Redundant Hart Communications Card Configuration Example

RTP Corporation
2832 Center Port Circle
Pompano Beach, FL 33064
Phone: (954) 597-5333
Internet: http://www.rtpcorp.com

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Hart Communications Card Configuration Overview

This document provides an example of how to configure the 3145 Analog Output card with Hart. Our hardware configuration example consists of connecting one of channel from the 3145 Analog Output Card to a Device with Hart Functionality.

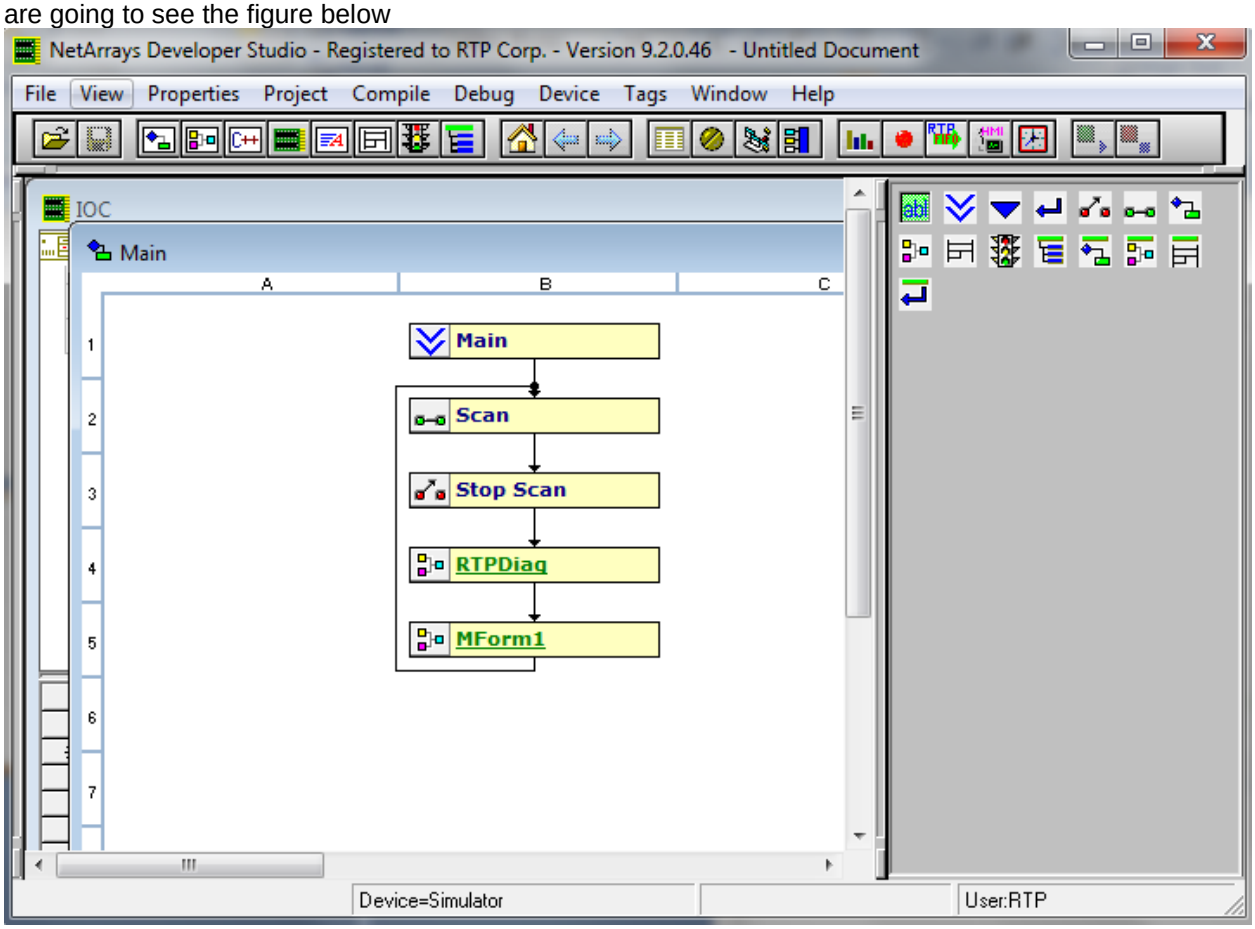
Hart Communications Card Installation

The channel 0 from the 3145 Analog Output card is connected to the Hart Device

In this example, the Hart Device will be powered by the 3145 Analog Output card..

Hart Protocol Port Configuration

- Open NetArrays and log in. If you have not created a user account please refers to the file ug-netsuite.pdf found in the directory C:\RTP NetSuite\Manuals. After logging in, you are going to see the figure below

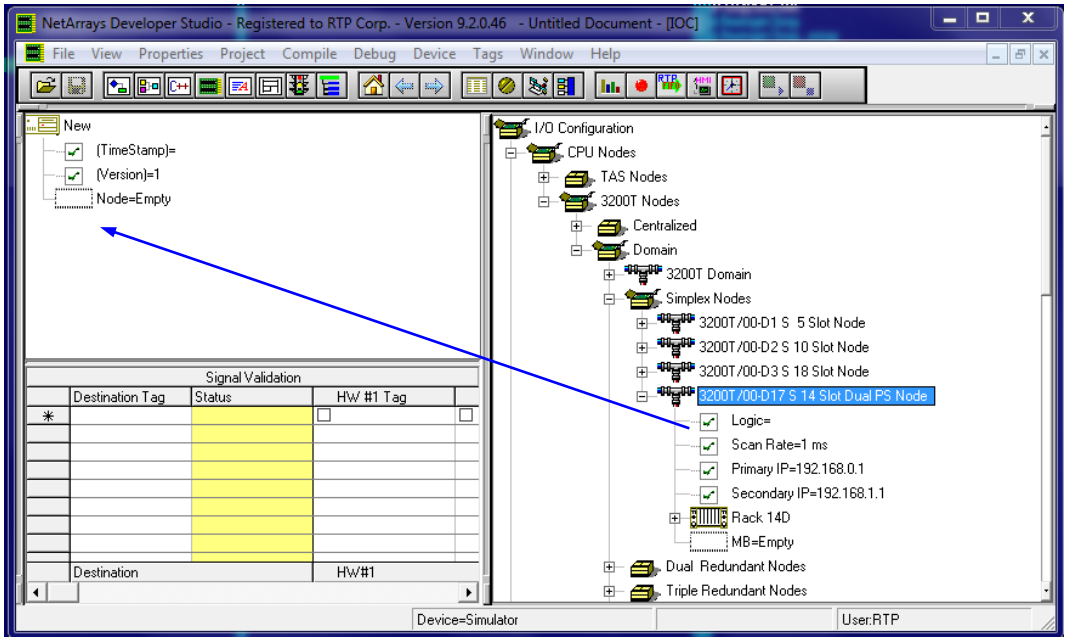


- Click on the I/O Configuration Studio button in the NetArrays main toolbar  .

Maximize the I/O Configuration form using the Maximize Icon.

- Drag an icon **RTP3200T Node** from the I/O Configuration Toolbox **CPU Nodes->3200T Nodes->Domain->Simplex Nodes folder** to the "**Node=Empty**" position on the I/O Configuration Form. For this example, the **RTP3200T/00-D17 S 14 Slot Dual PS Node** was chosen. Select an RTP3200T Node that matches your configuration. (This example shows a domain configuration).

