Getting started with a laser device sample project

For Siemens S7-300/400 PLC

(rev 0 - December 2011)

Overview

This document is intended to lead the user to start and practice the communication between a Datalogic laser device and a Siemens S7-300/400 PLC over Profibus/Profinet. Following the simple steps explained below the user will be able to run a complete PLC project, in order to capture barcode data and display them on his PLC.

To find out more, please refer to the following documents:

- **DAD-DPD Function Block** (Step7_SamplesPackage_1.1)
- **DAD DPD Driver Reference Manual** (Genius CD, Datalogic Automation Website)
- **How to configure a DS2KN-DS4K8 laser scanner to run over Profibus** (Datalogic Automation Website)

Basic Steps

1. **Make your Profibus layout**
2. **Install the GSD file of the reader**
3. **Load and open the sample project**
4. **Customize the project HW configuration**
5. **Align the SW configurations of project and reader**
6. **Run the reading session**
7. **Check the data traffic**
8. **(most common)Troubleshooting**

1. Make your Profibus layout

Please, refer to the "**How to configure a DS2KN-DS4K8 laser scanner to run over Profibus.doc**", **pagg. 1..7**, to properly realize a Profibus layout

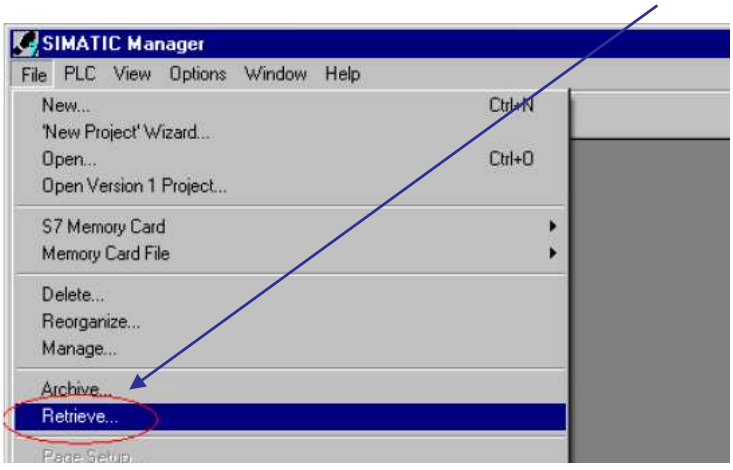
2. Install the GSD file of the reader

Please, refer to the "**How to configure a DS2KN-DS4K8 laser scanner to run over Profibus.doc**", **pagg. 7..14**, to install the correct GSD file and upgrade the PLC HW catalogue

3. Load and open the sample project

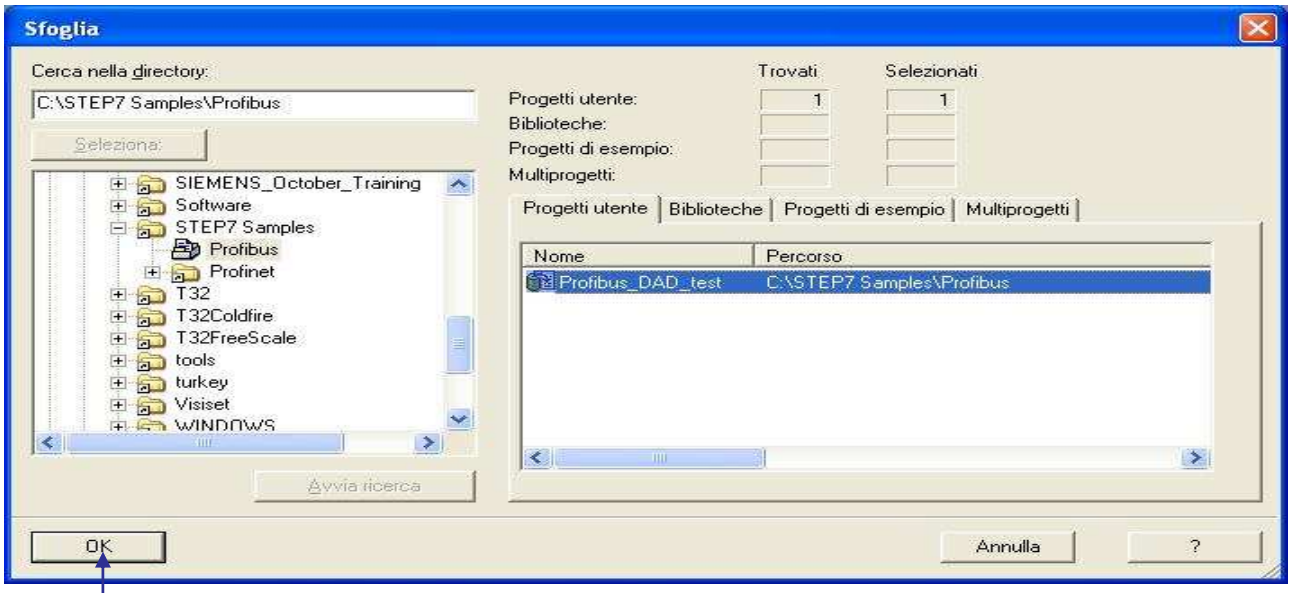
The sample project is "**Profibus_DAD_test**"; it is available as the compressed archive "**Profibus_DAD_test.zip**".

Load the project archive on a user folder, then "**Retrieve**" it selecting the option showed below

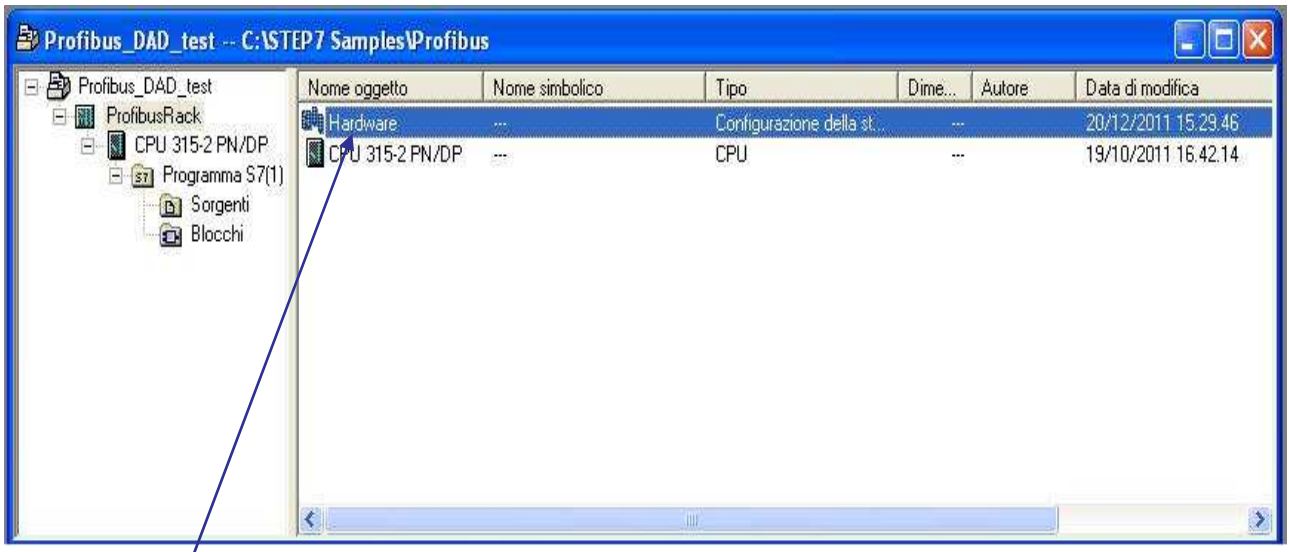


(the example folder here is "**C:\STEP7 Samples\Profibus**")

