

# Datalogic Lighter built-in ProfiNet I/O for Laser Marking Systems





# Installation and User Manual

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# Master Revision History

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Datalogic S.r.I. recommends to read this User Manual carefully before performing any kind of operation both on the PLC and the Laser Marker. I case of any doubts, please contact your local Datalogic Technical Support or fill in the Support Webform on the Datalogic s.r.I website at the following link.

#### 1. Introduction to this User Manual

This User manual has been developed for PLC programmers who intend to connect a Datalogic Laser Marker to a PLC via ProfiNet/IO, in order to handle the Laser Marker and its operations following the flow of the Production Chain.

All the screenshots and tests made as a reference for the creation of this User Manual were made using the following versions of HW and SW:

Element used	Versioning
PLC	Siemens S7-1200 CPU 1214C DC/DC/DC Article no. 6ES7 214-1AG31-0XB0 Firmware rev. 3.0
PLC programming SW tool	TIA Portal v.13 SP1
Datalogic Laser Marker	Arex430
Lighter version	Lighter 7.2.0 Alpha 8

#### 2. Setup over ProfiNet/IO Network

In order to have ProfiNet/IO connection between the PLC and the Datalogic Laser Marker, it is necessary to set up both elements: this chapter want to show the necessary steps and the choices which the PLC programmer can make according to his needs, in order to have communication between these two ProfiNet/IO devices.

#### 2.1. Configuring the Laser Marker for use over PNIO

Some operations must be made on the Laser in order to have it working on an Profinet/IO network; PLC programmers will need to assign on each Laser Marking a **Device Name** and make changes to the **Firewall Rules**: moreover, the User, according to his application will have to choose the **dimension of the Input and Output Memory Areas**. These changes are described in the following paragraphs.

# Basic net settings of the Laser Marker

The Datalogic Laser Marking systems can be discovered on an ProfiNet/IO network only if a number of parameters on the Laser Marker and on the PLC match. The parameters which should match are the following:

- Device Name;
- Size of Input and Output memory maps.

The Device Name of the Laser Marker can be changed following these steps:

a) Open the 'Laser Configuration' on the Laser Marking System, by right-clicking the Laser Engine icon in the Windows tray bar.



 b) Once the Laser Configurator is open, select the 'Network' voice of the menu from the left side of the interface and the Device Name can be found under the voice 'Device Network Name'.



General	Property	Value
Scapper	P Network	
Sedminer	Device Network Name	Arex400
aser	🖃 TCP Server	
-ield Orientation	Port Number	2709
	Ethernet/IP	
orrection	Network Adapter	LAN 1
Aiming	🕀 Profinet	
oput / Output	··· Network Adapter	LAN 3
inpacy output	Input Memory Size	64
( Axis	Output Memory Size	64
/ Axis	E LAN 1	
	Media Status	Disconnected
2 AXIS	E LAN 2	
R Axis	Media Status	Disconnected
Marking on the Elv	E LAN 3	
narrang on che rity	···· Media Status	Connected
Vetwork	DHCP Settings	Specify IP address manually
MARVIS	IP Address	192.168.0.10
	Subnet Mask	255.255.255.0
Distance Sensor	··· Default Gateway	
Service	Preferred DNS Server	
	Alternate DNS Server	

c) The size of the Input and Output Memory Maps has to be set also inside the 'Profinet' section, choosing from the 3 possible sizes expressed in Bytes (64, 128 or 254).

Seneral	Property	Value
capper	- Network	
cannor	Device Network Name	Arex400
aser	🕂 TCP Server	
ield Orientation	Port Number	2709
	🛱 Ethernet/IP	
Correction	Network Adapter	LAN 1
Aiming	🛱 Profinet	
Input ( Output	Network Adapter	LAN 3
npacy oacpac	Input Memory Size	64
( Axis	- Output Memory Size	64
/ Axis	E LAN 1	
	Media Status	Disconnected
. Axis	E LAN 2	
R Axis	Media Status	Disconnected
Aarking on the Fly	E-LAN 3	
ianing off cherry	···· Media Status	Connected
letwork	DHCP Settings	Specify IP address manually
/ARVIS	···· IP Address	192.168.0.10
	Subnet Mask	255.255.255.0
istance Sensor	Default Gateway	
iervice	Preferred DNS Server	
	Alternate DNS Server	

d) Once these parameters have been set, press 'Apply' followed by 'OK' on the bottom of the Interface.

#### Advanced net settings of the Laser Marker

All Datalogic Laser Marking devices are controlled by the Windows Firewall, which by default settings does not allow Inbound and Outbound ProfiNet/IO traffic; in order to establish a ProfiNet/IO connection between the PLC and the Laser Marker, the user can either completely disable the control of the Windows Firewall, or **allow all Inbound and Outbound traffic regarding 'LaserEngine.exe'**.

