



Abstract:

This document explains how to set the configuration parameters required to facilitate communications between a Kuka robot and an approved Red Lion Controls (RLC) product when using the EtherNet/IP Slave Adaptor driver.

Products:

RLC CR1000 Human Machine Interface (HMI), CR3000 HMI, G3 HMI, G3 Kadet HMI, Graphite[®] HMI, Modular Controller, Data Station Plus (DSP), and ProducTVity Station[™] (PTV)

Use Case: Kuka Robot EtherNet/IP Communications

The Kuka robots are equipped with an Ethernet/IP communication option; this document explains how to configure the robot and an approved RLC product to communicate using Red Lion's EtherNet/IP Slave Adapter driver.

Required Software:

Crimson[®] 2.0, 3.0, or 3.1

Required Operating System:

Microsoft Windows 2000, or above

Introduction

The instructions and configuration settings provided in this document were tested with a Kuka robot (R6-R900-SIXX-KRC4C, V8.2.1) equipped with the EtherNet/IP option. The approved RLC product was connected to the Kuka robot via an X66 Robot Ethernet connector, as shown in Figure 1. Crimson was used to configure the EtherNet/IP Slave Adaptor Driver and WorkVisual 2.4 was used to configure the Kuka robot.

Prerequisites

The following prerequisites are required to ensure proper communications:

- Ethernet/IP option installed on the robot
- Red Lion device connected via the X66 Robot Ethernet connector



Figure 1.

NOTE: Crimson is required and is only available to Windows 2000 or above users. Please update your version of Crimson to the latest, available online at: www.redlion.net.

Crimson Configuration

Referring to Figure 2, perform the following:

1. Navigate to the Communications section.
2. Click on *Network* in the Navigation Pane.
3. Click on the *Ethernet 1* tab.
4. Set up the device's IP address. It must be in the same subnet as the robot, which by default it is: 172.31.1.xxx - 255.255.255.0.

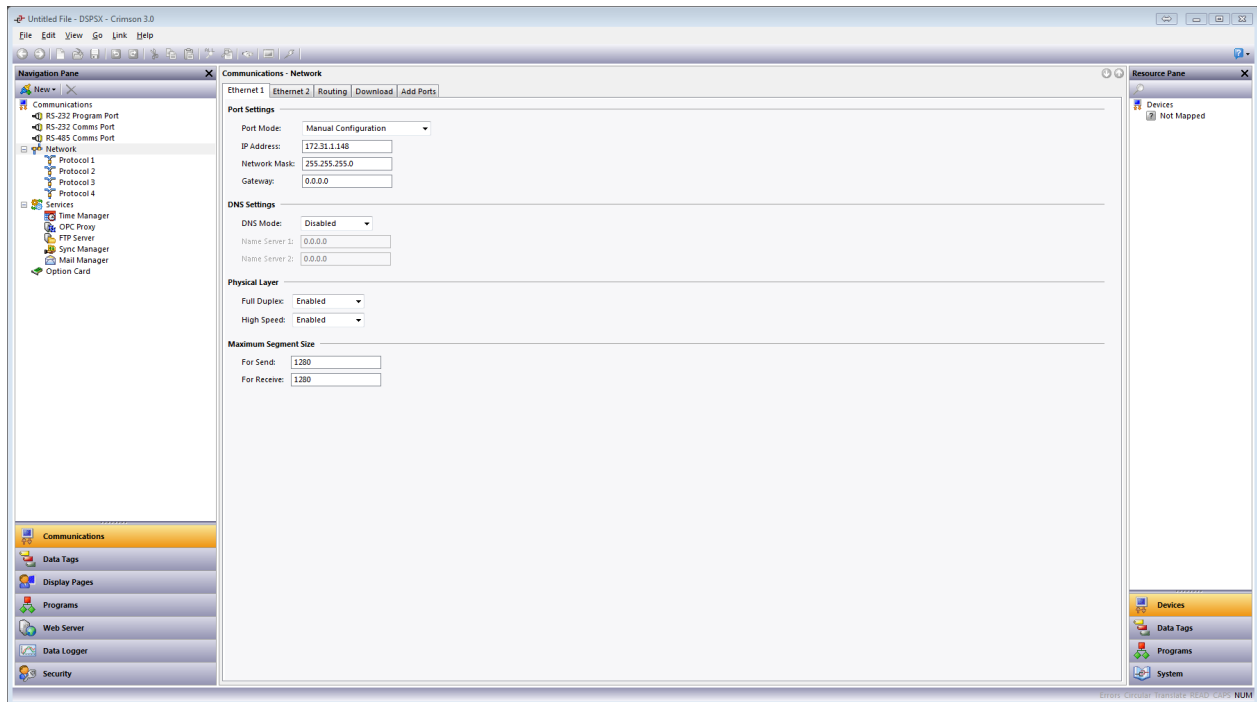


Figure 2.

5. Referring to Figure 3, click on the first available protocol; *Protocol 1* in this case.
6. Click the *Pick* button next to the driver selection; the Driver Picker popup appears.
7. Select the *EtherNet/IP* under Manufacturer.
8. Select *Slave Adaptor* under Driver. Click the *OK* button; the Communication - Network - Protocol 1 popup appears, as shown in Figure 4.

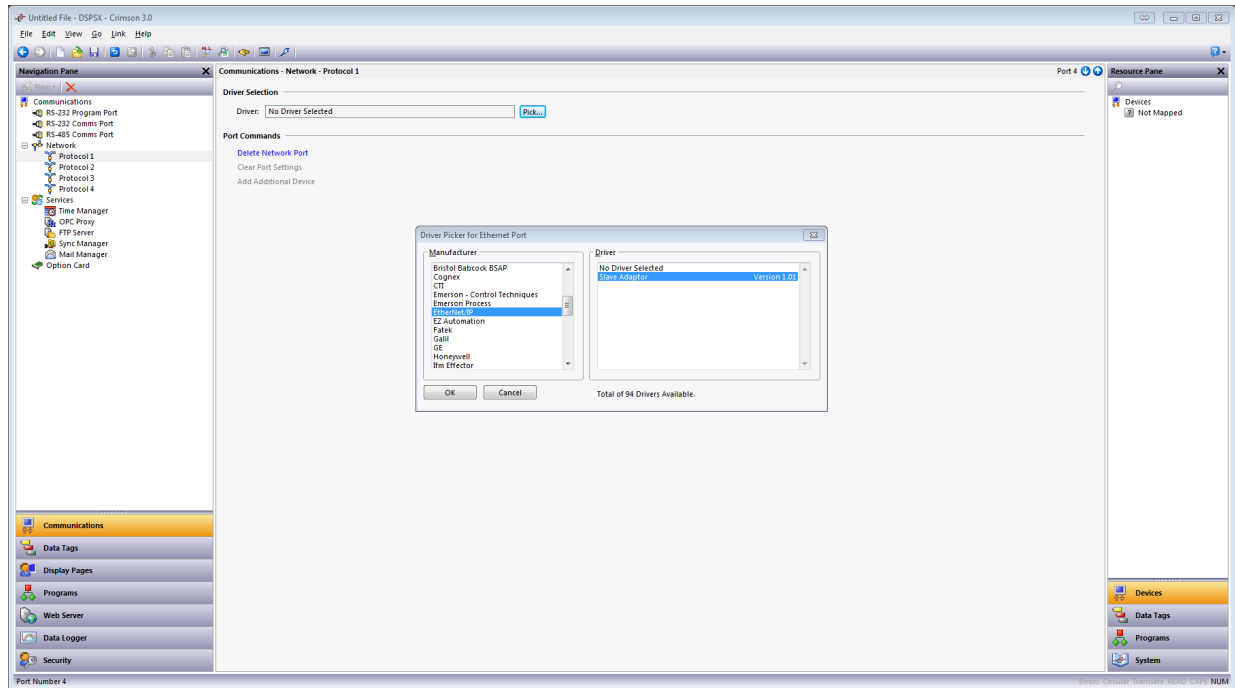


Figure 3.