Now select the sample project to open, as below



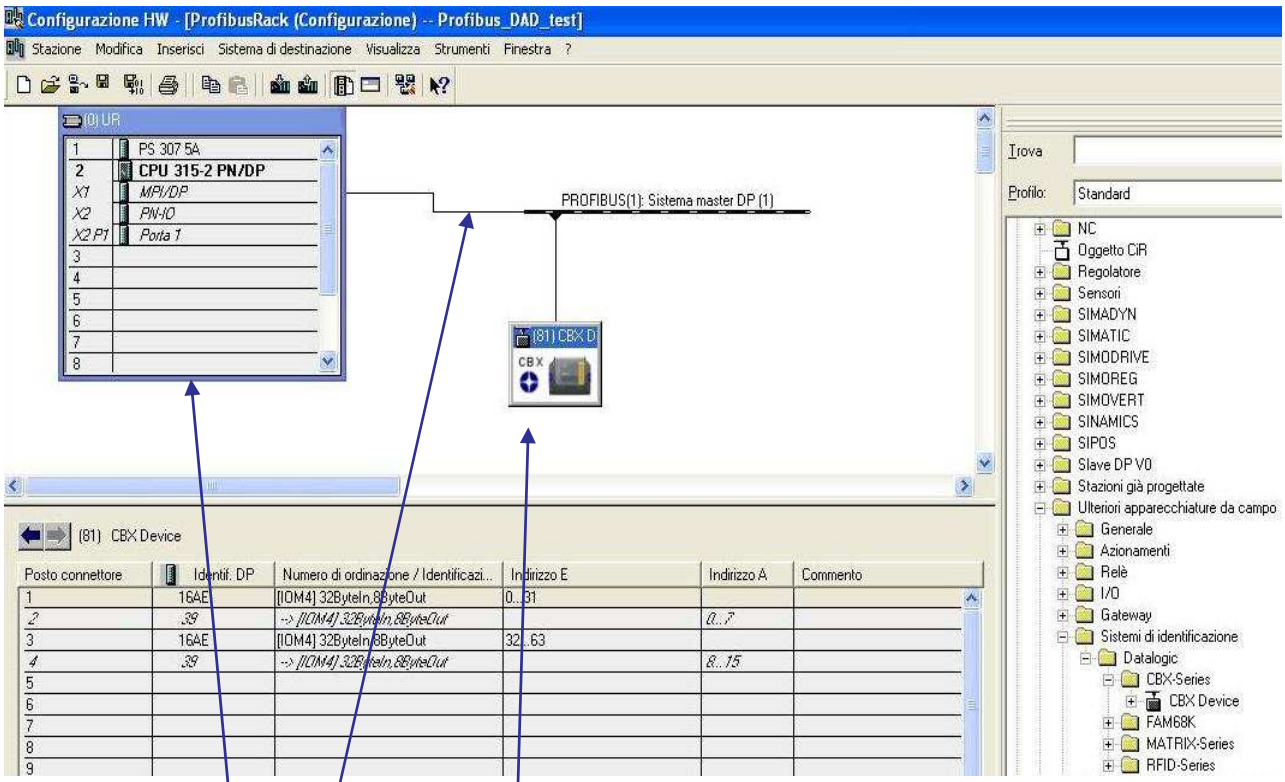
Press **OK** to confirm. The project main window appears, as showed below:



Select "**Hardware**" under "**ProfibusRack**" then double click on it .

The "**Configuration HW**" window appears, as showed on the next section.

4. Customize the project HW configuration



This HW configuration includes the following items:

- **CPU 315-2PN/DP**
- N. 1 **Profibus Node**, "**CBX device**" labelled, address = 81, referred to the DLA_0BAC[1] gsd file.
- Profibus channel

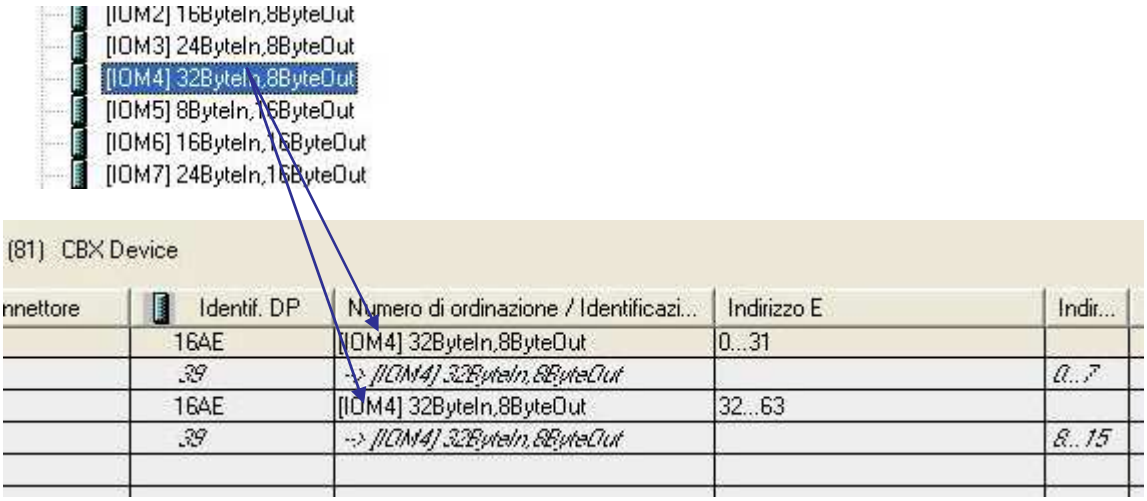
[1] The Gsd file for laser devices

Take a look at the node I/O configuration:

i. **64 bytes input** (starting address = **0**)

ii. **16 bytes output** (starting address = **0**)

NOTE: the I/O configuration is the result of 2 instances of the [IOM4] GSD module, it placed (twice) to the I/O table to implement the requested I/O size.



If the application requires more I/O area, take and append more I/O modules, until the requested I/O size has reached.

WARNING: take care about the **maximum allowed size**

- for PROFIBUS, it is 152 bytes, adding input and output size

- for PROFINET, it is 64 bytes, adding input and output size

***Profibus**-Example:*

- *output bytes: 16 bytes*
- *input bytes: 64 bytes*

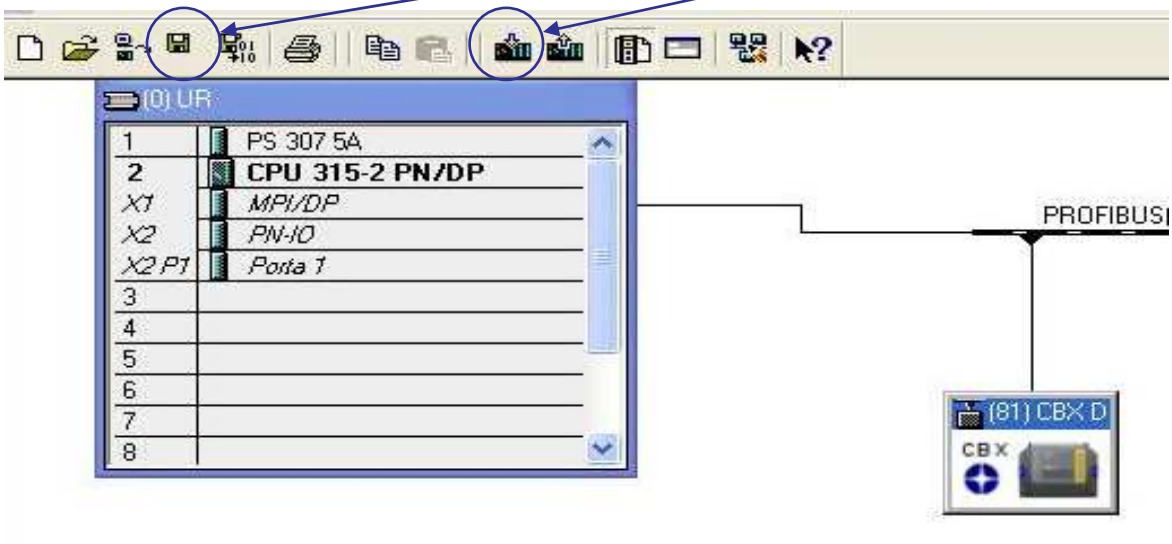
*Output bytes + Input bytes = 16 + 64 = 80 bytes → It's less than 152 → **OK!***

