



**How to run a
Matrix 300
over
PROFINET-IO**



**Instructions Manual for
Siemens S7-300/400 PLC**

**How to run a Matrix300 over
PROFINET-IO****Instructions Manual****Summary**

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Master Revision History

Revision	Date	Author(s)	Change Description
0	31/10/2013	D.Natati	Preliminary Revision
1	07/02/2014	D.Natati	First Revision, GSDML file upgrading
1.1	27/02/2014	D.Natati	GSDML file upgrading to 20140214 version

**How to run a Matrix300 over
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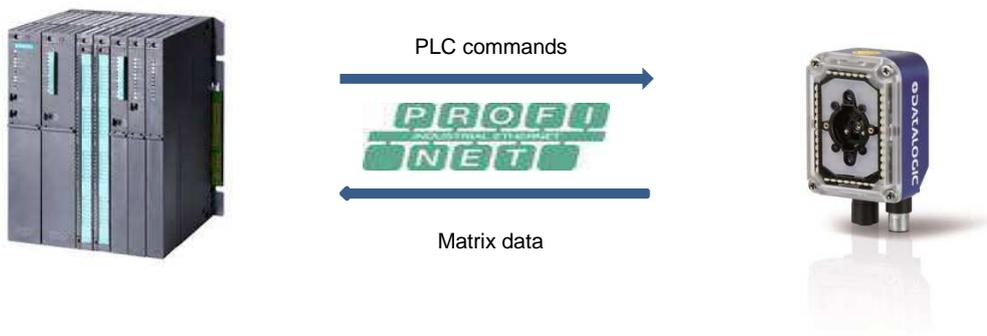
This document is intended to lead the user to start and practice the communication between a Datalogic imager **Matrix300** device and a **Siemens S7-300/400 PLC** over **PROFINET-IO**.

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.

The communication can be a “control-free” communication or handled by the Datalogic Data Flow Control “DAD” named.

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

- **DAD FB 2.0 Instruction Manual**
- **DAD-DPD Driver Reference Manual**

**Referenced PLC Project**

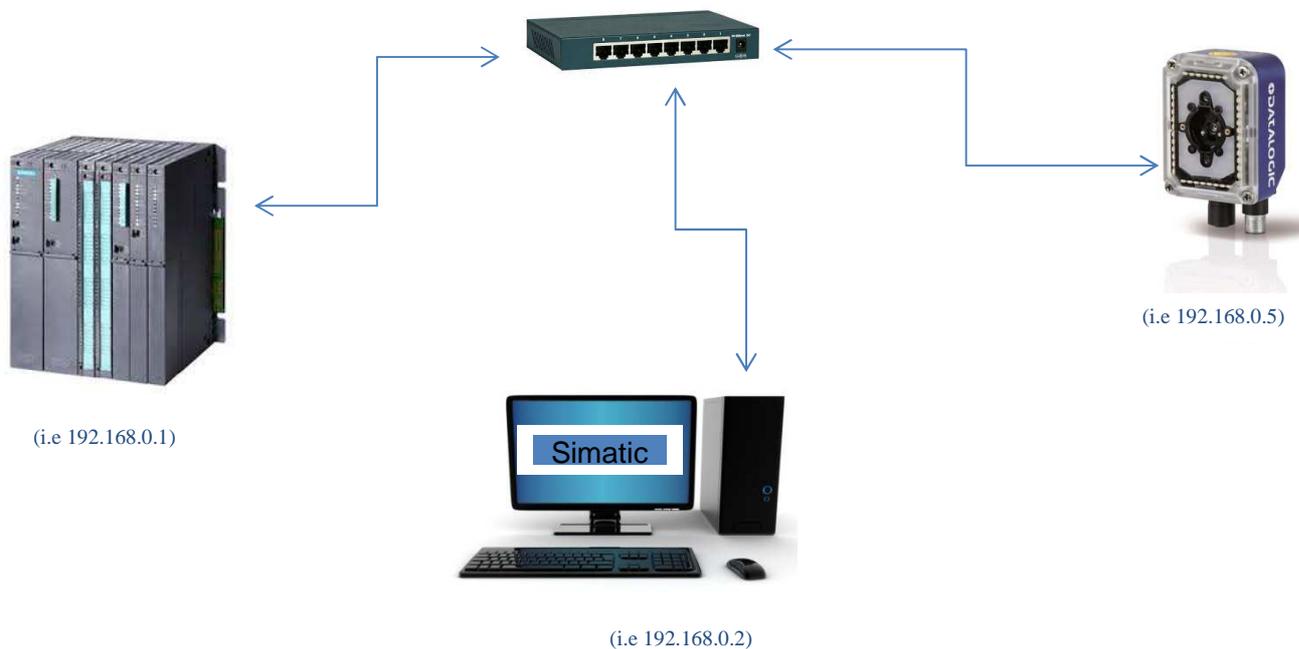
This document refers a sample project for S7-300 PLC, so called “Matrix_PNEbd_DAD2”.

