PROFINET Device
Status and Control

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Preface

This tech note is focused on the application of monitoring the communication status of PROFINET IO-Devices from a Siemens PROFINET IO-Controller and the Enabling and Disabling of communication to a PROFINET IO-Device. TIA Portal V16 software was used in the creation of this document. If you need further assistance, please don't hesitate to contact us at C&E Advanced Technologies.

General Scope

From large production lines and machines to the smallest of manufacturing equipment, distributed I/O networks are used on a regular basis employing wired and wireless Ethernet technology and serial buses. Distributed I/O systems allow for quick deployment and connection using standard quick connect cabling for sensors, actuators, and communication. It is critical to know if individual devices, nodes, or slaves on a network are powered and communicating, providing the necessary diagnostics to the IO Controller, Master, or Client to ensure maximum uptime, performance, and throughput. In some applications there may be distributed I/O stations, drives, etc. that may only be powered on for certain product builds, providing the need to be able to activate or deactivate communications to a device and prevent nuisance alarms.

Creating an array of animated circles on an HMI screen, representing the connected status of configured distributed I/O nodes, is common practice for troubleshooting. Siemens provides the necessary instructions to monitor and control the status of PROFINET IO-Device communication on a specific PROFINET Network in both S7-1500 and S7-1200 PLC systems. This information can be displayed on a Siemens Comfort or Basic HMI Panel.

You may be familiar with System Diagnostics. This is a unique feature specific to the Siemens S7-1500 PLC in its ability to monitor the communication and health of its I/O modules, short circuits, and broken wires, both locally and distributed, over PROFINET regardless if the PLC is in Run mode or Stop mode. No programming is required in the PLC, and a single Diagnostic View graphic on a Comfort Panel HMI screen is all that is required. System Diagnostics is not a feature of the S7-1200. Therefore, having the ability to monitor the communication status of a PROFINET IO-Device outside of System Diagnostics is important.

Monitoring the Status of PROFINET IO Devices

The instruction DeviceStates provides the ability to monitor the status of PROFINET IO-Devices on a PROFINET network (or PROFIBUS network) defined at the LADDR input pin, using one of five possible conditions defined at the MODE input pin, and placing the results defined at the STATE input/output pin.
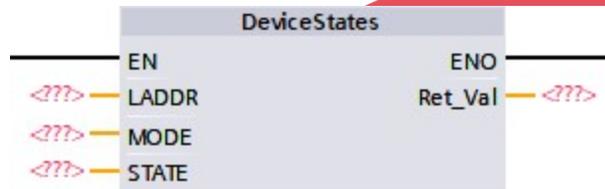
The DeviceStates instruction can be in found in the Instructions task card in the Extended Instructions section, and under the Diagnostics folder. You can view the help at any time by single clicking on DeviceStates, wait a few moments for a tool tip to appear, and then click in the link to display the online help. Once you have added the DeviceStates instruction to a network, it can be found in Program Blocks\System Blocks\Program Resources folder for future use.

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DeviceStates Input Pin LADDR