***Profinet**-Example:*

- *output bytes: 8 bytes*
- *input bytes: 60 bytes*

*Output bytes + Input bytes = 8 + 60 = 68 bytes → It's more than 64 → **KO!**[2]*

Just the HW configuration matches your requirements, first **SAVE** then **DOWNLOAD** the configuration to the unit

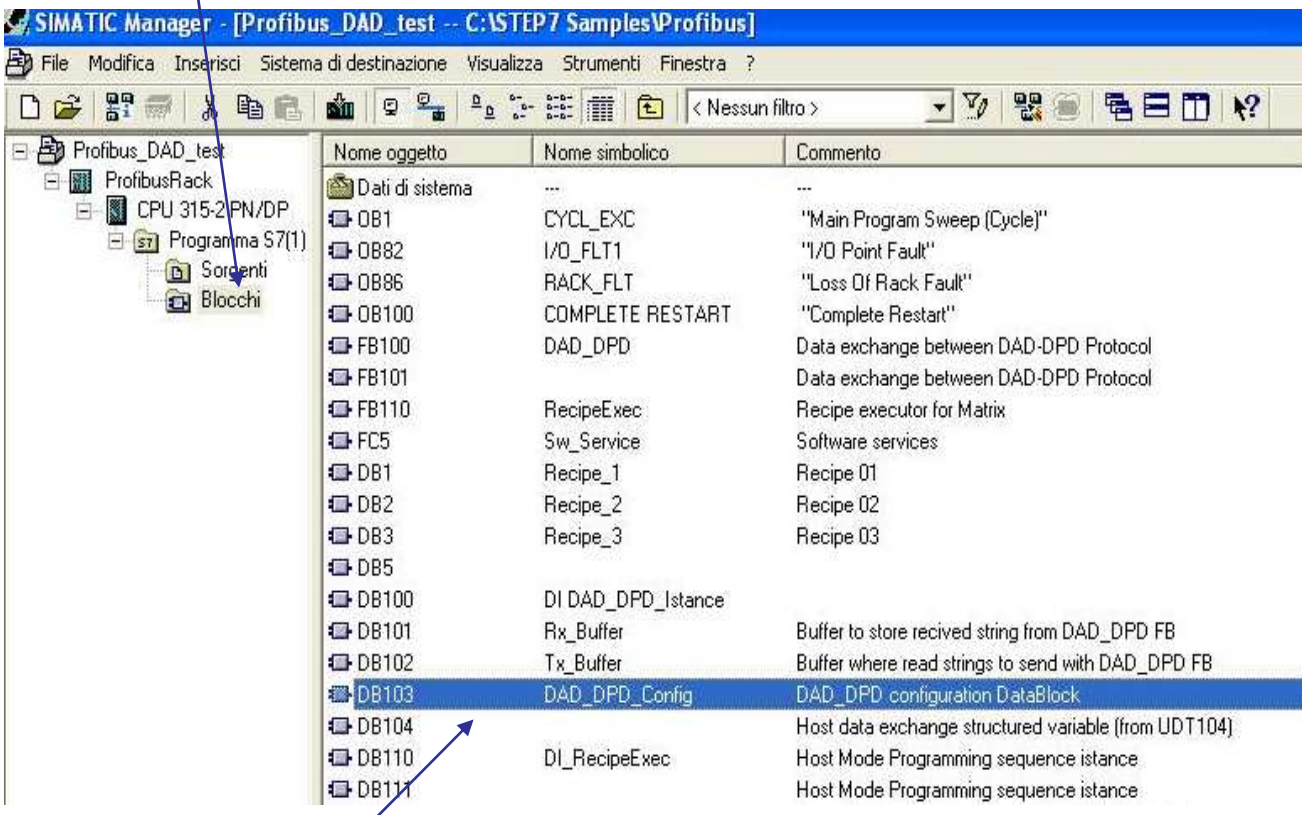


[2] Do not run the download procedure: it runs unsuccessful

The window below appears; confirm the destination unit (CPU), then press **OK** to start the (first step) download procedure. Confirm all the next download procedure steps.

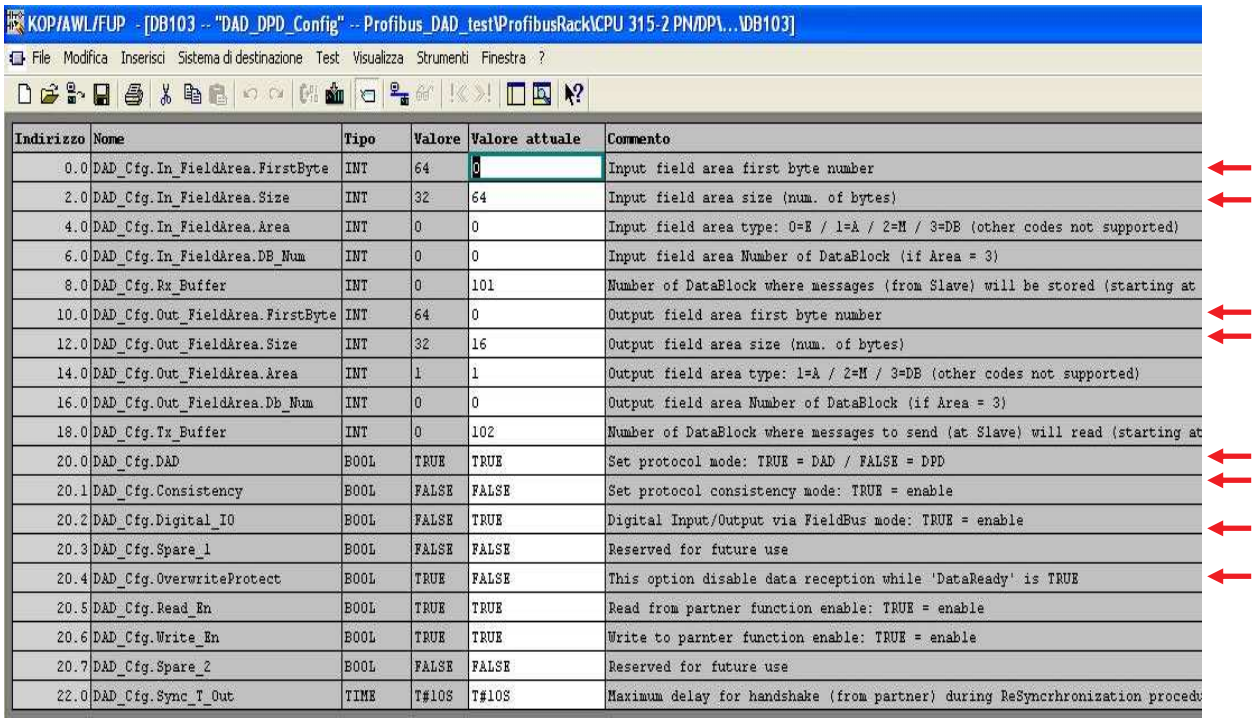
5. Align the SW configurations of project and reader

Select the "**Blocks**" object on the project main window: the PLC blocks are listed here



Then select the "**DB103" (DAD_DPD Configuration Datablock)** block, double-clicking on it.

