بسم الله الرحمن الرحيم

PCS Platform 2022

طاقة الشمال

North Lebanon Alternative Power

www.nlap-lb.com

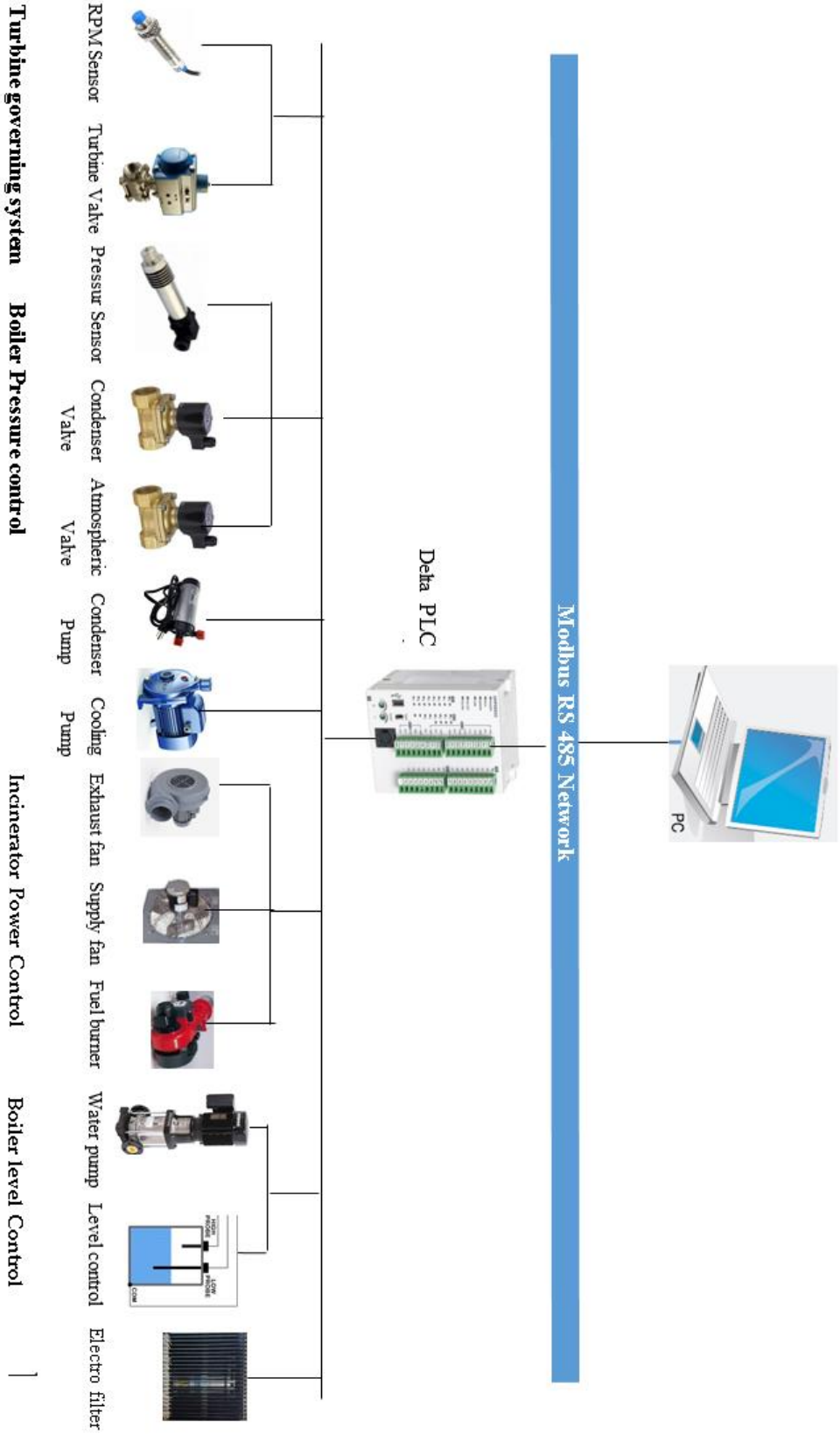
نظام التحكم

Process Control System (PCS) for NLAP incineration plant
Platform System

Last update: Sunday, May 15, 2022

نظام التحكم بمحطة حرق النفايات وتوليد الطاقة عن طريق الحاسوب من خلال ال PLC

(Process Control system of station for waste incineration & Power generation by PLC & PC)



Contents

1 DELTA PLC

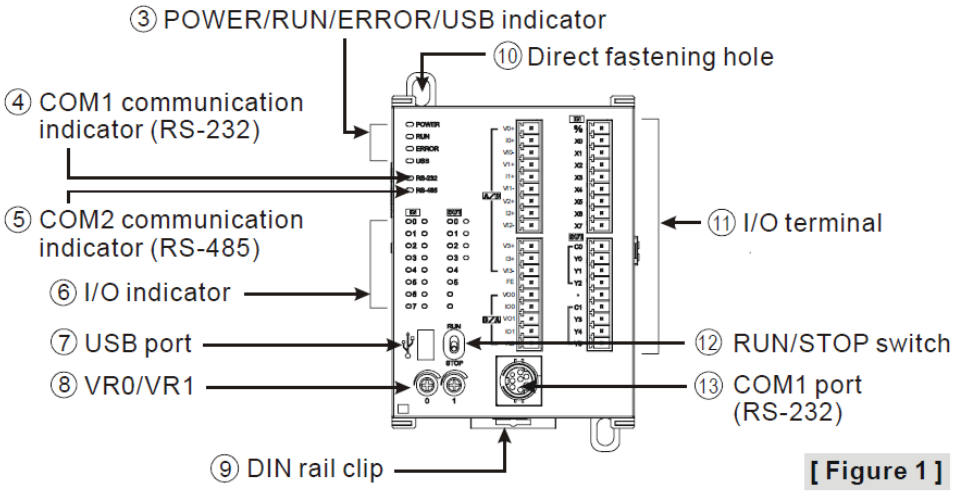
1.1 DELTA DVP20SX211R

1.2 Specifications

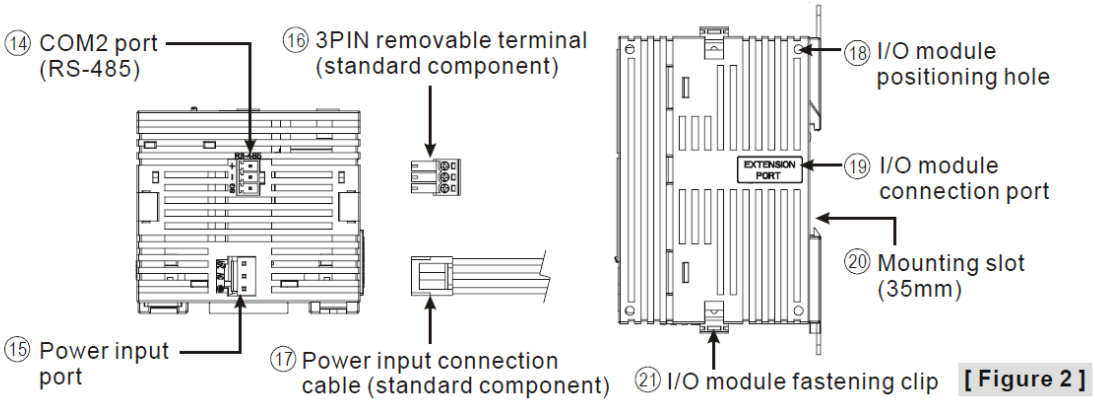
_ Program capacity: 16k steps/Data register: 10k words
_ Higher execution speed compared to the competition: LD: 0.35μs, MOV: 3.4μs
_ Built-in mini-USB, RS-232 and RS-485 ports (Master/Slave) Supports standard MODBUS ASCII/RTU protocol and PLC Link function
_ Supports real time clock for version 2.0 and above (no battery required) It operates for at least one week after power off.
_Built-in 4 analog inputs / 2 analog outputs / 8 Digital Inputs & 6 Digital Outputs (Relay)
_ Supports DVP-S series left-side and right-side modules
_Power supply voltage: 24V DC

Built-in Analog I/O			
Analog Input		**Analog Output**	
Channels	4	**Channels**	2
Resolution	12-bit	**Resolution**	12-bit
Spec.	-20 ~ 20 mA or -10 ~ 10 V or 4 ~ 20 mA	**Spec.**	0 ~ 20 mA or -10 V ~ 10 V or 4 ~ 20 mA

1.3 Product Profile



[Figure 1]



[Figure 2]

1.4 Point Specifications

1.4.1 Input point Specifications

Items \ Spec.		Input Point		
		24VDC (-15% ~ 20%) single common port input		
Input No.		X0, X2	X1, X3	X4 ~ X7
Input type		DC (SINK or SOURCE)		
Input Current (± 10%)		24VDC, 5mA		
Input impedance		4.7K Ohm		
Action level	Off→On	> 15VDC		
	On→Off	< 5VDC		
Response time	Off→On	< 2.5μs	< 10μs	< 20us
	On→Off	< 5μs	< 20μs	< 50us
Filter time		Adjustable within 0 ~ 20ms by D1020 (Default: 10ms)		

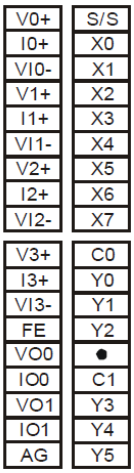
1.4.2 Output point Specifications

Items \ Spec.		Output Point
		Relay
Output No.		Y0 ~ Y5
Max. frequency		1Hz
Working voltage		250VAC, < 30VDC
Max. load	Resistive	1.5A/1 point (5A/COM)
	Inductive	#2
	Lamp	20WDC/100WAC
Response time	Off→On	Approx. 10 ms
	On→Off	

1.4.3 Analog input & Analog output Specifications

Items	Analog Input (A/D)			Analog Output (D/A)		
	Voltage	Current		Voltage	Current	
Analog I/O range	±10V	±20mA	4 ~ 20mA#1	±10V	0 ~ 20mA	4 ~ 20mA#1
Digital conversion range	±2,000	±2,000	0 ~ +2,000	±2,000	0 ~ +4,000	0 ~ +4,000
Resolution #2	12-bit					

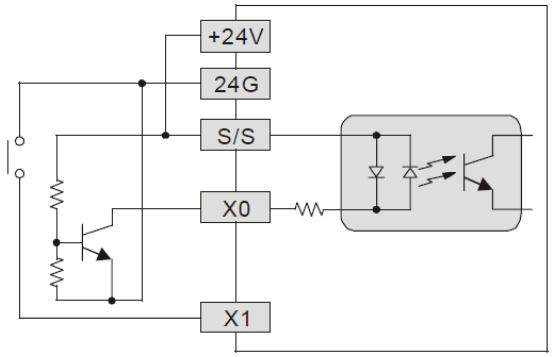
1.5 Point Wiring



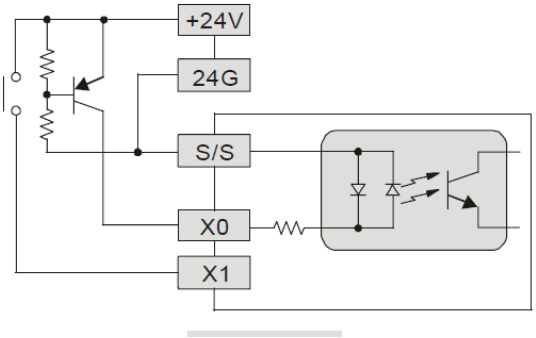
1.5.1 Input Point Wiring

There are 2 types of DC inputs, SINK and SOURCE. (See the example below. For detailed point configuration, please refer to the specification of each model.)

• DC Signal IN – SINK mode
Input point loop equivalent circuit

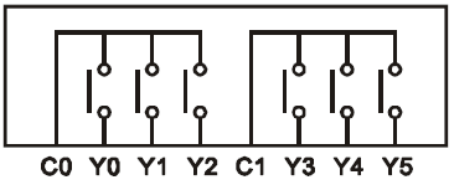


• DC Signal IN – SOURCE mode
Input point loop equivalent circuit

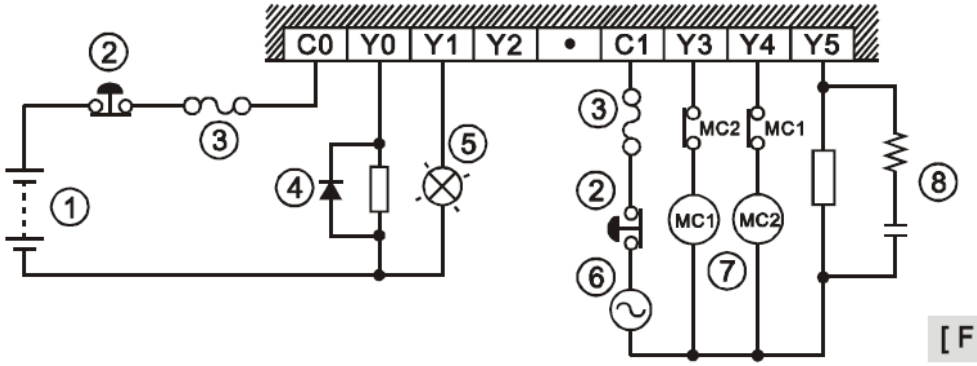


1.5.2 Output Point Wiring

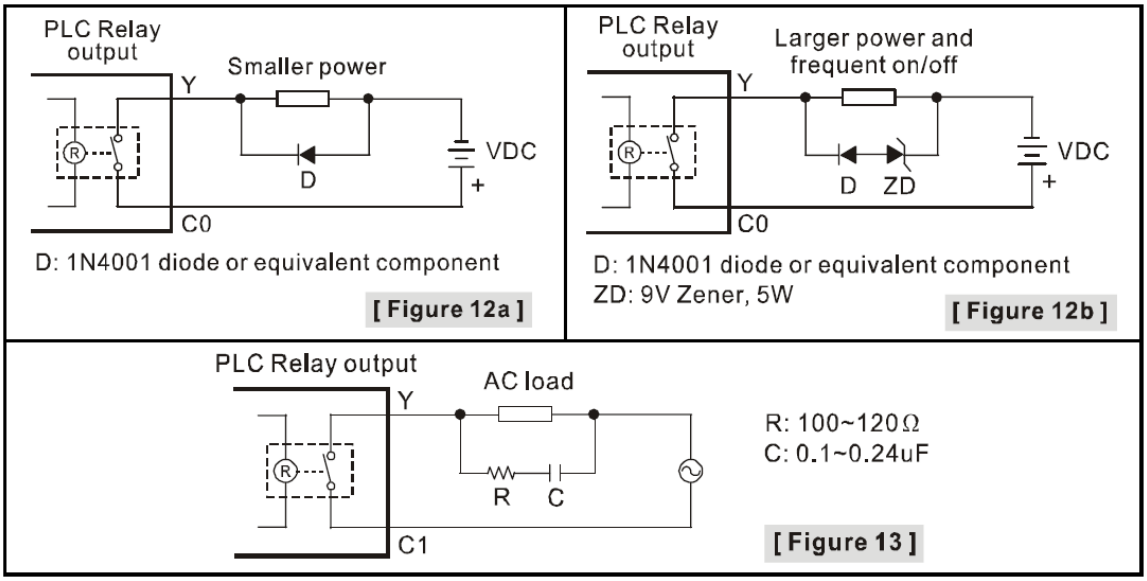
Output terminals, Y0, Y1, and Y2, of relay models use C0 common port; Y3, Y4, and Y5 use C1 common port; as shown in the Figure. When output points are enabled, their corresponding indicators on the front panel will be on.



Relay (R) output circuit wiring

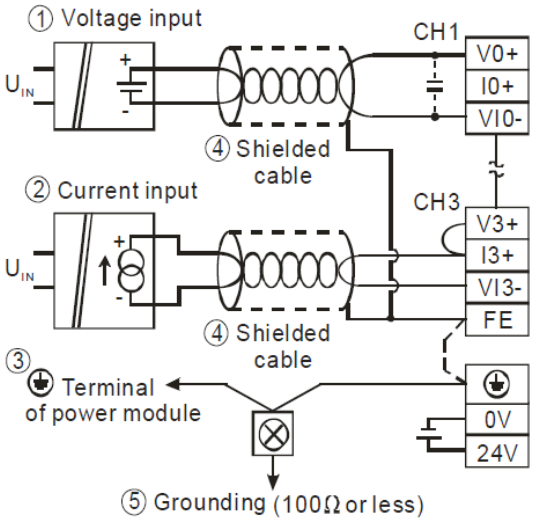


[Figure 11]



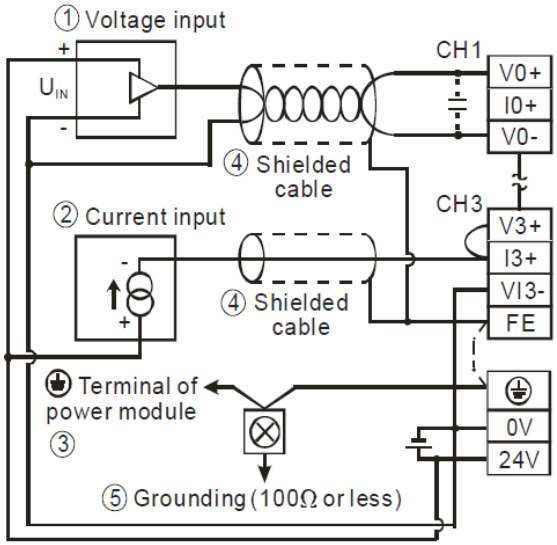
1.5.3 Analog input A/D & Analog output D/A External Wiring

• A/D: Active



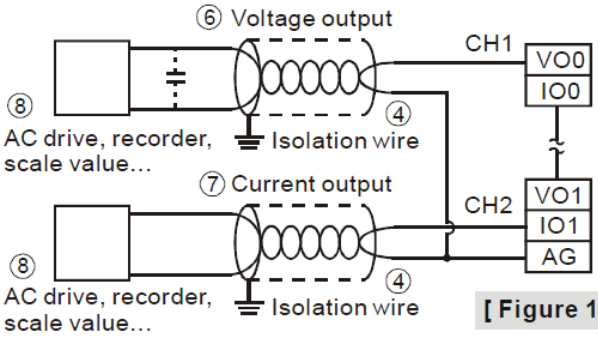
[Figure 16]

• A/D: Passive



[Figure 17]

• D/A



[Figure 18]

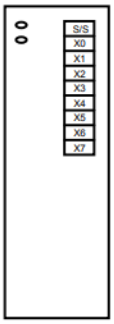
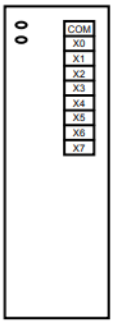
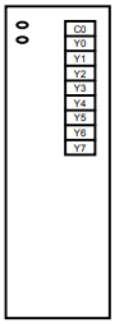
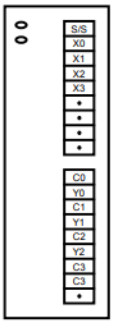
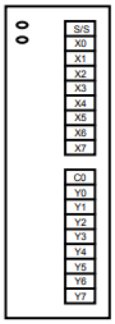
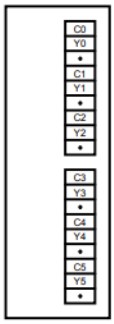
1.6 DVP Slim Digital I/O Extension Unit

Model Explanation & Peripherals Thank you for choosing DVP-SS/SA/SX/SC series PLC. The 6~ 16 points extension offered by SS/SA/SX/SC series make the maximum digital I/O extension including the MPU reach 128 points. In addition, maximum 8 special modules (AD/DA/PT/TC/XA/RT) are extendable to DVP Slim series.

1.6.1 Model Numbers

Model	Input Unit		Output Unit	
	Point	Type	Point	Type
DVP08SP11R	4	DC Type Sink/Source	4	Relay
DVP16SP11R	8		8	
DVP08SP11T	4		4	Transistor
DVP16SP11T	8		8	
DVP08SM10N	8	100~120VAC	0	None
DVP08SM11N	8	DC Type Sink/Source	0	None
DVP08SN11R	0		8	Relay
DVP08SN11T	0		8	Transistor
DVP06SN11R	0		6	Relay

1.6.2 Terminal layout

DVP08SM11N	DVP08SM10N	DVP08SN11R DVP08SN11T	DVP08SP11R DVP08SP11T	DVP16SP11R DVP16SP11T	DVP06SN11R
					

1.6.3 Input/Output points numbering order

No matter how many points of MPU, the input of the first I/O extension unit will start from X20 and output will start from Y20.

System combined Example:

PLC	Models	Input Points	Output Points	Input Numbering	Output Numbering
MPU	SS/SA/SX/SC	8	4/6	X0~X7	Y0~Y5
EXT1	DVP16SP11T	8	8	X20~X27	Y20~Y27
EXT2	DVP08SM11N	8	0	X30~X37	-
EXT3	DVP06SM11R	0	6	-	Y30~Y35
EXT4	DVP08SP11R	4	4	X40~X43	Y40~Y43

Extension unit 3 DVP06SM11R will be used as 8 outputs, the higher 2 numbers of output points have no corresponding output points. Extension unit 4 DVP08SP11R will be used as 8 input points/8 output points, the higher part numbers of inputs points and output points have no corresponding input/output points. It is recommended to place them at the end of serial wiring, so that I/O points numbering will be continuous.

1.7 DVP20SX2 Memory Map

Specifications					
Control Method				Stored program, cyclic scan system	
I/O Processing Method				Batch processing method (when END instruction is executed)	
Execution Speed				LD instructions – 0.54μs, MOV instructions – 3.4μs	
Program language				Instruction List + Ladder + SFC	
Program Capacity				15872 steps	
Bit Contacts	X	External inputs		X0~X377, octal number system, 256 points max.	Total 480+32 I/O(*4)
	Y	External outputs		Y0~Y377, octal number system, 256 points max.	
	M	Auxiliary relay	General	M0~M511, 512 points, (*1) M768~M999, 232 points, (*1) M2000~M2047, 48 points, (*1)	Total 4096 points
			Latched	M512~M767, 256 points, (*2) M2048~M4095, 2048 points, (*2)	
			Special	M1000~M1999, 1000 points, some are latched	
	T	Timer	100ms (M1028=ON, T64~T126: 10ms)	T0~T126, 127 points, (*1) T128~T183, 56 points, (*1)	Total 256 points
				T184~T199 for Subroutines, 16 points (*1)	
				T250~T255(accumulative), 6 points (*1)	
			10ms (M1038=ON, T200~T245: 1ms)	T200~T239, 40 points, (*1)	
				T240~T245(accumulative), 6 points, (*1)	
			1ms	T127, 1 points, (*1) T246~T249(accumulative), 4 points, (*1)	

	C	Counter	16-bit count up	C0~C111, 112 points, (*1) C128~C199, 72 points, (*1)	Total 233 points
				C112~C127, 16 points, (*2)	
			32-bit count up/down	C200~C223, 24 points, (*1)	
				C224~C232, 9 points, (*2)	
			32bit high-speed count up/down — Soft-ware	C235~C242, 1 phase 1 input, 8 points, (*2)	Total 22 points
				C233~C234, 2 phase 2 input, 2 points, (*2)	
			32bit high-speed count up/down — Hard-ware	C243~C244, 1 phase 1 input, 2 points, (*2)	
				C245~C250, 1 phase 2 input, 6 points, (*2)	
				C251~C254 2 phase 2 input, 4 points, (*2)	
	S	Step point	Initial step point	S0~S9, 10 points, (*2)	Total 1024 points
			Zero point return	S10~S19, 10 points (use with IST instruction), (*2)	
			Latched	S20~S127, 108 points, (*2)	
			General	S128~S911, 784 points, (*1)	
			Alarm	S912~S1023, 112 points, (*2)	

Specifications					
Word Register	T	Current value		T0~T255, 256 words	
	C	Current value		C0~C199, 16-bit counter, 200 words	
				C200~C254, 32-bit counter, 55 words	
	D	Data register	General	D0~D407, 408 words, (*1) D600~D999, 400 words, (*1) D3920~D9799, 5880 words, (*1)	Total 10000 points
			Latched	D408~D599, 192 words, (*2) D2000~D3919, 1920 words, (*2)	
			Special	D1000~D1999, 1000 words, some are latched	
			Righ-side special module	D9900~D9999, 100 words (*1) (*6)	
			Left-side special module	D9800~D9899, 100 words (*1) (*7)	
			Index	E0~E7, F0~F7, 16 words, (*1)	
Pointer	N	Master control loop		N0~N7, 8 points	
	P	Pointer		P0~P255, 256 points	
	I	Interrupt Service	External interrupt	I000/I001(X0), I100/I101(X1), I200/I201(X2), I300/I301(X3), I400/I401(X4), I500/I501(X5), I600/I601(X6), I700/I701(X7), 8 points (01: rising-edge trigger ⌋⌈, 00: falling-edge trigger ⌉⌊)	
			Timer interrupt	I602~I699, I702~I799, 2 points (Timer resolution = 1ms) I805~I899, 1 point (Timer resolution = 0.1ms) (Supported by V2.00 and above)	
			High-speed counter interrupt	I010, I020, I030, I040, I050, I060, I070, I080, 8 points	
			Communication interrupt	I140(COM1), I150(COM2), I160(COM3), 3 points, (*3)	

Constant	K	Decimal	K-32,768 ~ K32,767 (16-bit operation), K-2,147,483,648 ~ K2,147,483,647 (32-bit operation)
	H	Hexadecimal	H0000 ~ HFFFF (16-bit operation), H00000000 ~HFFFFFFFF (32-bit operation)
Serial Ports		SA2	COM1: built-in RS-232 ((Master/Slave) COM2: built-in RS-485 (Master/Slave) COM3: built-in RS-485 (Master/Slave) COM1 is typically the programming port.
		SX2	COM1: built-in RS-232 ((Master/Slave) COM2: built-in RS-485 (Master/Slave) COM3: built-in USB (Slave) COM1 is typically the programming port.
Real Time Clock			Year, Month, Day, Week, Hours, Minutes, Seconds
Special I/O Modules			Right side: Up to 8 I/O modules can be connected Left side: Up to 8 high-speed I/O module can be connected
File Register (*5)			K0~K4999, 5000 points (*2)

1.8 PLC Device Address

Device	Range	Effective Range			MODBUS Address	Address
		ES2/EX2	SS2	SA2/SE SX2		
S	000~255	000~1023	000~1023		000001~000256	0000~00FF
S	256~511				000257~000512	0100~01FF
S	512~767				000513~000768	0200~02FF
S	768~1023				000769~001024	0300~03FF
X	000~377 (Octal)	000~377	000~377		101025~101280	0400~04FF
Y	000~377 (Octal)	000~377	000~377		001281~001536	0500~05FF
T	000~255 bit	000~255	000~255		001537~001792	0600~06FF
	000~255 word	000~255	000~255		401537~401792	0600~06FF
M	000~255	0000 ~ 4095	0000~4095		002049~003584	0800~08FF
M	256~511					0900~09FF
M	512~767					0A00~0AFF
M	768~1023					0B00~0BFF
M	1024~1279					0C00~0CFF
M	1280~1535					0D00~0DFF

Device	Range	Effective Range			MODBUS Address	Address
		ES2/EX2	SS2	SA2/SE SX2		
M	1536~1791	0000 ~ 4095	0000~4095		045057~047616	B000~B0FF
M	1792~2047					B100~B1FF
M	2048~2303					B200~B2FF
M	2304~2559					B300~B3FF
M	2560~2815					B400~B4FF
M	2816~3071					B500~B5FF
M	3072~3327					B600~B6FF
M	3328~3583					B700~B7FF
M	3584~3839					B800~B8FF
M	3840~4095					B900~B9FF
C	000~199 (16-bit)	000~199	000~199		003585~003784	0E00~0EC7
		000~199	000~199		403585~403784	0E00~0EC7
C	200~255 (32-bit)	200~255	200~255		003785~003840	0EC8~0EFF
		200~255	200~255		401793~401903 (Odd address valid)	0700~076F

D	000~255	0000 ~ 9999	0000 ~ 4999	0000 ~ 9999	404097~405376	1000~10FF
D	256~511					1100~11FF
D	512~767					1200~12FF
D	768~1023					1300~13FF
D	1024~1279					1400~14FF
D	1280~1535				405377~408192	1500~15FF
D	1536~1791					1600~16FF
D	1792~2047					1700~17FF
D	2048~2303					1800~18FF
D	2304~2559					1900~19FF
D	2560~2815					1A00~1AFF
D	2816~3071					1B00~1BFF
D	3072~3327					1C00~1CFF
D	3328~3583					1D00~1DFF
D	3584~3839					1E00~1EFF
D	3840~4095					1F00~1FFF
D	4096~4351				436865~440960	9000~90FF
D	4352~4999					9100~91FF
D	4608~4863					9200~92FF
D	4864~5119					9300~93FF
D	5120~5375		N/A			9400~94FF
D	5376~5631					9500~95FF
D	5632~5887					9600~96FF
D	5888~6143					9700~97FF

D	6144~6399	0000 ~ 9999	N/A	0000 ~ 9999	436865~440960	9800~98FF
D	6400~6655					9900~99FF
D	6656~6911					9A00~9AFF
D	6912~7167					9B00~9BFF
D	7168~7423					9C00~9CFF
D	7424~7679					9D00~9DFF
D	7680~7935					9E00~9EFF
D	7936~8191					9F00~9FFF
D	8192~8447				440961~442768	A000~A0FF
D	8448~8703					A100~A1FF
D	8704~8959					A200~A2FF
D	8960~9215					A300~A3FF
D	9216~9471					A400~A4FF
D	9472~9727					A500~A5FF
D	9728~9983					A600~A6FF
D	9984~9999					A700~A70F
D	10000~11999	Applicable to DVP-SE			442769~444768	A710~AEDF

1.9 Instructions

Instruction	Function	Operand	Execution speed (us)		Steps
			ES2/EX2/SS2 SA2/SX2	SE	
LD	Load NO contact	X, Y, M, S, T, C	0.76	0.64	1~3
LDI	Load NC contact	X, Y, M, S, T, C	0.78	0.68	1~3
AND	Connect NO contact in series	X, Y, M, S, T, C	0.54	0.58	1~3
ANI	Connect NC contact in series	X, Y, M, S, T, C	0.56	0.62	1~3
OR	Connect NO contact in parallel	X, Y, M, S, T, C	0.54	0.62	1~3
ORI	Connect NC contact in parallel	X, Y, M, S, T, C	0.56	0.64	1~3
ANB	Connect a block in series	N/A	0.68	0.68	1
ORB	Connect a block in parallel	N/A	0.76	0.76	1
MPS	Start of branches. Stores current result of program evaluation	N/A	0.74	0.68	1
MRD	Reads the stored current result from previous MPS	N/A	0.64	0.54	1
MPP	End of branches. Pops (reads and resets) the stored result in previous MPS	N/A	0.64	0.54	1
OUT	Output coil	Y, S, M	0.88	0.68	1~3
SET	Latches the ON status	Y, S, M	0.76	0.68	1~3
RST	Resets contacts, registers or coils	Y, M, S, T, C, D, E, F	2.2	1.04	3
MC	Master control Start	N0~N7	1	0.8	3
MCR	Master control Reset	N0~N7	1	0.8	3
END	Program End	N/A	1	0.8	1
NOP	No operation	N/A	0.4	0.5	1
P	Pointer	P0~P255	0.4	0.5	1
I	Interrupt program pointer	I□□□	0.4	0.5	1
STL	Step ladder start instruction	S	2.2	2	1
RET	Step ladder return instruction	N/A	1.6	1.4	1
NP	Negative contact to Positive contact	N/A	1.66	0.72	1
PN	Positive contact to Negative contact	N/A	1.62	0.72	1

2 WPL Soft

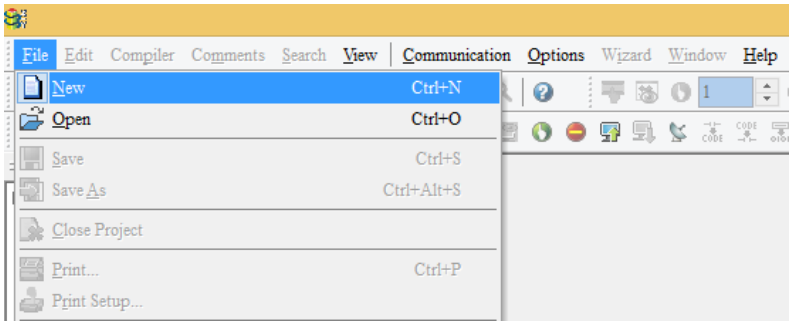
البرنامج المخصص لبرمجة ال PLC هو "WPL Soft"

2.1 الوصلة المخصصة لبرمجة ال PLC

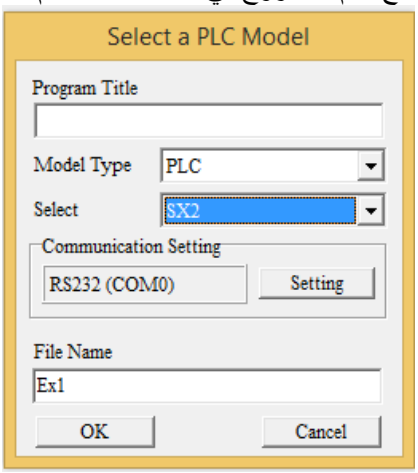
نحتاج لوصلة UC-RRG020-12A مع التعريف من اجل توصيل الحاسوب بال PLC لبرمجتها.