9. Referring to Figure 4, check the *Run/Idle Header* check box.

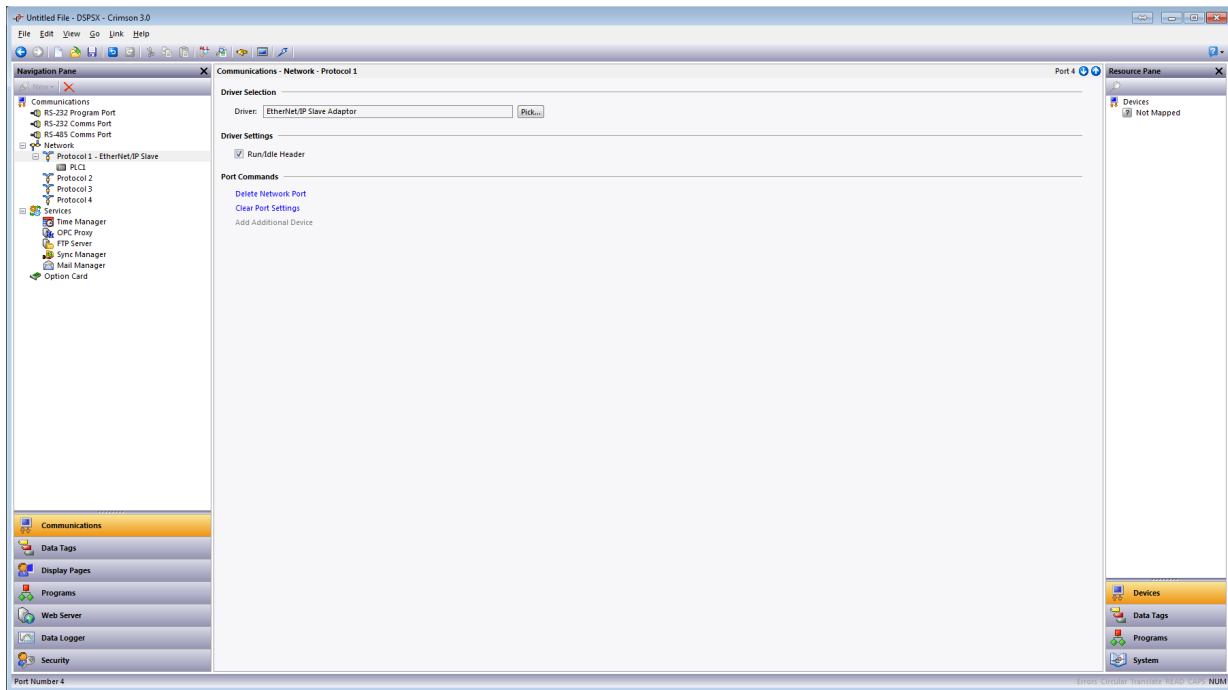


Figure 4.

10. Referring to Figure 5, click on the device below the driver; *PLC1* in this case.
11. Create 2 Gateway blocks by clicking on *Add Gateway Block*, two times. Returning to the Navigation Pane, note that *Block 1* and *Block 2* now appear beneath *PLC1*.

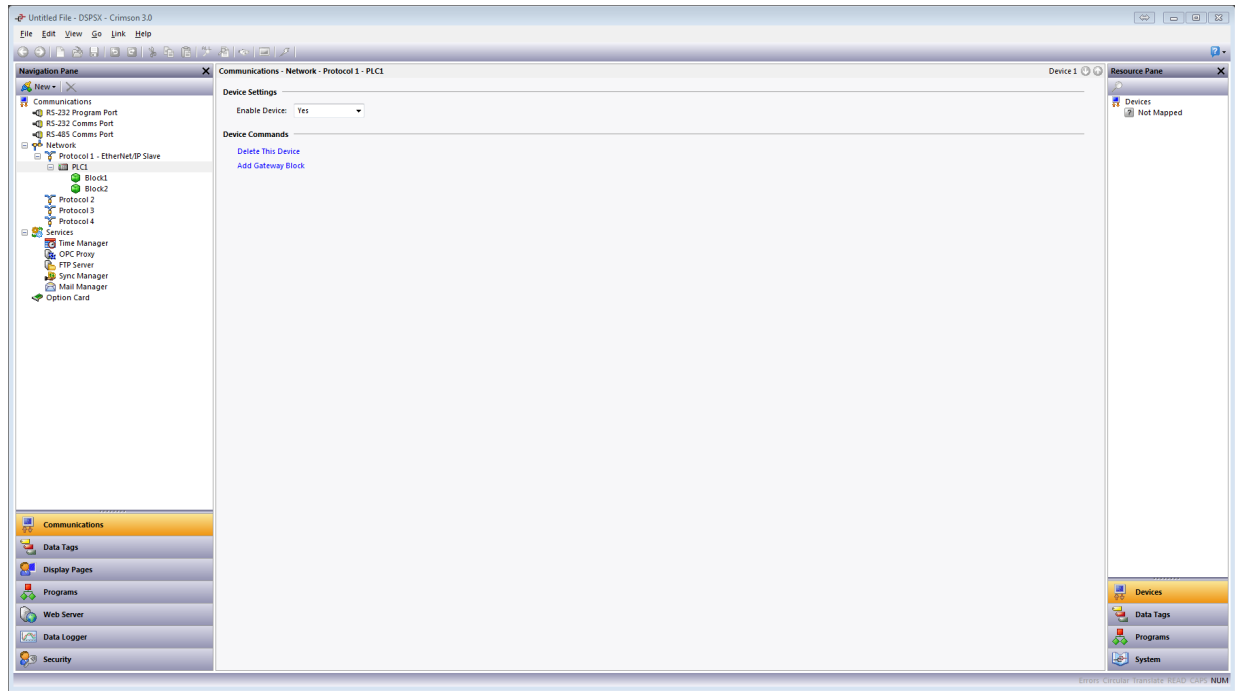


Figure 5.

1. Referring to Figure 6, go to the Navigation Pane and select *Block1*; the Communications - Network - Protocol 1 - Block1 popup appears. Configure Block 1 as a Read block by performing the following:
 - a. Select *Block1*.
 - b. Go to the *Start Address* field and click the *Pick* button; the Select Address for EtherNet/IP Slave popup appears.
 - c. Go to the *Connection Point* field and enter the Instance number; *06* in this example. This number can only be used for one block.
 - d. Go to the *Data Type* field and select the data type to transmit; *Byte as Byte* in this example. Click the *OK* button; the Driver Picker popup disappears.

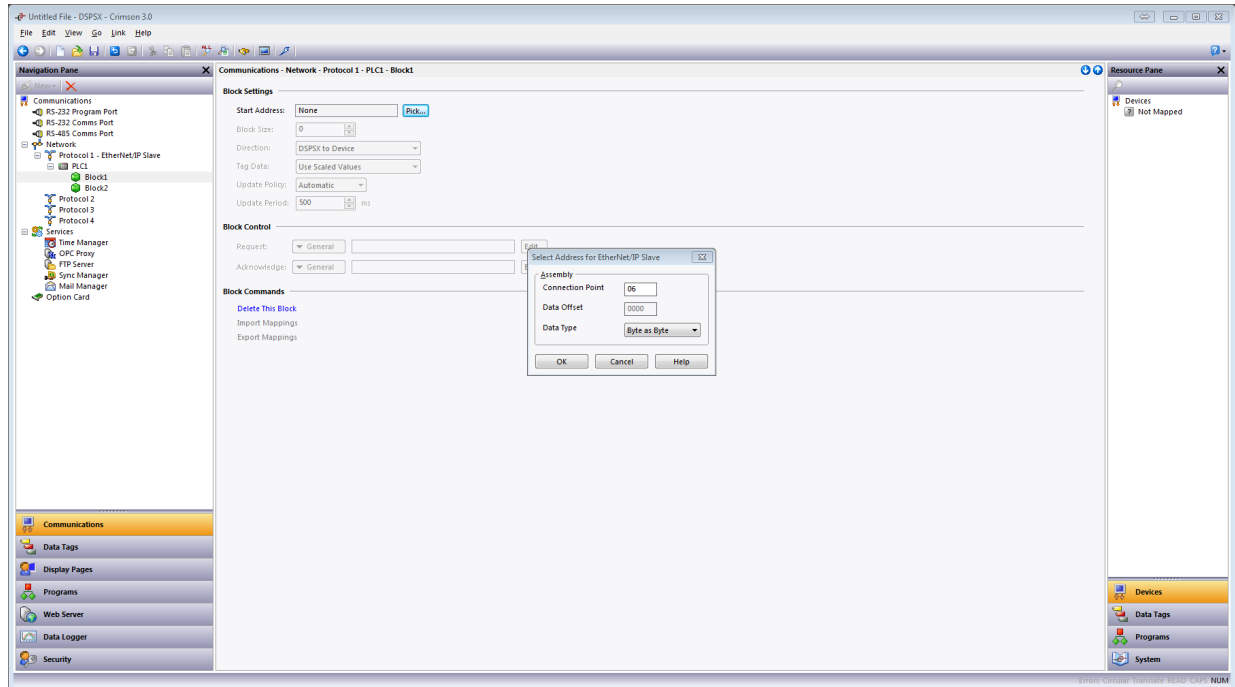


Figure 6.

e. Referring to Figure 7, specify the Block Size: field; 2 in this example.

