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P-Series CPUs to NITRA Pneumatic Automation Link (PAL)

Integration Walk-Through

Revision: 1.1
3-23-2021

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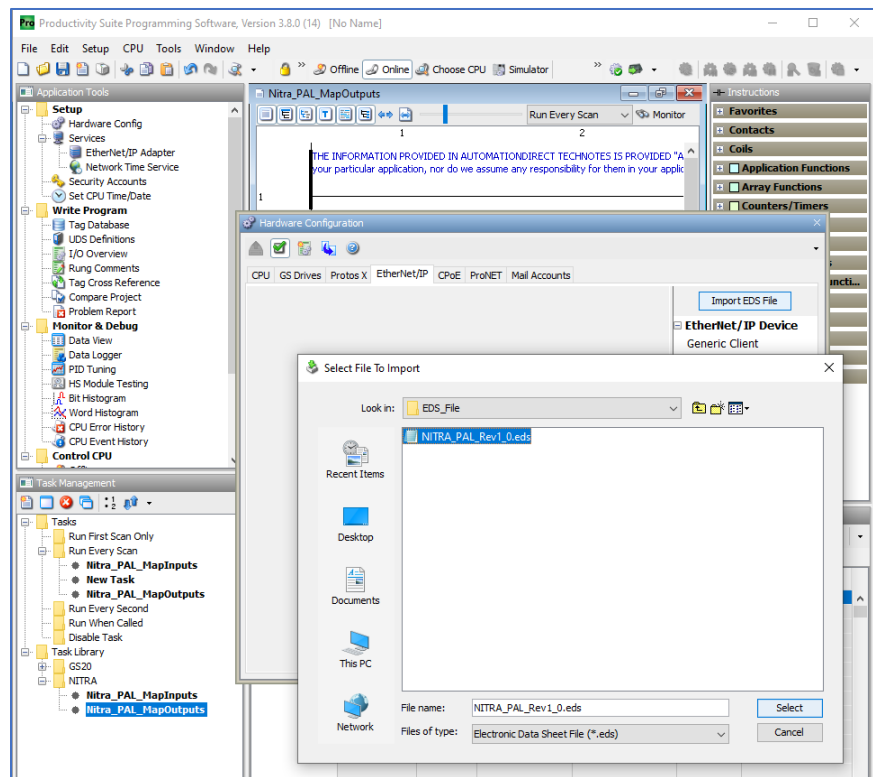
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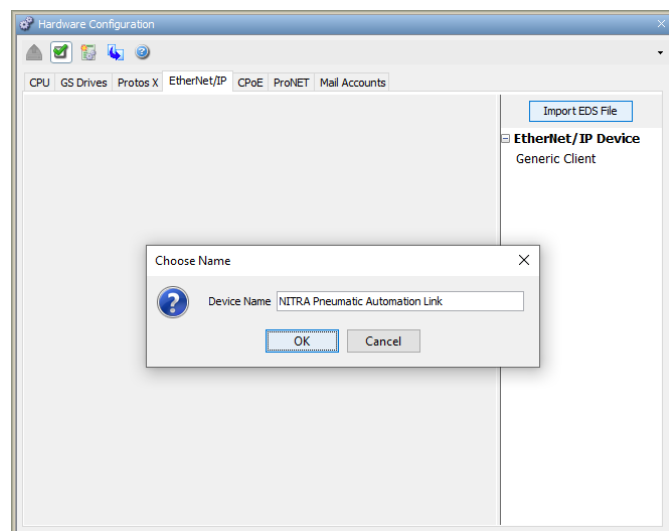
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Import EDS File

From the Hardware Configuration, select the EtherNet/IP tab and click the 'Import EDS File' button. Navigate to the directory where the NITRA_PAL_Rev1_0 file has been saved and select the file.