Referenced Configuration Tool

This document refers the Simatic Step 7 v. 5.4 + SP5 configuration tool.

**How to run a Matrix300 over
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Connect Matrix300, PLC and Pc hosting the STEP-7 configuration tool (SIMATIC) over the same subnet (i.e through an Ethernet switch)



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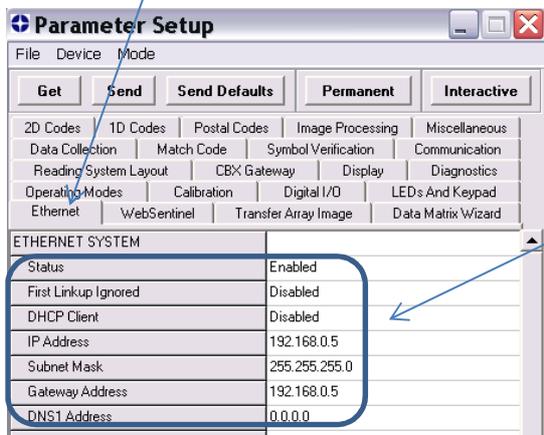
Matrix300 setup with Visiset

The picture below shows the needed setup to enable the PROFINET-IO driver on Matrix300.

Ethernet

First it needs to connect the reader to the communication network (i.e. 192.168.0.x).

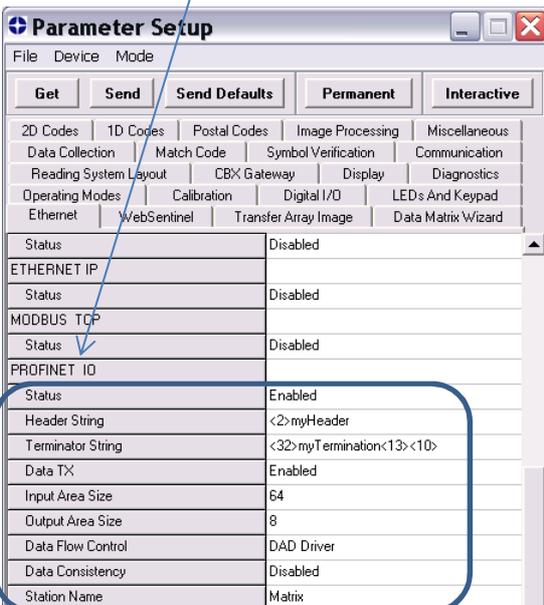
Select **"Ethernet"** tab on the Parameter Setup, then **"Ethernet System"** and set the network parameters.



PROFINET-IO

Then it needs to enable PROFINET-IO.

On the **"PROFINET IO"** section of **"Ethernet"** tab set as following:



- Status = enabled
- Input Area Size = PLC configuration aligned (default = 64)
- Output Area Size = PLC configuration aligned (default = 8)
- Data Flow Control = PLC configuration aligned (default = DAD Driver)
 - Data Consistency = PLC configuration aligned (default = disabled)
- Station Name = PLC configuration aligned (default = Datalogic, now "Matrix")
 - Data TX = enabled

"Header String" and "Terminator String" parameters are for output data format only.



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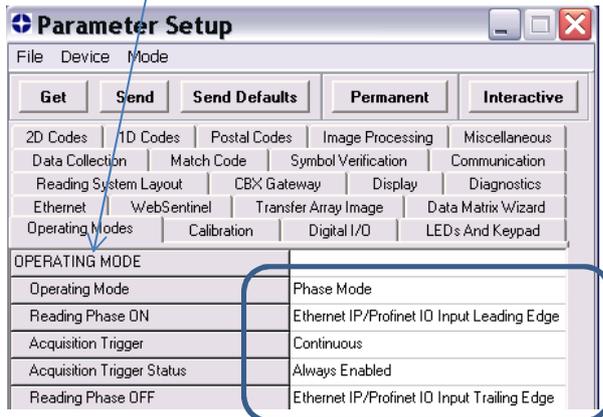
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**How to run a Matrix300 over
PROFINET-IO****Instructions Manual****Operating Mode**

Now it needs to select the Operating Mode for the reader.

Select **“Operating Mode”** tab on the Parameter Setup, then set as following:



- Operating Mode = Phase Mode
- Reading Phase ON = Ethernet IP/Profinet IO Input

Leading Edge

- Acquisition Trigger = Continuous
- Acquisition Trigger = Always enabled
- Reading Phase OFF = Ethernet IP/Profinet IO Input

Trailing Edge

Finally, click on **“Send”** button to send and save this setup into the reader.

Note:

Setting **“Reading Phase ON”** or **“Reading Phase OFF”** to a fieldbus activates the I/O Control making byte 0 of I/O Data Exchange Area reserved for control operations and not available for data exchange (ref. section **“AB 0: I/O byte”** of pag.18).