To create these Inbound and outbound rules regarding the Windows Firewall, the User can follow this procedure on the Laser Marker:

Windows Firewall			-
🗲 🕞 - 🔐 🔹 Control Panel 🔹 A	Il Control Panel Items 👻 Windows Firewall	👻 🐼 🛛 Search Control Panel	
ile Edit View Tools Help			
Control Panel Home	Help protect your computer with Window	vs Firewall	
Allow a program or feature through Windows Firewall	Windows Firewall can help prevent hackers or m Internet or a network.	alicious software from gaining access to your computer through the	
Change notification settings	How does a firewall help protect my computer?		
Turp Windows Firewall op or off	What are network locations?		
Restore defaults	🔮 Home or work (private) netwo	rks Not Connected 🔽	
Advanced settings	Vublic networks	Connected 属	
	Networks in public places such as airports or co	offee shops	
	Windows Firewall state:	On	
	Incoming connections:	Block all connections to programs that are not on the list of allowed programs	
	Active public networks:	Inidentified network	
	Notification state:	Notify me when Windows Firewall blocks a new program	
See also			

1. Enter the Control Panel and select 'Advanced settings'.

2. New Inbound and Outbound rules need to be set for the 'LaserEngine.exe' program: click on 'Inbound Rule' and then select 'New Rule...'.

🖗 Windows Firewall with Advance	ed Security							_ 0
File Action View Help								
🗢 🔿 🚺 🔂 🖬								
Windows Firewall with Advanced S	Inbound Rules						Actions	
Inbound Rules	Name	Group 🗠	Profile	Enabled	Action	0. 💌	Inbound Rules	
Connection Security Rules	Enable Echo Ping Request		All	Yes	Allow	Nc	New Rule	-
E Monitoring	🖉 LaserEngine Control		All	Yes	Allow	Nc	individuality	2.
	LaserEngine Control		All	Yes	Allow	No	Filter by Profile	
	LaserEngine Ethernet Protocol		All	Yes	Allow	No	Tilter by State	
	🖉 LaserEngine Signal		All	Yes	Allow	No		
	🖉 LaserEngine Transfer		All	Yes	Allow	No	Y Filter by Group	
	BITS Peercaching (Content-In)	BITS Peercaching	All	No	Allow	Nc	View	
	BITS Peercaching (RPC)	BITS Peercaching	All	No	Allow	Nc	R	
	BITS Peercaching (RPC-EPMAP)	BITS Peercaching	All	No	Allow	Nc	Refresh	
	BITS Peercaching (WSD-In)	BITS Peercaching	All	No	Allow	Nc	Export List	
	BranchCache Content Retrieval (HTTP-In)	BranchCache - Content Retrie	All	No	Allow	No	2 . Lake	
	BranchCache Hosted Cache Server (HTTP-In)	BranchCache - Hosted Cache	All	No	Allow	No	I Help	
	BranchCache Peer Discovery (WSD-In)	BranchCache - Peer Discovery	All	No	Allow	Nc		
	Core Networking - Destination Unreachable (ICI	MPv6-In) tworking	All	Yes	Allow	No		
	Ocore Networking - Destination Unreachable	Core Networking	All	Yes	Allow	No		
	Ocore Networking - Dynamic Host Configurati	Core Networking	All	Yes	Allow	No		
	Ocore Networking - Dynamic Host Configurati	Core Networking	All	Yes	Allow	Nc		
	Ore Networking - Internet Group Managem	Core Networking	All	Yes	Allow	No		
	Core Networking - IPHTTPS (TCP-In)	Core Networking	All	Yes	Allow	No		
	Core Networking - IPv6 (IPv6-In)	Core Networking	All	Yes	Allow	No		
	Core Networking - Multicast Listener Done (T	Core Networking	All	Yes	Allow	No		
	Core Networking - Multicast Listener Query (	Core Networking	All	Yes	Allow	Nr		
	Core Networking - Multicast Listener Report	Care Networking	ΔI	Yes	Allow	Nr		
	Core Networking - Multicast Listener Report	Core Networking	All	Yes	Allow	Nr		
	Core Networking - Neighbor Discovery Adve	Care Networking	All	Yes	Allow	Nc		
	Orre Networking - Neighbor Discovery Solicit	Core Networking	All	Yes	Allow	No		
	Core Networking - Packet Top Big (ICMPv6-In)	Core Networking	All	Yes	Allow	No		
	Ocre Networking - Parameter Problem (ICMP	Core Networking	All	Yes	Allow	No		
	Core Networking - Router Advertisement (IC	Core Networking	All	Yes	Allow	N		
	Core Networking - Router Solicitation (ICMP	Core Networking	All	Yes	Allow	No		
	Core Networking - Teredo (LDP-To)	Core Networking	All	Yes	Allow	N		
	Core Networking - Time Exceeded (ICMPv6-In)	Core Networking	All	Yes	Allow	No		
	Distributed Transaction Coordinator (BPC)	Distributed Transaction Coordia	Privat	No	Allow	Nr		
	Distributed Transaction Coordinator (RPC)	Distributed Transaction Coordi	Domain	No	Allow	Nr = 1		
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	121					-	I	_
						J		
Start 🛜 📴 🦪 🚟						IT	1 🔏 🛄 🔝 🖡	12:36



3. A Wizard GUI will guide you through the procedure: select 'Program'.

🍿 New Inbound Rule Wizard		×
Rule Type		
Select the type of firewall rule to c	reate.	
Steps:		
Rule Type	What type of rule would you like to create?	
Protocol and Ports		
<ul> <li>Action</li> </ul>	Program     Bule that controls connections for a program	
<ul> <li>Profile</li> <li>Name</li> </ul>	C. Part	
<ul> <li>Name</li> </ul>	Rule that controls connections for a TCP or UDP port.	
	O Predefined:	
	BITS Peercaching	
	Rule that controls connections for a Windows experience.	
	O Custom	
	Lustom rule.	
	Learn more about rule types	
	< Back. Next > Cancel	

4. In the Program And Services tab, browse towards the 'LaserEngine.exe' application, present in *C:* |*ProgramFiles* |*Lighter* | *7.2*.

