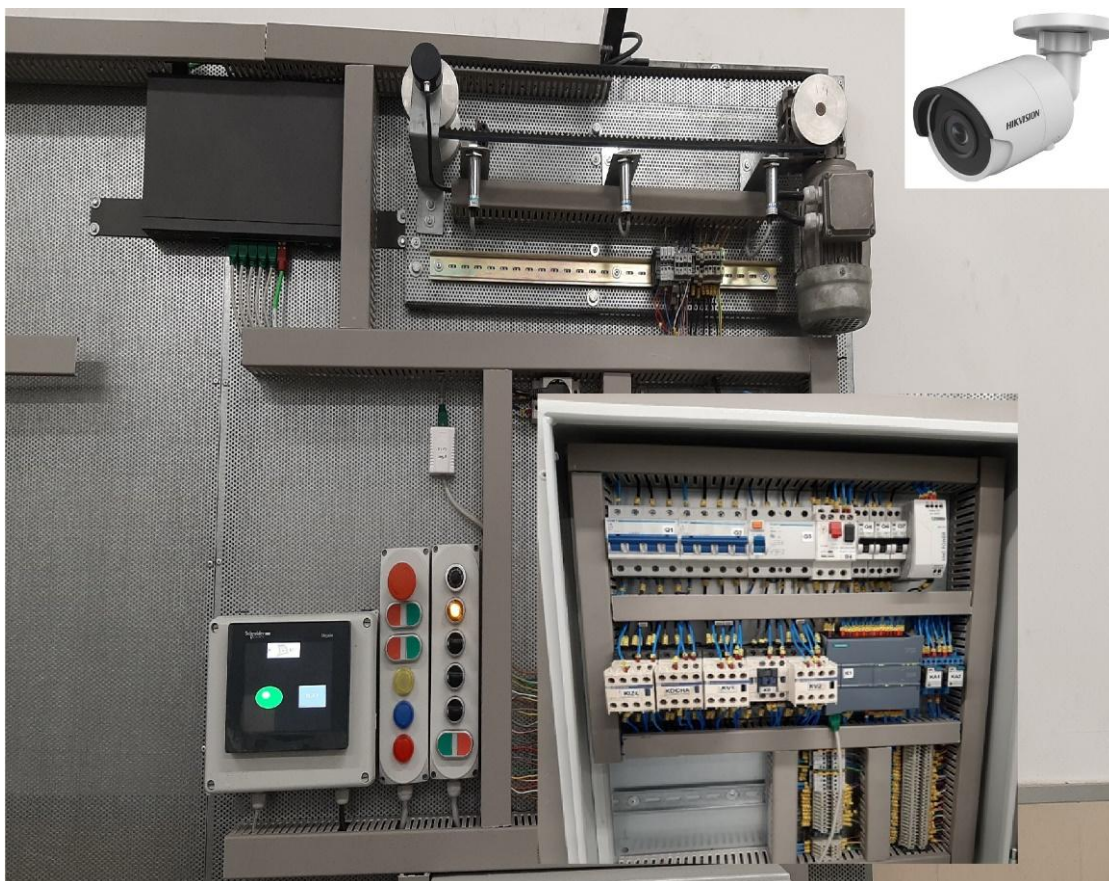


REMOTE WORKSHOP MANUAL



PROGRAMING ELECTRICAL AUTOMATION SYSTEMS

Version_20251105

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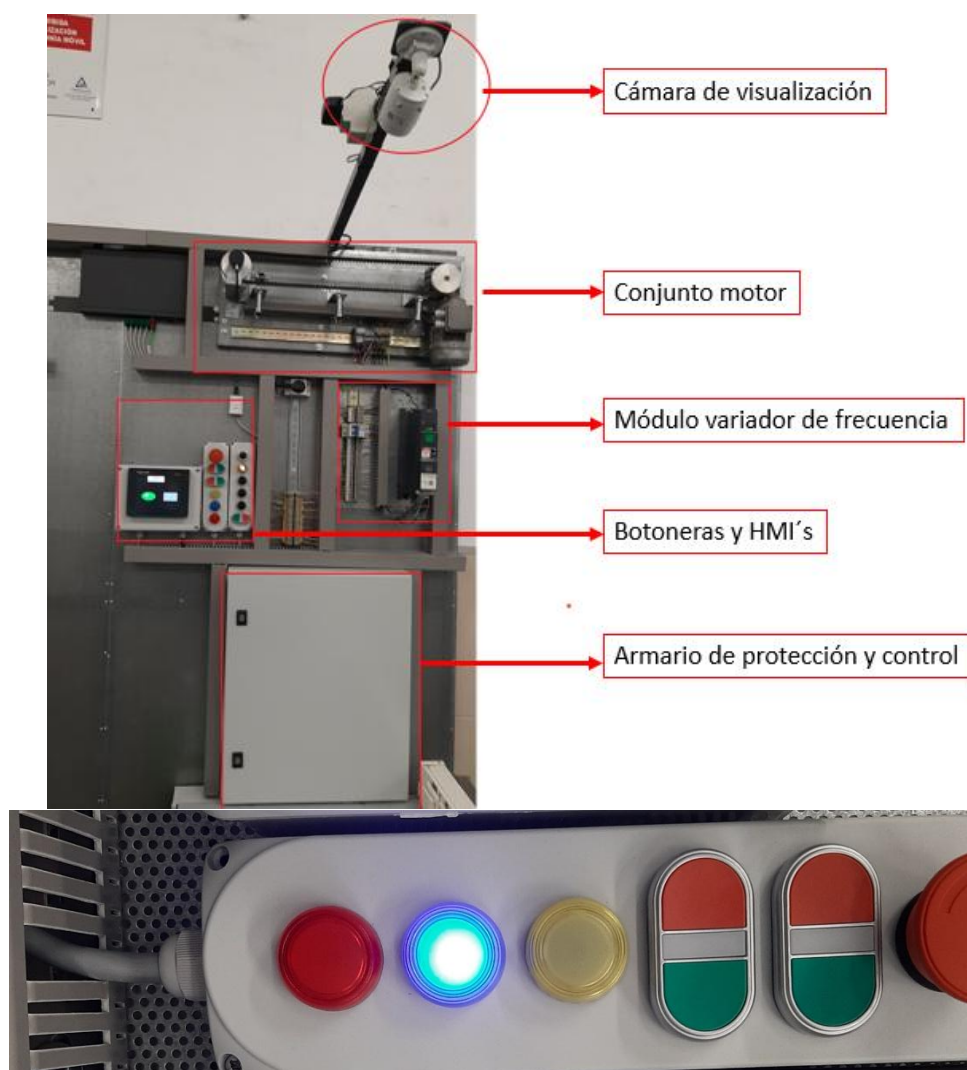
1. WorkShop Description.....	4
1.1 Motor Assembly with Belt and sensors.....	5
1.2 Pushbutton Unit.	6
1.3 Human Machine Interface.....	7
1.4 Electrical Panel: Protections, Contactors, Relays and PLC.....	7
Protections	7
Contactors:	8
Relays:	8
Power Supply 230Vac/24Vdc.....	9
Programmable Logic Controller (PLC) S1214 AC/DC/Rly:.....	9
1.5 Frequency inverter.....	11
2. Motor Connection Configuration.	11
3. Device IP Address Configuration.	12
4. Access System.....	12
4.1 Registration process in the VETWORc platform.	12