I/O Configuration Form I/O Configuration Toolbox

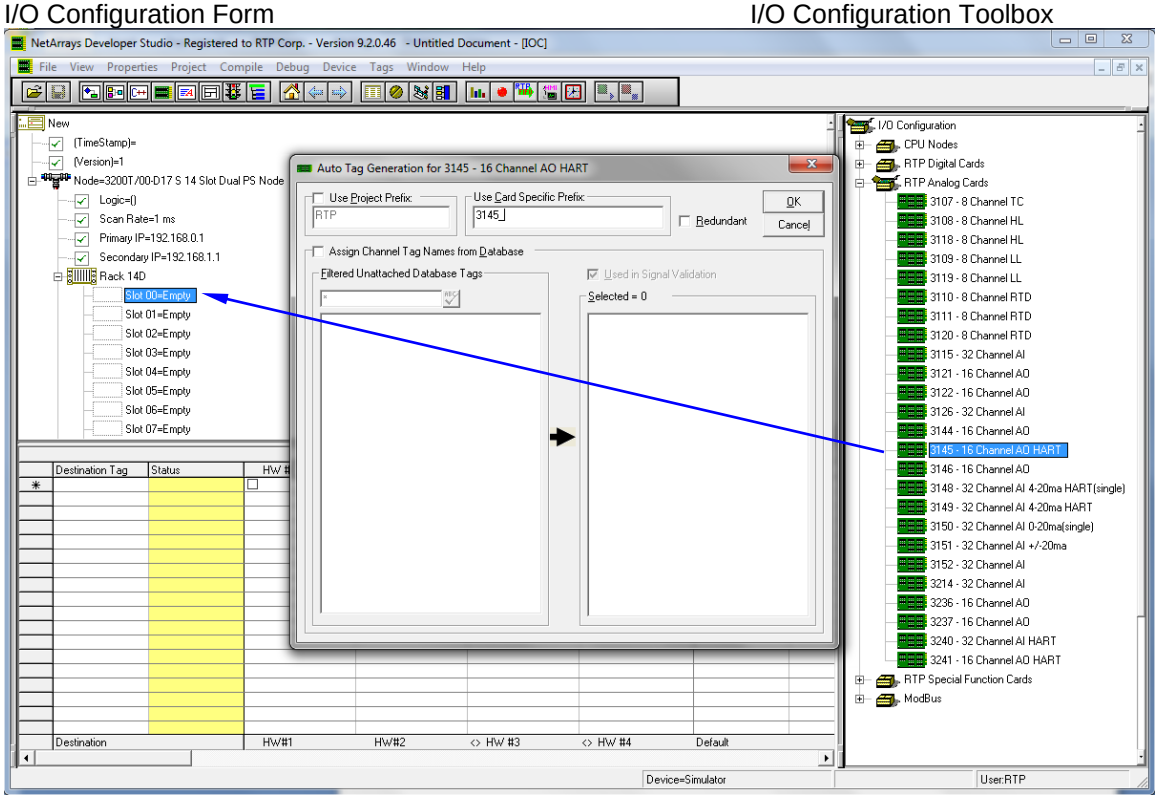


Add a Hart Communications Card

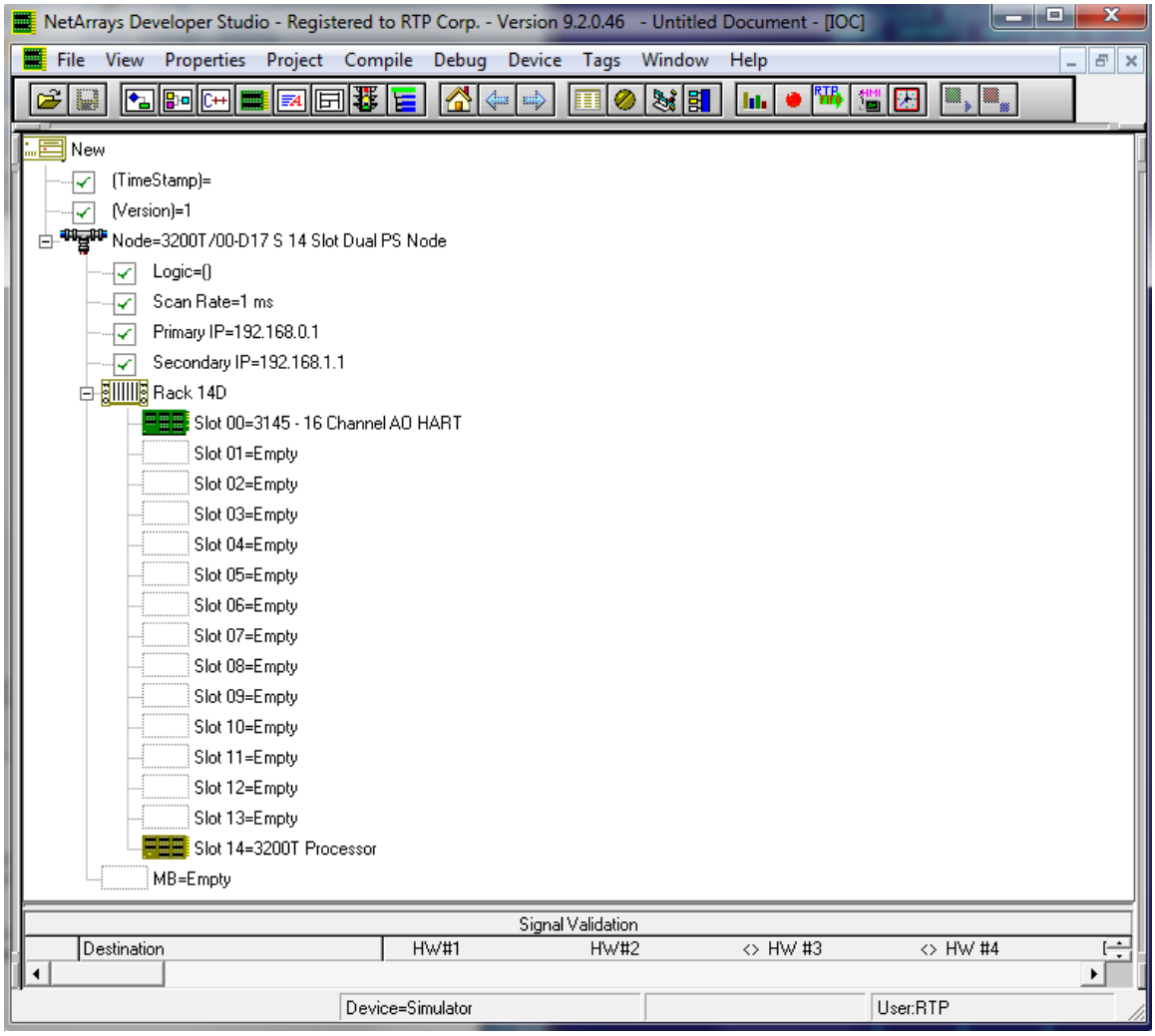
Add a Communications Card

- In the I/O Configuration Form, expand the “Rack 00=Rack 14D” (left-click on the ⊞). In the I/O Configuration toolbox expand the “RTP Analog Cards” branch (left-click on the ⊞). Drag the “3145- 16 Channel AO Hart” icon to the “Slot 00=Empty”. The Auto Tag Generation dialogue box will appear. Type in “3145_” and click OK. The Prefix of the Tag names for the Hart Communications Card will be set to “3145_”.

I/O Configuration Form I/O Configuration Toolbox



After adding the card the system configuration will look like this.

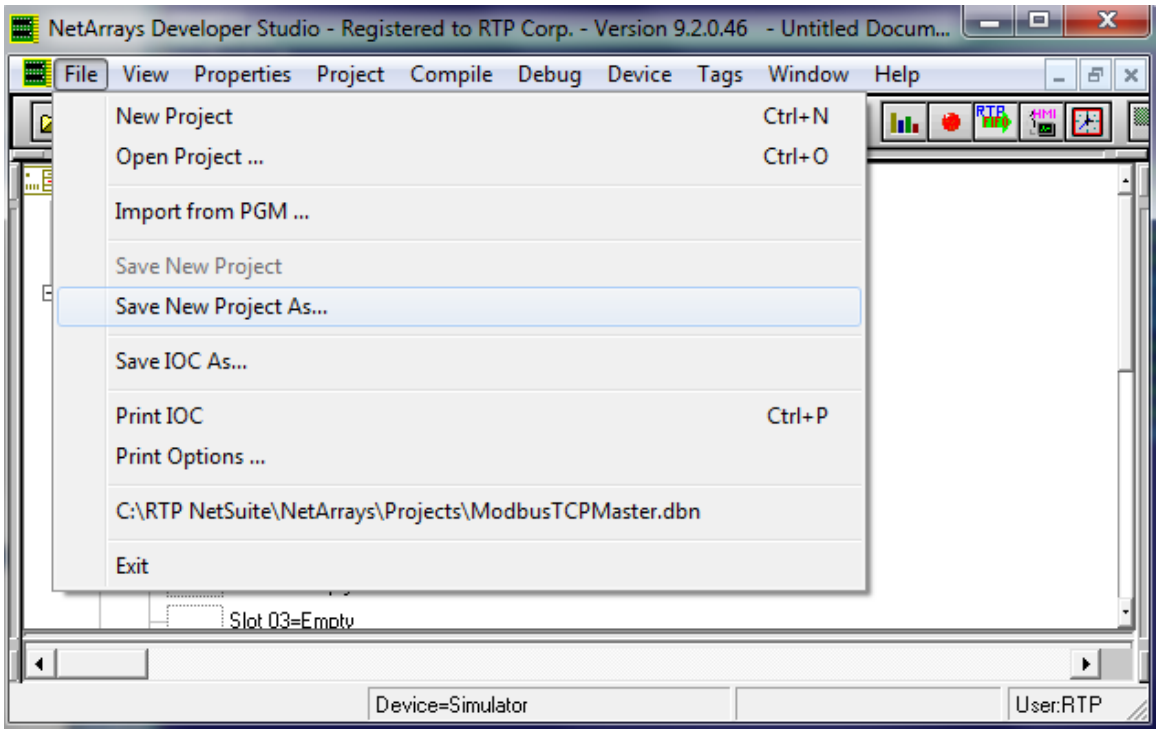


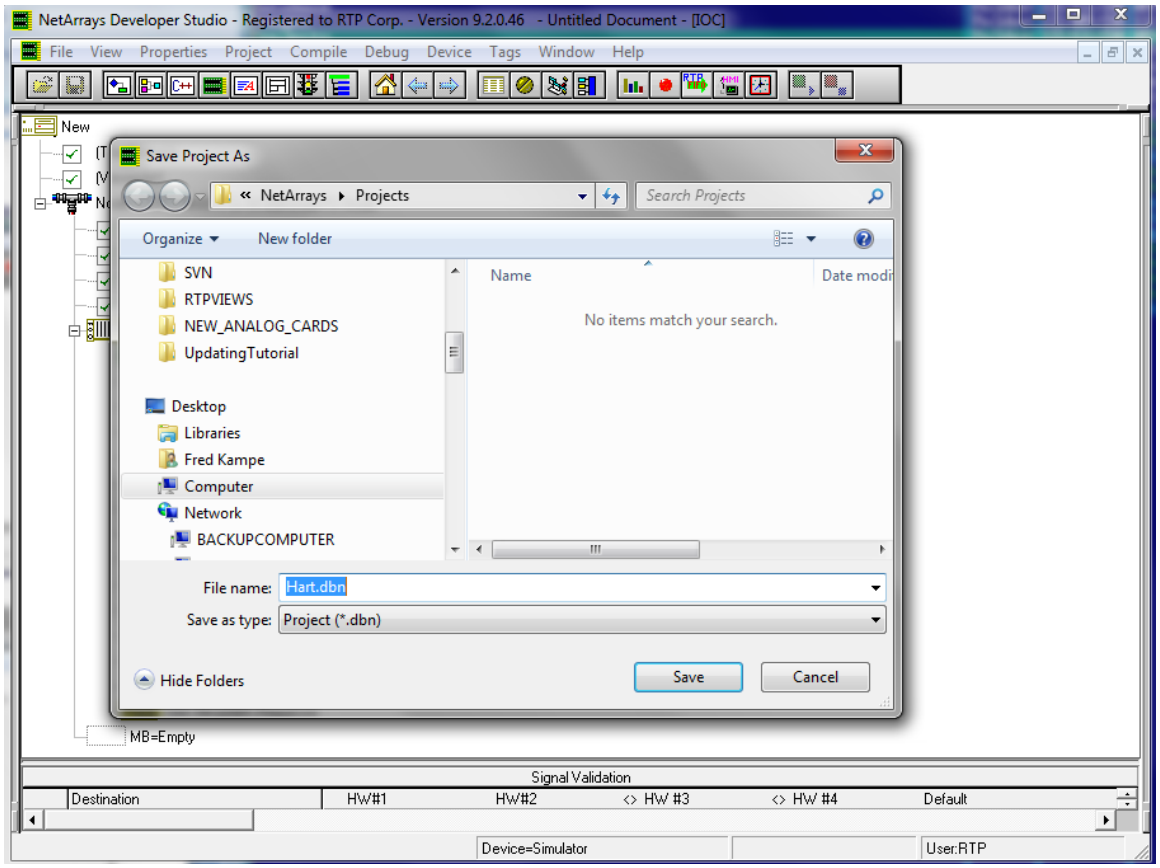
NetArrays Project Program

You have completed the I/O configuration of the Hart Communications Card. The next step is to add some logic to the NetArrays project program to test the card's operation.

Save the Project

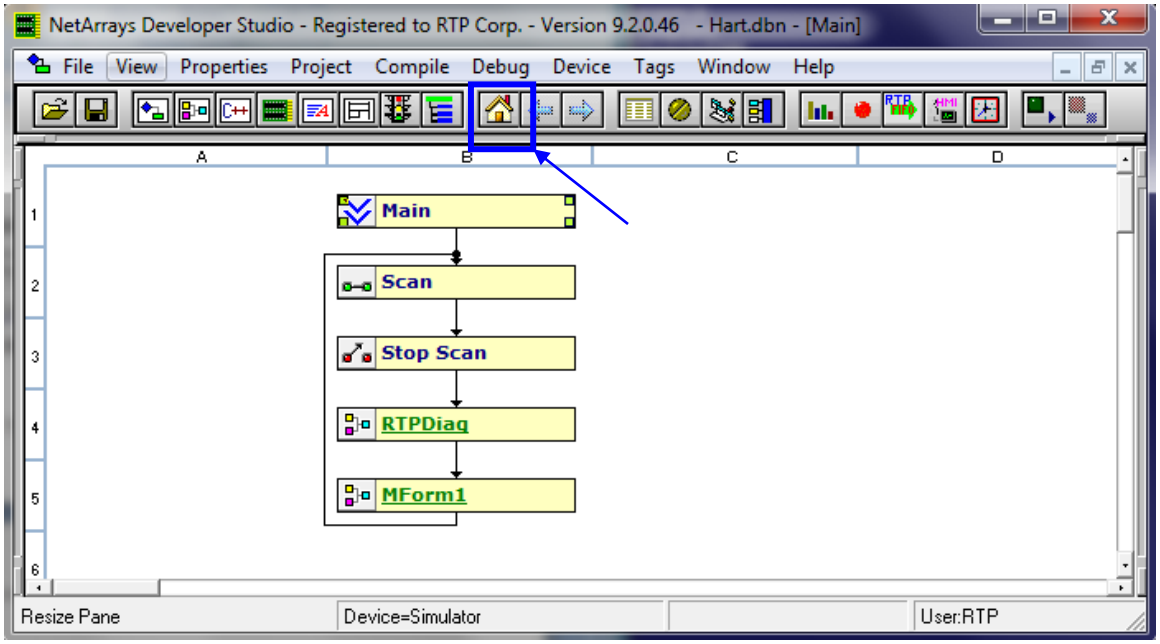
- First save the project. From the NetArrays **File** menu select **Save New Project As…** type the project name in **File name:** and click **Save** (We used "Hart".)