2.2 كيفية انشاء برنامج لل PLC

نضغط على File – New

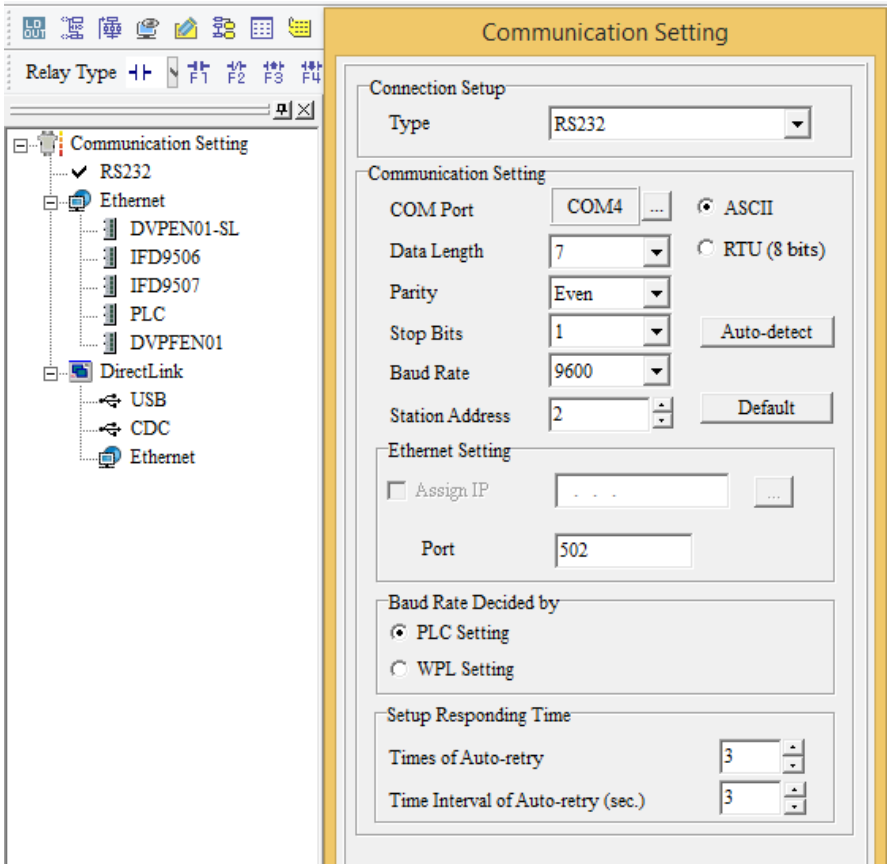


نختار نوع ال PLC (SX2) ونضع اسم للمشروع في File Name ثم نضغط OK .



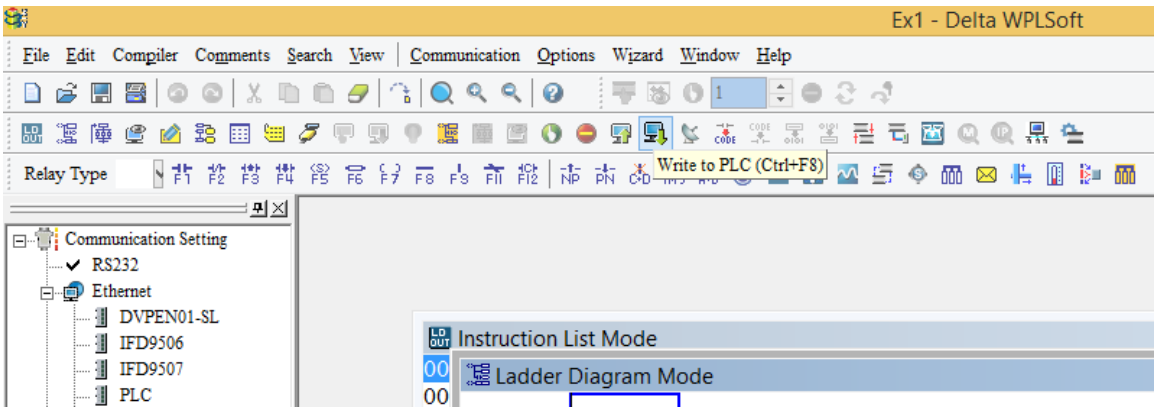
2.3 خصائص تتعلق بتنزيل البرنامج على ال PLC

- بعد ربط الحاسوب بال PLC نضغط على RS232 في Communication setting على يسار البرنامج لتفقد وجود ال Port (COM4) لكي تتمكن من تنزيل البرنامج.
- يجب اختيارال station address الخاص بال PLC (قبل استعمال ال PLC يكون ال address 1 ويمكن تغيره من خلال البرمجة) .
- يمكنا اختيار برمجة ال PLC اما ASCII او RTU .



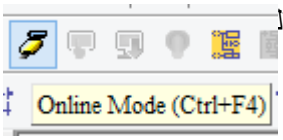
2.4 تنزيل البرنامج عل ال PLC

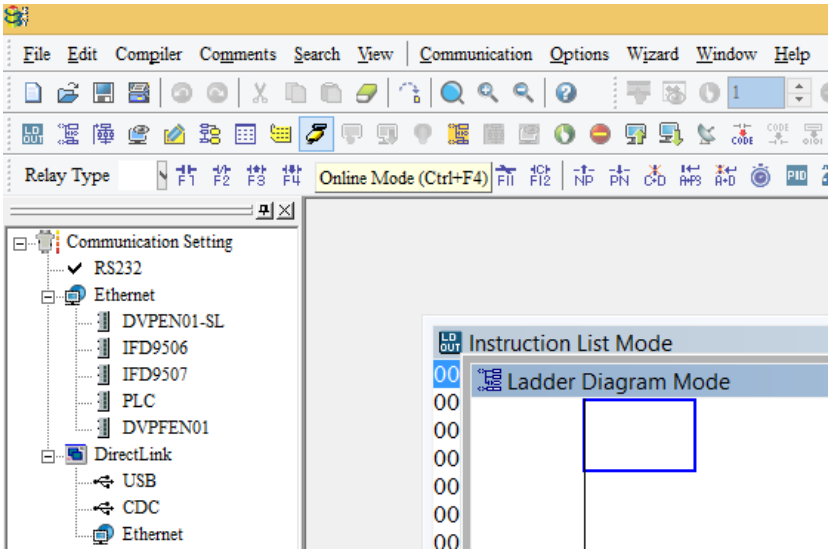
لتنزيل البرنامج نضغط الزر التالي 



2.5 مراقبة عمل ال PLC

لمراقبة عمل البرنامج في ال PLC نضغط على الز التال





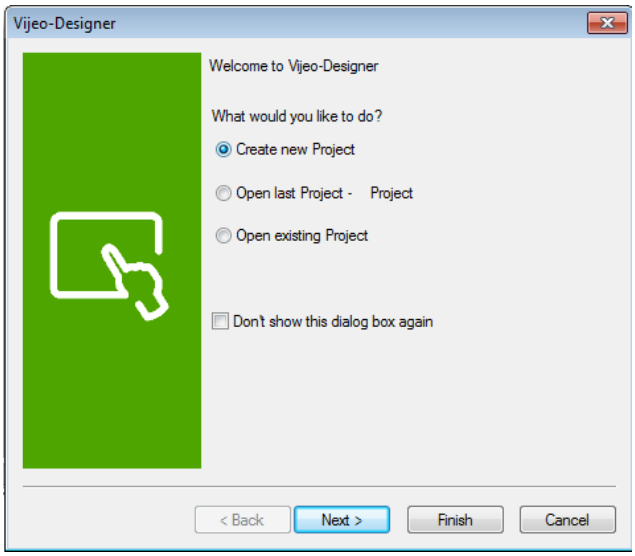
3 Vijeo designer software

Vijeo Designer is a state-of-the-art software application with which you can create operator panels and configure operating parameters for human machine interface (HMI) devices. It provides all the tools needed to design an HMI project, from the data acquisition to the creation and display of animated drawings.

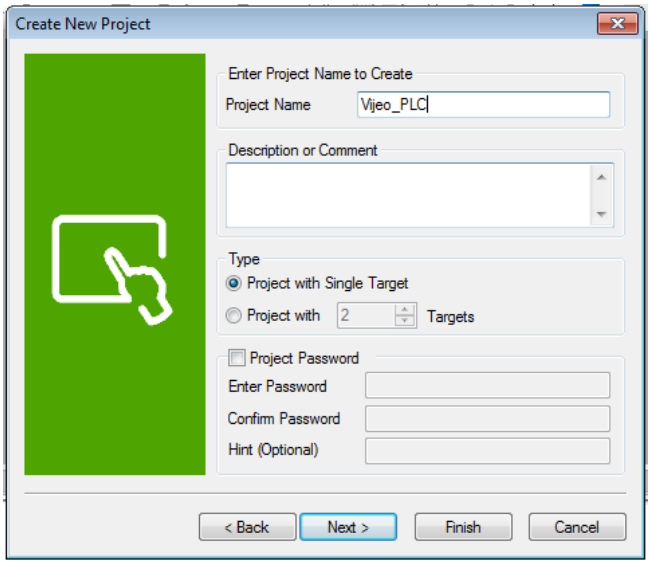
Realization of an application
The procedures to follow to implement an application are:
1- Create a new project,
2- Selection of the communication protocol.
3- Creating Variables
4- Create a Command Button
5- Create an alarm lamp.
6- Create a Numeric Indicator

3.1 Create a new project

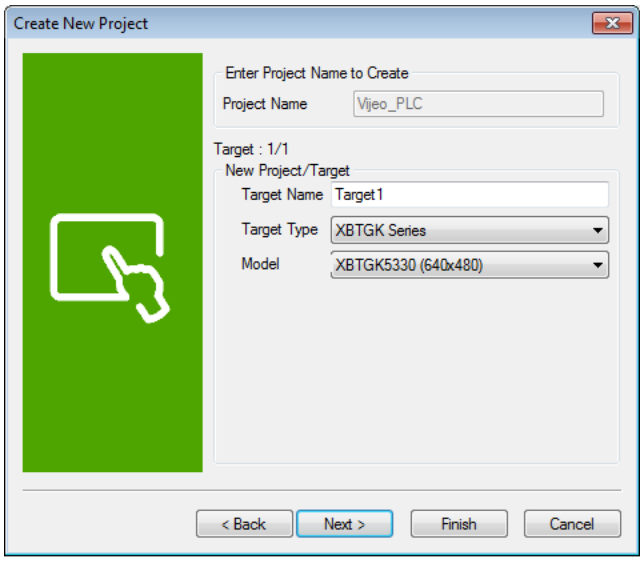
Create a new project, this dialog box appears when you start Vijeo Designer. Make sure Create new project is selected and click "Next" to continue.



Enter the name of your project and click **Next**. In our case, type "**Manual**".

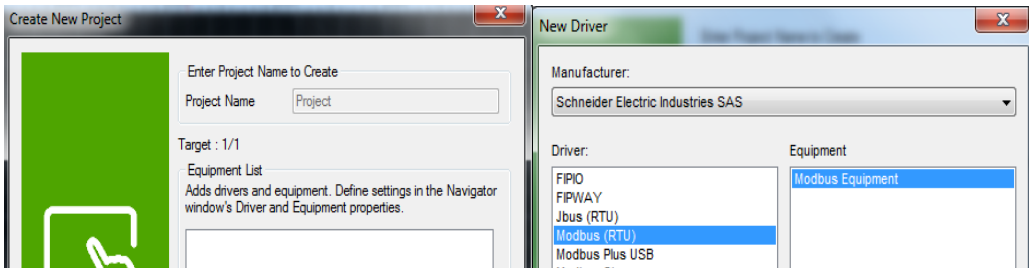


Select the target type …, and the model ..., Click **Next, Next.**



3.2 Selection of the communication protocol

Select the relevant driver for the device type using the Add button. Select “Schneider Electric Industrie SAS” as the Manufacturer, “ Modbus_(RTU)” as the driver, and “Modbus Equipment” as the Equipment. Then click on Finish.



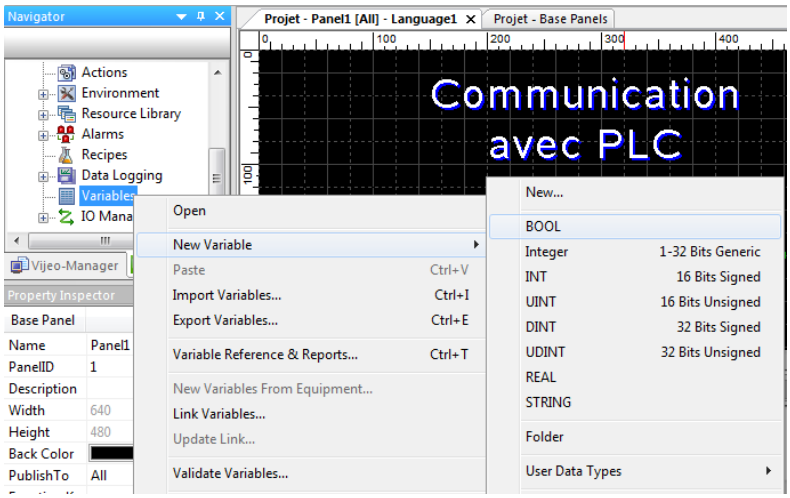
3.3 Creating Variables

A variable is a memory address indicated by a name. Vijeo Designer handles the following types of variables:

- BOOL
- INT (16 bit signed integer)
- UINT (16 bit unsigned integer)
- DINT (32 bit signed integer)
- UDINT (32 bit unsigned integer)
- Integer (1-32 bit generic integer)
- REAL
- STRING
- User Data Type (Array or Structure)
- Folder
- Block INT (16 bit signed block integer)
- Block UINT (16 bit unsigned block integer)
- Block DINT (32 bit signed block integer)
- Block Integer (1-32 bit generic block integer)
- Block REAL

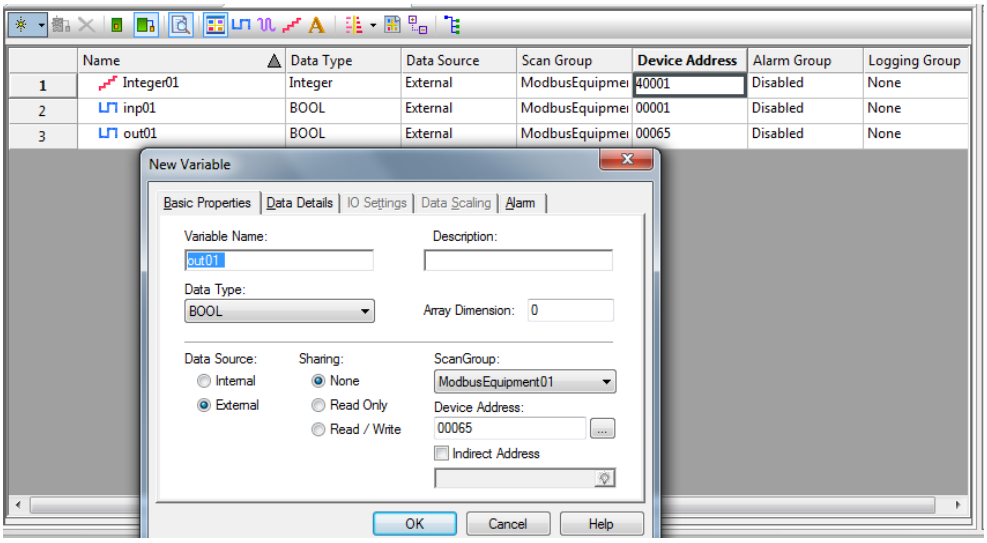
Vijeo Designer uses the variables to communicate with devices. You can also define internal variables that will only be used by Vijeo Designer.

Right-click the "**Variables**" node in the "**Navigator**" window, select "**New Variable**" and click "**BOOL**".



Change the name of the Boolean-type "**BOOL01**" variable. In this window, specify the variable source (**external** in this case). In the **Device Address** property,

Right-click the "**Variables**" node in the "**Navigator**" window, select "**New Variable**" and click "**Integer**".
Change the name of the Boolean-type " **Integer 01**" variable to "High_level" in the Property Inspector. In this window, specify the variable source (**external** in this case). In the **Device Address** property,



3.4 Create a Command Button

Select the "Switch" icon in the toolbar and draw an area on the panel where the button will be placed.
Select the "**Switch**" icon in the toolbar and use it to draw a **rectangle**, defining an area on the screen where it will be placed.

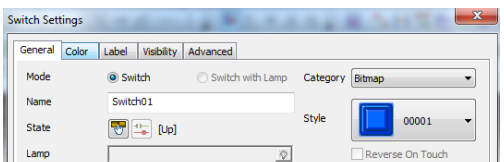
The **Switch Settings** window is displayed. Configure the properties as shown in the screen below:

In the **General** window:

- Select **00001** as the switch style.

Under the "**When To**[illegible]**h**" tab, click the icon and:

- Select the "**BOOL**" "Emptying" variable,
- Select "**Set**" which will switch ON the Emptying bit when the button is pressed
- Click **Add** to confirm the selection.



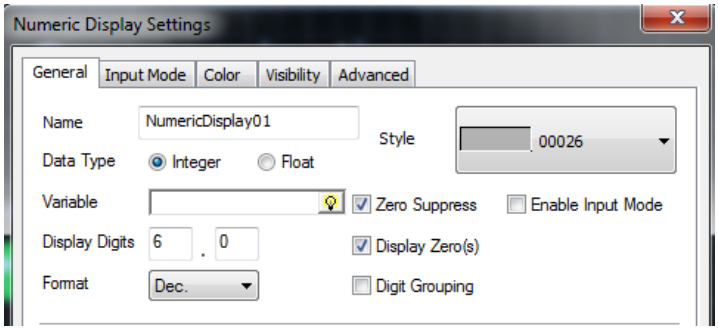
Under the "**When Release**" tab, click th con and:

- select the "**BOOL**" "Emptying" variable,
- select "Re**set"** which will switch OFF the Emptying bit when the button is released
- Click **Add** to confirm the selection.

3.5 Create a Numeric Indicator

Select the "Data Display" icon in the toolbar and draw an area on the screen where the numeric window will be placed.

The **Numeric Display Settings** window is displayed. Configure the properties as shown in the screen below:



In the "**General**" tab:
Click the icon then:
double-click on the "Level" variable, then on **OK** in the expression editor,
To write in this indicator, Select the **« Enable Input Mode »** In the "**Input mode**" tab.

3.6 Create an alarm lamp

The lamp animates depending on the state of the variable: red if it is active and green if it is inactive.

Select the "**Lamp**" icon in the toolbar and use it to draw a **Lamp**, defining an area on the screen where the lamp will be placed.

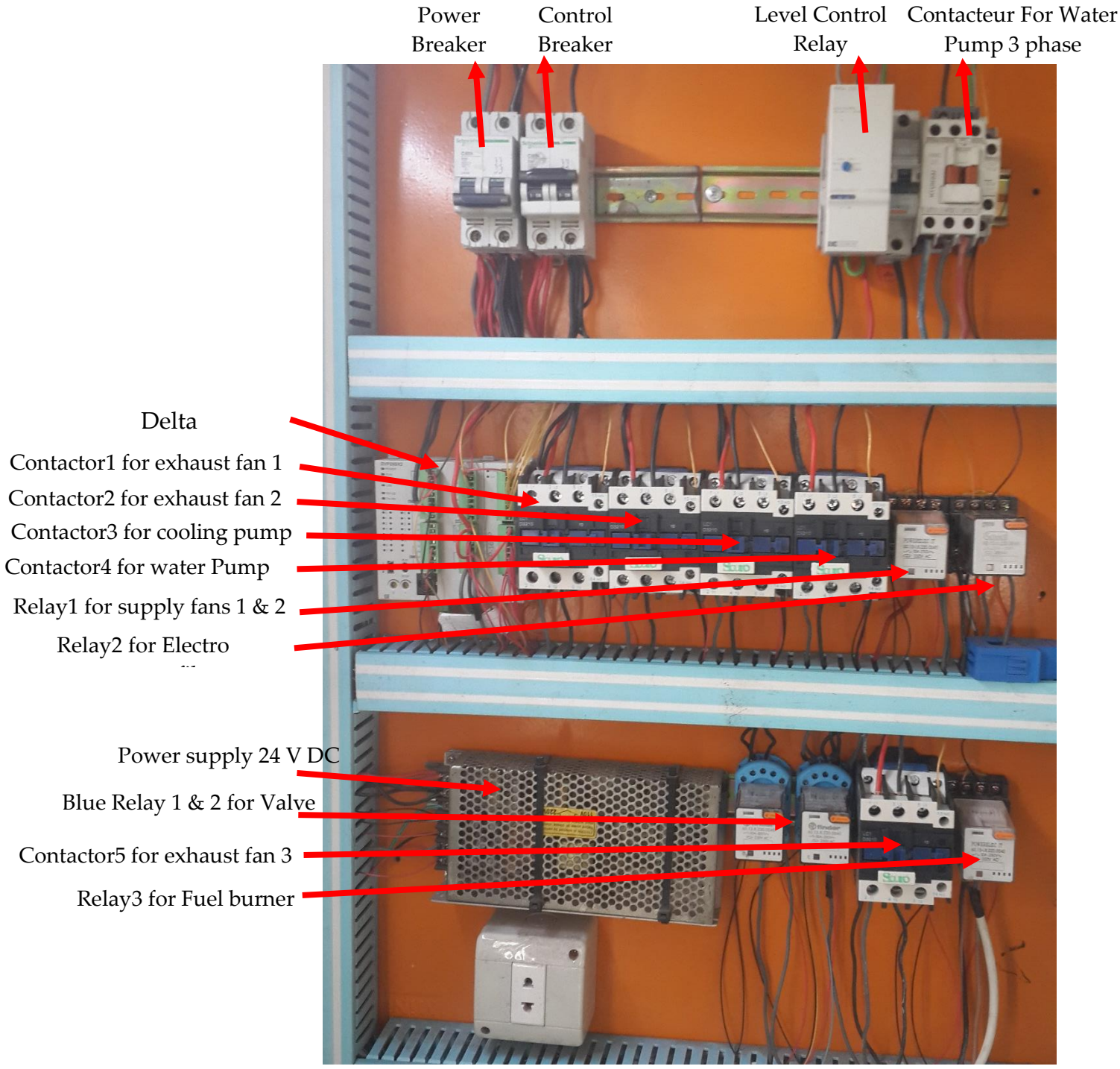
In this window, from the "**General**" tab:

Click the icon  then:

- Select the "**BOOL**" variable,
- Retain the lamp style **10001**.

4 PLC Programing & wiring

4.1 Control Panel



Version 12.04.22: Added: in top line: Contactor (changing power source: fuel generator/NLAP-IPP Power (after full function)) (only for exhaust fan 2 (green fan)):

4.2 تفعيل "Modbus Protocol" مع RS485 على ال PLC

الهدف من تفعيل **"Modbus Protocol"** هو ربط ال PLC ب الحاسوب (GUI)

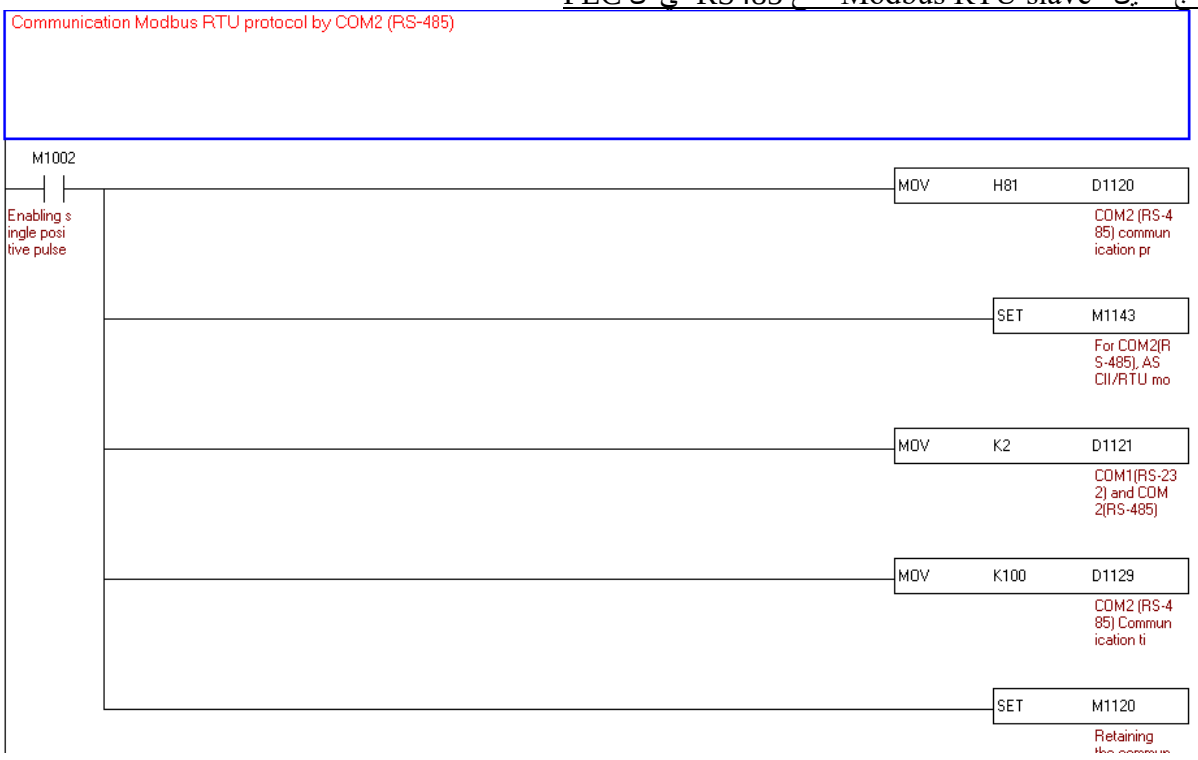
Function Group COM Port Function

Number

Item \ Port	COM1	COM2	COM3
Communication format	D1036	D1120	D1109
Communication setting holding	M1138	M1120	M1136
ASCII/RTU mode	M1139	M1143	M1320
Slave communication address	D1121		D1255

Contents:
COM ports (COM1: RS-232, COM2: RS-485, COM3: RS-485) support communication format of MODBUS ASCII/RTU modes. When RTU format is selected, the data length should be set as 8. COM2 and COM3 support transmission speed up to 921kbps. COM1, COM2 and COM3 can be used at the same time.
COM1:
Can be used in master or slave mode. Supports ASCII/RTU communication format, baudrate (115200bps max), and modification on data length (data bits, parity bits, stop bits). **D1036:** COM1 (RS-232) communication protocol of master/slave PLC. (b8 - b15 are not used) Please refer to table below for setting.
COM2:
Can be used in master or slave mode. Supports ASCII/RTU communication format, baudrate (921kbps max), and modification on data length (data bits, parity bits, stop bits). **D1120:** COM2 (RS-485) communication protocol of master/slave PLC. Please refer to table below for setting.
COM3:
Can be used in master or slave mode. Supports ASCII/RTU communication format, baudrate (921kbps max), and modification on data length (data bits, parity bits, stop bits). **D1109:** COM3 (RS-485) communication protocol of master/slave PLC. (b8 - b15 are not used) Please refer to table below for setting.

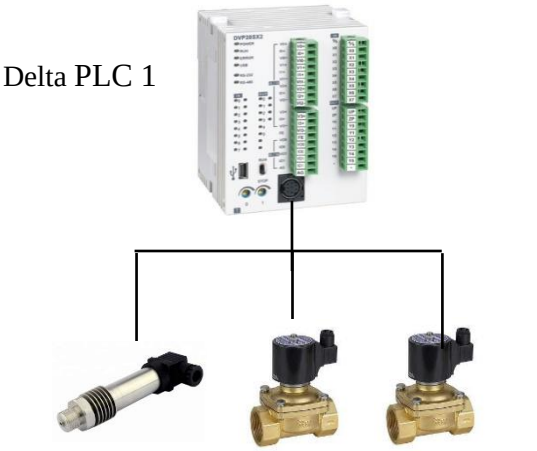
برنامج تفعيل "Modbus RTU slave" مع RS485 في ال PLC



M1002: Enable single positive pulse at the moment when RUN is activate (Normally OFF)
H81: Set up communication protocol as 9600, 8, N, 1
D1120: COM2 (RS-485) communication protocol
MOV H81 D1120: Set up communication protocol as 9600, 8, N, 1
SET M1143: For COM2 (RS-485), ASCII/RTU mode selection (OFF: ASCII; ON: RTU)
MOV K2 D1121: COM1 (RS-232) and COM2 (RS-485) PLC communication address 2 (K2= address 2)
MOV K100 D1129: COM2 (RS-485) Communication time-out setting (ms) (time k100=100ms)

SET M1120: Retaining the communication setting of COM2 (RS-485), modifying D1120 will be invalid when M1120 is set.

4.3 التحكم في ضغط ال Boiler (BPC Boiler Pressure control)

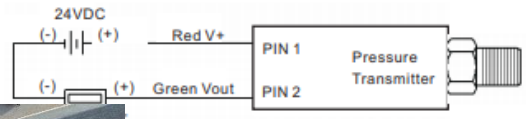


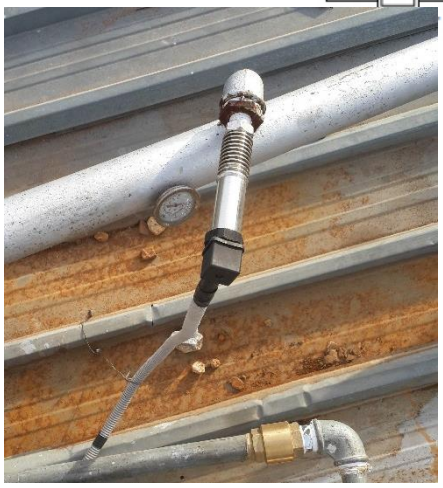
نظام التحكم يكون عل الشكل التالي : أل PLC نقرأ ضغط البخار في Boiler من خلال "Pressure sensor" وعند ارتفاع الضغط و بلوغ معدل "Condenser Pressure Setpoint" مثلا 14.5bar تفتح "Condenser valve" لتخفيف البخار في Boiler وتحويله الى ال Condenser وعندما يرتفع الضغط اكثرفي ال Boiler ويبلغ معدل "Atmospheric Pressure Setpoint" مثلا 15 bar تفتح ال "Atmospheric valve" لتفريغ من البخار في الهواء وعند انخفاض الضغط الى معدل "Min Pressure Setpoint" مثلا 14 bar فتغلق ال valve.

