

## Connecting UniOP to Ethernet/IP CIP

Connecting UniOP to Rockwell Automation Control Logix 5550 controller equipped with the Ethernet card 1756-ENET.

Sitek S.p.A. Tn162 Ver. 1.2



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### 1 Introduction

The protocol Ethernet/IP CIP is implemented in the UPLC159.DLL driver file. The protocol has been implemented according to the published Ethernet/IP specifications (available from <u>www.odva.org</u>). Implementation on the CIP protocol for access to ControlLogix data is based on the information published by Rockwell Automation.

UniOP requires the optional module SCM11 to support TCP/IP communication.

#### 1.1 Communication Media

The supported Ethernet physical layer is 10BASE-T.

The SCM11 module requires the ETAD01 adapter to convert the 9-pin connector of the AUX port to the standard Ethernet 10BASE-T RJ45 connector. The adapter is delivered with the communication module.

### 2 Setting up UniOP

To create a UniOP application for Ethernet/IP CIP, select the driver "Ethernet/IP CIP" from the list of available communication drivers in the Change Controller Driver... dialog box.

#### 2.1 The Controller Setup

The system can be composed by one or more ControlLogix systems, each of them equipped with one 1756-ENET Ethernet interface card. Each Ethernet card has its own IP address. In the Controller Setup dialog box you can enter the IP address of the ControlLogix Ethernet card you what to connect. The Control Logix 5550 system has a multiprocessor architecture; the UniOP panel can access data in all the processor modules installed in the rack.

*Note:* The Control Logix system can have more than one processor module mounted in the same rack. Each rack can have only one Ethernet card.

EtherNet/IP CIP - PLC Setup						
C Access Multiple Drives	OK					
IP address 192 168 1 138	Cancel					
Slot 0						
PLC <u>M</u> odel						
Logix 5000 📃						
~						
,						

Figure 1

Figure 1 shows the Controller Setup dialog configured for accessing only one controller placed in the slot 0 of the rack. The ENET card has the IP address 192.168.1.138.

#### 2.1.1 More than one Processor in the Same Rack

If the ControlLogix system includes more than one processor in the same rack, the Designer project can be configured to access each individual CPU using the "Access Multiple Drives" options.

EtherNet/IP CIP - PLC Setup	
Access Multiple Drives	OK
IP address 0 0 0 0	Cancel
Slot	
PLC <u>M</u> odel	
Logix 5000	
Configured Slaves	
192.168. 1.138 (0) Logix 5000 192.168. 2.145 (0) Logix 5000	~
Add Modify	<u>D</u> elete

Figure 2

Figure 2 shows the case of two processors mounted in the same rack respectively in the slot 0 and in the slot 4.

Any additional processor mounted in the same rack can be added to the configuration using the "Add" button and specifying both the IP address of the ENET card and the slot number of the processor module. Figure 3 shows the dialog for adding a processor mounted in slot 4.

EtherNet/IP CIP - PLC Setup						
C Access Multiple Drives	ОК					
IP address 192 168 1 138	Cancel					
Slot 4						
PLC <u>M</u> odel						
Logix 5000						
~						

Figure 3

*Note:* As only one ENET card is present in the rack, the IP address is unique for all the processors mounted in that rack.

#### 2.1.2 Access to Multiple Racks

In the case the complete control system is composed of more than one ControlLogix racks and each rack contains one or more controllers, the "Access Multiple Drives" option can still be used to configure the Designer project to access to each individual CPU mounted in the different racks. In this case the IP address specified in the "PLC Setup" dialog must be different for each rack.

EtherNet/IP CIP - PLC Setup	
Access Multiple Drives	OK
IP address 0 0 0 0	Cancel
Slot 0	
PLC <u>M</u> odel	
Logix 5000	
Configured Slaves	
192.168. 1.138 (0) Logix 5000 192.168. 2.145 (0) Logix 5000	~
Add Modify	Delete

Figure 4

Figure 4 shows the case of a system with two ControlLogix racks, the two ENET cards mounted have IP address respectively 192.168.1.138 and 192.168.2.145.