**How to run a Matrix300 over
PROFINET-IO****Instructions Manual****GSDML file installation**

Copy the content of the zip package “GSDML_Matrix_20140214” on a local directory.

Open the Hardware configuration and select “Install new GSD” in “Tools” tab.

From that local directory select the file: **GSDML-V2.1-Datalogic-Matrix-PNIO-20140214** then confirm the loading.

After the installation has completed, following 3 new nodes and related icons

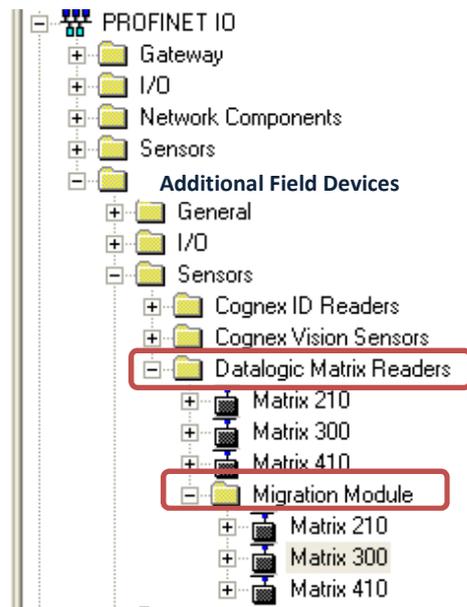
- Matrix210
- Matrix300
- Matrix410

appear in the PLC HW catalogue under the folders:

PROFINET IO/Additional Field Devices/Sensors/Datalogic Matrix Readers

and

PROFINET IO/Additional Field Devices/Sensors/Datalogic Matrix Readers/Migration Module¹



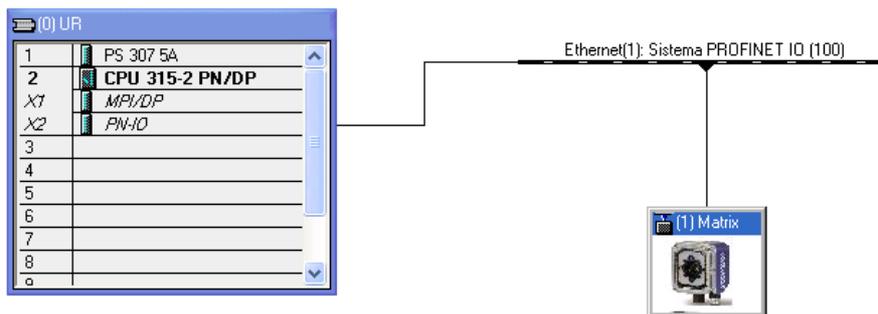
¹ Select “Migration” nodes for Controller (PLC) not supporting the extended PROFINET-IO diagnostic

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Setting the HW Configuration

Select "Matrix300" node for the project, the default I/O modules are 8 bytes for OUTPUT and 64 bytes for INPUT



Porto connettore	Unità	Numero di ordinazione	Indirizzo E	Indirizzo A	Indirizzo di diagnostica
	Matrix	MA750X-300			2043"
	8 Byte Output	MODULE-8BYTE-DUT		0...7	
	64 Byte Input	MODULE-64BYTE-IN	0...63		

The I/O configuration must match the following requirements:

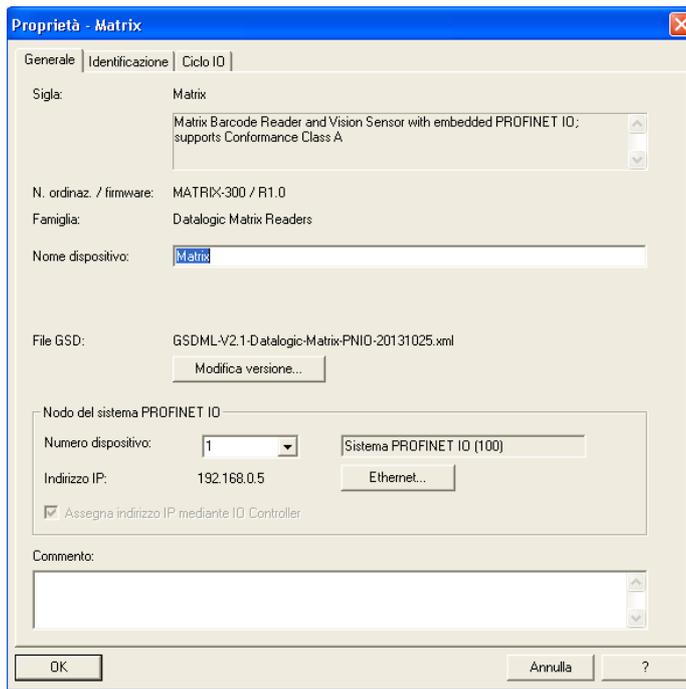
- 1 module for OUTPUT
- 1 module for INPUT
- OUTPUT module must be placed into the slot #2
- INPUT module must be placed into the slot #3
- Modules appending is not allowed

Datalogic GSDML file automatically controls the right position of the I/O modules, avoiding incorrect positions and showing specific warning messages.

