

INSTRUCTION MANUAL FOR *THE FRAGRANCE DISPENSER* MANAGED BY PLC SIEMENS S7-1200



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1.1 Purpose of the Manual

This manual provides detailed instructions for the installation, configuration, and use of a remote laboratory based on a Siemens S7-1200 PLC. It includes information on hardware, programming, and system monitoring, accompanied by electrical diagrams and images to facilitate learning.

1.2 Overview of the Remote

Laboratory

The remote laboratory allows users to program and test industrial automation applications on a Siemens S7-1200 PLC remotely. The system consists of a fragrance dispenser, which includes a brushless motor controlled by a driver that monitors the position of the carriage and the bottle.

For vertical movement, which enables the bottle to press on the dispenser, an electropneumatic system is used.

When starting the machine, the user will be prompted on the initial software page to select the language in which they wish to work.



ITALIANO



ENGLISH

On the PC, the interface will be fully displayed in touch screen mode, providing an experience similar to being physically present.

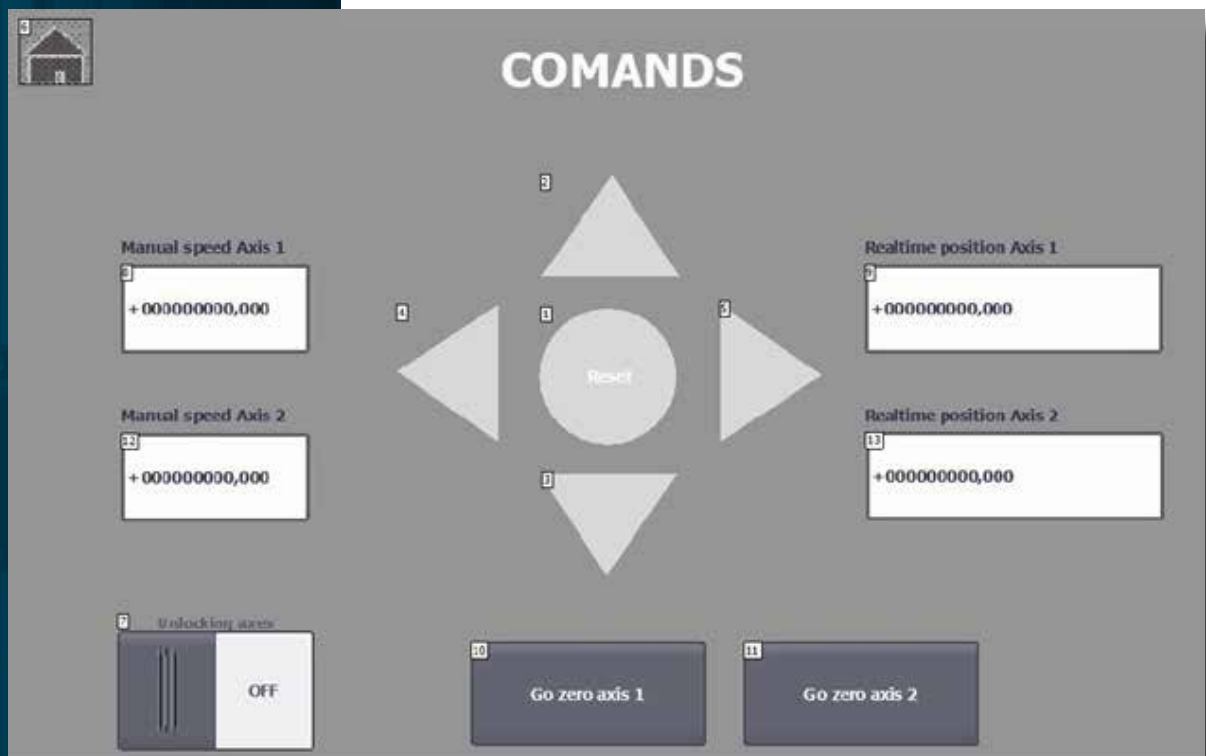


After selecting the language, the initial software page will appear, allowing access to various functions:

The fundamental buttons that we absolutely need to know are the Control button, the Setting button, and the Start button.

ATTENTION!!