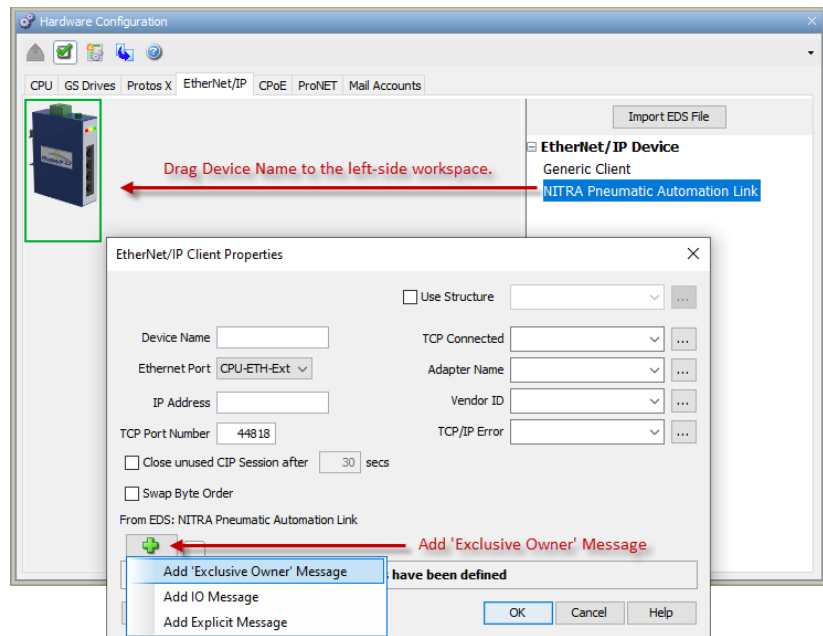


Provide a name for the device. The name 'NITRA Pneumatic Automation Link' has been provided by default.



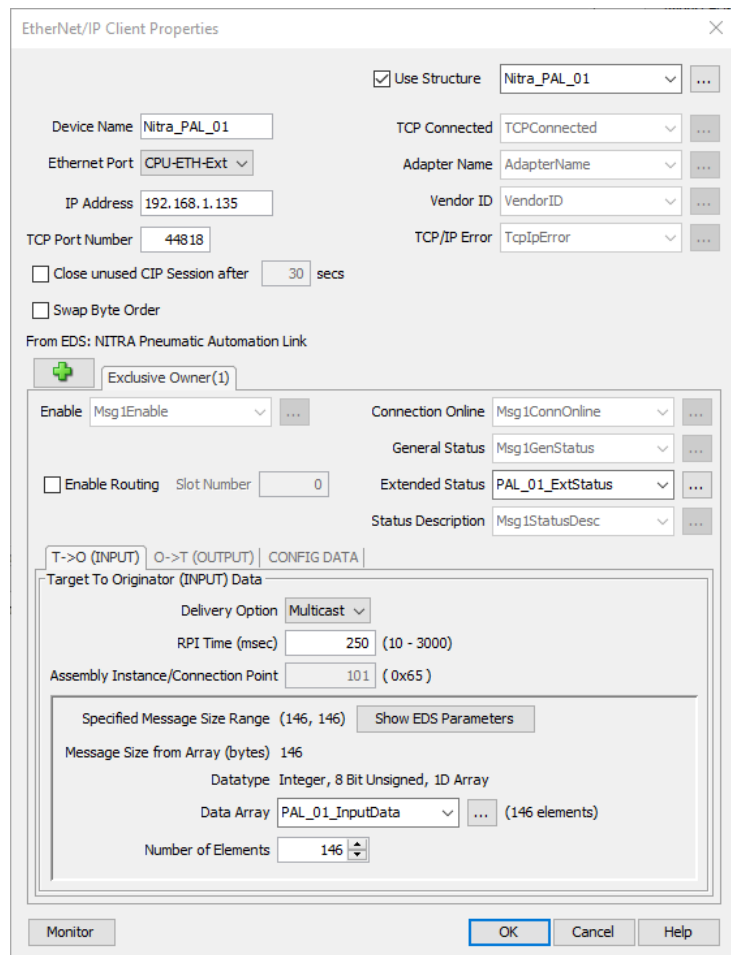
Drag the newly added device from the right-side list to the left-side workspace.

Add the 'Exclusive Owner' Message.



Create an 8 Bit Unsigned 1D Array of 146 elements for use with the IO Messaging Input Data from the Nita PAL.