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In the Node Properties Set:

- IP address matching with the Matrix reader configuration (i.e. "192.168.0.5")
- "Station Name" matching with the Matrix reader configuration (i.e. "Matrix")



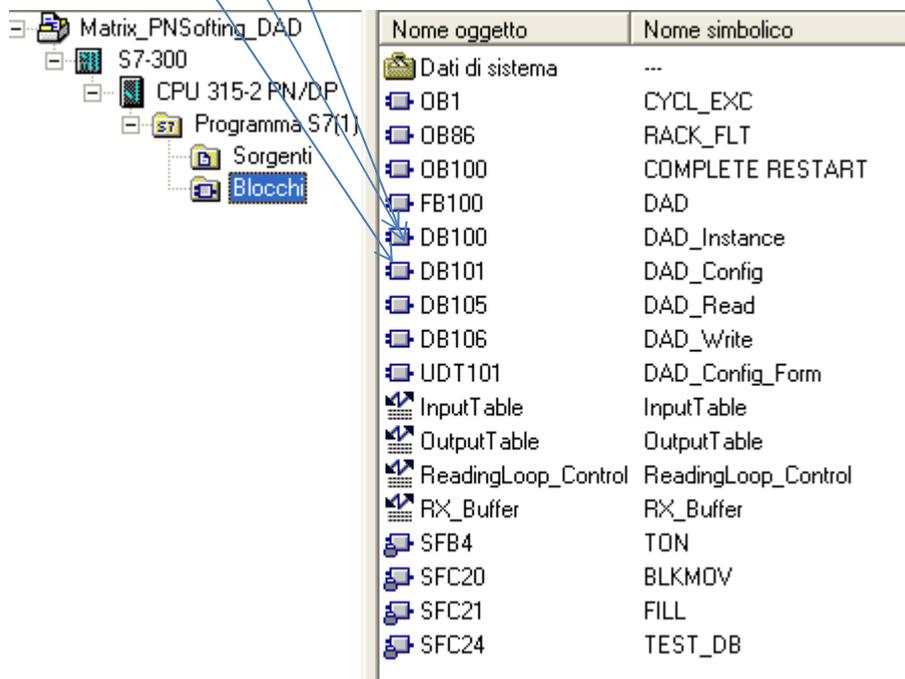
**How to run a Matrix300 over
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This section shows how to use the referred PLC project; it implements an endless reading loop for Datalogic devices belonging to the “Matrix 2x0/3x0/4x0” series.

The involved PLC is a **Siemens S7 PLC**, the fieldbus in use is **PROFINET-IO**; anyway, this project can be easily adjusted in order to run over PROFIBUS; a simple modification on the HW configuration of the PLC project achieves this goal.

The basic items of this project are:

- FB100: **DAD** FB
the data flow control block, it handles the communication between PLC and Matrix device;
- DB100: FB100 instance
- DB101: Configuration Data Block for FB100



Nome oggetto	Nome simbolico
Dati di sistema	---
OB1	CYCL_EXC
OB86	RACK_FLT
OB100	COMPLETE RESTART
FB100	DAD
DB100	DAD_Instance
DB101	DAD_Config
DB105	DAD_Read
DB106	DAD_Write
UDT101	DAD_Config_Form
InputTable	InputTable
OutputTable	OutputTable
ReadingLoop_Control	ReadingLoop_Control
RX_Buffer	RX_Buffer
SFB4	TON
SFC20	BLKMOV
SFC21	FILL
SFC24	TEST_DB

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Aligning the project and reader configurations

Select **DB101** data block then choose the “Data” view.