Choose the "**Data**" view, and the table below appears



KOP/AWL/FUP - [DB103 -- "DAD_DPD_Config" -- Profibus_DAD_test\ProfibusRack\CPU 315-2 PN/DP\...\DB103]

File Modifica Inserisci Sistema di destinazione Test Visualizza Strumenti Finestra ?

Indirizzo	Nome	Tipo	Valore	Valore attuale	Commento
0.0	DAD_Cfg.In_FieldArea.FirstByte	INT	64	0	Input field area first byte number
2.0	DAD_Cfg.In_FieldArea.Size	INT	32	64	Input field area size (num. of bytes)
4.0	DAD_Cfg.In_FieldArea.Area	INT	0	0	Input field area type: 0=E / 1=A / 2=M / 3=DB (other codes not supported)
6.0	DAD_Cfg.In_FieldArea.DB_Num	INT	0	0	Input field area Number of DataBlock (if Area = 3)
8.0	DAD_Cfg.Rx_Buffer	INT	0	101	Number of DataBlock where messages (from Slave) will be stored (starting at
10.0	DAD_Cfg.Out_FieldArea.FirstByte	INT	64	0	Output field area first byte number
12.0	DAD_Cfg.Out_FieldArea.Size	INT	32	16	Output field area size (num. of bytes)
14.0	DAD_Cfg.Out_FieldArea.Area	INT	1	1	Output field area type: 1=A / 2=M / 3=DB (other codes not supported)
16.0	DAD_Cfg.Out_FieldArea.Db_Num	INT	0	0	Output field area Number of DataBlock (if Area = 3)
18.0	DAD_Cfg.Tx_Buffer	INT	0	102	Number of DataBlock where messages to send (at Slave) will read (starting at
20.0	DAD_Cfg.DAD	BOOL	TRUE	TRUE	Set protocol mode: TRUE = DAD / FALSE = DPD
20.1	DAD_Cfg.Consistency	BOOL	FALSE	FALSE	Set protocol consistency mode: TRUE = enable
20.2	DAD_Cfg.Digital_IO	BOOL	FALSE	TRUE	Digital Input/Output via FieldBus mode: TRUE = enable
20.3	DAD_Cfg.Spare_1	BOOL	FALSE	FALSE	Reserved for future use
20.4	DAD_Cfg.OverwriteProtect	BOOL	TRUE	FALSE	This option disable data reception while 'DataReady' is TRUE
20.5	DAD_Cfg.Read_En	BOOL	TRUE	TRUE	Read from partner function enable: TRUE = enable
20.6	DAD_Cfg.Write_En	BOOL	TRUE	TRUE	Write to parnter function enable: TRUE = enable
20.7	DAD_Cfg.Spare_2	BOOL	FALSE	FALSE	Reserved for future use
22.0	DAD_Cfg.Sync_T_Out	TIME	T#10S	T#10S	Maximum delay for handshake (from partner) during ReSyncrhronization procedu

This table sets the sw configuration of the PLC project: **these values MUST match with the reader configuration and with the PLC HW configuration.**

Following the table items to check and match (look at the arrows on the table):

1. the INPUT area first byte number

0.0	DAD_Cfg.In_FieldArea.FirstByte	INT	64	0	Input field area first byte number

The current value (0) must match the INPUT area starting address set in the HW configuration

2. the INPUT field area size

2.0	DAD_Cfg.In_FieldArea.Size	INT	32	64	Input field area size (num. of bytes)

The current value (64) must match the INPUT field area size set in the HW configuration

3. the OUTPUT area first byte number

10.0	DAD_Cfg.Out_FieldArea.FirstByte	INT	64	0	Output field area first byte number

The current value (0) must match the OUTPUT area starting address set in the HW configuration

4. the OUTPUT field area size

12.0	DAD_Cfg.Out_FieldArea.Size	INT	32	16	Output field area size (num. of bytes)

The current value (16) must match the OUTPUT field area size set in the HW configuration

5. Data Flow Control parameters

20.0	DAD_Cfg.DAD	BOOL	TRUE	TRUE	Set protocol mode: TRUE = DAD / FALSE = DPD
20.1	DAD_Cfg.Consistency	BOOL	FALSE	FALSE	Set protocol consistency mode: TRUE = enable

The current values must match the reader configuration:

- DAD_Cfg.DAD = TRUE → Data Flow Control = DAD driver
- DAD_Cfg.Consistency = FALSE → Data Consistency = Disabled

6. Digital I/O

20.2	DAD_Cfg.Digital_IO	BOOL	FALSE	TRUE	Digital Input/Output via FieldBus mode: TRUE = enable

The current value must match the reader and PLC HW configuration

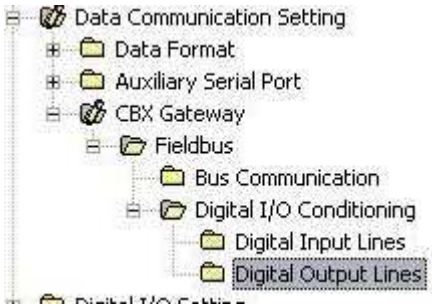
- DAD_Cfg.Digital_IO = TRUE → Digital I/O conditioning is in use

NOTE: "**Digital I/O conditioning in use**" means that

a) reader **Digital Input Lines** are enabled (1 parameter at least)

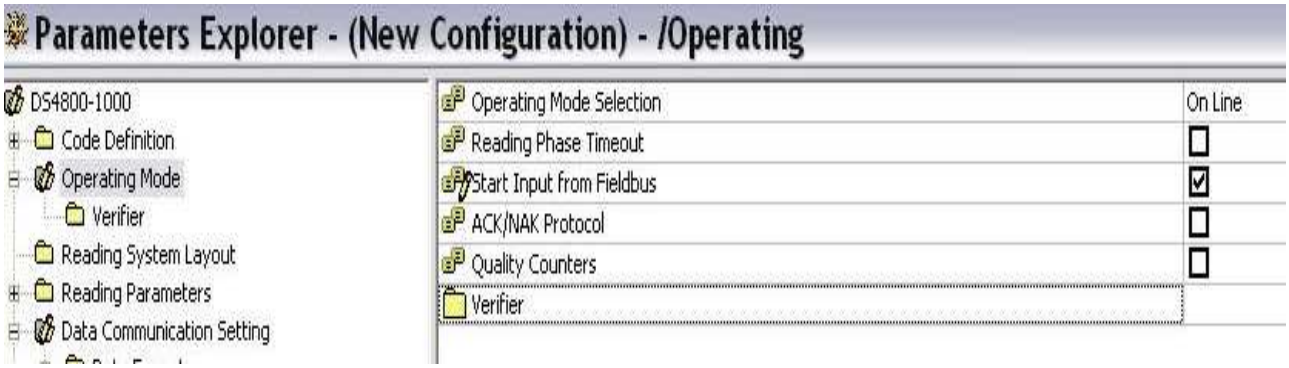
OR

b) reader **Digital Output LInes** are enabled (1 parameter at least)



OR

c) reader **Operating Mode = Start Input from Fieldbus**



WARNING: for the current PLC project the option "Operating Mode/Start Input from Fieldbus" MUST be set on the laser device through the Genius configuration tool

