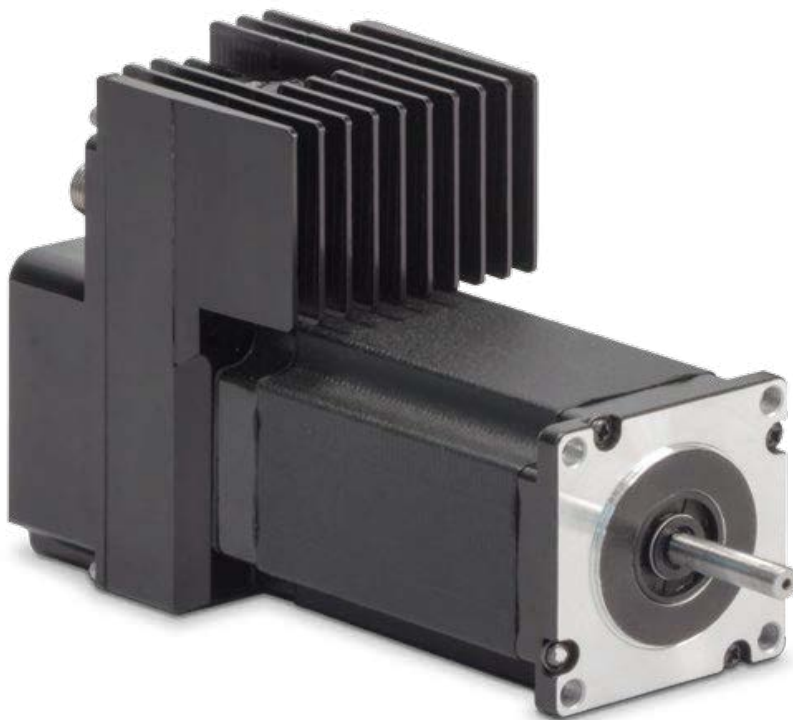


PROFINET USER'S GUIDE

ACSI Servo



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Table of Contents

1.1 Introduction	4
1.2 Network.....	4
1.3 Definitions	5
1.4 OSI Network Layer Structure	6
1.5 Supported Features of PROFINET.....	7
1.6 Device Names.....	7
1.7 References.....	7
2.1 Ethernet Cabling	8
2.2 Tolomatic Motion Interface (TMI) Requirements.....	8
3.1 Input Modules	9
4.1 Output Modules.....	13
5.1 Getting Started.....	16

Figures

Figure 1: PROFINET OSI Network Layer Model	6
Figure 2 - Edge Triggered Commands	14

1.1 Introduction

Device Information

Vendor ID: 0x03C3

Vendor Name: Tolomatic, Inc.

Device ID: 0x2362

Product Family: ACSI Drive & Controller

Main Family: Drives

For use with 36043189_ACSI_GSDML definitions file.

A sample Siemens Program is available for reference. Please contact Tolomatic Support for details.

- *PROFINET is the standard for industrial networking in automation. It connects devices, systems, and cells, facilitating faster, safer, less costly and higher quality manufacturing. It easily integrates existing systems and equipment while bringing the richness of Ethernet down to the factory floor. PI North America is the independent governing body of PROFINET.*



- *PI North America was founded as the PROFIBUS Trade Organization in 1994 and was generally known as simply PTO. Although an autonomous non-profit trade organization, PTO renamed itself to PI North America to more closely identify with the international umbrella organization for the Regional PI Associations.*

PI North America is dedicated to showing industry the beneficial results of using fieldbuses in general and PROFIBUS and PROFINET in particular while assisting device manufacturers throughout North America in the development and marketing of PROFIBUS and PROFINET products.

Over 1,500 companies organized in 27 Regional PROFIBUS Associations develop and supply fieldbus and Industrial Ethernet solutions for cost efficient and highly reliable automation.