NetArrays Developer Studio - Registered to RTP Corp. - Version 9.2.0.46 - Untitled Docum...
File View Properties Project Compile Debug Device Tags Window Help
New Project Ctrl+N
Open Project ... Ctrl+O
Import from PGM ...
Save New Project
Save New Project As...
Save IOC As...
Print IOC Ctrl+P
Print Options ...
C:\RTP NetSuite\NetArrays\Projects\ModbusTCPMaster.dbn
Exit
Slot 03=Empty
Device=Simulator
User:RTP

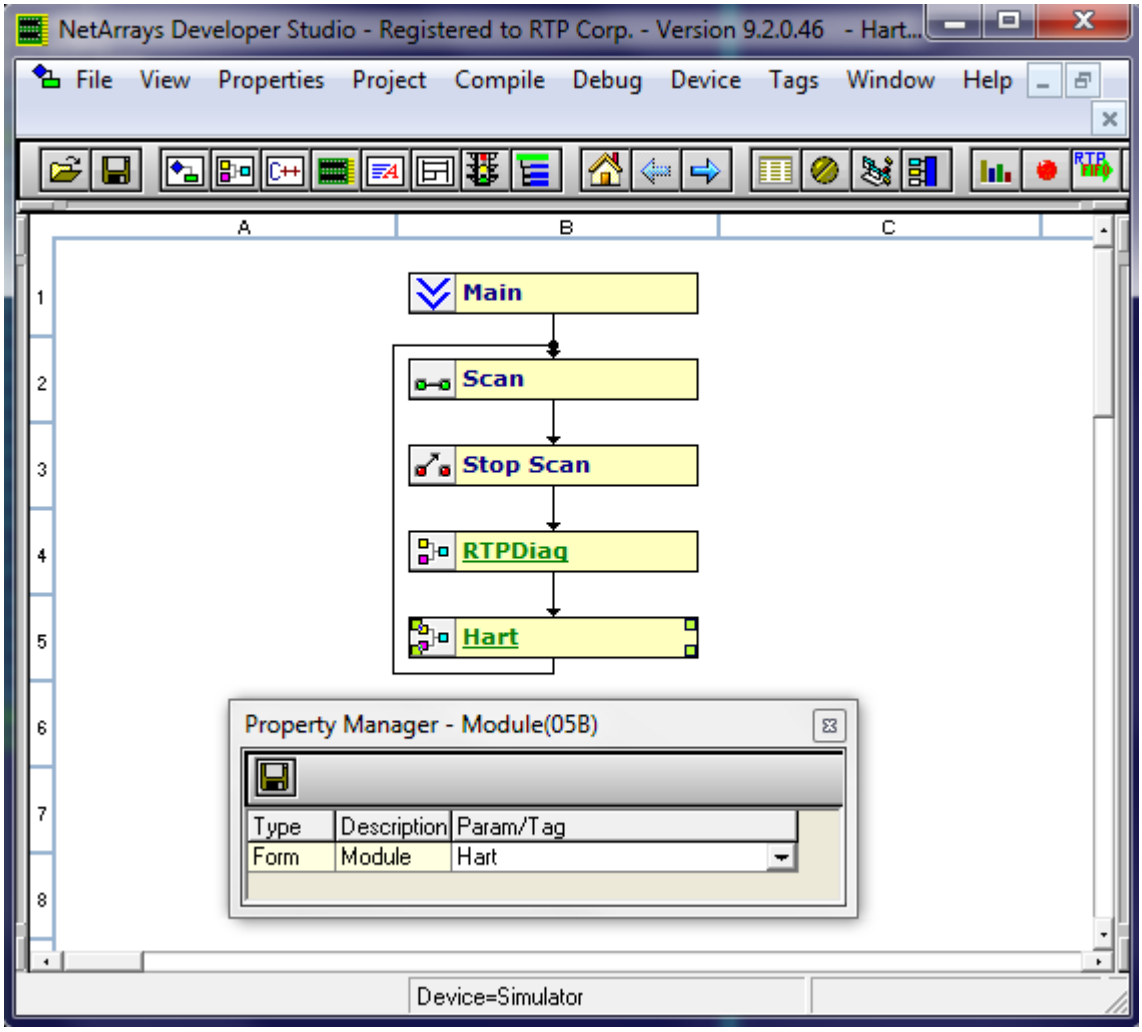

NetArrays Developer Studio - Registered to RTP Corp. - Version 9.2.0.46 - Untitled Document - [IOC]
File View Properties Project Compile Debug Device Tags Window Help
New
Save Project As
« NetArrays ▸ Projects
Search Projects
Organize New folder
SVN
RTPVIEWS
NEW_ANALOG_CARDS
UpdatingTutorial
Name
Date modi
No items match your search.
Desktop
Libraries
Fred Kampe
Computer
Network
BACKUPCOMPUTER
File name: Hart.dbn
Save as type: Project (*.dbn)
Hide Folders
Save
Cancel
MB=Empty
Signal Validation
Destination HW#1 HW#2 <> HW #3 <> HW #4 Default
Device=Simulator
User:RTP

Modify the Main Flow Chart Form

In Modbus Hart.dbn project, click on the  icon.

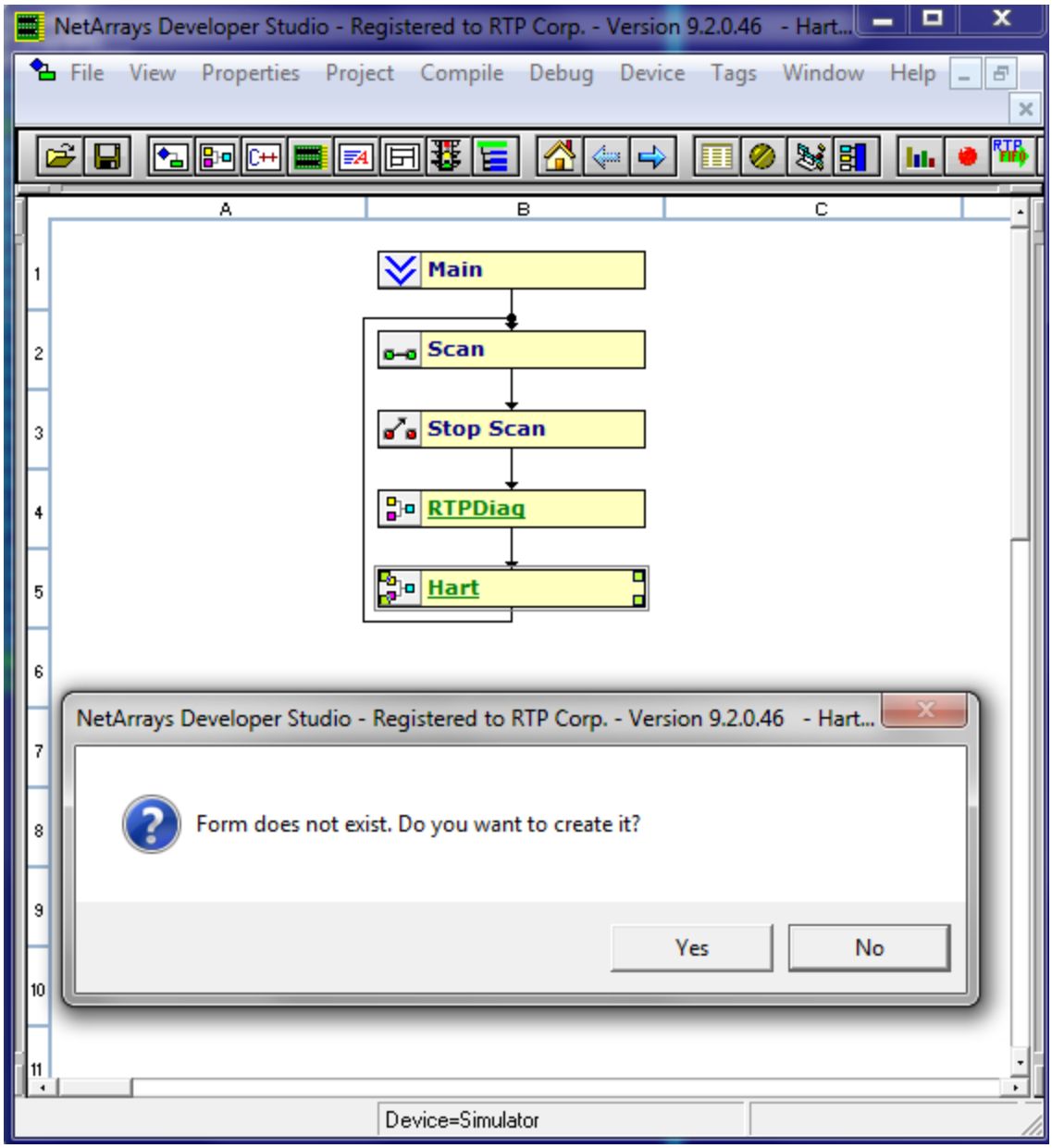


- Right click on the **MForm1** and select **Properties** from the pop-up menu. In the Property Manager display, type in the Tag name **Hart**, followed by **Enter**. Close the Property Manager display

