



PLCs

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# Ambiente de Desarrollo



# PLC del Laboratorio

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- Marca: ABB
- Serie: AC500
- Modelo: AC500-eCo
- CPU: PM554-T-ETH
- Alimentación: 24 VDC
- Memoria: 128 kB
- I/O (Onboard):
  - 8 entradas digitales 24VDC
  - 6 salidas digitales 24 VDC, transistor



# PLC del Laboratorio

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- Puertos de comunicación:
  - 1 x Ethernet TCP/IP
  - 1 x Serial RS485 (ej: MODBUS)
- Módulo de entradas analógicas: AI562
  - 2 entradas de RTD (temperatura)
- 2 x Relés auxiliares, bobina de 24 VDC, contactos para 220 VAC



# PLCs del Laboratorio

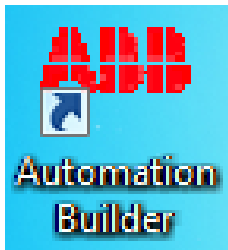
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- Hardware:

- Serie AC500 de ABB
- Modelo: AC500-eCo PM554-T-ETH

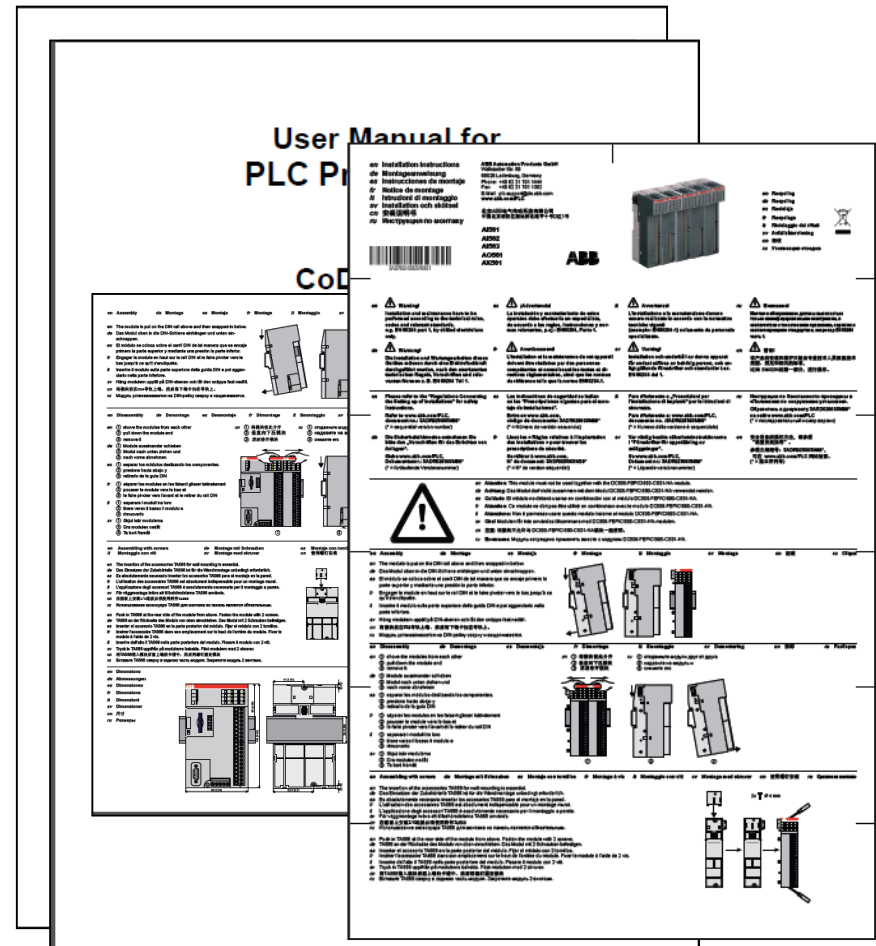
- Software:

- Ambiente de desarrollo: Automation Builder (basado en CoDeSys)



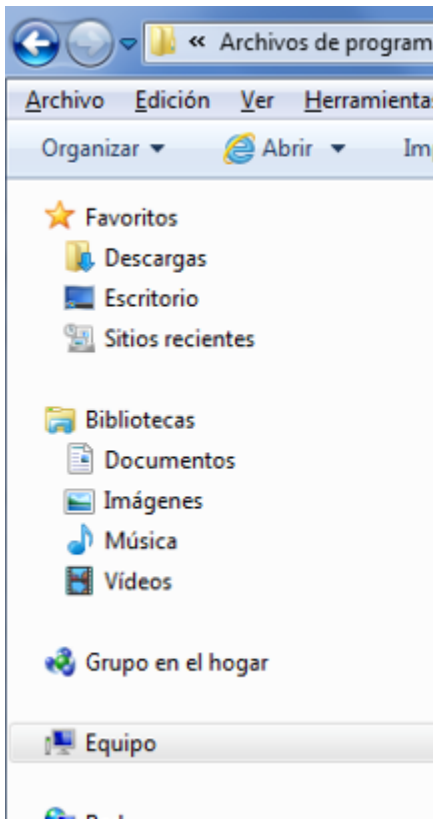
# Documentación

- En la página del Curso:
  - AC500 eCo Starter Kit
  - Manual CoDeSys
  - Hojas de Datos del hardware (CPU, Módulo de I/O)
- En el Automation Builder



# Documentación

## ■ En el Automation Builder:



### English Documentation

#### Marking Stripes

File format: DOC (Microsoft Word)

Document title	ID number
<a href="#">Marking Stripes for TA523</a>	3ADR020024X00xx

#### Installation Instructions for AC500/S500 hardware (en, de, es, fr, it, sv, cn, ru)

These installation instructions are enclosed in the packing units of the modules and components.

File format: PDF

#### Analog Input/Output Modules

Document title	ID number
<a href="#">AI523(-XC) Analog input module</a>	3ADR024040M68xx
<a href="#">AI531(-XC) Analog input module</a>	3ADR024041M68xx
<a href="#">AI561, AI562, AI563 Analog input modules</a>	3ADR024062M68xx
<a href="#">AI581-S(-XC) Analog Safety input module</a>	3ADR024012M68xx
<a href="#">AO523(-XC) Analog output module</a>	3ADR024057M68xx
<a href="#">AO561 Analog output module</a>	3ADR024062M68xx
<a href="#">AX521(-XC) Analog input/output module</a>	3ADR024042M68xx
<a href="#">AX522(-XC) Analog input/output module</a>	3ADR024043M68xx

# Documentación – Help

## PM554-T-ETH

HTML Help

Online Help

Contents

Automation Builder

- Automation Builder Installation Manager
- Getting Started
- IEC 61131-3 editor
- Libraries and Solutions
- PLC Integration
- PLC Introduction
- Device Specifications
  - Terminal Bases (AC500 Standard)
  - Processor Modules
    - AC500-eCo
      - PM55x-xP and PM56x-xP**
- Onboard I/Os in Processor Module PM55x
- Onboard I/Os in Processor Module PM56x

- AC500 (Standard)
- Communication Modules (AC500 Standard)
- Terminal Units (AC500 Standard)
- I/O Modules
- Function Modules

PM55x-xP and PM56x-xP

Device Specifications > Processor Modules > AC500-eCo > PM55x-xP and PM56x-xP

### PM55x-xP and PM56x-xP

- PM55x-xP: Processor module with integrated digital inputs and outputs
- PM56x-xP: Processor module with integrated digital and analog inputs and outputs

15

16

1

2

3

4

5

6

7

8

9

10

11

12

13

17

ABB

PM564

PWR

RUN

ERR

DI0

DI1

DI2

DI3

DI5

AI0

AI1

NO

NO1

NO2

NO3

AO

AO

C 2A

2M

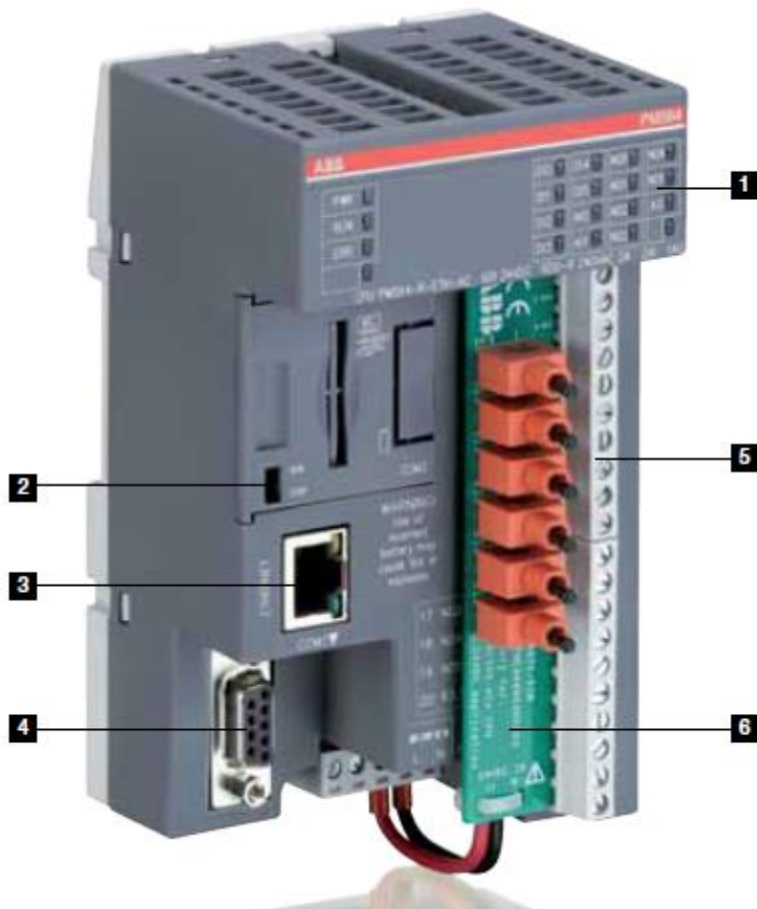
1AO

CPU PM564-RP-ETH 6DI24V/DC

COM2

WARNING! Use of

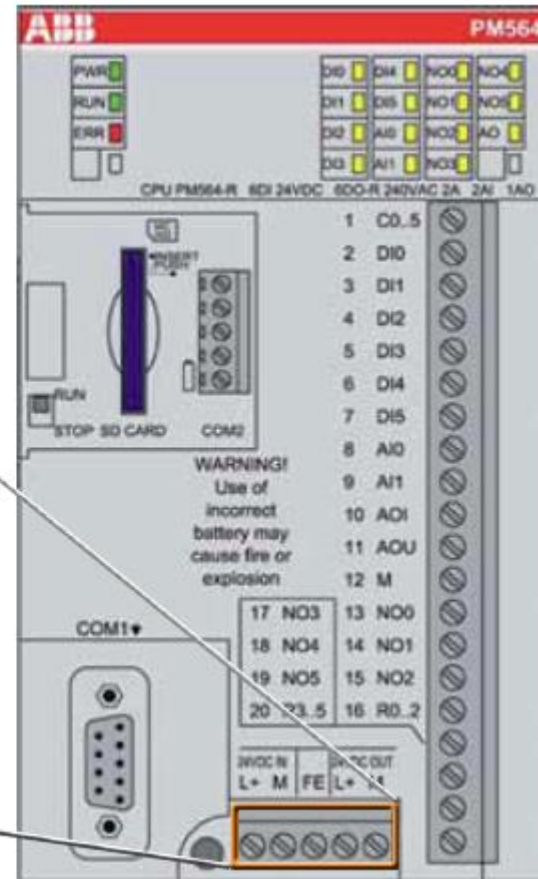
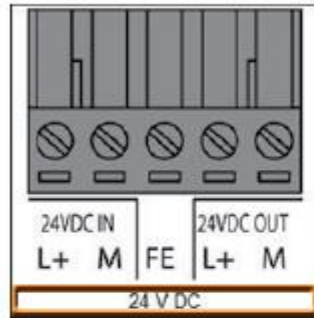
# PLC AC500-eCo PM554