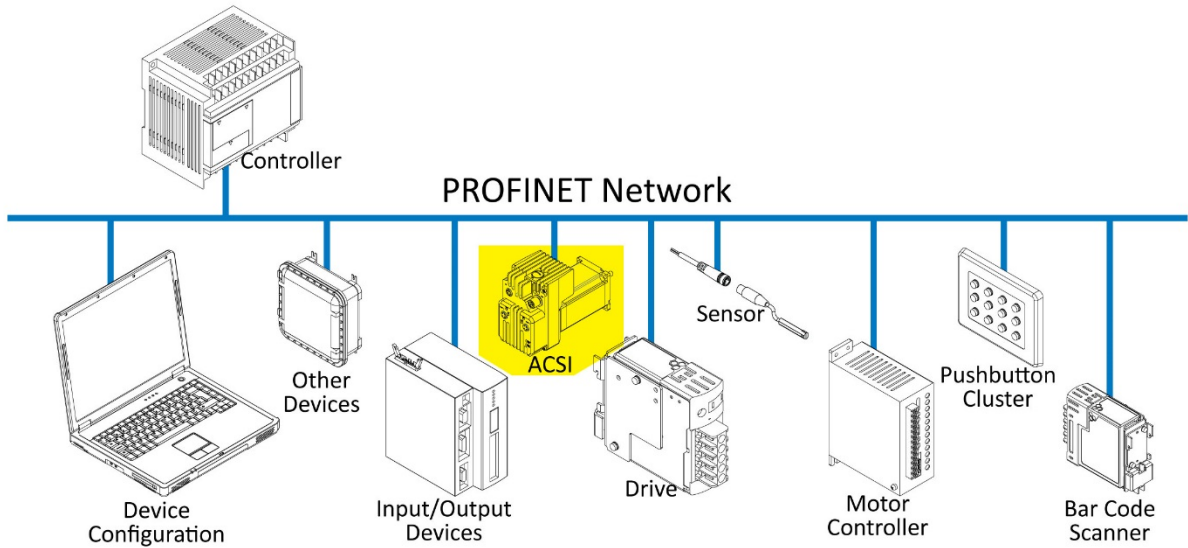
PI North America is part of the global PI community that includes 27 Regional PI Associations (RPAs).

1.2 Network

ACSI PROFINET implementation supports RT 2.33 network configuration (RT Class 1).

1: PRODUCT OVERVIEW

No additional settings must be set on the drive. Support for IRT (RT Class 3) is currently in development.



ACSI PROFINET implementation currently does not support media redundancy (ring topology).

NOTE: PROFINET networks do not support network hubs or routers. Including these devices in line with the network could result in data corruption, data collisions, and other network issues.

NOTE: Internal testing has shown that unmanaged switches are unreliable in PROFINET topologies. Tolomatic recommends only using managed switches when required.

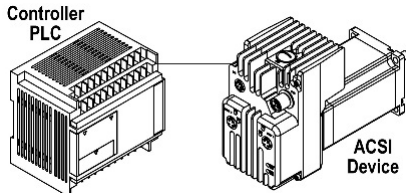
1.3 Definitions

Connection: A connection is a logic link between two devices that may share more than one connection

GSDML: General Station Description Markup Language. A GSDML is an XML based language used to describe the supported functions and behavior of a PROFINET IO-Device.

Device: A node (drive, motor controller, I/O, sensor, etc.) on a PROFINET network that takes commands from a controller.

Controller: The master devices in command of the PROFINET network and all devices on the network.



Module: Modules are user defined components that plug into slots. Modules can be real or virtual.

RT: Real Time - the Real Time PROFINET IO Channel. I/O and Alarm Data are transferred over the RT Channel.

IRT: Isochronous Real Time - Provides scheduled, synchronous communication for use with motion control applications

DCP: Discovery Control Protocol – A communications protocol with PROFINET IO that allows an IO controller or Supervisor to find every PROFINET IO device on a subnet.

1.4 OSI Network Layer Structure

Figure 1 below shows the seven layers of protocol implementation. Tolomatic's ACS Drive user device profile resides on the seventh layer.