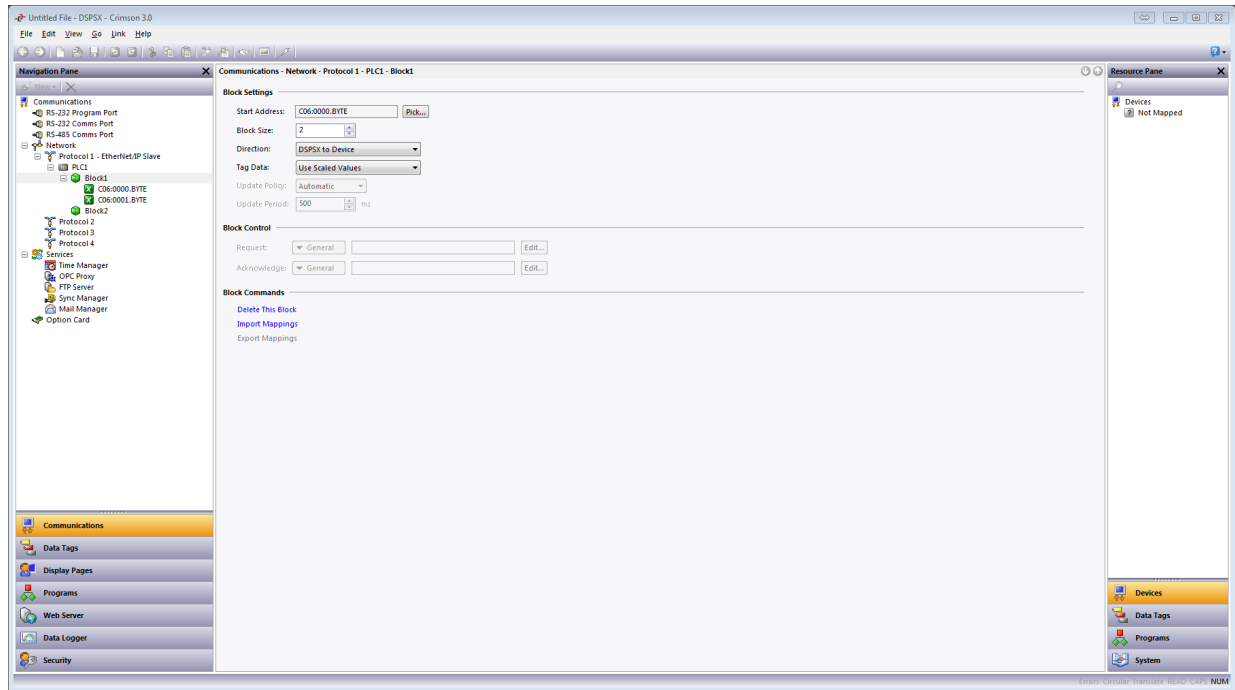


Figure 7.

1. Referring to Figure 8, go to the Navigation Pane and select *Block2*; the Communications - Network - Protocol 1 - Block2 popup appears. Configure Block 2 as a Write block by performing the following:
 - a. Select *Block2*.
 - b. Go to the *Start Address* field and click the *Pick* button; the Select Address for EtherNet/IP Slave popup appears.
 - c. Go to the *Connection Point* field and enter the Instance number; *07* in this example. This number can only be used for one block.
 - d. Go to the *Data Type* field and select the data type to transmit; *Byte as Byte* in this example. Click the *OK* button; the Driver Picker popup disappears.

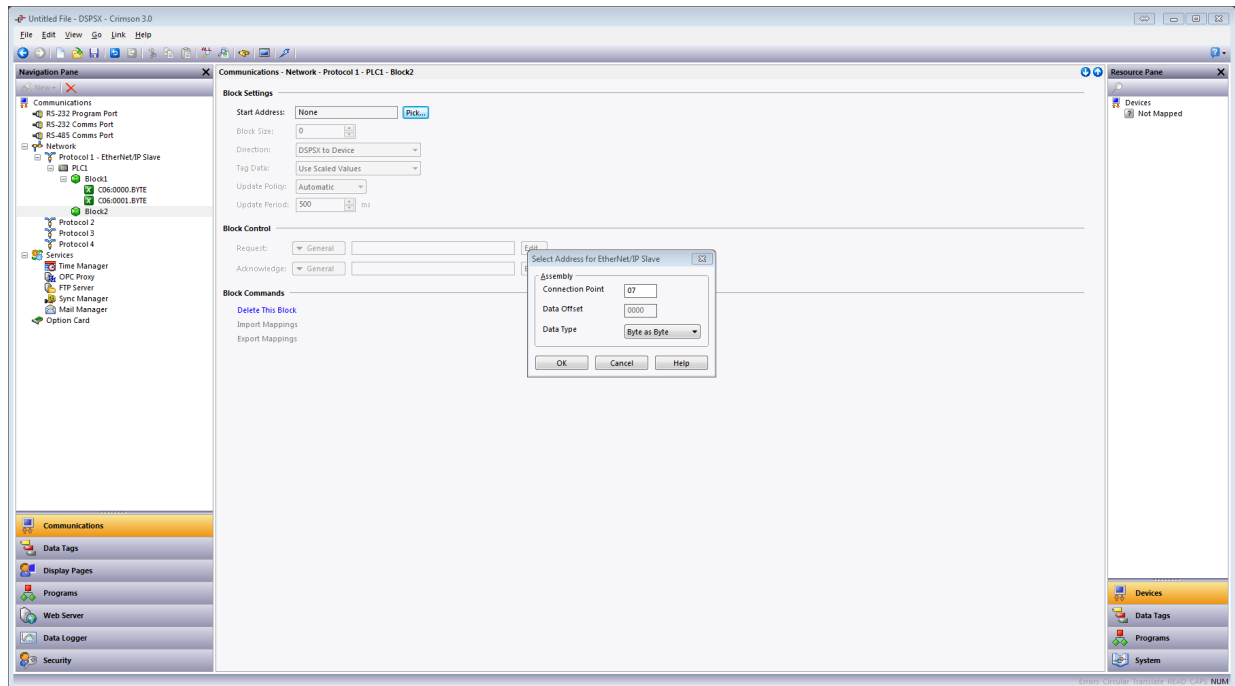


Figure 8.

- e. Referring to Figure 9, specify the `Block Size`; 2 in this example.
- f. Specify the `Direction`; *Device to DSPSX* in this example.

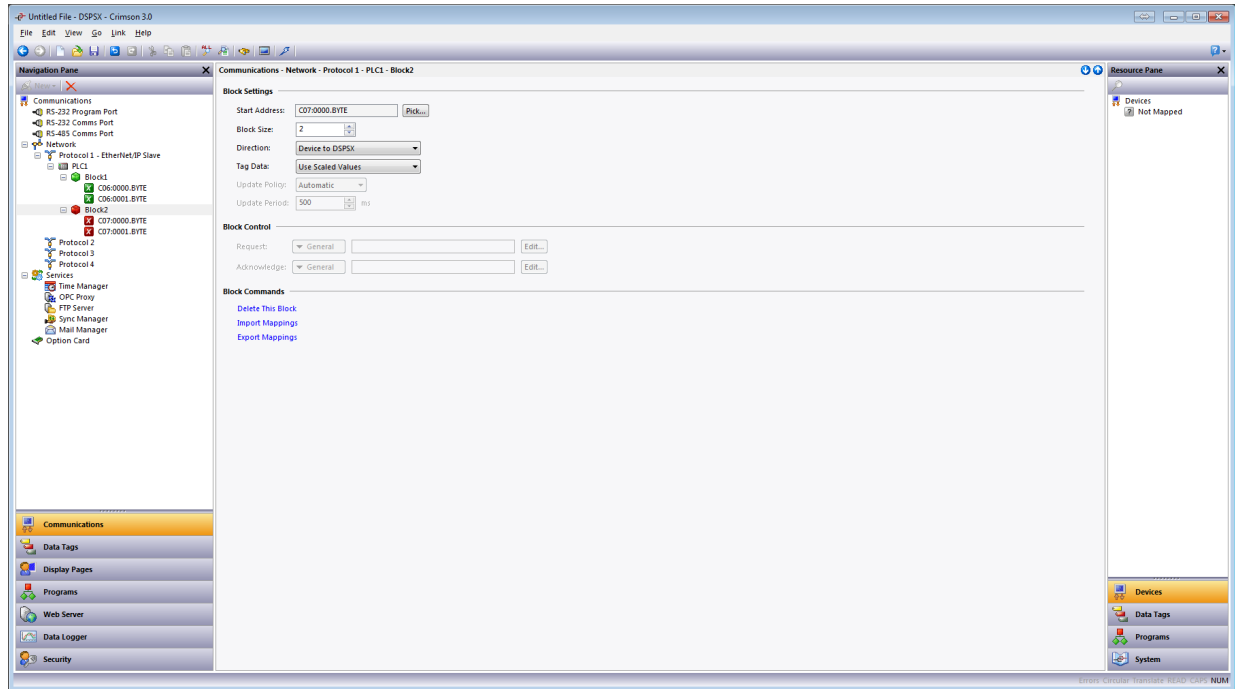


Figure 9.

- Referring to Figure 10, navigate to the Data Tags section.
- Create 4 new Numeric Tags by clicking *New* at the top of the Navigation Pane, four times. Note that four new data tags appear under Data Tags: *Tag1*, *Tag2*, *Tag3*, and *Tag4*.