LADDR is the input pin with a data type of Hw_IoSystem that determines which PROFINET (or PROFIBUS) network to check the status of the devices. A Siemens CPU can have more than one PROFINET (or PROFIBUS) network. A project could have more than one CPU on the same subnet.
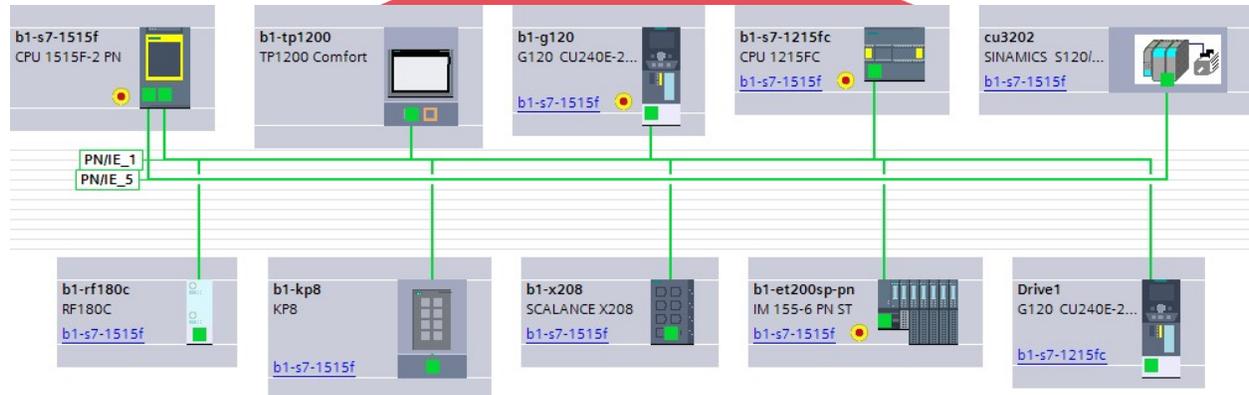
There are three ways to find this information. First, in the Network view, single click on the horizontal green line representing PN/IE_1, which is connected to port X1 of the CPU 1515F-2 PN. You should notice a small popup window with the ability to Highlight and IO System. PLEASE NOTE there are two PROFINET IO Systems! Select the system for the 1515F.
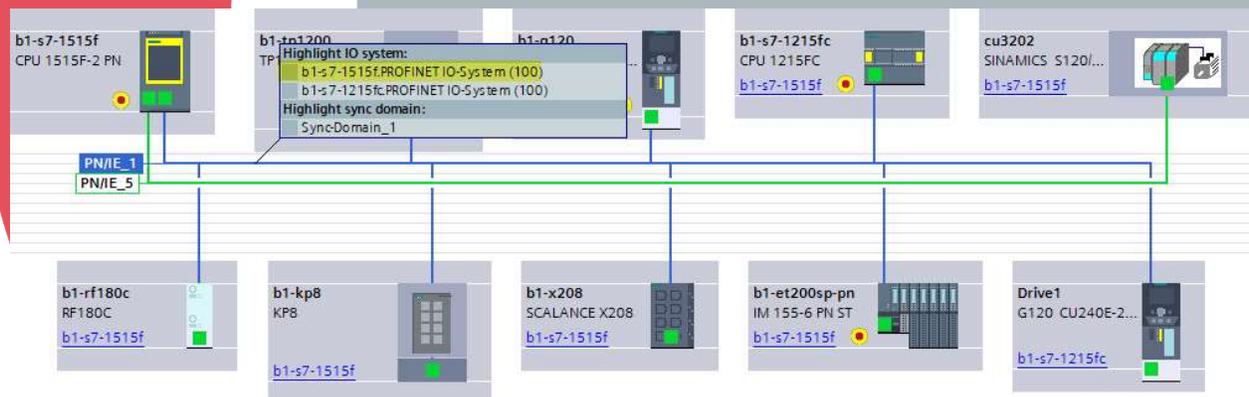
With the 1515F IO System selected in the Highlight box, the solid line now becomes a boxed-dashed line and the PROFINET IO System referencing the X1 port of the 1515F is displayed. Click on the boxed dashed line. In the General area of Properties, of the Inspector Window Below, click on Hardware Identifier. Please note the value is 262. Please note the area highlighted in green. Click one above on General. The Name is PROFINET IO System. It is a good idea to rename this to a unique name with meaning, especially if you have more than one PROFINET IO System from a CPU. The name has been changed to Atlantic.
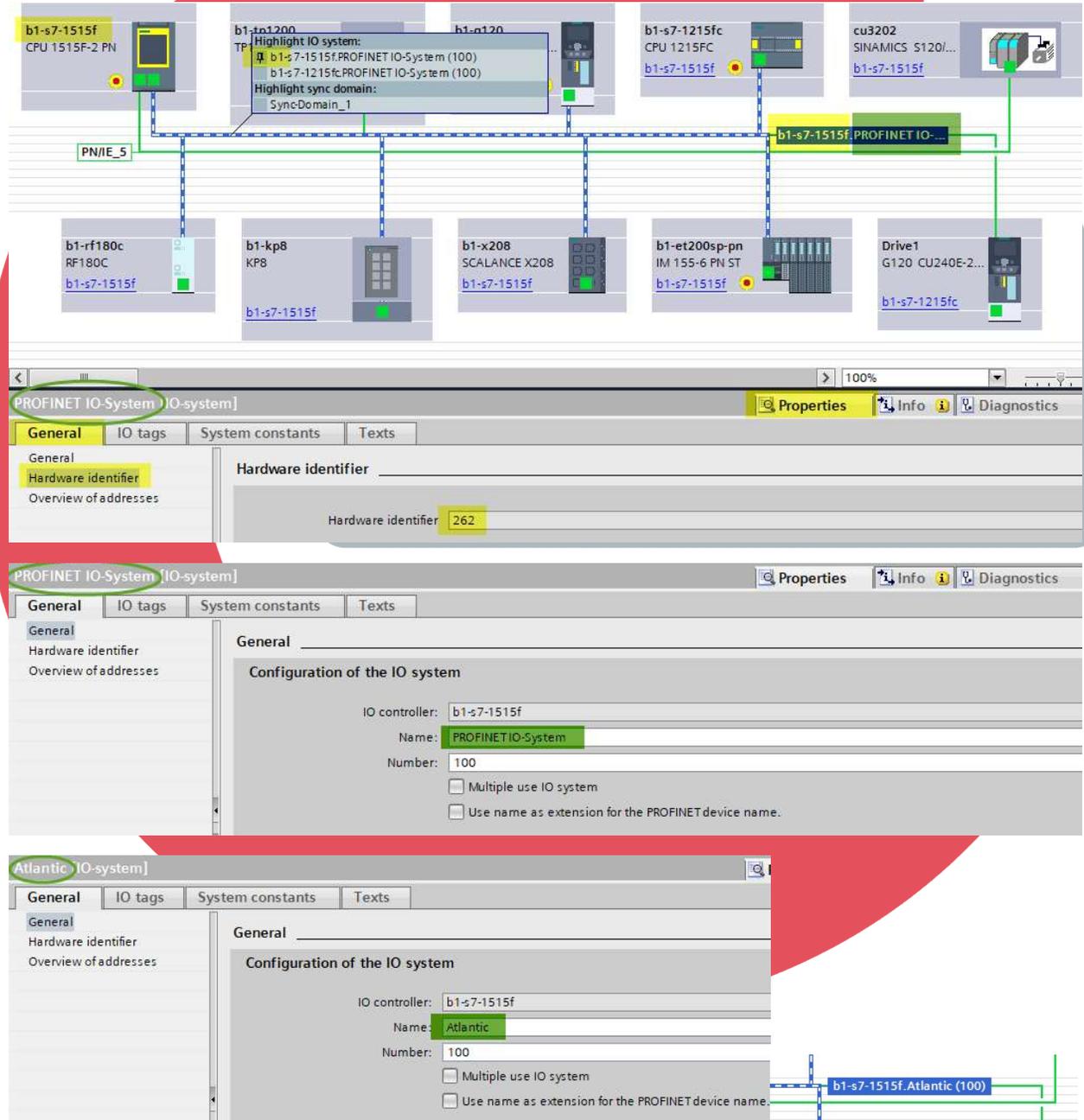
The second way of locating the Hw_IoSystem data type or Hardware Identifier is by double clicking on Show all tags in the PLC tags folder in the Project Tree for the respective 1515F CPU.
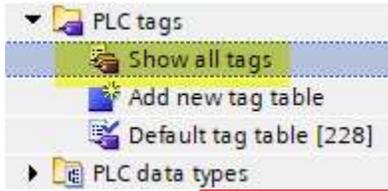
Select the System Constants tab and click on the Data Type column to so like data types are together. Scroll down until you locate Hw_IoSystem. Because there is more than one system and the Name does not allude to the PROFINET IO System belonging to the CPU 1515F-2 PN, be sure you are noting the correct system. Since the name was change to Atlantic, it is obvious the value is 262.