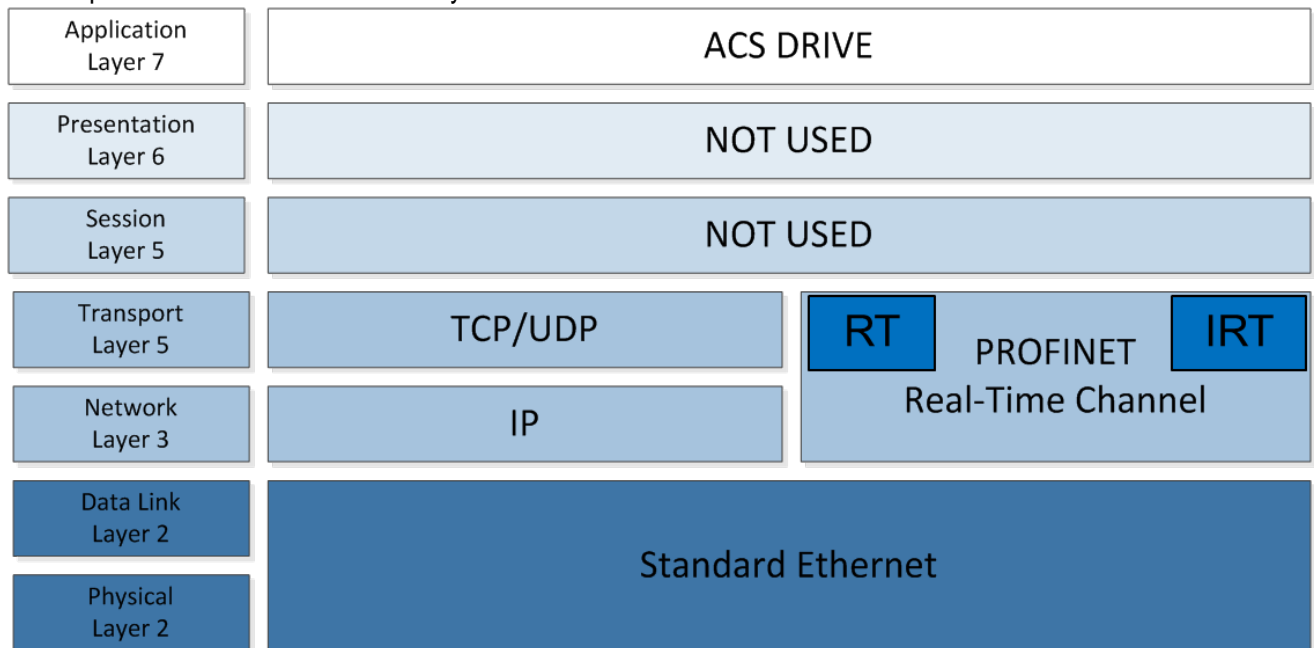


Figure 1: PROFINET OSI Network Layer Model

- **Open TCP/IP Channel**
 - Device parameterization
 - Reading of diagnostics data
 - Loading of interconnections
 - Negotiations of communication channel for user data
- **Real-time channel (RT)**
 - High-performance transmission
 - Cyclic data
 - Event-controlled signals
- **Real-time channel (IRT)**
 - High-performance transfer
 - Data in isochronous mode
 - Jitter <1 μsec
 - Real-time network switch

1.5 Supported Features of PROFINET

ACSI Supports PROFINET RT 2.33.

1.6 Device Names

The following rules apply for PROFINET V2.3 device names.

1. The device name must not be longer than 240 characters. The following characters are permitted:
 - a. Letters “a” to “z”
 - b. Numbers “0” to “9”
 - c. Hyphen or period
2. One name component in the device name, a character string between two periods may not be longer than 63 characters.
3. The device name may not begin with a hyphen.
4. The device name may not begin with the character string “port-xyz” (x,y,z = 0 to 9).
5. The device name may not have the form n.n.n.n (n = 0 to 9)

1.7 References

<http://us.profinet.com/>

2.1 Ethernet Cabling

ACSI uses circular M12 D-code 4 pin connectors. Please refer to the hardware manuals for further cable information (Hardware and Installation Guide; ACSI: 3604-4185) See appendix for network cable type and length specification.

Table 1 - Cable Wire Type versus Cable Length

The following information regarding cable length is from commercial building telecommunications cabling standard ANSI/TIA/EIA-568-B.1. The maximum length of a cable segment is 100 meters (328 ft). Category 5e cable is capable of transmitting data at speeds up to 1000 Mbps – 1Gbps (ACSI has a maximum speed of 100 Mbps). The specifications for 10BASE-T networking specify a 100-meter length between active devices. This allows for 90 meters of fixed cabling, two connectors, and two patch leads of 5 meters, one at each end.

2.2 Tolomatic Motion Interface (TMI) Requirements

PROFINET Ethernet configuration settings are controlled by the Controller setup using the engineering tool. There are no Ethernet configuration settings established by Tolomatic Motion Interface (TMI). Application motor tuning, home settings, and other safety limits should be set in TMI before operation.