4.3.1 توصيل "Pressure transmitter" مع ال PLC وبرمجته

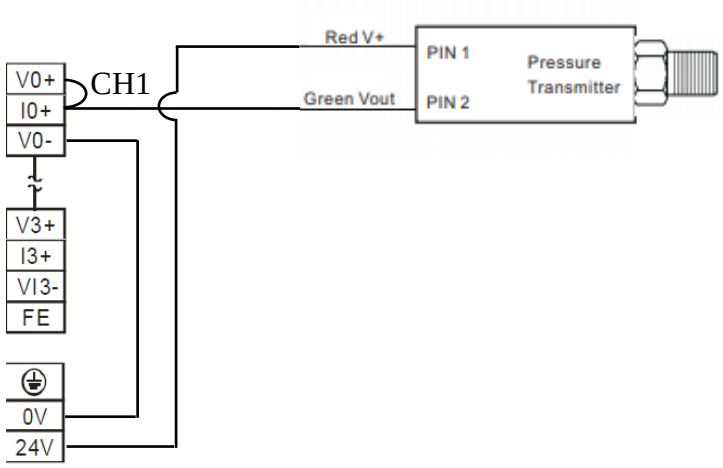
4.3.1.1 مواصفات ال Pressure transmitter

COMPANY: GAMICOS
MODEL: GPT220
Range: 0-16bar
Output: 4-20 mA
Power: 12- 36V
Temperature: 220^0 C





4.3.1.2 طريقة توصيل ال Sensor مع ال PLC



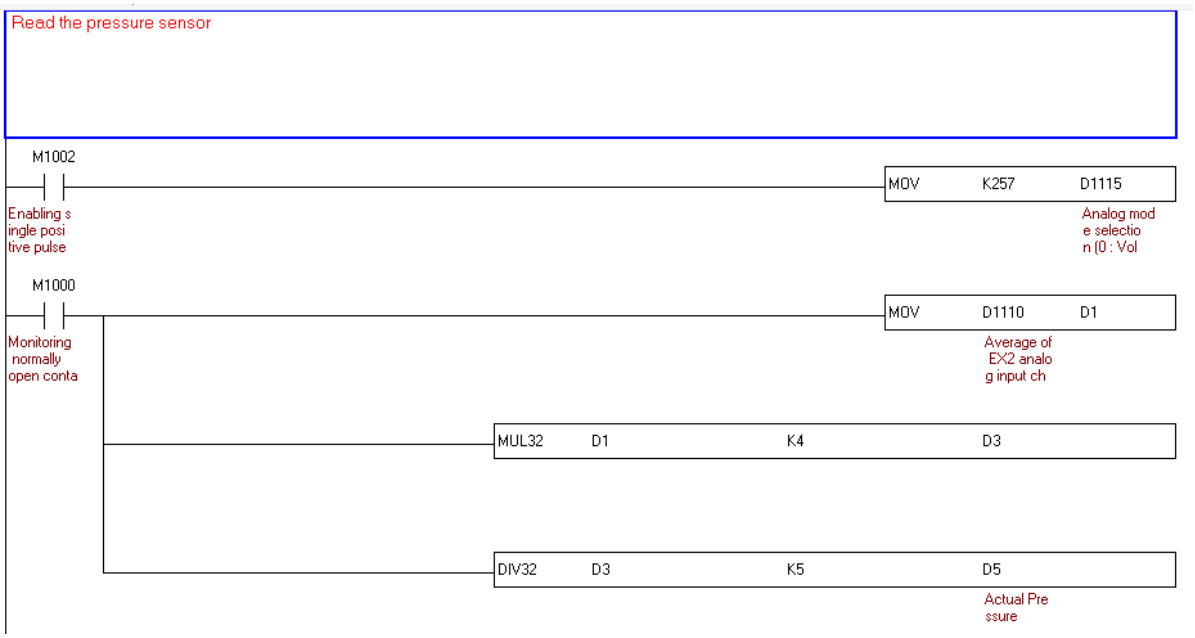
4.3.1.3 برنامج قراءة ضغط الBoiler في ال PLC

طريقة قراءة الضغط تكون عل الشكل التالي :

ال PLC تقرأ من Sensor (0 bar = 0 in PLC , 16bar =2000 in PLC)

لتحويل قراءة ال PLC الى قراءة شبيهة بالحساس نعمل ما يلي ($x \times \frac{4}{5}$ مثلا $2000 \times \frac{4}{5} = 1600$) نقرا قيمة الحساس من D1110 ونحفظها في D1 ثم نضرب 4 وتحفظ في D3 D4 ثم نقسم على 5 وتحفظ في D5 D6 على شكل شبيه بقيمة الحساس .

(0 bar = 0 in D5, 16bar =1600 in D5)



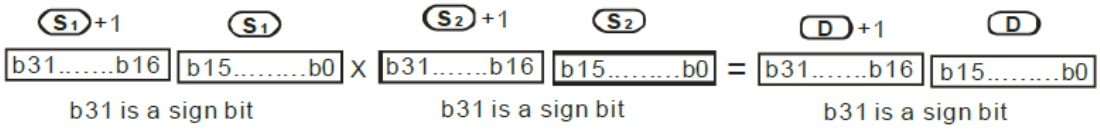
M1000: normal on

D1115: analog input/output mode setting

Device number	Function
D1115	20EX2/SX2 analog input/output mode setting (Default=H'0) bit0~bit5: Selection between the voltage/current mode (0: Voltage; 1: Current; Default: Voltage) bit0~bit3: Analog inputs (AD0~AD3) bit4~bit5: Analog outputs (DA0~DA1) bit8~bit 13: Current mode bit8~bit11: AD0~AD3 (0: -20 mA~20 mA; 1: 4~20 mA) bit12~bit13: DA0~DA1 (0: 0~20 mA; 1: 4~20 mA)

MOV K257 D1115: (257 decimal = 0000 0001 0000 0001 Binary),
Bit 0 = 1: analog input mode of AD0 is the current mode
Bit 8 =1: current 4-20 mA.
D1110: analog input channel 0 (AD 0)
MOV D1110 D1: move D1110 in D1
MUL32 D1 K4 D3:
(D2, D1) × (4) = (D4, D3)

6. 32-bit binary multiplication



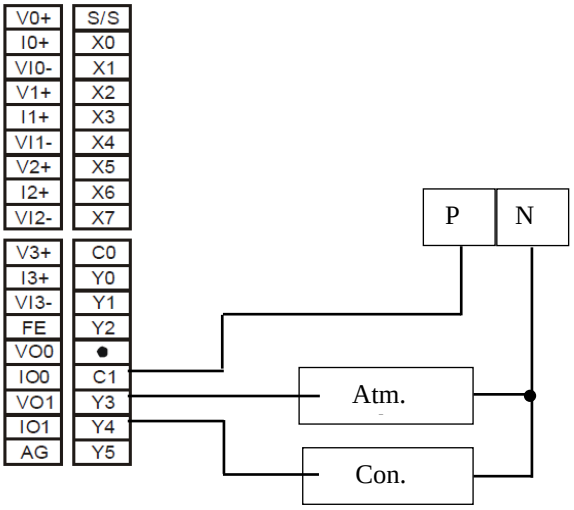
DIV32 D3 K5 D5:
(D4, D3) / (5) = (D6, D5)

4.3.2 توصيل "Atmospheric valve & Condenser valve" مع ال PLC والتحكم بهم

Condenser Solenoid valve

Atmospheric Solenoid valve

4.3.2.1 طريقة توصيل ال "Atmospheric valve & Condenser valve" مع ال PLC

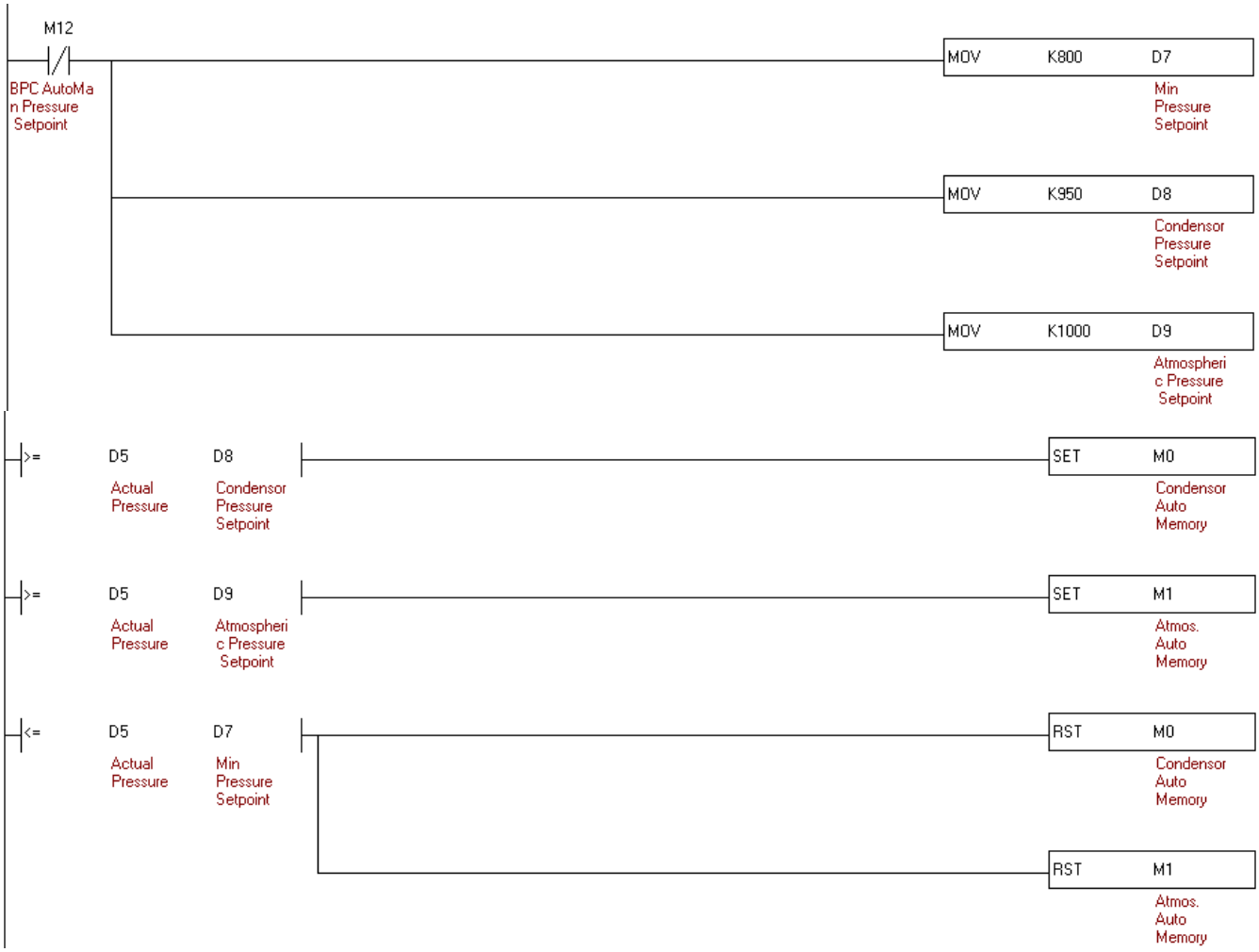


4.3.2.2 برنامج التحكم ب "Atmospheric valve & Condenser valve"

يمكن التحكم بال (Condenser valve) بشكل يدوي (Manual) عن طريق الحاسوب من خلال Address M10 (ارسال من الحاسوب بواسطة Modbus "1" الى M10 فتعمل Y3 ON فيفتح ال valve او ارسال "0" الى M10 فتصبح Y3 OFF فيغلق ال valve) . يمكن ايضا التحكم بال Atmospheric valve بشكل يدوي (Manual) عن طريق الحاسوب من خلال Address M11 & M44 فعند ارسال "1" الى M44 يتم تحويل التحكم الى يدوي ومن ثم ارسال "1" الى ال M11 فيتم تشغل Y4 فيفتح ال Valve او ارسال "0" الى ال M11 فيتم فصل Y4 فيغلق ال Valve .

يمكن التحكم بال "Condenser valve" بشكل اوتوماتيكي عن طريق ال Pressure : فعند ارتفاع ال pressure (في ال D5) وبلوغ معدل" Condensor Pressure Setpoint " (في ال D8 وهو 950 اي 950 bar والذي يمكن تعديله) فتصبح M0 ON والتي بدورها تشغل Y3 لتفتح ال valve. وعند انخفاض ال Pressure (في ال D5) وبلوغ معدل"Min Pressure Setpoint" (في ال D7 وهو 800 اي 8 bar والذي يمكن تعديله) فتصبح M0 OFF والتي بدورها تفصل Y3 فتغلق ال valve.

عندما تكون "M44 OFF" (يتم التحكم بال M44 بواسطة الحاسوب) يمكن التحكم بال "Atmospheric valve" بشكل اوتوماتيكي عن طريق ال Pressure : فعند ارتفاع ال pressure (في ال D5) وبلوغ معدل "Atmospheric Pressure Setpoint" (في ال D9 وهو 1000 اي 10 bar والذي يمكن تعديله) فتصبح M1 ON والتي بدورها تشغل Y4 لتفتح ال valve. وعند انخفاض ال Pressure (في ال D5) وبلوغ معدل"Min Pressure Setpoint" (في ال D7 وهو800 اي 8 bar والذي يمكن تعديله) فتصبح M1 OFF والتي بدورها تفصل Y4 فتغلق ال valve.



يمكن السماح بتعديل ال Set point بشكل يدوي من خلال الحاسوب عن طريق ارسال"1"عن طرق ال Modbus الى address M12 او "0" لالغاء التعديل وابقاء Auto Setpoint.

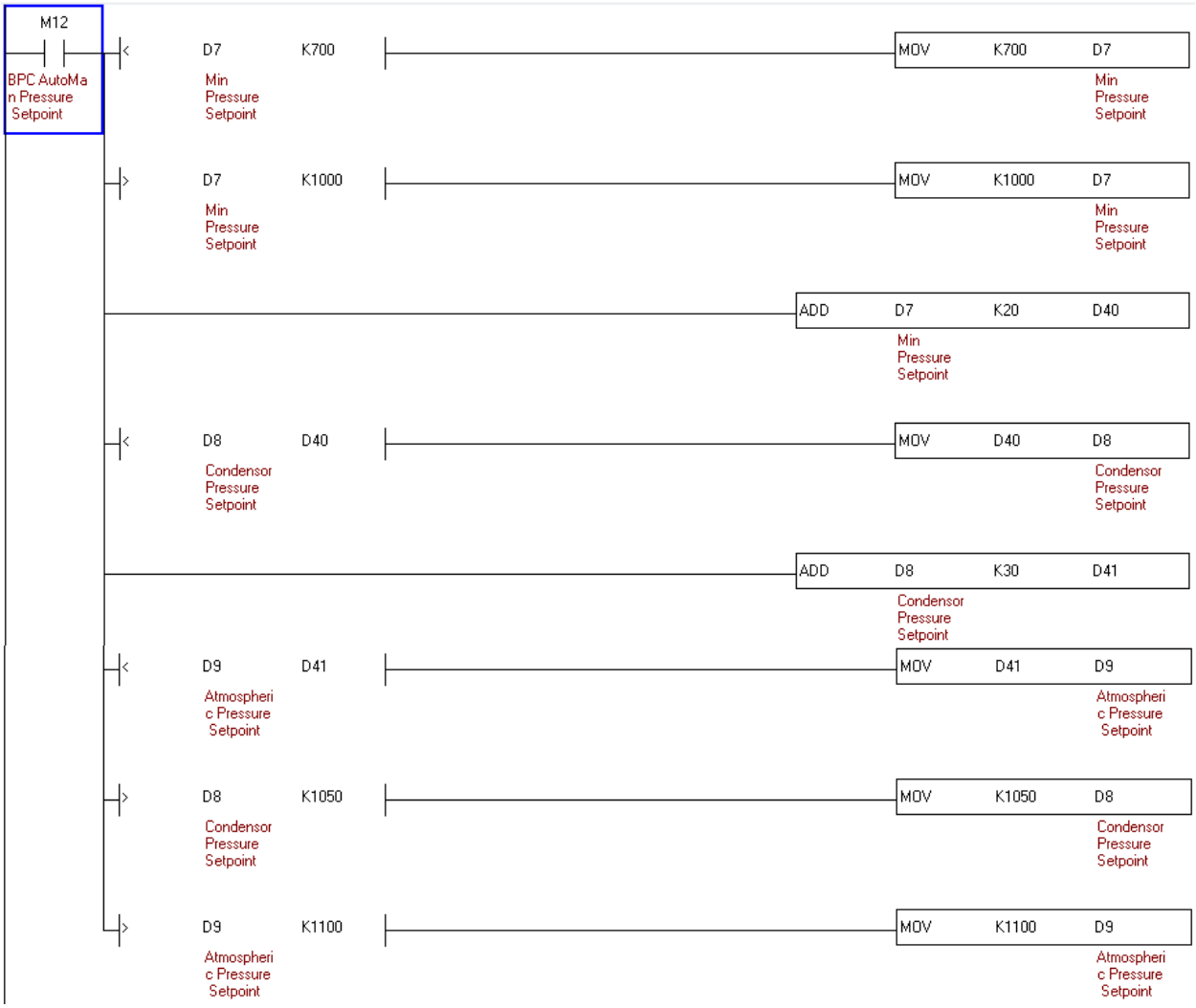
يمكن السماح بتعديل ال Set point من الحاسوب ضمن حدود محددة في ال PLC ويجب ان يكون

ال "Atmospheric Pressure Setpoint" هو الاعلى وان لا يتخطى ال 11 bar وان يزيد عل الاقل ب 0.3 bar عن

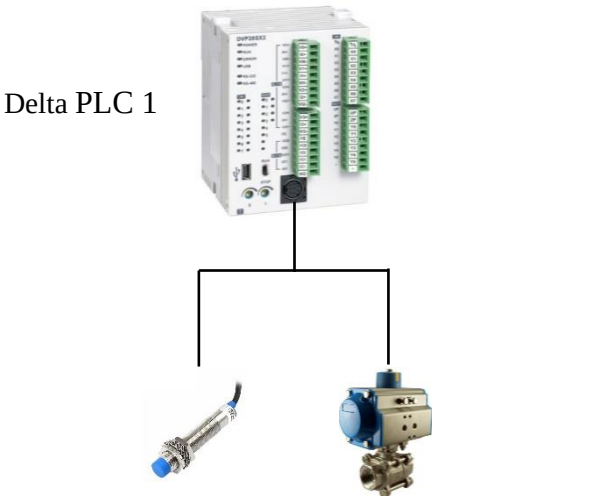
ال " Condensor Pressure Setpoint ".

اما ال " Condensor Pressure Setpoint " فيجب ان لا يتخطى "Atmospheric Pressure Setpoint" وان يزيد عل الاقل ب 0.2 bar عن "Min Pressure Setpoint".

في ما يخص ال "Min Pressure Setpoint" وهو الأدنى ويجب ان لا يتخطى ال "Condensor Pressure Setpoint" وان لا ينخفض الى ما دون ال 7 bar.



4.4 نظام التحكم بال (Turbine Govering System TGS) Turbine

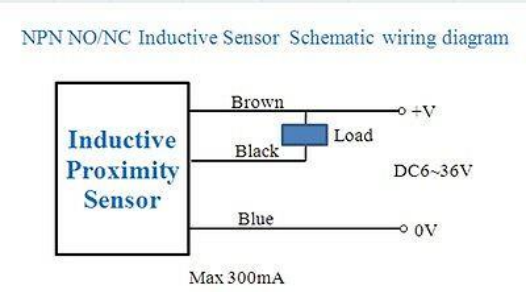


نظام التحكم يكون عل الشكل التالي : عند ارتفاع الضغط الى الحد المطلوب (مثلا 7 bar) فيتم تشغيل M42 من خلال الحاسوب فيبدأ التحكم بفتح ال Turbine valve ويدور ال Turbine من خلال البخار.
نقرأ بواسطة ال PLC سرعة ال Turbine من خلال RPM sensor فاذا كانت السرعة تعادل 1500 RPM فتبقى نسبة فتح ال Valve ثابتة واذ انخفضت السرعة الى ما دون ال 1500 فتعمل ال PLC عل زيادة نسبة فتح ال valve (زيادة نسبة فتح ال Valve يؤدي الي ذيادة البخارفيزيد من سرعة ال Turbine) حتى نصل الى سرعة 1500, اما اذا تخطت السرعة 1500 فتعمل ال PLC عل تخفيض نسبة فتح ال Valve حتى نصل للسرعة المطلوبة.

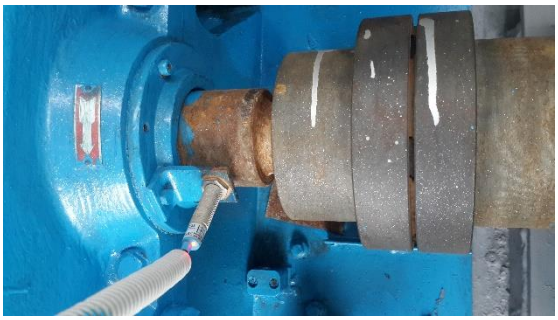
4.4.1 توصيل ال "Proximity Sensor" مع ال PLC وبرمجته

4.4.1.1 مواصفات ال "Proximity Sensor" وطريقة عمله

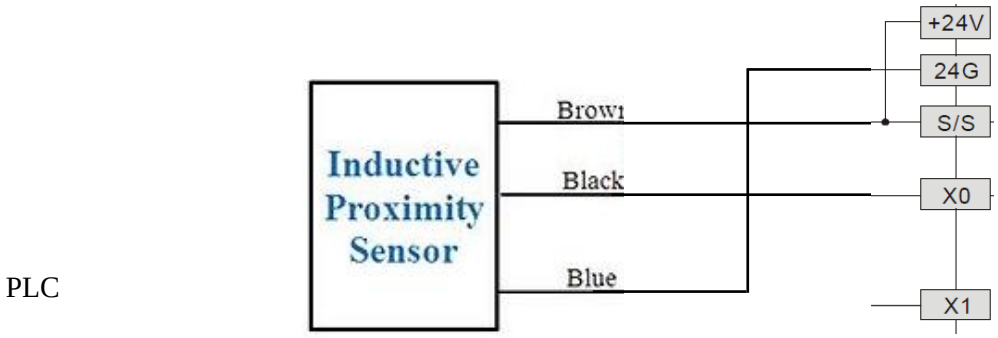
Proximity Sensor LJ12A3-4-Z/BX



قبل عمل الحساس يكون المفتاح مفتوح (Contact Normally opened) وعند اقتراب مادة معدنية من الحساس يتغير الى مغلق.

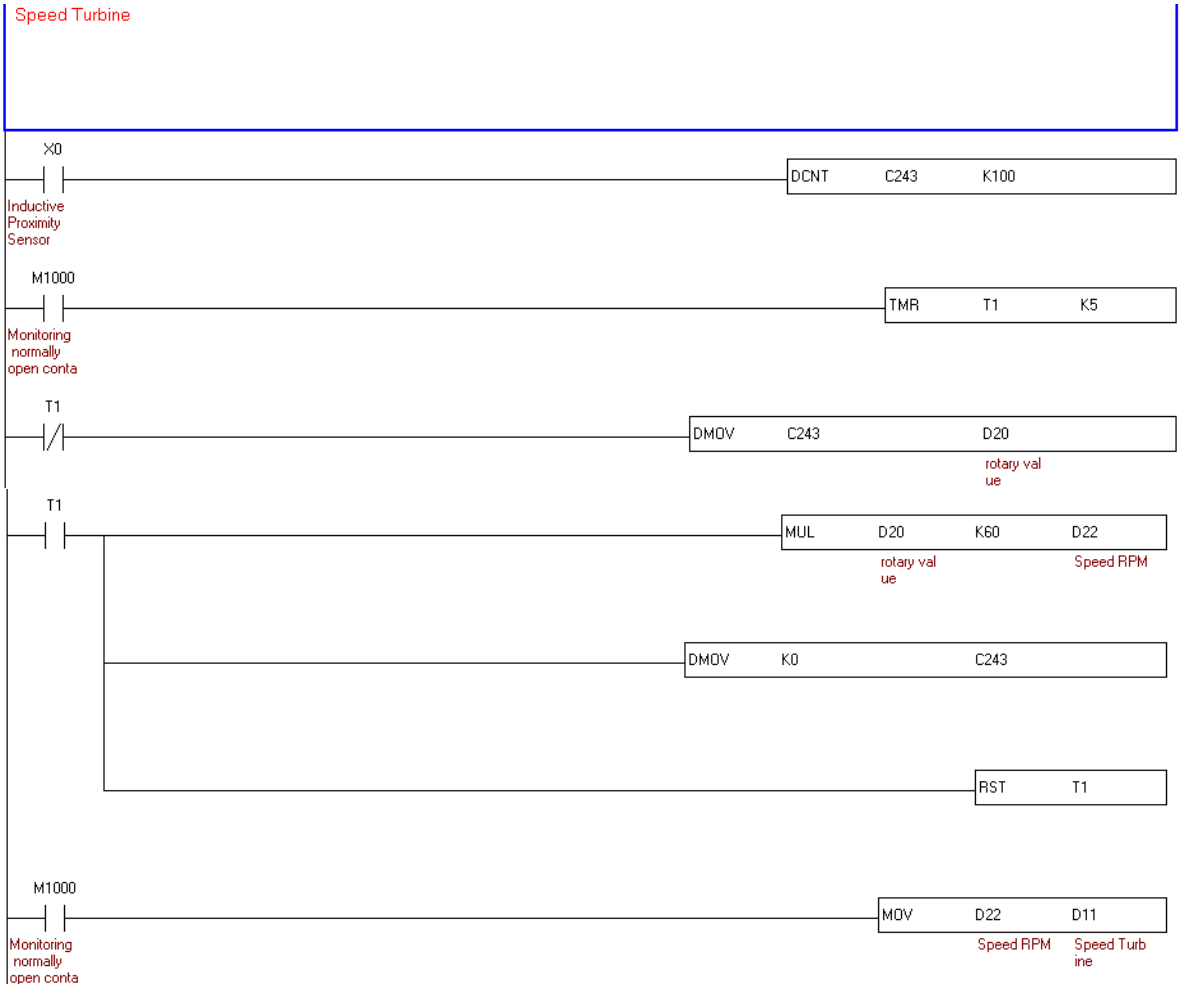


4.4.1.2 طريقة توصيل ال Sensor مع ال PLC



4.4.1.3 برنامج لاحتساب سرعة المولد في ال PLC

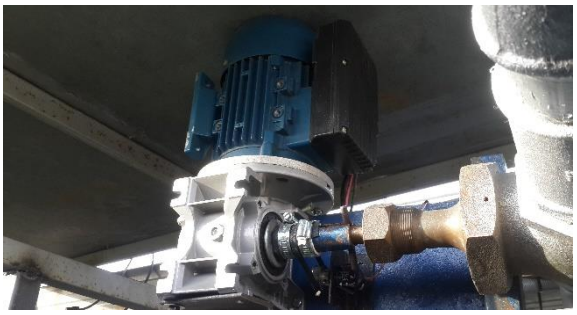
طريقة احتساب السرعة تكون عل الشكل التالي : في كل نصف دورة يلتقط "Proximity Sensor" اشارة فيتلقى X0 هذه الإشارة ويضاف 1 في ال D20 ثم تتكرر العملية لمدة نصف ثانية من خلال العداد (T1) وخلال هذه المدة يتم تسجيل عدد الدورات في نصف الثانية وتحفظ في D21 وعندما تنهي المدة (T1 ON) نحصل عل السرعة في الدقيقة وتحفظ في ال D22 ويتم تصفير العداد (D0 & T1) لاحتساب السرعة من جديد.



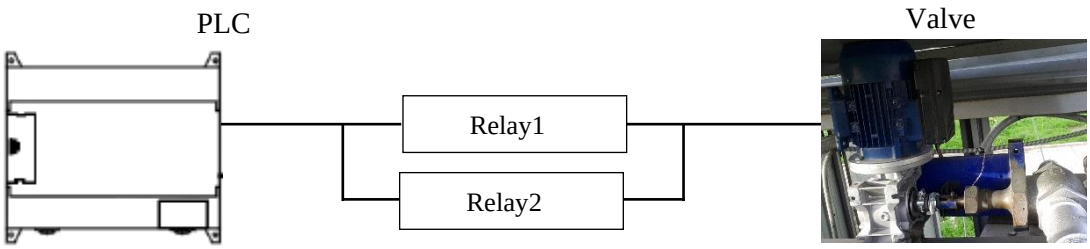
-INCP D20: When X0 is triggered, the content of D20 will be incremented by 1.

-TMR T1 K15 : M1000 is ON, T1 is activated After 0,1 seconds (K5 × 0.1 sec = 0,5 sec), contact T1 is ON.
-When T1 is OFF move D20 in D21
-When T1 is ON : Multi D21 x 60 and move in D22; D20 is cleared & Reset T1
-When Reset T1 then the operation is repeated.

4.4.2 توصيل محرك (single-phase motor) ال valve مع ال PLC والتحكم به

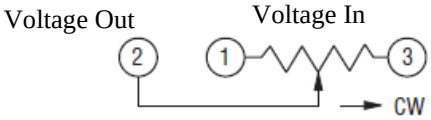


4.4.2.1 طريقة ربط محرك ال valve بال PLC



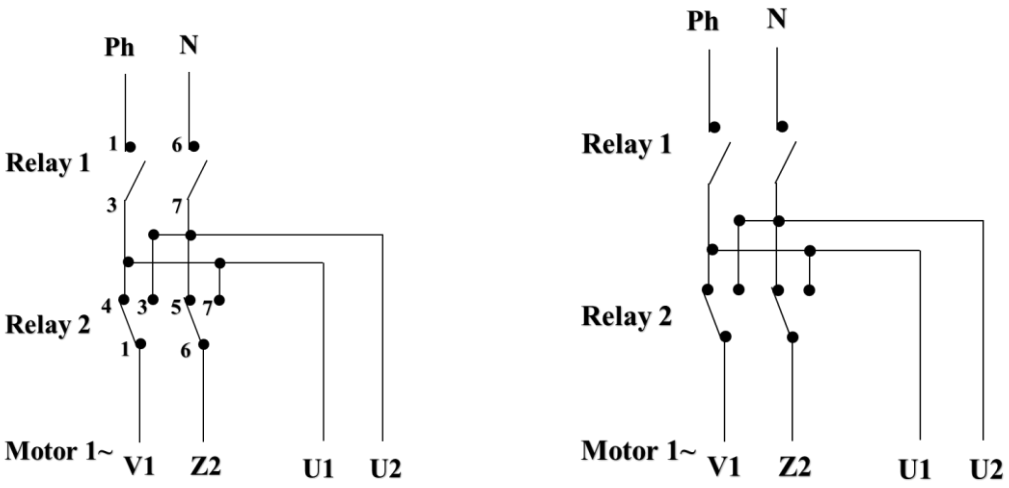
ال Relay 1 لتشغيل المحرك وال Relay 2 لتغير الاتجاه (عند تشغيل Relay 2 فهذا يعني أن المحرك جاهز لإغلاق ال Valve وعند توقيف Relay 2 يعني ان المحرك مستعد لفتح ال Valve) نقرأ نسبة الفتح او الاغلاق التي نفذت من خلال وجود ال Potentiometer (نحصل عل نسبة voltage من potentiometer عل حسب نسبة فتح ال valve).