Protocols and Ports       Scope       Advanced       Users         General       Programs and Services       Computers         Programs <ul> <li>All programs that meet the specified conditions</li> <li>This program:</li> <li>% ProgramFiles %\Lighter\7.2\LaserEnc</li> <li>Browse</li> </ul> Services         Services       Specify the services to which this rule       Settings         Specify the services to which this rule       Settings			1.6.13		
Protocols and Ports       Scope       Advanced       Users         General       Programs and Services       Computers         Programs <ul> <li>All programs that meet the specified conditions</li> <li>This program:</li> <li>% ProgramFiles %\Lighter\7.2\LasetEnc</li> <li>Browse</li> </ul> Services         Services       Specify the services to which this rule       Settings         applies.       Settings       Settings	rofinet Properties				2
Programs <ul> <li>All programs that meet the specified conditions</li> <li>This program:</li> <li>?ProgramFiles?*Lighter\7.2*LaserEnc</li> <li>Browse</li> </ul> <li>Services         <ul> <li>Specify the services to which this rule</li> <li>Settings</li> </ul> </li> <li>Learn more about programs and services</li>	Protocols and Ports S General Program	cope   Adv ns and Services	anced     Co	Users mputers	
	Programs  All programs that me  This program:  Program:  Program:  ProgramFiles % L  Services  Specify the services to applies.  Learn more about programs and se	ghter\7.2\LaserEng which this rule	nditions Browse Settings		



Open			
• OS (C:)	• Program Files • Lighter • 7.2 •	• 🚱 Search 7.2	
Organize 👻 New folder		8==	- 🗌 🕐
★ Favorites	Name *	Date modified Ty	rpe
🧮 Desktop	Docs	3/15/2019 12:06 PM Fil	e folder
📕 Downloads	📕 🔒 Help	3/15/2019 12:01 PM Fil	e folder
🔠 Recent Places	) imageformats	3/15/2019 12:01 PM Fil	e folder
E Librarios	Resources	3/15/2019 12:01 PM Fil	e folder
Documents	📕 sqldrivers	3/15/2019 12:01 PM Fil	e folder
J Music	i tools	3/15/2019 12:01 PM Fil	e folder
Pictures	🔍 assistant.exe	3/22/2017 3:22 PM Ap	plication
Videos	LaserController.exe	3/13/2019 11:40 AM Ap	plication
	LacorEditor.oxo	2/12/2010 11:40 AM AF	plication
Computer	🔎 LaserEngine.exe	3/13/2019 11:40 AM Ap	plication
DATA (D:)	aninstall.exe	3/15/2019 12:01 PM Ap	plication
👊 Network 📃			•
File	name: LaserEngine.exe	<ul> <li>Programs (*.exe)</li> </ul>	•
		Open	Cancel

5. Select 'Allow the connection', then press 'Next'.

💣 New Inbound Rule Wizard	×
Action	
Specify the action to be taken who	en a connection matches the conditions specified in the rule.
Steps:	
Rule Type	What action should be taken when a connection matches the specified conditions?
Protocol and Ports	Allow the connection
<ul> <li>Action</li> </ul>	This includes connections that are protected with IPsec as well as those are not.
Profile	O Allow the connection if it is secure
<ul> <li>Name</li> </ul>	This includes only connections that have been authenticated by using IPsec. Connections will be secured using the settings in IPsec properties and rules in the Connection Security Rule node.           Customize           © Block the connection
	<back next=""> Cancel</back>



6. Select all 3 types of Network.

🍻 New Inbound Rule Wizard		×
Profile		
Specify the profiles for which this r	ule applies.	
Steps:		
<ul> <li>Rule Type</li> <li>Protocol and Ports</li> </ul>	When does this rule apply?	
<ul> <li>Action</li> <li>Profile</li> </ul>	Domain Applies when a computer is connected to its corporate domain.	
<ul> <li>Name</li> </ul>	Private Applies when a computer is connected to a private network location.	
	Public Applies when a computer is connected to a public network location.	
	Learn more about profiles	
	< Back Next > Can	cel

7. Give this property a recognizable name.

Name				
Specify the name and des	cription of this rule	e.		
Steps:				
Rule Type				
Program				
Action		News		
Profile		Name: PNIO Inbound		
Name		I the meaning		
		Description (optional):		
			< Back Fini	sh Cancel

8. Now the Outbound rule must be set, making sure that all connection would be allowed also in an Output direction. Basically, the procedure must be repeated from point 2 to point 9, selecting 'Outbound Rules' at point 2 of the procedure. Once this is done, the created input and output rules will be seen along with all the other firewall rules.

Once all these settings have been entered, in order to make them permanent on the Laser Marking System, please double click on the 'Save-Data.bat' icon, present on the Desktop of the Laser Marker.

At this point, to activate ProfiNet/IO communication on the Datalogic Laser Marker side, it is sufficient to set Laser Engine in Remote Mode, by clicking on the indicated Push Button from the Laser Engine GUI:



In order to have the Laser Engine starting in Remote Mode also after the Laser Marker has rebooted, click 'Start in remote mode' from the Laser Engine icon in the Windows tray bar.