3: INPUT MODULES

3.1 Input Modules

The following are the input modules, as defined by the GSDML file for use with the ACSI Integrated Drive & Controller.

Input Modules						
Direction (Perspective of PLC)	Fixed in Slot	Type	Description	Units	Module Ident	SubModule Ident
Input	1	Float32	Current Position	mm or rotary (linear mm, rotary defined by TMI)	0x10400000	0x10440001
	2	Integer32	Drive Status	bitmask (defined below)	0x10500000	0x10550001
	3	Integer32	Drive Faults	bitmask (defined below)	0x10600000	0x10660001
	4	Integer32	Digital Inputs	bitmask (first 4 bits represent 4 inputs)	0x10700000	0x10770001
	5	Integer32	Digital Outputs	bitmask (first 2 bits represent 2 outputs)	0x10800000	0x10880001
	6	Float32	Analog Input (Remappable Register 1*)	v or mA (as defined by TMI)	0x10900000	0x10990001
	7	Float32	Analog Output (Remappable Register 1*)	v or mA (as defined by TMI)	0x10A00000	0x10AA0001

*As of ACSI Firmware Version 1.7

Table 2 - Input Module Definitions

3: INPUT MODULES

DRIVE STATUS DEFINITION	
BIT	DESCRIPTION
0	Drive Enable: 0 = Not Enabled; 1 = Enabled
1	Drive Homed: 0 = Not Homed; 1 = Homed
2	Drive In Motion: 0 = Not In Motion; 1 = In Motion
3	Software Stop: 0 = OFF; 1 = ON
4 - 19	(internal use)
20	Brake Not Active: (0 = Brake Active)
21 – 25	(internal use)
26	Drive In Position: 1 = In Commanded Position
27 - 30	(internal use)
31	Drive Control: 0 = off (I/O, CTROFF) 1 = on (Host, CTRON)

Table 3 - Drive Status Bitmask Definition

DRIVE FAULTS DEFINITION	
BIT	DESCRIPTION
0	Positive Limit
1	Negative Limit
2	Software Stop
3	Position Error
4	Feedback Error
5	Overcurrent
6	Motor Overtemperature
7	Drive Overtemperature
8	Drive OverVoltage
9	Drive UnderVoltage
10	Flash Error
11	I2T Limit
12	Short Circuit
13	Watchdog Reset
14	Velocity Error
15 to 21	Reserved

Table 4 - Drive Faults Bitmask Definition

3: INPUT MODULES

ACS SERVO DRIVE/ACSI REMAPPABLE REGISTERS
Analog Input (Default Register 1)
Analog Output (Default Register 2)
Actual Position
Actual Position Error
Actual Velocity
Actual Velocity Error
Actual Current
Commanded Position
Commanded Velocity (Trajectory)
I2T Accumulation Value*
I2T Limit*
Bus Voltage
Board Temperature (Drive)
Digital Inputs
Digital Outputs

* When I2T Accumulation value exceeds limit, I2T fault occurs. Accumulation happens any time motor is running

Table 5 – ACS Servo Drive/ACSI Remappable Registers

4: OUPUT MODULES

4.1 Output Modules

The following are output modules, as defined by the GSDML file for use with the ACSI Integrated Drive & Controller.

Output Modules						
Direction (Perspective of PLC)	Slot	Type	Description	Units	Module Ident	SubModule Ident
Output	8	Integer8	Drive Command	bitmask (defined below)	0x11400000	0x11440001
	9	Integer8	Move Select	profile index (0 - uses defined target 0 profile, 1-16 uses index profiles defined in TMI)	0x11500000	0x11550001
	10	Integer16	Reserved	not used	0x11600000	0x11660001
	11	Float32	Target 0 Position	mm or rotary (linear mm, rotary defined by TMI)	0x11700000	0x11770001
	12	Float32	Target 0 Velocity	mm or rotary (linear mm, rotary defined by TMI)	0x11800000	0x11880001
	13	Float32	Target 0 Acceleration	mm or rotary (linear mm, rotary defined by TMI)	0x11900000	0x11990001
	14	Float32	Target 0 Deceleration	mm or rotary (linear mm, rotary defined by TMI)	0x11A00000	0x11AA0001
	15	Float32	Target 0 Force	%	0x11B00000	0x11BB0001
	16	Integer32	Target 0 Motion Type	enumeration (defined below)	0x11C00000	0x11CC0001
	17	Integer32	Digital Outputs	bitmask (first 2 bits represent 2 outputs)	0x11D00000	0x11DD0001