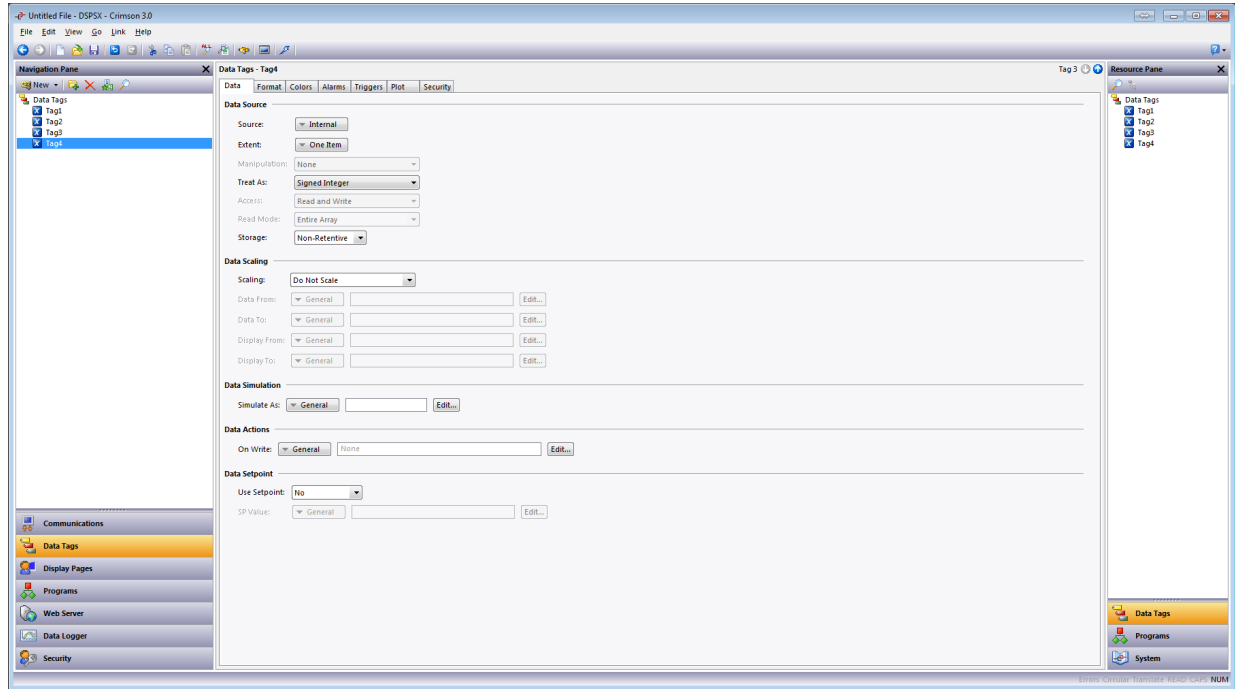


Figure 10.

- Referring to Figure 11, rename the tags to something application-specific; *R1*, *R2*, *W1*, and *W2* in this example.

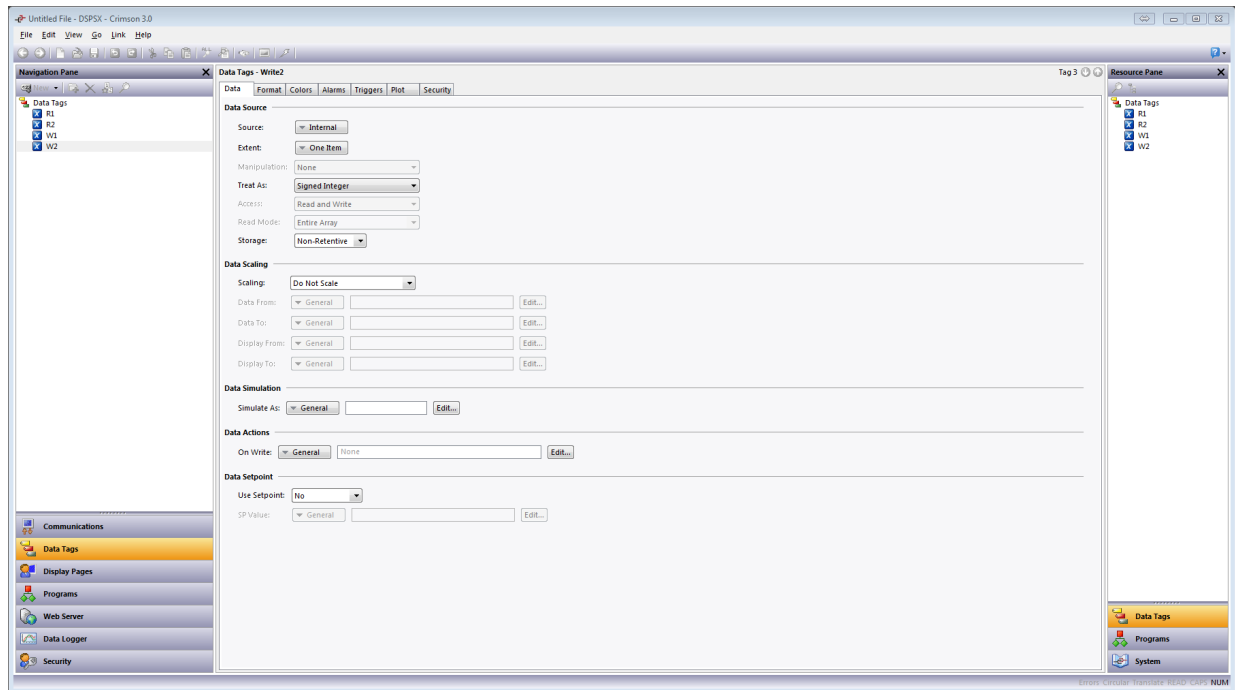


Figure 11.

5. Referring to Figure 12, navigate back to the Communications section.
6. Click on the first address below Block 1; *C06:000 BYTE* in this example.
7. Click on *Data Tags* in the Resource Pane.
8. Drag the *R1* tag from the Resource Pane to the address in the Navigation Pane.

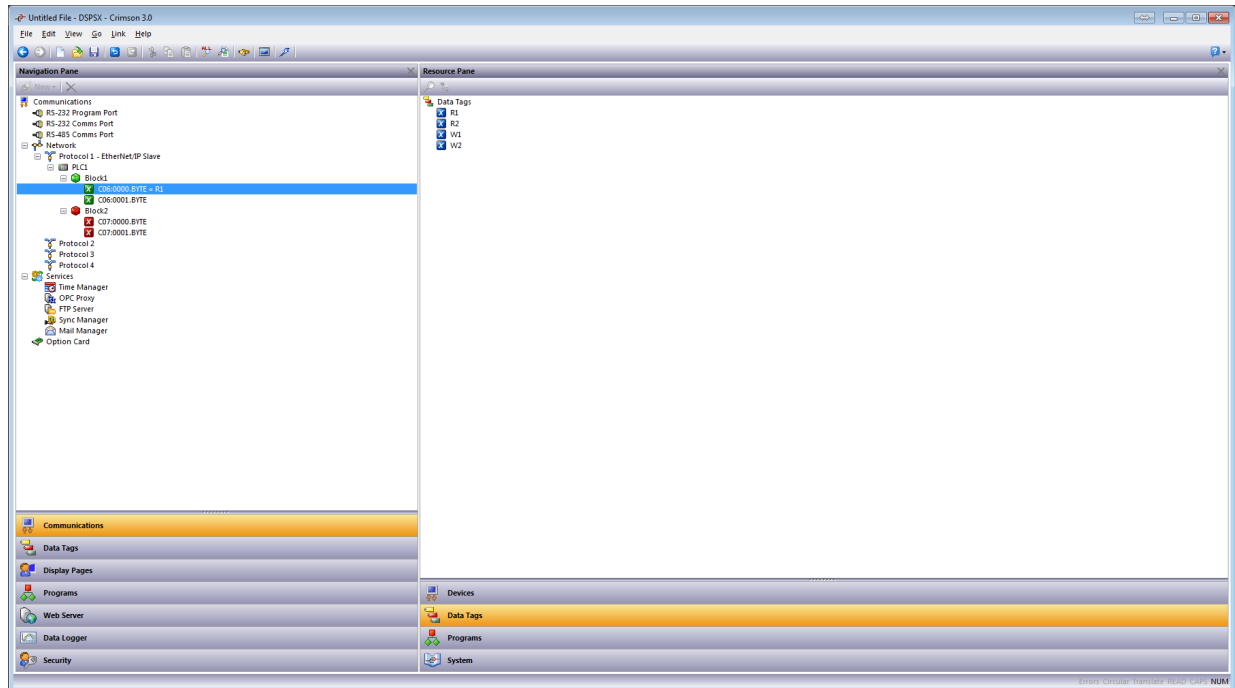


Figure 12.

9. Drag the remaining tags to their associated addresses. When complete, the Communications section will be updated with the new tags, as shown in Figure 13.