Note: a 16-element array for the Extended Status has been created. This is very useful when troubleshooting.



Create an 8 Bit Unsigned 1D Array of 102 elements for use with the IO Messaging Output Data from the Nitra PAL

EtherNet/IP Client Properties

☒ Use Structure Nitra_PAL_01 ...

Device Name Nitra_PAL_01 TCP Connected TCPConnected ...

Ethernet Port CPU-ETH-Ext ... Adapter Name AdapterName ...

IP Address 192.168.1.135 Vendor ID VendorID ...

TCP Port Number 44818 TCP/IP Error TcpIpError ...

☐ Close unused CIP Session after 30 secs

☐ Swap Byte Order

From EDS: NITRA Pneumatic Automation Link

☒ Exclusive Owner(1)

Enable Msg1Enable ... Connection Online Msg1ConnOnline ...

General Status Msg1GenStatus ...

☐ Enable Routing Slot Number 0 Extended Status PAL_01_ExtStatus ...

Status Description Msg1StatusDesc ...

T->O (INPUT) O->T (OUTPUT) CONFIG DATA

Originator To Target (OUTPUT) Data

☒ Include Status Header (When checked the message size will be increased by 4 bytes)

RPI Time (msec) 250 (10 - 3000)

Assembly Instance/Connection Point 100 (0x64)

Specified Message Size Range (102, 102) Show EDS Parameters

Message Size from Array (bytes) 102

Datatype Integer, 8 Bit Unsigned, 1D Array

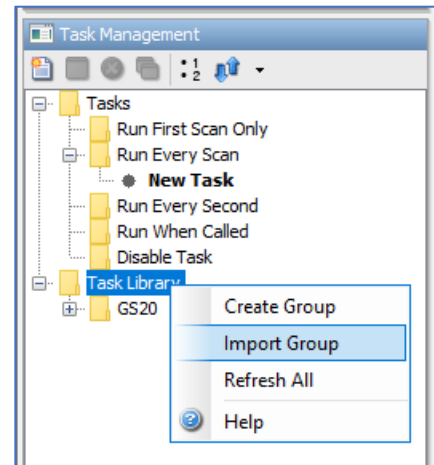
Data Array PAL_01_OutputData ... (102 elements)

Number of Elements 102

Monitor OK Cancel Help

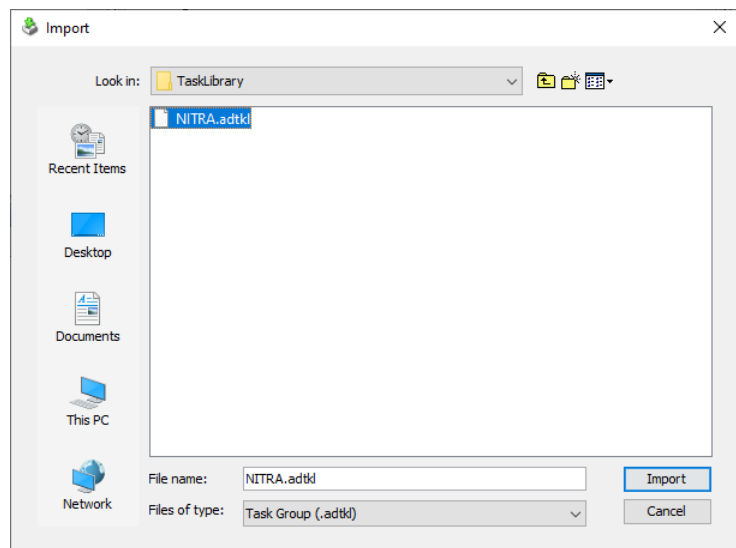
Import Task Library

From the Task Management window in the Productivity Suite, right-click on Task Library and select 'Import Group.'