Table 6 - Output Modules Definitions

4: OUTPUT MODULES

DRIVE COMMAND DEFINITION	
DESCRIPTION	VALID COMMANDS (BIT COMBINATIONS)
ENABLE = 1; DISABLE = 0	0 (0x00): Disable
START MOTION	1 (0x01): Enable/Clear Start Motion
HOME	3 (0x03): Start Motion
SOFTWARE STOP	5 (0x05): Home
STOP MOTION	8 (0x08): Software Stop
RESERVED	17 (0x11): Stop Motion 21 (0x15): Home Here

Table 7 - Drive Command Definitions

NOTE:

The drive processes commands issued over the network in an edge-triggered manner. The drive does not process new commands unless they differ from the previous command. For motion, this means the drive will not make a new move until it detects a new “Start Motion” command. To clear the previous Start Motion command, the PLC program must set the command to something other than Start Motion. “Enable” is typically used. This can be done while the drive is in motion, or in a time-based scheme as long as the drive has sufficient time to detect the transition from Start Motion to Enable (>10 ms).

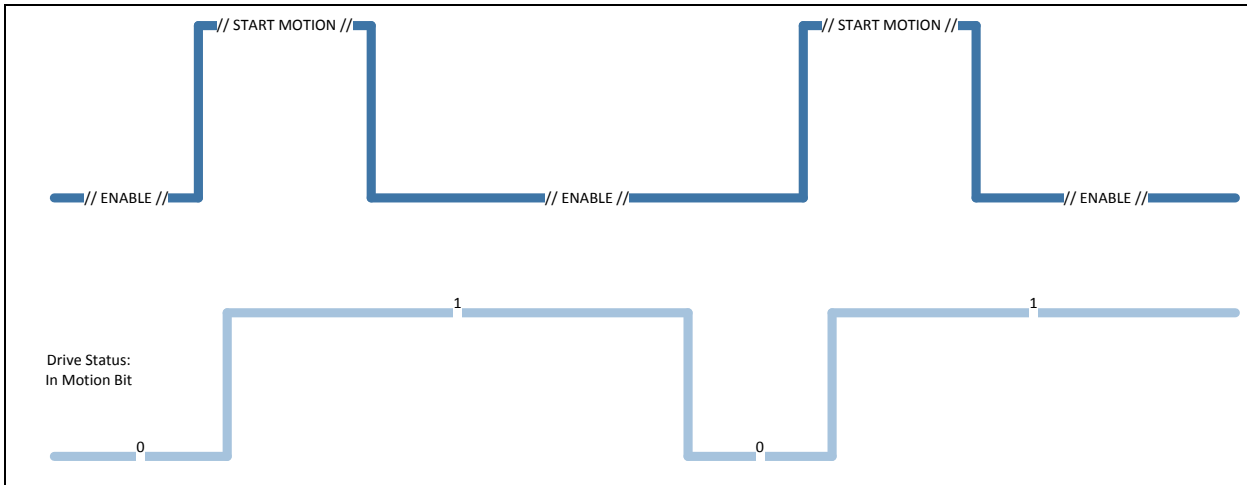


Figure 2 - Edge Triggered Commands

4 : OUTPUT MODULES

MOTION TYPES ENUMERATION		
NAME	VALUE	DESCRIPTION
Absolute	0	Moves to location at profile defined for Target 0 using the defined motion profile
Incremental Positive	1	Moves in the positive direction to the distance specified by Target 0 Position using the defined motion profile
Incremental Negative	2	Moves in the negative direction to the distance specified by Target 0 Position using the defined motion profile
Home	5	Executes a home motion using the homing profile defined in TMI
No Action	6	Does not execute motion
Force	9	Press to Force % specified by motion profile (See TMI manual for complete description)
Incremental Positive Rotary	11	Moves in the positive direction to the distance specified by Target 0 Position at the defined motion profile. If position is commanded past max distance, the current position is reset, and the unit is un-homed
Incremental Negative Rotary	12	Moves in the negative direction to the distance specified by Target 0 Position at the defined motion profile. If position is commanded past max distance, the current position is reset, and the unit is un-homed
Velocity Forward	13	Starts a velocity move in the positive direction at profile velocity and acceleration
Velocity Reverse	14	Starts a velocity move in the negative direction at profile velocity and acceleration