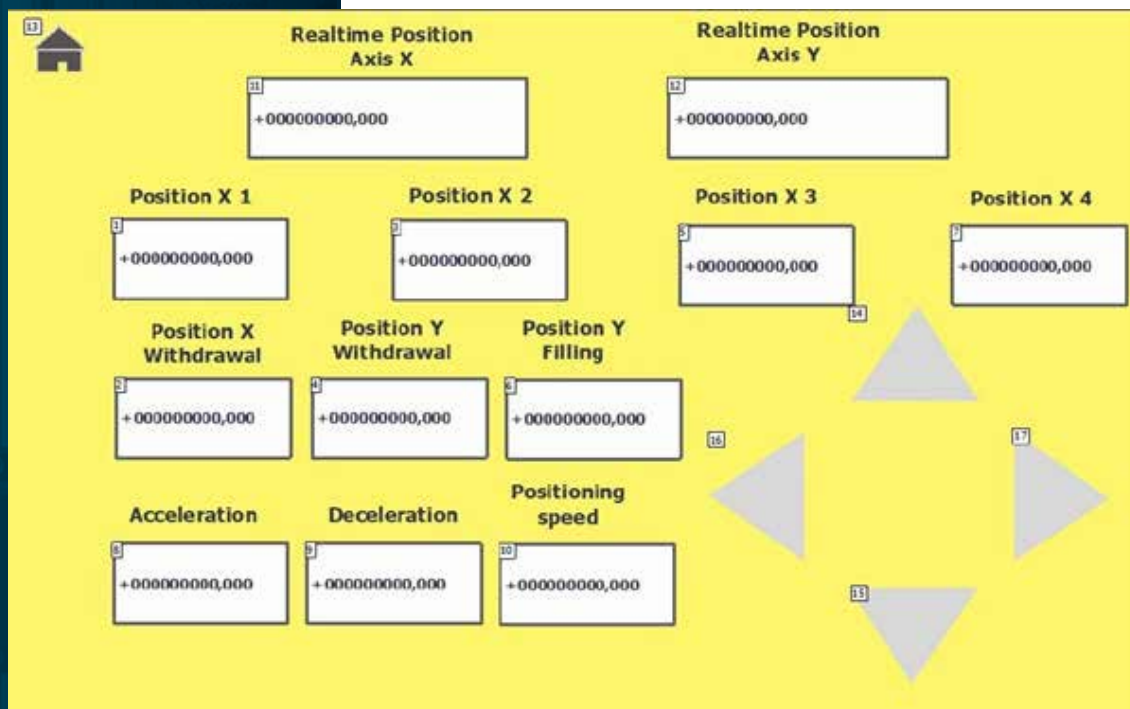
The product selection and, therefore, the correct operation can only take place after the reset of the X and Y axes, detected by two inductive sensors located at the beginning of the carriage. The reset can be performed through the command menu on the monitor (virtual button at the bottom left).



The virtual buttons located at the center of the image are to be used in manual mode only. This option is not available for partners working remotely.

Through the onboard machine monitor via the button, which is also accessible remotely on a PC, it is possible to control parameters such as:

- Motor speed;
- Bottle coordinates;
- Axis settings.



The advanced system programming is carried out via TIA Portal V18.

The laboratory is equipped with a separate power supply to ensure operational availability for all partners. The attached documentation includes the electrical diagram with the connection of all components.

The system includes:

- Siemens S7-1200 PLC with I/O modules;
- Virtual touch screen monitor on a physical PC positioned next to the machine;
- Sensors for monitoring the soap descent;
- Physical panel with Start, Stop, Emergency, and Automatic Cycle buttons;
- Camera connected to the PC for remote monitoring via internal software.

2. Hardware Description

2.1 Siemens S7-1200 PLC

- CPU with Ethernet communication ports
- I/O expansion modules for managing inputs and outputs
- Compatibility with TIA Portal for programming (TIA Portal V18)

2.2 Sensors and Actuators

- Level sensors for detecting the soap quantity
- Valves for dispensing the 4 different fragrances (managed by dispensing time)
- Touch screen for user interaction

2.3 Electrical Diagram

- Electrical diagram attached to the manual

3. System Configuration

3.1 Communication Configuration

- Set the PLC IP address:
10.102.0.1/255.255.255.0
- Set the onboard PC address: 10.102.0.10 /
255.255.255.0
- Connect the PLC to the PC via Ethernet
- Connect the partners through remote desktop

4. PLC Programming

4.1 Control Logic

- Start from the electrical diagram provided by the owner
- Assign parameters as per the attached manual
- Modify the attached Ladder diagram
- Assign new addresses to the I/Os

distributore sapone_rev_2_V18 / PLC_1 [CPU 1212C DC/DC/DC] / Blocchi di programma

Allarmi [FC2]

Allarmi Proprietà					
Generale					
Nome	Allarmi	Numero	2	Tipo	FC
Numerazione	Automatico				
Informazioni					
Titolo		Autore		Commento	
Versione	0.1	ID definito dall'utente		Famiglia	

Allarmi			
Nome	Tipo di dati	Valore di default	Commento
Input			
Output			
InOut			
Temp			
Constant			
▼ Return			
Allarmi	Void		

Segmento 1: Circuito di emergenza

Se la centralina di sicurezza interviene, viene mosso il valore di uno nella variabile touch screen allarmi



distributore sapone_rev_2_V18 / PLC_1 [CPU 1212C DC/DC/DC] / Blocchi di programma

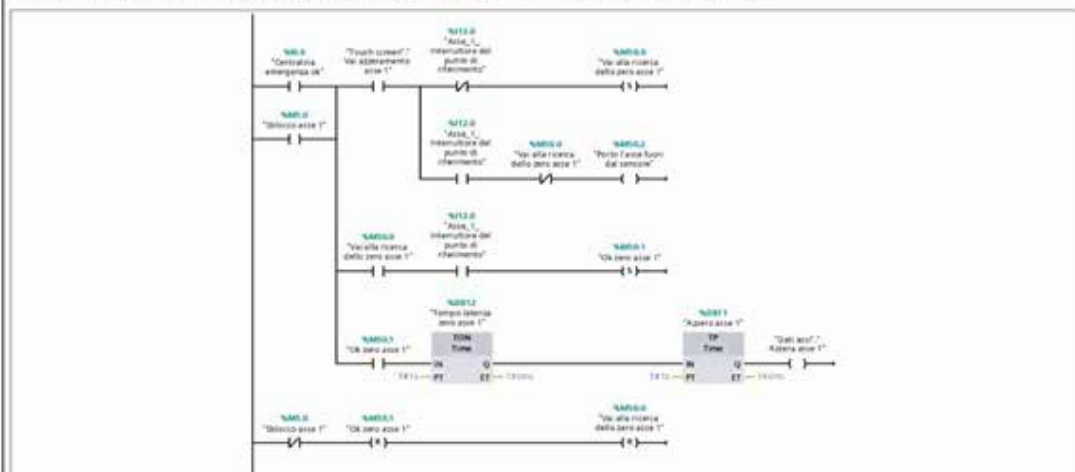
Automatic [FC3]