When in Remote Mode, the Laser Engine GUI will look like this (having all the Push Buttons disabled except for the one which brings Laser Engine back to Local Mode).



#### 2.2. Configuring the Siemens<sup>™</sup> S7–1200 Controller for use over PNIO

In order to create a Datalogic Laser Marker new ProfiNet/IO node in an already existing TIA Portal project, it is necessary to install the GSDML file.

Once the new ProfiNet/IO node has been imported inside the project, there are some parameters which need to be set before starting to work on the data exchange between the PLC and the Laser Marker.

#### Creating a PNIO node using the GSDML file

• Select the 'Manage general station description files (GSD)' from the Options Menu.

Ma Siemens - C:\Users\MPierpaolini\Documents\TIA programs\LM_V13_CPU1214C\LM_V13_CPU1214C					
Project Edit View Insert Online	Options Tools Window Help	_			
📑 📑 🔚 Save project 📑 🐰 🗉 🛍	🍸 Settings	🖉 Go offline			
Project tree	Support packages	tworks			
Devices	Manage general station description files (GSD)				
	Start Automation License Manager	(*****			
	Show reference text	tion			
Name	🛄 Global libraries 🕨 🕨				
T IM V13 CPU1214C	<u>^</u>	_			
	PLC 1	-			

• Now follow the steps in order to install the GSDML file, indicating the filepath of the GSDML file on the PC where TIA is running.

Manage general station descripti	on files			×
Source path: Users\MPierpaolini\Do	ocuments\TIA p	rograms\LM_V1	3_CPU1214C\AdditionalFiles\	GSD
Content of imported path				
File	Version	Language	Status	Info
GSDML-V2.33-Datalogic-Laser-Ma	V2.33	English	Already installed	Datalogic s
GSDML-V2.33-Datalogic-Laser-Ma	V2.33	English	Already installed	Datalogic s
GSDML-V2.33-Datalogic-Laser-Ma	V2.33	English	Already installed	Datalogic s
GSDML-V2.33-Softing-WindowsPC	V2.33	English	Already installed	Portation o
GSDML-V2.33-Softing-WindowsPC	V2.33	English	Already installed	Portation o
				_
<				>
			Delete Install	Cancel
			·	

Once the GSML installation is complete, you will be able to import a 'Laser marker' device from the HW catalog under this filepath: Other field devices -> PROFINET IO -> General -> Datalogic S.r.l. -> Laser Marker -> LASER MARKER 1P. To do so, drag&drop the device from the Hardware Catalog into the HW configuration of the device.



• Once you have imported the device into the HW configuration of your project, you will need to link it to the PLC which will communicate with the Datalogic Laser Marker

1			Totally Integrated Automati POI	on RTAL
LM_V13_CPU1214C  ▶ Devices & networks		_ <b>- -</b> ×	Hardware catalog	
	📱 Topology view 🛔 Network view	Device view	Options	-
Network Connections HMI connection	벤 🐮 🖽 🔍 ±			
		^	✓ Catalog	_
			Search>	) ivit
			- Filter	
CPU 1214C	LASER MAR		Controllers	
	PIC 1		M HM	
	122_1		BC systems	
			Drives & starters	
	PN/IE_1		Network components	
			Detecting & Monitoring	
			▶ 🛅 Distributed I/O	
		~	Field devices	
		• two	<ul> <li>Other field devices</li> </ul>	
HML1		- 74		
KP300 Basic		200	Drives	
			Encoders	
			🕨 🛅 Gateway	
			🕶 🛅 General	
			✓ Im Datalogic S.r.I.	
			- 🕞 Laser Marker	
			LASER MARKER 1P	
			Image: Imag	
			• <u>11</u> 1/0	
			I ident Systems	
		~		
< III	> 100% 💌			

# Configuring the Laser Marker PNIO node on TIA Portal

Once the Laser Marker node has been imported, the user could want to check or change the settings of this node.

By double clicking on the Laser Marker from the 'Network View' of the HW configuration, the interface will switch to Device View. From here the user is able to:

assign a new Device Name to the Laser Marker PNIO node;

- choose the size (64, 128 and 254 Bytes) of the Input and/or Output Memory Maps.

A new Device Name can be entered in the Module properties in the section 'General'- > 'Name'.

Regarding Input and Output Memory sizes, users will be able to check the dafult size of both areas (254 bytes) from the 'Device Overview': if the user wants to change such memory sizes, he can cancel the default settings from the 'Device overview' and then drag and drop into the Device Overview one of the possible sizes for the Input and Output Modules.



Both the Device Name and the sizes of the Input and Output memory Maps must be the same as the ones set inside the Laser Configurator (page 6 of this manual).

#### 3. Cyclic communication between the PLC and the Datalogic Laser Marking System

A ProfiNet/IO network allows the PLC to monitor and command each device which is connected: in order to do so, there needs to be a continuous flow of information between the PLC and each device on the network. After every Update Time whole memory areas are exchanged from the Laser Marker in one way (Laser Marker  $\rightarrow$  PLC) and in the other (PLC  $\rightarrow$  Laser Marker) so to accomplish this behavior. In order to properly command the Laser Marker and to give the PLC an appropriate feedback, all the information must be entered in precise portions of these memory maps exchanged periodically between the devices.