Table 8 - Motion Types Definitions

PROFINET LED Indicators			
MOD LED	System Status	NET LED	System Status
Off	Startup	Off	Startup
Blinking Green	Blink Test	Blinking Red	No PLC Connection
Solid Green	Config Complete	Solid Green	PLC Connected

Table 9 – PROFINET LED Indicators

5.1 Getting Started

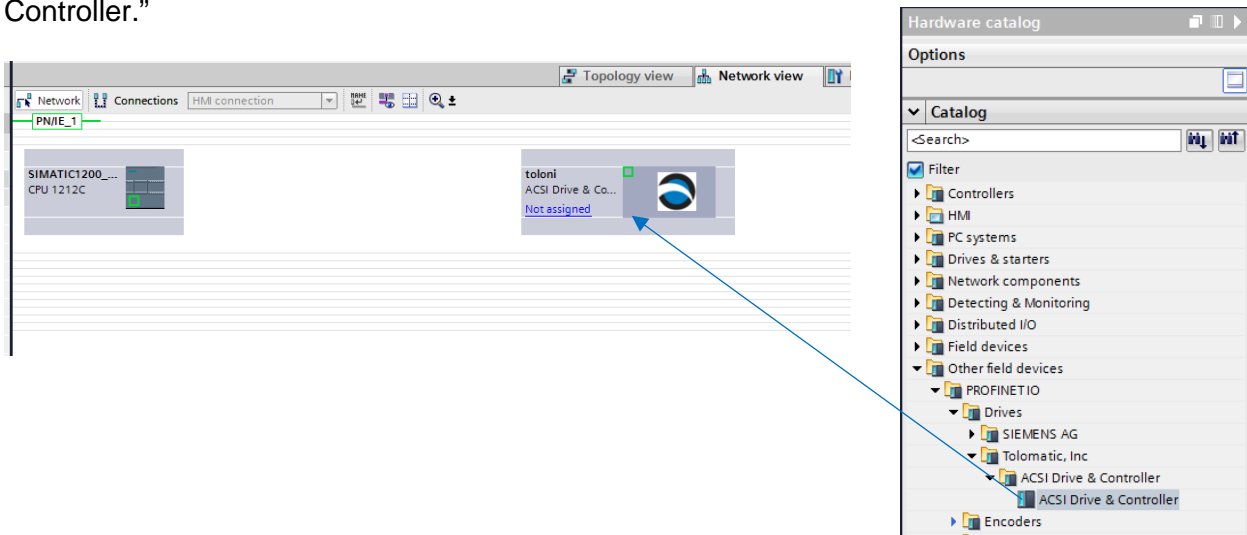
NOTE: The following steps define the basic device configuration for PROFINET. Further setup information is specific to the controller vendor. Please see additional Tech Bulletins available on www.Tolomatic.com or contact Tolomatic.



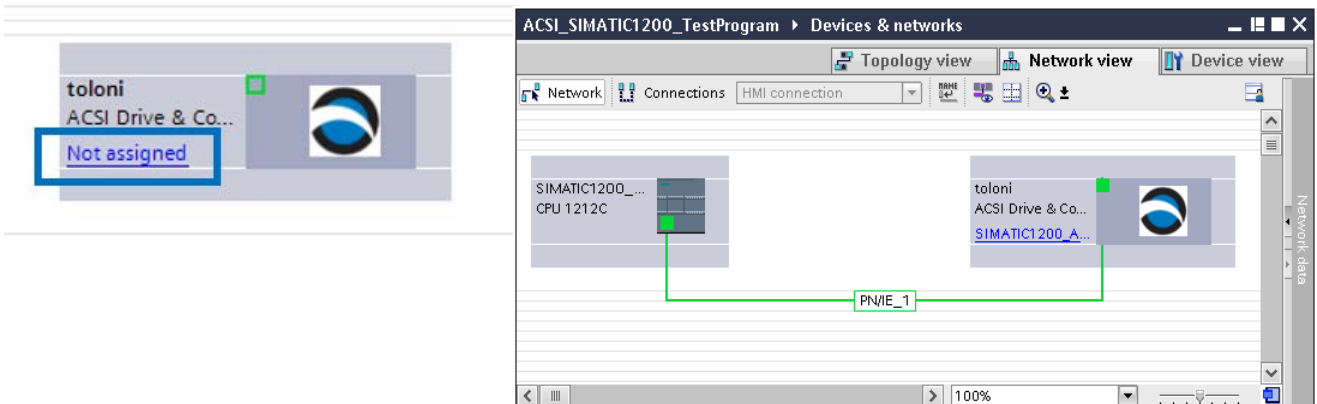
In this example Siemens TIA Portal V14 is used (See [3600-4197](#) for further information.), but these steps can be applied to any PROFINET engineering configuration tool.