Potentiometer

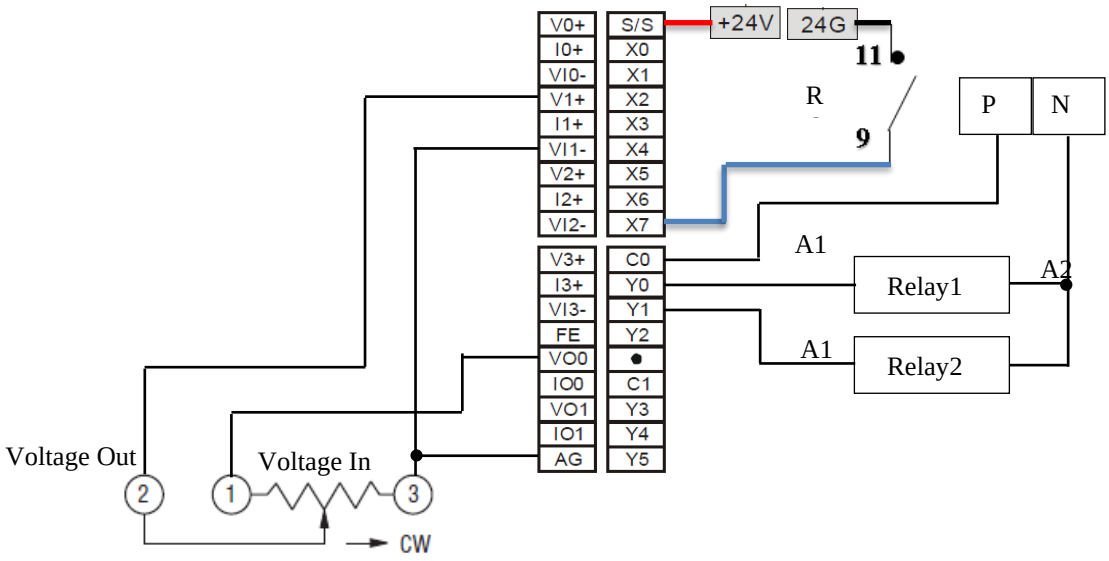


A potentiometer is a manually adjustable, variable resistor with three terminals. Two terminals are connected to a resistive element, the third terminal is connected to an adjustable wiper. The position of the wiper determines the output voltage.

4.4.2.2 طريقة توصيل المحرك مع ال Relay



4.4.2.3 طريقة توصيل ال Relay وال potentiometer مع ال PLC



4.4.2.4 برنامج التحكم ب Valve في ال PLC

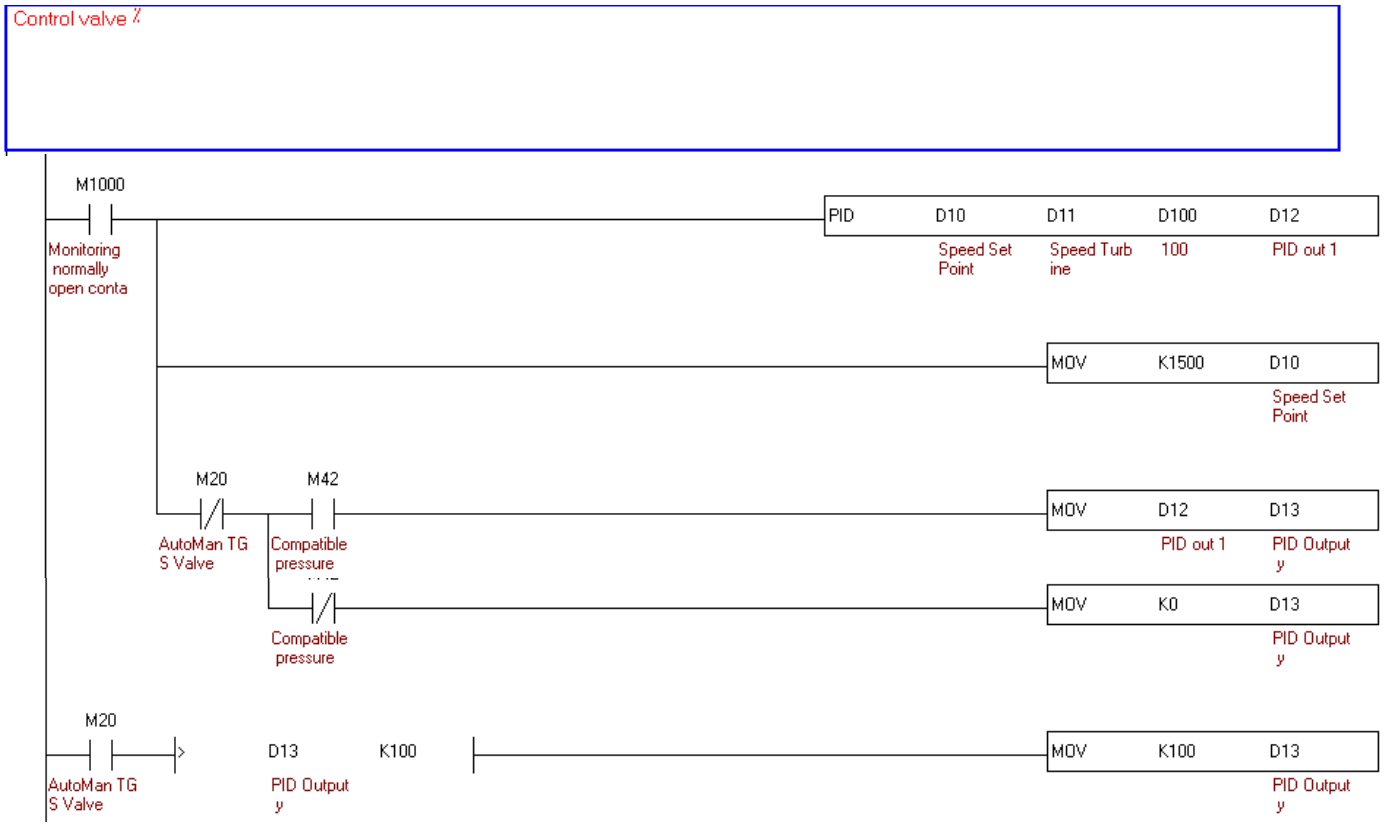
عندما يصبح الضغط في D5 حوالي 7 bar نقوم بتشغيل "M42 ON" من خلال الحاسوب لنبدأ التحكم بنسبة فتح ال "turbine valve".

يتم تحديد نسبة فتح "turbine valve" من خلال ال PID في ال PLC او بشكل يدوي من خلال الحاسوب (GUI)

تعمل ال PID بمقارنة السرعة المطلوبة "Speed SetPoint" في D10 مع سرعة ال Turbine في D11 وتحدد نسبة المئوية المطلوبة لفتح ال Valve في D12 .

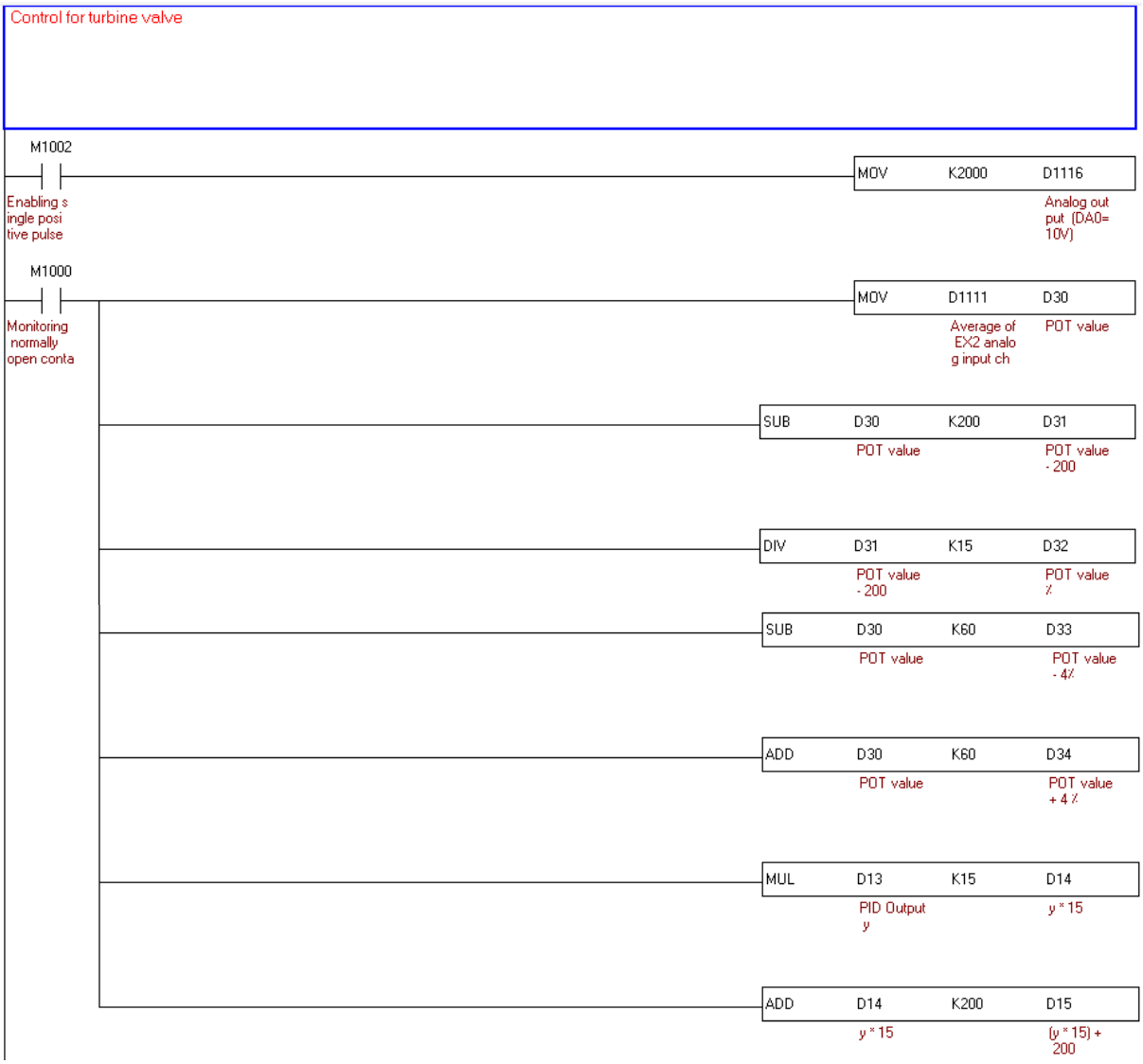
يكون التحكم بنسبة فتح ال valve المطلوبة بشكل اوتوماتيكي عندما تكون "M20 OFF" , فاذا كانت "M42 OFF" لا يسمح بفتح ال Valve اي نسبة الفتح صفر وتحفظ في D13 اما عندما "M42 ON" فيتم حفظ نسبة فتح ال Valve المطلوبة من PID في D13.

يمكن التحكم بنسبة فتح ال valve المطلوبة بشكل يدوي من خلال الحاسوب (GUI) ارسال "1" عن طريق ال Modbus الى PLC-M20 فتصبح "M20 ON" ومن ثم نرسل النسبة المئوية لفتح ال valve الى D13 (اذا كان الرقم المرسل الى D13 اكثر من مئة يستبدل ب 100).

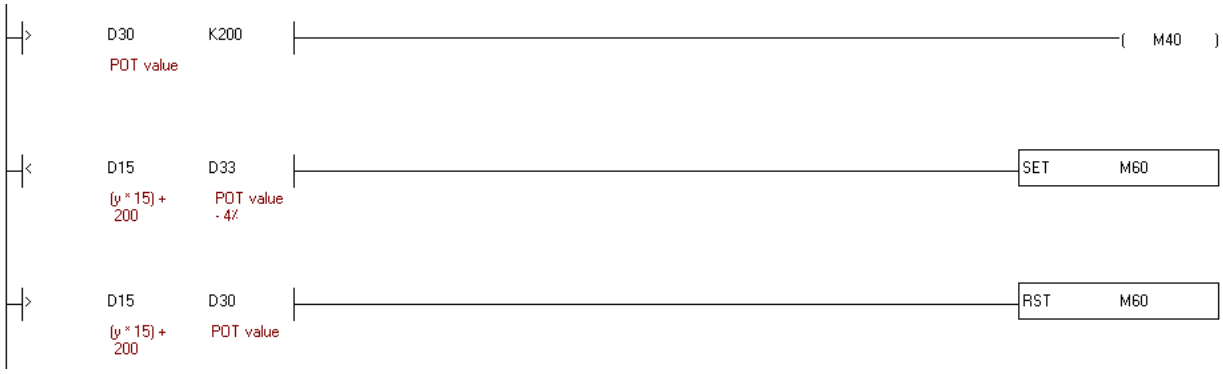


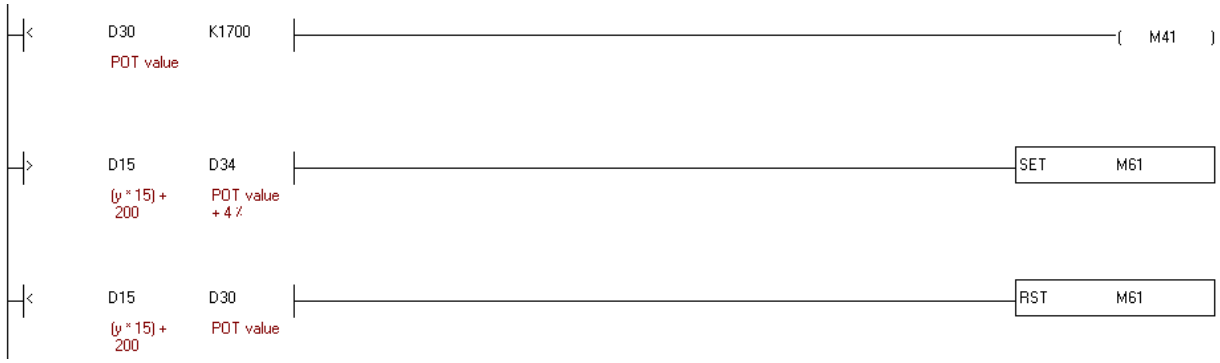
نغزي ال potentiometer بـ10V من خلال DA0 (VO0) ونقرأ من ال potentiometer نسبة فتح ال valve من خلال AD1 (V1+) وتحفظ في ال D30 (عندما يكون ال valve مغلق يعطينا ال قيمة1V potentiometer 200) in PLC) وعند الفتح بشكل كامل يعطينا 8.5V (1700 in PLC)) ثم نحول الرقم الى نسبة مئوية ويحفظ في D32 (D32 =$\frac{Pot\ Value\ -200}{15}$).

يتم تحويل نسبة المئوية لفتح ال Valve المطلوبة الى رقم (بين ال 200 و ال 1700) وحفظه في D15 (D15 =$D13 \times 15 + 200$) لنتمكن من مقارنته مع قيمة ال potentiometer .



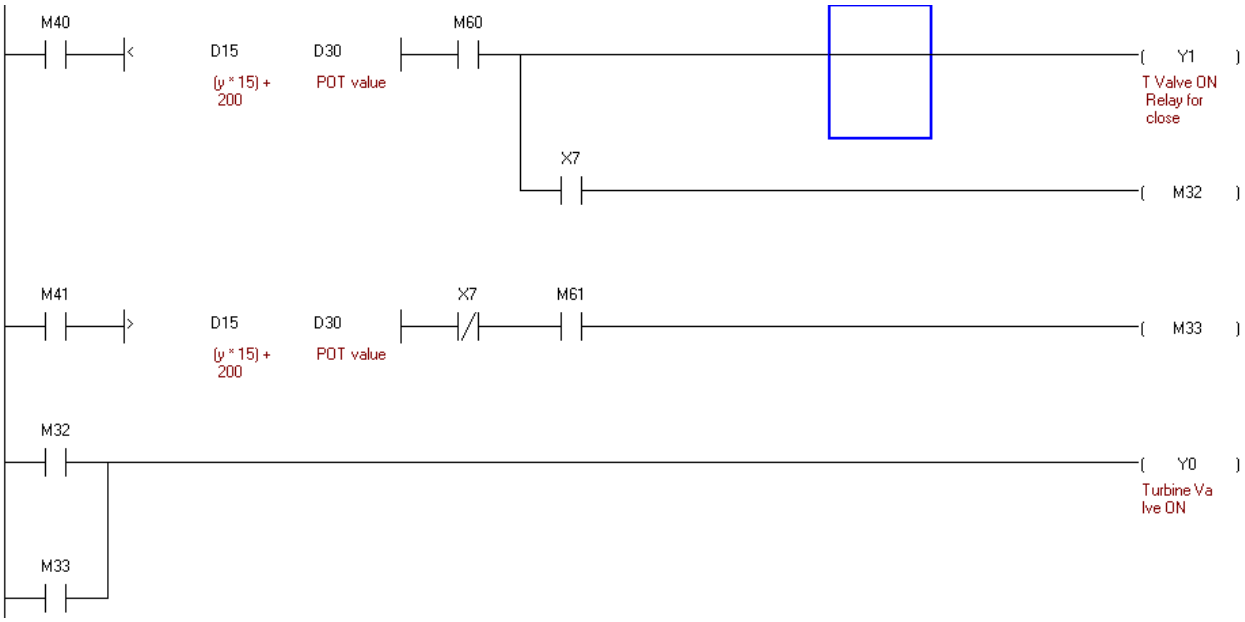
اذا كانت قيمة ال Potentiometer اكبر من 200 ,تصبح "M40 ON" أي تسمح باغلاق ال Valve.
اما اذا كانت قيمة ال Potentiometer تعادل 200 ,تصبح "M40 OFF" أي لا تسمح باغلاق ال Valve.
اذا كانت قيمة ال Potentiometer اكبر من 1700 ,تصبح "M41 ON" أي تسمح بفتح ال Valve.
اما اذا كانت قيمة ال Potentiometer تعادل 1700 ,تصبح "M41 OFF" أي لا تسمح بفتح ال Valve.
(1% =15 in PLC; 4% =60 in PLC)
اذا كان الفارق بين نسبة فتح ال valve المطلوبة و قيمة ال Potentiometer, اكثر من 4% , يسمح بتحريك ال valve من خلال M60 للاغلاق و M61 للفتح, اما اذا كان الفارق اقل من 4% فلا يسمح بتحريكه.





عندما تكون قيمة فتح ال valve المطلوبة اكثر من قيمة ال Potentiometer بما يزيد عن 4% تصبح "M33 ON" فتفتح ال valve بواسطة Y0 حتى يصبح قيمة ال potentiometer تعادل القيمة المطلوبة بشرط ان يكون ال potentiometer اقل من 8,5V .

اما عندما تكون قيمة فتح ال valve المطلوبة اقل من قيمة ال Potentiometer بما يزيد عن 4% تصبح"Y1 ON" اي تم اختيار اتجاه الاغلاق . نقرأ حالة الاتجاه (Relay 2) من خلال ال "X7" فاذا كانت "Relay2 ON" تصبح "M34 ON" فتغلق ال valve بواسطة Y0 و Y1 بما يعادل القيمة المطلوبة بشرط أن يكون ال Potentiometer اكثر من 1V.



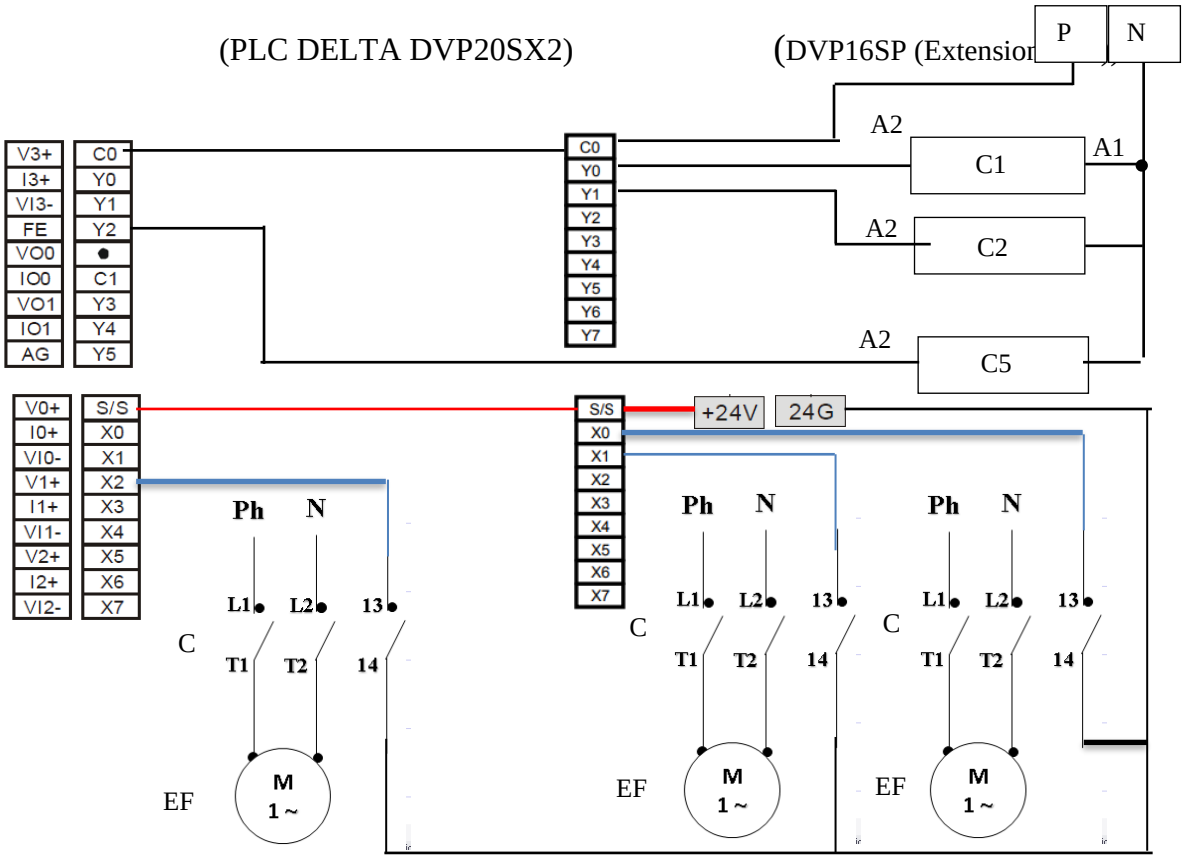
4.5 توصيل ال "Exhaust Fans" مع ال PLC والتحكم بهم من خلال الحاسوب (GUI)

Exhaust Fan 3 **Exhaust Fan 2** **Exhaust Fan 1**

الهدف من ال "Exhaust fans" هو شفط الدخان من المحرقة لذلك يتم تشغيل ال fans بشكل يدوي عن طريق الحاسوب عند بداية الحرق.

4.5.1 طريقة توصيل ال fans مع ال PLC

Contactor 1(C1) for Exhaust fan 1; Contactor 2 (C2) for Exhaust fan 2; Contactor 5 (C5) for Exhaust fan 3.



4.5.2 التحكم ومراقبة ال Exhaust fans:

يتم التحكم ومراقبة ال Exhaust fans بشكل يدوي عن طريق الحاسوب (User interface) بواسطة ال Modbus على الشكل التالي :

Exhaust fan 1 :

التحكم بال fan : ارسال "1" من (PC) الى PLC-Y0,Extension يؤدي الى تشغيل ال Contactor 1 والذي بدوره يشغل ال fan.

اما ارسال "0" الى Y0,Extension يؤدي الى توقيف ال Contactor 1 والذي بدوره يفصل ال fan.

مراقبة حالة ال fan : عند تشغيل ال Contactor تصبح "1" = PLC-X0,Extension وهي تعني ان ال fan تعمل.

وعندما يكون ال Contactor مفصول فتكون ال "0" = X0,Extension وهي تعني ان ال fan لا تعمل.

Exhaust fan 2:

التحكم بال fan : ارسال "1" من (PC) الى PLC-Y1,Extension يؤدي الى تشغيل ال Contactor 2 والذي بدوره يشغل ال fan .

اما ارسال "0" الى Y1,Extension يؤدي الى توقيف ال Contactor 2 والذي بدوره يفصل ال fan.

مراقبة حالة ال fan : عند تشغيل ال Contactor تصبح "1" = PLC-X1,Extension وهي تعني ان ال fan تعمل.

وعندما يكون ال Contactor مفصول فتكون ال "0" = X1,Extension وهي تعني ان ال fan لا تعمل.

Exhaust fan 3:

التحكم بال fan : ارسال "1" من (PC) الى PLC-Y2 يؤدي الى تشغيل ال Contactor 5 والذي بدوره يشغل ال fan

اما ارسال "0" الى Y2 يؤدي الى توقيف ال Contactor 5 والذي بدوره يفصل ال fan.

مراقبة حالة ال fan : عند تشغيل ال Contactor تصبح "1" = PLC-X2 وهي تعني ان ال fan تعمل.

وعندما يكون ال Contactor مفصول فتكون ال "0" = X2 وهي تعني ان ال fan لا تعمل.

4.6 توصيل ال Supply Fans مع ال PLC والتحكم بهم من خلال الحاسوب (GUI)

Supply fan 2

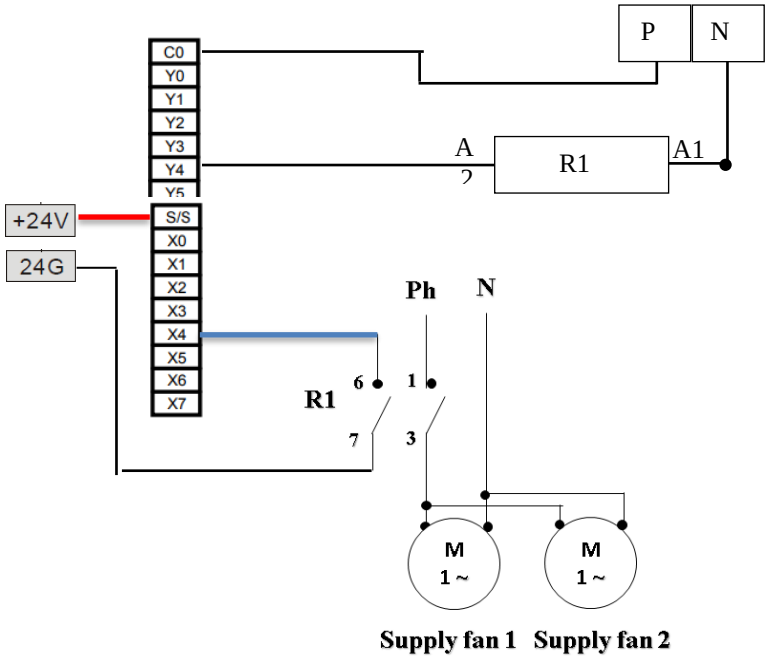
Supply fan 1

الهدف من ال "Supply fans" هو تزويد المحرقة بالهواء لاستمرار عملية الحرق, لذلك يتم تشغيل ال fans بشكل يدوي من خلال الحاسوب (GUI) عند بداية الحرق.

4.6.1 طريقة توصيل ال fans مع ال PLC

(Relay1 for Supply fans)

(DVP16SP (Extension Unit)



4.6.2 التحكم ومراقبة ال Supply fans:

يتم التحكم ومراقبة ال Supply fans بشكل يدوي عن طريق الحاسوب (User interface) بواسطة ال Modbus على الشكل التالي :

<u>التحكم بال fan :</u> ارسال "1" من (PC) الى PLC-Y4,Extension يؤدي الى تشغيل ال Relay 1 والذي بدوره يشغل ال fans.

اما ارسال "0" الى Y4,Extension يؤدي الى توقيف ال Relay 1 والذي بدوره يفصل ال fans.

<u>مراقبة حالة ال fans</u> : عند تشغيل ال Relay تصبح "1" = PLC-X4,Extension وهي تعني ان ال fans تعمل.

وعندما يكون ال Relay مفصولة فتكون ال "0" = X4,Extension وهي تعني ان ال fans لا تعمل.

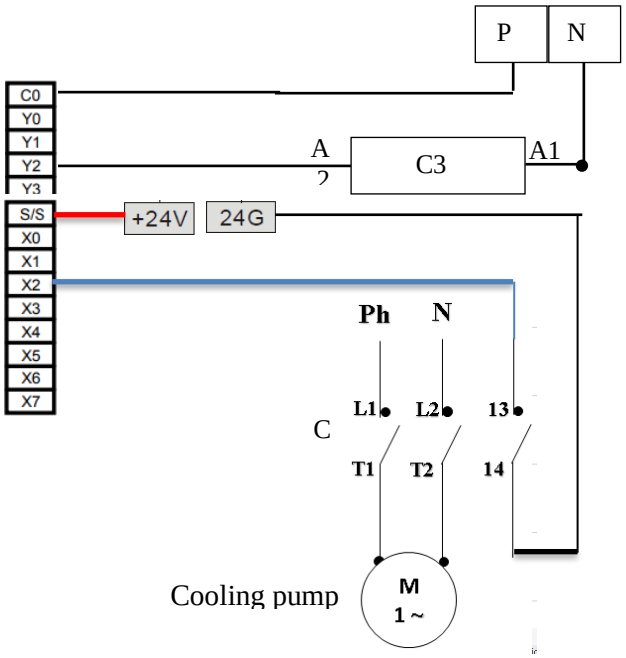
4.7 توصيل "Cooling pump" مع ال PLC والتحكم بها من خلال الحاسوب (GUI)

الهدف من "Cooling pump" تزويد ال Condenser بالمياه لتبريد البخار لذلك يتم تشغيل ال Pump بشكل يدوي بواسطة الحاسوب (GUI) عندما يفتح ال "Condenser valve" او "Turbine valve" .

4.7.1 طريقة توصيل ال "Cooling pump" مع ال PLC

(Contactor 3 for cooling pump)

(DVP16SP (Extension Unit))



4.7.2 التحكم ومراقبة ال Cooling pump:

يتم التحكم ومراقبة ال Cooling pump بشكل يدوي عن طريق الحاسوب (GUI) بواسطة ال Modbus على الشكل التالي:

التحكم بال pump : ارسال "1" من (PC) الى PLC-Y2,Extension يؤدي الى تشغيل ال Contactor3 والذي بدوره يشغل ال pump . اما ارسال "0" الى Y2,Extension يؤدي الى توقيف ال Contactor3 والذي بدوره يفصل ال pump.

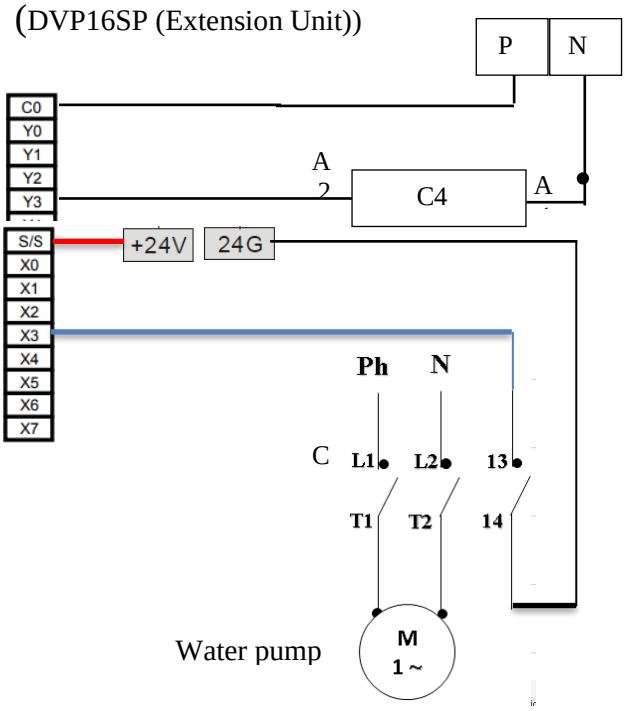
مراقبة حالة ال pump : عند تشغيل ال Contactor تصبح "1" = PLC-X2,Extension وهي تعني ان ال pump تعمل. وعندما يكون ال Contactor مفصولة فتكون ال "0" = X2,Extension وهي تعني ان ال pump لا تعمل.

4.8 توصيل ال "Water pump" مع ال PLC والتحكم بها من خلال الحاسوب (GUI)

الهدف من "Water pump" هو ملأ خزان ال Boiler بالماء الى حدود "level-Max" لذلك يتم تشغيل ال pump بشكل يدوي من خلال الحاسوب (GUI) قبل تشغيل المحطة.

4.8.1 طريقة توصيل ال "water pump 1" مع ال PLC

(Contactor 4 for water pump 1)



4.8.2 التحكم ومراقبة ال Water pump:

يتم التحكم ومراقبة ال Water pump بشكل يدوي عن طريق الحاسوب (User interface) بواسطة ال Modbus على الشكل التالي:

التحكم بال pump : ارسال "1" من (PC) الى PLC-Y3,Extension يؤدي الى تشغيل ال Contactor4 والذي بدوره يشغل ال pump . اما ارسال "0" الى Y3,Extension يؤدي الى توقيف ال Contactor4 والذي بدوره يفصل ال pump.