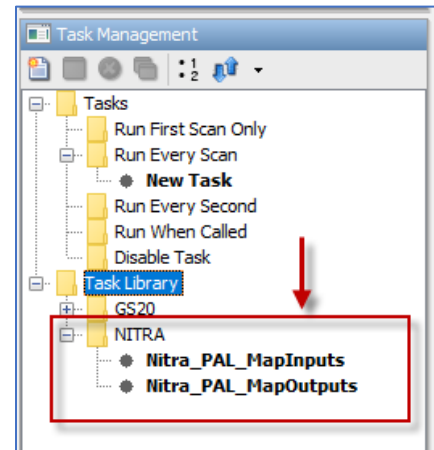
Select the NITRA.adtkl file from the directory user saved directory.

Click 'Import.'

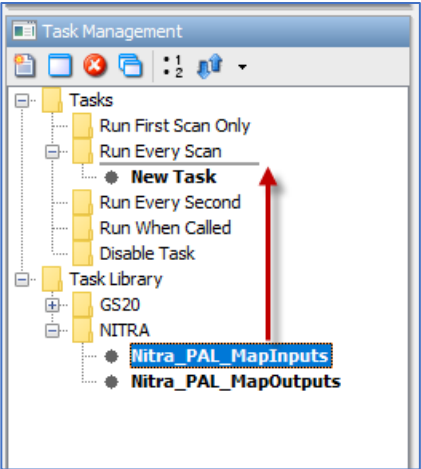


The following two Tasks will be imported:

- Nitra_PAL_MapInputs
- Nitra_PAL_MapOutputs



Move the Nitra_PAL_MapInputs Task to the 'Run Every Scan' section, placing it early in the execution order of other tasks.



The following tags and User Defined Structure will be imported into the main project.

Click 'OK.'

Pro Tag Conversion

The following tags with names and data types from the first two column are found in the copied instructions and will be converted to either compatible tags in the tag DB or new tags.

If a tag is chosen from the tag DB in the New Tag Name column, the New Data Type column will show the data type from the tag DB.

If a new tag name is entered, the New Data Type column will be empty and the new tag will have the data type from the Data Type column.

If a user structure is found with the same name but is not identical, the user structure of a tag will be renamed as shown in the Data Type column.

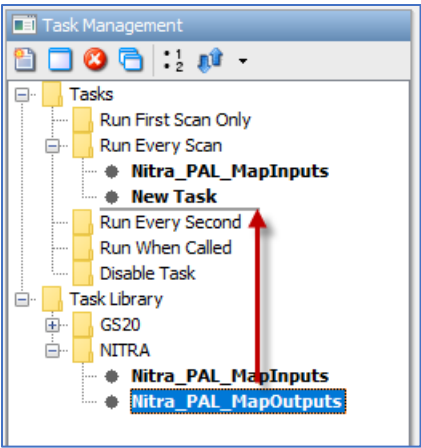
Click OK to accept the conversion or Cancel to abort.

| Tag Name | Data Type | New Tag Name | New Data Type |
|-----------------|------------------------------------|-----------------|---------------|
| LoopIndex | Integer, 8 Bit Unsigned | LoopIndex | |
| Temporary_USINT | Integer, 8 Bit Unsigned, 1D Array | Temporary_USINT | |
| MaxNo_PAL_Units | Integer, 32 Bit | MaxNo_PAL_Units | |
| Temporary_UINT | Integer, 16 Bit Unsigned, 1D Array | Temporary_UINT | |
| PAL_Unit | Structure, User, 1D, PAL_Struct | PAL_Unit | |

OK

Cancel

Move the Nitra_PAL_MapOutputs Task to the 'Run Every Scan' section, placing it later in the execution order of other tasks



The following tags and User Defined Structure will be imported into the main project.
Note: Most of these tags are the same as the previous import.

Click 'OK.'

Tag Conversion

The following tags with names and data types from the first two column are found in the copied instructions and will be converted to either compatible tags in the tag DB or new tags.

If a tag is chosen from the tag DB in the New Tag Name column, the New Data Type column will show the data type from the tag DB.

If a new tag name is entered, the New Data Type column will be empty and the new tag will have the data type from the Data Type column.

If a user structure is found with the same name but is not identical, the user structure of a tag will be renamed as shown in the Data Type column.