The memory area which is generated by the Laser Marker towards the PLC will be called **Input Assembly Memory Map**, while the memory area generated by the PLC towards the Laser Marker will be called **Output Assembly Memory Map**.

Once connection is established between the PLC and the Datalogic Laser Marker, most certainly the PLC programmer will want to program the PLC so to command the Laser System by giving it an automatic flow of commands: this process will include the handling of a simple protocol handshake, regarding the use of different bits, both on the Input and Output Assembly Memory Map:

- **Command Bit**: single bit (part of a group of bits) which are present on the Output Assembly Memory Map and according to its position, it will represent the command which the PLC wants the Laser Marker to execute.
- Mirroring Bit: single bit (part of a group of bits) which are present on the Input Assembly Memory Map and according to its position, it will inform the PLC that the requested command has been started (when HIGH) and that it has been completed (when LOW) if the Handshake is followed.

Nearly all Command Bit have a matching Mirroring Bit: this means that whatever command the PLC requests the laser to execute by setting a Command Bit  $0 \rightarrow 1$ , there will nearly always be a dedicated Mirroring bit which informs the PLC about the stage of the command execution.

In order to make sure that the command is fully executed by the laser, a simple Handshake must be respected by the PLC programmer. Here are the 5 steps:

- 1. Check the State of the Laser System (address 0 and 1 of the Input Memory Map) and that the protocol is still running correctly (address 2 and 3 must be '0' in DEC format): see the list of possible errors at paragraph 2.3.
- 2. Set the *Command Bit*  $0 \rightarrow 1$  (e.g. if the requested command is to Start Marking, then the Command Bit is bit 0 at Address 0, which must now pass  $0 \rightarrow 1$ ), and <u>if</u> <u>necessary</u> also the Request Data field along with the Request Data size.
- 3. As soon as the Laser starts executing the command requested by the PLC, both the *Mirroring Bit* and the *Command Executing* bit on the Input Memory Map pass  $0 \rightarrow 1$ .

- 4. The PLC must reset the *Command Bit*  $1 \rightarrow 0$  as soon as it detects the *Mirroring Bit* and the *Command Executing bit* are changing state  $0 \rightarrow 1$  (e.g. the Mirroring Bit for the 'Start Marking Command' is at Address 10 Bit 0). If the command does not have a Mirroring Bit, then the PLC should reset the *Command Bit*  $1 \rightarrow 0$  when the only *Command Executing* bit changes state  $0 \rightarrow 1$ .
- 5. When the *Mirroring bit* and the *Command Executing* bit pass  $1 \rightarrow 0$ , it means that the requested command has been completed: the Laser System is ready to start again from step 1 with another command.



This behavior is summed up by this State Diagram:



As soon as the connection is established, the State diagram is positioned at its Entry Point: the protocol will not accept any command from the PLC before receiving an Output Assembly Memory Map fully made of '0'. Until this condition is fulfilled, the Laser State Diagram will remain in BOOTING UP state and the 'Booting Up' bit=1 (the 'Booting Up' bit is bit 7 address 3 of the Input Assembly Memory Map).

When this condition is achieved, the 'Booting Up' bit passes  $1 \rightarrow 0$ , meaning that the LISTENING state has been reached. Now the PLC can request the execution of a command to the Laser Marker.

The execution of the command is underway when the *Command Executing bit* and the *Mirroring Bit* change state  $0 \rightarrow 1$ ; moreover, **as soon as the** *Command Executing bit* **and the** *Mirroring Bit* **change state**  $0 \rightarrow 1$ , **the PLC must reset the** *Command Bit*  $1 \rightarrow 0$ . If the selected *Command Bit* doesn't have a matching *Mirroring Bit*, then the *Command Bit* can be pulled down whenever *Command Executing bit* changes state  $0 \rightarrow 1$ .

If, by any chance, the *Command Bit* is not pulled down when the *Mirroring Bit* and *Command Executing* bit turns  $0 \rightarrow 1$ , then the *Command Executing bit* and the *Mirroring Bit* will not turn to 0 when the command is ended. The Protocol State will pass in LISTENING as soon as the *Command Executing bit* passes  $1 \rightarrow 0$ .

#### 3.1. Input Assembly Memory Map

The input Assemby Memory Map has been developed in order to structure all the data coming from the Datalogic Laser Marker towards the PLC. Depending on the information that the Laser is returning at every Update Time, the PLC could need to check a single bit or multiple bytes from the following memory map.

Address	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Laser Emission	Laser Ready Shutter Closed	Laser Ready	Laser Standby Shutter Closed	Laser Standby	Laser Wait for start	Laser Warm Up	Laser Off
1						Laser Error	Laser Warning	Laser Busy Shutter Closed
2						Protocol Error	Command Error	Command Executing
3	Protocol Boot Up							
4				Commar	nd Error Code			
5				Protoco	Error Code			
6							Auto Mode	Manual Mode
7 to 9				Re	eserved			
10			Set to Auto mode	Set to Manual mode			Stop Marking	Start Marking
11							Get Laser Engine Version	
12	Set Global String Value	Get Global String Value	Set Global Counter Value	Get Global Counter Value	Set Data Field Value	Get Data Field Value	Save Document	Open Document From Device
13							Disable Data Field	Enable Data Field
14							Move data field	Move and rotate document

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15 to 53		Reserved	
54		Response Data Size (Low Bite)	
55		Response Data Size (High Bite)	
56 to 63/127/253		Response Data	

# Description of the Input Assembly Memory Map

According to the logic state of the following bits, the PLC is constantly informed about the Datalogic Laser System state, in addition to the state of a requested command.