		Name	Data type ▲	Value	Comment	
35		Local~PROFINET_interface_1	Hw_Interface	64		^
36		b1-rf180c~RF180C_interface~Port_2	Hw_Interface	261		
37		b1-g120~PROFINET_interface~Port_1	Hw_Interface	293		
38		b1-rf180c~RF180C_interface	Hw_Interface	267		
39		b1-rf180c~RF180C_interface~Port_1	Hw_Interface	260		
40		Local~PROFINET_IO-System_1	Hw_IoSystem	320		
41		Local~Atlantic	Hw_IoSystem	262		
42		b1-et200sp-pn~DI_16x24VDC_ST_1	Hw_SubModule	308		
43		b1-s7-1215fc~PROFINET_interface_1~01_F-CD_1515_to_...	Hw_SubModule	316		
44		b1-s7-1215fc~PROFINET_interface_1~01_SYSTEM_GENER...	Hw_SubModule	317		
45		cu3202~Head	Hw_SubModule	326		
46		cu3202~DO_Control_Unit_1~Module_Access_Point	Hw_SubModule	328		
47		cu3202~DO_Control_Unit_1	Hw_SubModule	327		
48		b1-g120~PROFINET_interface~SIEMENS_telegram_352	Hw_SubModule	297		
49		cu3202~DO_SERVO_1_Red~Module_Access_Point	Hw_SubModule	331		
50		cu3202~DO_Control_Unit_1~without_PROFIsafe	Hw_SubModule	329		
51		b1-g120~PROFINET_interface~ModuleAccessPoint	Hw_SubModule	296		
52		cu3202~DO_Control_Unit_1~SIEMENS_telegram_394__PZ...	Hw_SubModule	330		v