Automatico Proprietà							
Generale							
Nome	Automatico	Numero	3	Tipo	FC	Linguaggio	KOP
Numeraazione	Automatico						
Informazioni							
Titolo		Autore		Commento		Famiglia	
Versione	0.1	ID definito dall'utente					

Automatico			
Nome	Tipo di dati	Valore di default	Commento
Input			
Output			
InOut			
Temp			
Constant			
▼ Return			
Automatico	Void		

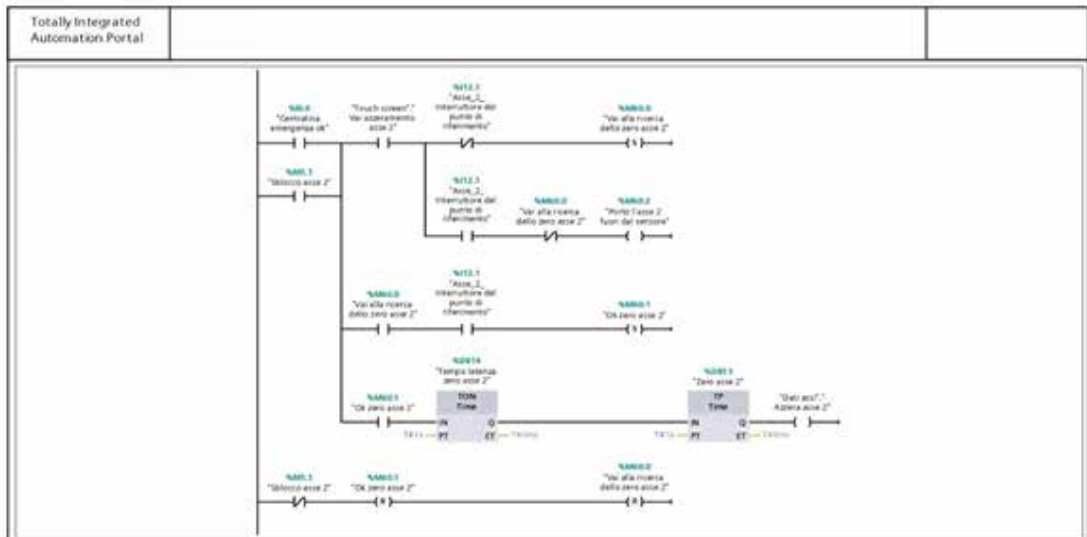
Segmento 1: Azzeramento asse 1

Ciclo automatico per l'azzeramento dell'asse x, comando che viene dato solo tramite lo sblocco degli assi e da touch screen



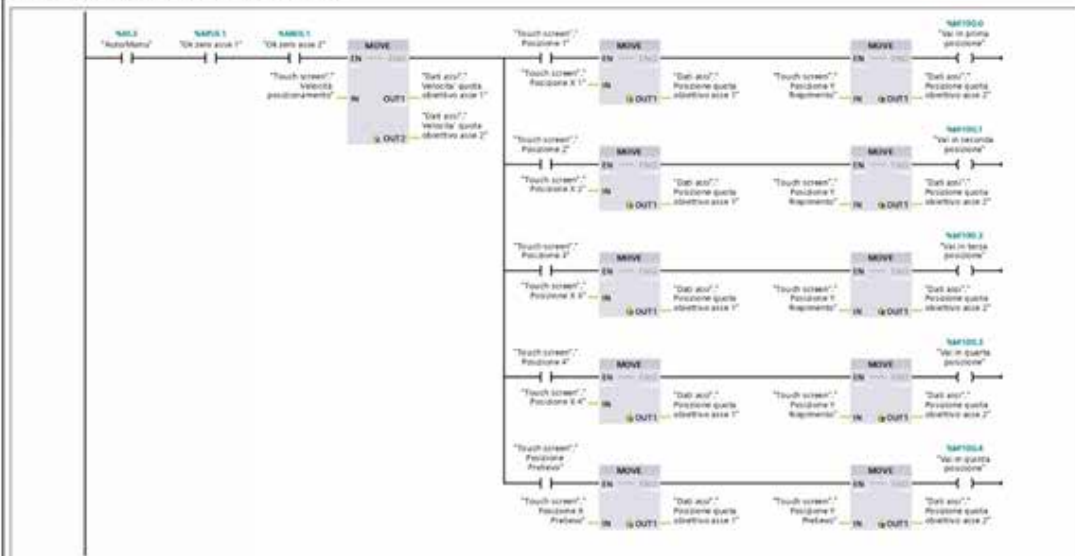
Segmento 2: Azzeramento asse 2

Ciclo automatico per l'azzeramento dell'asse x, comando che viene dato solo tramite lo sblocco degli assi e da touch screen



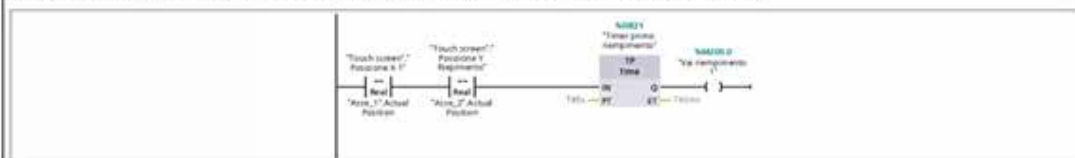
Segmento 3: Posizionamenti assi

Ciclica automatica per il posizionamento degli assi in quota obbiettivo.
La quota obbiettivo viene determinata inserendo i valori sia da touch o da computer.
Le 4 posizioni vengono selezionate nel pannello touch.