1. Install the GSDML File. The Tolomatic ACSI – PROFINET GSDML file is available at www.Tolomatic.com.

2. In Network view, drag and drop device from catalog under “Other Field Devices → PROFINET IO → Drives → Tolomatic, Inc. → ACSI Drive & Controller → ACSI Drive & Controller.”

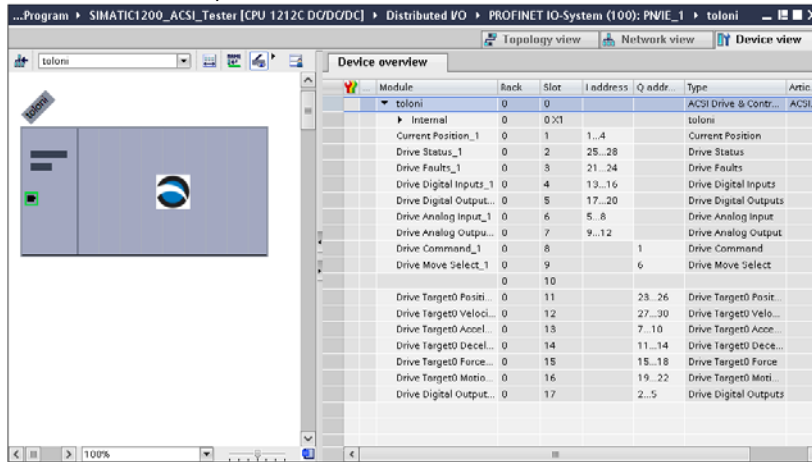


3. Click “not assigned” on the device picture and assign to the controller by selecting the controller name and network name, once connected there should be a dashed green line between controller and the device.

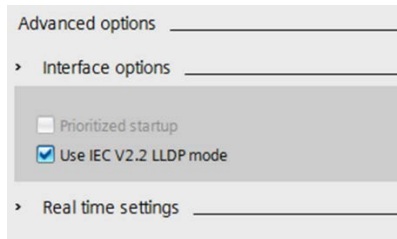


5: GETTING STARTED

4. Double click the device to enter device view (or click device view tab and select device with dropdown) and configured the IP address (if needed) and device name (under properties → Ethernet addresses) and modules (the modules will automatically be configured in the ACSI device overview).



5. Please ensure that 'Use IEC V2.2 LLDP Mode' is checked for proper drive/PLC communication.



6. Always set IP Address on PLC manually, if necessary. (This can be done automatically, vendor specific tools, or PN browser in PROFINET Commander, TIA to set IP on controller in advance).

7. Set or Download the device names on the PROFINET IO devices with your Engineering Configuration Tool. In TIA highlight PN Network in network view, right click → Assign Device Name. Assign each name to the correct device from the list. Once the device names are set, compile the configuration and download to the controller.

Warning: If the device names are not set correctly, the controller will not find the device at startup.

Warning: The following rules apply for PROFINET V2.3 for device names.

1. The device name must not be longer than 240 characters. The following characters are permitted:
 - a. Letters "a" to "z"
 - b. Numbers "0" to "9"
 - c. Hyphen or period
2. One name component in the device name, a character string between two periods may not be longer than 63 characters.
3. The device name may not begin with a hyphen.
4. The device name may not begin with the character string "port-xyz" (x,y,z = 0 to 9).
5. The device name may not have the form n.n.n.n (n = 0 to 9)

5: GETTING STARTED

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