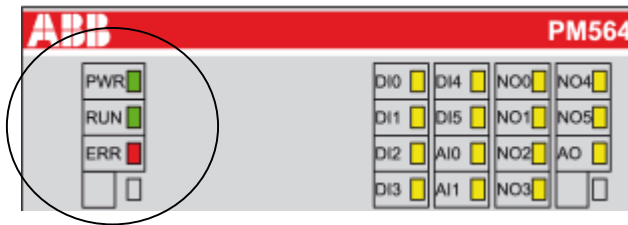
- 1** Status LED indicators  
CPU operation and onboard I/O status
- 2** Run / Stop Switch  
Control CPU operation
- 3** Ethernet CPU (in selected models)  
with RJ45 Port
- 4** COM1  
Online access, Modbus RTU, CS31-Bus master,  
ASCII
- 5** Integrated onboard I/O  
Convenient cost effective solution
- 6** Simulator input, inserted into the terminals and  
screws tightened



# PLC AC500-eCo PM554



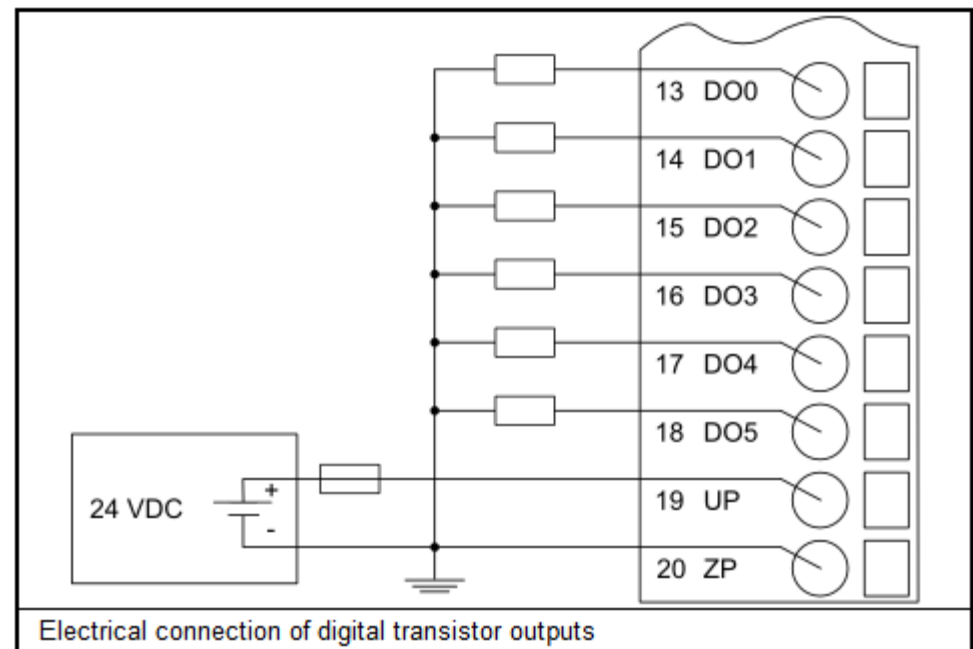
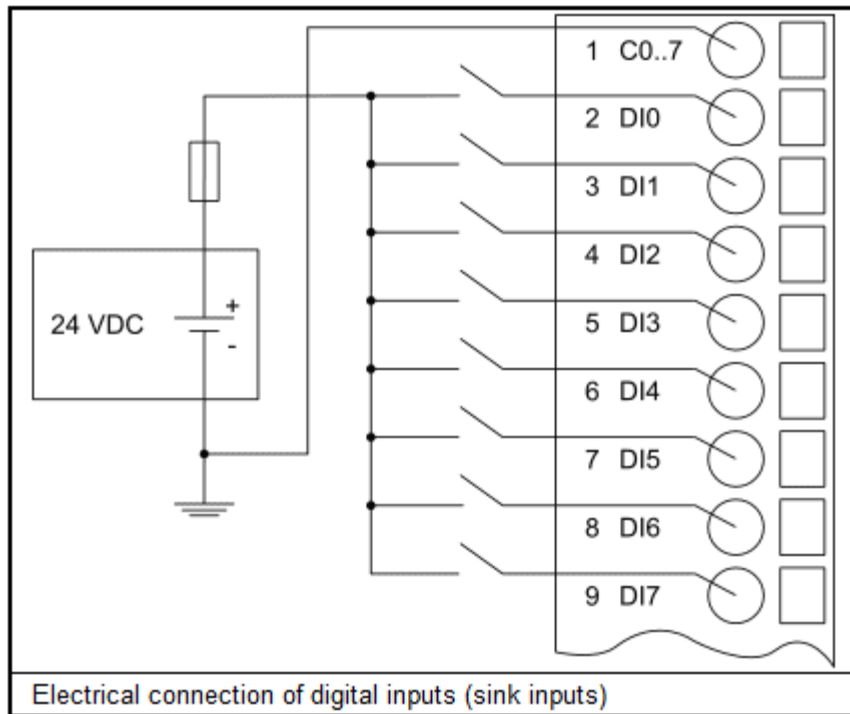
# PLC AC500-eCo PM554



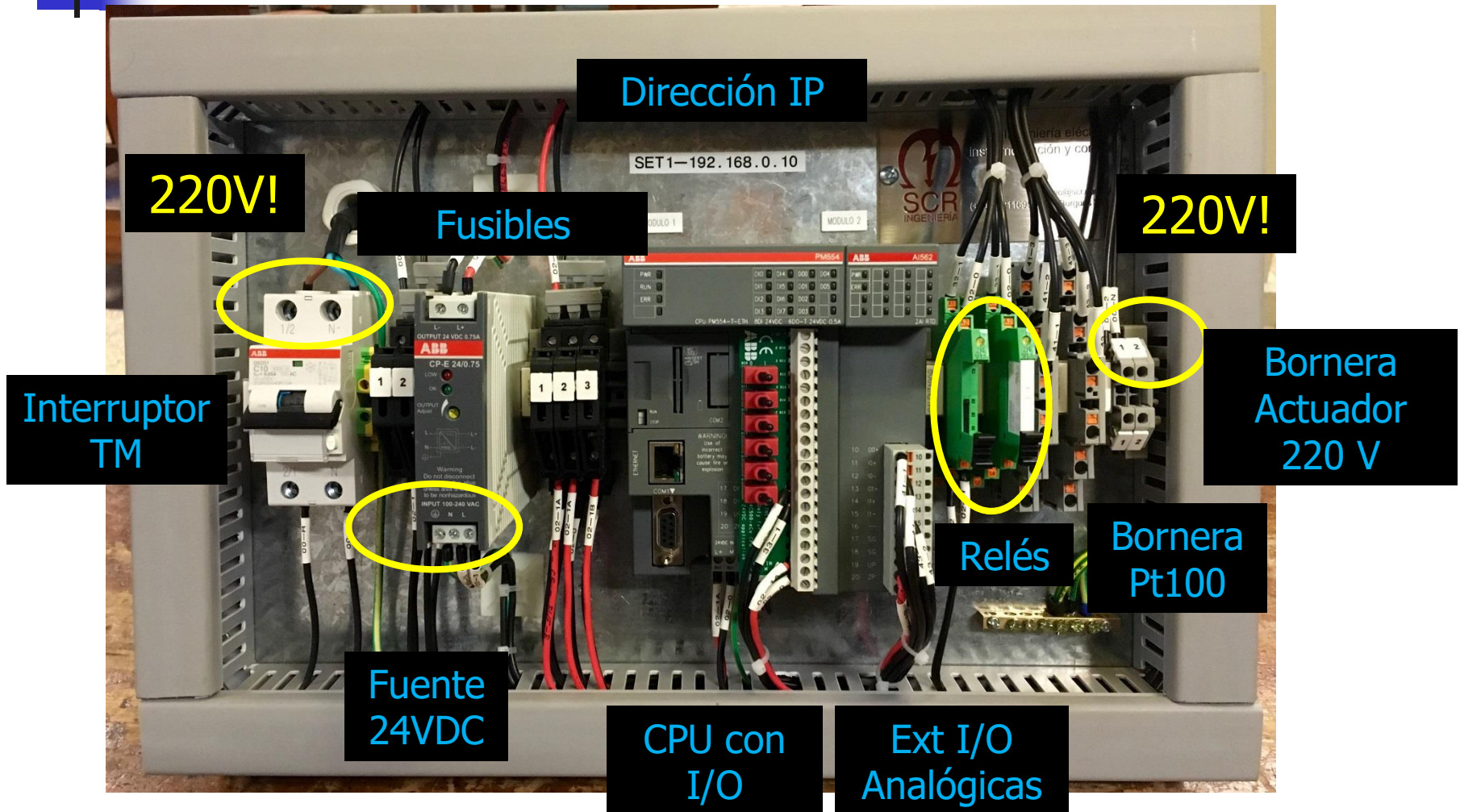
LED	Status	Color	LED = ON	LED = OFF	LED flashing
PWR	Power supply	green	Power supply present	Power supply missing	--
RUN	RUN/STOP Status	green	CPU is in status RUN	CPU is in status STOP	<p>Fast flashing (4 Hz): The CPU is reading/writing data to the SD Memory Card. If the ERR-LED is also flashing, data is written to the Flash-EEPROM.</p> <p>Slow flashing (1 Hz): The firmware update from the SD Memory Card has been finished successfully.</p>
ERR	Error indication	red	An error occurred	No errors or only warnings encountered (E4-errors). The LED behaviour by the error classes 2 to 4 is configurable.	with 4 Hz (fast): displays together with the RUN LED a currently running firmware-upgrade or writing data to the Flash-EPROM.

