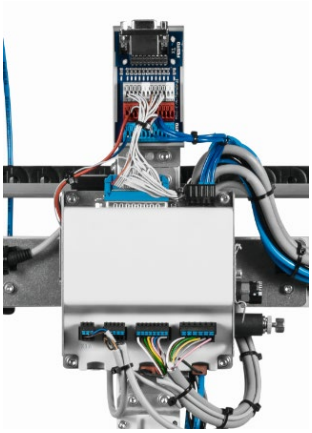
SCS: Details of Module Handling Stepper (actuators and sensors)



PIN ON SUB-D	COLOUR DIN47100	PIN I/O MINI-TERMINAL	PIN - FUNCTION	PIN I/O TERMINAL FILL IN	FUNCTION
1	White	1	I0		Z-axis cylinder is up
2	Brown	7	Q0		Z-axis extend
3	Green	2	I1		Z-axis cylinder middle position
4	Yellow	8	Q1		Positioning cylinder extend
5	Gray	3	I2		Z-axis cylinder down position
6	Pink	9	Q2		Open gripper
7	Blue	4	I3		WP available
8	Red	10	Q3		Not used
9	Black	5	AI0		Not used
10	Violet	6	AI1		Not used
11	Gray-rose	11+12	AQ0		Not used
12	Red-blue	24VA	VCC-Out		
13	White-green	24VB	VCC – In		
14	Brown-green	GND A	GND Out		
15	White-yellow	GND B	GND In		

© WorldSkills International

SCS: Details of Module Handling Stepper (prewired to the Motor controller)