Indirizzo	Nome	Tipo	Valore	Valore attuale	Commento
0.0	V2_In_Field.FirstByte	INT	0	0	Input field area first byte number
2.0	V2_In_Field.Size	INT	0	64	Input field area size (num. of bytes)
4.0	V2_In_Field.Area	INT	1	1	Input field area type: 1 = Input (E) / 3 = Memory (M)
6.0	V2_Out_Field.FirstByte	INT	0	0	Output field area first byte number
8.0	V2_Out_Field.Size	INT	0	8	Output field area size (num. of bytes)
10.0	V2_Out_Field.Area	INT	2	2	Output field area type: 2 = Output (A) / 3 = Memory (M)
12.0	V2_Rx_Buffer.FirstByte	INT	0	0	Receive Buffer 1st byte address (number)
14.0	V2_Rx_Buffer.Size	INT	0	128	Receive Buffer size (num. of bytes) (Min. = 8)
16.0	V2_Rx_Buffer.Area	INT	0	4	Receive Buffer area type: 2 = Output (A) / 3 = Memory (M) / 4 = DataBlock (DB)
18.0	V2_Rx_Buffer.DB_Num	INT	0	105	Receive Buffer DB number (valid only if 'Area' = 4)
20.0	V2_Tx_Buffer.FirstByte	INT	0	0	Transmit Buffer 1st byte address (number)
22.0	V2_Tx_Buffer.Size	INT	0	128	Transmit Buffer size (num. of bytes) (Min. = 8)
24.0	V2_Tx_Buffer.Area	INT	0	4	Transmit Buffer area type: 1=Input(E)/ 2=Output(A)/ 3=Memory(M)/ 4=DataBlock(DB)
26.0	V2_Tx_Buffer.DB_Num	INT	0	106	Transmit Buffer DB number (valid only if 'Area' = 4)
28.0	V2_Setting.FC_Reserved	BOOL	TRUE	TRUE	Flow Control Reserved --- DON'T MODIFY ! ---
28.1	V2_Setting.Digital_IO	BOOL	FALSE	TRUE	Digital Input conditioning enabled
28.2	V2_Setting.Consistency	BOOL	FALSE	FALSE	Consistency mode is enabled
28.3	V2_Setting.Spare_1	BOOL	FALSE	FALSE	Reserved for future use
28.4	V2_Setting.OverwriteProtect	BOOL	FALSE	FALSE	This option disable data reception while 'DataReady' is TRUE
28.5	V2_Setting.Read_En	BOOL	TRUE	TRUE	Read from partner function enabled (HostMode bypass it)
28.6	V2_Setting.Write_En	BOOL	TRUE	TRUE	Write to partner function enabled (HostMode bypass it)
28.7	V2_Setting.ConsistencyAlarm	BOOL	FALSE	FALSE	Consistency Guard: On Consistency invalid -> ON=Alarm - OFF=Warning
30.0	V2_PartnerReady_TOut	TIME	T#20S	T#20S	Maximum delay for communication protocol data matching with Partner
34.0	V2_Functions_TOut	TIME	T#5S	T#5S	Maximum work time for procedures (ReSynchronization,FlushQueue command,Repeat)

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 red arrows on the right side of the table):

1. INPUT field area first byte number

The current value must match the INPUT area starting address in the HW configuration

2. INPUT field area size

The current value must match the INPUT field area size in the HW configuration and in the reader configuration

3. OUTPUT field area first byte number

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

4. the OUTPUT field area size

The current value must match the OUTPUT field area size set in the HW configuration and in the reader configuration

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**How to run a Matrix300 over
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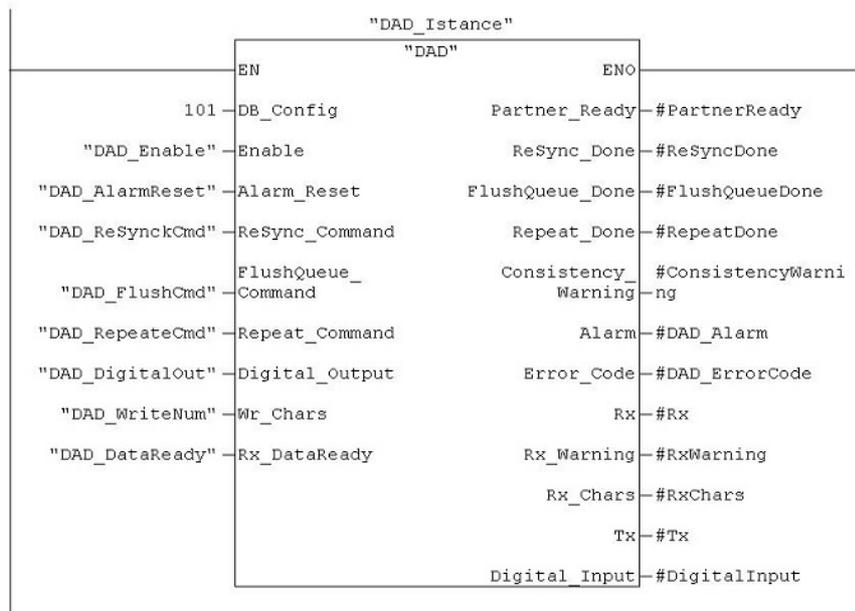
The current value must match the reader and PLC HW configuration