4.2 Access to Remote Workshop Resources.....	12
4.3 Evaluation questionnaire about the workshop use.	13
4.4 Calendar reservation.	14
4.5 Activities Report.	14

1. WorkShop Description

This is a didactic panel designed for remote training in automation systems based on PLC-programmed maneuvers and induction motor control via frequency inverter.

The main components of the panel are:

- Motor assembly with belt and sensors
- Actuators: physical and virtual pushbuttons
- Human-Machine Interface (HMI)
- Electrical panel: protections, contactors, relays, and PLC
- Frequency inverter module
- Camera for visual feedback



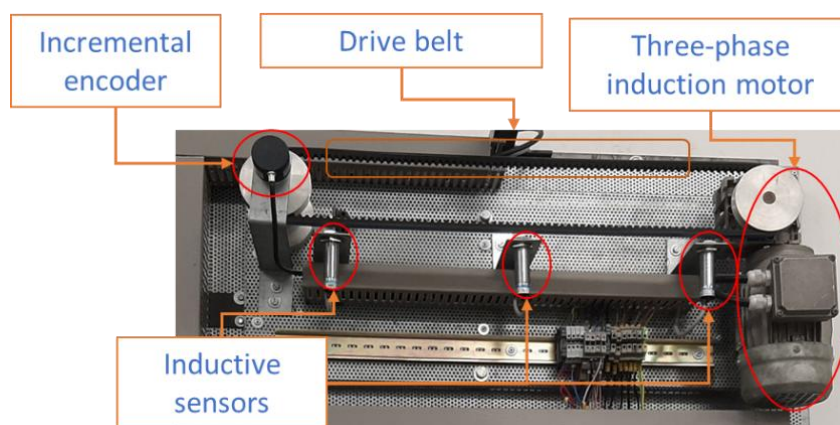
1.1 Motor Assembly with Belt and sensors.