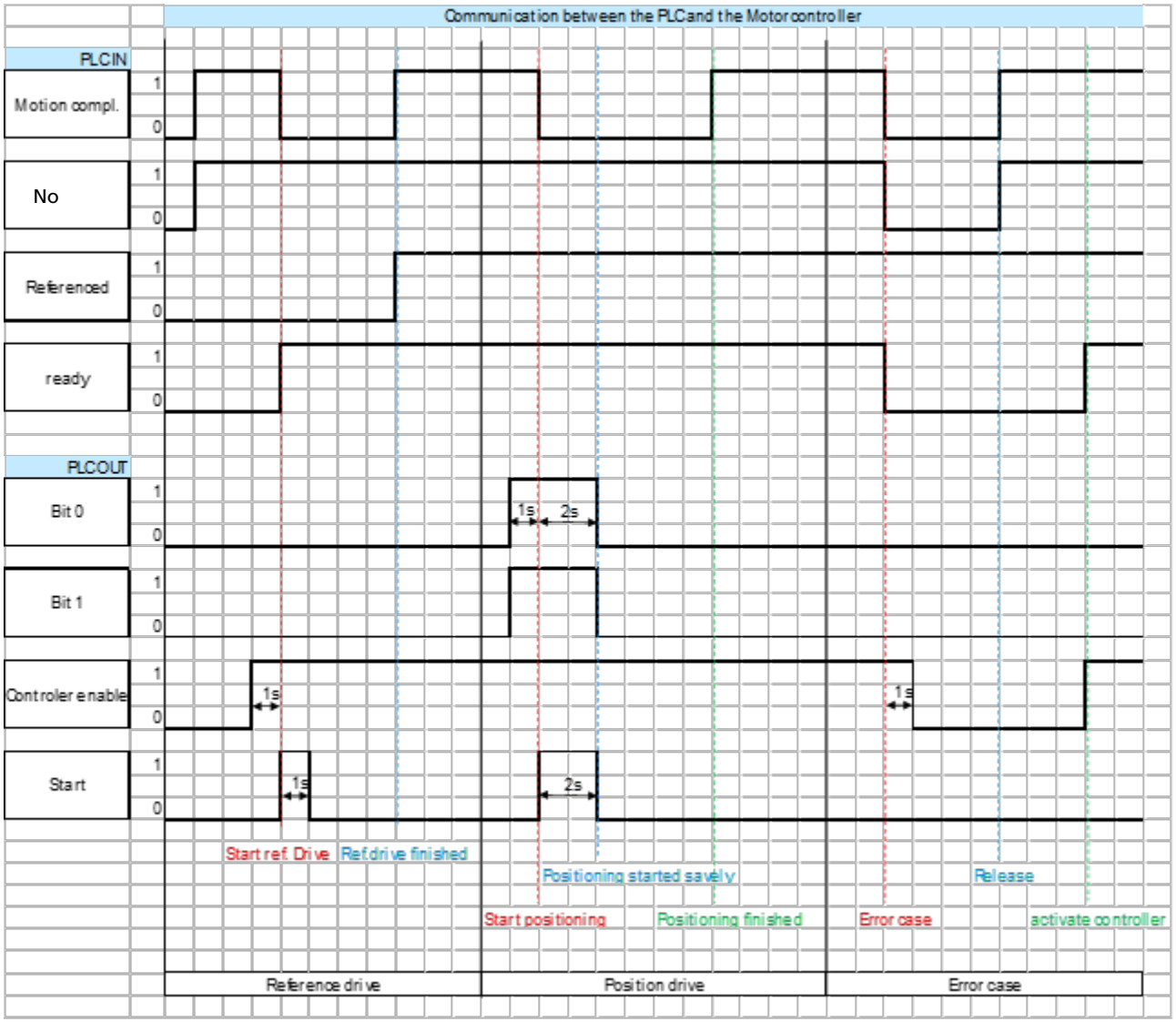


PIN ON SUB-D	COLOUR DIN47100	PIN I/O MINI-TERMINAL	PIN - FUNCTION	PIN I/O TERMINAL FILL IN	FUNCTION
1	White	1	I0		Motion complete
2	Brown	7	Q0		Bit addressing Bit 0
3	Green	2	I1		No Error
4	Yellow	8	Q1		Bit addressing Bit 1
5	Gray	3	I2		Referenced
6	Pink	9	Q2		Pause/control enable
7	Blue	4	I3		Ready
8	Red	10	Q3		Strobe/Start
9	Black	5	AI0		Not used
10	Violet	6	AI1		Not used
11	Gray-rose	11+12	AQ0		Not used
12	Red-blue	24VA	VCC-Out		
13	White-green	24VB	VCC – In		
14	Brown-green	GND A	GND Out		
15	White-yellow	GND B	GND In		

© WorldSkills International

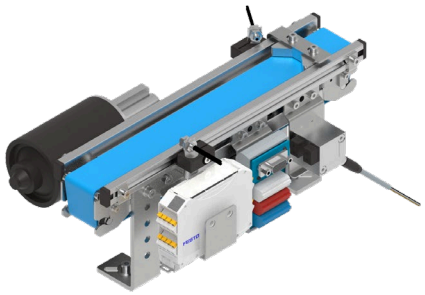
Communication and bit pattern code between Stepper Motor controller and PLC

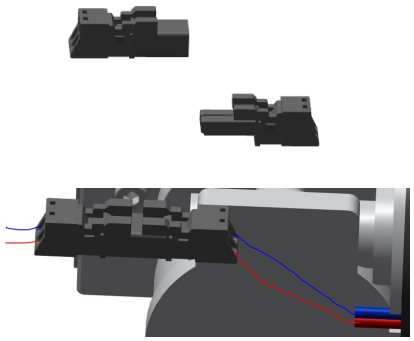
BIT 0	BIT 1	STROBE/START	DEFINITION	ACTION
0	0	I	Ref.	Reference Drive
I	0	I	Pos 1	Place WP on SkillsConveyor (P9)
0	I	I	Pos 2	Pickup WP from conveyor 300mm (P7)
I	I	I	Pos 3	Not used



© WorldSkills International

Details of Module: Conveyor 300x 40 and wiring allocation mini terminal

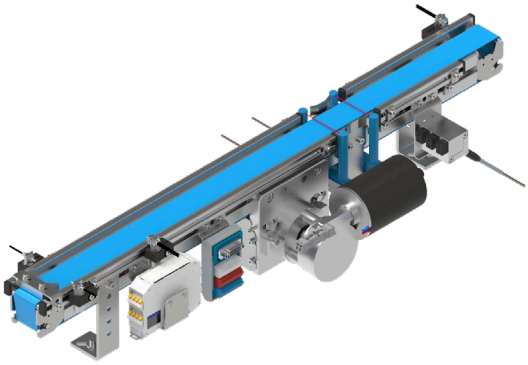


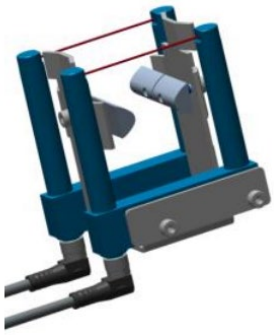


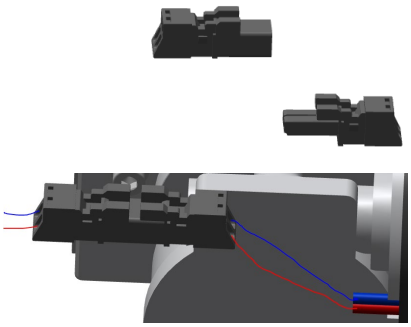
PIN ON SUB-D	COLOUR DIN47100	PIN I/O MINI-TERMINAL	PIN - FUNCTION	PIN I/O TERMINAL FILL IN	FUNCTION	POS
1	White	1	I0		WP at SKC slide position	8-1
2	Brown	7	Q0		Release WP SKC slide	
3	Green	2	I1		WP at pick-up position	7
4	Yellow	8	Q1		run belt to direction of Conveyor 700	
5	Grey	3	I2		Not used	
6	Pink	9	Q2		run belt to direction of Handling	
7	Blue	4	I3		Not used	
8	Red	10	Q3		Not used	
9	Black	5	AI0		Not used	
10	Violet	6	AI1		Not used	
11	Grey-rose	11+12	AQ0		Not used	
12	Red-blue	24VA	VCC-Out			
13	White-green	24VB	VCC – In			
14	Brown-green	GND A	GND Out			
15	White-yellow	GND B	GND In			