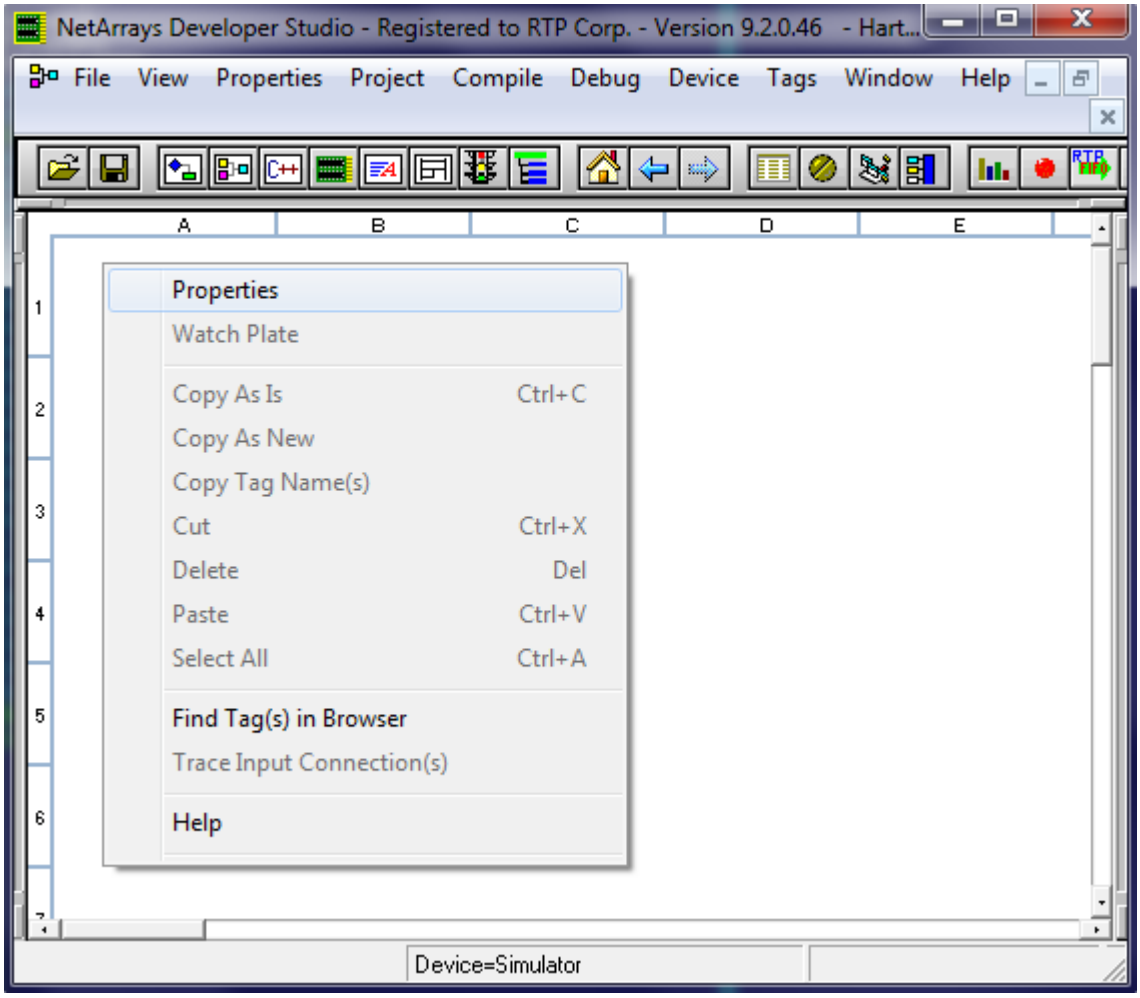


Construct the Hart Module Form

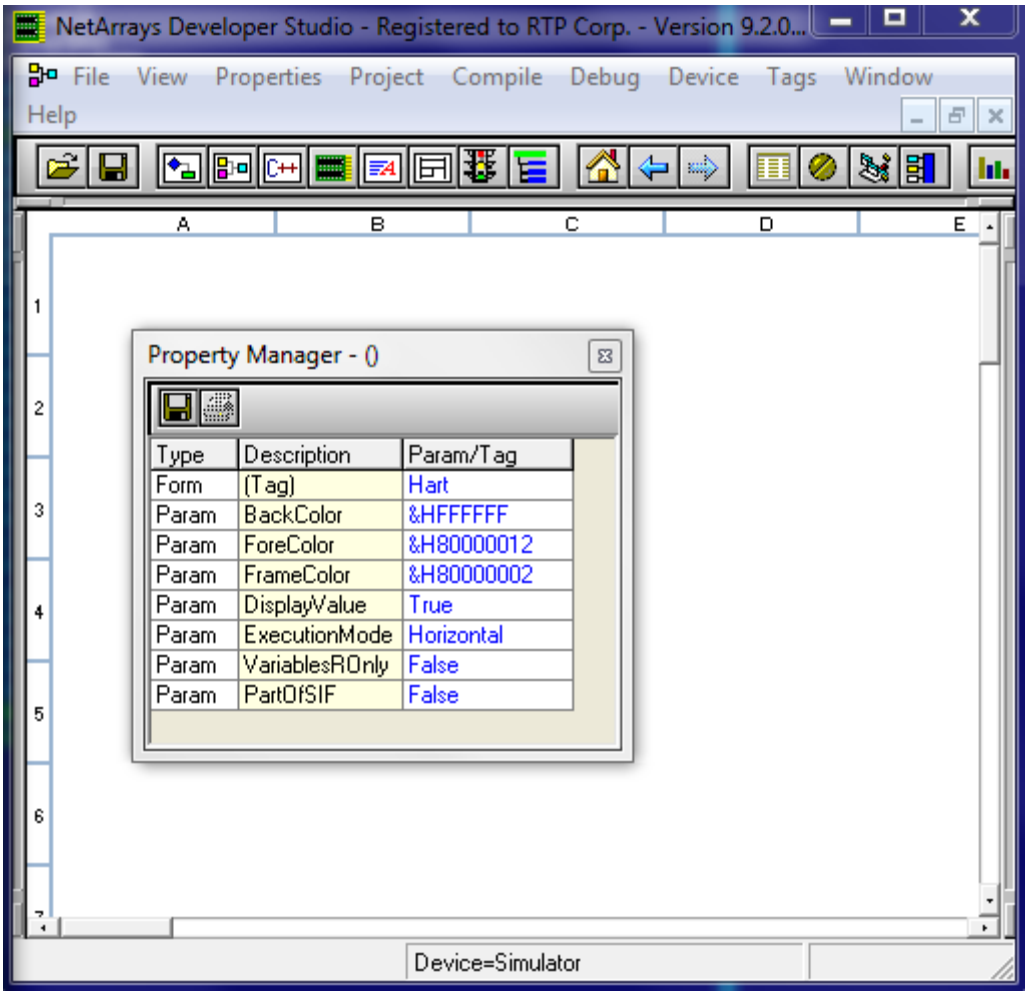
- Double-click on the **Hart Module Form** to display the module form.
- Select **Yes** to open **Hart**.



Right click in a blank area of the page and select **Properties**.



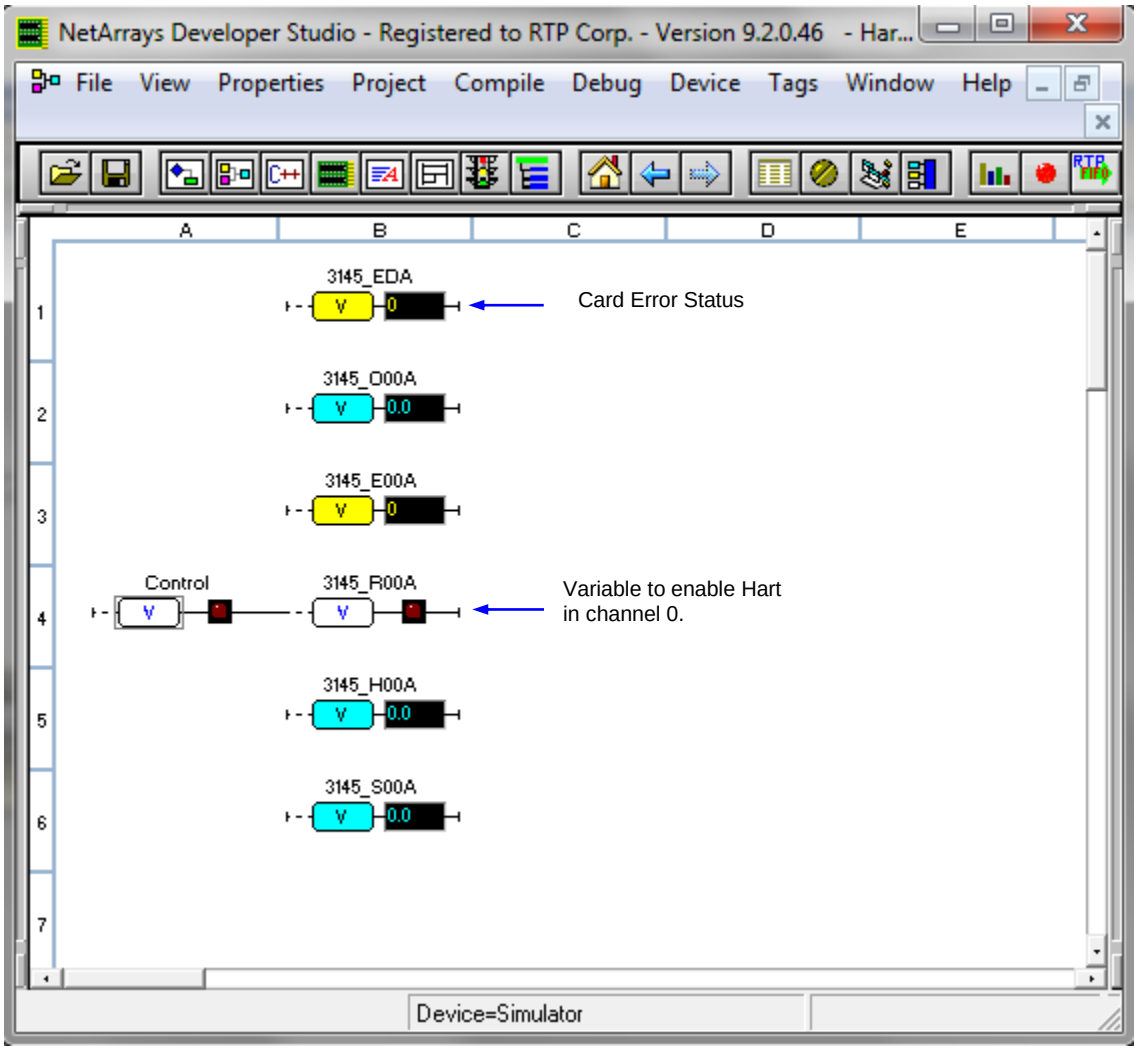
- Set "**PartOfSIF**" and "**VariablesROnly**" **False**. Close the **Property Manager** Window.



- Place the objects into the Module Form and connect the inputs to the outputs as shown in the following figures. Note: When entering a Tag name, you can either type the entire name or start typing the name and select the name from the available existing Tags. All of the I/O Tags will already exist as a function of the Auto Tag Generator. The Tag Prefix will be Hart_

Cell	Object	Properties
B1	Int Variable	(Tag) = 3145_EDA
B2	Float Variable	(Tag) = 3145_O00A
B3	Int Variable	(Tag) = 3145_E00A
A4	Bool Variable	(Tag) = Control
B4	Bool Variable	(Tag) = 3145_R00A
B5	Float Variable	(Tag) = 3145_H00A
B6	Float Variable	(Tag) = 3145_S00A

Note: Any properties not listed are to remain at their default value.