# PLC AC500-eCo PM554

- Onboard I/Os in PM554 CPUs



# Set del Laboratorio





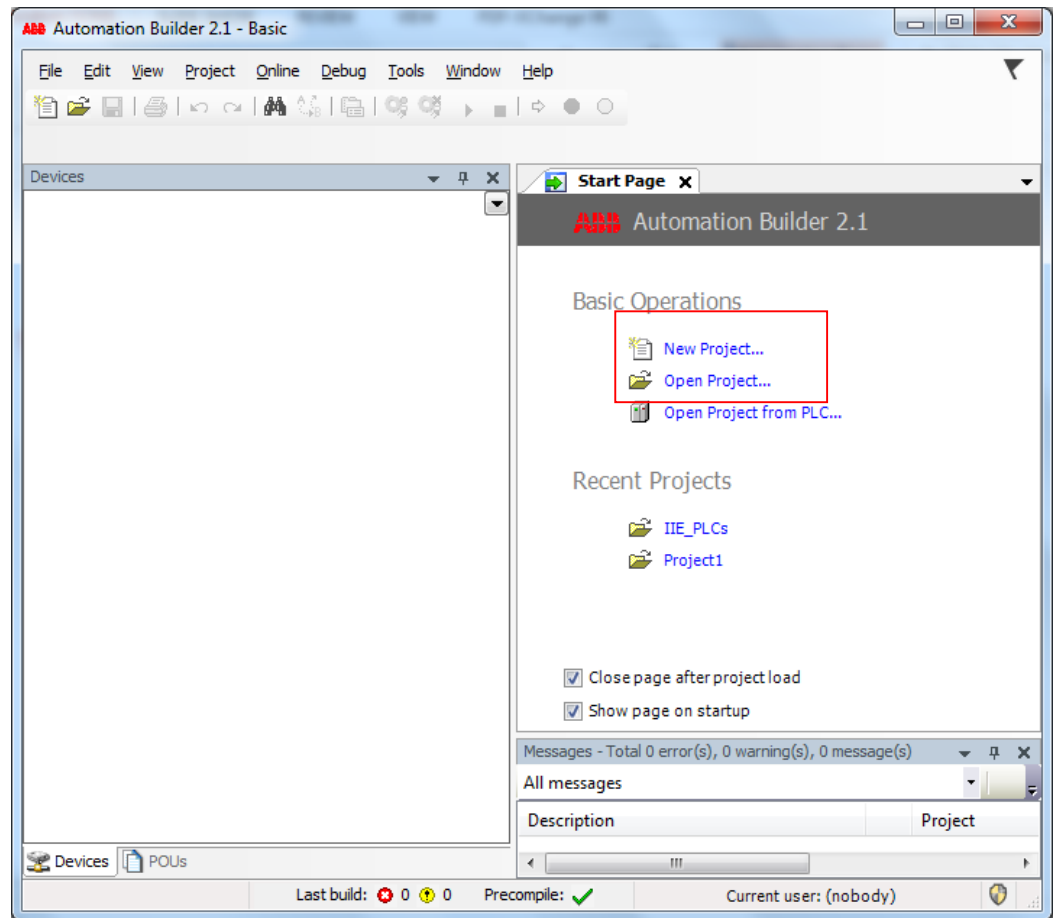
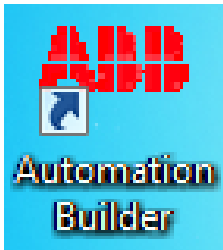
# Automation Builder

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- Permite:
  - Desarrollar programas para el PLC
  - Comunicación con PLC
- Comunicación:
  - Cargar configuración en el PLC
  - Cargar programas en el PLC
  - Determinar variables y estado del PLC

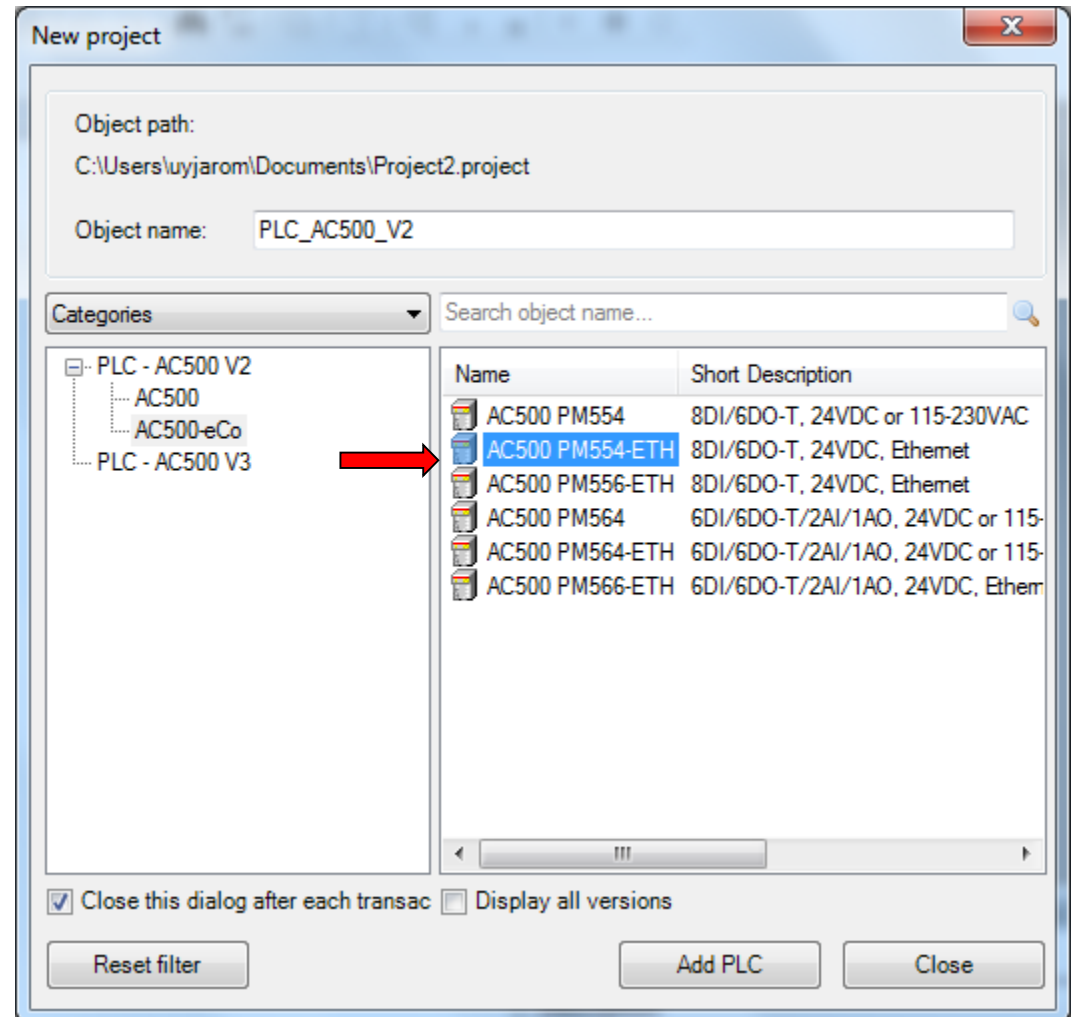
# Automation Builder

- New/Open Project



# Automation Builder

- Seleccionar el PLC de laboratorio:
- AC500 PM554-ETH



# Asignación de I/O

## Salidas Digitales

The screenshot displays the Siemens Automation Builder Basic V1 interface. The main window is titled "Project1.project - Automation Builder Basic V1". The left sidebar shows a project tree with "OBIO (8DI+6DO)" selected. The main workspace is divided into several panes:

- 8DI+6DO Parameters**: Shows "8DI+6DO I/O Mapping" and "I/O mapping list".
- Channels**: A table listing digital inputs and outputs with their addresses and types.
- Digital outputs**: A tree view showing "DO0" and "DO1" selected.

A red arrow points to the "OBIO (8DI+6DO)" folder in the left sidebar. Another red arrow points to the "DO0" output in the "Digital outputs" tree. The "Channels" table is as follows:

Variable	Mapping	Channel	Address	Type	Unit	Description
		Digital inp...	%IX4000.4	BOOL		
		Digital inp...	%IX4000.5	BOOL		
		Digital inp...	%IX4000.6	BOOL		
		Digital inp...	%IX4000.7	BOOL		
		Interrupt...	%IB4001	BYTE		
		Digital out...	%QB4000	BYTE		
		Digital out...	%QX4000.0	BOOL		
		Digital out...	%QX4000.1	BOOL		
		Digital out...	%QX4000.2	BOOL		
		Digital out...	%QX4000.3	BOOL		
		Digital out...	%QX4000.4	BOOL		
		Digital out...	%QX4000.5	BOOL		

At the bottom of the interface, there is a status bar showing "Last build: 0 error(s) 0 warning(s) 0 message(s)", "Precompile: ✓", and "Current user: (nobody)".



# Asignación de I/O

- Agregar módulo AI562 de entradas analógicas:
  - IO\_Bus -> Add Object
  - AI562

The screenshot shows the SIMATIC Manager interface. On the left, the 'Devices' tree is expanded to show the 'AI562 (AI562)' module under the 'IO\_Bus' object. A red arrow points to this module. The main window displays the 'AI562 Parameters' table, which is used to configure the module's inputs. The 'Input 0, channel configuration' parameter is highlighted in blue, and a red arrow points to its value, 'Pt100 (3-wire) -50...+400 °C'.

Parameter	Type	Value	Default Value	Unit
<input type="checkbox"/> Ignore module	Enumeration of BYTE	No	No	
<input type="checkbox"/> Check supply	Enumeration of BYTE	On	On	
<input checked="" type="checkbox"/> Input 0, channel configuration	Enumeration of BYTE	Pt100 (3-wire) -50...+400 °C	Not used	
<input checked="" type="checkbox"/> Input 1, channel configuration	Enumeration of BYTE	Not used	Not used	

# Acceso al Programa

Project1.project\* - Automation Builder Basic V1

File Edit View Project Tools Window Help

Devices

Project1

- PLC\_AC500 (PMS54+ETH)
- Application
- OBIO (8DI+6DO)
- IO\_Bus
  - AI562 (AI562)
- Interfaces
  - COM1\_Online\_Access (COM1 - Onli)
  - COM2\_None (COM2 - None)
- Ethernet
  - ETH1 (ETH1)
  - Protocols (Protocols)

OBIO x

8DI+6DO Parameters

8DI+6DO I/O Mapping

I/O mapping list

Channels

Variable	Mapping	Channel	Address	Type	Unit	Description
Digital inputs						
DI0		Digital inp...	%IB4000	BYTE		
DI1		Digital inp...	%IX4000.0	BOOL		
DI2		Digital inp...	%IX4000.1	BOOL		
		Digital inp...	%IX4000.2	BOOL		
		Digital inp...	%IX4000.3	BOOL		
		Digital inp...	%IX4000.4	BOOL		
		Digital inp...	%IX4000.5	BOOL		
		Digital inp...	%IX4000.6	BOOL		
		Digital inp...	%IX4000.7	BOOL		
		Interrupt...	%IB4001	BYTE		
Digital outputs						
DO0		Digital out...	%QB4000	BYTE		
DO1		Digital out...	%QX4000.0	BOOL		
		Digital out...	%QX4000.1	BOOL		

Reset mapping Always update variables: Use parent device setting

☀ = Create new variable    🗑 = Map to existing variable

Messages - Totally 0 error(s), 0 warning(s), 0 message(s)

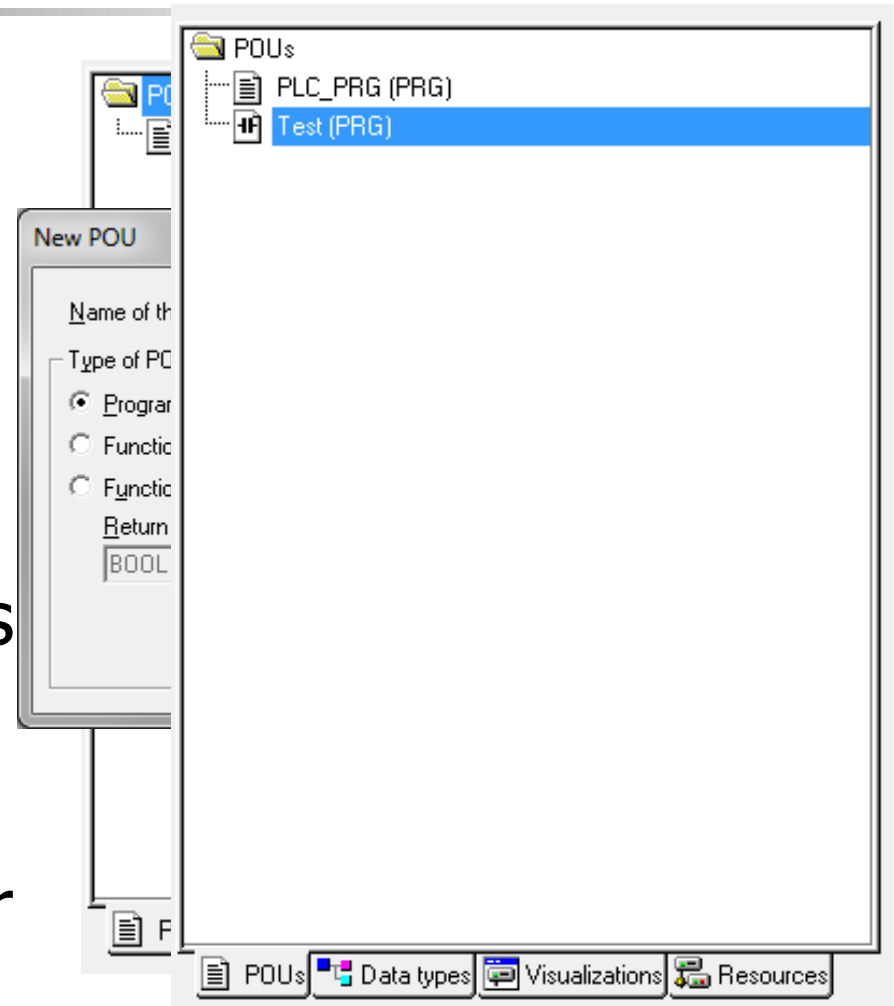
All messages 0 error(s) 0 warning(s) 1 message(s)