#### 2.2 Designer Panel Setup

The operator panel must have an IP address to connect to Ethernet.

The IP address of the panel must be entered in Panel Setup dialog box in the tab "External Devices". Enter the IP address in the "Ethernet board" field as shown in Figure 5 below.

Panel Setup 🔹 🤶 🔀
Panel Model Settings External Devices Passthrough Miscellaneous
Ethernet Board 192.168.1.130
Ethernet Settings
IP Address 192.168. 1 .130 OK
Cancel
Subnet Mask 255.255.0.0
Default Gateway 0.0.0.0
OK Cancel Help
Subnet Mask 255.255.0.0 Default Gateway 0.0.0.0 OK Cancel Help

Figure 5

#### 2.3 Tag Editor

The data in the ControlLogix system is based on tags.

The organization of the internal memory organization of the Logix 5550 CPU is not fixed but it is configured by the user at development time. Each data item can be identified by a string called "tag". The RSLogix5000 development environment can export the list of tags created for each controller in the configuration of the application.

The project in the panel must refer to the tag names assigned in the RSLogix programming software at development time. The Designer Tag Editor supports direct import of the tag file generated by the RSLogix software.

o RSLogix 5000 - FirstCPU			
<u>File E</u> dit <u>V</u> iew <u>S</u> earch <u>Logic</u> <u>Corr</u>	nmunications <u>T</u> ools	<u>W</u> indow <u>H</u> elp	
	3 64	•	- <b>A A A  B</b> <u>V</u>
Remote Run     ✓     No Forces       No Edits     ✓     Forces Disable       Path:* TCP-1\192.168.0.142\Backplane       □     ←       Controller FirstCPU	▼           led         ▼           \0		it Timer/Counter Input/O
Controller Tags Controller Fault Handler Power-Up Handler Tasks			
□ ··· ·· ·· ·· ·· ·· ·· ·· ·· ·· ·· ·· ·			
Trends Data Types			
⊕ I/O Configuration			
Ready			li li

Figure 6

Figure 6 shows an application created for one CPU mounted in slot 0 using an ENET card with IP address 192.168.0.142.

The project tree in the leftmost part of the window shows the "Controller Tags" folder. To export the tags defined for the selected controller, right-click on the "Controller Tags" folder and select "Export Tags..." as shown in Figure 7. The RSLogix5000 software will create a file in CSV format.

*Note:* Starting from version 5.21 – 4.08 the communication driver can access both Controller and Program Tags. Earlier versions supported only "Controller tags".

🔂 RSLogix 5000 - FirstCPU 📃 🖂 🖂
<u>File E</u> dit <u>V</u> iew <u>S</u> earch <u>Logic</u> <u>Communications</u> <u>T</u> ools <u>W</u> indow <u>H</u> elp
Remote Run  No Forces
No Edits
Path: 1 CP-1/192.168.0.142/Backplane/U
Controller Tags Controller Fau Power-Up Ha Power-Up Ha Verify MainTask MainTask MainBoutine MainBoutine Unscheduled Programs Trends Proge Print MainBoutine Unscheduled Programs Trends Proge NainPoc NainBoutine Unscheduled Programs Trends NainBoutine User-Defined Module-Defined Module-Defined Nodule-Defined
Export the selected tag collection, or all tag collections

Figure 7

#### 2.3.1 Importing the Tag File

The tag file exported from the RSLogix5000 software can be easily imported in Designer Tag Editor selecting the "Import tags" command from the "File" menu of the Tag Editor. The first step of the import process is shown in Figure 8; in the list of the available controllers the Ethernet IP/CIP is listed.