Address	Bit	Name	Value	Description
	0	Laser Off		USB connection with Ulyxe not established
	1	Laser Warm Up		Laser is in Warm Up State (KEY=1, ENABLE=0)
	2	Laser Wait For Start		Laser is in Wait For Start State (KEY=0, ENABLE=0)
	3	Laser Standby	0=not I E current state:	When one of the two Enables has been closed
0	4	Laser Standby Shutter Closed	1=LE current state	Laser is in Standby Shutter Closed State (KEY=1, ENABLE=0, after the Warm Up stage)
	5	Laser Ready		Laser is in Laser Ready State (KEY=1, ENABLE=1)
	6	Laser Ready Shutter Closed		N.A.
	7	Laser Emission		Laser is in Laser Emission State (KEY=1, ENABLE=1)
	0	Laser Busy Shutter Closed		Laser is in Laser Busy Shutter Closed State (KEY=1, ENABLE=0)
1	1	Laser Warning	0=not LE current state; 1=LE current state	Laser is in Laser Warning State
	2	Laser Error		Laser is in Laser Error State
	0	Command Executing		Lighter is executing a command
2	1	Command Error	0: Protocol is not	Lighter has generated a Command Error. Check address 4 for the Command Error Code
	2	Protocol Error	currently in this phase; 1: Protocol is currently in	Lighter has generated a Protocol Error. Check address 5 for the Protocol Error Code
3	7	Protocol Boot Up	uns phase	Lighter PNIO is in BOOTING UP phase: it will end as soon as a completely empty Output memory map is generated from the PLC towards the Laser Marker
4	0 to 7	Command Error Code	See error paragraph 3.3	Gives information about the Command Error
5	0 to 7	Protocol Error Code	See error paragraph 3.3	Gives information about the Protocol Error
6	0	Manual Mode	0: not LE current	Laser Engine is currently in Manual Mode
, v	1	Auto Mode	current operating mode	Laser Engine is currently in Auto Mode
7 to 9			Reserved	
	0	Start Marking	1:Laser started Marking; 0:Laser is not marking	Informs on the marking process, and turns to 0 when this has ended
	1	Stop Marking	1:Laser marking has been stopped; 0:Laser marking has not been stopped	Informs whether the marking process has been stopped
10	4	Set to Manual Mode	1:Laser Engine operating mode is being changed;	Informs whether the Laser Engine has switched operating mode
	5	Set to Auto Mode	0: Laser Engine operating mode has been changed	Informs whether the Laser Engine has switched operating mode
11	1	Get Laser Engine Version	0: Not executing this command; 1:Executing this command	Returning the Laser Engine Version



	0	Open Document From Device		Loading a document which is present inside the Laser Engine default filepath D:\Data\Docs\Layouts		
	1	Save Document		Saving the loaded and/or modified document		
	2	Get Data Field Value		Returning the content of the object with the specified ID		
12	3	Set Data Field Value		Setting the content of the object with a specified ID		
	4	Get Global Counter Value		Returning a Global Counter value		
	5	Set Global Counter Value	0: Not executing this	Setting a Global Counter value		
	6	Get Global String Value	this command	mmand Returning a Global String value		
	7	Set Global String Value		Setting a Global String value		
40	0	Enable Data Field		Enabling the specified Data Field		
13	1	Disable Data Field		Disabling the specified Data Field		
	0	Move and rotate document		Moving and rotating a document		
14	1	Move Data Field		Moving the specified Data Field to the given position, in relation to the center of the marking field		
15 to 53			Reserved			
54	0 to 7	Response Data Size (Low Byte)	"Response Data" field	Reporting the PLC how long the usable data is inside the		
55	0 to 7	Response Data Size (High Byte)	High byte)	Response Data field.		
56 to 63/127/253	0 to 7 (for each address Byte)	Response Data	Each byte represents an ASCII character that the laser is reporting towards the PLC	From Address 56 for a number of bytes specified by the 'Response Data Size' fields, the PLC can find the data returned by the Laser Marker		

# 3.2. Output Assembly Memory Map

The Output Assembly Memory Map has been developed in order to structure all the data coming from the PLC towards the Datalogic Laser System. The PLC will need to set a single bit or multiple bytes in the following memory map.

Address	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0			Set to Auto Mode	Set to Manual Mode			Stop Marking	Start Marking
1	Protocol Error Clear	Protocol Error Clear				Get Laser Engine Version		
2	Set Global String Value	Get Global String Value	Set Global Counter Value	Get Global Counter Value	Set Data Field Value	Get Data Field Value	Save Document	Open Document from Device
3							Disable Data Field	Enable Data Field
4								Move and rotate document
5 to 53		Reserved						
54		Request Data Size (Low Byte)						
55		Request Data Size (High Byte)						
56 to 63/127/253		Request Data						