Enter the constant value of 262 at the LADDR input pin and press Enter.

The third and final way of locating the Hw_IoSystem is from the input pin of the instruction. Double click on the question marks of the LADDR input pin to get the popup box and click on the list icon to the right.
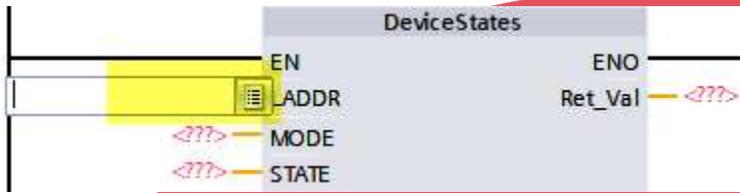
Scroll down until you locate the Hw_IoSystem data type and the correct PROFINET IO System. Since the name was changed to Atlantic, it is obvious which one to select. Click on it and press Enter.

DeviceStates Input Pin MODE

MODE is the input pin that determines what will be learned of the devices on a network. There are five modes that can be monitored and numbered as follows:

1) Configured – Is a device configured on the network?
2) Faulty – Is there an issue on a device (on if diagnostic on device or no communication)?
3) Disabled – Has a device been disabled or deactivated?
4) Exist – Is a device communicating on the network?
5) Problem – Is there a diagnostic on the device?

Enter the value at the input pin or reference a value in a variable tag with the data type UINT.

DeviceStates Input Pin STATE

STATE is the input pin that where the results of the MODE search will be stored. An array of Booleans from index 0 to 1023 is required for a PROFINET network (0 to 127 for PROFIBUS). Use a unique array for each MODE. The arrays can be combined into a common Global Data Block. A Word should be reserved in the Data Block for the Ret_Val output pin of each DeviceStates instructions for execution status.

Device Number of each PROFINET IO-Device

Every PROFINET IO-Device on a PROFINET IO-Controller's network is assigned a Device Number. The first device assigned to the PROFINET IO-Controller is assigned the device number value of 1, the second device is assigned the value of 2, etc. To determine what the Device Number is for each device, click on the Network View. Note that device name b1-et200sp-pn is an IO-Device on the b1-s7-1515f IO-Controller. In the Network Overview tab of the division (located to the right side of, or below, the graphical network) you will find the Device Numbers (orange) for the respective device names (green).