© WorldSkills International

Details of Module: Conveyor 700x 40 and wiring allocation mini terminal





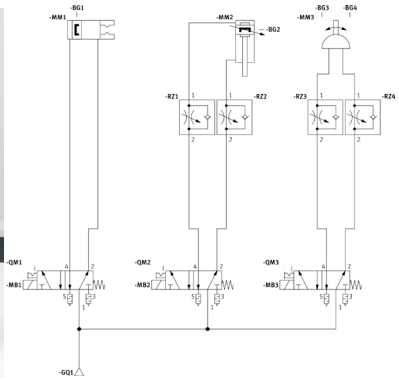


PIN ON SUB-D	COLOUR DIN47100	PIN I/O MINI-TERMINAL	PIN - FUNCTION	PIN I/O TERMINAL FILL IN	FUNCTION	POS
1	White	1	I0		WP at conveyor start/right	14
2	Brown	7	Q0		run belt to right hand side direction	
3	Green	2	I1		WP at right light barrier	15-R
4	Yellow	8	Q1		run belt to left hand side direction	
5	Grey	3	I2		WP at left light barrier	15-L
6	Pink	9	Q2		NOT used	
7	Blue	4	I3		WP not at conveyor end position/left	
8	Red	10	Q3		Not Used	
9	Black	5	AI0		Not used	
10	Violet	6	AI1		Not used	
11	Grey-rose	11+12	AQ0		Not used	
12	Red-blue	24VA	VCC-Out			
13	White-green	24VB	VCC – In			
14	Brown-green	GND A	GND Out			
15	White-yellow	GND B	GND In			

© WorldSkills International

Details of Module: Lift and Turn and wiring allocation Mini-Terminal

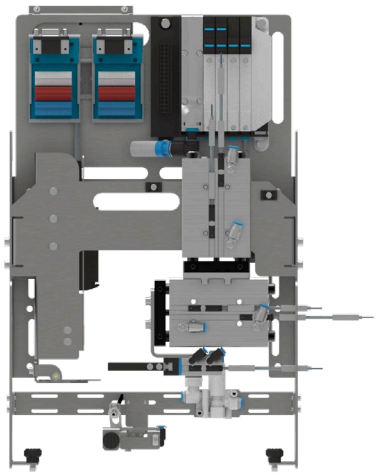


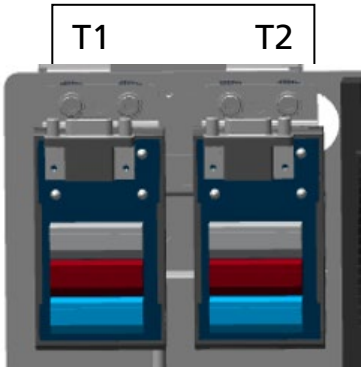


PIN ON SUB-D	COLOUR DIN47100	PIN I/O MINI-TERMINAL	PIN - FUNCTION	PIN I/O TERMINAL FILL IN	FUNCTION
1	White	1	I0		Gripper is open
2	Brown	7	Q0		Open gripper
3	Green	2	I1		Gripper (Z-axis) is up
4	Yellow	8	Q1		Move gripper down
5	Grey	3	I2		Gripper at conveyor
6	Pink	9	Q2		Move gripper
7	Blue	4	I3		Gripper at slide
8	Red	10	Q3		Not used
9	Black	5	AI0		Not used
10	Violet	6	AI1		Not used
11	Grey-rose	11+12	AQ0		Not used
12	Red-Blue	24VA	VCC-Out		
13	White-Green	24VB	VCC – In		
14	Brown-Green	GND A	GND Out		
15	White-yellow	GND B	GND In		

© WorldSkills International

Details of Module: Assembling and wiring allocation Mini-Terminal 1 and 2.





Mini-IO-Terminal 1

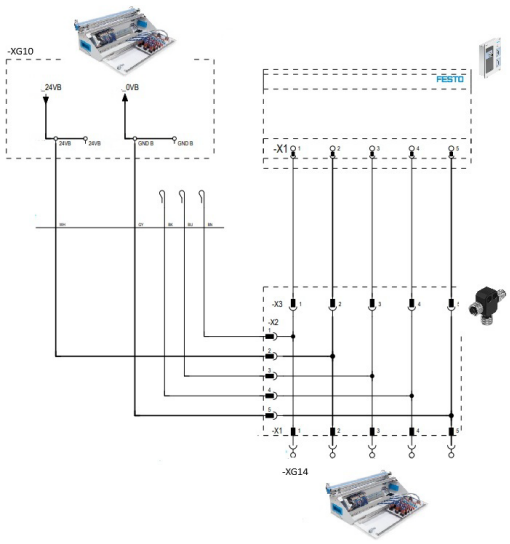
PIN ON SUB-D	COLOUR DIN47100	PIN I/O MINI-TERMINAL	PIN - FUNCTION	PIN I/O TERMINAL FILL IN	FUNCTION
1	White	1	I0		Gripper is down
2	Brown	7	Q0		Move Gripper down
3	Green	2	I1		Gripper is up
4	Yellow	8	Q1		Move gripper up
5	Grey	3	I2		Gripper is extended
6	Pink	9	Q2		Extend gripper
7	Blue	4	I3		Gripper is retracted
8	Red	10	Q3		Retract gripper
9	Black	5	AI0		Not used
10	Violet	6	AI1		Not used
11	Grey-rose	11+12	AQ0		Not used
12	Red-Blue	24VA	VCC-Out		
13	White-Green	24VB	VCC – In		
14	Brown-Green	GND A	GND Out		
15	White-yellow	GND B	GND In		