Description	Project	Object	Position
-------------	---------	--------	----------

Last build: 0 0 0 Precompile: ✓ Current user: (nobody)

# POUs

- POU – Program Organization Units
- Lenguajes: LD, IL, FBD, ST, SFC
- “Add Object...”
- Programas, bloques etc.
- “PLC\_PRG” se ejecuta una vez por ciclo por definición



# Editor de POU's

The screenshot shows the CoDeSys editor window titled "CoDeSys - AC500.AC500PRO - [Test (PRG-LD)]". The interface includes a menu bar (File, Edit, Project, Insert, Extras, Online, Window, Help), a toolbar, and a project tree on the left. The project tree shows a hierarchy: POU's > PLC\_PRG (PRG) > Test (PRG). The main editor area displays the following code:

```
0001 PROGRAM Test
0002 VAR
0003 END_VAR
0004
0005
0006
0007
0008
0009
0010
```

Below the code editor is a ladder logic editor showing a single rungs with a normally open contact. At the bottom, a console window displays the following text:

```
Loading library 'C:\Program Files (x86)\Common Files\CAA-Targets\ABB_AC500AC500_V12\Library\SysLib:
Loading library 'C:\Program Files (x86)\Common Files\CAA-Targets\ABB_AC500AC500_V12\Library\SysLib:
Loading library 'C:\Program Files (x86)\Common Files\CAA-Targets\ABB_AC500AC500_V12\Library\EtherNet:
Loading library 'C:\Program Files (x86)\Common Files\CAA-Targets\ABB_AC500AC500_V12\Library\BusDiag:
Loading library 'C:\Program Files (x86)\Common Files\CAA-Targets\ABB_AC500AC500_V12\Library\SysInt:
Loading library 'C:\Program Files (x86)\Common Files\CAA-Targets\ABB_AC500AC500_V12\Library\SysExt:
Loading library 'C:\Program Files (x86)\Common Files\CAA-Targets\ABB_AC500AC500_V12\Library\OnBoa
```

Red text annotations are overlaid on the screenshot:

- "POU's (programas, function blocks)" is centered in the project tree area.
- "Declaración de variables" is positioned over the VAR and END\_VAR lines of the code.
- "Programa" is positioned over the ladder logic editor.
- "Mensajes" is positioned over the console window.

At the bottom of the window, there are buttons for "POU's", "Data types", "Visualizations", and "Resources". The status bar at the bottom right shows "ONLINE", "OV", and "READ".

# Programa en LD

- Botón derecho:  
Add Object

**En PLC\_PRG invocar programa "Test"**

The screenshot displays the SIMATIC Manager interface. On the left, the 'POUs' tree shows 'PLC\_PRG (PRG)' selected. The 'New POU' dialog box is open, with the following settings:

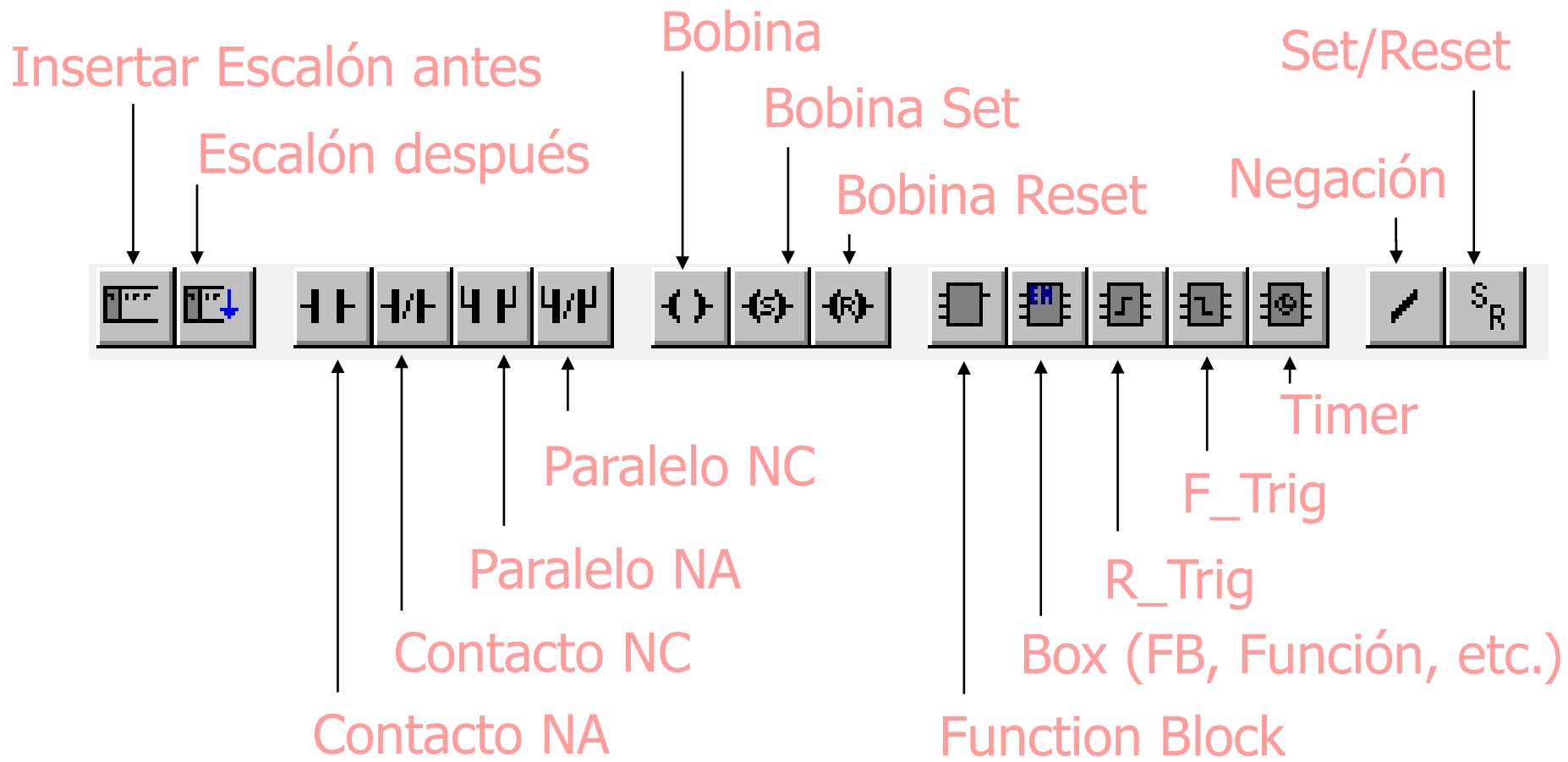
- Name of the new POU: Test
- Type of POU: Program (selected)
- Language of the program: LD (selected)
- Return Type: BOOL

The ladder logic editor shows the following program structure:

0001	PROGRAM PLC_PRG
0002	VAR
0003	END_VAR
0004	
0005	
0006	
0007	
0008	
0001	Test;
0002	
0003	
0004	
0005	

The 'Test;' line at address 0001 is circled in red, indicating the invocation of the new program.

# Herramientas LD





# Declaración de Variables

---

- Sintaxis:
  - Nombre: TIPO [:= Valor Inicial];
- Variables locales a un programa:

```
0001 PROGRAM Test
0002 VAR
0003     Var1: BOOL;
0004     Var2: BOOL;
0005     Tiempo1: TIME := T#5s;
0006     Temperatura1: REAL;
0007 END_VAR
0008
```

# Declaración de Variables

- Variables Globales

- Tab: "Resources"

- Variables globales internas



A screenshot of the software interface showing the 'Resources' tree structure on the left and the variable declaration code on the right. The tree structure includes 'Global Variables', 'OBIO', 'IO\_Module\_Mapping <R>', 'Global\_Variables', and 'Variable\_Configuration (VAR\_CONFIG)'. The 'Global\_Variables' folder is selected. The code on the right is:

```
0001 VAR_GLOBAL
0002   VarGlob: BOOL;
0003 END_VAR
0004
0005
0006
0007
```



# Declaración de Variables

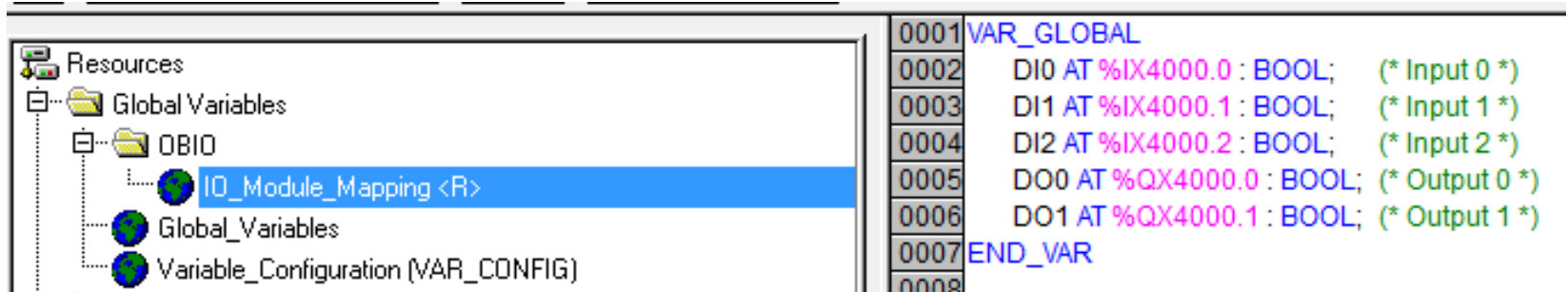
- Variables Globales

- Onboard I/O: Entradas/Salidas

- Sintaxis:

- Nombre **AT** %Dirección: TIPO [:= Valor Inicial];

Declaradas en  
Automation  
Builder



The screenshot displays the Automation Builder interface. On the left, a project tree shows the following structure:

- Resources
  - Global Variables
    - OBIO
      - ID\_Module\_Mapping <R>** (selected)
      - Global\_Variables
      - Variable\_Configuration (VAR\_CONFIG)

On the right, a code editor shows the following variable declarations:

```
0001 VAR_GLOBAL
0002 DI0 AT %IX4000.0 : BOOL; (* Input 0 *)
0003 DI1 AT %IX4000.1 : BOOL; (* Input 1 *)
0004 DI2 AT %IX4000.2 : BOOL; (* Input 2 *)
0005 DO0 AT %QX4000.0 : BOOL; (* Output 0 *)
0006 DO1 AT %QX4000.1 : BOOL; (* Output 1 *)
0007 END_VAR
0008
```