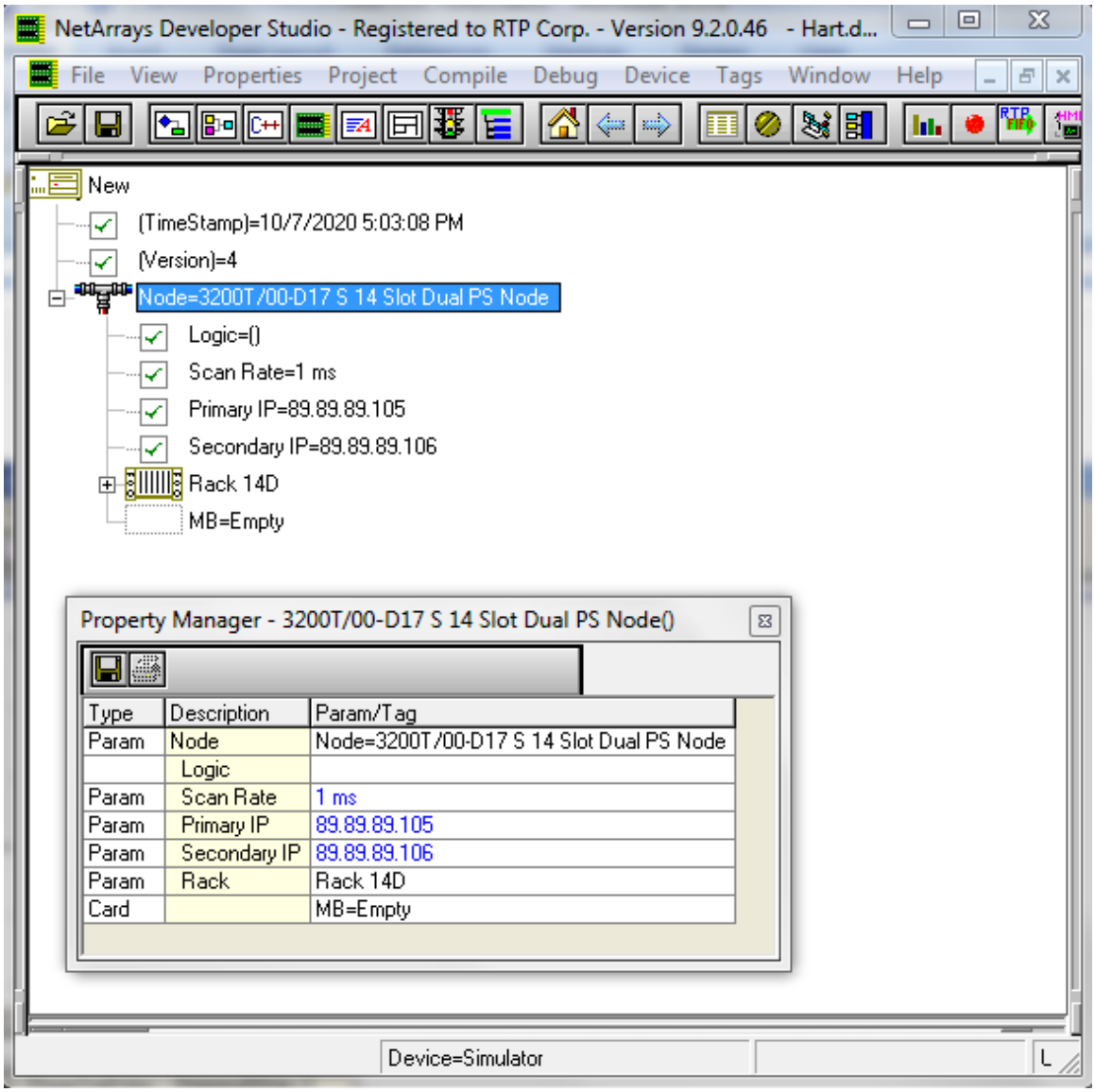


The following addresses are going to be used for the system node in this example:

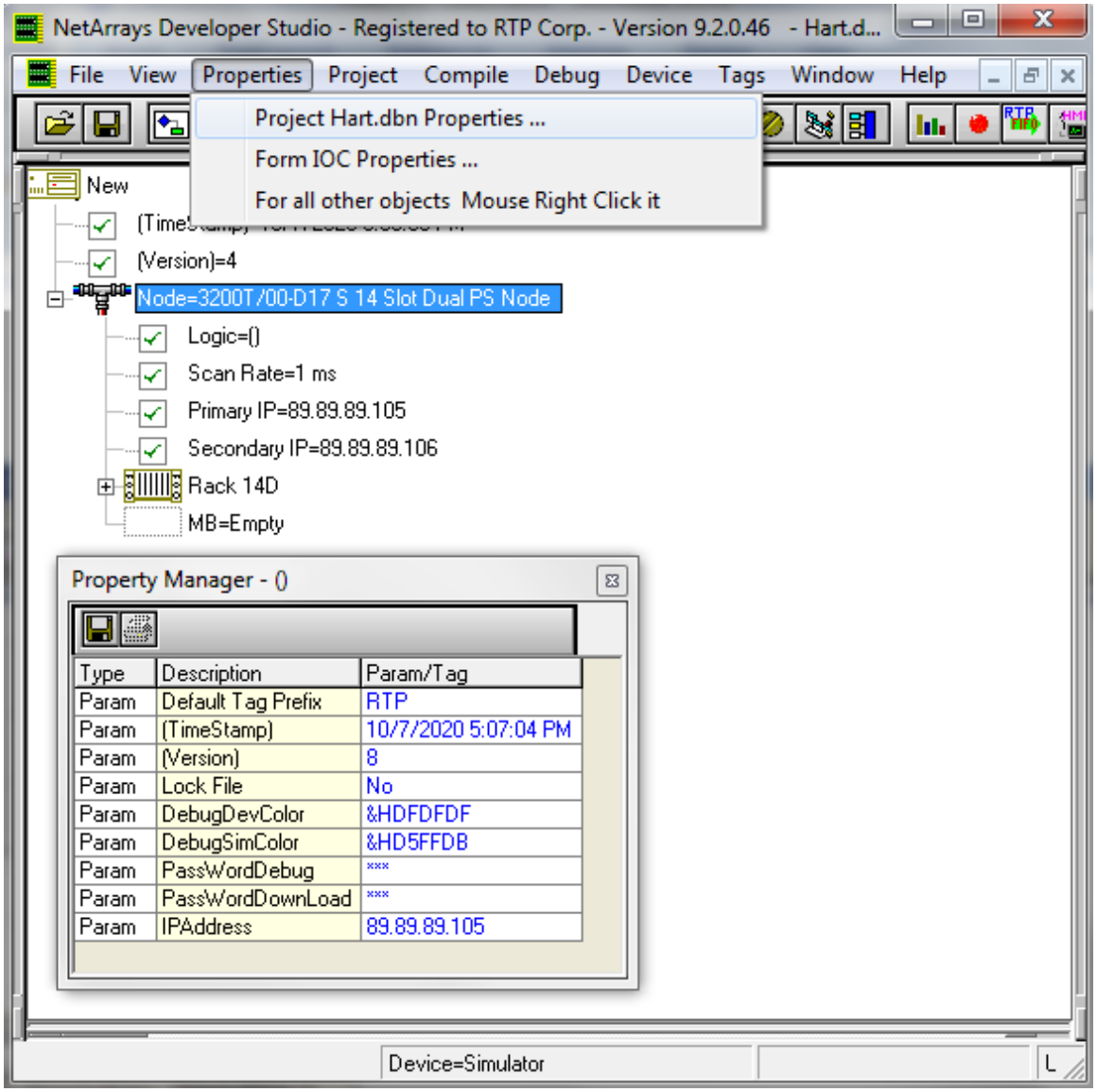
Device Name	Type	IP Address1	IP Address 2
Hart	Single	89.89.89.105	89.89.89.106

Enter Node IP Address and Save File for the Hart Project.

- Left Click on **Node=3200T/00-D17 S 14 Slot Dual PS Node,** select **Properties**, and enter the IP Addresses of your RTP3201T Node Processor (Primary IP **89.89.89.105** and Secondary IP **89.89.89.106** as shown in the picture below.)



- Click on **Properties,** select **Project Serial.dbn** (name of the NetArrays project) **Properties**, and enter the IP Address of your RTP3201T Node Processor (**89.89.89.105** is shown as an example) in the **IPAddress** field in the **Property Manager** window.



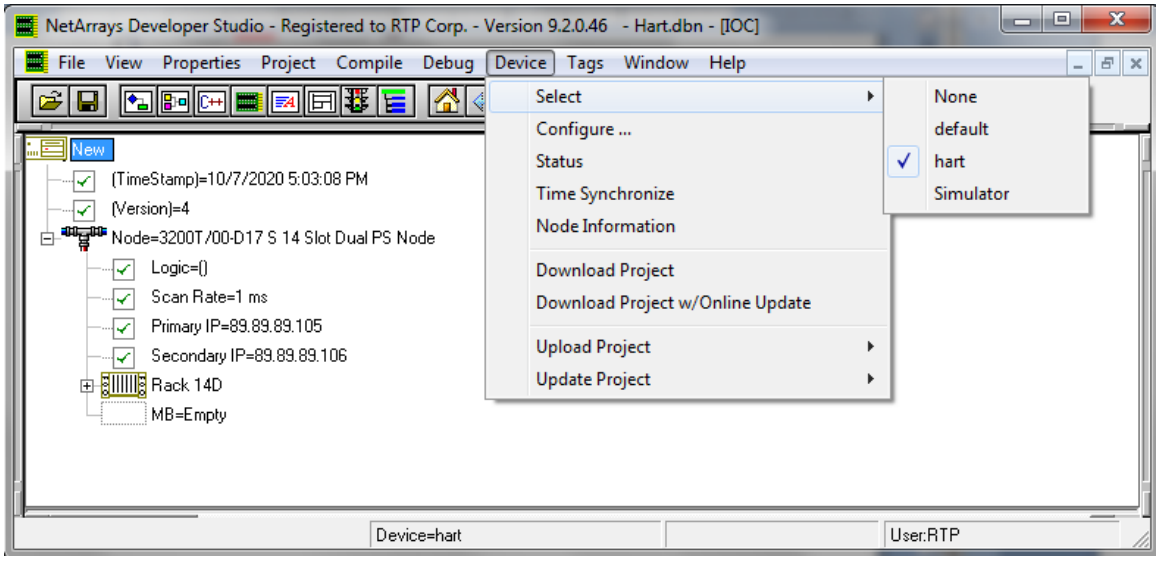
Note that **PassWordDebug** and **PassWordDownload** are set to "**rtp**" by default. If your RTP3200T Node has different passwords, change the **Properties** to match. Then use **<u>your</u>** passwords for the download and debug steps instead of "**rtp**".

- Save the project. From the NetArrays **File** menu select **Save Hart.dbn** (note that the name will be different if you saved the project file under another name).