© WorldSkills International

Mini-IO-Terminal 2

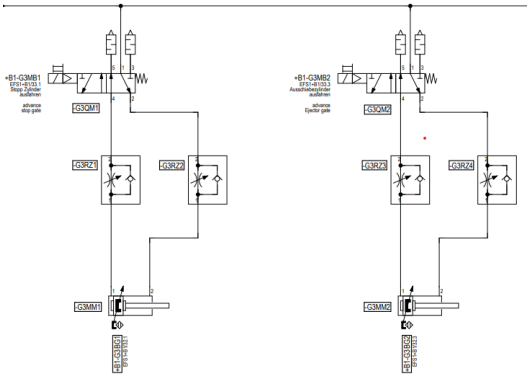
PIN ON SUB-D	COLOUR DIN47100	PIN I/O MINI-TERMINAL	PIN - FUNCTION	PIN I/O TERMINAL FILL IN	FUNCTION
1	White	1	I0		Gripper is open
2	Brown	7	Q0		Open gripper
3	Green	2	I1		Magazine not empty
4	Yellow	8	Q1		Open stopper
5	Grey	3	I2		Workpiece at stopper
6	Pink	9	Q2		Not used
7	Blue	4	I3		Not used
8	Red	10	Q3		Not used
9	Black	5	AI0		Not used
10	Violet	6	AI1		Not used
11	Grey-rose	11+12	AQ0		Not used
12	Red-Blue	24VA	VCC-Out		
13	White-Green	24VB	VCC – In		
14	Brown-Green	GND A	GND Out		
15	White-yellow	GND B	GND In		

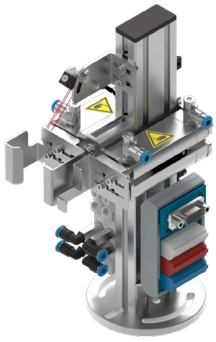
Optional auxiliary power



© WorldSkills International

Details of Module: Stop&Push and wiring allocation Mini-Terminal





PIN ON SUB-D	COLOUR DIN47100	PIN I/O MINI-TERMINAL	PIN - FUNCTION	PIN I/O TERMINAL FILL IN	FUNCTION
1	White	1	I0		Stop cylinder retracted
2	Brown	7	Q0		Extend stop cylinder
3	Green	2	I1		Ejector cylinder retracted
4	Yellow	8	Q1		Extend ejector cylinder
5	Grey	3	I2		Workpiece at stopper
6	Pink	9	Q2		Not used
7	Blue	4	I3		Not used
8	Red	10	Q3		Not used
9	Black	5	AI0		Not used
10	Violet	6	AI1		Not used
11	Grey-rose	11+12	AQ0		Not used
12	Red-Blue	24VA	VCC-Out		
13	White-Green	24VB	VCC – In		
14	Brown-Green	GND A	GND Out		
15	White-yellow	GND B	GND In		

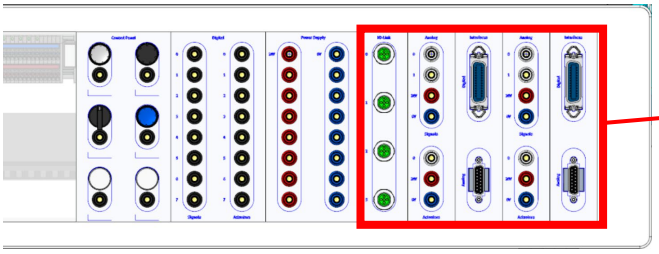
© WorldSkills International

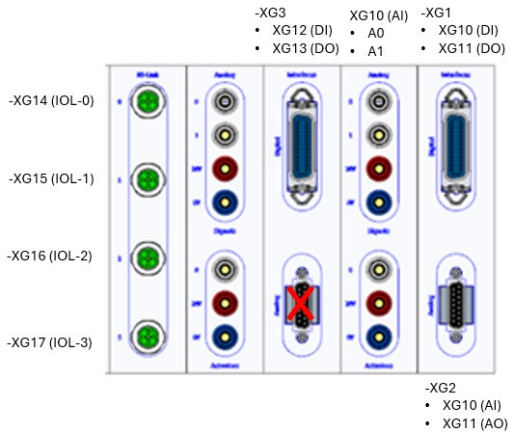
SCS: Details of Module Skills Conveyor (more on USB/file server)