				X
<b>Step 1</b> Select target di	ctionary			
Tag Dictionary New Dictionary	Name 3	Driver Model	-	
List of Controller	Drivers	r DII Name		
EIB TP Electro Craft Entrelec SCHI	4.03 4.00 FLE 4.01	D32Uplc210.dll D32Uplc079.dll D32Uplc079.dll D32Uplc144.dll	5.03	
Ethernet/IP CI Festo	P 4.08 4.07	D32Uplc159.dll D32Uplc023.dll	5.21 5.17 ⊻	
<u>, , , , , , , , , , , , , , , , , , , </u>		<u>R</u> efresh Controller Li	st	
Ľ	< <u>B</u> ack	<u>N</u> ext > C	ancel Help	>

Figure 8



Tag Import Wizard	
Step 2 Select a file to import	
Type the file name or Click button to browse the file	
	2
< <u>B</u> ack <u>N</u> ext > Cancel	Help

Figure 9

If more than one controller is present in the configuration, Designer project needs to be properly configured.

As the RSLogix5000 software does not include in the tag file any information on the controller owning the exported tag list, the Designer Tag Editor needs to associate explicitly the tags to the appropriate processor. The selection dialog is shown in Figure 10 below.

Se	lect	Tag Dic	tionary					×
Ĩ	Vode: I E Data	s   EnableTag abase	s					
	D:\	_Test_proj	ect\Ether	net IP.CIP\ETH.mo	db			.
	PL	Add	ess	Controller Bran	Controller	Model	Dictionary	,
	0	192.168.	1.138 SI	Ethernet/IP CIP	Logix 5000		Controller 1	-
	1	192.168.	2.145 SI	Ethernet/IP CIP	Logix 5000		Controller 2	
	<							
			0	K Canc	el 🔄	pply	Help	

Figure 10

In case the Designer project must be configured to connect to more than one controller, two Dictionaries must be present into the Tag Editor database.



🗊 TagEd - ETH.mdb : Controller 1 : Controller Tags							
<u>File E</u> dit Dictionary <u>R</u> ecord <u>V</u> iew <u>T</u> ools <u>W</u> indow <u>H</u> elp							
D 📽   ½ 🖻 🛍   🚭   K ∢ ► א   🤋 😥							
	🗗 ETH.mdb : Contro	ller 1 : ControllerTa	gs 💶 🔼				
E Controller 1	Tag	Logical _Address	Data_Format 🔺				
	Float_globale	FL	Float				
MaipProgram	int_array_global	INAO	WORD(Bin)				
Gentreller 2	Intero_globale	IN	WORD(Bin)				
	Timer_global.ACC	CA	DBLE WORD(Bin)				
Controller Lags	Timer_global.CTL	CC	DBLE WORD(Bin)				
IIII MainProgram	Timer_global.PRE	CP	DBLE WORD(Bin)				
	*						
E Dictionary							
For Help, press F1 Ethernet/IP CIP - Logix 5000 NUM							

Figure 11

Figure 12 shows the case of two controllers mounted respectively in slot 0 and slot 4 of two different racks. The first rack contains an ENET card with IP address 192.168.1.138 and the CPU is mounted in Slot 0; the second rack contains an ENET card with IP address 192.168.2.145 and the CPU is mounted in Slot 4.

Change Tag Dictionary					×	
N	Nodes					1
I EnableTags Database						
	D:\_Test_project\Ethernet IP.CIP\ETH.mdb					
	PLC #	Address	Contro	oller Brand	Controller	Moc
	0	192.168. 1.138 Slot 0	Etherne	t/IP CIP	Logix 5000	_
	1	192.168. 2.145 Slot 4	Ethernet	t/IP CIP	Logix 5000	
	<					>
		ОК	Cancel	Apply	н	elp

Figure 12

#### 2.3.2 The Define Field Dialog Box

When working with Designer software you can create data fields connected directly to any of the controller tags present in the dictionary.

Figure 13 shows the Define Field dialog box. The "Enable Tag" button is available to enter the name of the item.