- DAD_Cfg.Digital_IO = TRUE → Digital trigger(trigger by PLC)is enabled

6. Consistency Mode

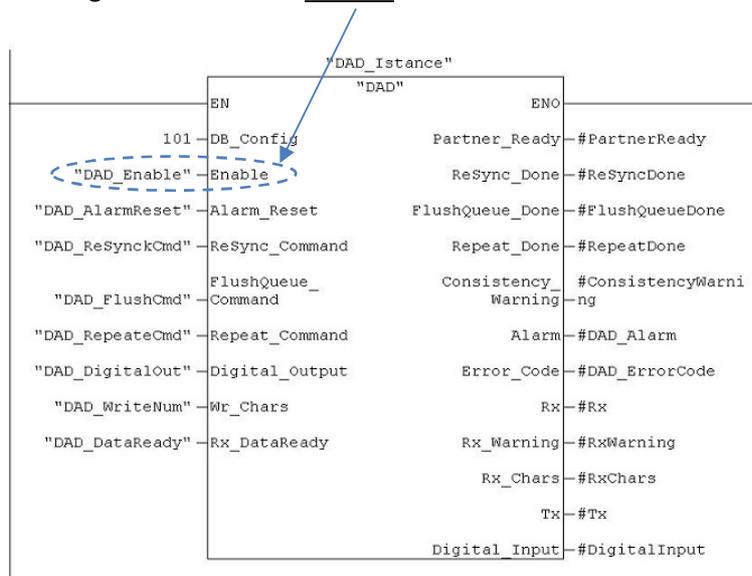
The current value must match the reader configuration:

- DAD_Cfg.Consistency = FALSE → Data Consistency = Disabled

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Logic and Functional Blocks
OB1: "DAD" FB


DAD block instance implements the data flow control; it can be used to handle the communication between PLC and Matrix device.

The flag below allows to **enable** the instance.

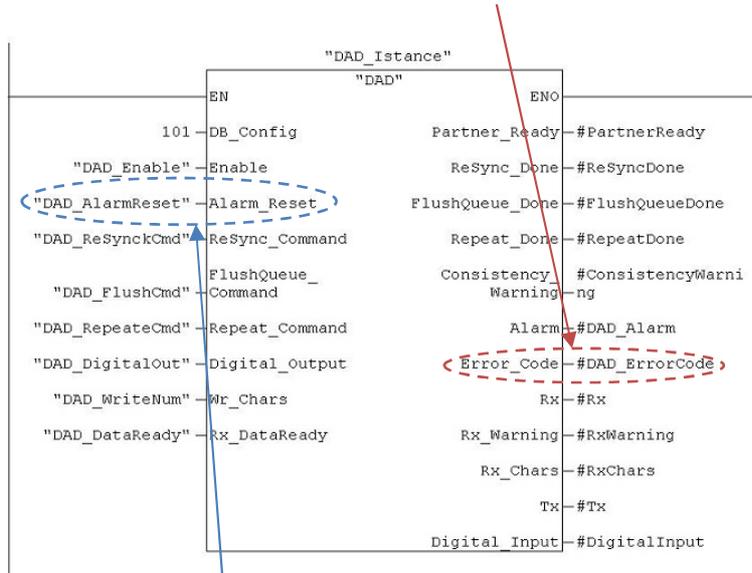


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Remember: in Matrix setup must be **“Ethernet/Profinet IO/ Data Flow Control = DAD Driver”**.

Note: in case of error condition ($\text{Error_Code} \neq 0$),



refer to the Alarm- and Troubleshooting- tables to analyze the issue; then activate the “Alarm_Reset” input to clear it.²

If no error condition is active, the project can run.

OB1: Reading Loop

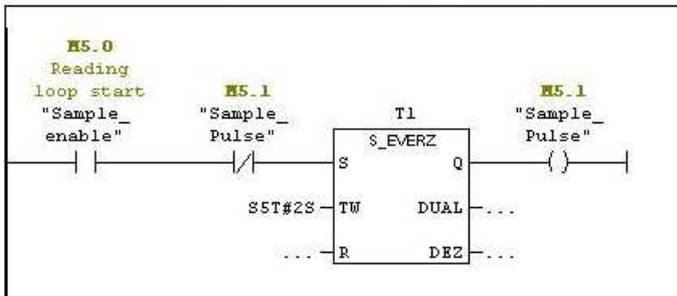
First, **it needs to provide a trigger to the device in order to start the reading phase.**

This project is able to provide a logical trigger by a PLC bit; see segments 4 and 5 of OB1:

² Refer to the “DAD FB 2.0 Instruction Manual”

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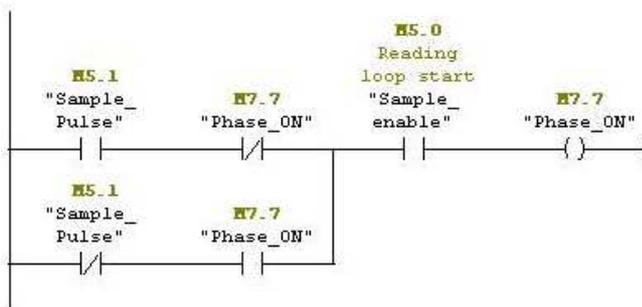
Set "Sample_enable" to start the reading loop
Set the timer to adjust the reading loop timing



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Segmento 5 : Reading Phase activation

```

Datalogic Reader has to be set as
LASER: Operating Mode = "Start From Fieldbus"
OR
MATRIX: Operating Mode = "Phase Mode"
        Phase ON/OFF = "Fieldbus Input Leading/Trailing Edge"
(external fieldbus interface card)
OR
        Phase ON/OFF = "EthernetIP-ProfinetIO Input Leading/Trailing Edge"
(embedded fieldbus)
    
```



These program segments implement an endless cycle, which set and reset the “**Phase_ON**” signal, it mapped on the **M7.7** bit of the PLC memory.