Device	Type	Address in subnet	Subnet	Master / IO system	Device number
▼ S71500/ET200MP station_1	S71500/ET200MP station				
▼ b1-s7-1515f	CPU 1515F-2 PN				
▶ PROFINET interface_1	PROFINET interface	192.168.9.19	PN/IE_1	PROFINET IO-System	
▶ PROFINET interface_2	PROFINET interface	192.168.1.1	Not connected		
▼ S7-1200 station_1	S7-1200 station				
▼ b1-s7-1215fc	CPU 1215FC DC/DC/DC				
DI 14/DQ 10_1	DI 14/DQ 10				
AI 2/AQ 2_1	AI 2/AQ 2				
HSC_1	HSC				
HSC_2	HSC				
HSC_3	HSC				
HSC_4	HSC				
HSC_5	HSC				
HSC_6	HSC				
Pulse_1	Pulse generator (PTO/P...				
Pulse_2	Pulse generator (PTO/P...				
Pulse_3	Pulse generator (PTO/P...				
Pulse_4	Pulse generator (PTO/P...				
OPC UA	OPC UA				
▼ PROFINET interface_1	PROFINET interface	192.168.9.18	PN/IE_1	PROFINET IO-System	6
Port_1	Port				
Port_2	Port				
▼ KP8_1	KP8				
▼ b1-kp8	KP8				
▶ Interface	KP8	192.168.9.1	PN/IE_1	PROFINET IO-System	2
▼ SCALANCE X-200	SCALANCE X-200				
▼ b1-x208	SCALANCE X208				
▶ SCALANCE interface_1	SCALANCE interface	192.168.9.16	PN/IE_1	PROFINET IO-System	3
▼ ET 200SP station_1	ET 200SP station				
▼ b1-et200sp-pn	IM 155-6 PN ST				
▶ PROFINET interface	PROFINET interface	192.168.9.24	PN/IE_1	PROFINET IO-System	5
▼ IO device_1	IID device				
▼ b1-rf180c	RF180C V2.2				
▶ RF180C interface	rf180c	192.168.9.25	PN/IE_1	PROFINET IO-System	1
▼ SINAMICS G_1	SINAMICS G				
▼ b1-g120	CU240E-2 PN-F				
▶ PROFINET interface	PROFINET interface	192.168.9.23	PN/IE_1	PROFINET IO-System	4
PM240-2 IP20	PM240-2 IP20				
▼ b1-tp1200	TP1200 Comfort				
HMI_RT_3	TP1200 Comfort				
▼ b1-tp1200.P_1	PROFINET Interface				
▶ PROFINET Schnittstell...	PROFINET Interface	192.168.9.21	PN/IE_1		
b1-tp1200.DP_CP_1	MPI/DP Interface	1	Not connected		

Activating and Deactivating a PROFINET IO Devices

After power is applied to a Siemens PLC, both the built-in PROFINET IO-Controllers and add-on PROFINET IO-Controller communication processors will begin attempting to establish communication will all configured devices on the respective PROFINET networks. The instruction D_ACT_DP provides the ability to Activate and Deactivate (Enable and Disable) communications to a single PROFINET IO-Device (or PROFIBUS node) defined at the LADDR input pin, using one of three actions defined at the MODE input pin, when the REQ or request input pin is TRUE.
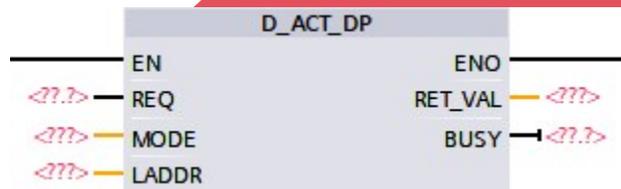
The D_ACT_DP instruction can be in found in the Instructions task card in the Extended Instructions section, and under the Distributed I/O folder. You can view the help at any time by single clicking on D_ACT_DP, wait a few moments for a tool tip to appear, and then click in the link to display the online help.

D_ACT_DP Input Pin LADDR

LADDR is the input pin with a data type of Hw_Device that determines which PROFINET IO-Device (or PROFIBUS node) to perform an action. A Siemens PROFINET IO-Controller can have more than one PROFINET IO-Device (or PROFIBUS node). More than one PROFINET IO-Controller can exist on S7-1500 system.

There are two ways to find this information. The first way of locating the Hw_Device data type or Hardware Identifier is by double clicking on Show all tags in the PLC tags folder in the Project Tree for the respective 1515F CPU.
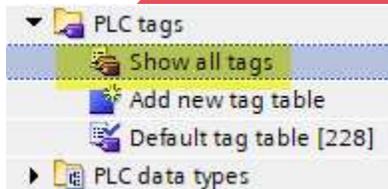
Select the System Constants tab and click on the Data Type column to so like data types are together. Scroll down until you locate Hw_Device and find the PROFINET Device name and the corresponding value. For the PROFINET Device name b1-et200sp-pn, the value is 300.