# Programa en LD

## ■ Posiciones del Cursor:

1. Every text field (possible cursor positions framed in black)



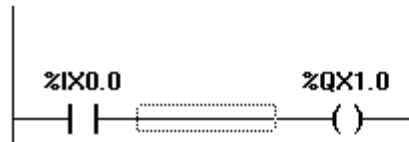
2. Every [Contact](#) or Function Block



3. Every Coil

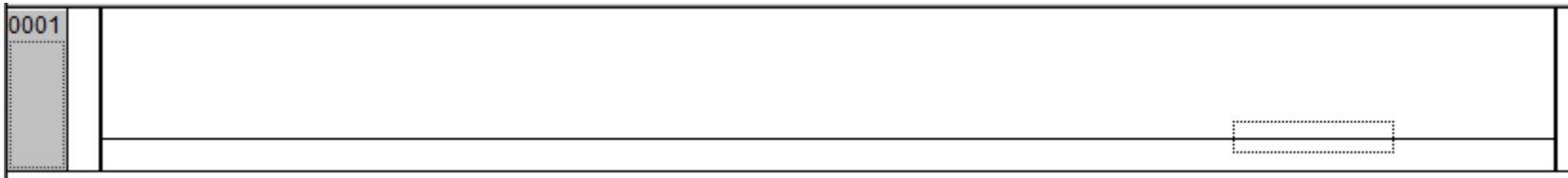


4. The Connecting Line between the Contacts and the Coils.

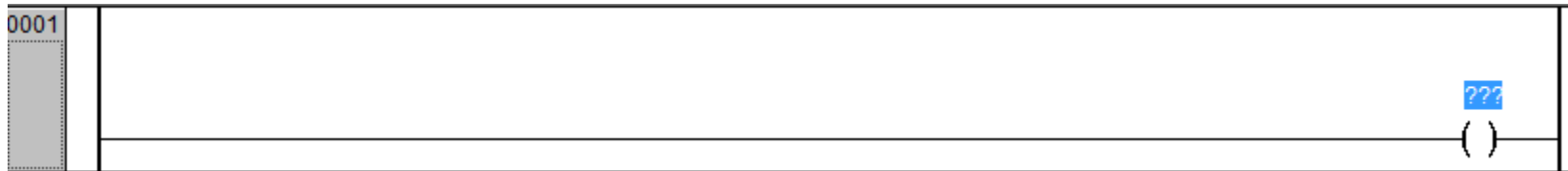


# Programa en LD

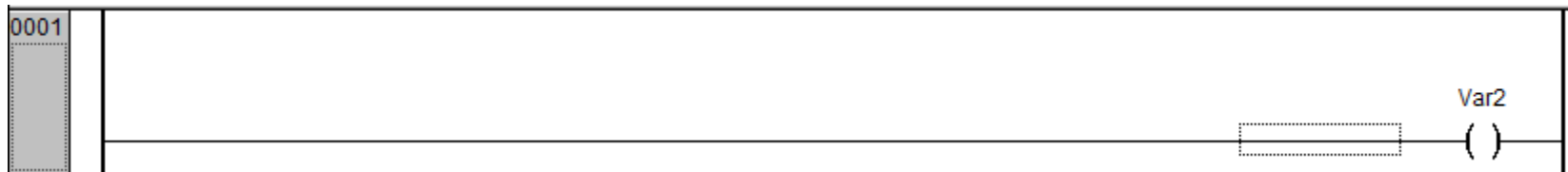
- Escalón vacío:



- Insertar bobina: 

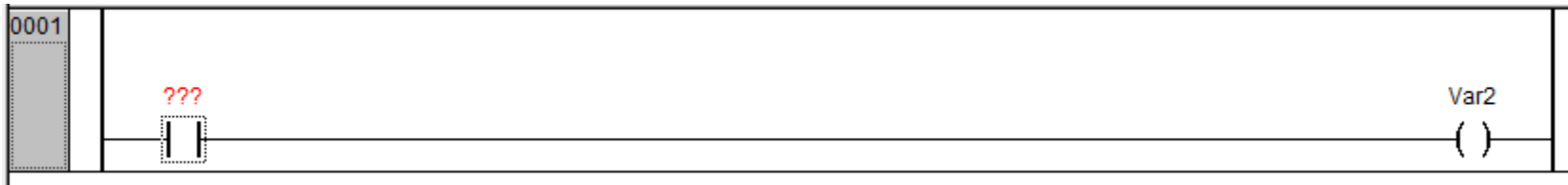


- Nombre de variable (texto directo o F2):

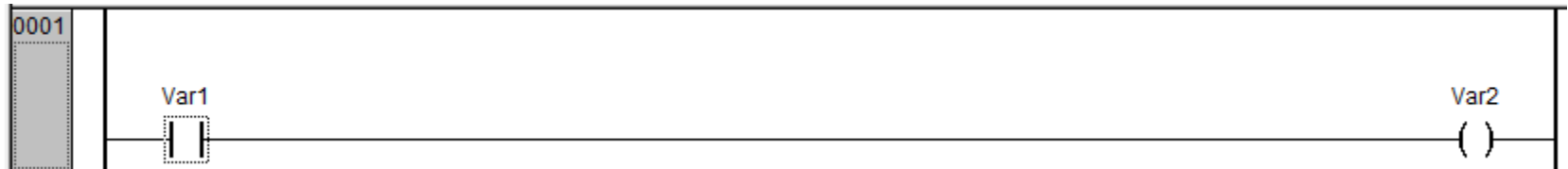


# Programa en LD

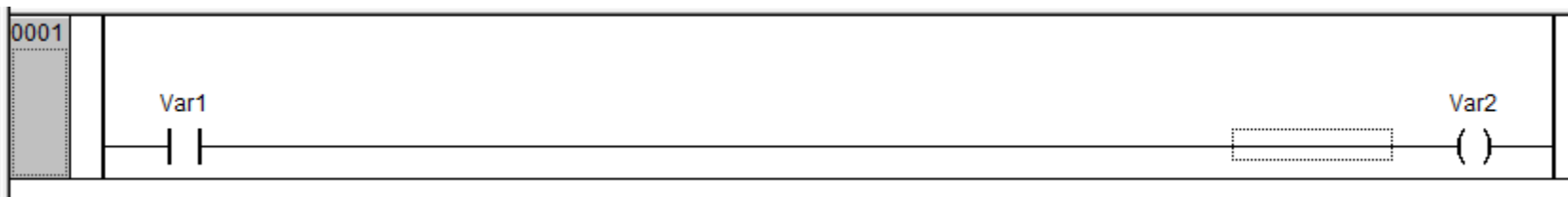
- Insertar contacto: 



- Insertar nombre de la variable:

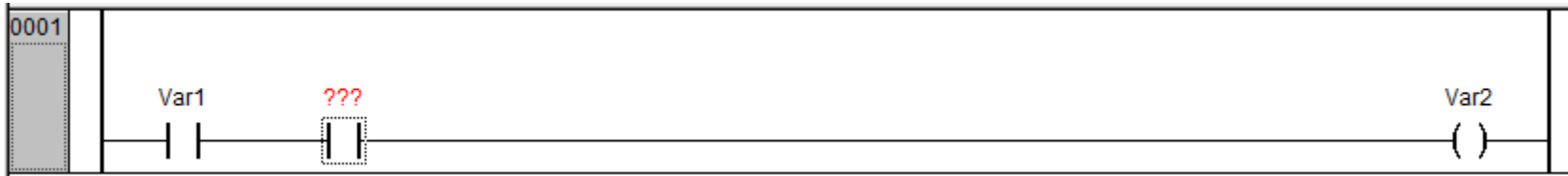


- Posicionar cursor:

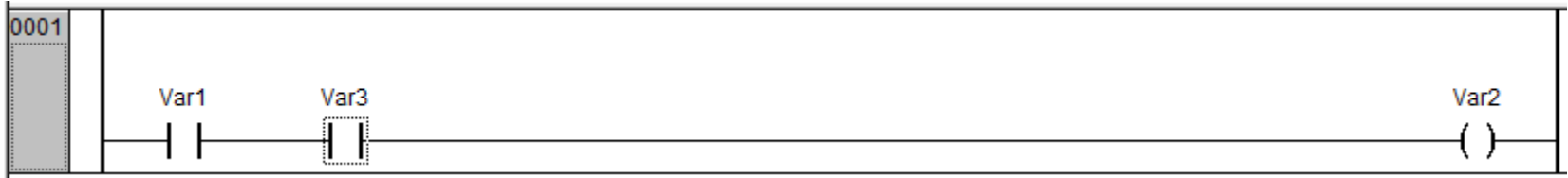


# Programa en LD

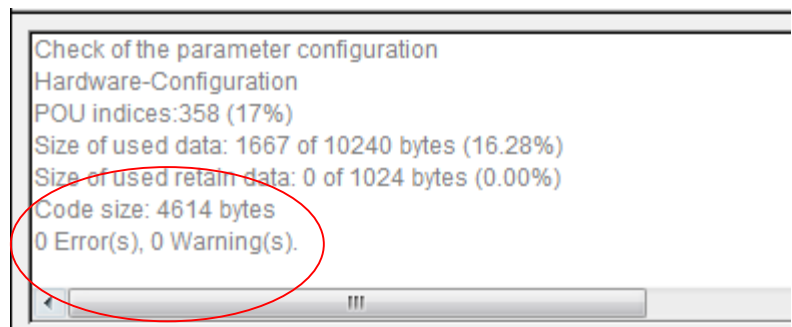
- Insertar contacto: 



- Insertar nombre de la variable:

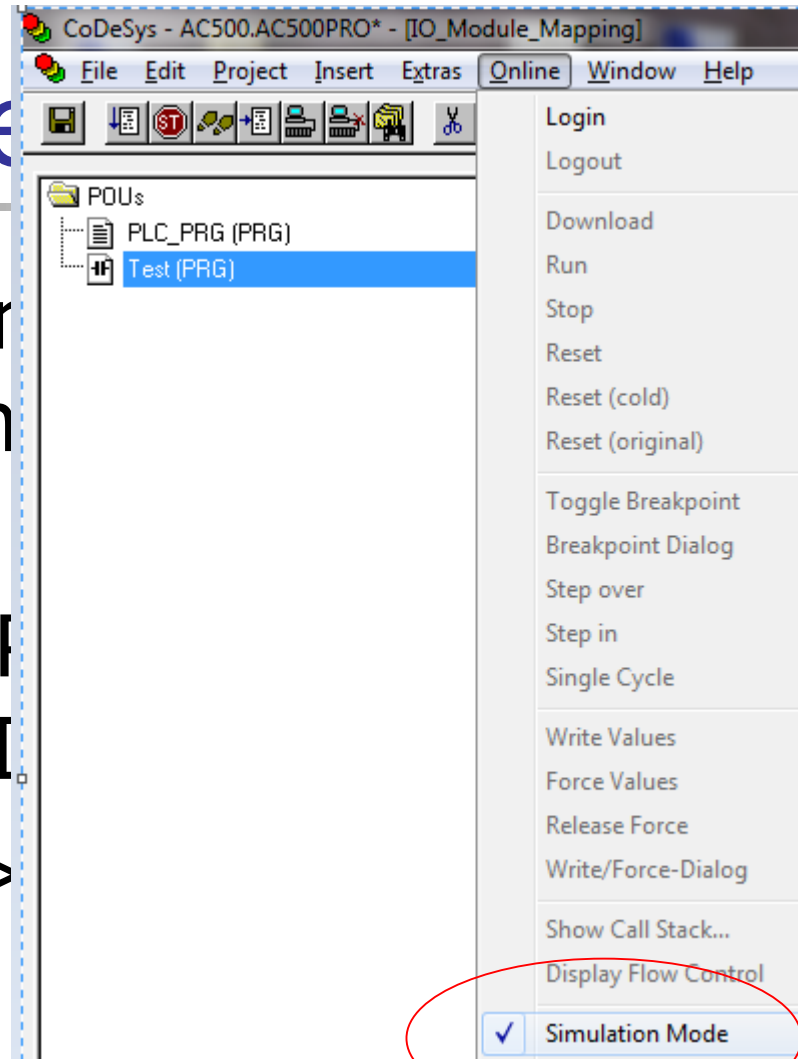


- Compilar: Menu - Project -> Build (F11)
- Mensajes:
  - Verificar Errores



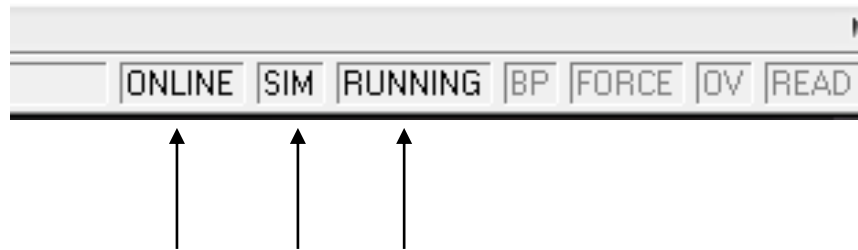
# Simulación de

- Simulación: permite ejecutar un programa sin en funcionamiento
- No se ejecutan I/O externas (ej: PII)
- Menu: Online ->



# Simulación del Programa

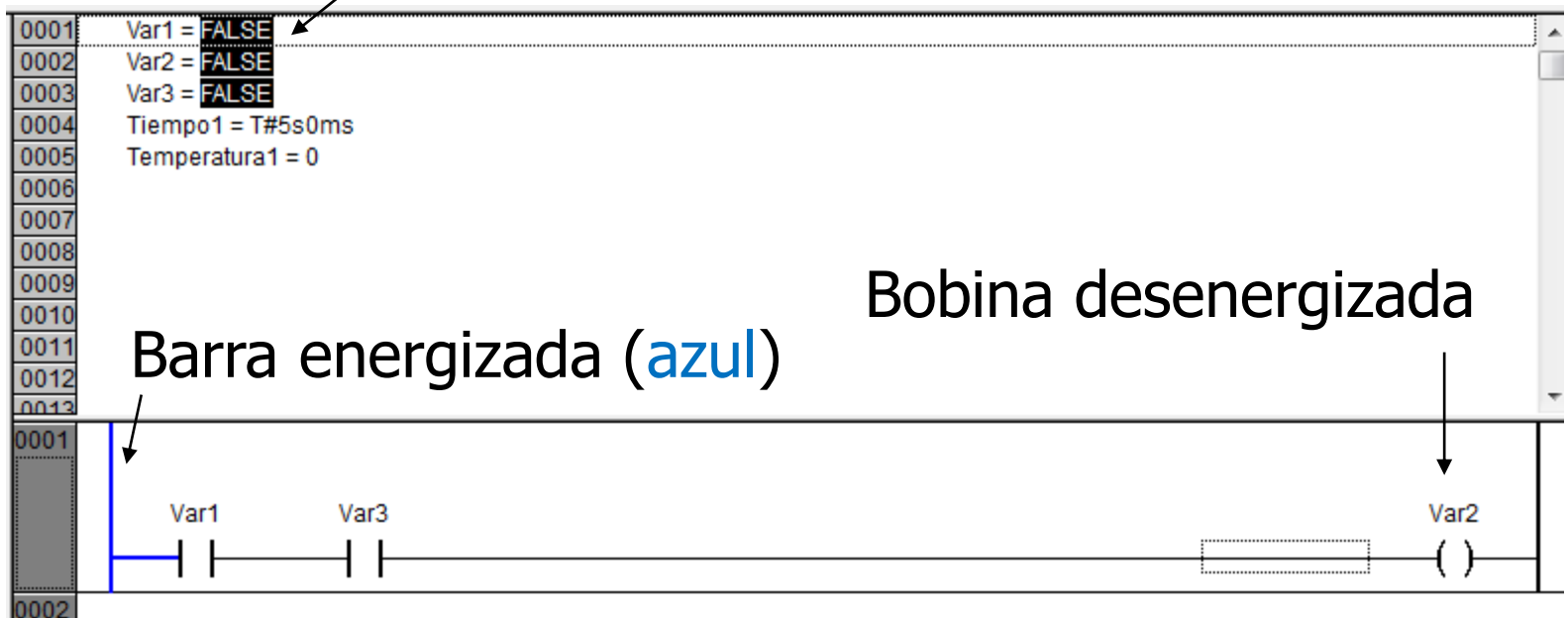
- Ejecución:
  - Menu: Online -> Login
  - Menu:Online -> Run
  - Barra de Status:



# Simulación del Programa

- Online:

Valor de las variables





# Simulación del Programa

- Online: Escribir variables (Write values)

Valor de la variable a escribir (preparado)

The screenshot displays a simulation environment with two main sections. The top section is a variable declaration table with the following content:

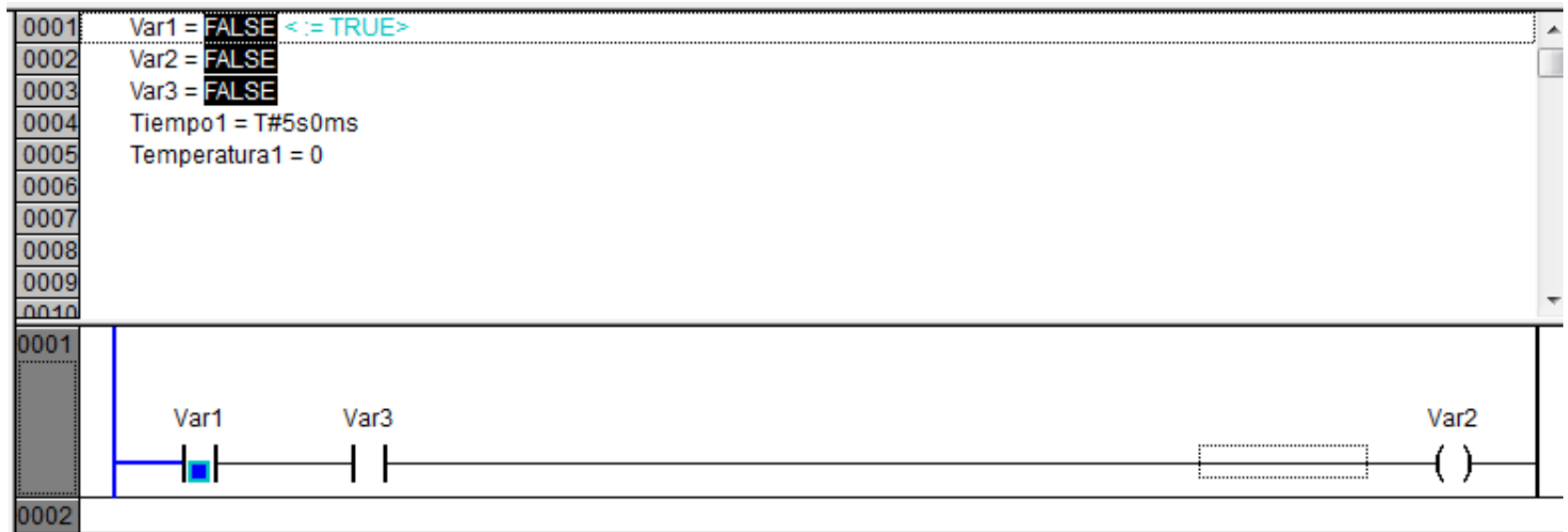
0001	Var1 = FALSE <:= TRUE>
0002	Var2 = FALSE
0003	Var3 = FALSE
0004	Tiempo1 = T#5s0ms
0005	Temperatura1 = 0
0006	
0007	
0008	
0009	
0010	

The bottom section is a ladder logic diagram. It features a normally open contact labeled 'Var1' with a blue square symbol, followed by a normally open contact labeled 'Var3'. The circuit then leads to a coil labeled 'Var2' with parentheses '()' next to it. A vertical blue line on the left indicates the start of the logic. An arrow points from the text 'Doble click en "Var1"' to the 'Var1' contact.

# Simulación del Programa

- Online: Escribir variables (Write values)

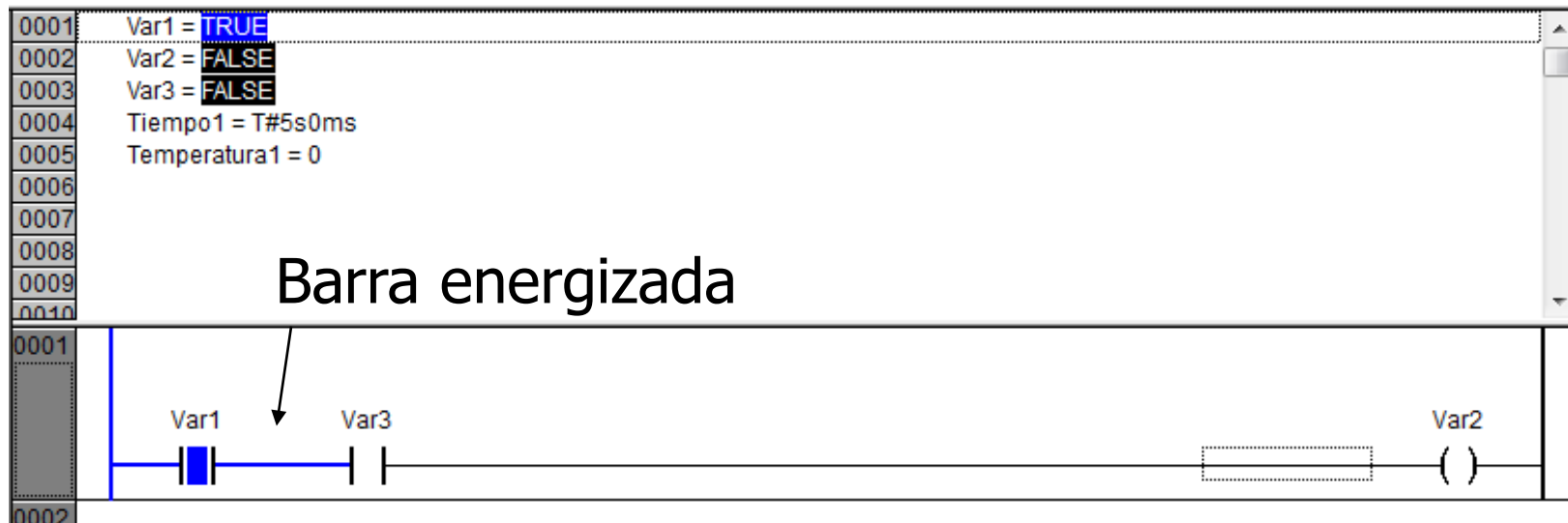
Escribir valores preparados: Ctrl+F7



# Simulación del Programa

- Online: Escribir variables (Write values)