This assembly features a motor coupled to a gearbox, which enables movement between two pulleys of a toothed belt. A metallic mark is placed

REM			CE			ISO9001		3~ IEC 34-30	
THREE - PHASE INDUCTION MOTOR									
FRAME MS 56B4 B14					NO. 1606124004				
INS.CL F			IP 55			S1			
V	Δ / Y	Hz	kW	HP	rpm	A	Δ / Y	cos φ	
230/400		50	0.09	0.12	1320	0.74/0.43		0.61	
275/480		60	0.11	0.14	1580	0.74/0.43		0.61	

on the belt, and three inductive sensors beneath it detect this mark. Additionally, an incremental encoder mounted on one of the pulleys allows precise measurement of the belt's position and speed.

The inductive sensors are used to monitor the belt's movement, while the encoder provides feedback on both position and velocity, which is essential for automation and control exercises.



1.2 Pushbutton Unit.

The panel features two physical **pushbutton units**: BOT and BOTVF.

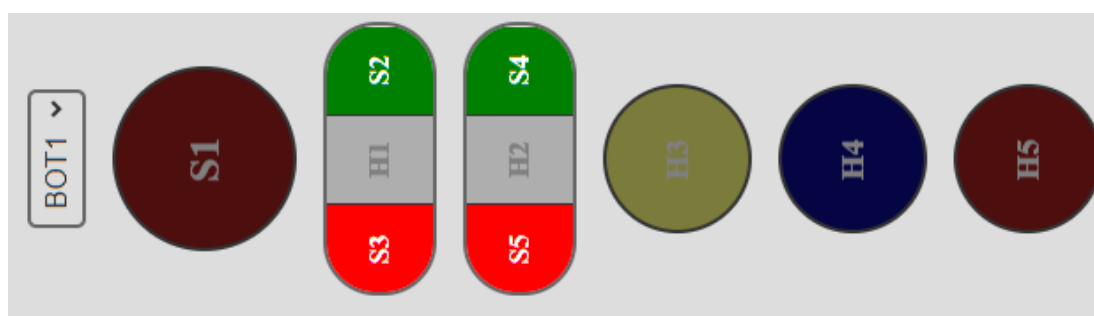
Pushbutton unit 1 (BOT1) is primarily designed for local motor control, with all actuators and indicators connected to the PLC.



Pushbutton unit 2 (BOTVF) is primarily intended for controlling the motor via the frequency inverter. All actuators and indicators are connected to the inverter, except for S6, which powers the coils of relays. When the S6 selector is activated (H6 indicator on) – see image – the inverter inputs are then controlled by the PLC outputs, overriding the actions of the BOTVF pushbutton unit.



In addition, there is a virtual HTML pushbutton unit identical to the physical one.



1.3 Human Machine Interface

These are not included in the planned exercises and are intended only for advanced levels:

- HMI MAGELIS
- HMI SIEMENS

1.4 Electrical Panel: Protections, Contactors, Relays and PLC

Above the panel, there is the protection and control cabinet.

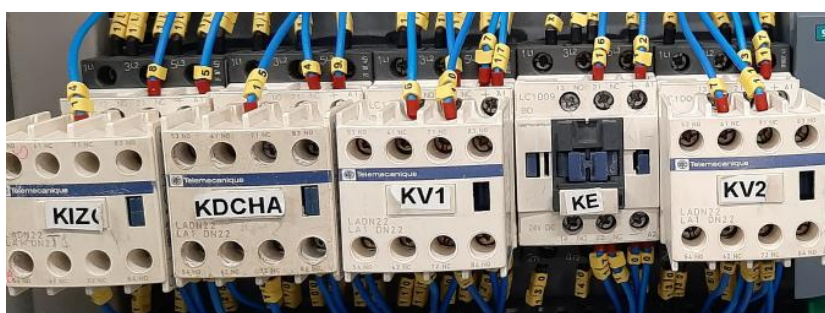
Protections

- Q1: Main circuit breaker
- Q2: General panel circuit breaker
- Q3: Main differential (residual-current) breaker
- Q4: Motor protection switch
- Q5: Circuit breaker for frequency inverter protection
- Q6: Circuit breaker for PLC power supply protection
- Q7: Circuit breaker for 24VDC power supply protection