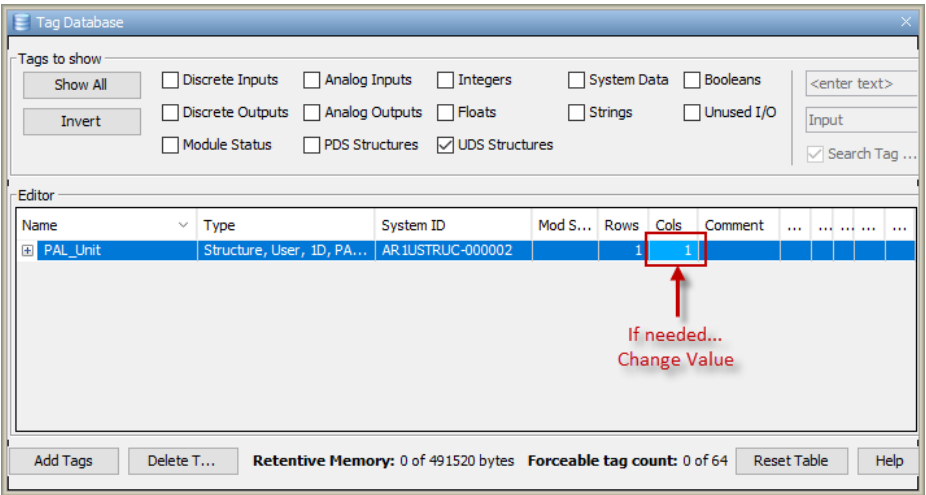
Click OK to accept the conversion or Cancel to abort.

| Tag Name | Data Type | New Tag Name | New Data Type |
|-----------------|---------------------------------|-----------------|---------------------------------|
| LoopIndex | Integer, 8 Bit Unsigned | LoopIndex | Integer, 8 Bit Unsigned |
| Temporary_USINT | Integer, 8 Bit Unsigned, 1D ... | Temporary_USINT | Integer, 8 Bit Unsigned, 1D ... |
| MaxNo_PAL_Units | Integer, 32 Bit | MaxNo_PAL_Units | Integer, 32 Bit |
| Temporary_UINT | Integer, 16 Bit Unsigned, 1... | Temporary_UINT | Integer, 16 Bit Unsigned, 1... |
| PAL_Unit | Structure, User, 1D, PAL_S... | PAL_Unit | Structure, User, 1D, PAL_S... |
| Temporary_BOOL | Boolean, 1D Array | Temporary_BOOL | |