Enter the constant value of 300 at the LADDR input pin and press Enter.
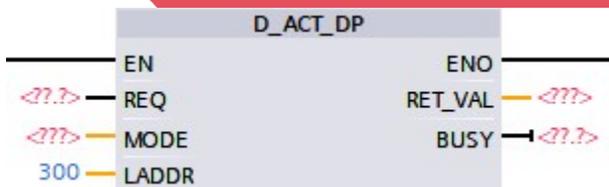
The second and final way of locating the Hw_Device is from the input pin of the instruction. Double click on the question marks of the LADDR input pin to get the popup box and click on the list icon to the right.
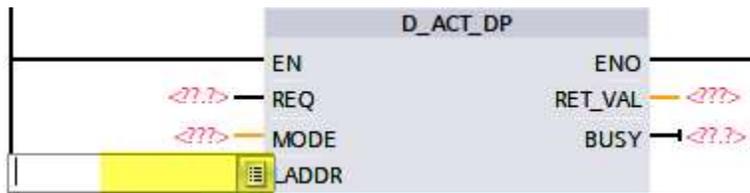
Scroll down until you locate the Hw_Device data type for the PROFINET IO-Device name. Select the item for b1-et200sp-pn and press Enter.
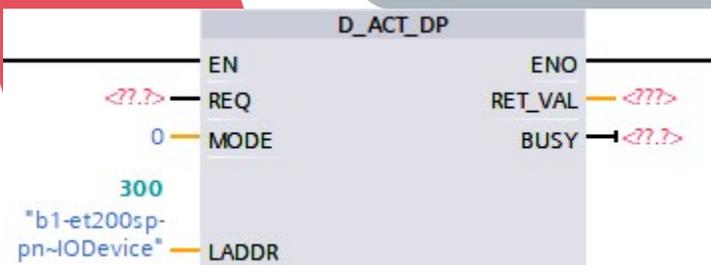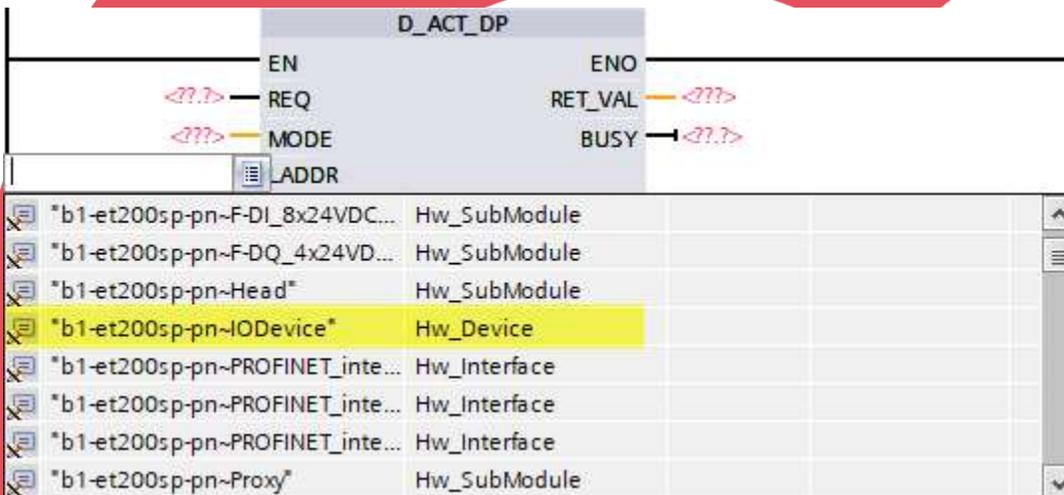
D_ACT_DP Input Pin MODE
MODE is the input pin that determines what action will be taken for the PROFINET IO-Device (or PROFIBUS node). There are three modes that can be chosen and numbered as follows:

0) Requests information if the device is activated or deactivated (result in RET_VAL)
1) Activates the device
2) Deactivates the device

Enter the value at the input pin or reference a value in a variable tag with the data type USINT. Place a TRUE value at the REQ input to execute the request.

RET_VAL uses a WORD data type to display results in hexadecimal form. You can find this info by giving focus to the instruction and pressing F1 to access the help.

References and Useful Links

Siemens trial software provides for a 21-day trial license and can be downloaded from the following Siemens Industry Online Support web links. Please note the PLC, Safety, and HMI are on the same installation "DVDs". If you do not have one, you will need to create a login (one-time). This is required to download the *.exe file for each trial software.

STEP7 Basic/Professional V16... and

STEP7 Safety Basic/Advanced V16... and

WinCC Basic/Comfort/Advanced and WinCC Unified V16

PLCSIM V16 is on its own installation "DVD"

https://support.industry.siemens.com/cs/document/109772803/simatic-step-7-incl-safety-and-wincc-v16-trial-download?dti=0&pnid=24462&lc=en-US

Startdrive Advanced V16

https://support.industry.siemens.com/cs/document/109771710/sinamics-startdrive-v16?dti=0&pnid=13438&lc=en-US

Acknowledgments

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