Data Field Properties	? 🛛
Network Reference	
Dictionary Controller 1	Group : ControllerTags
Tag : Intero_globale	<u> </u>
Reference	
Data Type - Subtype Integer	Index 0
Data Format WORD(Bin)	
	OK Cancel Help

Figure 13

Figure 14 shows the Define field dialog box automatically filled by Designer after a tag item has been selected.

)at	a Field	d Properties			?
Network Reference					
Configured Nodes					
ſ	PLC#	Address	Controller Brand	Controller Mode	
ľ	0	192.168. 1.138 Slot 0	Ethernet/IP CIP	Logix 5000	
	1	192.168, 2.145 Slot 4	Ethernet/IP CIP	Logix 5000	
	2				
	- Comm	unication Prioritu			
	Comm	anication nonty	t		
C Low Priority C High Priority					
			OK	Cancel He	elp



The "PLC Slave ID" specifies the controller that contains the requested data item.

#### 2.3.3 Downloading the Project

Since the UniOP protocols needs for communication with the controller the name of the tags used in the project, the tag items have to de downloaded to the panel. Before starting the project download the "Download tags (New)" options available from the Transfer advanced menu following the path Transfer\Option\Transfer Advanced Option has to be checked (normally is checked by default). See Figure 15.



Properties 🛛 ? 🗙				
Ports Transfer	Transfer advance	d Compati	bility with ve	ersion 1
_ <u>D</u> ownload				
O Project on	ly C Protocol	only		
Both Do not download protocol if exists in the target				
Download G		Download I	ana (nouu)	
			ays (new)	
I Download F	onts 🖌	Download I	ext Ubject	Info
Compress Fo	onts 🔽	Download (	bject Forma)	at Info
🔲 Disable Uplo	oad 🔽	Download 9	VG Files	
	0K		Cancel	Help

Figure 15

### **Appendix A. Communication Error Codes**

Current communication status is displayed in the System Menu of the UniOP.

A message and a numeric error code describe the error status.

The message reports the current communication status. The number shows the code of the current communication error or, if the communication is correct, the code of the last error encountered. When the error code 0 is shown, it means there have been no communication errors since this system start-up.

Code	Description	Notes
00	No error	There are no communication errors and there have
		been no errors since start-up.
04	Negative acknowledgement to request	The request sent to the PLC was not valid and the PLC responded with a NAK. This can occur because: a) the request was trying to access a tag that doesn't actually exist in the PLC b) the request was trying to access an array element beyond the maximum array size for the tag c) the request was trying to write a value to the tag outside the allowed range for the tag type d) the request was trying to write a value to a read only type
05	Failed to create a connection with the Controller	The Forward Open request failed. Perhaps the PLC has too many open connections
06	Unexpected response length	Means that the response frame was received from the PLC but the frame length was not what was expected.
08	Failed to decode the PLC response or the PLC did not respond to the request within the timeout interval	It is the typical timeout error caused by a disconnected communication cable or tags not downloaded with the Designer project.
10	Unexpected response format	Indicates that the response frame was received from the PLC but the frame format was not what was expected.
12	Unexpected response data length	Indicates that the response frame was received from the PLC but the length of its data part was not what was expected.
16	Low level protocol error	Should never happen. Contact the manufacturer.



### **Appendix B. Requirements and Compatibility**

This communication driver is included in the Designer DLL file UPLC159.DLL. The initial release level is 3.00 for the communication driver and 5.03 for the DLL (both version numbers can be seen in the Change Controller Driver dialog box of the Designer software).

The format of the RSLogix5000 tag file is compatible with RSLogix5000 version 2.51.00 and may not be compatible with other versions of the software.

Designer software version 5.08 or higher is required for supporting tags.

A communication module of type SCM11 is required. The UniOP panel must have hardware type –0045 or -0050; firmware version number 4.42 or higher is required to support operation with the SCM11 module.

Direct Access is not supported.