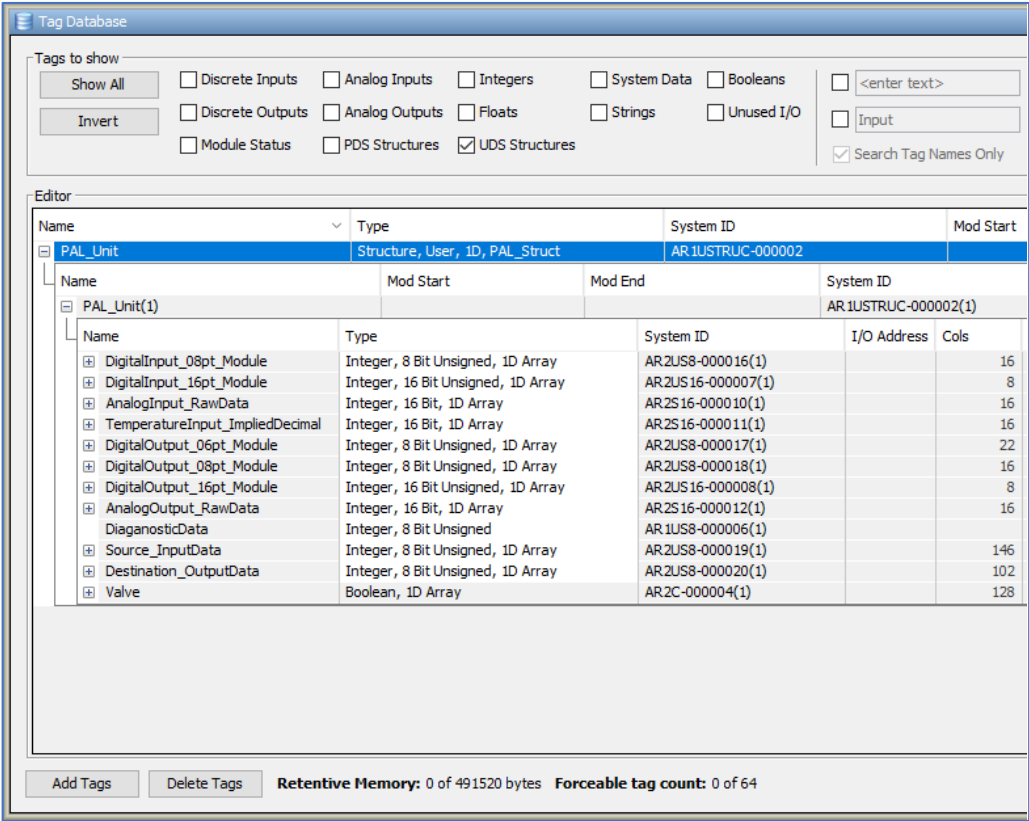
OK Cancel

Modifying the Program

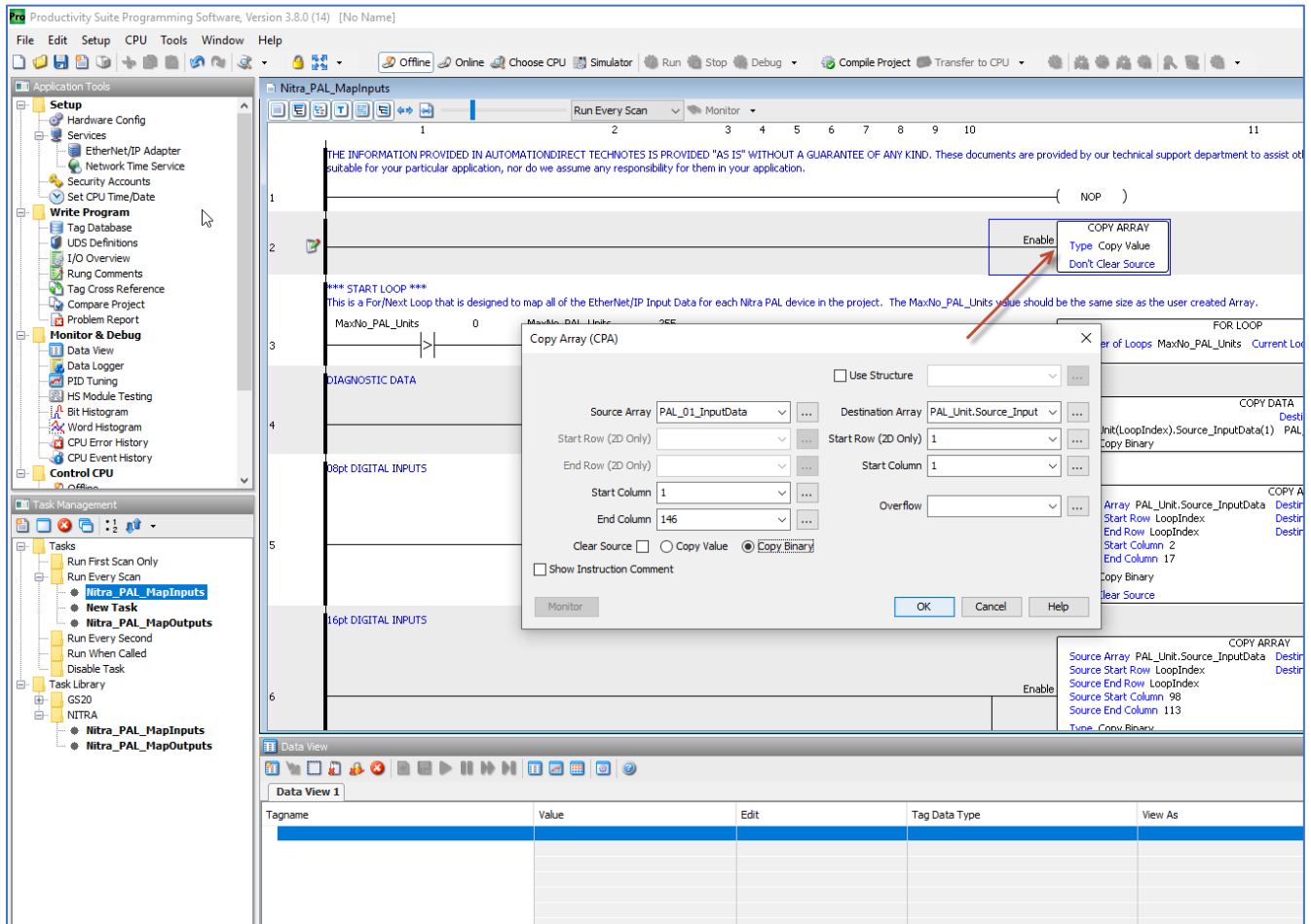
The imported code blocks from the Task Library contain a User Defined Structure (UDS) named 'PAL_Struct' and a single Instance of this UDS (single element 1D array), named 'PAL_Unit(1)' within the Tag Name Database. If your system has a single Pneumatic Automation Link unit, then the default quantity of one is correct. If your system has more than one PAL unit, then the size of the 'PAL_Unit' array will need to be adjusted to accommodate the number of units in the system.