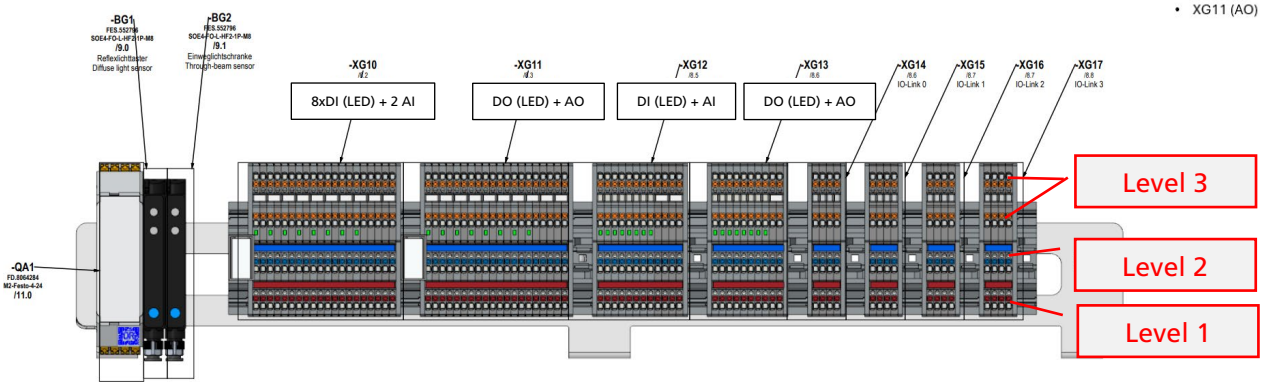


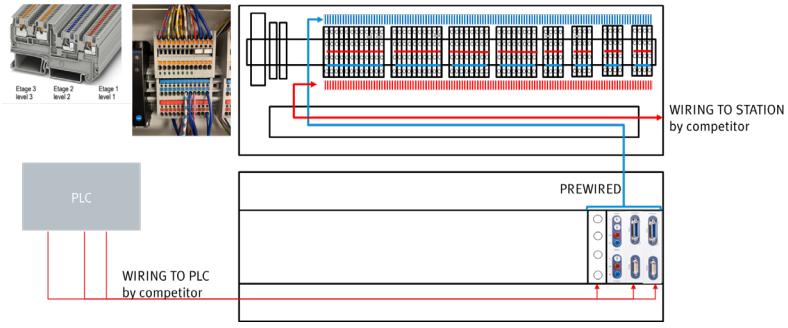


Front plate









© WorldSkills International

Allocation of the prewired front plate

Syslink XG1:

LEVEL	PIN	TERMINAL	FUNCTION	COLOUR		LEVEL	PIN	TERMINAL	FUNCTION	COLOUR
3	1-2	-XG10	DI 0	GYPK		3	1-2	-XG11	DO 0	WH
3	3-4	-XG10	DI 1	RDBU		3	3-4	-XG11	DO 1	BN
3	5-6	-XG10	DI 2	WHGN		3	5-6	-XG11	DO 2	GN
3	7-8	-XG10	DI 3	BNGN		3	7-8	-XG11	DO 3	YE
3	9-10	-XG10	DI 4	WHYE		3	9-10	-XG11	DO 4	GY
3	11-12	-XG10	DI 5	YEBN		3	11-12	-XG11	DO 5	PK
3	13-14	-XG10	DI 6	WHGY		3	13-14	-XG11	DO 6	BU
3	15-16	-XG10	DI 7	GYBN		3	15-16	-XG11	DO 7	RD
						2	15M	-XG11	0V	PKBN
						2	16M	-XG11	0V	VT
						1	16L+	-XG11	24V	BK
2	15M	XG10	0V	WHPK						
1	15L+	XG10	24V	WHBU						

Syslink XG3:

LEVEL	PIN	TERMINAL	FUNCTION	COLOUR		LEVEL	PIN	TERMINAL	FUNCTION	COLOUR
3	1	-XG12	DI 0	GYPK		3	1	-XG13	DO 0	WH
3	2	-XG12	DI 1	RDBU		3	2	-XG13	DO 1	BN
3	3	-XG12	DI 2	WHGN		3	3	-XG13	DO 2	GN
3	4	-XG12	DI 3	BNGN		3	4	-XG13	DO 3	YE
3	5	-XG12	DI 4	WHYE		3	5	-XG13	DO 4	GY
3	6	-XG12	DI 5	YEBN		3	6	-XG13	DO 5	PK
3	7	-XG12	DI 6	WHGY		3	7	-XG13	DO 6	BU
3	8	-XG12	DI 7	GYBN		3	8	-XG13	DO 7	RD
						2	7M	-XG13	0V	PKBN
						2	8M	-XG13	0V	VT
						1	8L+	-XG13	24V	BK
2	7M	-XG12	0V	WHPK						
1	7L+	-XG12	24V	WHBU						