مراقبة حالة ال pump : عند تشغيل ال Contactor تصبح "1" = PLC-X3,Extension وهي تعني ان ال pump تعمل. وعندما يكون ال Contactor مفصولة فتكون ال "0" = X3,Extension وهي تعني ان ال pump لا تعمل.

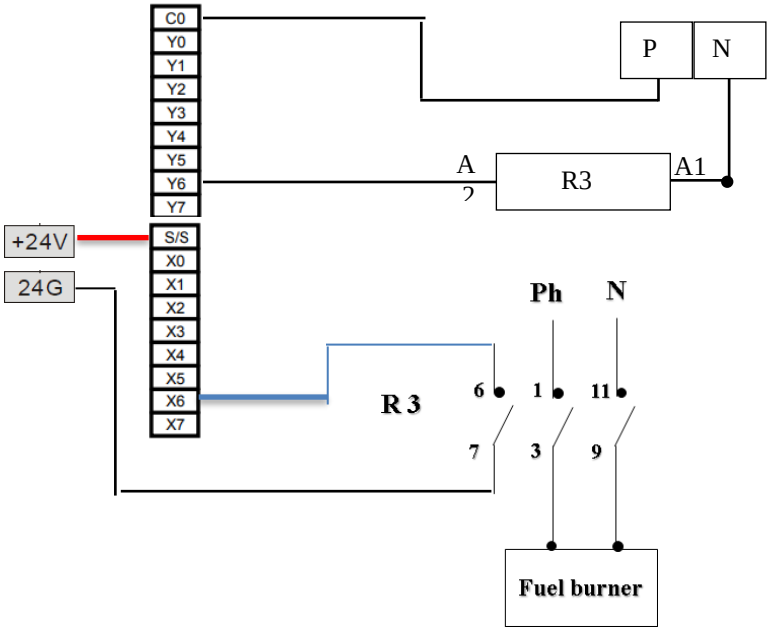
4.9 توصيل ال "Fuel burner" مع ال PLC والتحكم بها من خلال الحاسوب (GUI)

الهدف من الحراق **"Fuel burner"** هوبدأ عملية الحرق من خلال تشعيل النفايات او تغذية عملية الحرق بالوقود لذلك يتم تشغيل الحراق بشكل يدوي عن طريق الحاسوب (GUI) لبدأ عملية الحرق او عند الحاجة لتغذية عملية الحرق.

4.9.1 طريقة توصيل ال "Fuel burner" مع ال PLC

(Relay3 for Fuel burner)

(DVP16SP (Extension Unit))



4.9.2 التحكم ومراقبة ال "Fuel burner":

(يجب ان نضغط عل الكباس الموجود عل الحراق لكي نستطيع التحكم به)

يتم التحكم ومراقبة ال "Fuel burner" بشكل يدوي عن طريق الحاسوب (GUI) بواسطة ال Modbus على الشكل التالي:

التحكم بال Fuel burner : ارسال "1" من (PC) الى PLC-Y6,Extension يؤدي الى تشغيل ال Relay3 والذي بدوره يشغل ال Fuel burner. اما ارسال "0" الى Y6,Extension يؤدي الى توقيف ال Relay 3 والذي بدوره يفصل ال Fuel burner.

مراقبة حالة ال Fuel burner : عند تشغيل ال Relay تصبح "1" = PLC-X6,Extension وهي تعني ان ال Fuel burner موصول ليعمل.

وعندما تكون ال Relay مفصولة فتكون ال "0" = X6,Extension وهي تعني ان ال Fuel burner مفصول ولا يعمل.

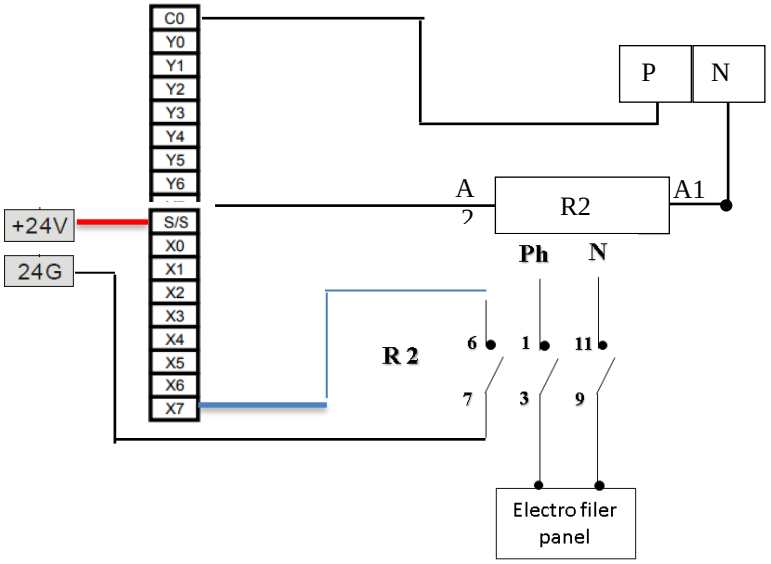
4.10 توصيل ال "Electro filter panel" مع ال PLC و التحكم بها من خلال الحاسوب (GUI)

الهدف من "Electro filer" تنقية الهواء الذي يخرج من المحرقة لذلك يتم تشغيل "Electro filter panel" بشكل يدوي بواسطة الحاسوب (GUI) عند تشغيل المحرقة.

4.10.1طريقة توصيل ال "Electro filer panel" مع ال PLC

(Relay2 for "Electro filer panel")

(DVP16SP (Extension Unit))



4.10.2التحكم ومراقبة ال "Electro filer panel":

يتم التحكم ومراقبة ال "Electro filer panel" بشكل يدوي عن طريق الحاسوب (User interface) بواسطة ال Modbus على الشكل التالي:

<u>التحكم بال "Electro filer panel"</u> : ارسال "1" من (PC) الى PLC-Y7,Extension يؤدي الى تشغيل ال Relay2 والذي بدوره يشغل ال "Electro filer panel".

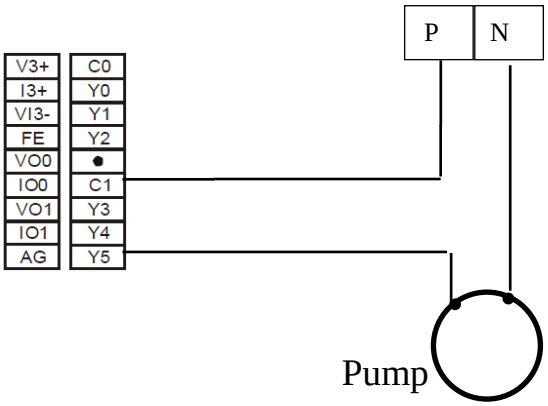
اما ارسال "0" الى Y7,Extension يؤدي الى توقيف ال Relay 2 والذي بدوره يفصل ال "Electro filer panel".

<u>مراقبة حالة ال "Electro filer panel"</u> : عند تشغيل ال Relay تصبح "1" = PLC-X7,Extension وهي تعني ان ال "Electro filer panel" موصول ليعمل.

وعندما يكون ال Relay مفصولة فتكون ال "0" = X7,Extension وهي تعني ان ال "Electro filer panel" مفصول ولا يعمل.

4.11 توصيل ال "Condenser Water Tank Pump" مع PLC والتحكم بها من خلال الحاسوب (GUI)

4.11.1 طريقة توصيل ال "Condenser Pump" مع ال PLC



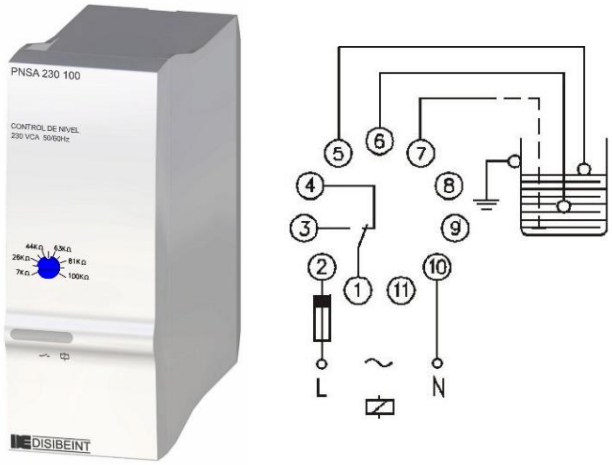
4.11.2 التحكم بال "Condenser Water Tank Pump"

يتم التحكم بال "Condenser pump" بشكل يدوي "Manual" عن طريق الحاسوب بواسطة ال Modbus من خلال Address PLC-Y5 (عند ارسال "1" الى Y5 فتصبح Y5 ON فتعمل ال pump اما عند ارسال "0" الى Y5 فتصبح Y5 OFF فتفصل ال pump) .

4.12 توصيل ال "Water Steam Cycle Main Pump (3 phases pump)" و "Level Control Relay" مع ال PLC والتحكم بهم

Water Steam Cycle Main Pump (3phases)

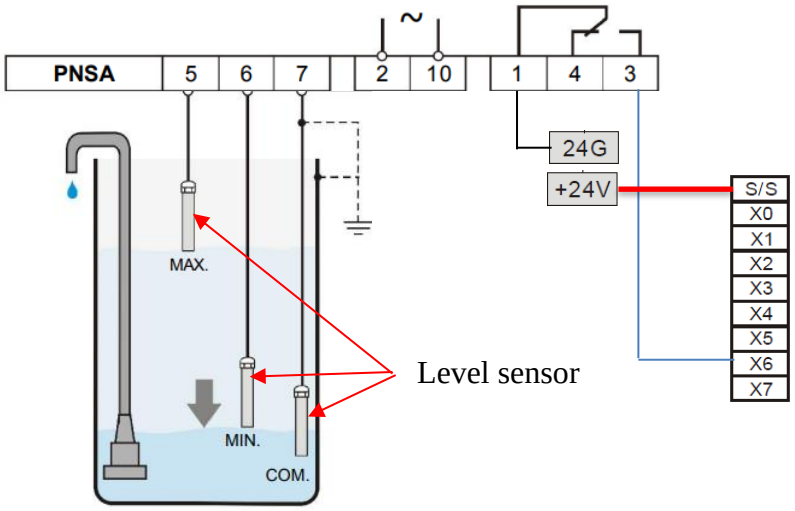
Level Control Relay (PNSA 230 100)



Level sensors

الهدف من Level Control معرفة خزان ال Boiler اذا كان ممتلأ او فارغ فاذا كان الخزان فارغ يتم تشغيل ال "Water Steam Cycle Main Pump (3phase)" بشكل اوتوماتيكي لملأ خزان ال Boiler بالماء حتى حدود Level-Max.

4.12.1 طريقة توصيل "Level Control" مع ال PLC



PLC DELTA

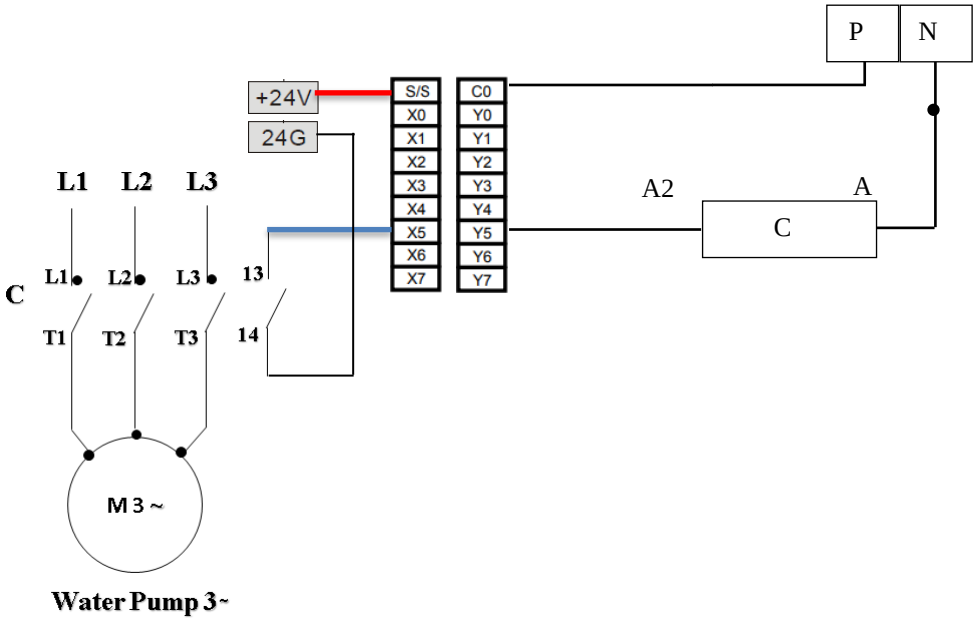
4.12.2مراقبة مستوى الماء في "Boiler tank" عن طريق ال PLC

عندما ينخفض الماء في الخزان الى ما دون Min – level sensor يصبح المفتاح ال Relay 3-1 موصول وبالتالي"1"=PLC-X6 وهي تعني ان الخزان فارغ.

وعندما يمتلأ الخزان الى حدود level sensor – Max فيصبح المفتاح ال Relay 1-3 مفصول وبالتالي PLC-X6="0" وهي تعني ان الخزان ممتلأ.

4.12.3 توصيل "Water Steam Cycle Main Pump (3phase)" مع ال PLC

(DVP16SP-Extension Unit)



4.12.4 التحكم ومراقبة ال "Water Steam Cycle Main Pump (3phase)"

يمكن التحكم بال "Pump 3~" بشكل اوتوماتيكي عن طريق ال "Level Control" : فعند انخفاض الماء في الخزان تكون "PLC-X6 ="1 فيصبح "PLC-Y5,Extension" ON فيعمل ال Contactor وتشتغل ال Pump .

اما عندما يمتلأ الخزان فيصبح "PLC-X6 ="0 وبالتالي "PLC-Y5,Extension" OFF فيفصل ال Contactor وتتوقف ال Pump .

يمكن التحكم بال "Water Pump 3~" بشكل يدوي عن طريق الحاسوب "GUI" بواسطة ال Modbus : للتشغيل اليدوي يجب ان نرسل"1" الى PLC-M50 لكي نستطيع التحكم بال Pump ومن ثم ارسال "1" الى ال PLC-M51 فتصبح "PLC-Y5, Extension" ON فيعمل ال Contactor وتشتغل ال Pump او ارسال "0" الى الPLC-M51 فيصبح "PLC-Y5, Extension" OFF فيفصل ال Contactor وتتوقف ال Pump.

مراقبة حالة ال Pump 3~

عند تشغيل ال Contactor تصبح "PLC-X5,Extension = "1 وهي تعني ان ال "Pump" تعمل.

وعندما يكون ال Contactor مفصولة فتكون ال "X5,Extension = "0 وهي تعني ان ال "Pump" لا تعمل.

4.13 Electrofilter Current Monitoring

The electrofilter uses a high voltage potential between 2 coductors that charges the light polluted gas coming from previous filtering stage (and thus generates a small current at the secondary) and makes them heavy. These heavy particles will then drop down and thus significantly reduce the total pollution coming from the station.

To ensure the functionality of the electrofilter, a non-invasive current sensor is used to measure the current at the primary of the HV transformer. The current sensor used is shown below which has a linear curve and the following specs:

Figure 1. YHDC Current Transformer

Table 1. YHDC SCT013-010 Specs

Parameter	Value
Rated input	$0-10A$
Rated output	$-1\ to\ 1V$
Accuracy	$\pm 1\%$
Linearity	$\leq 0.2\%$
Turns ratio	$1:1800$
Working voltage, frequency	$660V, 50-1KHz$

4.13.1 Connecting the Current Sensor to Controller

The current sensor produces an output voltage between -1V and +1V which represents -10 A to +10A respectively. However, every controller accepts only positive analog numbers (0 – 5V in case of Arduino) and (-10V-10V in case of PLC), so an offset is a must. The below circuit in figure 2 is designed to offset the readings coming from the current sensor.

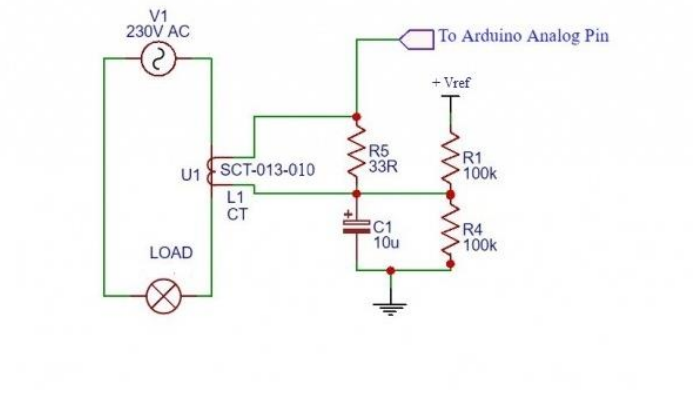


Figure 2. Current Sensor with Offset Schematic

R1 and R4 are used to divide the reference voltage by half. So, the voltage across the capacitor is:

$$V_C = \frac{R_4}{R_1 + R_4} \times V_{ref} = \frac{1}{2} \times V_{ref} \quad (1)$$

If $V_{ref} = 5V$, the measurements from the current sensor will be offset by 2.5V. And thus, the output from the sensor will be between 1.5V and 3.5V. The reference voltage affects the selection of the burden resistor (R5) which is chosen according to:

$$R_{burden}(\Omega) = \frac{A_{ref} \times n}{2\sqrt{2} \times I_{p_{max}}} \quad (2)$$

Where:

- A_{ref}: Reference voltage in V
- n: Current transformer number of turns (= 1800)
- $I_{p_{max}}$: Maximum primary current in A (= 10 A)

4.13.1.1 Extracting RMS Readings

The current sensor measures instantaneous current by converting the electrical field generated by the current passing through a conductor into voltage. The drawing below in Figure 3 shows the location of the current sensor in the real system. The CT is connected into the primary and the readings will be transformed to secondary by ideal transformer relation between the 2 windings as in equation (3) below.

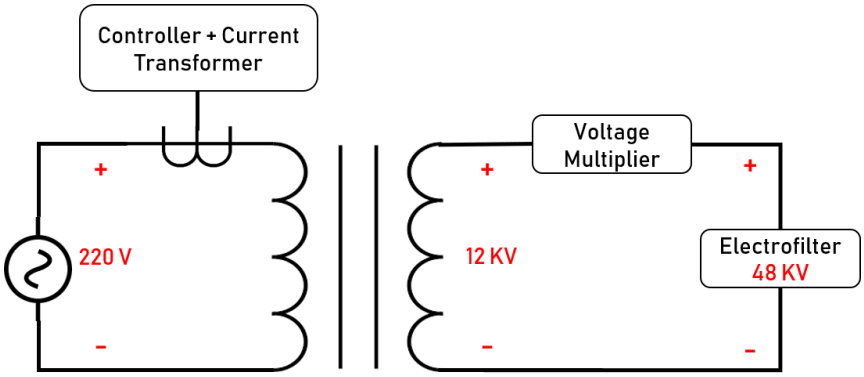


Figure 3. System Diagram

$$\frac{V_1}{V_2} = \frac{I_2}{I_1} = \frac{n_1}{n_2} \quad (3)$$

The procedure of extracting the current from the CT sensor is discussed in the flowchart below in figure 4.

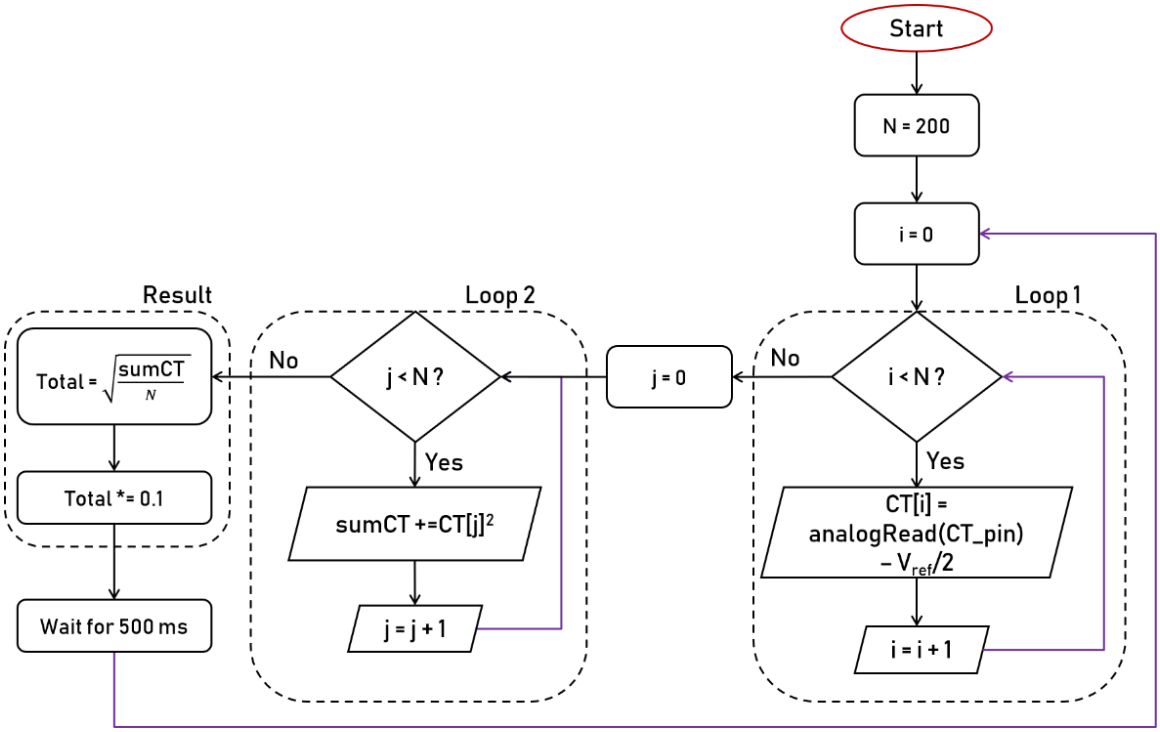


Figure 4. Programming Flowchart

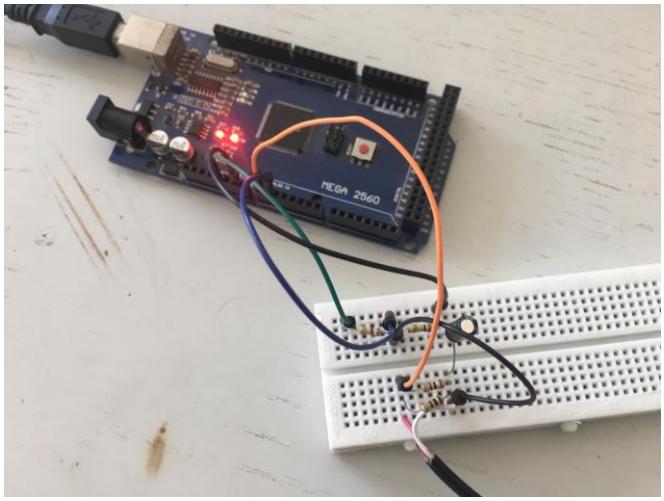
In order to calculate the RMS current (which follows equation (4) below) from instantaneous current measurements, the code is divided into 3 sections as seen above:

$$I_{RMS} = I_{cal} \times \frac{V_{ref}}{ADC_{res}} \sqrt{\frac{1}{N}\int_0^N \left(CT_{analog} - V_{analog}^{offset}\right)^2} \qquad (4)$$

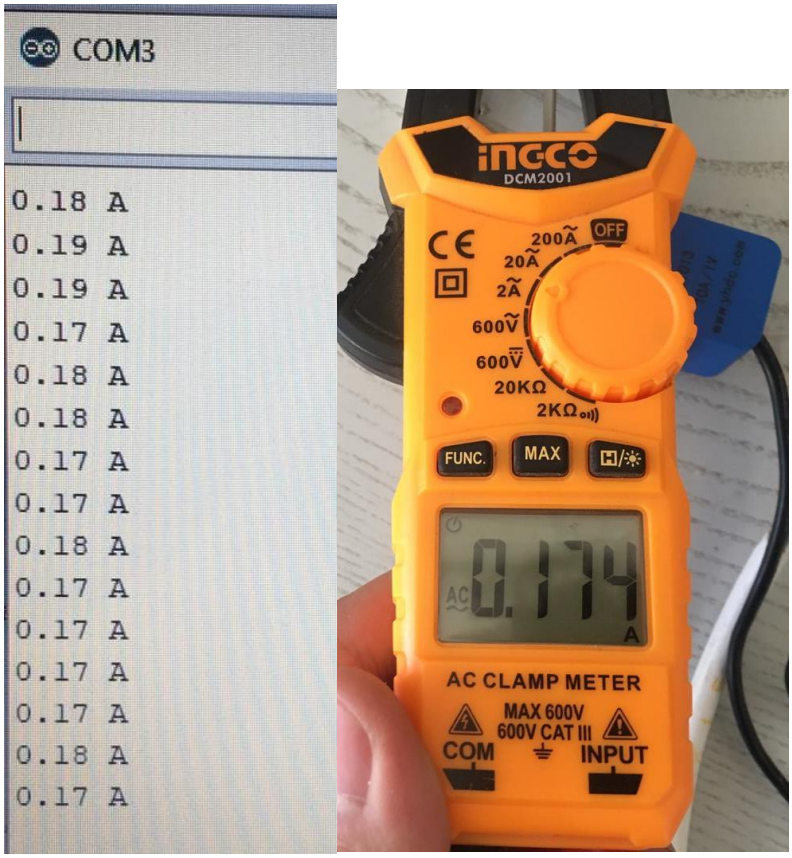
- Loop 1: In this loop, 200 analog readings taken from the CT are subtracted from the offset value (V_{ref} / 2) and are saved in an array.
- Loop 2: The values of the voltages in the previous loop (generated by the CT with an offset) are squared and integrated.
- Result: In this section of the code, the RMS value of the current is calculated by doing a square-root of the integrated square voltages (which are image of the current) and then multiplied by the conversion factor $\left(I_{cal} = 0.1\frac{V}{A}\right)$ which is given in the datasheet of the YHDC SCT013-010 CT.

4.13.1.2 CT and Arduino Testing

Before connecting the CT to PLC, it was tested by Arduino to ensure its functionality. The circuit in figure 2 was connected with V_{ref} was set to 5V, burden resistance was put to 50 ohms, and a load of 40 W (or 0.18 A) was tested. A commercial Ammeter was used to make sure the readings generated from the CT are correct.



As can be seen from the results below, the CT connected to an Arduino gave the exact same current reading as a commercial ammeter.



The Arduino code is listed below:

```
const unsigned int numReadings = 200; //samples to calculate Vrms.

int readingsVClamp[numReadings];    // samples of the sensor SCT-013-010
int readingsGND[numReadings];      // samples of the span
float SumSqGND = 0;
float SumSqVClamp = 0;
float total = 0;

int PinVClamp = A0;    // Sensor SCT-013-010
int PinVirtGND = A1;

void setup() {
  Serial.begin(115200);
  // initialize all the readings to 0:
  for (int thisReading = 0; thisReading < numReadings; thisReading++) {
    readingsVClamp[thisReading] = 0;
    readingsGND[thisReading] = 0;
  }
}

void loop() {
  unsigned int i=0;
  SumSqGND = 0;
  SumSqVClamp = 0;
  total = 0;

  for (unsigned int i=0; i<numReadings; i++)
  {
    readingsVClamp[i] = analogRead(PinVClamp) - analogRead(PinVirtGND);
    delay(1); //
  }

  //Calculate Vrms
  for (unsigned int i=0; i<numReadings; i++)
  {
    SumSqVClamp = SumSqVClamp + sq((float)readingsVClamp[i]);

  }

  total = sqrt(SumSqVClamp/numReadings);
  total= (total * 0.1);

  Serial.println(String(total) + " A");
  delay(500);
}
```

4.13.1.3 CT PLC

The connections of the current sensor and the PLC are shown in the diagram below:

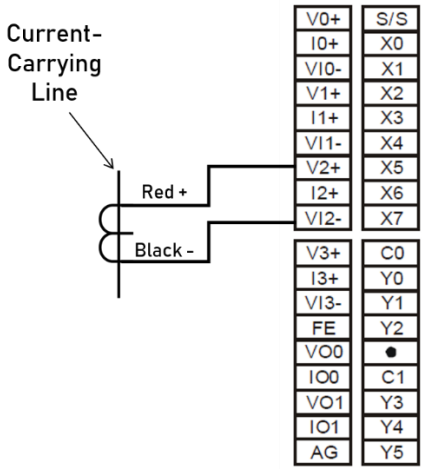
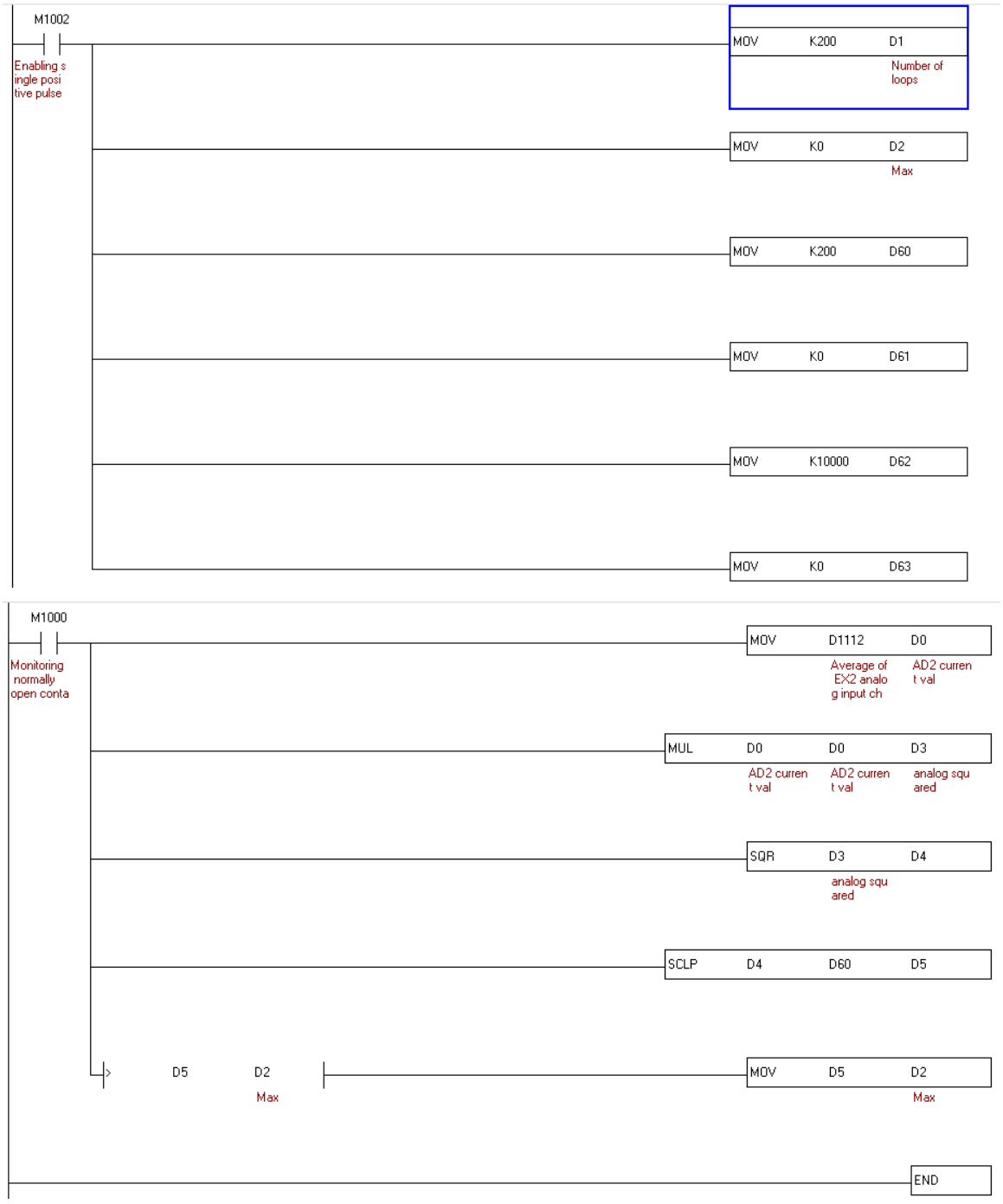