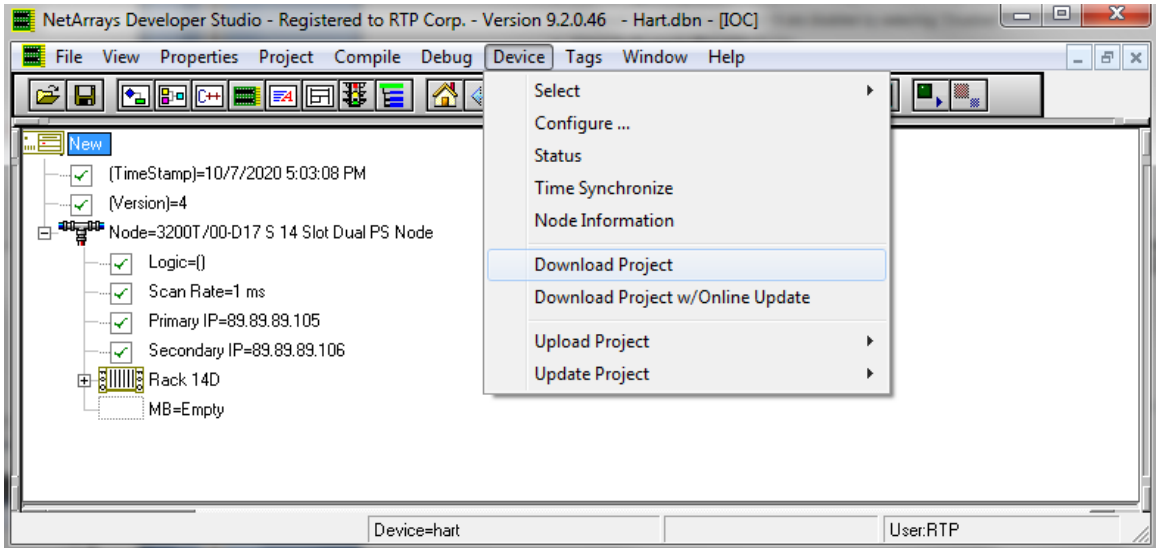
Verification

Downloading the Program

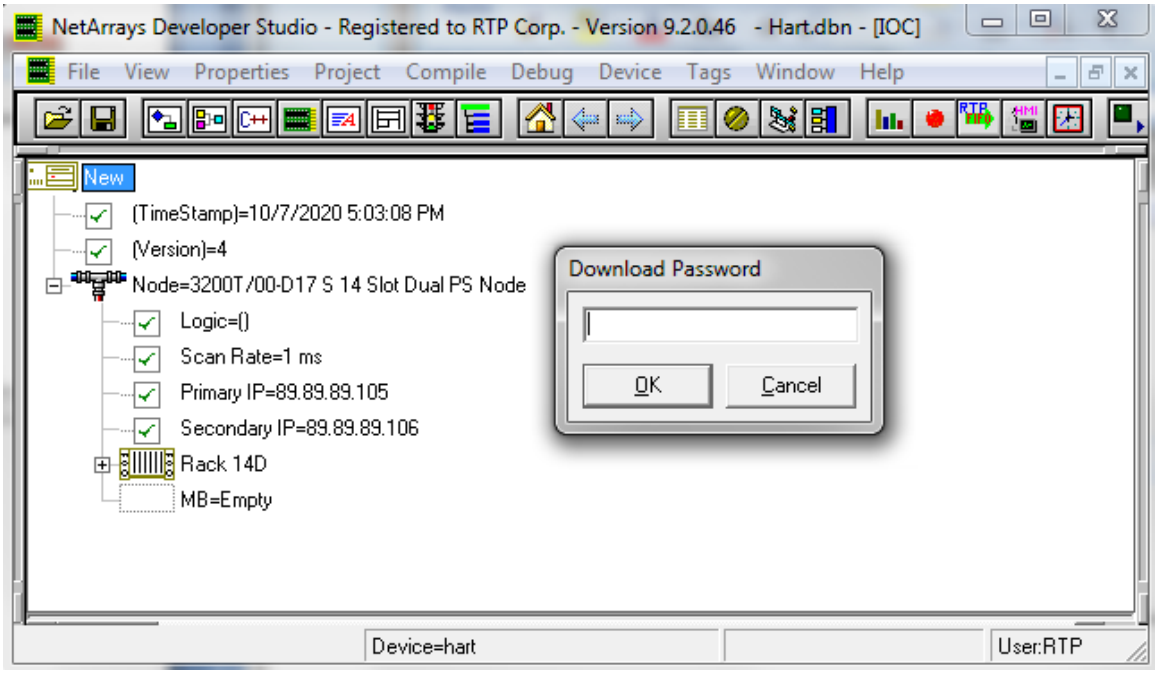
- Connect power to the chassis power supply.
- In NetArrays, select the target node containing 3145 Analog Output Card connected to the device with hart functionality from the **Device** ▸ **Select** menu.



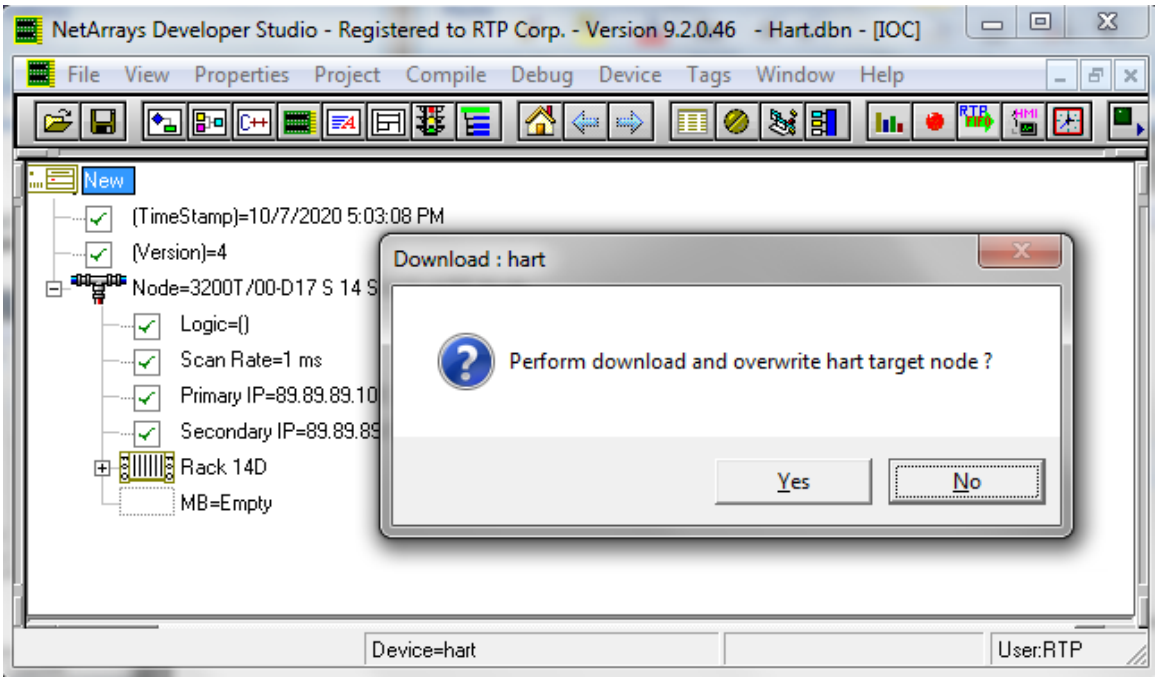
- Select **Device** and **Download Project** to download the project.



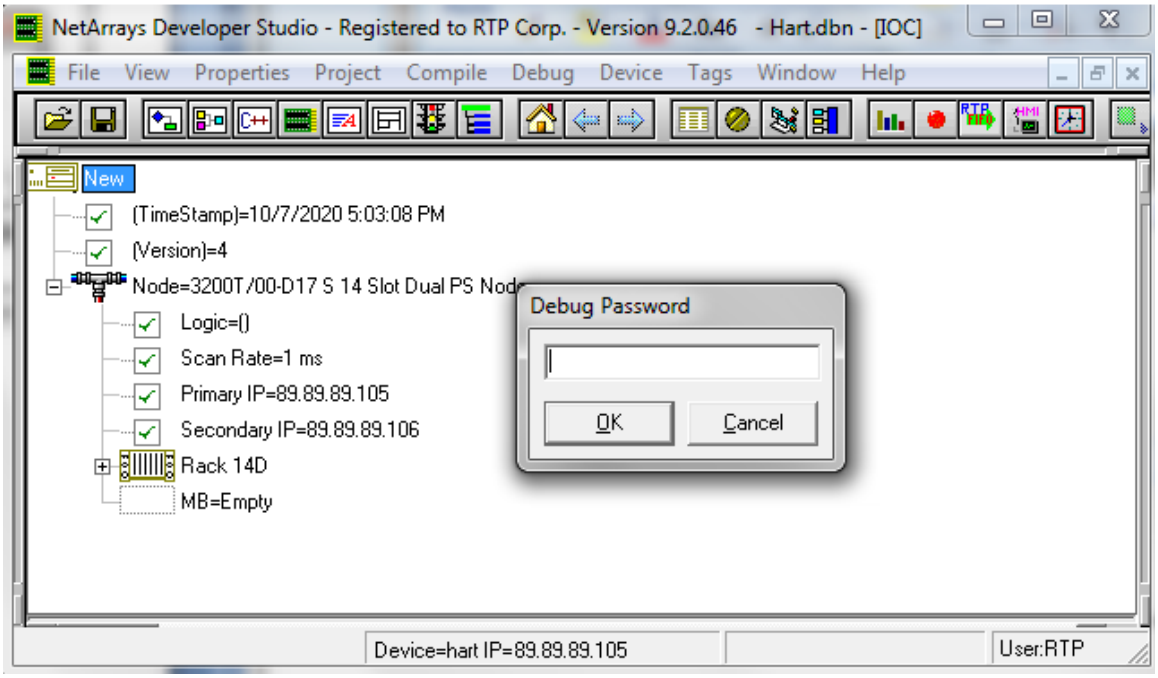
- Enter the Download Password, we use **rtp**, and select **OK**.



- Click "**Yes**" to overwrite to the current Target Node.

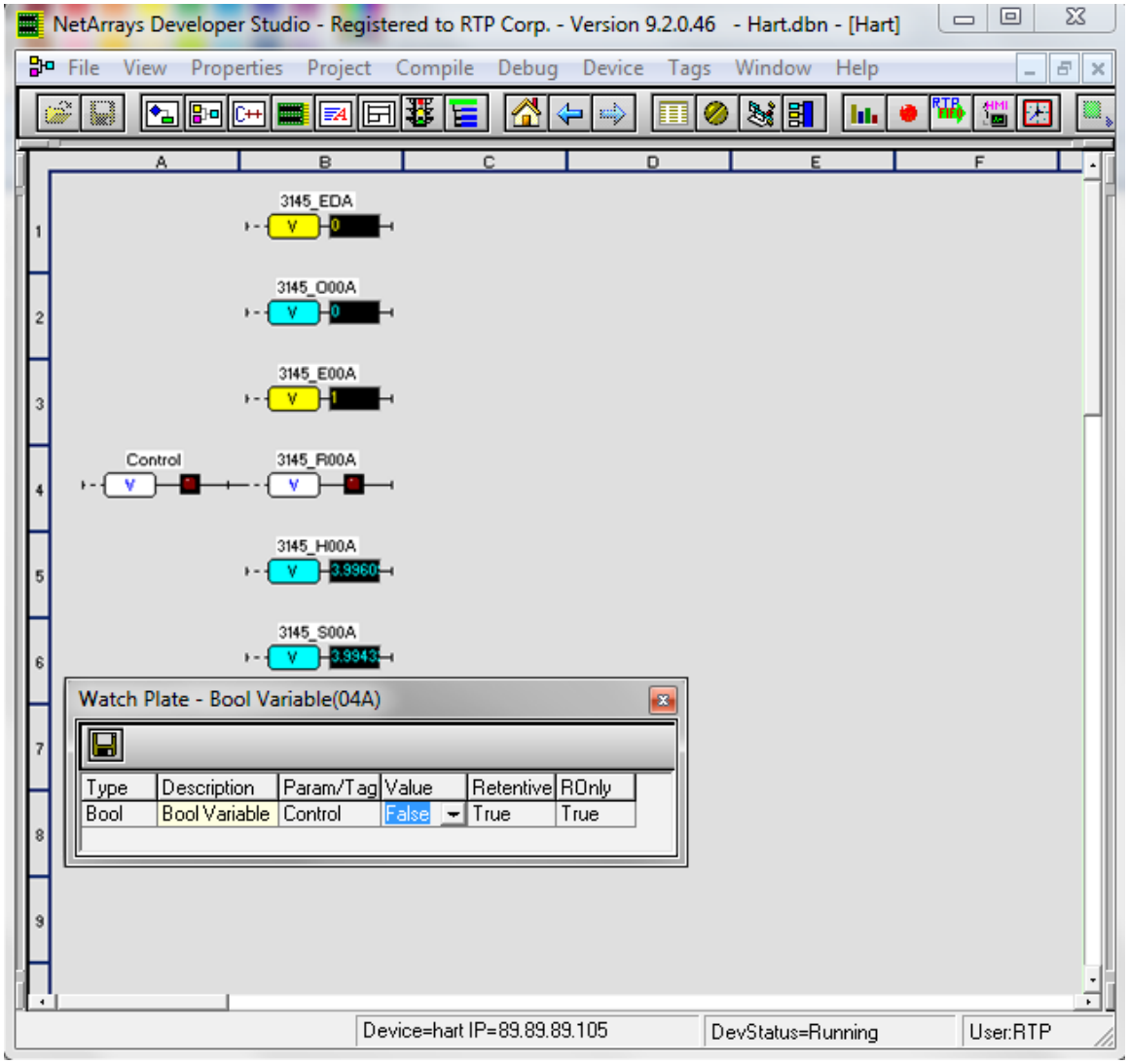


- Run the project in Debug mode by clicking on the **Run** button  in the Main Toolbar.
- Enter the Debug Password, we use **rtp**, and select **OK**.