© WorldSkills International

Analog XG2:

LEVEL	PIN	TERMINAL	FUNCTION	COLOUR	
3	17	-XG10	AI 0	RD	
3	18	-XG10	AI 0	BU	4mm Plug A0
3	19	-XG10	AI 1	BU	
3	20	-XG10	AI 1	BU	4mm Plug A1
2	17M	-XG10	0V	PK	

IO-Link XG14-XG17

LEVEL	PIN	TERMINAL LEVEL 3	FUNCTION	COLOUR
3	1	-XG14/15/16/17	IOL - Signal	BK
2	1M	-XG14/15/16/17	0V	BU
2	2M	-XG14/15/16/17	0V	GY
1	1L+	-XG14/15/16/17	24V	BN
1	2L+	-XG14/15/16/17	24V	WH

© WorldSkills International

Allocation checked with Simulation Box (Station 1 - 3MS)

I/O TERMINAL: T1 (IN) 1 SIGNAL INDICATES	
DI 0 - 2: Module Conveyor 700: no change (see Task A)	
DI 3: Module Conveyor 300: WP at SKC slide position	
DI 4: Module Conveyor 300: WP at pick-up position	
DI 5: Module Ejector: Stopper Cylinder retracted	
DI 6: Module Ejector: Ejector Cylinder retracted	
DI 7: Module Ejector: WP at stopper	

I/O TERMINAL: T1 (OUT), 1 SIGNAL SET	
DO 0 - 2: Module Conveyor 700: no change (see Task A)	
DO 3: Module Conveyor 300: Release WP SKC slide	
DO 4: Module Conveyor 300: run belt in the direction of Conveyor 700	
DO 5: Module Conveyor 300: run belt in the direction of Handling Module	
DO 6 - 7: not used	

I/O TERMINAL: T2 (IN) 1 SIGNAL INDICATES	
DI 0: not used	
DI 1 - 6: Module Magazine 3 and Identification: no change (see Task A)	

I/O TERMINAL: T2 (OUT) 1 SIGNAL SET	
DO 0 - 4: Module Magazine 3 and Signal Tower: no change (see Task A)	
DO 5: Module Ejector: Extend Stopper cylinder	
DO 6: Module Ejector: Extend Ejector cylinder	

© WorldSkills International

Allocation checked with Simulation Box (Station 2 - SCS)

FRONT PLATE INTERFACE XG1: I/O TERMINAL: -XG10 (IN), SIGNAL INDICATES	
DI 0: Module SKC: WP not at conveyor start/left	
DI 1: Module SKC: WP at conveyor end/right	
DI 2: Module SKC: Height sensor. Cap correct	
DI 3: Module SKC: Switch extended	
DI 4: Module Conveyor 700: WP at conveyor start/right	
DI 5: Module Conveyor 700: WP at right light barrier	
DI 6: Module Conveyor 700: WP at left light barrier	
DI 7: Module Conveyor 700: WP not at conveyor end position/left	

FRONT PLATE INTERFACE XG1: I/O TERMINAL: -XG11 (OUT), SIGNAL SET	
DO 0: Module SKC: run belt to right hand side direction	
DO 1: Module SKC: run belt to left hand side direction	
DO 2: Module SKC: Extend Switch	
DO 3: Module Lift-Turn: Open Gripper	
DO 4: Module Lift-Turn: Move Gripper down	
DO 5: Module Lift-Turn: Move Gripper	
DO 6: Module Conveyor 700: run belt into right hand side direction	
DO 7: Module Conveyor 700: run belt into left hand side direction	

© WorldSkills International

FRONT PLATE INTERFACE XG3: I/O TERMINAL: -XG12 (IN), SIGNAL INDICATES	
DI 0: Module Lift Turn: Gripper open	
DI 1: Module Lift Turn: Gripper up	
DI 2: Module Lift Turn: Gripper at conveyor	
DI 3: Module Lift Turn: Gripper at slide	

Front plate Interface XG3: I/O Terminal: -XG13 (OUT), signal set	
Not used	

FRONT PLATE INTERFACE XG2 VIA XG10: I/O TERMINAL ANALOG: (IN) MEASURING VIA EXT. CONNECTORS	
AI 0: Optical sensor (height sensor analogue)	No. 0: Measuring with the multimeter: red reference WP upside down = (5,5V +/- 0,2 V)

FRONT PLATE IO-LINK TERMINAL -XG5 VIA XG14	
Module Assembling:	