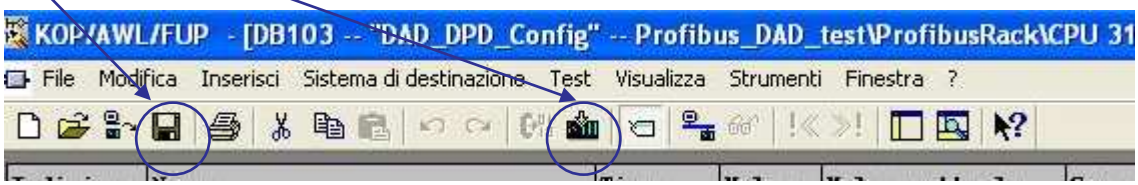
7. the Overwrite protection (suggested)

20.4	DAD_Cfg.OverwriteProtect	BOOL	TRUE	FALSE	This option disable data reception while 'DataReady' is TRUE

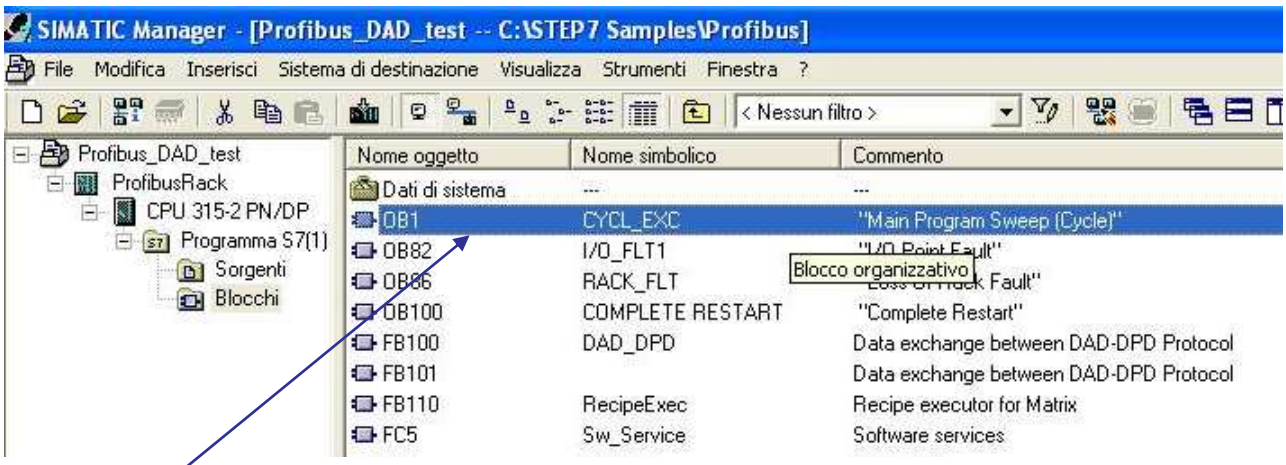
The current value (FALSE) allows to run an endless data capture session, no need to handle the DataReaady control line

Just the DB103 configuration matches the reader and PLC HW requirements,

SAVE then **DOWNLOAD** to the unit

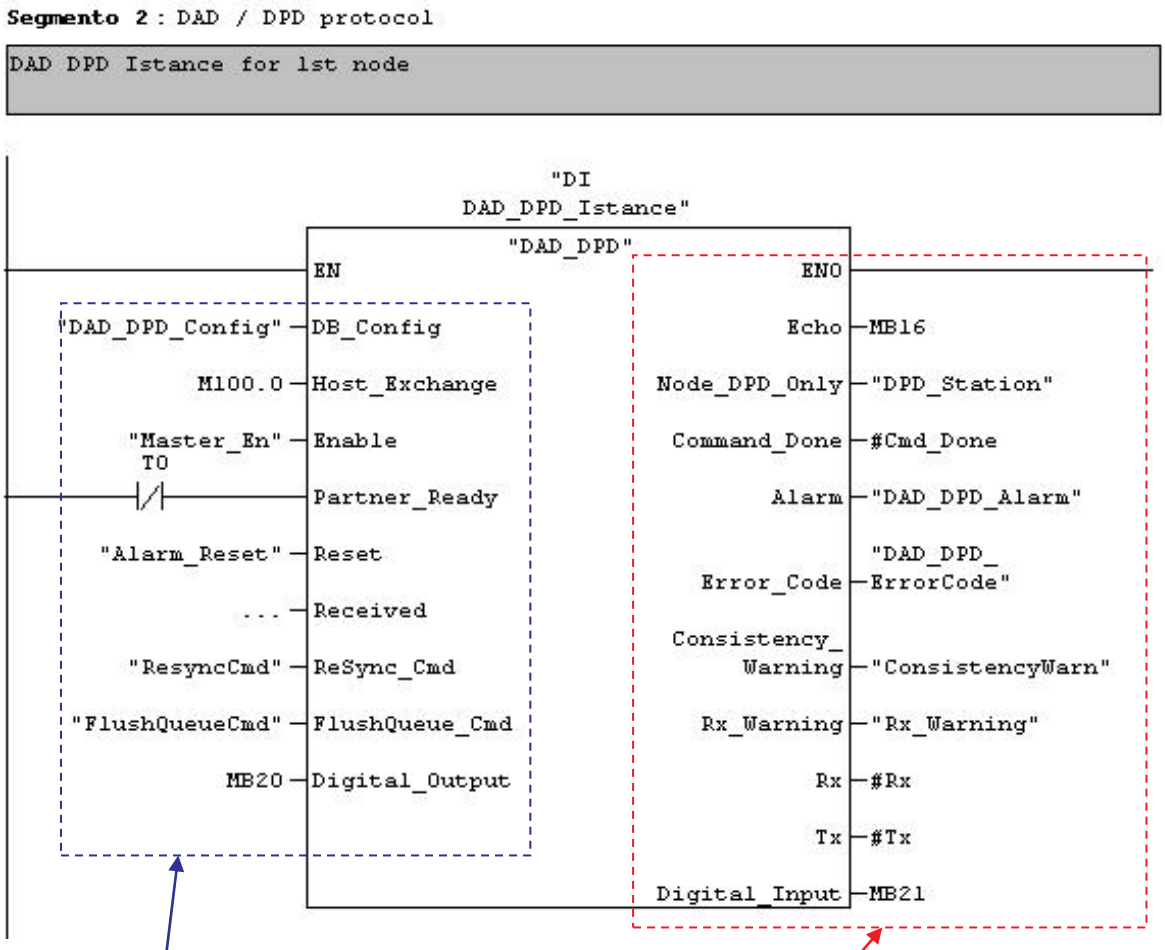


6. Run the reading session



Select the "**OB1**" main program block, double click on it to open:

the "**DAD_DPD Instance**" is the first block, **this is the core of the project**. Let's analyze it.



On the **LEFT** side of the instance there are the **INPUT and CONTROL lines** while on the **RIGHT** side there are the **OUTPUT lines**.