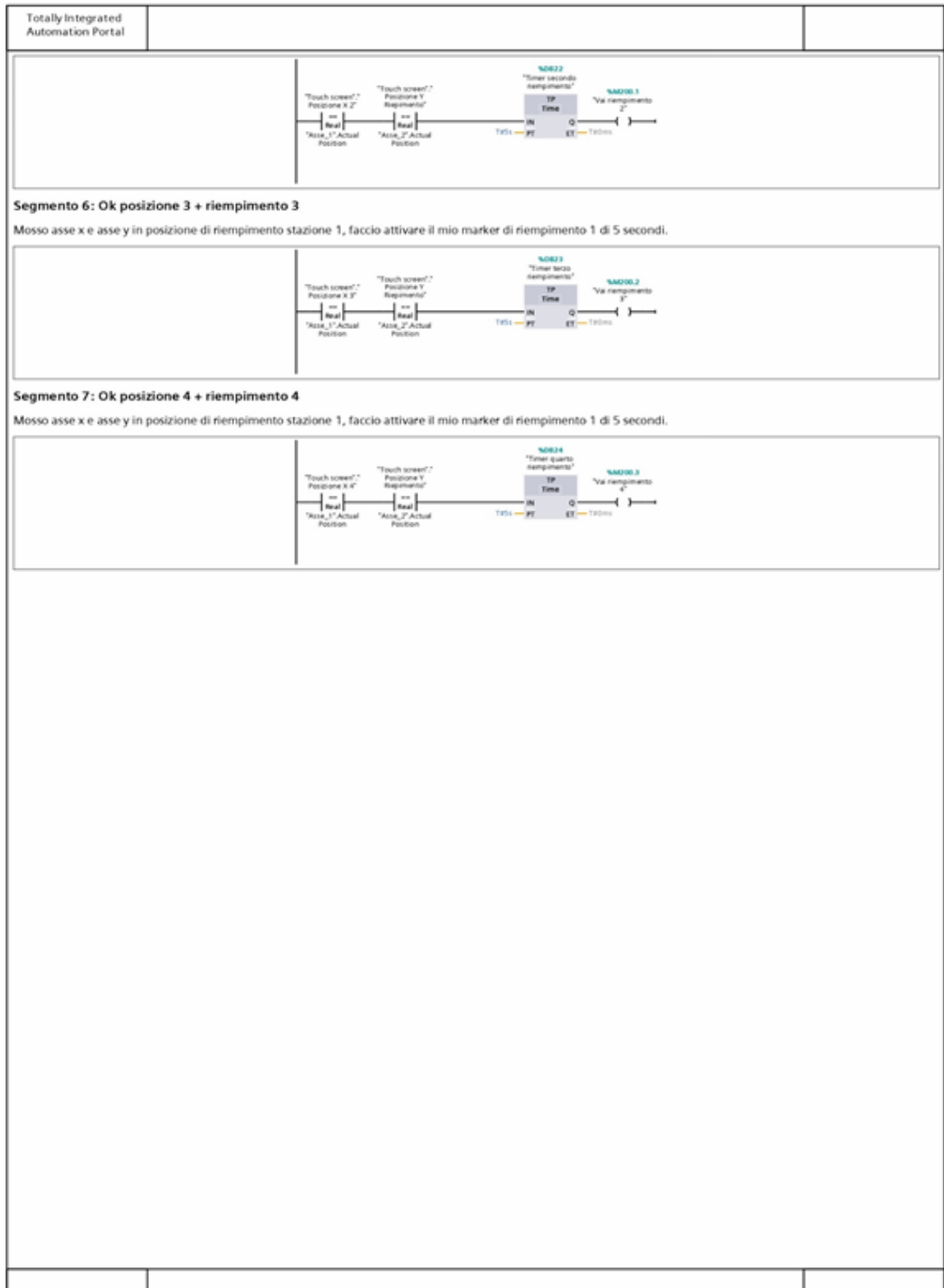
Segmento 4: Ok posizione 1 + riempimento 1

Mosso asse x e asse y in posizione di riempimento stazione 1, faccio attivare il mio marker di riempimento 1 di 5 secondi.