# Description of the Output Assembly Memory Map

Address	Bit	Name Value		Description & examples		
	0	Start Marking	$0 \rightarrow 1$ Start Marking ; $1 \rightarrow 0$ as soon as the mirroring bit is HIGH	This action starts the Marking process (in order to have Laser emission, the Laser Marker must be in Laser Ready State before this bit goes HIGH)		
	1	Stop Marking	$0\!\rightarrow\!1$ Stop Laser Emission; $1\!\rightarrow\!0$ as soon as the mirroring bit is HIGH	This action stops the Marking process.		
0	4	Set to Manual Mode	0 → 1 Sets Laser Engine in Manual Mode; 1 → 0 as soon as the mirroring bit is HIGH	Sets the Laser Engine in Manual mode. The command will be completed also if Laser Engine is already in Manual Mode.		
5	5	Set to Auto Mode	0 → 1 Sets Laser Engine in Auto Mode; 1 → 0 as soon as the mirroring bit is HIGH	Sets the Laser Engine in Auto mode. The command will be completed also if Laser Engine is already in Auto Mode.		
4	1	Get Laser Engine Version	$0 \rightarrow 1$ Asking the Laser Marker to reply with the Laser Engine version ; $1 \rightarrow 0$ as soon as the mirroring bit is HIGH	Gets the Laser Engine Version running on the PC communicating with the PLC.		
1 7	7	Protocol Error Clear	$0 \rightarrow 1$ Sets back into 'Listening' state after a 'Protocol Error' ; $1 \rightarrow 0$ as soon as the 'Command Error' bit is HIGH	Sets the Laser Marker back to 'Listening' state after that a Command Error is notified to the PLC. No 'Mirroring bit' has been implemented for this command		
	0	Open Document From Device	0→1 Asking to load an XLP ; 1→0 as soon as the mirroring bit is HIGH	Loads the document specified in the Request Data Field (".xlp" extension must be included); the document must be in the Laser Engine default filepath D:\Data\Docs\Layouts		
	1	Save Document	0 → 1 Save current document; 1 → 0 as soon as the mirroring bit is HIGH	Overwrites the current *.xlp file		
	2	Get Data Field value	0 → 1 Gets the content of the Data Field specified inside the Requested Data Field; $1 \rightarrow 0$ as soon as the mirroring bit is HIGH	Requests the content of the object which is present in the currently loaded *.xlp. Request Data Field: <fieldid></fieldid>		
2	3	Set Data Field Value	0→1 Sets the content of the specified Data Field ; 1→0 as soon as the mirroring bit is HIGH	Sets a new content to a specified object which is present in the currently loaded *.xlp. Request Data Field: <fieldid><lf><newvalue></newvalue></lf></fieldid>		
	4	Get Global Counter Value	$0 \rightarrow 1$ Asking to return the value of the Global Counter; $1 \rightarrow 0$ as soon as the mirroring bit is HIGH	Requests the base10 value of the specified Global Counter. Request Data Field: <globalcountername></globalcountername>		
	5	Set Global Counter Value	0 → 1 Setting the value of the Global Counter; $1 \rightarrow 0$ as soon as the mirroring bit is HIGH	Sets the base10 value of the specified Global Counter. Request Data Field: <globalcountername><lf><newvalue></newvalue></lf></globalcountername>		
	6	Get Global String Value	$0 \rightarrow 1$ Asking to return the value of the Global String; $1 \rightarrow 0$ as soon as the mirroring bit is HIGH	Requests the value of the specified Global String. Request Data Field: <globalstringname></globalstringname>		
	7	Set Global String Value	$0 \rightarrow 1$ Setting the value of the Global String; $1 \rightarrow 0$ as soon as the mirroring bit is HIGH	Sets the value of the specified Global String. Request Data Field: <globalstringname></globalstringname>		

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3	0	Enable Data Field Disable Data Field		0→1 Enables the specified Data Field; 1→0 as soon as the mirroring bit is HIGH	Enables the laser object with the specified ID. Request Data Field: <fieldid></fieldid>	
J	1			$0 \rightarrow 1$ Disables the specified Data Field; $1 \rightarrow 0$ as soon as the mirroring bit is HIGH	Disables the laser object with the specified ID. Request Data Field: <fieldid></fieldid>	
	0	Move and Rotate Document		$0 \rightarrow 1$ Moves and/or rotates the document; $1 \rightarrow 0$ as soon as the mirroring bit is HIGH	Moves the document's origin and then rotates it according to the specified offsets Request Data Field: < <i>X</i> >,< <i>Y</i> >,< <i>Angle</i> > (HEX example byte per byte of the Request Data field when using this command with offsets <0>, <10>, <+45°>: 30 2C 31 30 2C 34 35 )	
4	1	Move Data Field		$0 \rightarrow 1$ Moves the specified Data Field to the position specified inside Request Data Field; $1 \rightarrow 0$ as soon as the mirroring bit is HIGH	Moves the laser object with a specified ID to the specified position. The movement is done considering the object's origin. Request Data Field: <fieldid><lf><x>,<y></y></x></lf></fieldid>	
5 to 53				Reserv	ved	
54	0 to 7	Request D	Data Size (Low Byte)	"Response Data" field usable		
55	0 to 7	Reques (Hig	st Data Size gh Byte)	length (Low and High byte)	Low/High Byte which must reflect the length of the Request Data	
56 to 63/127/253	0 to 7 (for each address Byte)	Request Data		Each byte represents an ASCII character that the PLC is reporting towards the Laser Marker, which the Laser Marker will interpret depending on the Command Bit which has been pulled $0 \rightarrow 1$	field. Example: Low Byte=12 in DEC format (in BIN format, address 54 from bit 7 to bit 0 is '0001100'), High Byte=0 in DEC format, means that the laser will need to take into account only the first 12 bytes of the Request Data Field starting from address 56 onwards	

# 3.3. Possible Errors

There are 2 kinds of error which can turn up during the normal use of a Datalogic Laser Marker via ProfiNet/IO:

-Command Error;

-Protocol Error.