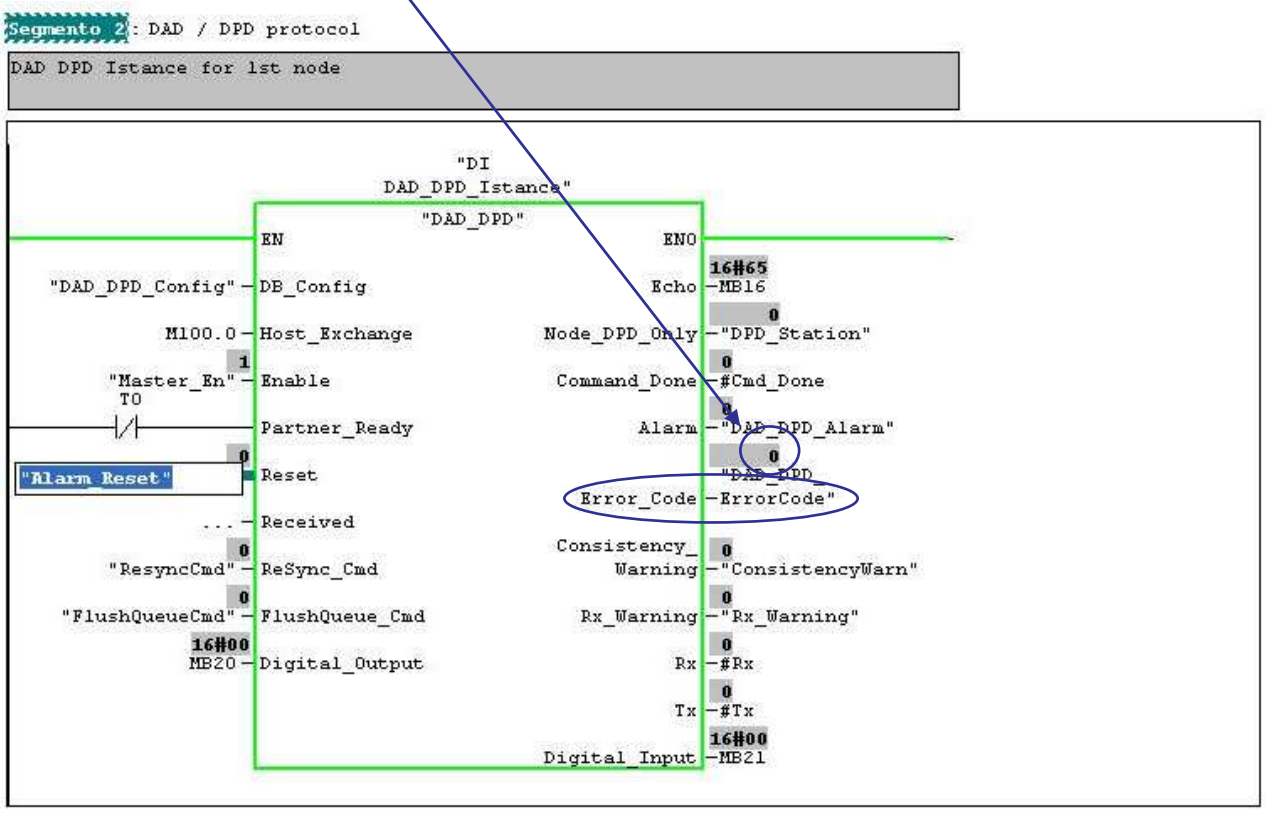
To find any detail about them, please refer to the "**DAD-DPD Function Block**" manual, also included in the zip sample package for Step7.

Click on the "**eyeglasses**" button to start the **ON-LINE** mode,

then check the **DAD-DPD ErrorCode** output:

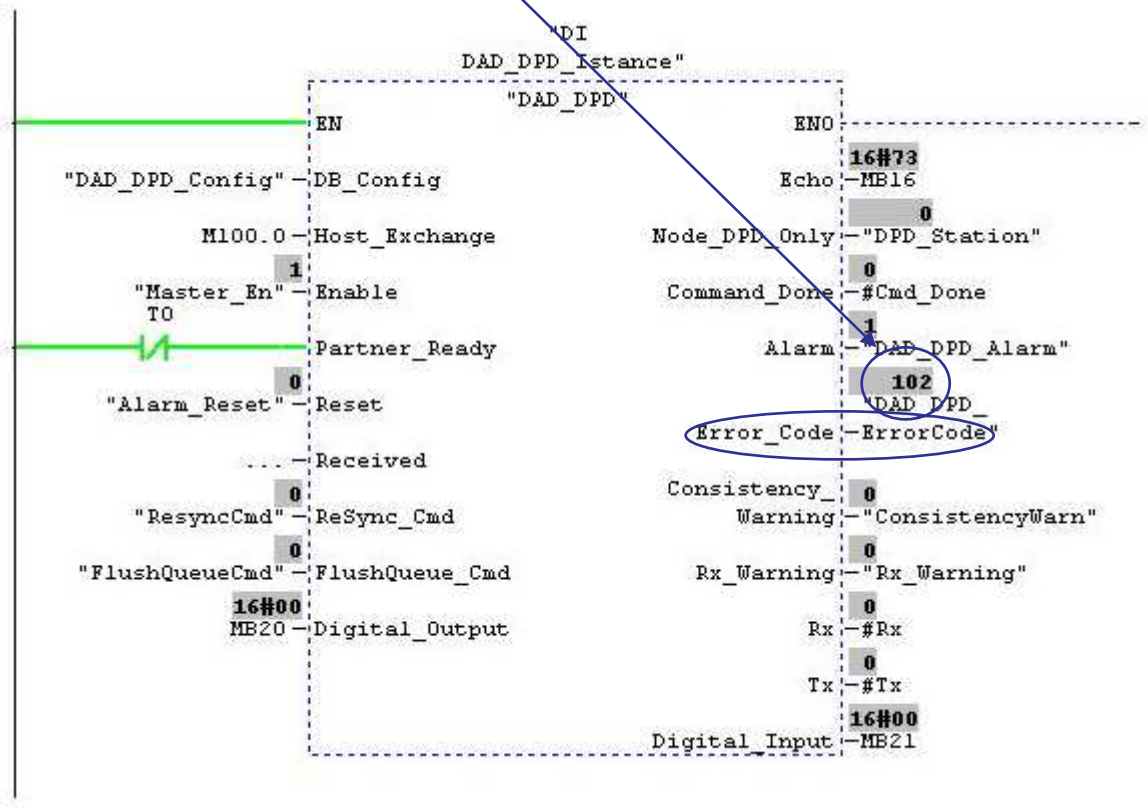
- **if its value is "0", there are no active alarm conditions and the project is well running**.

Note: a **continuous green line** confirms also the no-error condition and the instance is properly running, as below



- **if its value is not "0" (here is "102"), there are active alarm conditions and the instance can not execute the job as designed.**

Note: a **dotted line** confirms also an error condition is active (see below)