Figure 5. CT with PLC Connections

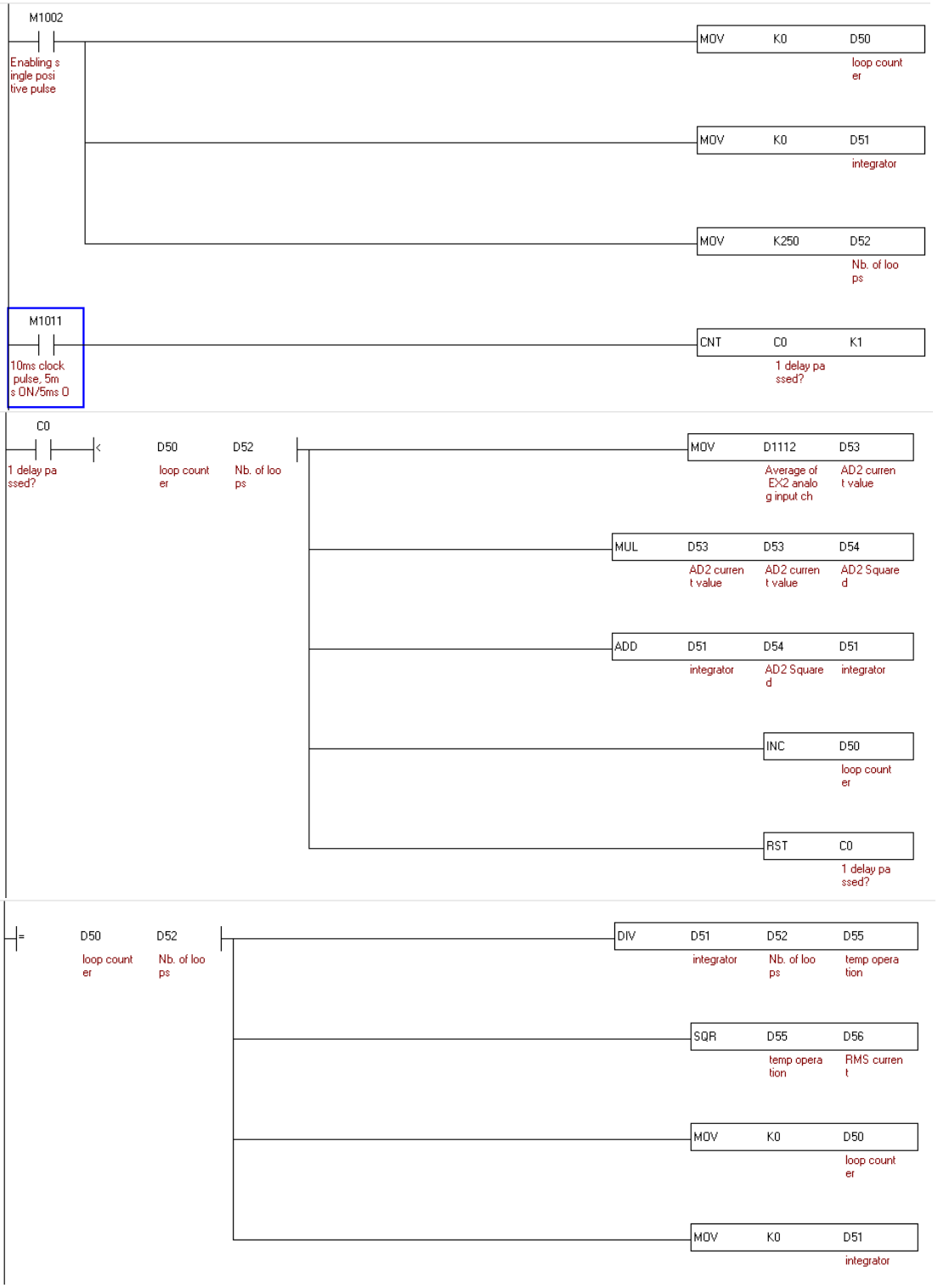
4.13.1.4 Experiment 1 (Not Recommended)



- M1002: Enables a positive pulse at the start of the PLC.
- MOV k0 D2: Set D2 to 0 which describes the max value later.
- MOV k200 D60: Set D60 to 200 which corresponds to 1V analog input max sensor input$\left(200\ bit\ \times \frac{10\ V}{2000\ bit}\right)$.
- MOV k0 D61: Set D61 to 0 which corresponds to 0V analog input minimum sensor input.
- MOV k10000 D62: Set D62 to 10000 which corresponds to $(1000\ mV\ \times \frac{10A}{V})$ that represents the desired upper limit scaling for input.
- MOV k0 D63: Set D3 to 0 which corresponds to the lower limit scaling for input.
- M1000: Monitoring normally open contact (closes when the PLC runs).
- MOV D1112 D0: Move the current readings from the AD2 (Analog input 2) to D0.
- MUL D0 D0 D3: $D3 = D0^2$
- SQR D3 D4: $D4 = \sqrt{D3}$
- SCLP D4 D60: Scale the square-rooted variable D4 to numbers between 0 and 10000.
- > D5 D2: if D5 is greater than D2 (D2 represents the max value), put the max value equal to D5.

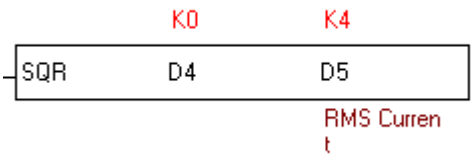
And finally, the value stored in D5 should be divided by $\left(\frac{1}{1000 \times \sqrt{2}} \approx \frac{1}{1410}\right)$ to get an estimated value of the RMS current.

4.13.1.5 Experiment 2 (Working Well)

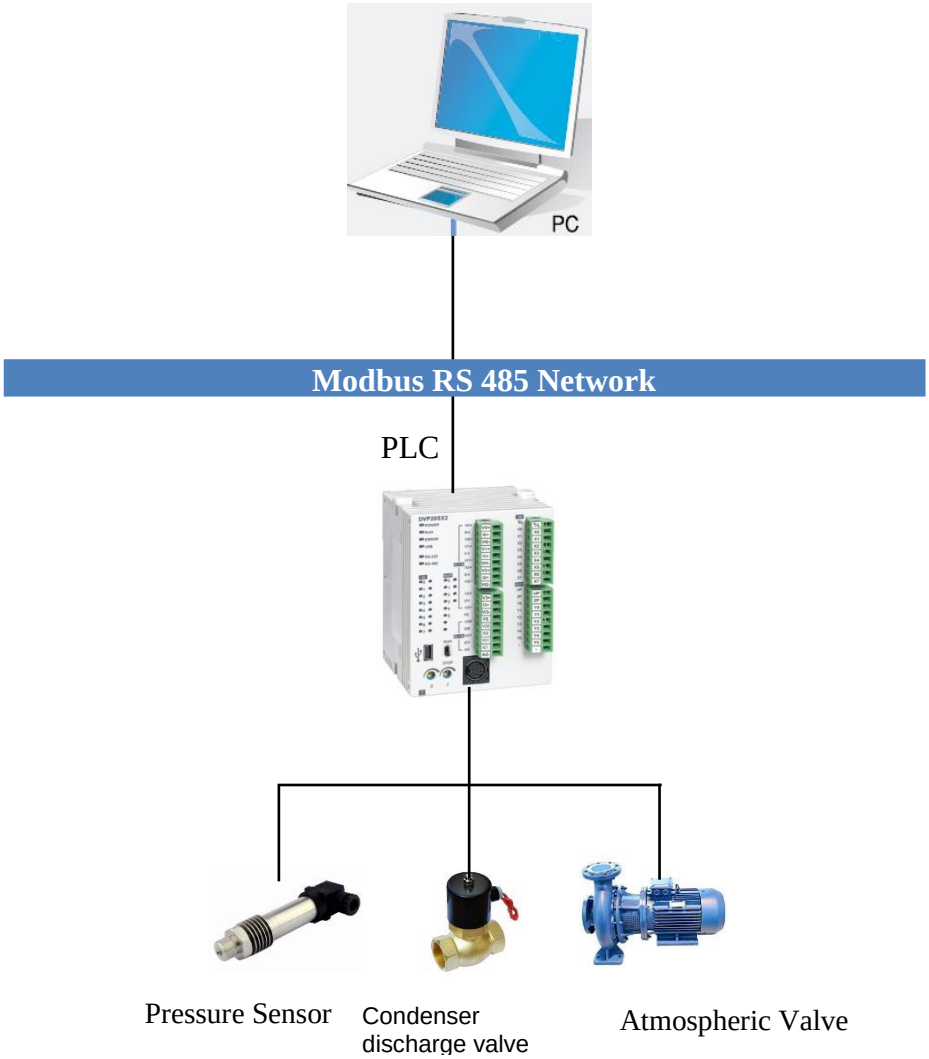


- M1002: Single positive pulse at the start of the PLC.
- MOV k0 D50 (Init step): set the loop counter variable to 0. Used to count the integral loops. Necessary for taking several actions.
- MOV k0 D51 (Init step): Begin the integrator with 0. This will be used to accumulate the voltages generated from the current transducer.
- MOV k250 D52 (Init step): Number of loops. The RMS current will be calculated every 250 loops.
- M1011: 10 ms clock pulse (5 ms ON and 5 ms OFF).
- CNT C0 k1: Enables a counter to only count for a single shot (each 10 ms). It is used to schedule the current readings at 10 ms.
- If 10 ms passed (C0 counts 1) and the loop counter is still less than the number of loops:
    - MOV D1112 D53: take a current measurement from AD2 and store it in D53.
    - MUL D53 D53 D54: $D54 = D53^2$. The squared values of the voltages generated from the current sensor are stored in D54.
    - ADD D51 D54 D51: $D51 = D51 + D54 = \int D54$. Nothing but an integration process.
    - INC D50: Increment the loop timer by 1.
    - RST C0: Reset the counter.
- If the loop counter is equal to the number of loops:
    - DIV D51 D52 D55: $D55 = \frac{D51}{D52} = \frac{integrator}{number\ of\ loops}$.
    - SQR D55 D56: $D56 = Current_{RMS} = \sqrt{D55} = \sqrt{\frac{integrator}{Number\ of\ loops}}$.
    - MOV k0 D50: Clear the loop counter.
    - MOV k0 D51: Clear the integrator.

The RMS current (D56) is the desired value to be read. It should be divided by 20 to have the full reading of the current. A typical result is shown below. The real RMS load current is approximately 0.2A. The RMS current calculated by the PLC is found to be 4 (k4). This number should be divided by 20 ($10\frac{A}{V} \times \frac{10V}{2000\ Bits} = \frac{1A}{20\ Bits}$) to give ($4\ bits\ \times \frac{1A}{20\ Bits} = 0.2A$).

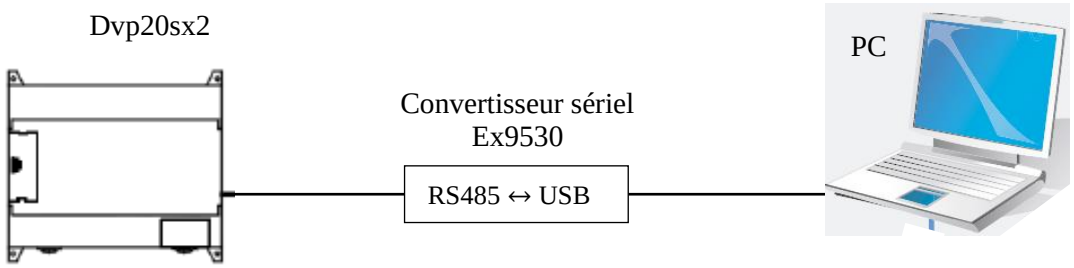


4.14 Boiler Pressure Control (BPC) by PLC & “Vijeo Designer”



يكون التحكم في ال valves بشكل اوتوماتيكي بواسطة ال PLC (عندما يرتفع الضغط الى 15 bar يفتح Condenser valve وعندما ينخفض الضغط الى 14.1 bar يغلق valve . اما عندما يصل الضغط الى 15.5 bar فيفتح atmospheric valve وعندما ينخفض الضغط الى 14.1 bar فيغلق ال Valve .

4.14.1 Communication between Vijeo software and the PLC



لربط ال PLC مع برنامج ال Vijeo نحتاج لوصلة Ex9530 مع التعريف

4.14.2 Configure the communication settings

The communication parameters are given in the following table:

Item	Specification
Protocol	Modbus (RTU)
Port	COM2
Slave address	2
Baud Rate	9600
Data bits	8
Parity	None
Stop bit	1

Application development
In this application, the Vijeo software:
Read the status of atmospheric valve
Read the status of condenser valve
Manual Control of atmospheric valve
Manual Control of condenser valve
Monitoring the pressure
Write in the PLC default pressure for test

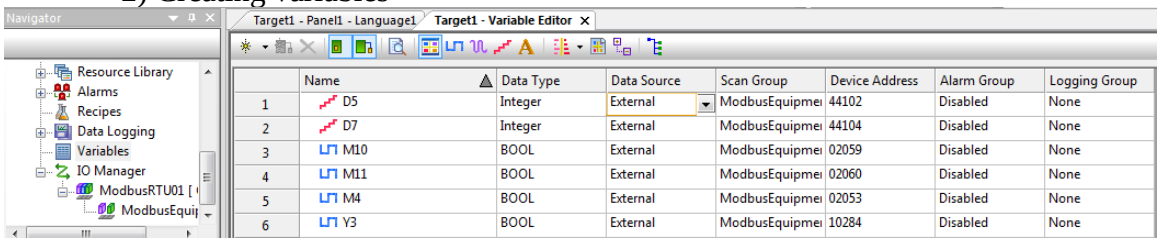
The Application Settings are given in the following table:
Parameter

Device in PLC	**The address in decimal**	**Function**	**Action**
M4	02053	Read	Status of atmospheric valve
M10	02059	Write	Control of atmospheric valve
M11	2060	Write	Control of condenser valve
Y3	01284	Read	Status of condenser valve

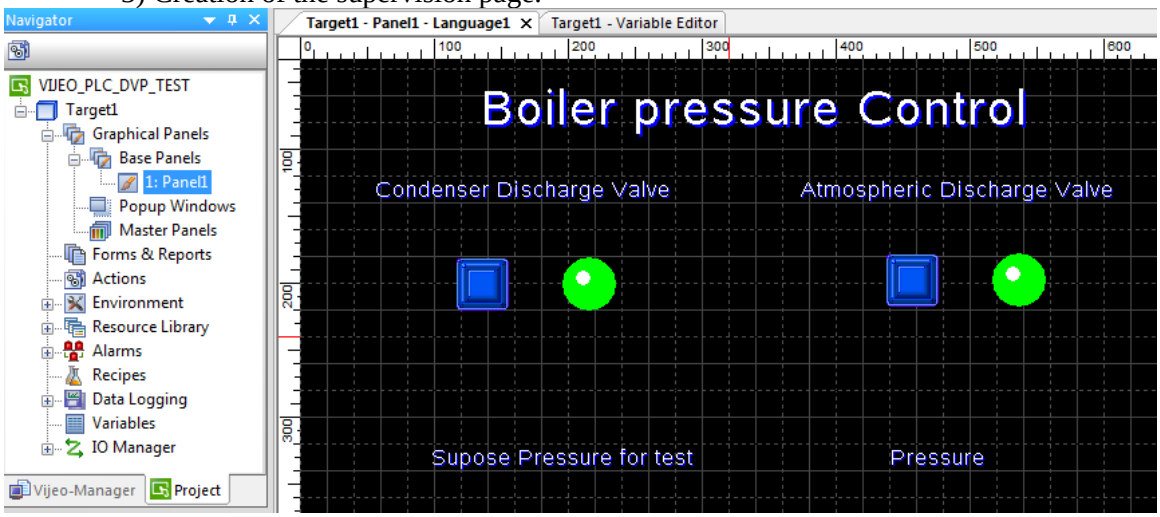
D5	44102	Read	Monitoring the pressure
D7	44104	Write	Write the default pressure for test

4.14.3 Create a Project in the Vijeo software for PC

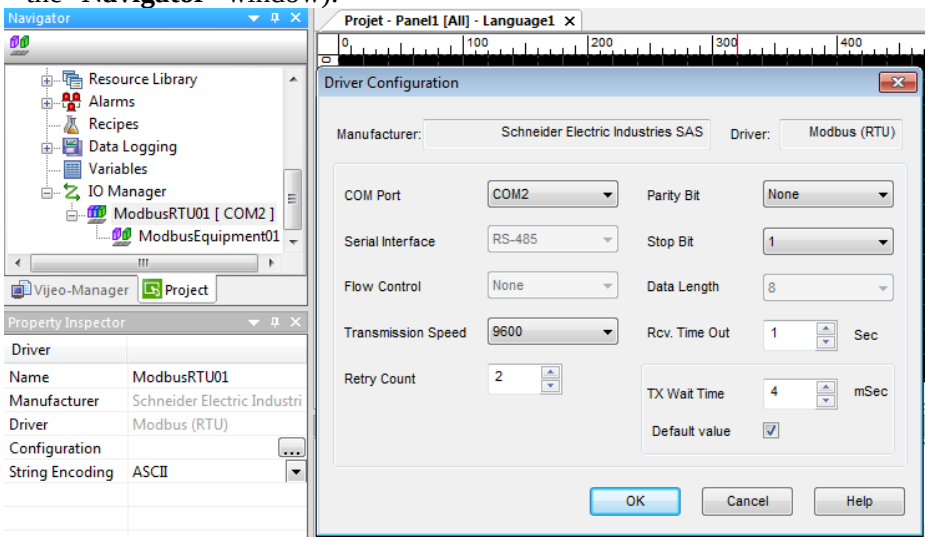
1) Creation of a new project and one chooses Modbus RTU Protocol
2) Creating variables

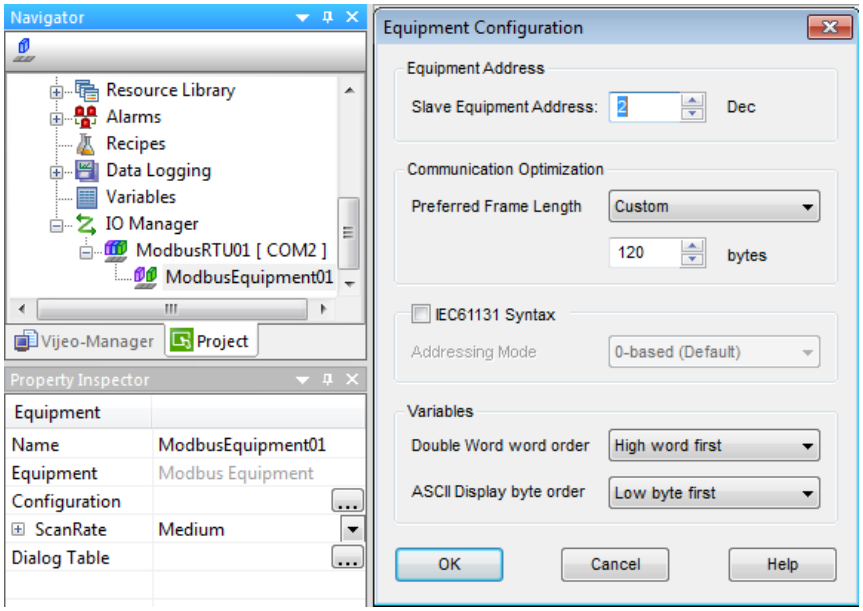


3) Creation of the supervision page.

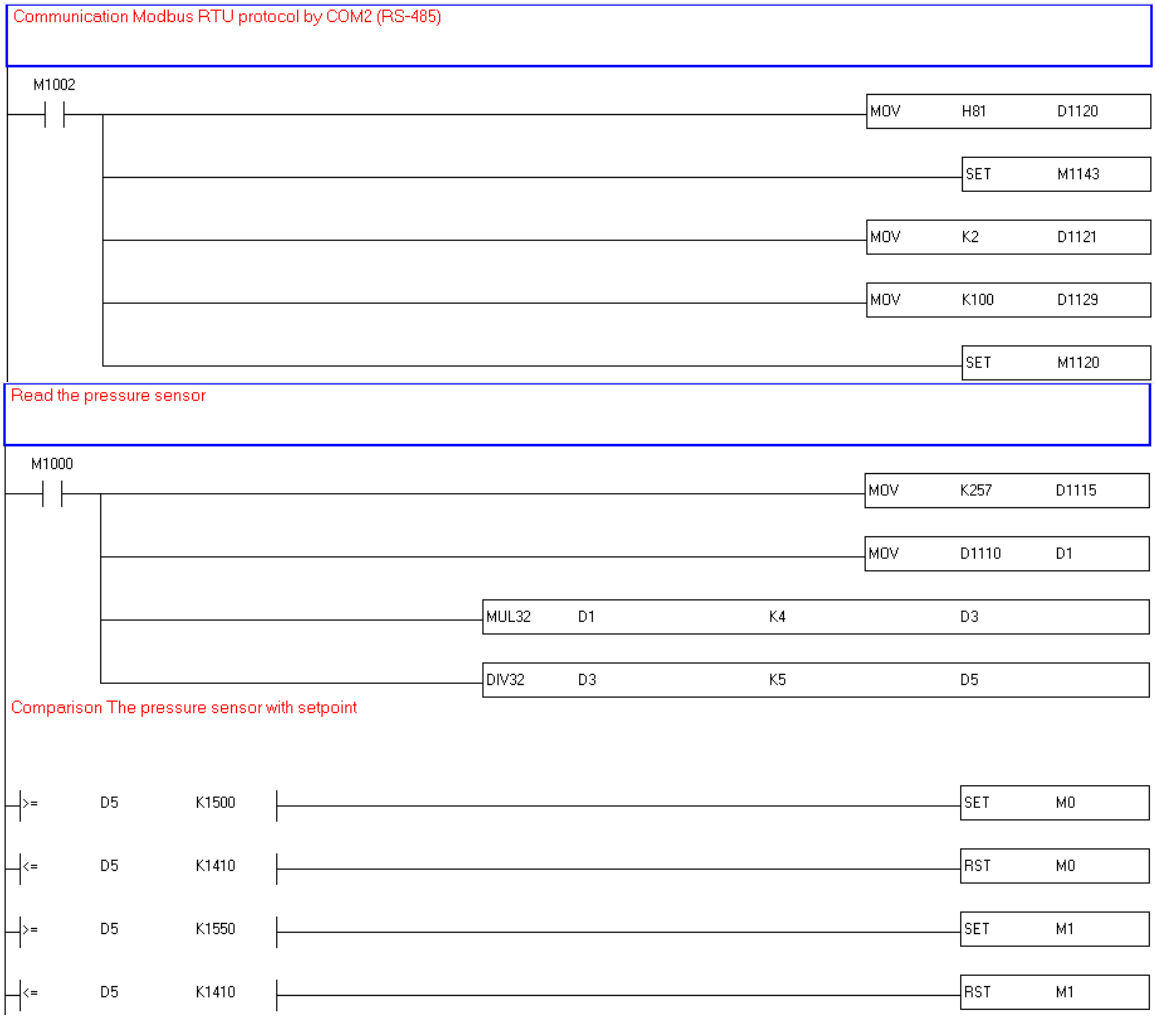


4) Definition of the communication parameters in the "Driver configuration" and "Equipment Configuration" windows ((the communication parameters in the "**IO Manager**" node from the "**Navigator**" window).



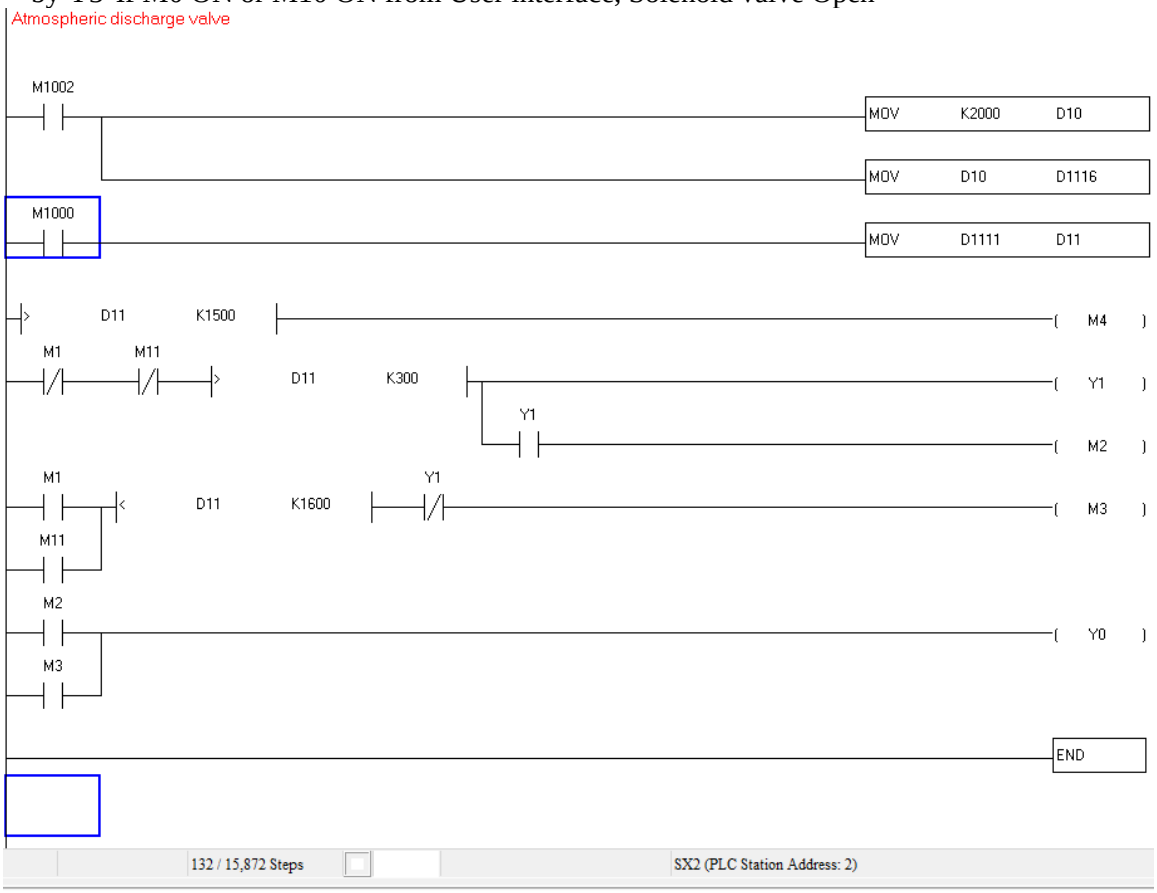


4.14.4 Create Project in the WPL soft for PLC

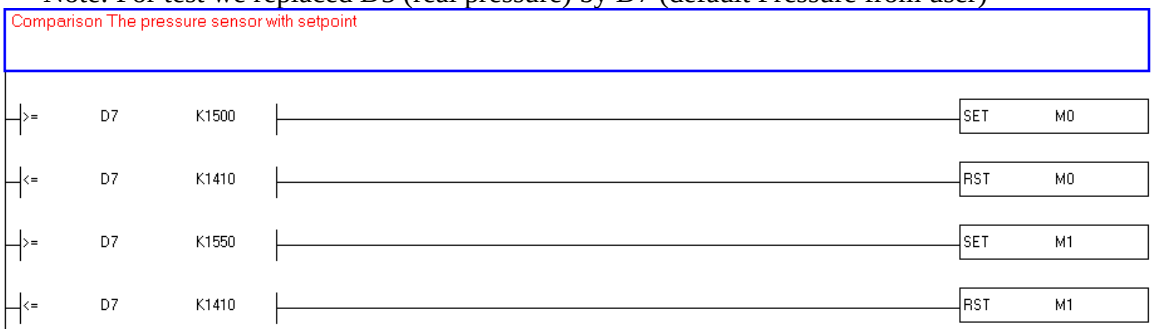


If the pressure >= 15 bar, M0 ON & if the pressure <=14.1 bar, M0 OFF
If the pressure >= 15,5 bar, M1 ON & if the pressure <=14.1 bar, M1 OFF

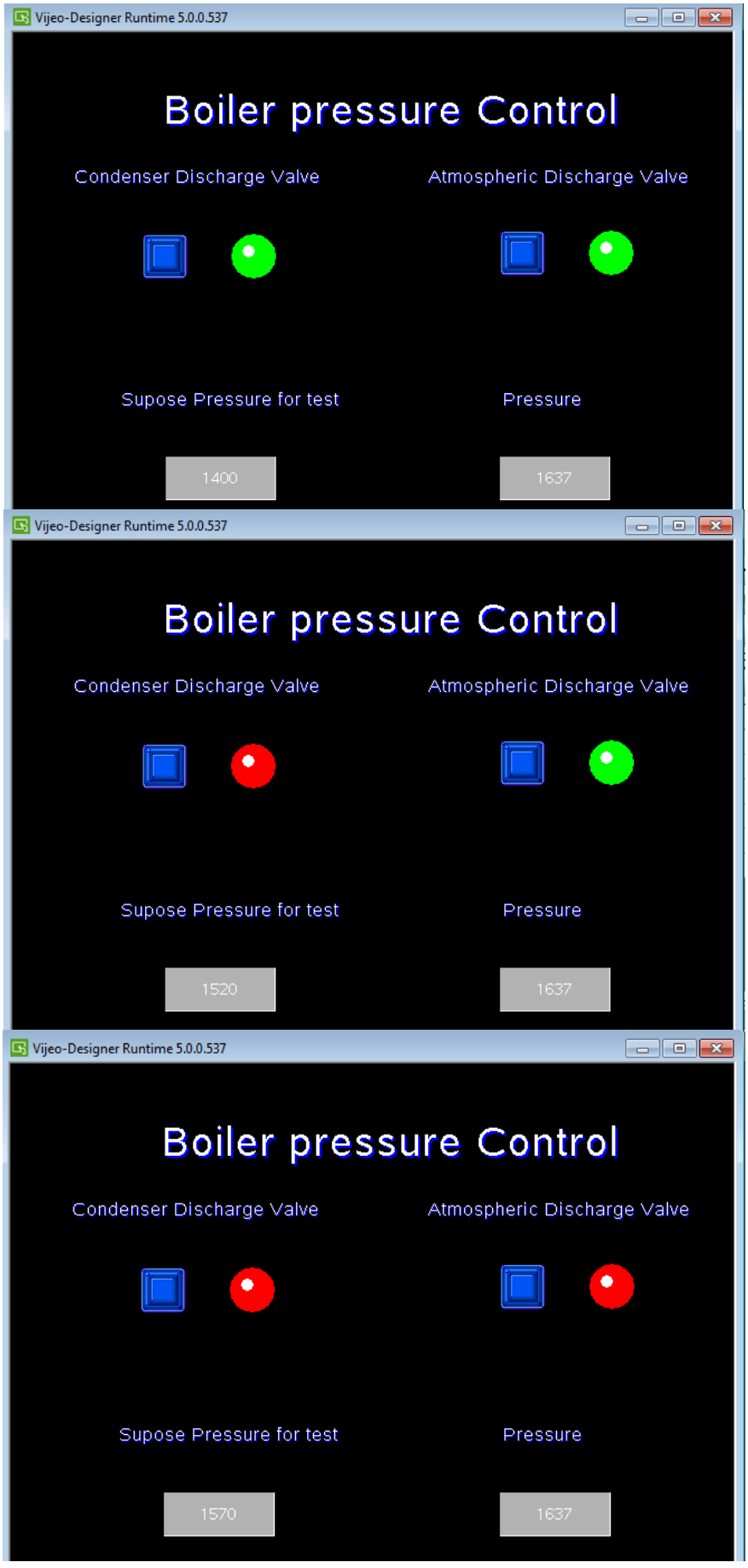
by Y3 If M0 ON or M10 ON from User interface, Solenoid valve Open