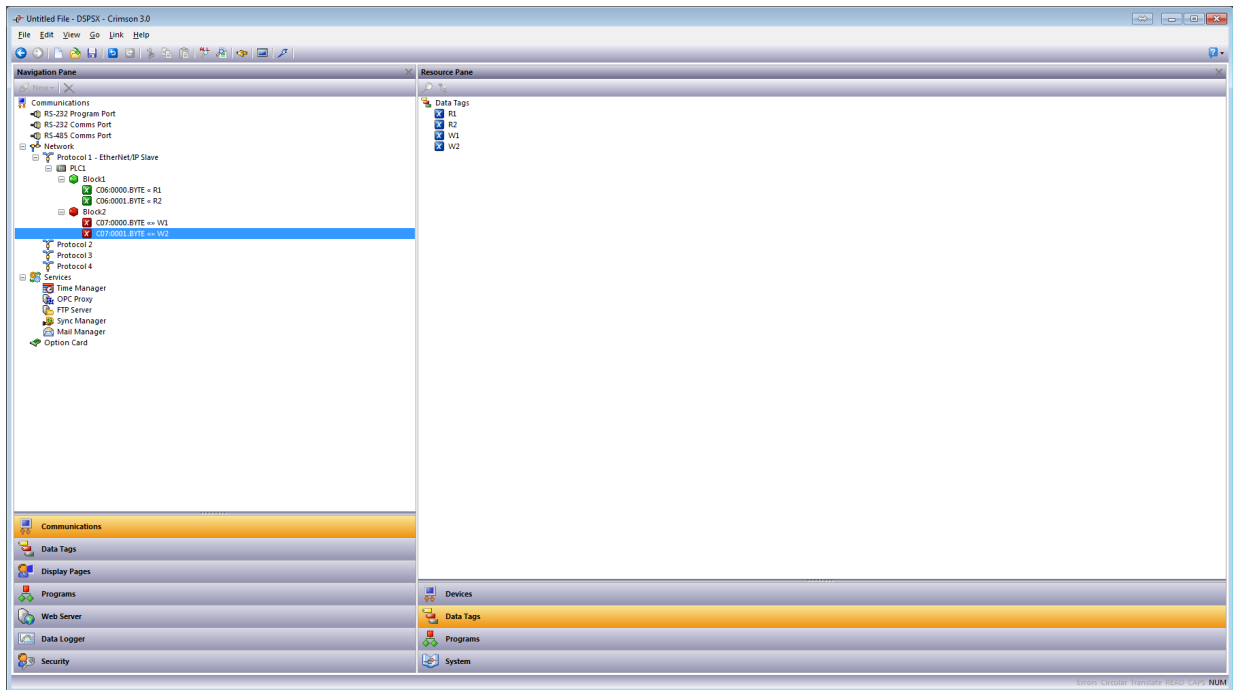


Figure 13.

10. Load the application into the device by clicking *Link-Update* from the menu bar.

Kuka Robot Configuration

Start the WorkVisual software and configure the robot by performing the following:

1. Specify Ethernet/IP protocol by right clicking on *Bus Structure*; the Project Structure popup shown in Figure 14 appears.
2. Click *Add...*

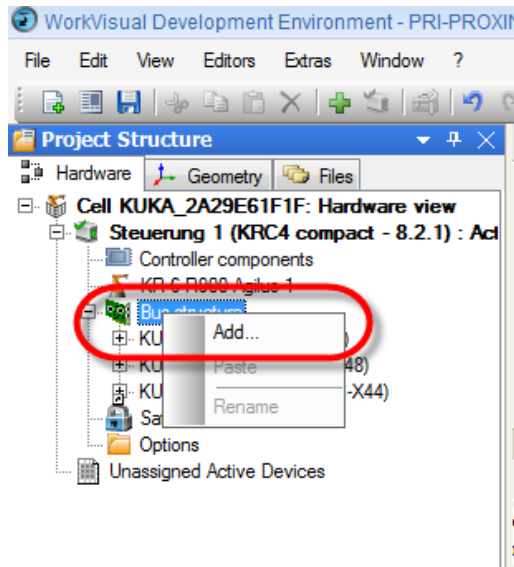


Figure 14.

- Referring to Figure 15, go to the Navigation Pane and select *EtherNet/IP*; the DTM Selection popup appears.
- Click the OK button; the EtherNet/IP - Settings tab popup shown in Figure 16 appears

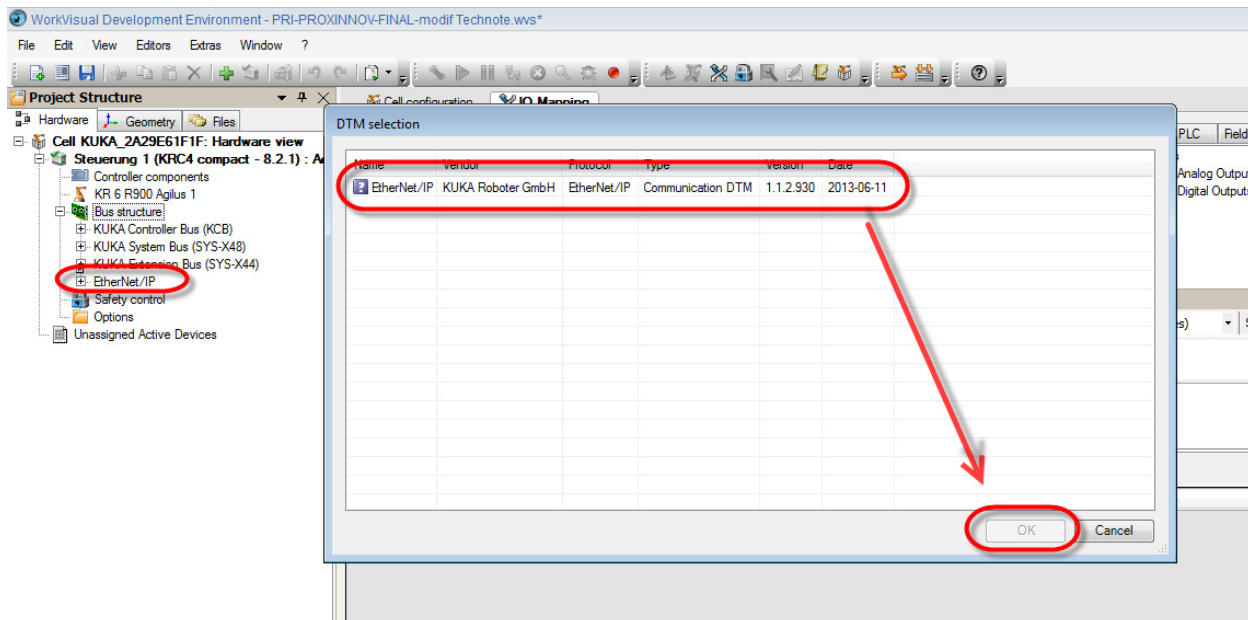


Figure 15.

5. Referring to Figure 16, go to the Navigation Pane and select *Bus structure>EtherNet/IP*; the Communications settings popup appears.
6. From the Communication settings tab, perform the following:
 - a. Go to the IP source address : field and select the computer network interface connected on the robot network; 172.31.1.149 in this example.
 - b. Go to the EtherNet/IP network detection: heading and configure the IP address range where the EtherNet/IP slave devices are defined. The IP address range consists of two fields, the Begin detection range address: field (172.31.1.1 in this example), and the End detection range address: field (172.31.1.254 in this example); both fields must be configured.
 - c. Go to the Scanner heading and configure the Scanner IP address: field; 172.31.1.147 in this example.

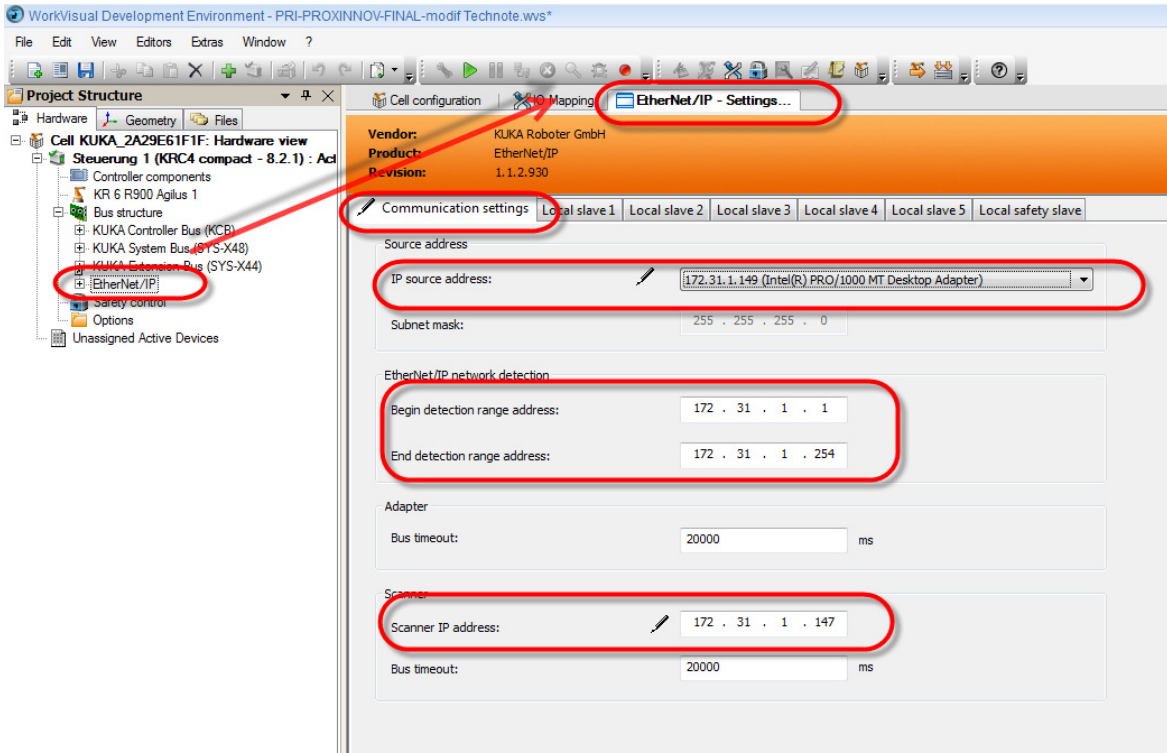


Figure 16.