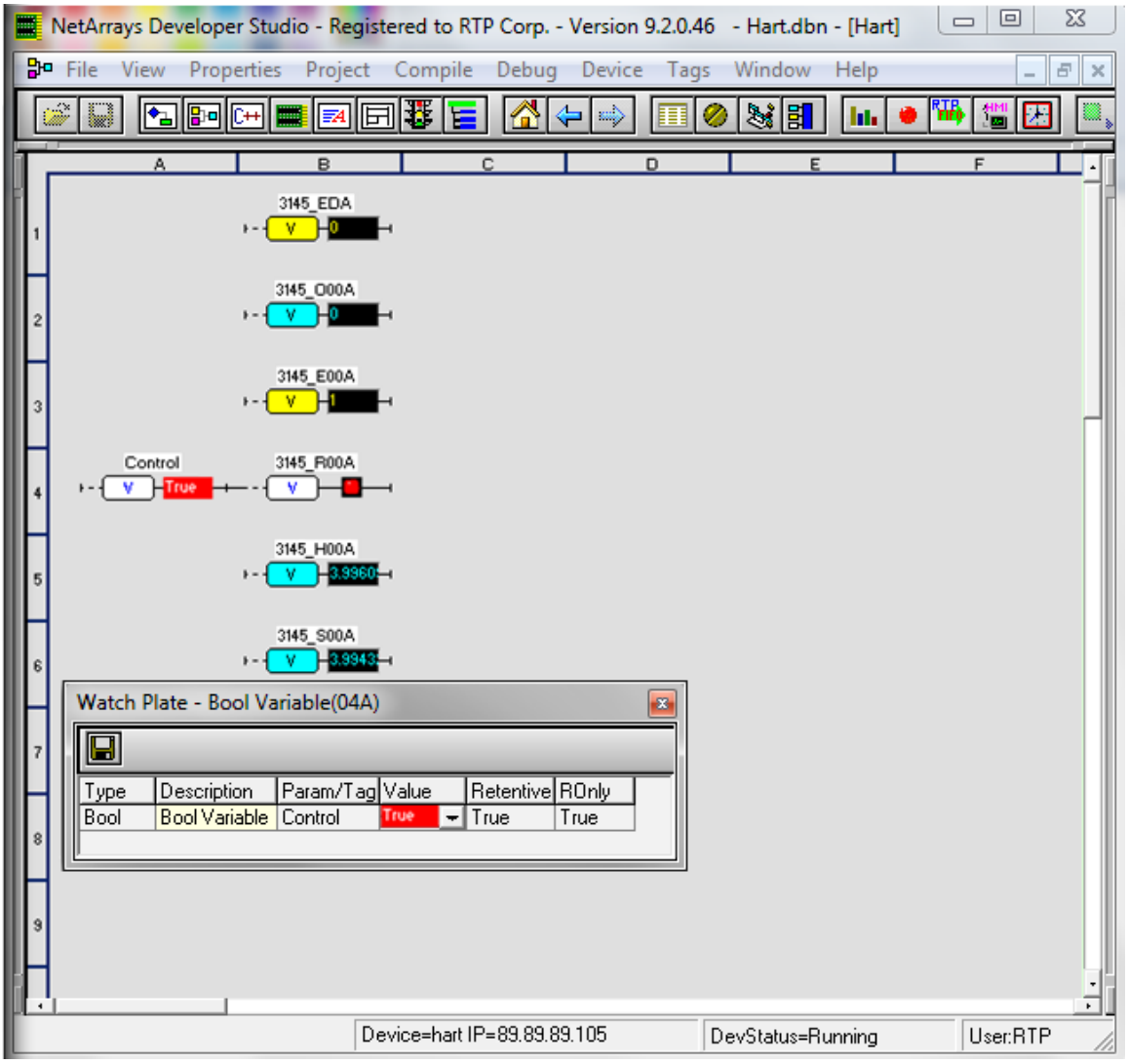
Verify Integer Module Form

- Return to the Main Form by clicking on the button in the Main Toolbar.
- Double-click on the **Hart** object to open the Module Form.
- Right click once on the light of the Boolean Control variable as shown below. This will prompt Watch Plate Window that allows changing the value of the control variable.
- Observe that the value of the variable 3145_H00A is equal to zero because the Boolean value of 3145_R00A is false.



- Change the value Control Boolean Variable to True. This action activates the HART communication in the channel 0- of the 3145 Analog Output Card.

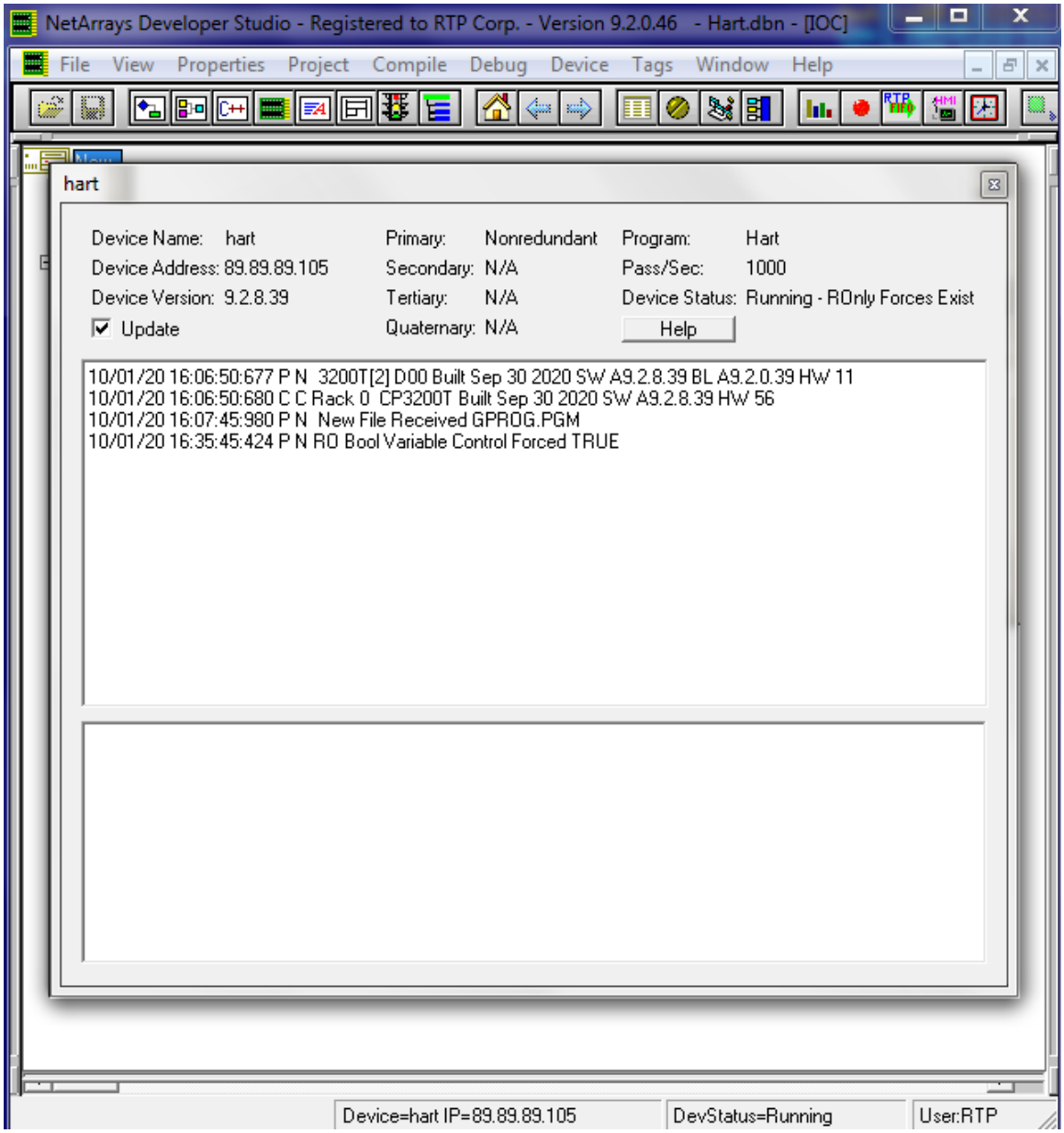
- Observe that the value of the variable 3145_H00A is changing because the Boolean value of 3145_R00A is TRUE. The 3145 Card is receiving data from the Hart Device.



- If the input 3145_H00A is not changing after the Boolean variable 3145_R00A is set to TRUE, carefully check the configuration of the HART Communications Card and connection to the Hart device.

Status Window

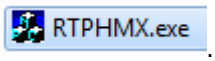
The Status Window should show the RTP3200T Node's **Device Status: =** "**Running**". The bottom panel should be empty to indicate that there are no I/O Errors. The top panel shows historical messages.



Congratulations! You have successfully completed the configuration and testing of a 3145 Analog Output Card with Hart.

RTP HART MULTIPLEXEX

RTP Hart multiplexex is a software utility from the RTP Netsuite aimed to acquire the Hart communication data from the node and transmitting out using the RS232 protocol

Go to the directory C:\RTP NetSuite\RTPHMX and open 

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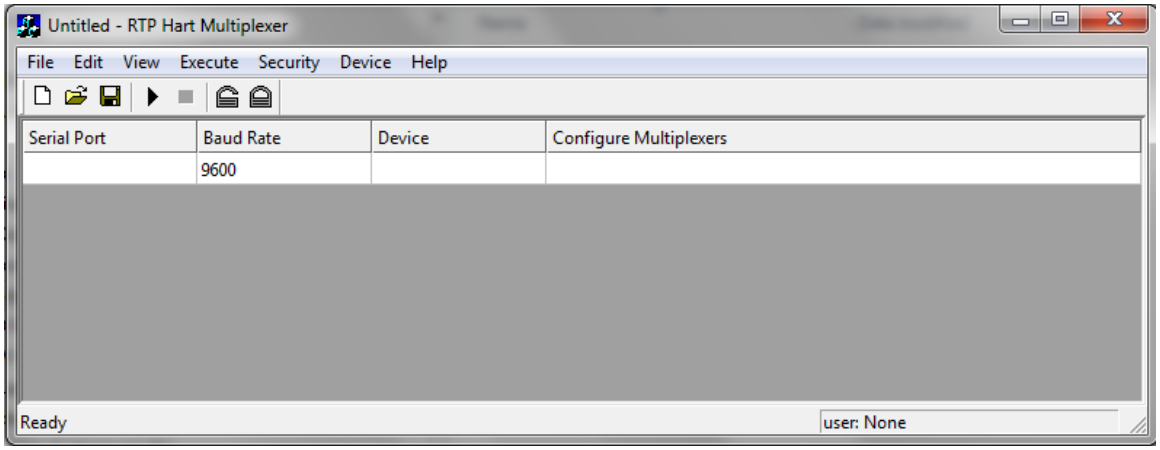
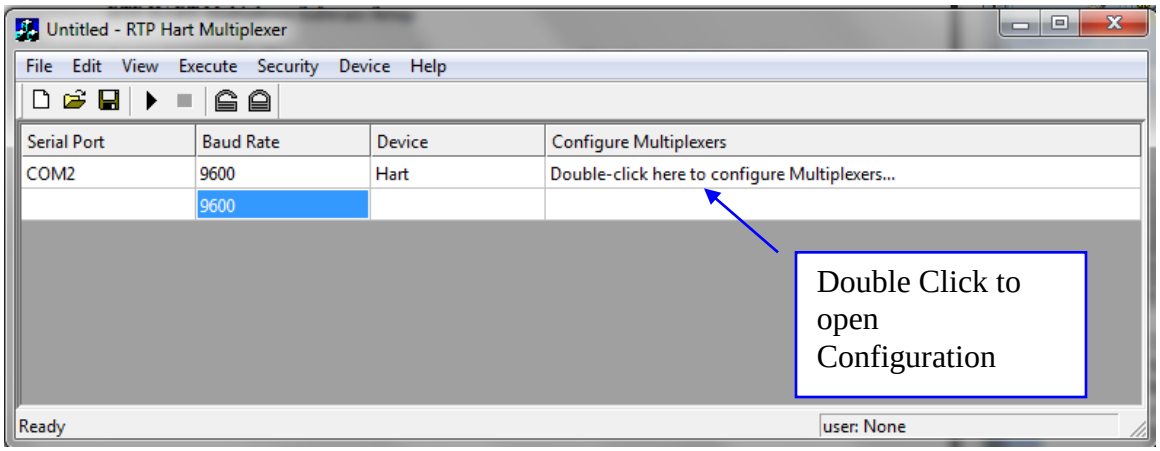