The UDS provides structure members for the maximum quantity of each IO module type, the maximum valve count, a Diagnostic Data element, as well as members for mapping the EtherNet/IP Source Input Data and Destination Output Data.



At the top of the Task: Nitra_PAL_MapInputs, the 146 bytes from the T->O array needs to be copied into the PAL_Unit.Source_InputData array elements. Insert a rung above the FOR/NEXT loop and use the Copy Array (CPA) instruction and the Copy Binary selection to map the data.



Using the Copy Data (CPD) instruction, write the number of Pneumatic Automation Link units (used in the system) to the 'MaxNo_PAL_Units' tag. This tag value dictates the number of loop iterations for mapping the data for one or more units.

The screenshot displays the Productivity Suite Programming Software interface. The main workspace shows a ladder logic program for 'Nitra_PAL_MapInputs'. A 'Copy Data (CPD)' instruction is being configured, with the 'Source' set to 'PAL_01_InputData' and the 'Destination' set to 'MaxNo_PAL_Units'. The 'Type' is 'Copy Value'. The 'Number of Loops' is set to 'MaxNo_PAL_Units'. The 'Copy Data' dialog box is open, showing the 'Source' and 'Destination' fields. The 'Copy Data' dialog box also shows the 'Copy Value' radio button selected, and the 'Show Instruction Comment' checkbox is checked. The 'Copy Data' dialog box also shows the 'Copy Value' radio button selected, and the 'Show Instruction Comment' checkbox is checked.

The 'Copy Data (CPD)' dialog box shows the following configuration:

- Source: PAL_01_InputData
- Destination: MaxNo_PAL_Units
- Type: Copy Value
- Number of Loops: MaxNo_PAL_Units
- Copy Value (selected)
- Show Instruction Comment (checked)

The 'Copy Data' dialog box also shows the following configuration:

- Source: PAL_01_InputData
- Destination: MaxNo_PAL_Units
- Type: Copy Value
- Number of Loops: MaxNo_PAL_Units
- Copy Value (selected)
- Show Instruction Comment (checked)

The 'Copy Data' dialog box also shows the following configuration:

- Source: PAL_01_InputData
- Destination: MaxNo_PAL_Units
- Type: Copy Value
- Number of Loops: MaxNo_PAL_Units
- Copy Value (selected)
- Show Instruction Comment (checked)

At the bottom of the Task: Nitra_PAL_MapOutputs, the 102 bytes from the O->T array needs to be populated by the PAL_Unit.Destination_OutputData array elements. Insert a rung below the FOR/NEXT loop and use the Copy Array (CPA) instruction and the Copy Binary selection to map the data.