7. Referring to Figure 17, expand *Bus structure - EtherNet/IP*, then right click on *Bus structure - EtherNet/IP - EtherNet IP*, and then click *Add...* in response to the popup; the DTM selection popup shown in Figure 18 appears.

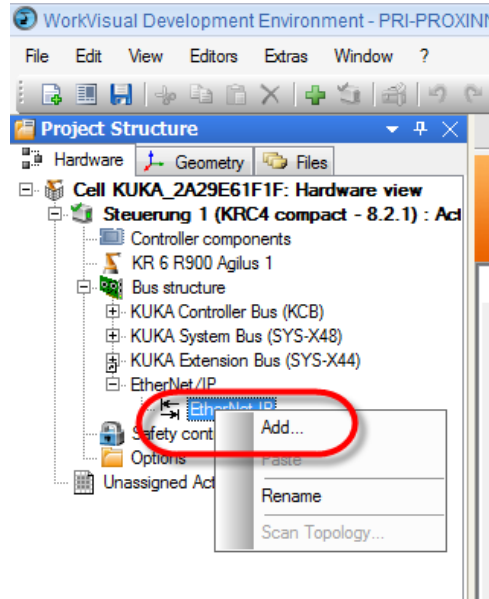


Figure 17.

8. Referring to Figure 18, select the protocol *Generic Device* from KUKA Roboter GmbH, and click the *OK* button; the Generic Device - Settings popup shown in Figure 19 appears.

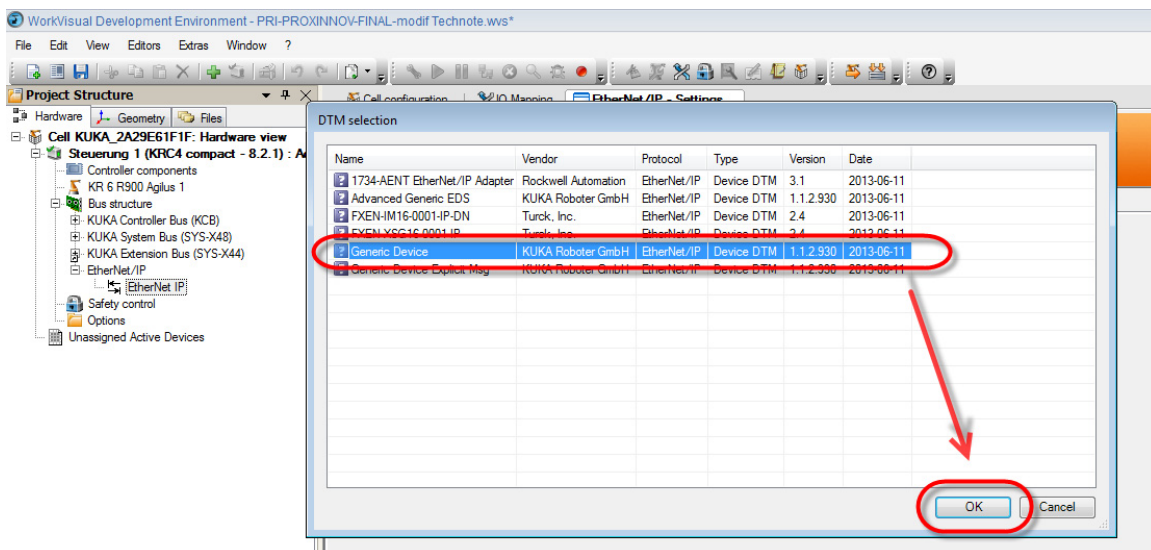


Figure 18.

9. Referring to Figure 19, double click on *Generic Device*.
10. Under the Address setting tab, go to the IP address : field and enter the Crimson product IP address; 172.31.1.148 in this example.

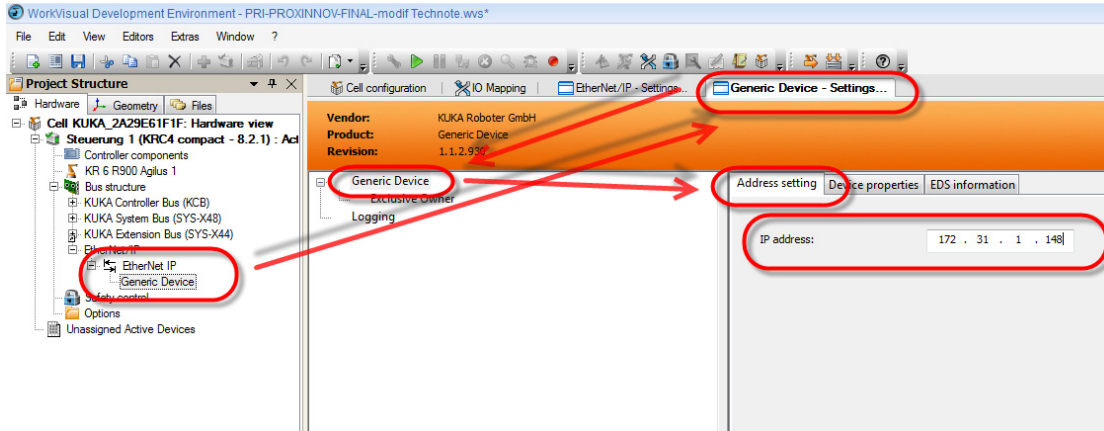


Figure 19.

11. Referring to Figure 20, click on the Device properties tab and enter the Device name : , *Red Lion - DSP* in this example, and click the *Apply* button.

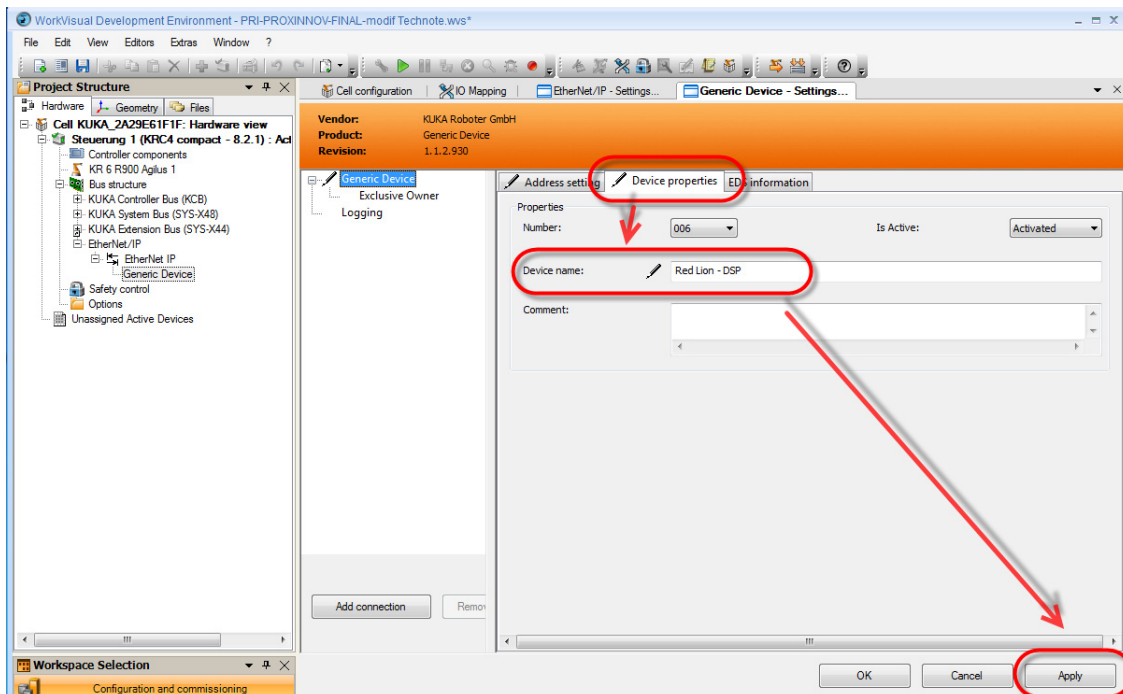


Figure 20.

12. Referring to Figure 21, configure the EtherNet/IP Inputs and Outputs by clicking on *Exclusive Owner – General*, and click the *Apply* button.