Valor de la variable

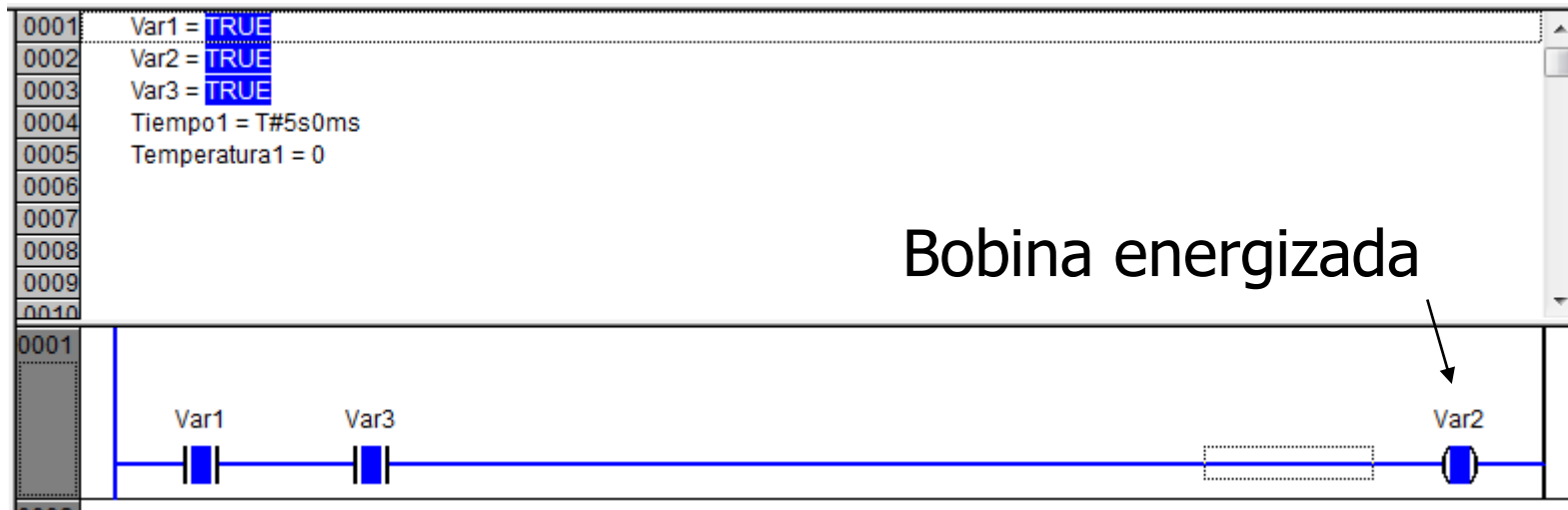


# Simulación del Programa

- Online: Escribir variables (Write values)

Doble click en Var 3

Escribir valores preparados: Ctrl+F7



# Simulación del Programa

- Online: Escribir variables (Write values)

Valor de la variable a  
escribir (preparado)



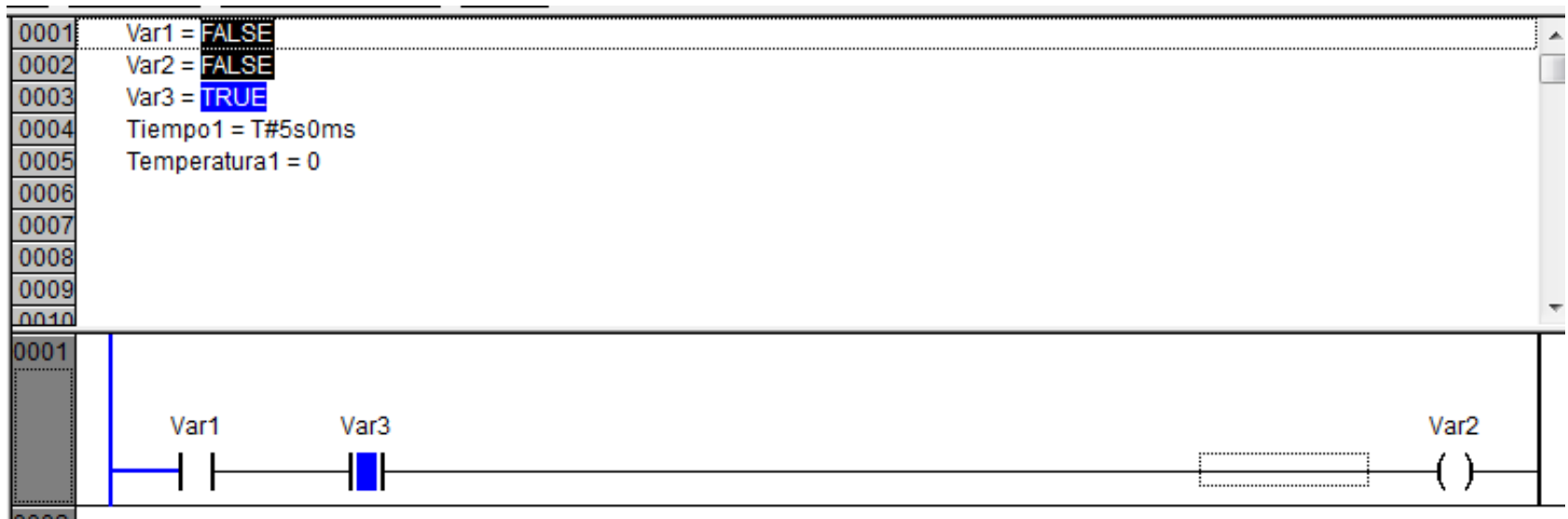
The screenshot displays a simulation interface with two main sections:

- Variable Declaration Table:** A table with 11 rows (0001 to 0010) and one column. The first three rows contain variable assignments: 0001: Var1 = TRUE <:= FALSE>, 0002: Var2 = TRUE, and 0003: Var3 = TRUE. The remaining rows (0004-0010) contain other declarations: Tiempo1 = T#5s0ms, Temperatura1 = 0, and empty rows.
- Ladder Logic Diagram:** A diagram for step 0001 showing a series connection of three normally open contacts labeled Var1, Var3, and Var2. The Var1 contact is highlighted with a blue background. A text label 'Doble click' with an arrow points to the Var1 contact.

# Simulación del Programa

- Online: Escribir variables (Write values)

Escribir valores preparados: Ctrl+F7





# Simulación del Programa

---

- Online: Forzar variables (Force values)
- Diferencia con Escribir:
  - Escribir (Ctrl+F7): asigna el valor una vez y libera la variable para ser manejada por el programa
  - Forzar (F7): asigna el valor en forma permanente sin importar el resultado del programa

¡Cuidado con su  
utilización!

# Simulación del Programa

- Online: Forzar variables (Force values)

Valor de la variable a forzar (preparado)

The screenshot displays a simulation environment with two main sections. The top section is a variable declaration table with the following content:

0001	Var1 = FALSE <:= TRUE>
0002	Var2 = FALSE
0003	Var3 = FALSE
0004	Tiempo1 = T#5s0ms
0005	Temperatura1 = 0
0006	
0007	
0008	
0009	
0010	

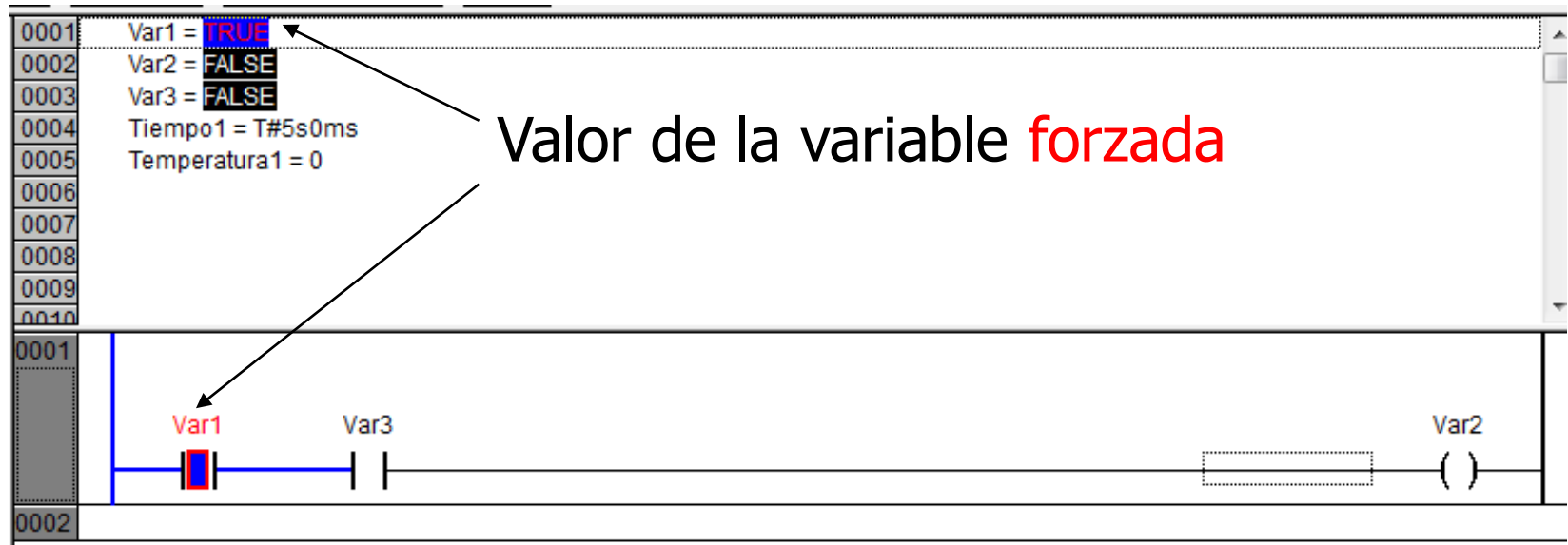
The bottom section shows a ladder logic diagram for step 0001. It features a normally open contact labeled 'Var1' with a blue square indicator below it, followed by a normally open contact labeled 'Var3'. The circuit then leads to a coil labeled 'Var2' with parentheses '()' next to it. An arrow points from the text 'Doble click en "Var1"' to the 'Var1' contact. Another arrow points from the text 'Valor de la variable a forzar (preparado)' to the '<:= TRUE>' value in the variable declaration table above.