The screenshot shows the Productivity Suite Programming Software interface. The main window displays the 'Nitra_PAL_MapOutputs' task configuration. The ladder logic diagram shows a FOR/NEXT loop. A 'Copy Array (CPA)' dialog box is open, showing the configuration for copying data from 'PAL_Unit.Destination_C' to 'PAL_01_OutputData'. The dialog includes fields for Source Array, Destination Array, Start Row, End Row, Start Column, End Column, and an 'Overflow' field. The 'Copy Binary' option is selected under 'Clear Source'. A red arrow points to the 'Enable' button of the CPA instruction in the ladder logic diagram.

Copy Array (CPA) Dialog Box Configuration:

| Field | Value |
|--------------------------|---|
| Source Array | PAL_Unit.Destination_C |
| Destination Array | PAL_01_OutputData |
| Start Row (2D Only) | 1 |
| End Row (2D Only) | 1 |
| Start Column | 1 |
| End Column | 102 |
| Overflow | |
| Clear Source | <input type="radio"/> Copy Value <input checked="" type="radio"/> Copy Binary |
| Show Instruction Comment | <input type="checkbox"/> |

Ladder Logic Diagram Configuration:

| Rung | Instruction | Source Array | Destination Array | Start Row | End Row | Start Column | End Column | Type | Clear Source |
|------|-------------------|-------------------------------|-------------------|-----------|---------|--------------|------------|--------------|--------------------|
| 6.2 | COPY ARRAY | Temporary_USINT | PAL_Unit | 1 | 16 | 1 | 16 | Copy Binary | Don't Clear Source |
| 7 | COPY ARRAY | PAL_Unit.AnalogOutput_RawData | Temporary_USINT | 1 | 16 | 1 | 16 | Copy Binary | Don't Clear Source |
| 7.1 | UNPACK WORD ARRAY | Temporary_USINT | Temporary_USINT | 1 | 16 | 1 | 16 | Word to Byte | |
| 7.2 | COPY ARRAY | Temporary_USINT | PAL_Unit | 1 | 32 | 1 | 32 | Copy Binary | Don't Clear Source |
| 8 | NEXT | | | | | | | | |
| 9 | COPY ARRAY | | | | | | | Copy Value | Don't Clear Source |

To verify the data mapping, enable the communication between the PLC and the PAL unit using the .Msg1Enable bit. Note: This can be done through ladder or a Data View.

The screenshot displays the Productivity Suite Programming Software interface. The top menu bar includes File, Edit, Setup, CPU, Tools, Window, and Help. The main workspace shows a ladder logic diagram with 10 rungs. Rung 1 contains a coil labeled 'Nitra_PAL_01.Msg1Enable' with 'OUT' in parentheses. A red box highlights this coil, and a red arrow points from it to the 'Nitra_PAL_01.Msg1Enable' entry in the Data View table below.

The left sidebar contains the 'Application Tools' tree, which is expanded to show 'Monitor & Debug' tasks. The 'Task Management' pane shows a list of tasks, including 'Nitra_PAL_MapInputs', 'New Task', 'Nitra_PAL_MapOutputs', 'Run Every Second', 'Run When Called', and 'Disable Task'.

The 'Data View' window at the bottom right shows a table of data points for 'E/IP Scanner - Nitra_PAL_01'. The table has three columns: Tagname, Value, and Edit. The 'Nitra_PAL_01.Msg1Enable' tag is highlighted in blue.

| Tagname | Value | Edit |
|--------------------------------|--------------------------|--------------------------|
| Nitra_PAL_01.AdapterName | | |
| Nitra_PAL_01.Msg1ConnOnline | <input type="checkbox"/> | <input type="checkbox"/> |
| Nitra_PAL_01.Msg1Enable | <input type="checkbox"/> | <input type="checkbox"/> |
| Nitra_PAL_01.Msg1GenStatus | 0 | 0 |
| Nitra_PAL_01.Msg1StatusDesc | | |
| Nitra_PAL_01.TcpIpConnected | <input type="checkbox"/> | <input type="checkbox"/> |
| Nitra_PAL_01.TcpIpError | | |
| Nitra_PAL_01.VendorID | 0 | 0 |
| PAL_01_ExtStatus | | |
| PAL_01_InputData | | |
| PAL_01_OutputData | | |