M7 byte is mapped on the first byte of the Output area, it means this bit acts as trigger bit for the device over the fieldbus.

Remember: in Matrix setup must be

- Operating Mode = Phase Mode
- Reading Phase ON = Ethernet IP/Profinet IO Input Leading Edge
- Reading Phase OFF = Ethernet IP/Profinet IO Input Trailing Edge

The active period of the trigger is controlled by the **T1** timer, its value is currently set to 2 seconds. The user can freely modify the timing, if needed.

In order to start the trigger cycle, set “**Sample_enable**” (**M5.0**) flag.

A VAT table “**ReadingLoop_Control**” named is also available to control the reading loop (see below)

	Operando	Simbolo	Formato di visualizzazione	Valore di stato
1	/Reading Loop Enable			
2	M 5.0	"Sample_enable"	BOOL	true
3	/Phase ON			
4	M 7.7	"Phase_ON"	BOOL	false
5	/Reading Loop Timer			
6	T 1		TEMPO SIMATIC	S5T#1s380ms



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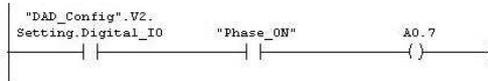
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Data flow control (DAD) enabling is NOT mandatory to run this sample PLC project.
It's also possible to start a "control-free" communication, disabling DAD both on the reader setup and on DB101 Configuration Data Block.

The project segment n.6 (see below) allows the reading loop anyway.

Segmento 6 : Reading Loop even no DAD

If Digital IO enabled, this segment drives the reading loop



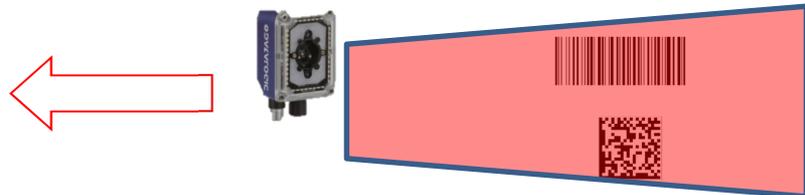
Informazioni sul simbolo:

"DAD_Config".V2.Setting.Digital_IO	DB101.DBX28.1	-- Digital Input conditioning enabled
Phase_ON	M7.7	

If the device has been correctly placed in front of an enabled bar code, an endless reading session starts to capture data then forward them to the PLC over PROFINET- IO.



PLC S7-300



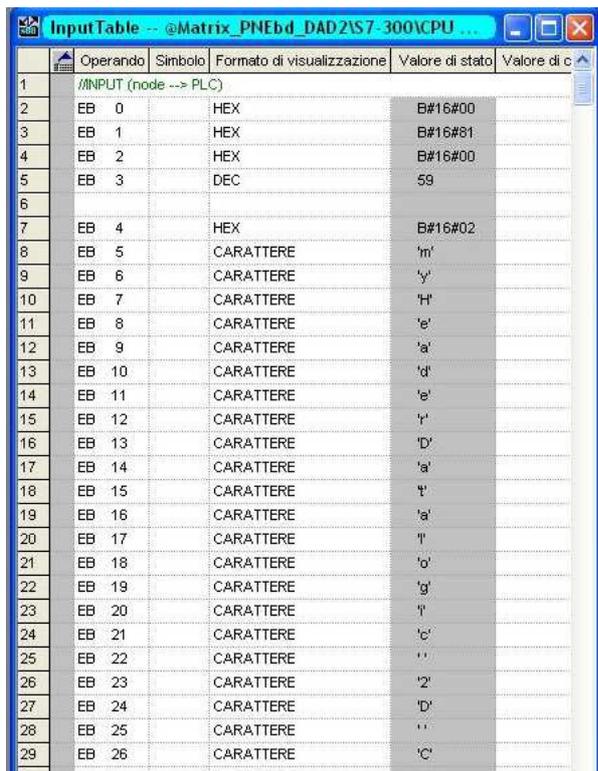
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Check the data traffic

In order to check the current status of the I/O data exchange between reader and PLC, VAT tables are very useful. On the project block list select and open:

- **“InputTable”**, already designed to check the first 64 input bytes
- **“OutputTable”**, already designed to check the first 8 output bytes