# Simulación del Programa

- Online: Forzar variables (Force values)

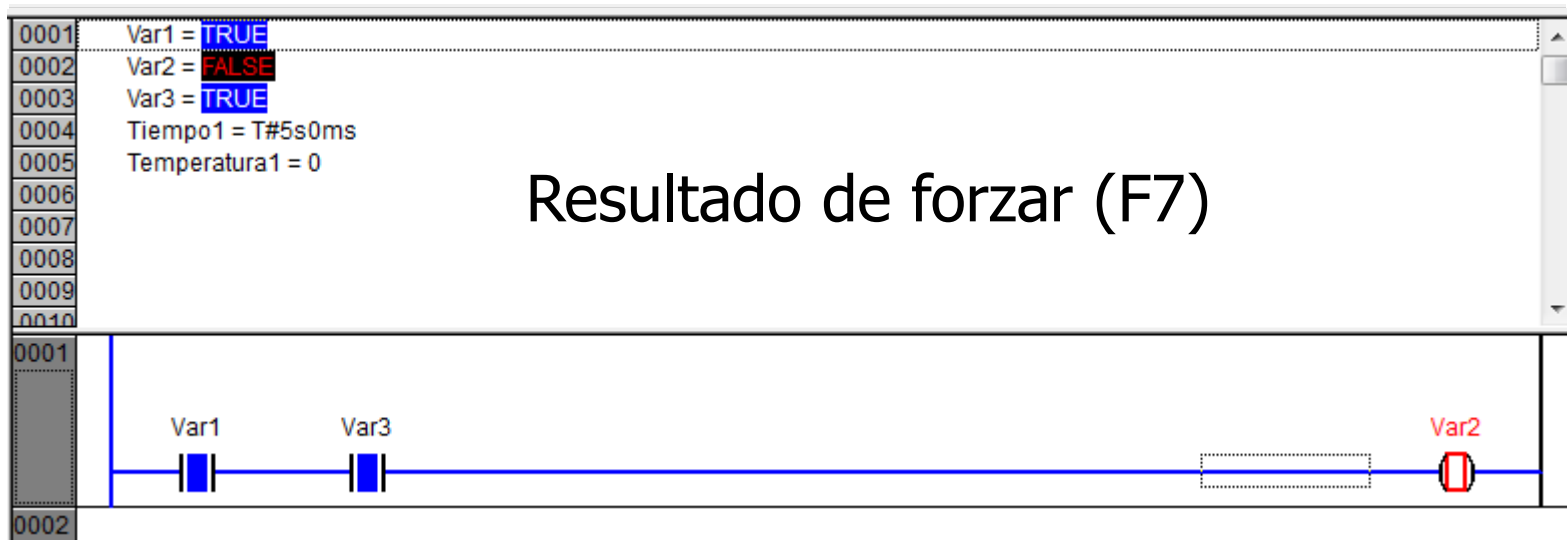
Forzar valores preparados: F7



# Simulación del Programa

- Online: Forzar variables (Force values)

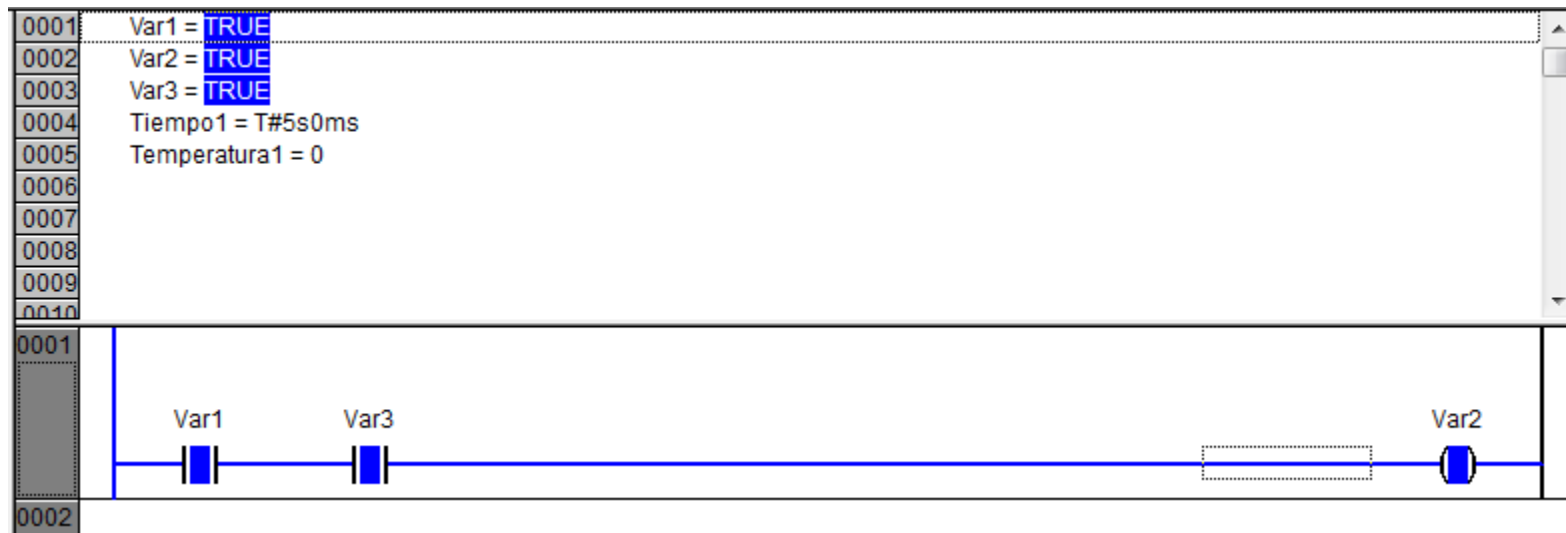
Escribir/Forzar variable asociada a la bobina



# Simulación del Programa

- Online: Forzar variables (Force values)

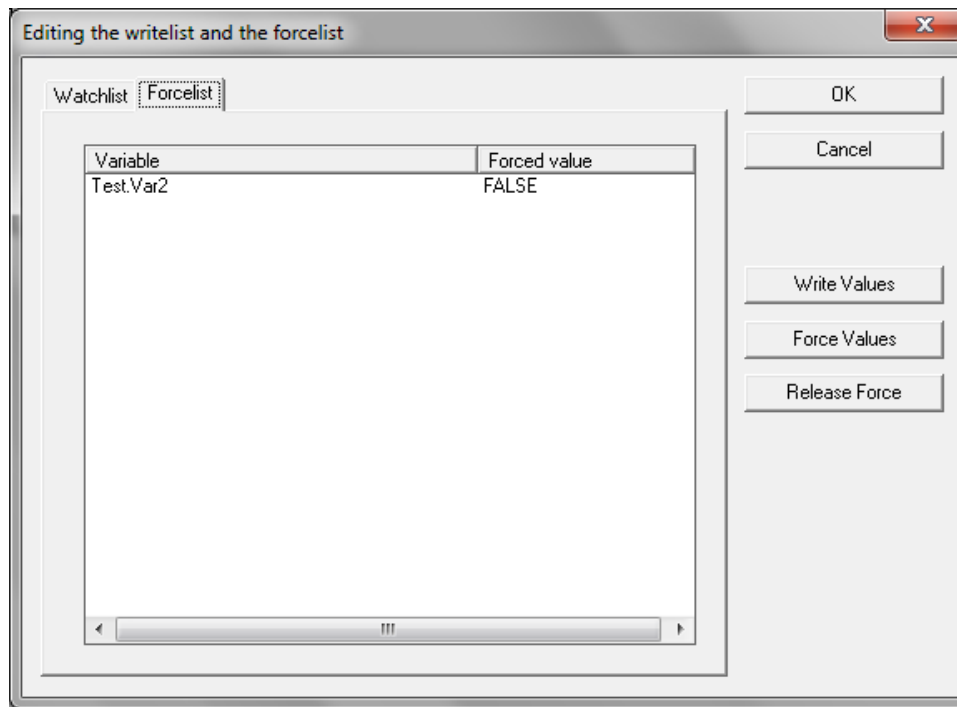
Liberar forzado de variables (Shift+F7)



# Simulación del Programa

- Online: Forzar variables (Force values)

Visualizar lista de forzados (Ctrl+Shift+F7)





# Shortcuts

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- F1 - Ayuda
- F2 – Input Assistant
- F11 – Build - Compilar
- F5 – Run – Ejecutar el programa
- Ctrl+F7 – Write values – Escribir
- F7 – Force values – Forzar
- Shift+F7 – Release value – Liberar forzado

# Programa en LD

- Ejemplo con Variables de I/O

Variables globales asociadas a entradas/salidas

The screenshot shows a software interface for programming a PLC. On the left is a project tree with folders for 'Resources', 'Global Va', 'OBIO', and 'Variat'. The main window displays a variable declaration table and a ladder logic program.

0001	PROGRAM Test
0002	VAR
0003	Var1: BOOL;
0004	Var3: BOOL;
0005	Var2: BOOL;
0006	END_VAR
0007	
0008	
0000	

← Variables globales no declaradas en programa

0001

Var1	Var3	Var2
		( )

0002

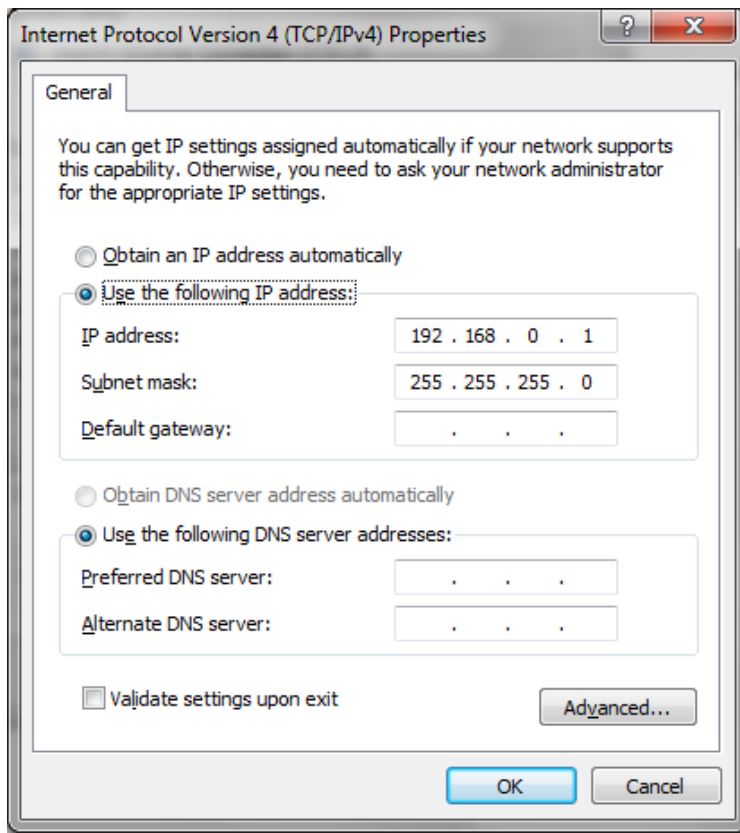
Comentario: Ejemplo con variables de I/O ← Comentario

DI0	DI1	DO0
		( )

Nuevo escalón

# Conexión Ethernet al PLC

- IP de PC: 192.168.0.XXX
- Mask: 255.255.255.0
- IP de PLC: 192.168.0.YYY



Set	IP PLC
1	192.168.0.10
2	192.168.0.20
3	192.168.0.30
4	192.168.0.40
5	192.168.0.50
6	192.168.0.60

# Conexión Ethernet al PLC

- Objeto AC500\_PM554...
- Botón derecho, "Communication Settings"
- Colocar dirección IP del PLC

The screenshot displays the ABB Automation Builder 2.0 interface. The main window shows a project tree with the following structure:

- IIE\_PLCS
  - AC500\_PM554 (PM554-ETH) (highlighted with a red circle)
    - AC500
      - App
        - OBIO (8DI+6DO)
        - IO\_Bus
        - Interfaces
          - COM1\_Online\_Access\_1 (COM1 - COM1)
          - COM2\_Modbus (COM2 - None)
        - Ethernet
          - ETH1 (ETH1)
          - Protocols (Protocols)
            - Modbus\_TCP\_IP\_Server (Modbus)

A dialog box titled "Communication Settings for 'AC500\_PM554'" is open, showing the following configuration:

- IP Address: 192 . 168 . 0 . 10
- Use advanced settings
- Buttons: OK, Cancel

The status bar at the bottom indicates: Messages - Total 0 error(s), 0 warning(s), 0 message(s). The message list shows: All messages, 0 error(s), 0 warning(s), 0 message(s).





# Descarga al PLC

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- Desactivar modo Simulación
- Menu: Online -> Login
- Menu: Online -> Download
- Descargar programa al PLC, se sobrescribe programa en ejecución

¡Cuidado con un  
PLC en marcha!

- Menu: Online -> Run



# Descarga al PLC

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- Salvar programa en Memoria Flash
- Menu: Online -> Create boot project
- El programa se ejecuta luego de encendido el PLC