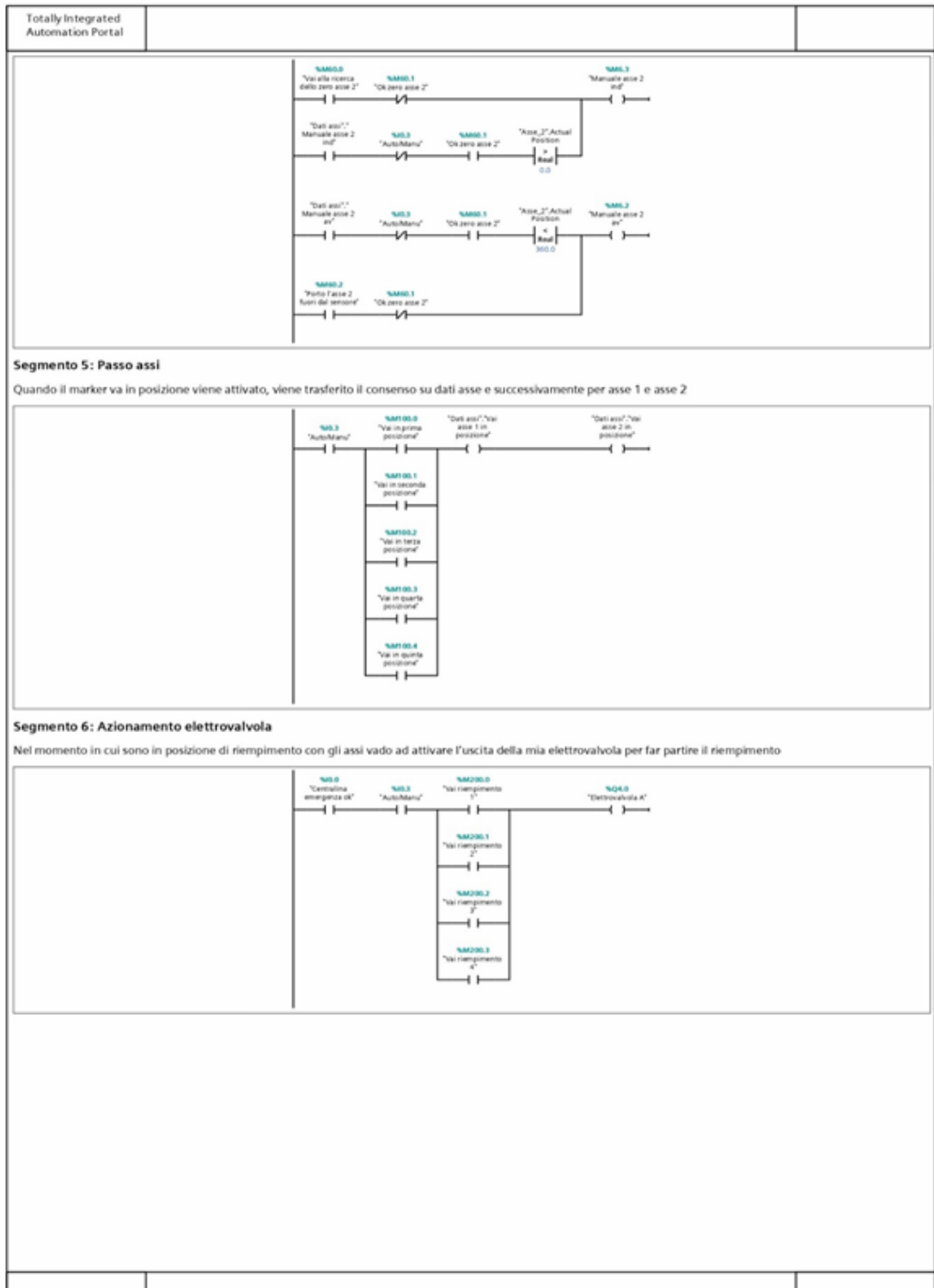
Segmento 5: Ok posizione 2 + riempimento 2

Mosso asse x e asse y in posizione di riempimento stazione 1, faccio attivare il mio marker di riempimento 1 di 5 secondi.



Totally Integrated Automation Portal							
distributore sapone_rev_2_V18 / PLC_1 [CPU 1212C DC/DC/DC] / Blocchi di programma							
Main [OB1]							
Main Proprietà							
Generale							
Nome	Main	Numero	1	Tipo	OB	Linguaggio	KOP
Numerazione	Automatico						
Informazioni							
Titolo	"Main Program Sweep (Cycle)"	Autore		Commento		Famiglia	
Versione	0.1	ID definito dall'utente					
Main							
Nome		Tipo di dati		Valore di default		Commento	
▼ Input							
Initial_Call		Bool				Initial call of this OB	
Remanence		Bool				=true, if remanent data are available	
Temp							
Constant							
Segmento 1: Blocco regia							
Nel blocco regia vado ad includere tutti i miei blocchi fc presenti nel programma. Questo blocco regia è il blocco principale di esecuzione del mio programma							
							

Totally Integrated Automation Portal					
distributore sapone_rev_2_V18 / PLC_1 [CPU 1212C DC/DC/DC] / Blocchi di programma					
Uscite [FC4]					
Uscite Proprietà					
Generale					
Nome	Uscite	Numero	4	Tipo	FC
Numerazione	Automatico			Linguaggio	KOP
Informazioni					
Titolo		Autore		Commento	
Versione	0.1	ID definito dall'utente		Famiglia	
Uscite					
Nome	Tipo di dati	Valore di default	Commento		
Input					
Output					
InOut					
Temp					
Constant					
▼ Return					
Uscite	Void				
Segmento 1: Sblocco asse 1					
Segmento che permette lo sblocco dell'asse 1 se la centralina di emergenza è ok posso dare lo sblocco degli assi tramite lo switch presente nel pannello touch					
Segmento 2: Gestione giog asse 1					
Procedura del posizionamento dell'asse 1, andando alla ricerca del punto 0, insero un interblocco che impedisce all'assedi spostarsi in valori negativi se premuto il tasto manuale					
Segmento 3: Sblocco asse 2					
Segmento che permette lo sblocco dell'asse 1 se la centralina di emergenza è ok posso dare lo sblocco degli assi tramite lo switch presente nel pannello touch					
Segmento 4: Gestione giog asse 2					
Procedura del posizionamento dell'asse 1, andando alla ricerca del punto 0, insero un interblocco che impedisce all'assedi spostarsi in valori negativi se premuto il tasto manuale					