If D11> 1500 (the PLC Read from potentiometer > 7.5V), M4 ON (status of valve is open).
If M1 ON (the pressure >= 15.5 bar) or M11 ON from User interface & D11<1600 (if the valve is incomplete opening) & Y1 OFF, M3 ON (the valve is open by Y0)
If M1 OFF (the pressure <=14.1 bar) & M11 OFF from User interface & D11>300 (if the valve is incomplete closure), Y1 ON & M2 ON (the valve is close by Y0 & Y1)
Note: For test we replaced D5 (real pressure) by D7 (default Pressure from user)



4.14.5 Simulation



4.15 PLC Code

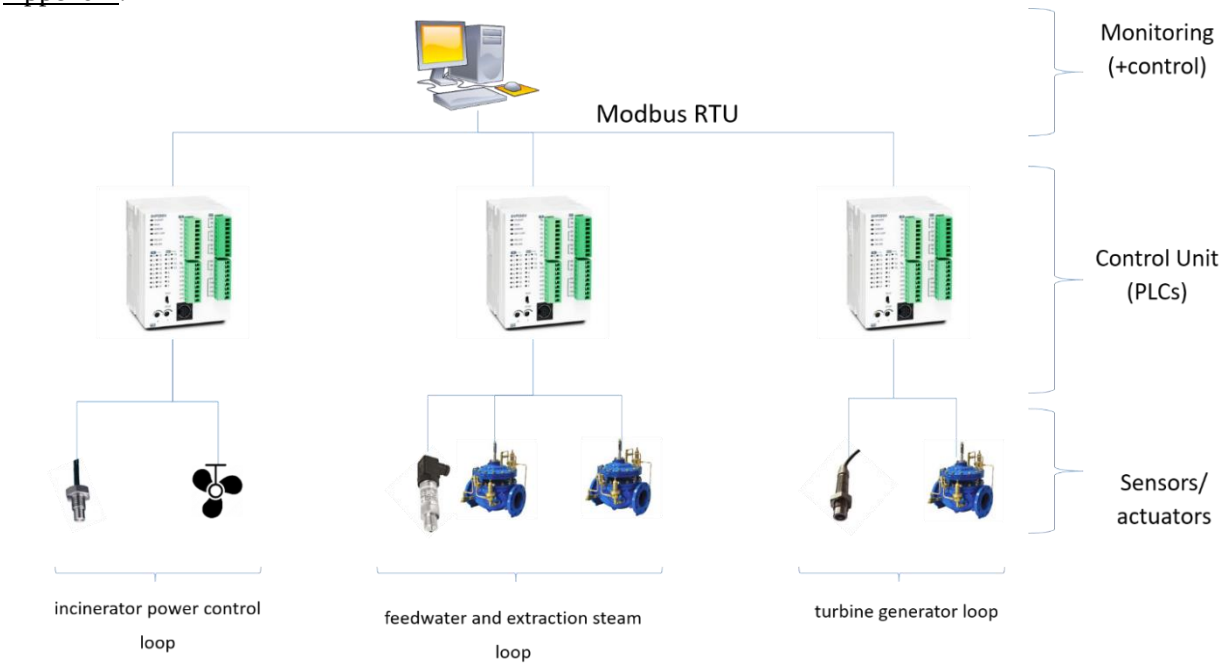
Code repository:

GUI (C#) Source Code	http://aecenar.com/index.php/downloads/send/5-nlap/840-nlap-ipp-gui-code-ver-2022
PLC Ladder Code	http://aecenar.com/index.php/downloads/send/5-nlap/839-nlap-ipp-plc-code-ver-2022

5 Graphical User Interface (GUI)

5.1 Introduction

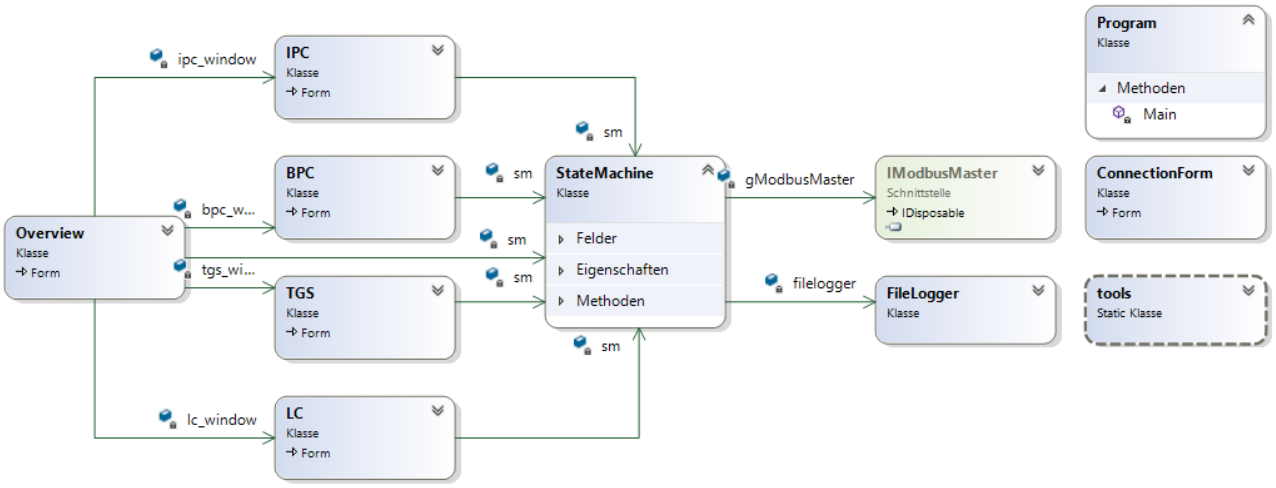
The graphical user interface (GUI) is used to monitor and control the power plant.
It is developed in C# using visual studio 2017.
The main task of the GUI is to initiate and monitor the plants, intervening from time to time. The main control has the control unit with their PLCs.
The PC running the GUI is connected with the Control Unit via Modbus RTU (see figure below) using a USB to Serial adapter (see figure below). To establish working connection drivers are necessary. For driver installation instructions and more information see Modbus-connection in the Appendix.

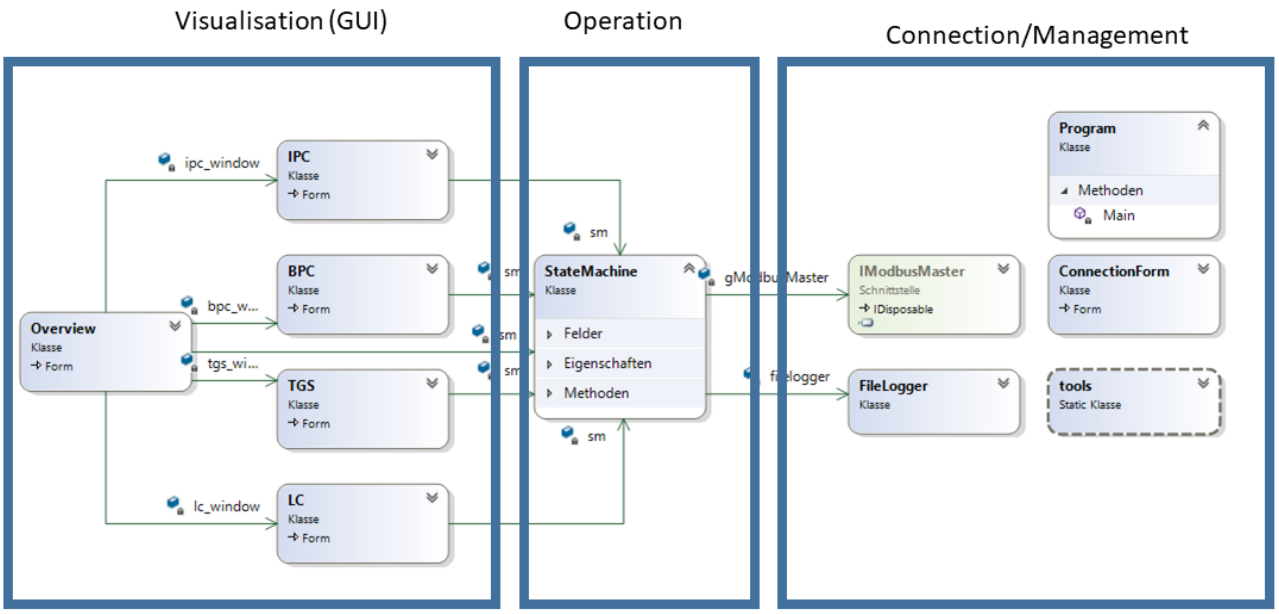


Most of the power plant is directly connected to the Control Unit and thus visible in the GUI and possibly also controllable. But a few things are not. Below the camera, which monitors the combustion chamber. More in the chapter camera.
In this document we will see how the GUI-Software is structured, what it can do, and how it's started and used. In addition, the source code is included in the appendix, as well as other instructions that are helpful in the further development.

5.2 Software Structure

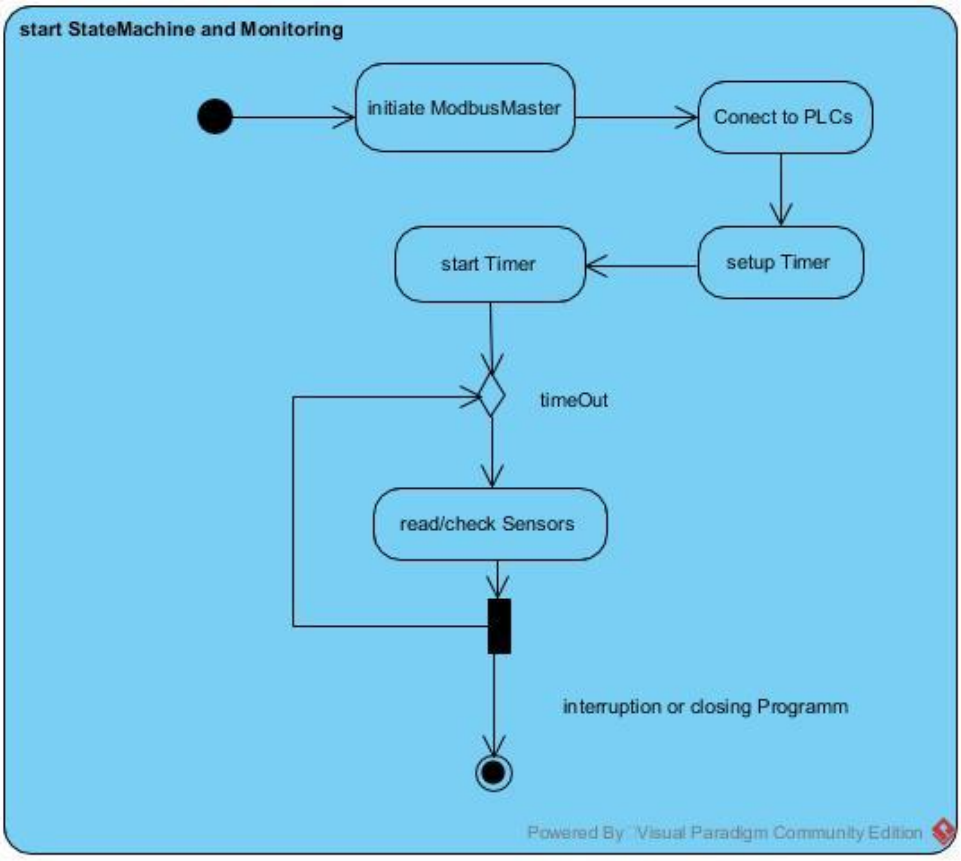
5.2.1 Class diagram



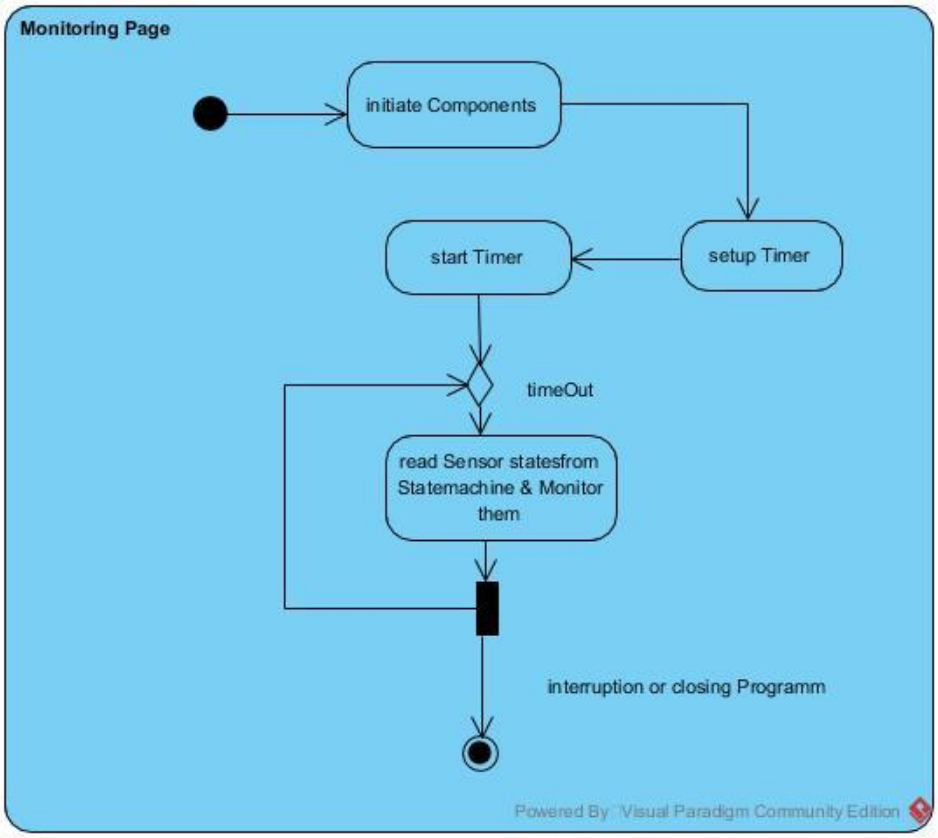


5.2.2 Activity diagrams

The following diagram shows a simplified view of how the state machine works

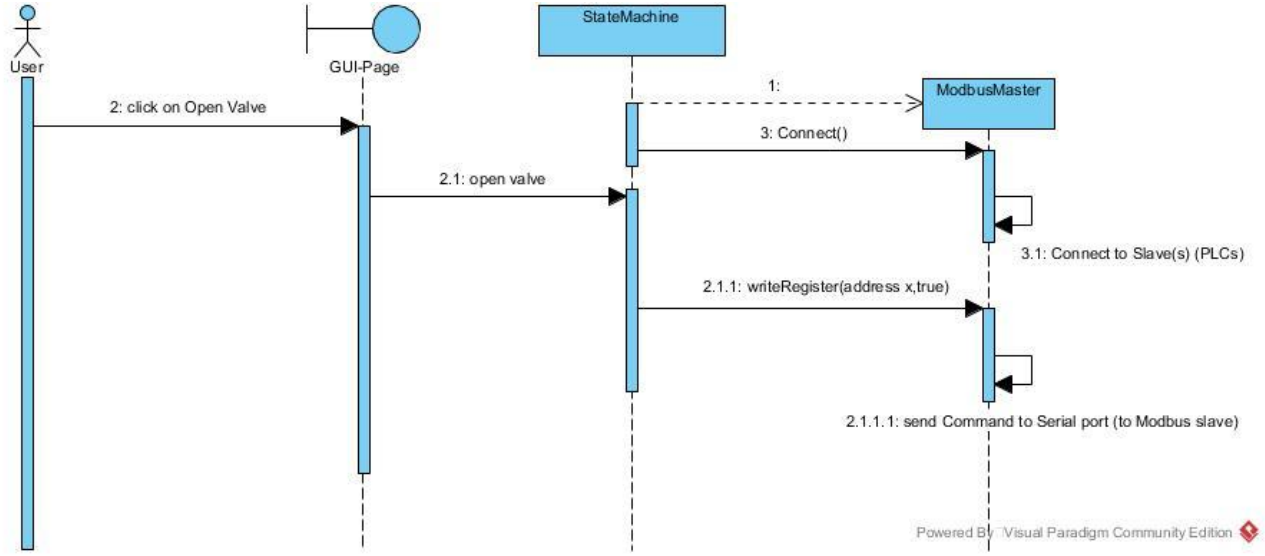


The following diagram shows how an GUI page works



5.2.3 Sequence diagrams

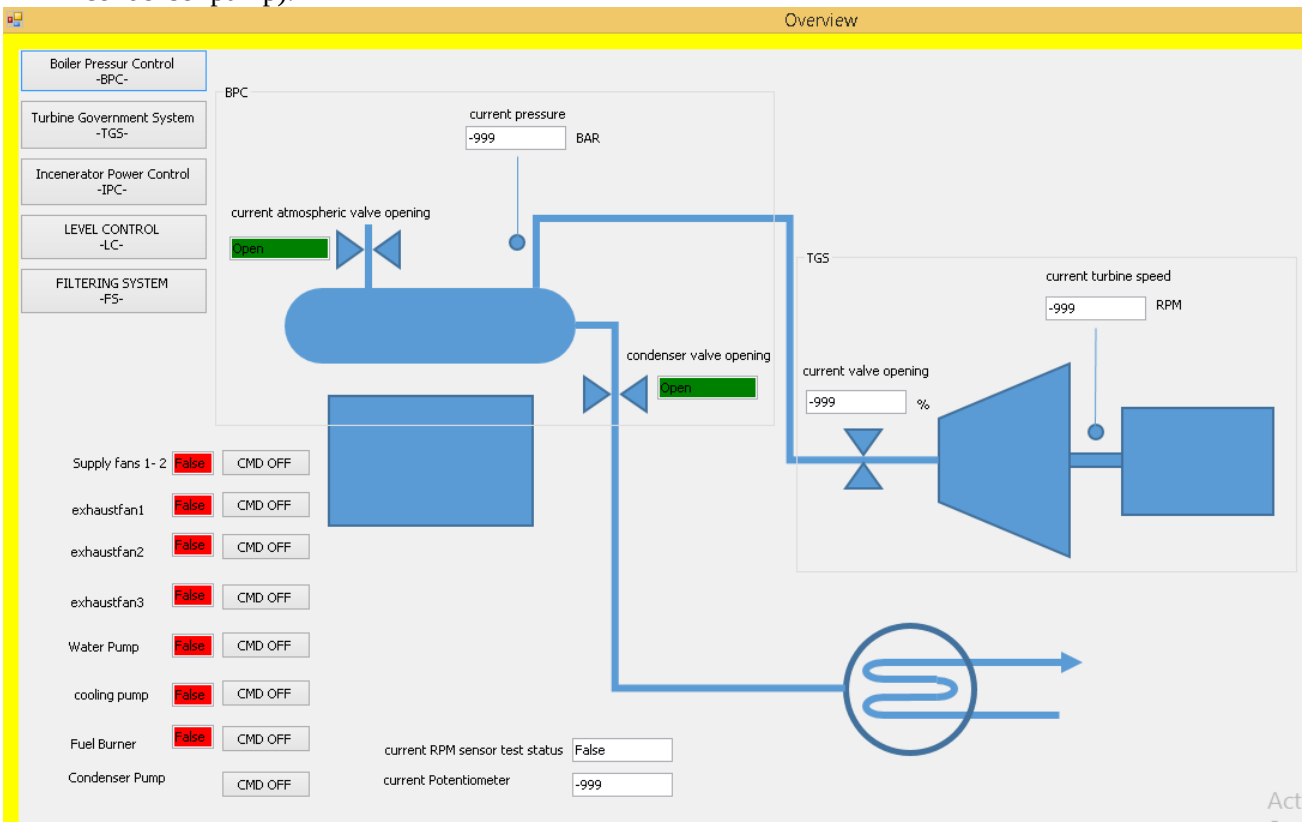
The following diagram shows an controlling interaction example (names may differ from code):



5.3 Pages

5.3.1 Overview

In the overview the most values/states of sensors and actuators are monitored. The control of some actuators is also possible (supply fan, exhaust fans, Fuel burner, cooling pump, water pump & condenser pump).



Color indication for states (Text fields):

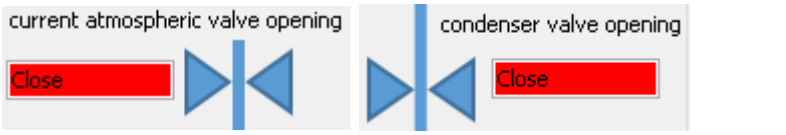
For supply fan, exhaust fans, water pump, cooling pump, Fuel Burner:

-Red→False/OFF 

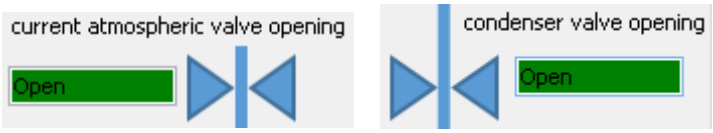
-Green→True/ON 

For atmospheric and condenser valves:

-Red→ CLOSE



-Green→ OPEN



Color indication for control commands (Buttons):

For supply fan, exhaust fans, fresh water pump, cooling pump, Fuel Burner & Condenser pump:

-Red→False/OFF Command is send (the state field should also be red (OFF))

-Green→True/ON Command is send (the state field should also be green (ON))

IMPORTANT NOTE:

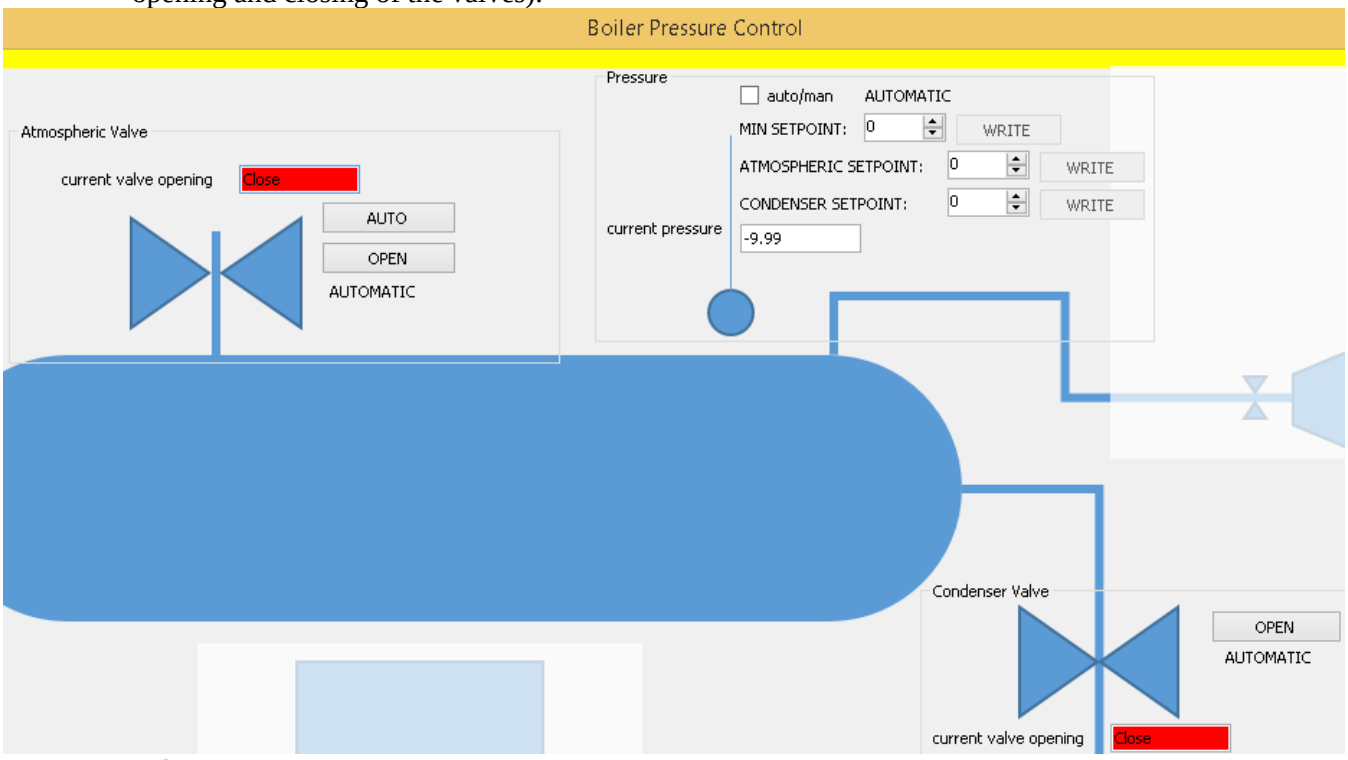
- If the buttons have a different color than the statefields, that means something is wrong with the sensor or the actuator.
- If the buttons don't change the color by clicking, that means something is wrong with the connection.

From the overview you can reach the other pages by clicking on the respective buttons (left upper side).

5.3.2 Other pages

5.3.2.1 Boiler pressure Control (BPC)

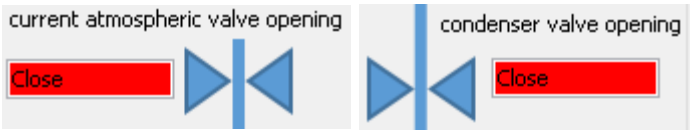
On this page, it's possible to view states of and control the atmospheric valve, condenser valve, and pressure. It is also possible to set different pressure setpoints (which affects the automatic opening and closing of the valves).



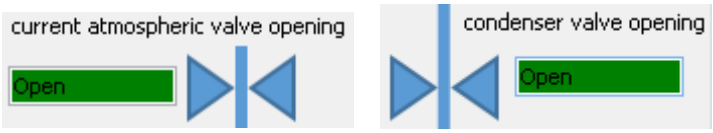
5.3.2.1.1 Valves

Color indication for states (Text fields):

For atmospheric and condenser valves:



-Red→ CLOSE



-Green→ OPEN

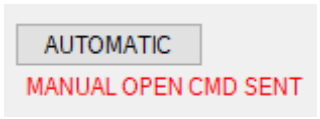
Control indications (Buttons):

By clicking the Buttons its possible to open the valves manually.

There can be 2 situations:

-

Thant means the valve is in AUTOMATIC mode. Clicking the button will open the valve manually and turn into MANUAL mode.



-

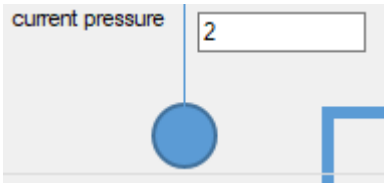
Thant means the valve is in MANUAL mode (and OPEN). The valve will never close until returning into AUTOMATIC mode. Clicking the button will return into AUTOMATIC mode.

IMPORTANT NOTE:

- If the label under the button indicates the MANUAL (OPEN) mode and the valve state (textbox) is not green (TRUE/OPEN), that means something is wrong with the sensor or the actuator.
- If the buttons and the labels among them don't change by clicking, that means something is wrong with the connection.

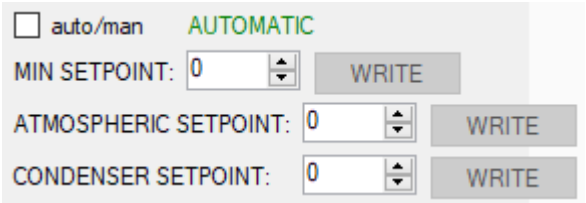
5.3.2.1.2Pressure

The current pressure is monitored in bar:

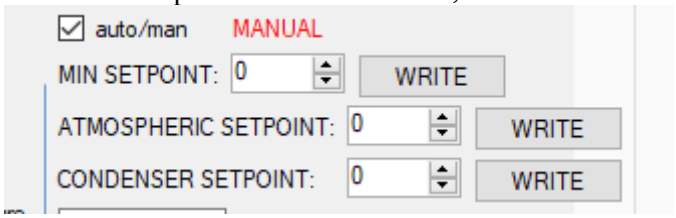


Considering the setpoints there are 2 modes:

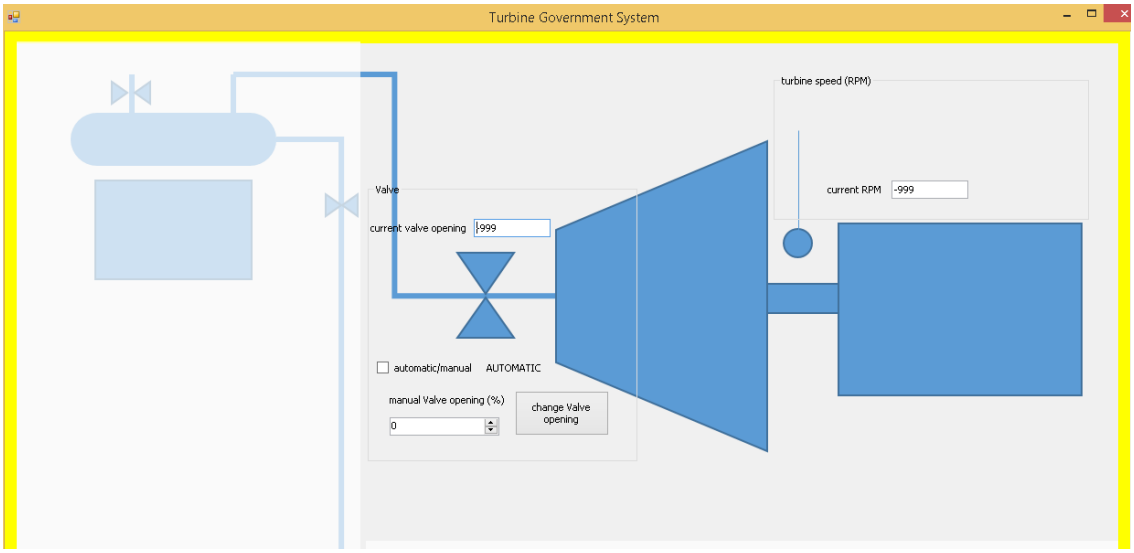
- AUTOMATIC: the auto/man checkbox is not checked and label indicates *AUTOMATIC*. In this mode its not possible to set any setpoint manually. The valves (if they are in automatic-mode) will be controlled depending on the default pressure-setpoints saved in the PLC. For more details, see the PLC documentation.



- MANUAL: the auto/man checkbox is checked and label indicates *MANUAL*. In this mode its possible to set the setpoints manually. By writing a setpoint, the valves (if they are in automatic-mode) will be controlled depending on the written setpoints. For more details, see the PLC documentation.

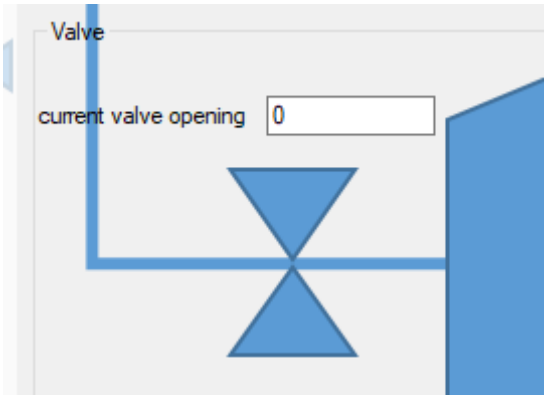


5.3.2.2 Turbine governing system (TGS)



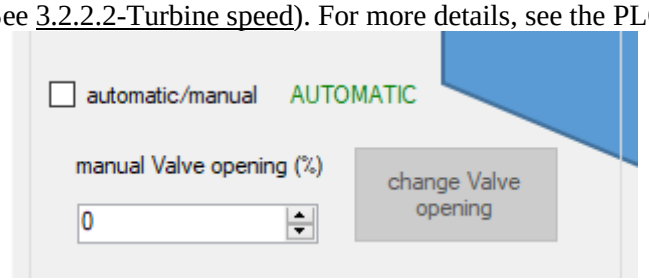
5.3.2.2.1 Valve

The current valve opening is monitored in %:

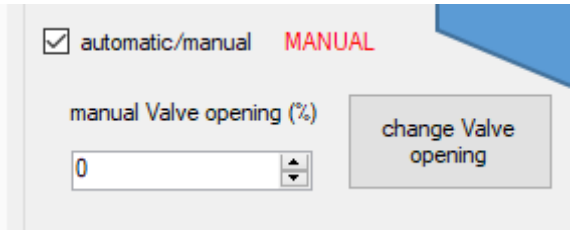


For the valve control there are 2 modes:

- AUTOMATIC: the auto/man checkbox is not checked and the label indicates *AUTOMATIC*. In this mode, it's not possible to set the valve opening manually. The valve will be controlled automatically depending on the turbine-speed-setpoint saved in the PLC (the setpoint can be either the default value or a manually written value. See 3.2.2.2-Turbine speed). For more details, see the PLC documentation.