	Operando	Simbolo	Formato di visualizzazione	Valore di stato	Valore di c
1	/INPUT (node --> PLC)				
2	EB 0		HEX	B#16#00	
3	EB 1		HEX	B#16#81	
4	EB 2		HEX	B#16#00	
5	EB 3		DEC	59	
6					
7	EB 4		HEX	B#16#02	
8	EB 5		CARATTERE	'm'	
9	EB 6		CARATTERE	'y'	
10	EB 7		CARATTERE	'H'	
11	EB 8		CARATTERE	'e'	
12	EB 9		CARATTERE	'a'	
13	EB 10		CARATTERE	'd'	
14	EB 11		CARATTERE	'e'	
15	EB 12		CARATTERE	'r'	
16	EB 13		CARATTERE	'D'	
17	EB 14		CARATTERE	'a'	
18	EB 15		CARATTERE	't'	
19	EB 16		CARATTERE	'a'	
20	EB 17		CARATTERE	'i'	
21	EB 18		CARATTERE	'o'	
22	EB 19		CARATTERE	'g'	
23	EB 20		CARATTERE	'f'	
24	EB 21		CARATTERE	'c'	
25	EB 22		CARATTERE	'.'	
26	EB 23		CARATTERE	'2'	
27	EB 24		CARATTERE	'D'	
28	EB 25		CARATTERE	'.'	
29	EB 26		CARATTERE	'C'	

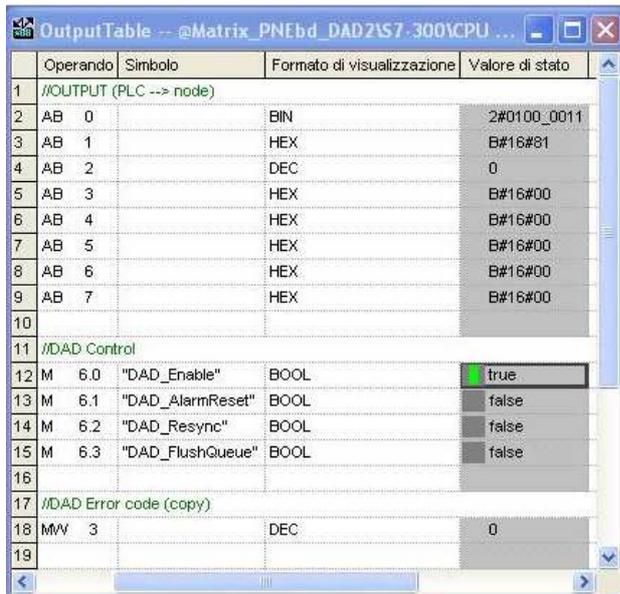
Here above a snapshots of the Input table during the I/O handshake.

Note that:

1. **EB 0: I/O byte** : it is reserved for the I/O control. See “Important note” of pag.6 to find out more.
2. **EB 1, 2, 3: DAD Header (reader)**
 - **EB 1:** DAD control byte. Note that the current value is 81(hex) (1 0 0 0 0 0 0 1 binary), it means:
 - Bit 7 = 1: DAD mark
 - Bit 0 = 1: it means the node sent data to the PLC
 - **EB 3:** length byte = 59, showing the node sent 59 bytes to the PLC

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- EB 4.....: data bytes:** data string the device sent to the PLC. These data are also stored into the data block DB105 "DAD_Read" named.



Operando	Simbolo	Formato di visualizzazione	Valore di stato
1 //OUTPUT (PLC --> node)			
2	AB 0	BIN	2#0100_0011
3	AB 1	HEX	B#16#81
4	AB 2	DEC	0
5	AB 3	HEX	B#16#00
6	AB 4	HEX	B#16#00
7	AB 5	HEX	B#16#00
8	AB 6	HEX	B#16#00
9	AB 7	HEX	B#16#00
10			
11 //DAD Control			
12	M 6.0 "DAD_Enable"	BOOL	true
13	M 6.1 "DAD_AlarmReset"	BOOL	false
14	M 6.2 "DAD_Resync"	BOOL	false
15	M 6.3 "DAD_FlushQueue"	BOOL	false
16			
17 //DAD Error code (copy)			
18	MW 3	DEC	0
19			

Here above a snapshots of the Output table during the I/O handshake.
Note that:

- AB 0: I/O byte**

it is reserved for the I/O control (ref. "Note" of pag.6)

Bit 7 is mapped with the M7.7 bit of the PLC memory, the trigger bit . The 7-bit value on picture is 0, it means the trigger is not active

- AB 1: DAD Control byte (PLC)**

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

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

- M6.0: DAD_Enable**

"TRUE" value shows DAD data flow control is running. Set/reset this flag to enable/disable DAD

**How to run a Matrix300 over
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Trouble	Cause	Action
Error code = 100	Configurations mismatch	Align DB101 parameters, reader parameters and PLC HW configuration.
Error code = 100 even after configuration aligning	Incorrect checksum detected on the initial PLC check	Enable/disable the "Alarm_reset" control line Disable/enable the "DAD_enable" control line Switch on/off the reader
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 DB101 block