Variabili PLC / Tabella delle variabili standard [81]

Variabili PLC

Variabili PLC									
Nome	Tipo di dati	Indirizzo	Riten- zione	Accessi- bile da HMI/OPC UA/Web API	Scrivibile da HMI/OPC UA/Web API	Visibile in Controllo HMI Engi- neering			
Asse_1_Impulso	Bool	%Q0.0	False	True	True	True			
Asse_1_Direzione	Bool	%Q0.1	False	True	True	True			
Asse_2_Impulso	Bool	%Q0.2	False	True	True	True			
Asse_2_Direzione	Bool	%Q0.3	False	True	True	True			
Asse_1_AbitolazioneAzionamento	Bool	%Q8.0	False	True	True	True			
Asse_2_AbitolazioneAzionamento	Bool	%Q8.2	False	True	True	True			
Centralina emergenza ok	Bool	%I0.0	False	True	True	True			
Sblocco asse 1	Bool	%M5.0	False	True	True	True			
Asse_1_Interruttore del punto di riferimento	Bool	%I2.0	False	True	True	True			
Vai alla ricerca dello zero asse 1	Bool	%M50.0	False	True	True	True			
Ok zero asse 1	Bool	%M50.1	False	True	True	True			
Manuale asse 1 sx	Bool	%M6.0	False	True	True	True			
Manuale asse 1 dx	Bool	%M6.1	False	True	True	True			
Sblocco asse 2	Bool	%M5.1	False	True	True	True			
Asse_2_Interruttore del punto di riferimento	Bool	%I2.1	False	True	True	True			
Vai alla ricerca dello zero asse 2	Bool	%M60.0	False	True	True	True			
Ok zero asse 2	Bool	%M60.1	False	True	True	True			
Manuale asse 2 av	Bool	%M6.2	False	True	True	True			
Manuale asse 2 ind	Bool	%M6.3	False	True	True	True			
Start	Bool	%I0.1	False	True	True	True			
Slop	Bool	%I0.2	False	True	True	True			
Auto/Manu	Bool	%I0.3	False	True	True	True			
Encoder 1 fase A	Bool	%I0.4	False	True	True	True			
Encoder 1 fase B	Bool	%I0.5	False	True	True	True			
Encoder 2 fase A	Bool	%I0.6	False	True	True	True			
Encoder 2 fase B	Bool	%I0.7	False	True	True	True			
Asse_1_Riduzione Corrente	Bool	%Q8.1	False	True	True	True			
Asse_2_Riduzione Corrente	Bool	%Q8.3	False	True	True	True			
Elettrovalvola A	Bool	%Q4.0	False	True	True	True			
Luce Verde	Bool	%Q4.1	False	True	True	True			
Luce Blu	Bool	%Q4.2	False	True	True	True			
Luce Selettore	Bool	%Q4.3	False	True	True	True			
Pompa 1	Bool	%Q8.4	False	True	True	True			
Pompa 2	Bool	%Q8.5	False	True	True	True			
Pompa 3	Bool	%Q8.6	False	True	True	True			
Pompa 4	Bool	%Q8.7	False	True	True	True			
Fc. A+	Bool	%I2.4	False	True	True	True			
Fc. A-	Bool	%I2.5	False	True	True	True			
Porto l'asse fuori dal sensore	Bool	%M50.2	False	True	True	True			
Porto l'asse 2 fuori dal sensore	Bool	%M60.2	False	True	True	True			
Vai in prima posizione	Bool	%M100.0	False	True	True	True			
Vai in seconda posizione	Bool	%M100.1	False	True	True	True			
Vai in terza posizione	Bool	%M100.2	False	True	True	True			
Vai in quarta posizione	Bool	%M100.3	False	True	True	True			
Vai in quinta posizione	Bool	%M100.4	False	True	True	True			
Vai riempimento 1	Bool	%M200.0	False	True	True	True			
Vai riempimento 2	Bool	%M200.1	False	True	True	True			
Vai riempimento 4	Bool	%M200.3	False	True	True	True			
Tag_7	Bool	%M200.4	False	True	True	True			
Vai riempimento 3	Bool	%M200.2	False	True	True	True			

4.2 Creating a New Project in TIA Portal

- Write code in KOP (Ladder Logic)
- Program the dosing functions
- Implement level sensor management

4.3 Programming Exercises

- Exercise 1 (Easy Level): Program the PLC to allow the operator to choose the fragrance. In this option, only one fragrance can be chosen, and it cannot be repeated.
- Exercise 2 (Medium Level): Program the PLC to create a new fragrance. To do this, the student must modify the default program by adding 2 automatic dispensing points: 3 seconds for the first fragrance and 5 seconds for the second fragrance. Configure the touch screen to allow the selection of the soap quantity.
- Exercise 3 (Hard Level): Program the PLC to create a new fragrance. The student must modify the default program by adding 3 automatic dispensing points: 3 seconds for the first fragrance, 3 seconds for the second fragrance, and 5 seconds for the third fragrance. Once the cycle is complete, the machine automatically positions the bottle for dispensing. Create a warning logic when a fragrance level is low (can we create a dispensing counter and set the max value to 10?).