FRONT PLATE IO-LINK TERMINAL -XG6 VIA XG15	
Module IO-Link Lamp	

© WorldSkills International

Control Part

Initial position

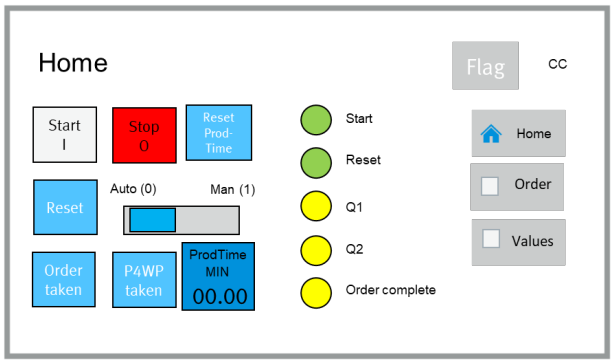
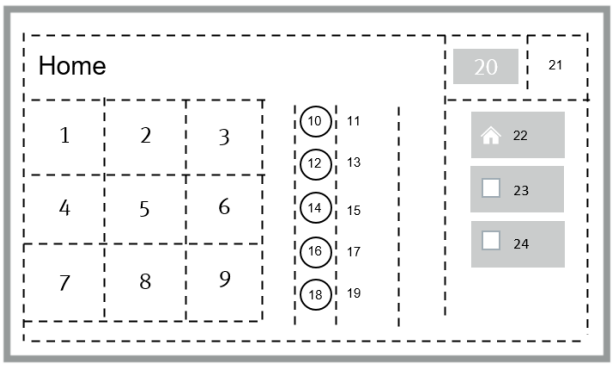
STATION 1: 3-MAGAZINE STATION (3MS):
Module Conveyors: Motor off, stopper extended, empty (not relevant during the process, only for the initial position run)
Module Magazine 1 - 3: Ejecting arm retracted, empty (not relevant during the process, only for the initial position run)
Module SKC Slide: Empty (not relevant during the process, only for the initial position run)
Module Handling Stepper: Gripper closed, Gripper up, Gripper in Pick-up position (P7)
Module Stop&Push: Cylinders retracted

STATION 2: SKILLS-CONVEYOR-STATION (SCS):
Module Conveyor700: Motor off, Stopper extended, empty (not relevant during the process, only for the initial position run)
Module SkillsConveyor: Switch open, Motor off, empty (not relevant during the process, only for the initial
Module Lift and Turn: Gripper closed, Gripper up, Gripper at Position Conveyor 700 (P15)
Module Assembling: Magazine empty (not relevant during the process, only for the initial position run), Gripper up, Gripper open, Gripper retracted, Stopper extended

© WorldSkills International

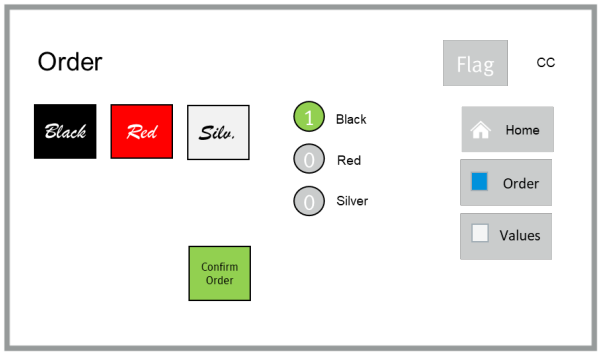
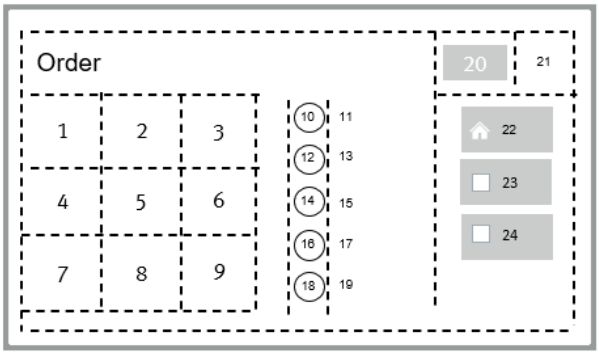
HMI Design and Function

Page“Home”

PAGE “HOME”	FIELD NO
	

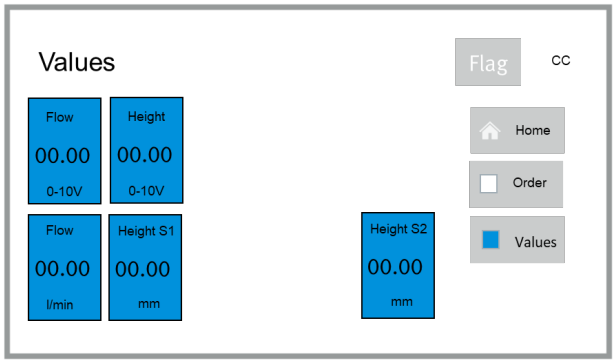
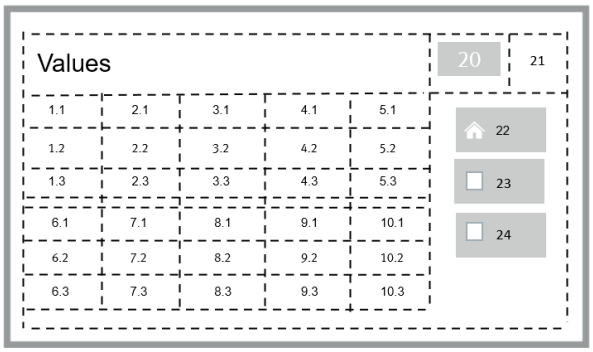
FIELD	TEXT	FUNCTION	SHAPE	COLOUR
8	P4WP taken	Push button with lamp	Square with text	Fill: blue Text: white ON: green