Contactors:

- **KIZQ:** Motor power contactor for 400V supply, rotation to the left
- **KDCHA:** Motor power contactor for 400V supply, rotation to the right
- **KE:** Motor connection contactor in star (Y) configuration
- **KV1:** Motor power contactor in delta (Δ) configuration, powered via the frequency inverter
- **KV2:** Motor power contactor in delta (Δ) configuration, powered via the frequency inverter



Relays:

KA1 and KA2: Relays that enable control of the frequency inverter inputs either from the PLC or from the BOTVF pushbutton unit.

These relays act as switching intermediaries, allowing the control signals to be routed safely and reliably, ensuring that either the PLC or the local pushbutton unit



can manage the inverter without conflicts. They are essential for flexible operation and safety in motor control exercises.

Power Supply 230Vac/24Vdc

This is a power conversion unit that transforms the standard 230V AC mains voltage into a stable 24V DC output. It is used to supply control circuits, PLCs, sensors, and other low-voltage devices on the panel safely and reliably.



Programmable Logic Controller (PLC) S1214 AC/DC/Rly:

- Article number: 6ES7 214-1BG40-0XB0
- Firmware V4.4.1
- Version TiaPortal: V17



Addressing table

PLC Address	Physical	Data Type	Identifier	Description
I0.0		Input/BOOL	BG1	Encoder Channel A
I0.1		Input/BOOL	BG1	Encoder Channel B
I0.2		Input/BOOL	B2	Left Inductive Sensor
I0.3		Input/BOOL	B2	Center Inductive Sensor
I0.4		Input/BOOL	B3	Right Inductive Sensor
I0.5		Input/BOOL		Reserved
I0.6		Input/BOOL		Reserved
I0.7		Input/BOOL		Reserved
I1.0		Input/BOOL	S1/KAR8	Emergency Stop (NC)
I1.1		Input/BOOL	S2/KAR7	NO Pushbutton
I1.2		Input/BOOL	S3/KAR6	NC Pushbutton
I1.3		Input/BOOL	S4/KAR5	NO Pushbutton
I1.4		Input/BOOL	S5/KAR4	NC Pushbutton
Q0.0		Output/BOOL	KIZQ/H1	Right Rotation Contactor & H1 Pilot
Q0.1		Output/BOOL	KDCHA/H2	Left Rotation Contactor & H2 Pilot
Q0.2		Output/BOOL	KE/H3	Star Connection Contactor & H3 Pilot
Q0.3		Output/BOOL	KV1/KV2/H4	Delta Connection Contactors & H4 Pilot
Q0.4		Output/BOOL	H5	H5 Pilot
Q0.5		Output/BOOL	S7 SLC/VFDI5	Digital Input 5 VF
Q0.6		Output/BOOL	S8 SLC/VFDI4	Digital Input 4 VF
Q0.7		Output/BOOL	S9 SLC/VFD3	Digital Input 3 VF
Q1.1		Output/BOOL	S10 SLC/VFD2	Digital Input 2 VF
Q0.7		Output/BOOL	S11 SLC/VFD1	Digital Input 1 VF

IW64	Analog Input	VFQW1	VF Analog Output
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1.5 Frequency inverter.

The didactic panel includes a module with a frequency inverter, protected by an additional circuit breaker Q7. The frequency inverter used is a Schneider Electric ATV320.

2. Motor Connection Configuration.

To connect the motor correctly, the following points must be considered:

1. If it will be powered directly from the workshop supply: 400V between phases and 230V between phase and neutral.
2. If it will be powered through the frequency inverter, which provides a 230V output.
3. The operating voltages of the motor are: 230V in delta (Δ) connection and 400V in star (Y) connection.

Therefore, if it is connected directly to the 400V workshop supply, it must be wired in star (Y) configuration. If it is connected via the inverter output, it must be wired in delta (Δ) configuration.