5. Execution and Testing

5.1 Laboratory Monitoring and Functionality Testing

- Monitor variables in real-time
- Verify remote communication
- Correct any programming errors
- Ensure proper use of available accessories

5.2 Results for Competencies Achieved

- Each teacher, leading their team of students, can assess the competencies of their students using a reference table with the achieved objectives:

Evaluation Criteria	Exercise 1 (Easy)	Exercise 2 (Medium)	Exercise 3 (hard)
Correctness of the Program	Verify that the operator can only choose one fragrance.	Verify that the dispensing points are configured correctly and that the 3 and 5 seconds are respected	Verify that the program handles 3 dispensing points with the defined times and that the machine places the bottle in the dispensing position.
Program Functionality	The fragrance is selected without the possibility of repetition.	The touch screen allows the selection of soap quantity.	The dispensing counter works correctly, and the low fragrance warning is triggered
Code Clarity and Management	Simple, clean, and well-structured code.	Code that integrates the addition of dispensing points and touch screen configuration.	Complex code, but well-structured and easily readable, with complete cycle management and low fragrance warning.
Technical and Practical Skills	Correct programming of a simple PLC system.	Advanced programming, managing time and touch screen configuration.	Advanced programming and handling complex logic (e.g., counter and low fragrance warning).
Execution and Testing Time	Adequate execution time, with tests conducted without errors.	Programming and tests are complete, and the system functions correctly.	Complete tests, verifying that the machine places the bottle in the dispensing position and checks the counter and warning.

In this way, not only technical competence is assessed, but also the ability to write clear code and perform tests effectively.

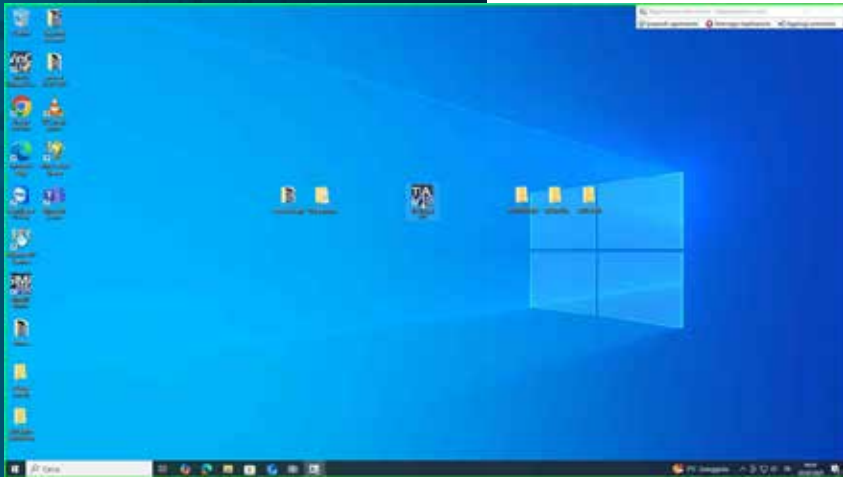
6. Appendices

6.1 Detailed Electrical Diagram

- Attach the detailed electrical diagram.

6.2 Photos of Connections and Devices

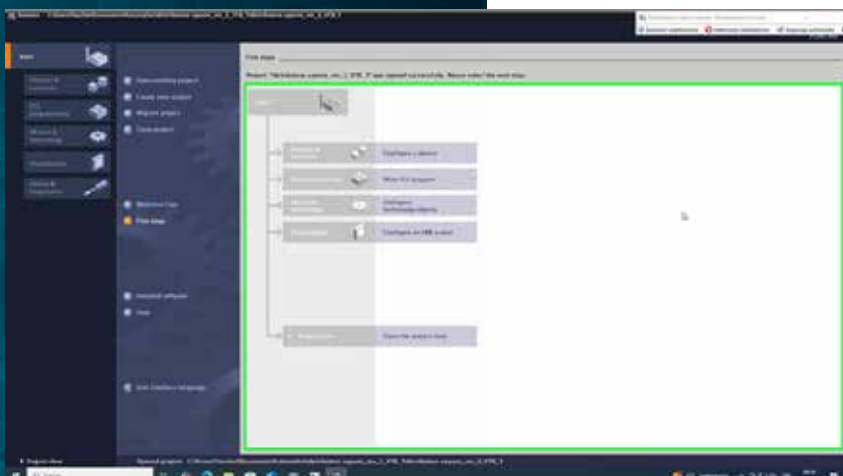
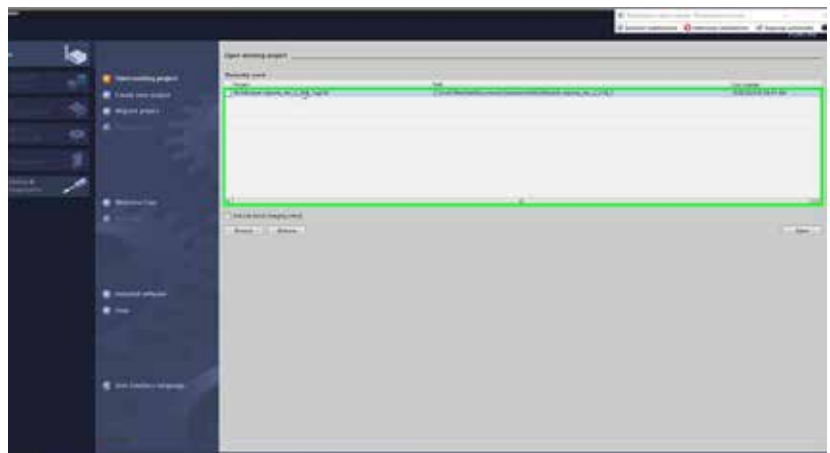




①

Double-click with the left mouse button on ①IA Portal V18 (list item)" in "Program Manager".