Page “Order”

HMI – DESIGN PAGE “ORDER”	FIELD NO
	

© WorldSkills International

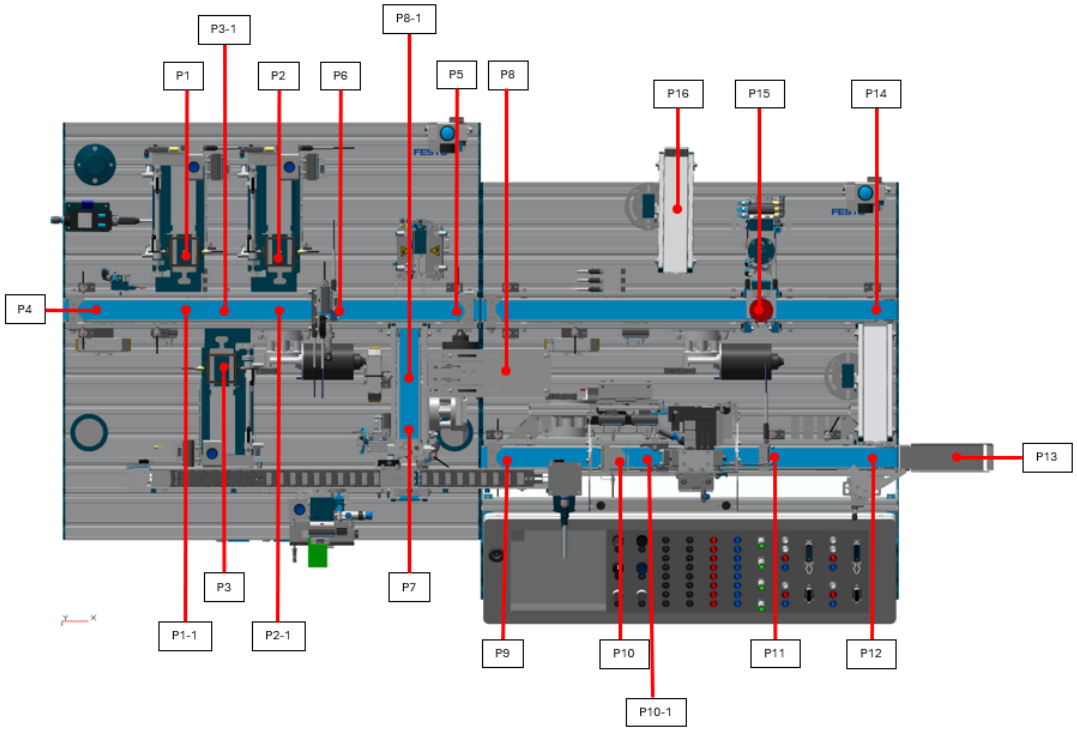
Page “VALUES”

HMI – DESIGN PAGE “VALUES”	FIELD NO
	

FIELD	TEXT	FUNCTION	SHAPE	COLOUR
6.1	Flow	Label		Text: black
6.2	00.00	Dynamic value	Rectangle	Fill: blue Text: black
6.3	l/min	Label		Text: black
7.1	Height S1	Label		Text: black
7.2	00.00	Dynamic value	Rectangle	Fill: blue Text: black
7.3	mm	Label		Text: black
10.1	Height S2	Label		Text: black
10.2	00.00	Dynamic value	Rectangle	Fill: blue Text: black
10.3	mm	Label		Text: black

© WorldSkills International

Positions



Flow chart Legend and Notes (see flow chart)

B: BUTTONS	L: INDICATORS/LIGHTS/COUNTER	WP: WORKPIECE STATE
B1 = START B2 = STOP B3 = AUTO(0)/MAN(1) B4 = RESET B5 = SELECT black B6 = SELECT red B7 = SELECT silver B8 = Confirm Order B9 = Order taken B10 = P4WP taken	L1 = HMI: START L2 = HMI: RESET L3 = HMI: Q1 (Wrong colour/usd) L4 = HMI: Q2 (Correct colour) L5/L6/L7 = HMI: black/red/silver**** L8/L9/L10 = HMI: Number of ordered black/red/silver L11 = HMI: Order complete L12 = SIGNAL TOWER: Green L13 = SIGNAL TOWER: Yellow L14 = SIGNAL TOWER: Red L15 = Lamp Magazin 1 L16 = Lamp Magazin 2 L17 = Lamp Magazin 3 L18 = P4WP taken L19 = IO-Link lamp	WP1 = black WP2 = red WP3 = silver WPX = Any wrong workpiece (wrong according to the selection) WP usd = workpiece upside down WP+C = workpiece with cap

© WorldSkills International