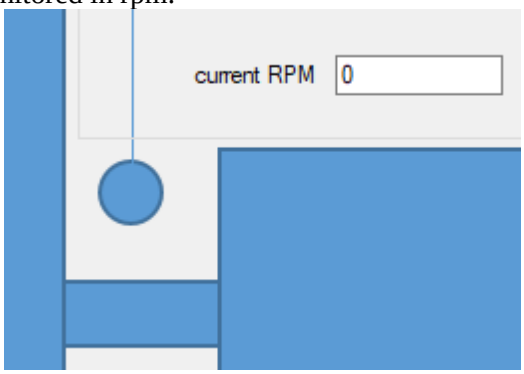


- MANUAL: the auto/man checkbox is checked and the label indicates *MANUAL*. In this mode, it's possible to control the valve manually by writing an opening % to the PLC. For more details, see the PLC documentation.



5.3.2.2.2 Turbine speed

The current turbine speed is monitored in rpm:



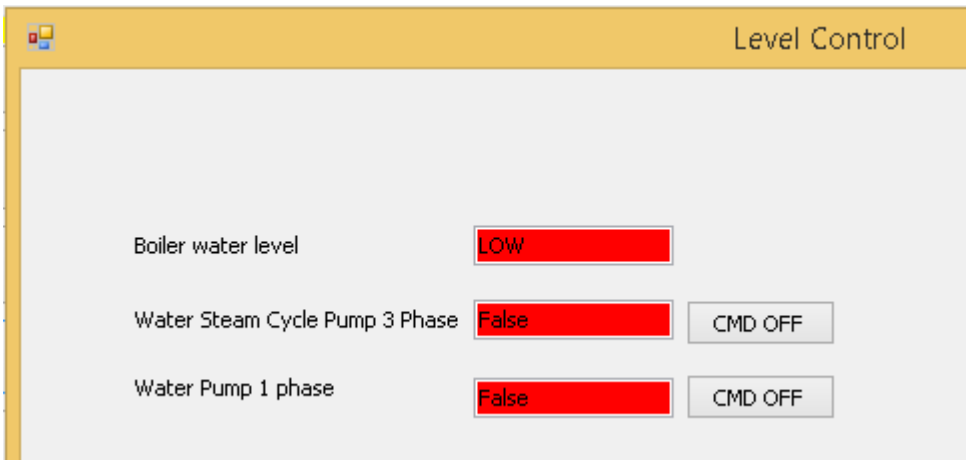
5.3.2.3 Incinerator power control (IPC)

On this page it's possible to view the state of and control:
Supply fan, exhaust fans, Fuel burner.

All works like in the overview. For more indications how to control or what the color indicate, see overview.

5.3.2.4 Level control (LC)

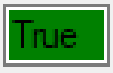
On this page it's possible to view the state of and control:
Water Pump 1 phase, Water steam Cycle Pump 3 phase, and Boiler water level.



Color indication for states (Text fields):

For Water Pump 1 phase, Water steam Cycle Pump 3 phase:

-Red→False/OFF 

-Green→True/ON 

For Boiler water level:

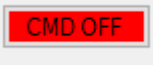
-Red→LOW 

-Green→HIGH 

Color indication for control commands (Buttons):

For Water Pump 1 phase, Water steam Cycle Pump 3 phase:

-Red→False/OFF Command is send (the state field should also be red (OFF))



-Green→True/ON Command is send (the state field should also be green (ON))

5.3.2.5 Filtering System (FS)

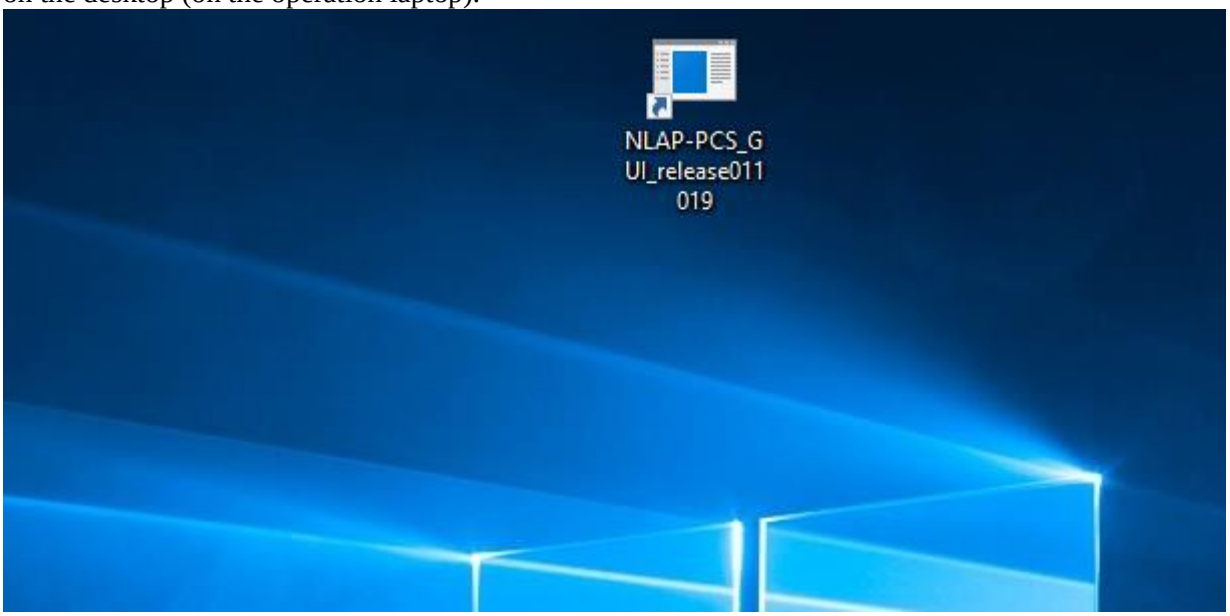
On this page, the state of the filtering actuators (compressor, compressor valve, and electrofilter) are shown. The “current“ tab shows the current passing through the electrofilter. This section works as IPC section before.

5.3.3 Settings window

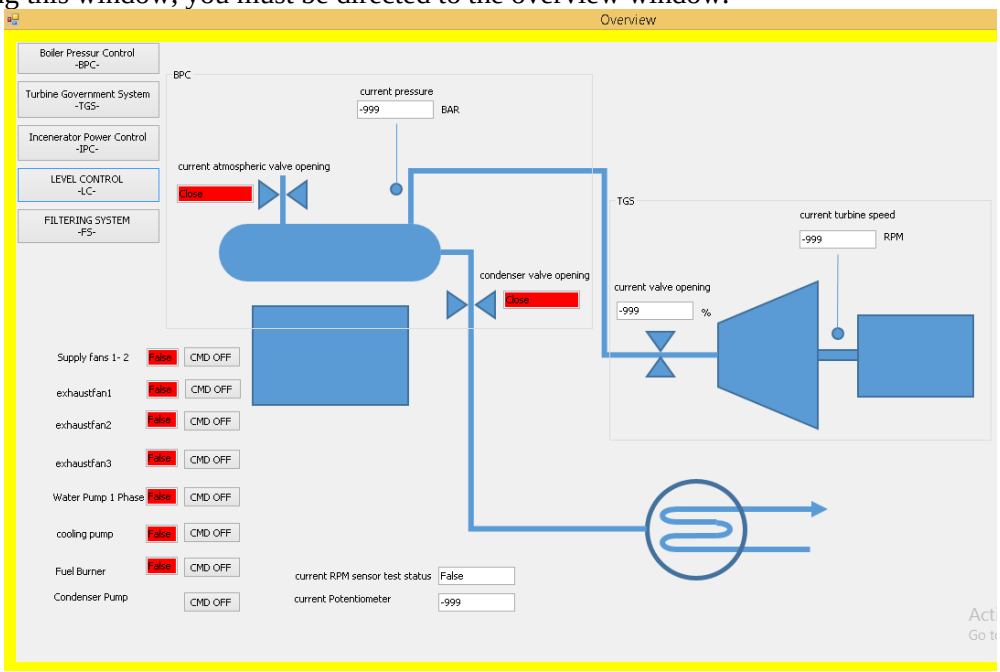
This window appears after starting the GUI-program. Here some settings can be set.
Until the current version there is no settings.

5.4 Use Instructions

To start the GUI double click on the binary executable 'ContSys.exe' in the release folder named 'release', or 'current release', or '<date>release', or 'release<date>'. Anyway, there must be a shortcut of the executable on the desktop (on the operation laptop).



Once ran, the the settings window must appear.
For information how to set settings and what they mean see Settings window.
After closing this window, you must be directed to the overview window.



From there, to operate see Overview in Pages.

5.5 Logger

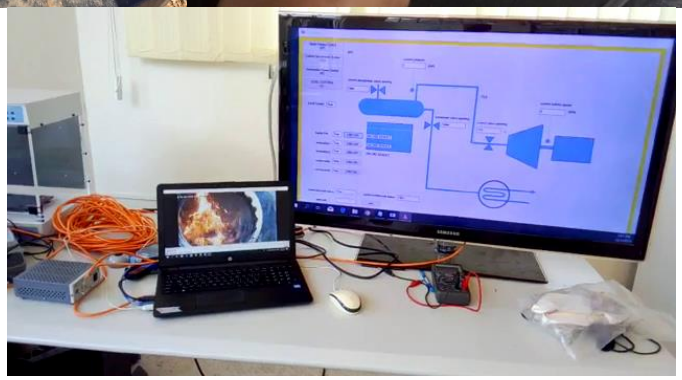
The logger records the read values of sensors and states. It writes them in a text file named *CS_log.txt* (may change) located in *C:/ControlSystemData* (may change). The file and directory are created automatically in case they do not exist.
Recording period: always when the values are read. (might change, see source code)
Current Version saves file at plain-text-file, so for further processing and analysis or visualization, the file content should be taken manually from the text-file.
Time format: DD.MM.YYYY HH:MM: SS. mS
Line format (maybe needed for parsing): time<tab><variable-name>:<tab><value><tab><next-variable-name>……
Recording example: (in real one record is listed in one single line)

```
25.9.2019 14:50:59.622
bpc_Current_pressure: 1
bpc_Current_atmospheric_valve_opening:     False
bpc_Current_condenser_valve_opening:       False
tgs_Current_turbine_speed:    60
tgs_Current_valve_opening:    65522
Current_exhaustfan1_status:   False
Current_exhaustfan2_status:   False
ipc_Current_wastemotor_status:       False
ipc_Current_supplyfan_status: False
Current_coolingpump_status:  False
lc_Current_levelControl_status:      False
```

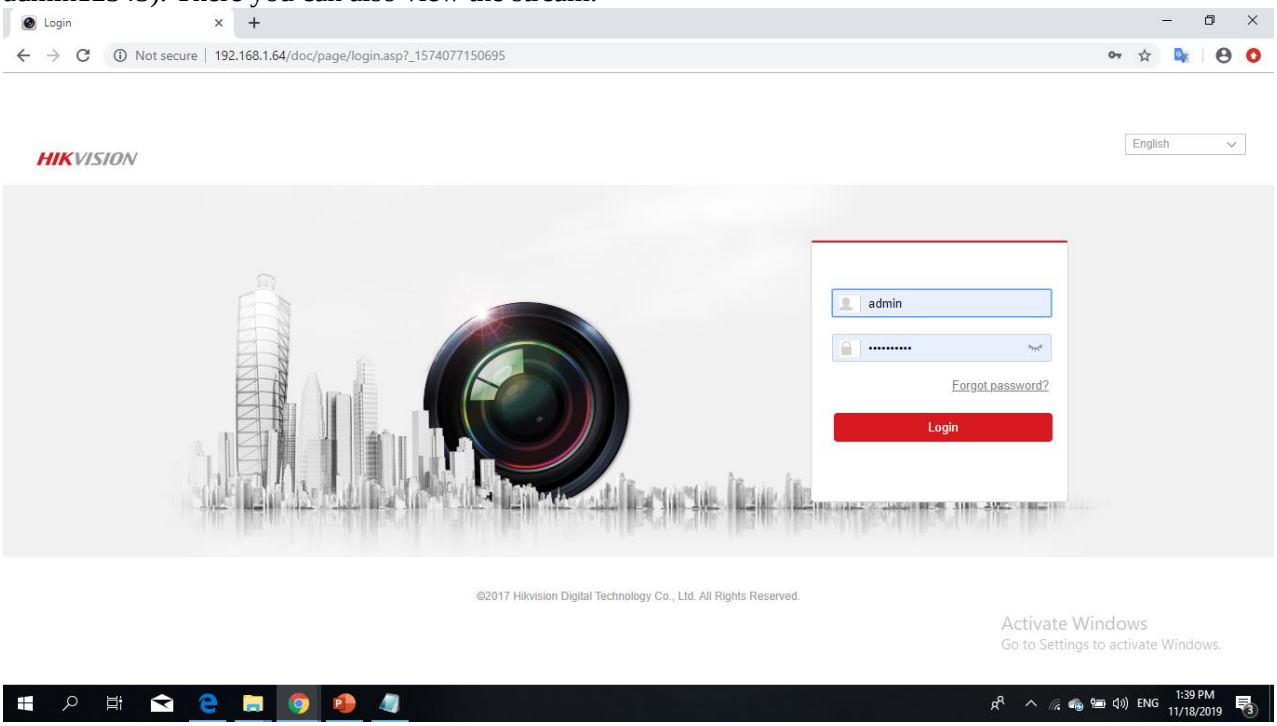
For more details, look in the source-code in the Appendix.

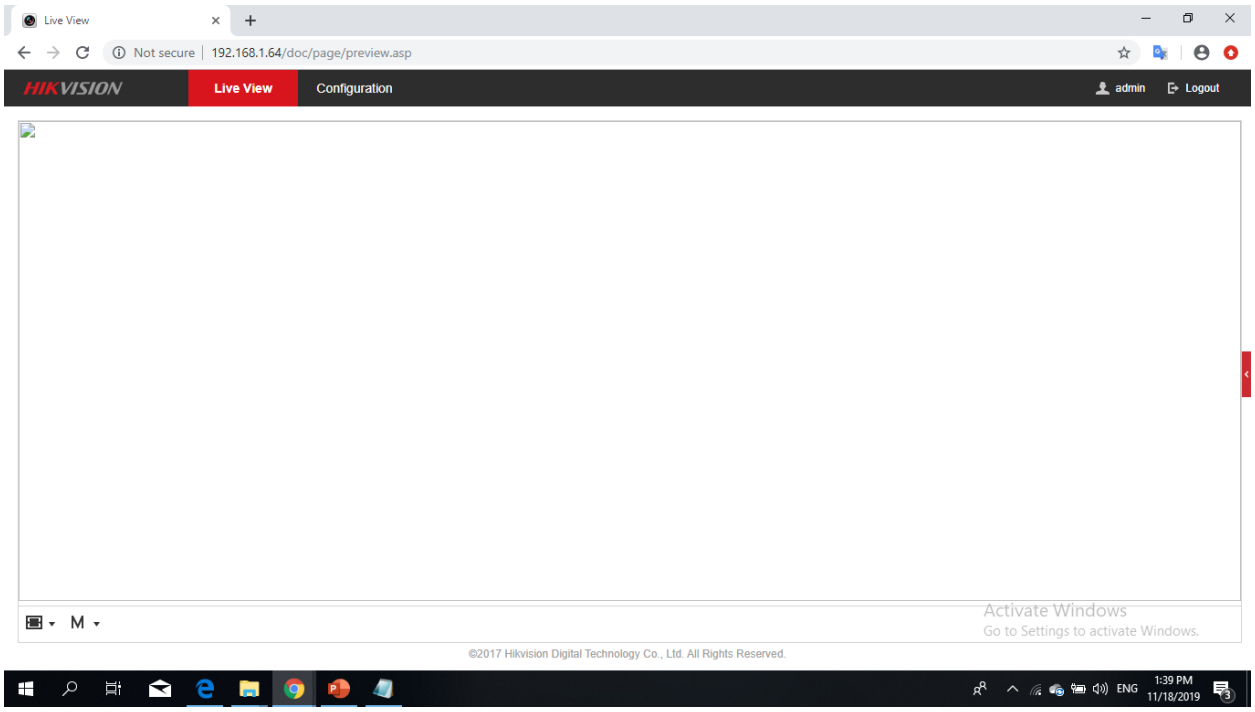
5.6 Camera

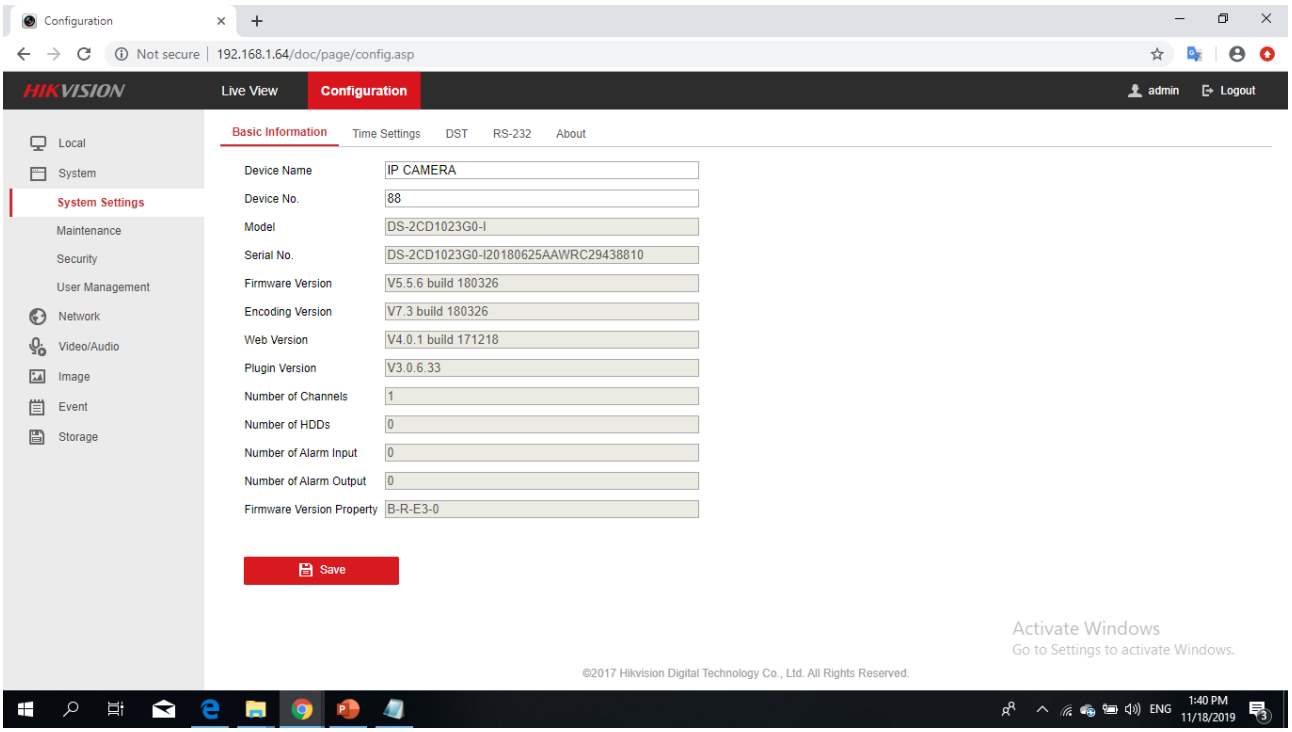
To keep the inside of the incinerator in look, an IP camera is put in front from the outside.



The camera is not integrated in the GUI-program. The camera is independently accessed per the local network.
For configurations enter the camera-ip address in the browser (ip: 192.168.1.64 username: admin pass: admin12345). There you can also view the stream.





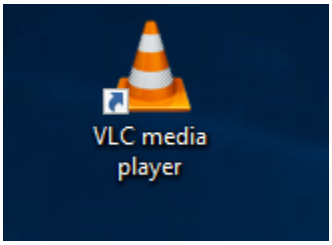


Another and better way to stream is through the direct streaming address using a streaming software like VLC.
There are 2 ways:

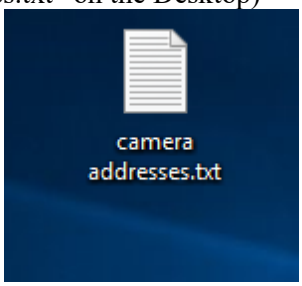
5.6.1 Manually enter the address in VLC:

Steps:

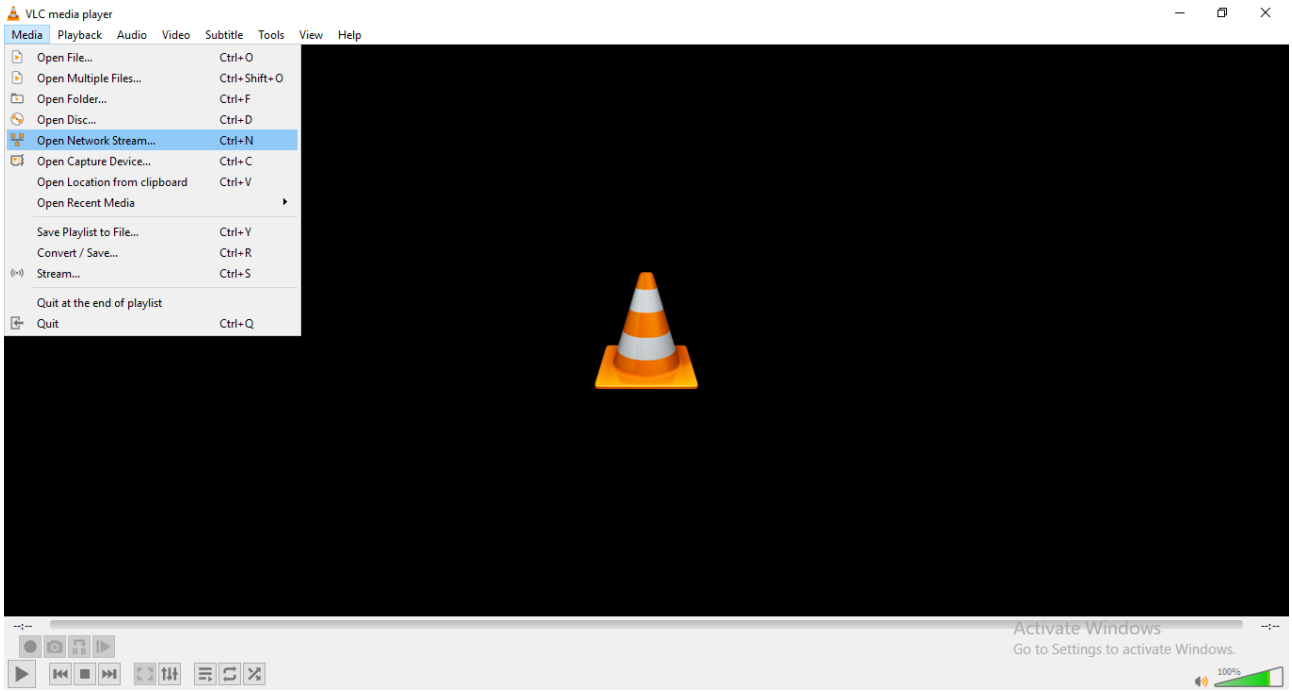
1- open VLC media player

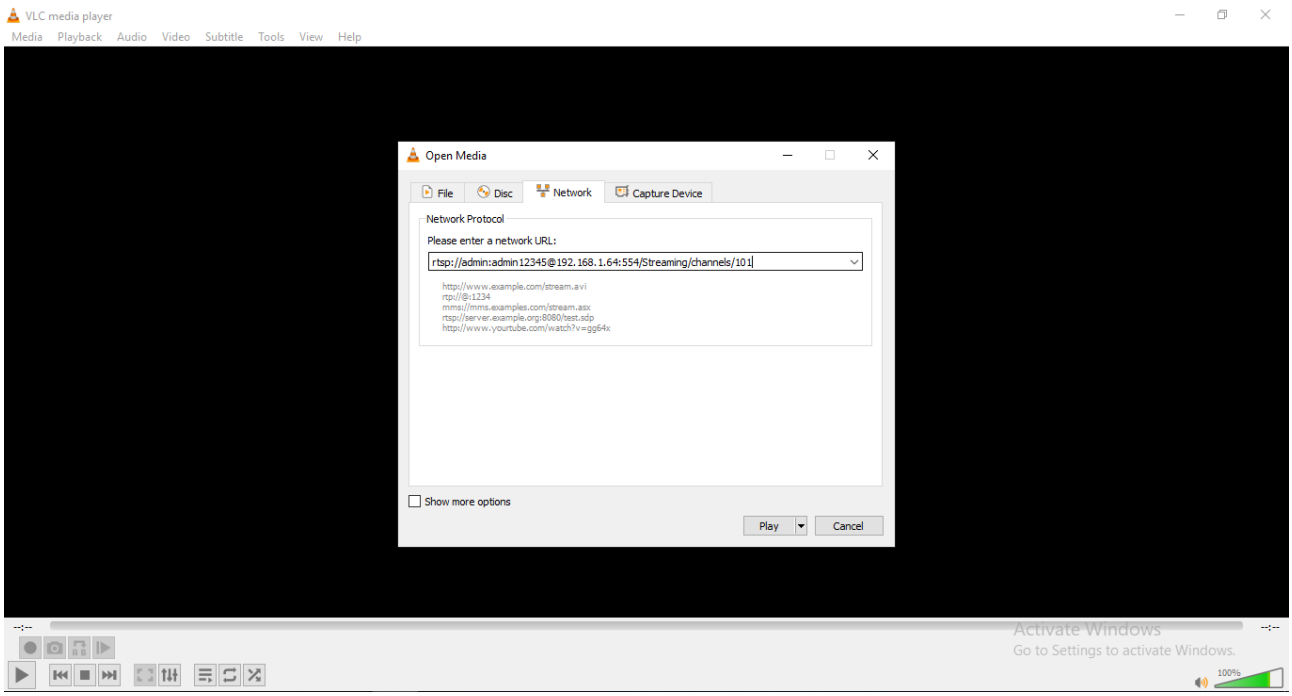


2- copy the address: rtsp://admin:admin12345@192.168.1.64:554/Streaming/channels/101 (possible addresses are in the text file “camera addresses.txt” on the Desktop)



3- paste it into VLC (Ctr+V) and press Enter (otherwise you can click on Media->open nwtwork stream and paste the link there)

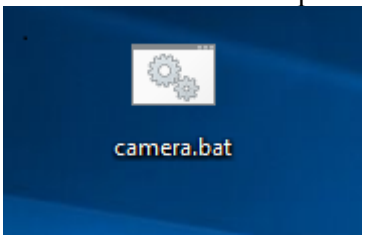




5.6.2 Use the script:

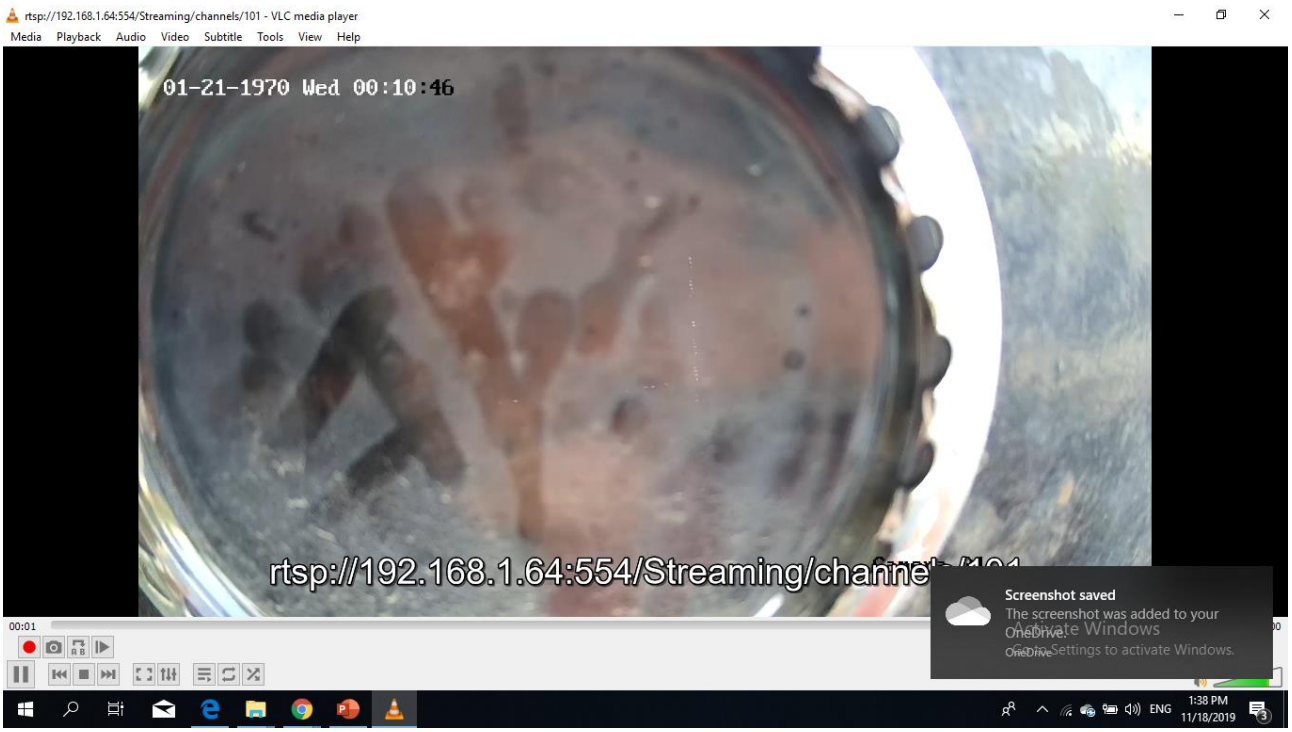
Steps:

1- Double Click the script “camera.bat” on the Desktop



camera.bat

2- VLC will open....



For more possibilities and configurations see the camera manual.

5.7 Appendix

5.7.1 Source code

Code repository:

GUI (C#) Source Code	http://aecenar.com/index.php/downloads/send/5-nlap/840-nlap-ipp-gui-code-ver-2022

5.7.2 Modbus connection

For a good introduction and understanding of the Modbus protocol and addressing, the following webpage is useful:

Modbus-explained.rar

5.7.2.1 RTU/ASCI

The Modbus protocol can be used in asci or in RTU mode. In which one is used depending on the PLC programming. Currently used in code: RTU.
To change that, change the variable ‘rtu_or_asci’ in StateMachine.cs.

5.7.2.2 Modbus driver

On Windows 7(like our NLAP-laptop), this adapter (Ex9530) needs a manual installation of the driver.
Driver name: Prolific USB-to-serial comm Port
Driver file:

pl2303.zip

Installation:

1- Install the driver from the zip file
2- Check in device manager and check connection in GUI. If all ok you are done
3- Open device manager
4- Right click on the new device (adapter must be connected) either in Ports (COM & LPT) or in unknown devices. -> update driver
5- Choose the second field (choose from computer…)
6- Choose the second field (pick from a list…)
7- Double-click on the new-installed driver.
8- Done (no more problem mark if there was one)

Com port must be set to “COM 2” (important because of the plc-programming):

1- In device manager on the device:
2- Right-click->properties
3- In “Port settings” tap:
4- Click on “advanced”
5- Choose “COM2” from drop list in Com Port number.
6- Ok->you are done

5.7.2.3 Modbus addresses

A List of all Modbus-addresses used are listen in the following excel List:

NLAP-WEDC PCS
(MODBUS-addresse

5.7.3 Development instructions

To make the further development easier some checklists or protocols list the steps for adding/removing sensors/actuators and changing the GUI background.

howto-protocols_2
01219.rar

5.7.4 Camera manual

Search here for the current manual (model: -):
https://www.hikvision.com/en/support/document-center/user-manual/