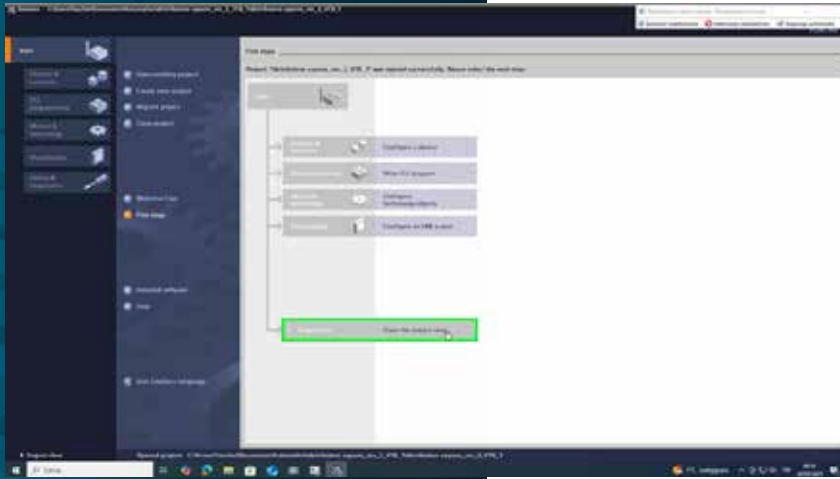
②
Double-click with the left mouse button on "Grid-Control (table)" in "Siemens" . open C:\Users\Teacher\Documents\Automation\distributore sapone_rev_2_V18_1\distributore sapone_rev_2_V18_1.



③

Left-click on "stepButtonContainer (panel)" in C:\Users\Teacher\Documents\Automation\distributore sapone_rev_2_V18_1\distributore sapone_rev_2_V18_1. And click on open the project view bottom

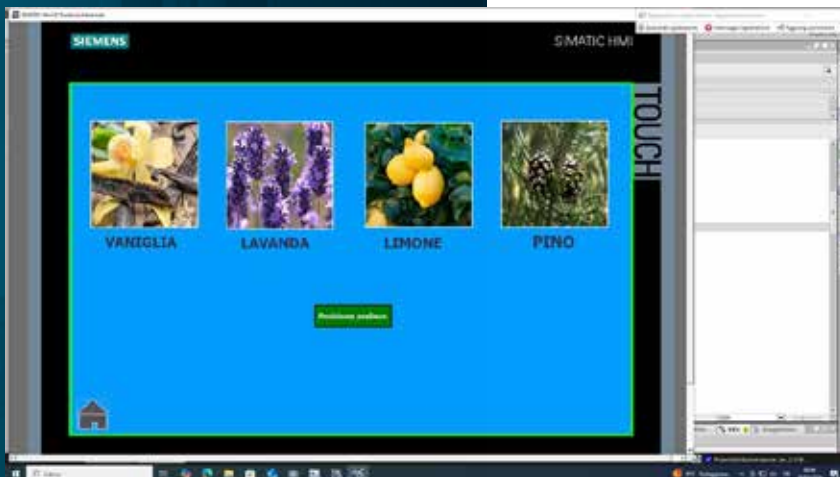
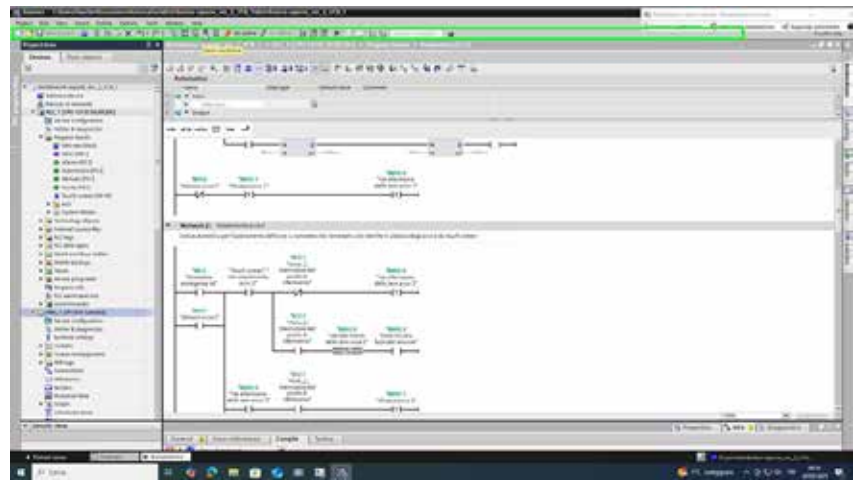
④



Navigate through the drop-down menu on the left side of the TIA Portal, under the HMI section.

Click once on the HMI_1500 COMFORT menu item, then press the Start Simulation button located in the quick access toolbar at the top, a few buttons to the left of the Go Online button. Once this step is completed, you will reach the main page of the menu (see page 3 of the manual).

⑤



⑥

You can open the camera from the Applications menu at the bottom of the Windows taskbar.

⑦