To make this connection, specific contactors must be powered according to the following table:

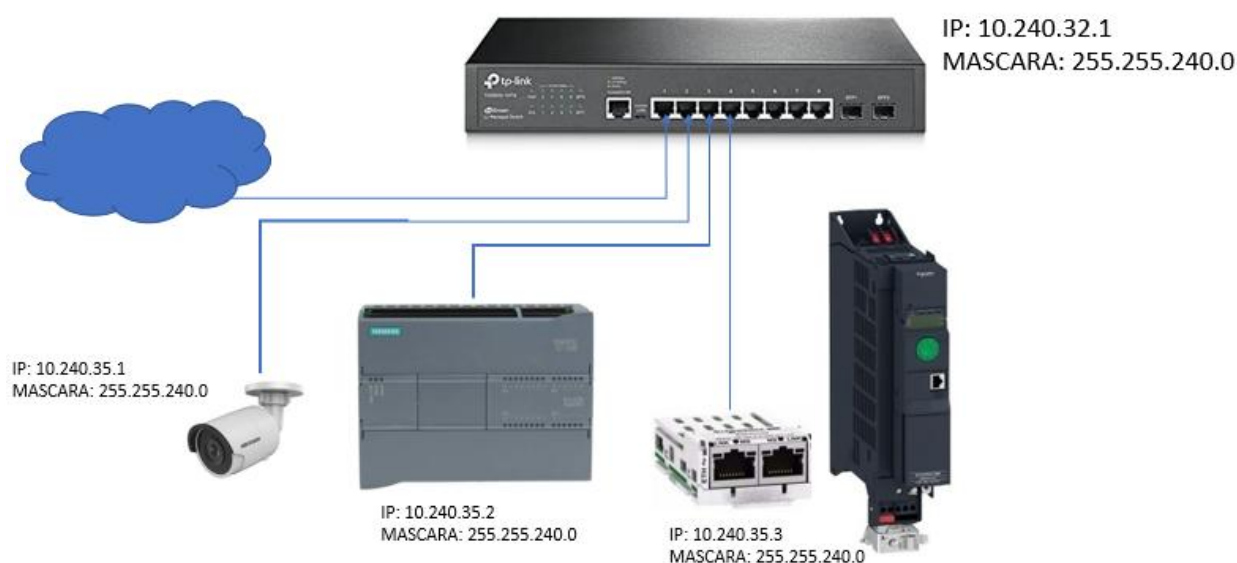
Power Supply Type	Connection Type	Contactors	Comments
Direct 400V supply	Star (Y)	KE, KIZQ, KDCHA	KE: Configures the motor in star connection KIZQ: Motor will rotate left KDCHA: Motor will rotate right
230V supply from inverter output	Delta (Δ)	KV1, KV2	KV1 and KV2: Configure the motor in delta connection

WARNING:

- Ensure that **KIZQ and KDCHA** are not activated simultaneously.
- Ensure that **KE and KV1 or KV2** are not activated simultaneously.

3. Device IP Address Configuration.

COMUNICACIÓN ETHERNET TCP/IP ENTRE EQUIPOS



4. Access System.

4.1 Registration process in the VETWORc platform.

The teacher at the training center will guide you through the registration process using a resource on the E-Learning platform. This resource will provide you with a username and password for access.

4.2 Access to Remote Workshop Resources.

On the VETWORc platform, you will have access to the following resources:



1. Document Repositories:

- **Didactic Guide:** Provides a comprehensive overview of the workshop.
 - **Workshop Manual:** Details the workshop's features and includes all necessary documentation to complete the exercises.
 - **Exercises:** At least one guided exercise is provided.
 - **Appendices:** Electrical diagrams, PLC datasheets, and other supporting documents.
2. **Camera Access:** Allows you to receive **real-time feedback** on your programming operations.
3. **Remote Desktop Access:** TIAPORTAL V17 software, required for programming the Siemens S1200 PLC.
4. **Virtual Control Panel:** Enables simulation and control of the panel remotely.

Note: Access to the **documentation** is available immediately upon logging in. Access to the **camera, remote desktop, and virtual control panel** will be granted **after successfully completing the workshop usage validation quiz**.

4.3 Evaluation questionnaire about the workshop use.

The instructor at the training center will indicate to the student **where to find the quiz**, which must be successfully completed (**score above 50 out of 100**) in order to receive a **time credit** redeemable on the reservation panel.

To complete the quiz, the student must **review and understand** the following repository documents:

- **Workshop Manual**
- **Electrical Diagram**



4.4 Calendar reservation.

The instructor at the training center will indicate to the student the resource where they can book a time slot to use the remote workshop.

4.5 Activities Report.

The teacher at the training center will indicate to the student where to record or report the activities corresponding to the proposed exercises.