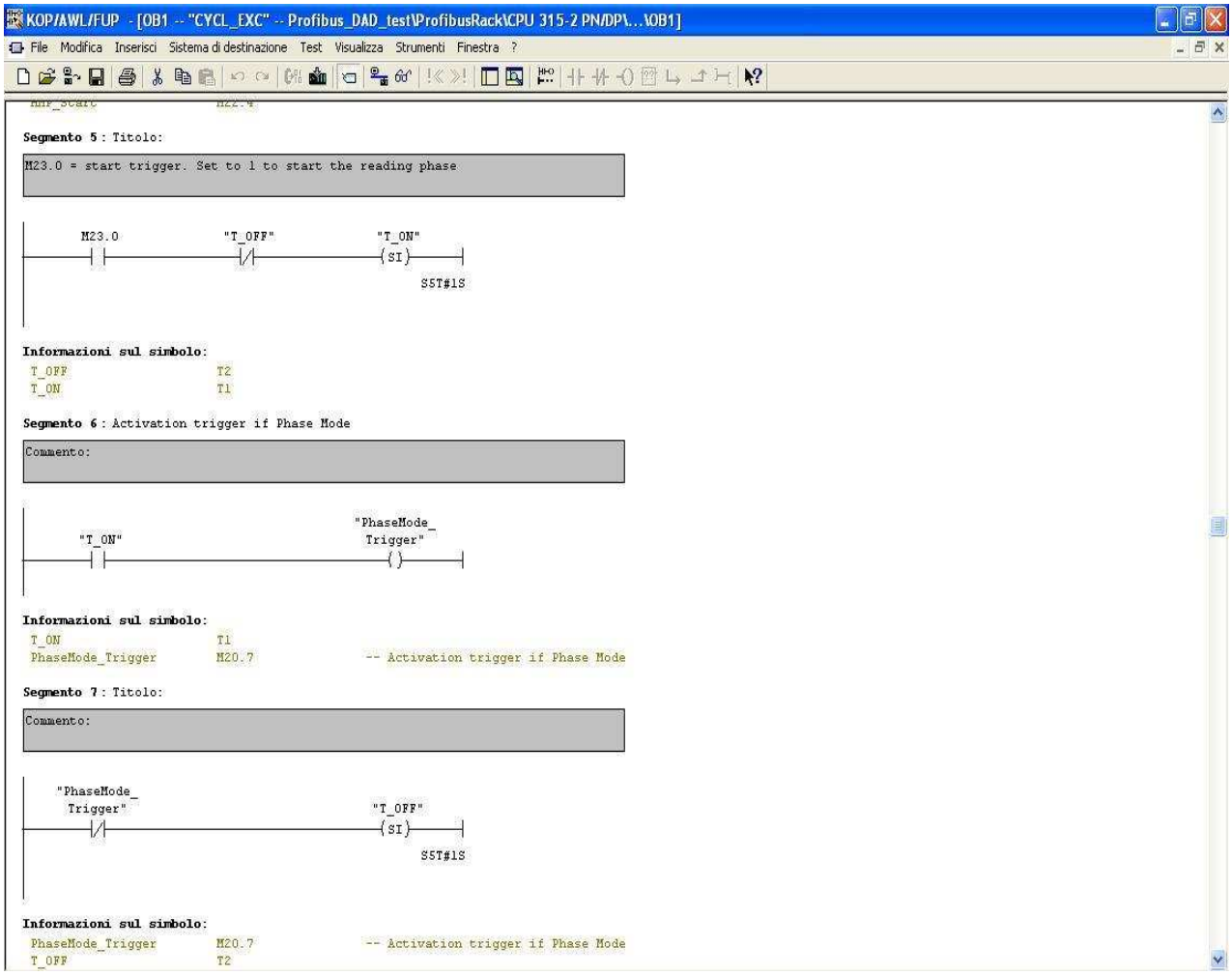
The alarm condition must be cancelled, see the "**Troubleshooting**" section for related instructions.

When the DAD-DPD instance becomes active, the reading session can run.

First, **it needs to provide a trigger to the laser device in order to start the reading phase**.

How can we do it?

Scrolling down the OB1 block, the segments 5,6 and 7 appear:



These program segments implement a simple endless cycle, which set and reset the "**PhaseMode_Trigger**" signal, it mapped on the **M20.7** bit of the PLC memory.

M20 register has mapped on the first byte of the Output area, it means this bit acts as trigger bit for the laser device over Profibus.

Note: it must be

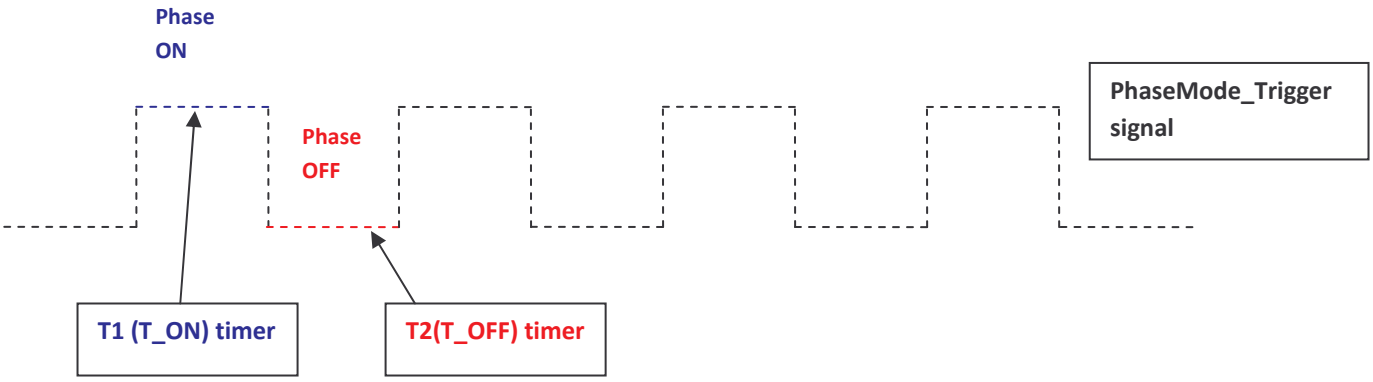
Operating Mode = Start Input from Fieldbus

for the laser device

The active period of the trigger has controlled by the **T1 (T_ON)timer**, its value is currently set to 1 second.

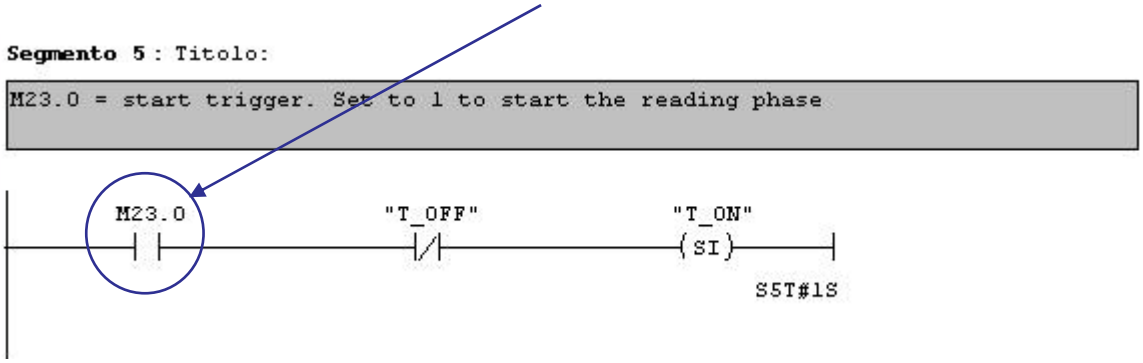
The inactive period of the trigger has controlled by the **T2 (T_OFF)timer**, its value is currently set to 1 second.

The timing runs as following (squarewave):



The user can freely modify the timing, if needed.

In order to start the trigger cycle, set the **M23.0** flag (i.e., right_click on it, then set to "1")