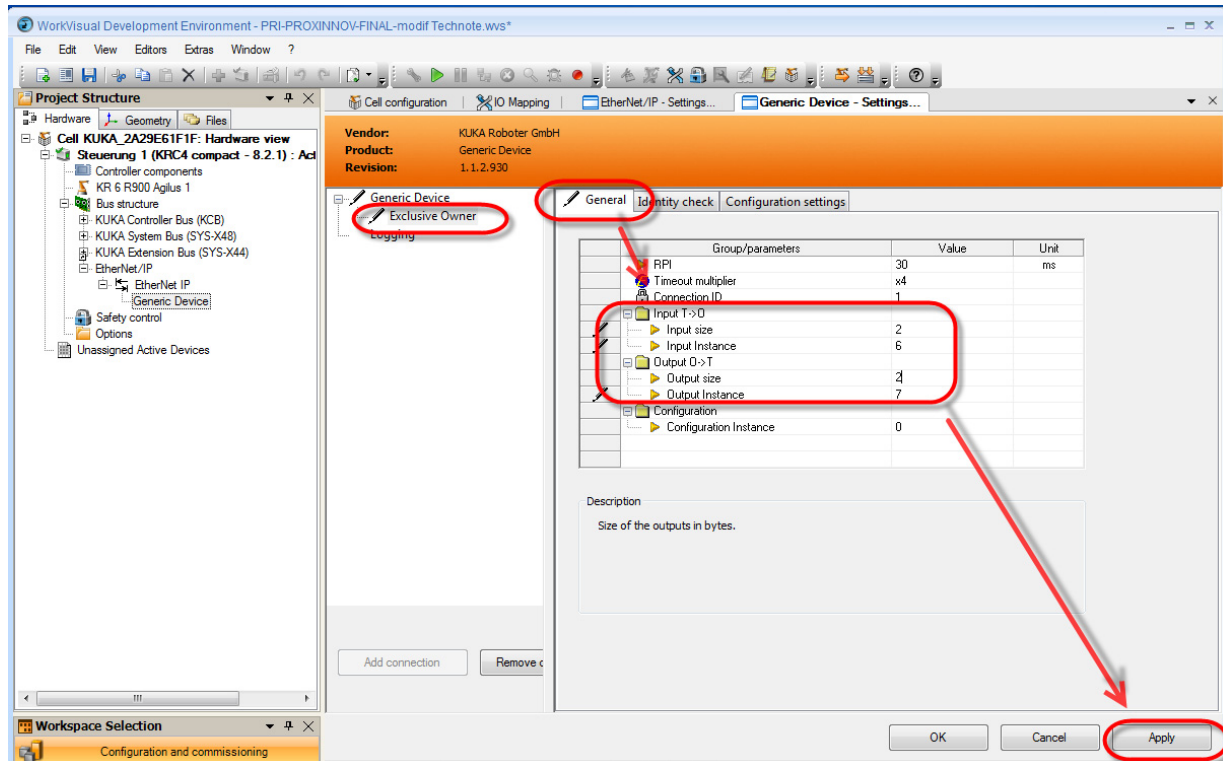


Figure 21.

- a. Referring to Figure 22, go to the `Input size:` field and enter the total number of Bytes the Crimson device reading block contains; 2 in this example.

Calculation examples:

- § With blocks containing 2 Byte type registers = 2 bytes size (shown here)
- § With blocks containing 2 word type registers = 4 bytes size
- § With blocks containing 4 byte type registers = 4 bytes size
- § With blocks containing 4 word type registers = 8 bytes size

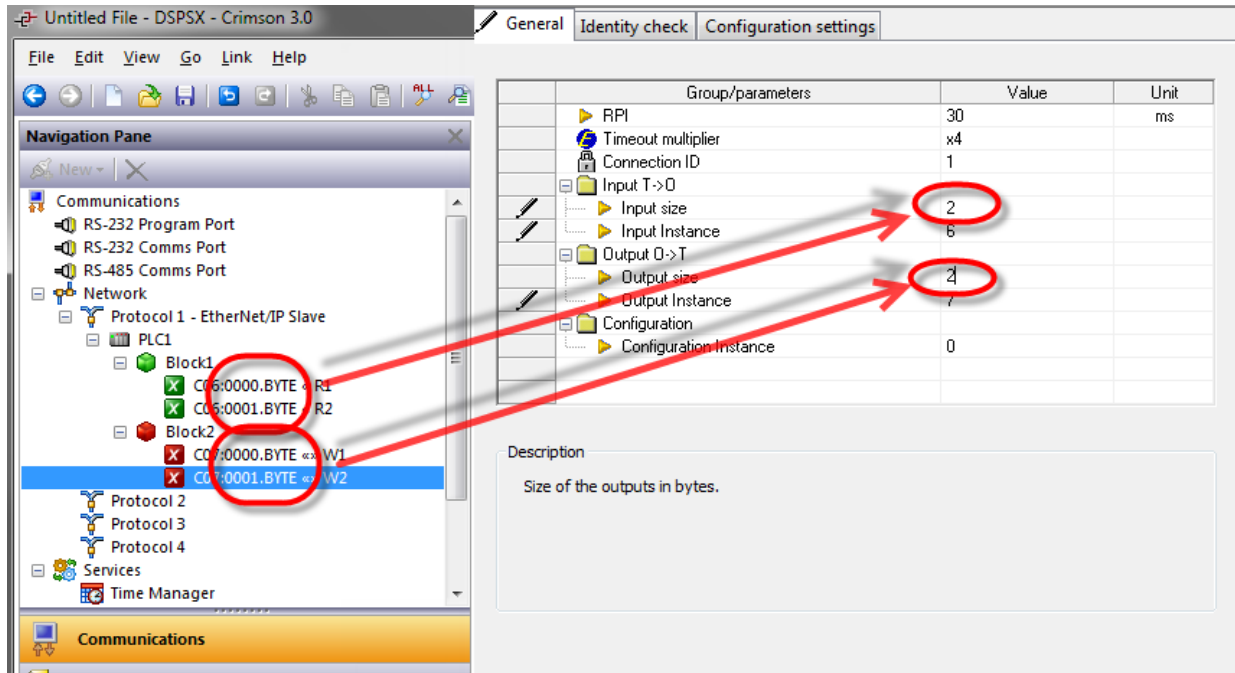


Figure 22.

- b. Referring to Figure 23, go the Input Instance : field and enter the Input Instance number; 6 in this example.
- c. Referring to Figure 23, go the Output Instance : field and enter the Output Instance number; 7 in this example.

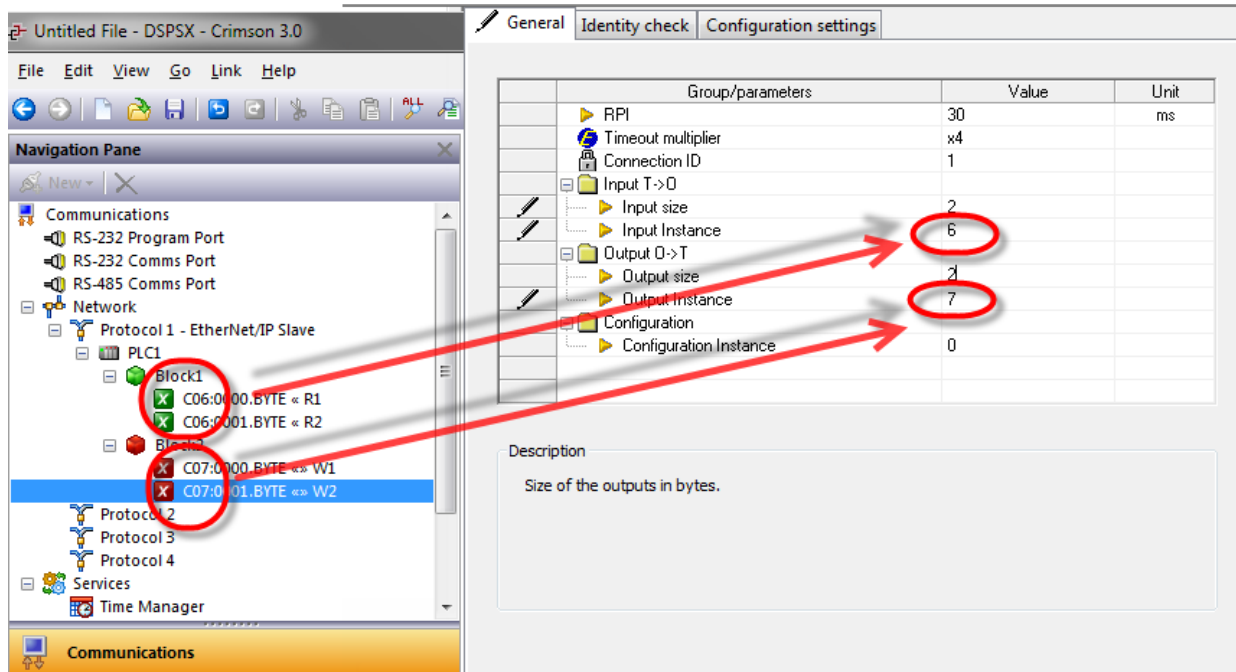


Figure 23.

Connect EtherNet/IP Register With Robot Inputs And Outputs

Refer to Figure 24 when performing the following steps to connect the EtherNet/IP Register to robot input/outputs.