The PLC is informed by 2 bits in the Input Assembly Memory Map if any kind of error happens: these 2 bits are bits 1 and 2 in Address 2 (respectively 'Command Error' and 'Protocol Error').

Both kinds of error should be monitored constantly and we advise the PLC programmer to think about a routine which will manage these errors.

# Command Error

A Command Error is notified to the PLC when the requested command cannot be executed.

In addition to the single 'Command Error' notification bit, a whole byte (address 4) of the Input Assembly Memory Map describes the reason of such an error. The values which address 4 can have when a Command Error is notified, are summed up in the following table.

Value	Description		
1	Command not recognized		
2	Invalid date value		
3	File does not exist		
4	File opening error		
5	Invalid I/O port		
6	Global variable does not exist		
7	Global variable is not a counter		
8	Global variable is not a string		
9	Bad command		
10	Invalid field		
11	No document loaded		
12	No document saved		
13	Laser already stopped		
14	Command not allowed by device status		



15	Invalid Field Symbol Object ID
16	Invalid reader result
17	Result not found
18	Symbol not found
19	Bad Grade required validation
20	MARVIS is not enabled
21	MARVIS License is not enabled
22	Focal Distance Sensor Unavailable
24	Focal Distance Sensor Focus Error
25	Focal Distance Sensor Reference Invalid
26	Focal Distance Sensor Out Of Range
27	Focal Distance Sensor Connection Error
28	Focal Distance Sensor Communication Error
29	Focal Distance Sensor Invalid Focus Search
100	Command exceeds memory area

Command Error are not blocking errors which request an acknowledgement from the PLC: after that any kind of Command Error is reported, the PLC will be able immediately request a new command to the Laser Marker, which will try to execute it normally.

# Protocol Error

A Protocol Error is notified to the PLC when the Laser Marking System is not able to correctly determinate a single command to execute.

In addition to the single 'Protocol Error' notification bit, a whole byte (address 5) of the Input Assembly Memory Map describes the reason of the error:

Value	Description
1	Command conflict: more than 1 command bit is set to 1
2	Unknown command: bit(s) in a reserved area is/are set to 1
3	Busy: Protocol in Executing state when Command bit is set to 1 (except for STOP command bit)
255	Critical: Protocol state machine is faulted



When a Protocol Error is notified, in case 1, 2 and 3 it is necessary for the PLC to set the 'Protocol Error Clear' bit (Address 1 bit 7), which sets the Protocol back into LISTENING state. This operation will not work if the value returned by the Protocol Error is point 4.: in this case, the ProfiNet/IO connection must be closed and then re-established between the Laser System and the PLC.



# 4. Troubleshooting

Each command which the PLC requests the Laser Marker is logged in detail in the Troubleshooting database, which can be opened as shown:



If opened, the user will find all the errors and the Event Tracking, depending on the selected tab: when the Event Tracing is selected, the user can check the details of each command which the Laser Marker has executed via ProfiNet/IO.

art Date	15/04/2019 00	0:00 💌 End Date	16/04/20	019 23:59 💌 Level ALL	▼ Type ▼
Date Time	Level	Туре	EndPoint	Description	
5/04/2019 5:15:13	INFO	PROFINET		Protocol state: LISTENING	1.///
5/04/2019 5:15:13	INFO	PROFINET		Command bit up : OPEN_DOCU	MENT 2
15/04/2019 15:15:14	INFO	PROFINET		Protocol state: EXECUTING	3. //
5/04/2019 5:15:14	INFO	PROFINET		Mirroring bit up	
5/04/2019 5:15:14	INFO	PROFINET		Write Fieldbus Memory	
5/04/2019 5:15:14	INFO	PROFINET		Command bit down	4.
5/04/2019 5:15:14	INFO	PROFINET		Write Fieldbus Memory	
5/04/2019 5:15:14	INFO	PROFINET		Mirroring bit down	5.
5/04/2019 5:15:14	INFO	PROFINET		Protocol state: LISTENING	
15/04/2019 15:15:14	INFO	PROFINET		Command bit up : SET_DATA_FI	IELD
Current Sessio	n C History Pao	pe 1 of 10 1	Prev Page	Next Page Update	Clear Export

By clicking on the '...' button in the4 Details column, the user can find the Data and the reported length which was either necessary to execute the command (present on the Request Data area) or the data which has been returned to the PLC along with its length.



	10/01/20.	15/04/2019 15:15:13 Command bit up : OPEN_DOCUMENT		1	
Date Time	Leve		-	Details	⊢
15/04/2019 15:15:13	INFO	(U17): Long_Layout_textDM2.xp			
15/04/2019 15:15:13	INFO		NT		
15/04/2019 15:15:14	INFO				
15/04/2019 15:15:14	INFO	(<1 ength>): ' <data>'</data>			
15/04/2019 15:15:14	INFO				
15/04/2019 15:15:14	INFO				
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