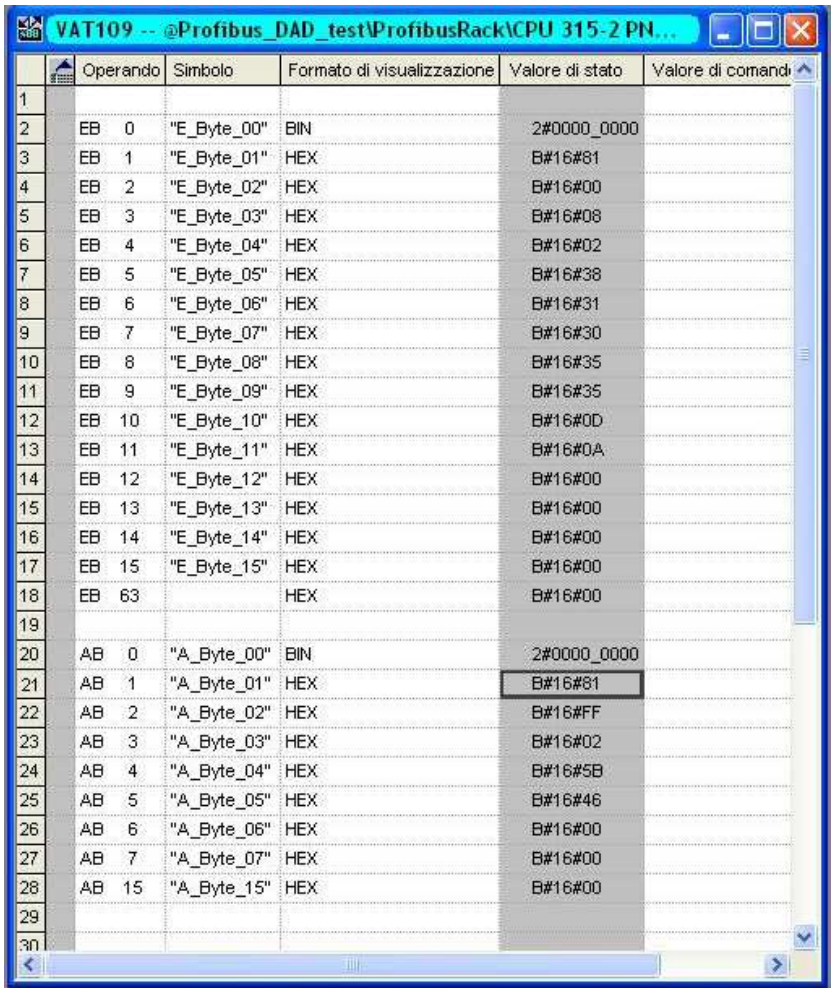


If the laser device has correctly placed in front of an enabled bar code, the laser beam continuously goes on and off, it means a correct reading session is in progress and captured data are going to the PLC over profibus.

Active reading phase

7. Check the data traffic

In order to check the current status of the I/O data exchange between laser scanner and PLC, a VAT table is very useful. On the project block list, select and open the "**VAT109**" block, already designed to check the first 16 input bytes and the first 8 output bytes



	Operando	Simbolo	Formato di visualizzazione	Valore di stato	Valore di comand
1					
2	EB 0	"E_Byte_00"	BIN	2#0000_0000	
3	EB 1	"E_Byte_01"	HEX	B#16#81	
4	EB 2	"E_Byte_02"	HEX	B#16#00	
5	EB 3	"E_Byte_03"	HEX	B#16#08	
6	EB 4	"E_Byte_04"	HEX	B#16#02	
7	EB 5	"E_Byte_05"	HEX	B#16#38	
8	EB 6	"E_Byte_06"	HEX	B#16#31	
9	EB 7	"E_Byte_07"	HEX	B#16#30	
10	EB 8	"E_Byte_08"	HEX	B#16#35	
11	EB 9	"E_Byte_09"	HEX	B#16#35	
12	EB 10	"E_Byte_10"	HEX	B#16#0D	
13	EB 11	"E_Byte_11"	HEX	B#16#0A	
14	EB 12	"E_Byte_12"	HEX	B#16#00	
15	EB 13	"E_Byte_13"	HEX	B#16#00	
16	EB 14	"E_Byte_14"	HEX	B#16#00	
17	EB 15	"E_Byte_15"	HEX	B#16#00	
18	EB 63		HEX	B#16#00	
19					
20	AB 0	"A_Byte_00"	BIN	2#0000_0000	
21	AB 1	"A_Byte_01"	HEX	B#16#81	
22	AB 2	"A_Byte_02"	HEX	B#16#FF	
23	AB 3	"A_Byte_03"	HEX	B#16#02	
24	AB 4	"A_Byte_04"	HEX	B#16#5B	
25	AB 5	"A_Byte_05"	HEX	B#16#46	
26	AB 6	"A_Byte_06"	HEX	B#16#00	
27	AB 7	"A_Byte_07"	HEX	B#16#00	
28	AB 15	"A_Byte_15"	HEX	B#16#00	
29					
30					

Here above a "snapshot" of the VAT109 during the I/O handshake.

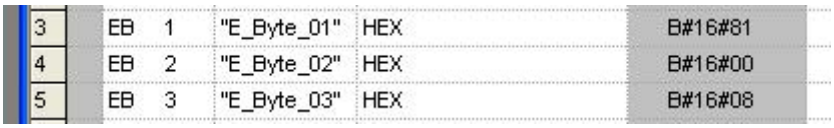
Note that:

1. **EB 0: I/O byte**

2		EB	0	"E_Byte_00"	BIN	2#0000_0000

It is now[3] reserved for the I/O control. It can host the Phase Echo (bit 7), and the status of the Digital Inputs (bit 0, bit 1, bit2)

2. **EB 1, 2, 3: DAD Header bytes (device side)**

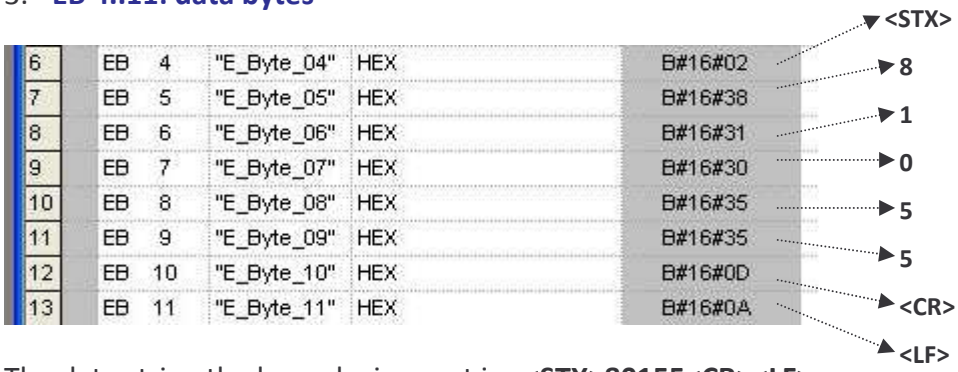


3		EB	1	"E_Byte_01"	HEX	B#16#81
4		EB	2	"E_Byte_02"	HEX	B#16#00
5		EB	3	"E_Byte_03"	HEX	B#16#08

- EB 1: the device handles the byte for the data handshake with the PLC. Note that the current value is "81hex" (1 0 0 0 0 0 0 1 binary), it means:
  - Bit 7 = 1: DAD bit
  - Bit 0 = 1: it means the node sent data to the PLC
- EB 3: length byte = 8, showing the node sent 8 bytes to the PLC

[3] Because I/O Conditioning is now enabled; otherwise the first byte of the I/O memory areas is the Control byte, if Data Flow Control enabled, or it is the first Data byte.

3. **EB 4..11: data bytes**

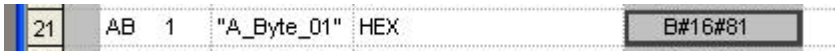


The data string the laser device sent is: **<STX>80155<CR><LF>**

AB 0: I/O byte

It is now reserved for the I/O control. Its bit 7 is just mapped with the M20.7 bit of the PLC memory, it' s the trigger bit . The bit value on the picture is 0, it means the trigger is not active

4. AB 1: DAD Control byte (PLC side)



The PLC handles this byte to answer the node, to acknowledge the received data string. Note that the current value is "81hex" (1 0 0 0 0 0 0 1 binary), it means:

- Bit 7 = 1: DAD bit
- Bit 0 = 1: acknowledge to EB 0.0 = 1, meaning the PLC recognized and accepted the last data transmission from the device

8. (most common)Troubleshooting

Trouble	Cause	Action
Error code = 102	Configurations mismatch	Align DB103 parameters, reader parameters and HW configuration.
Error code = 102 even after configuration aligning	Incorrect checksum detected on the initial PLC check	Enable/disable the “Alarm_reset” control line and Disable/enable the “Master_enable” control line
Data Flow Control handshake not running	Lost synchronization of PLC and reader	Enable/disable the “ResyncCmd” control line
Data traffic stopped, Rx_Warning ON	Overwrite protection enabled	Disable Overwrite protection in DB103 block