1. Inputs Connection: this value has to be specified according the actual application.
 - a. Click on the *IO Mapping* tab or Icon.
 - b. From the top left window, select the *KR C I/Os* tab and the *Digital Inputs* folder.
 - c. From the top right window, select the *Fieldbusses* tab and the *EtherNet/IP - Generic Device* folder.
 - d. From the Bottom right window, select a communications input and drag and drop it to the desired robot input on the left bottom window.

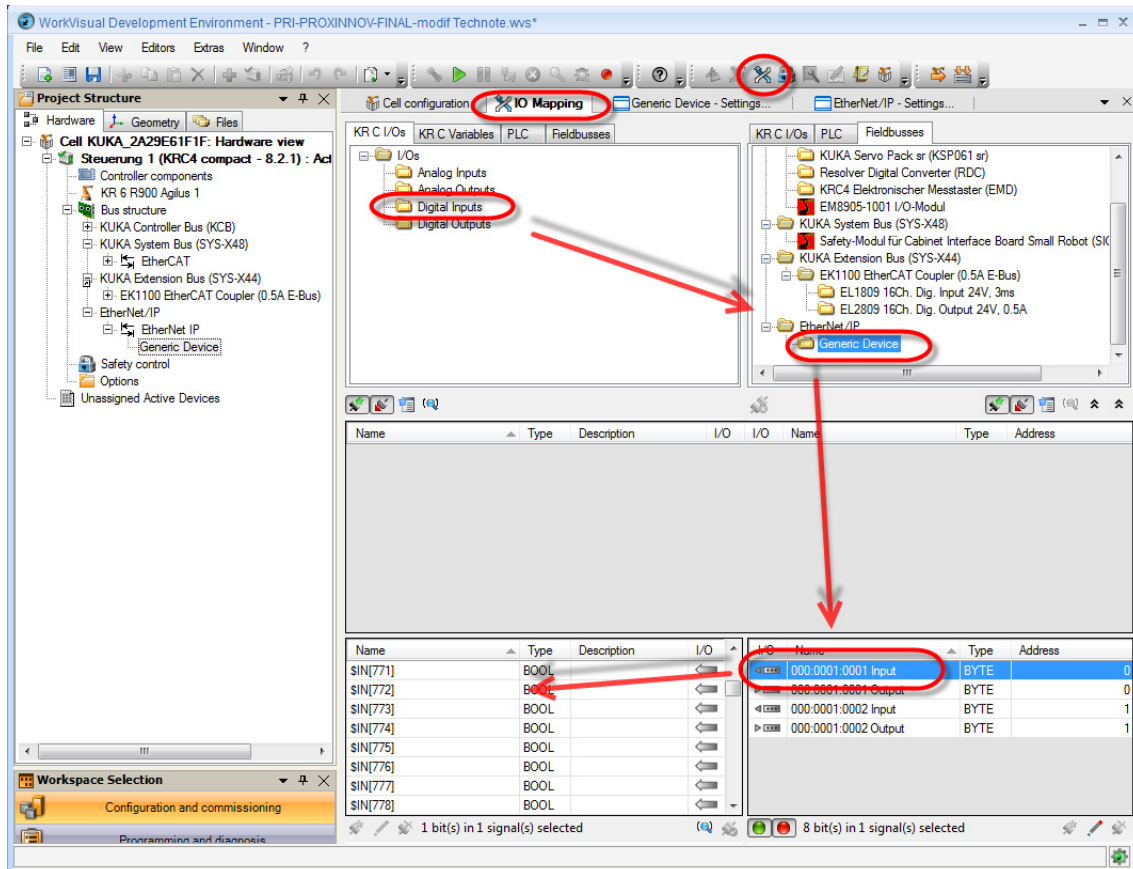


Figure 24.

2. When the Signal grouping information popup shown in Figure 25 appears, click the Yes button to enable several bits grouping to make a byte/word.

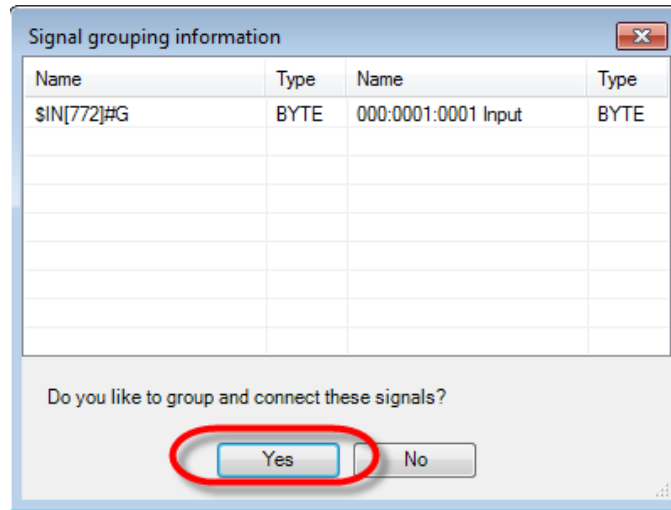


Figure 25.

3. Referring to Figure 26, repeat Steps 1 and 2 for both *Digital Outputs* and *EtherNet/IP Outputs*.

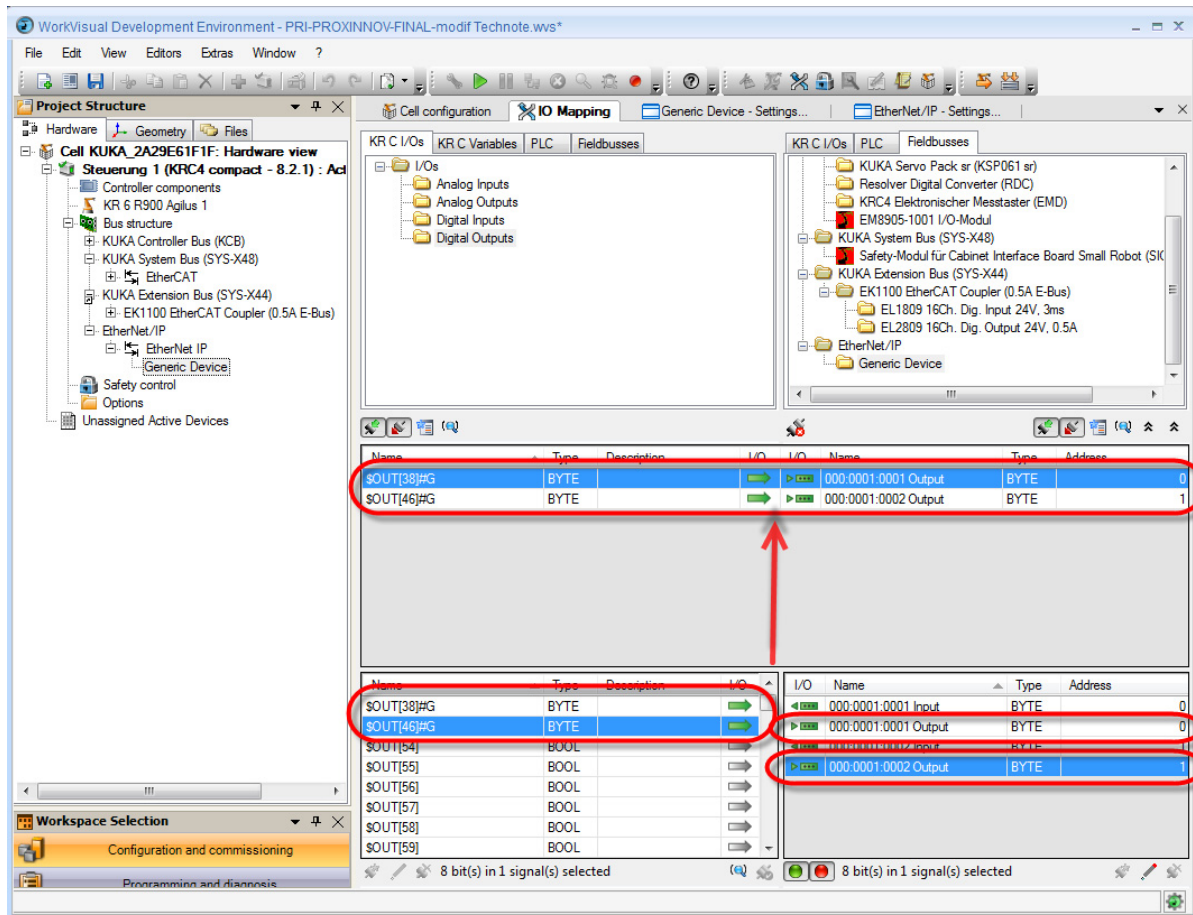


Figure 26.

Disclaimer

It is the customer's responsibility to review the advice provided herein and its applicability to the system. Red Lion makes no representation about specific knowledge of the customer's system or the specific performance of the system. Red Lion is not responsible for any damage to equipment or connected systems. The use of this document is at your own risk. Red Lion standard product warranty applies.

Red Lion Technical Support

If you have any questions or trouble contact Red Lion Technical Support by emailing support@redlion.net or calling 1-877-432-9908.

For more information: <http://www.redlion.net/support/policies-statements/warranty-statement>