Change the configuration for the RTP Hart Multiplexer as follows:
Serial Port: Choose COM2.
Baud Rate: Set the value 9600. This is the default value. Remember that the Baud Rate of the two serial com ports must be set to the same..
Device: Choose **Hart.**
Configure Multiplexers: Double-Left clicking on this field will open the Multiplexer Configuration pop-up window shown below.

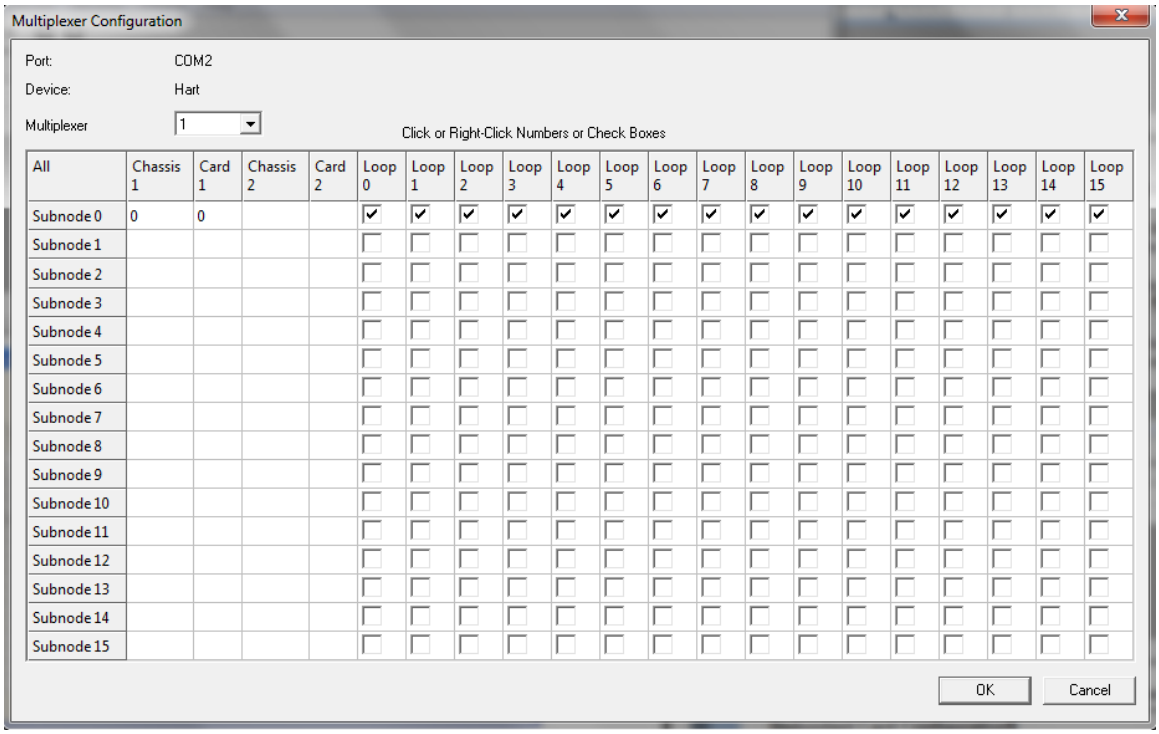
Note: Serial Port, Baud Rate, and Device must be defined before the Multiplexer configuration pop-up window will become available.



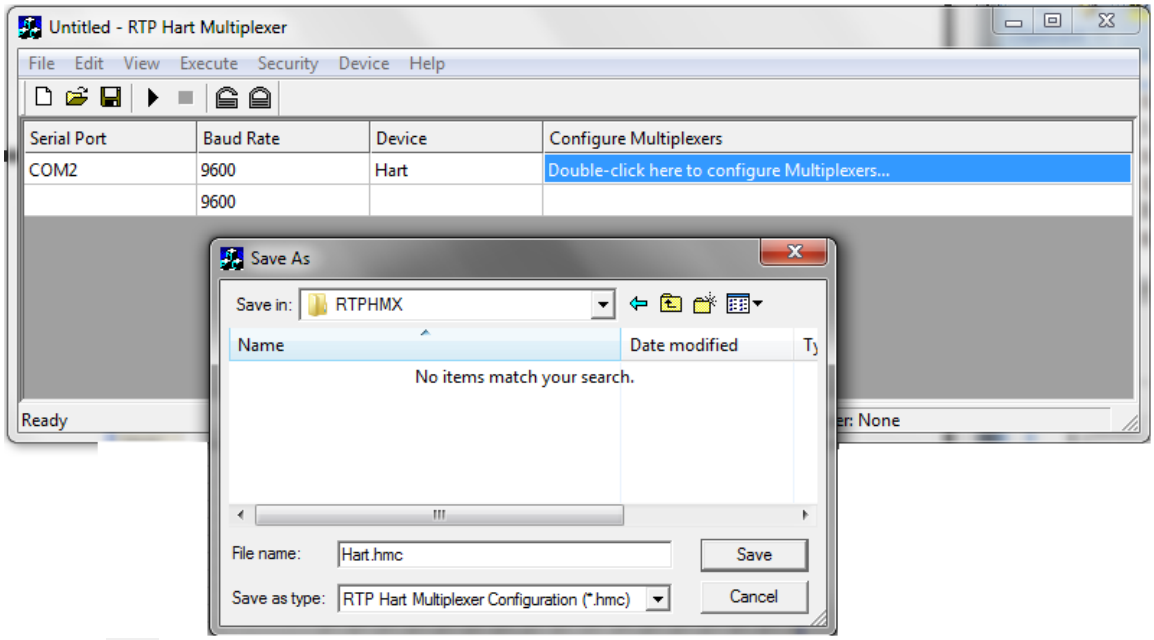
Modify the Multiplexer Configuration as following:

Go to the row for Subnode 0

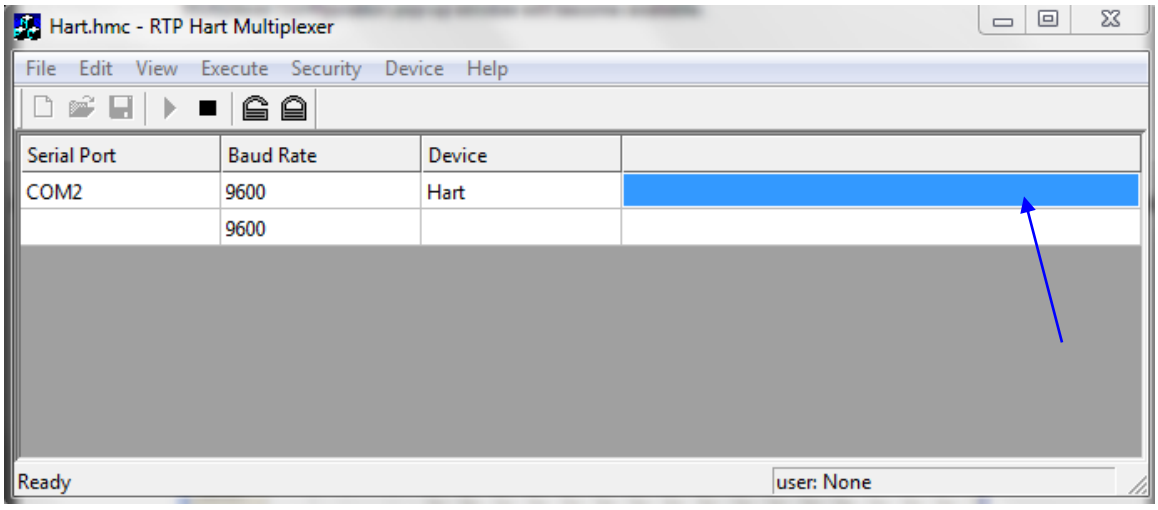
- For the column Chassis 1 set the value equal to 0 because the card is located in the rack 1.
- For the column Card 1 set the value equal to 0 because the card is located in the slot 0.
- For the column Chassis 2, leave it blank because there is not a redundant card in the system.
- For the column Card 2, set leave it blank because there is not a redundant card in the system.
- Enable the entire set of loops from 0 to 15. Loops represent the channels on the HART capbable I/O Card. For this exercise, all the channels are enabled even though only one is wired to a Hart Device.



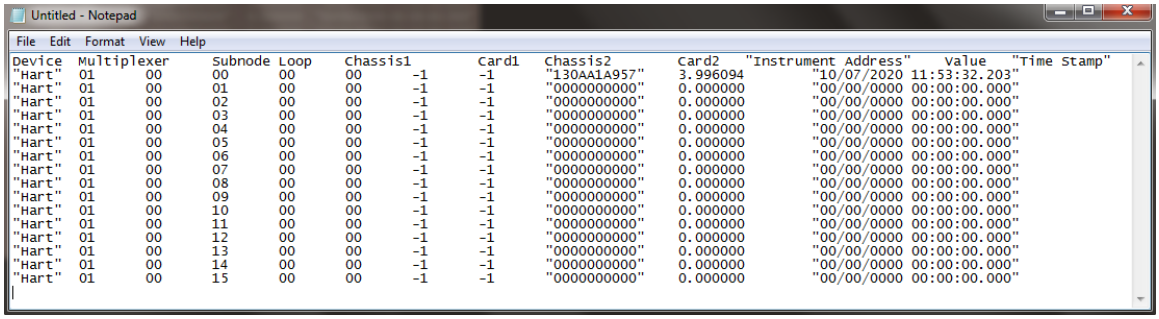
Click on OK.
Then, Go to file and click on Save As.. Save this file as Hart.hmc.



Click on  and start acquiring data. Click on the blue cell below and type Ctrl + C to copy the packet serial data out.



Open notepad and paste the collected data:



The captured data show that only one channel in the card is receiving data from a Hart Device. The value received is 3.996094 that is the same as the value captured in the NetArray Program.

Congratulations! You have successfully completed the configuration of RTP HART MULTIPLEXEX.

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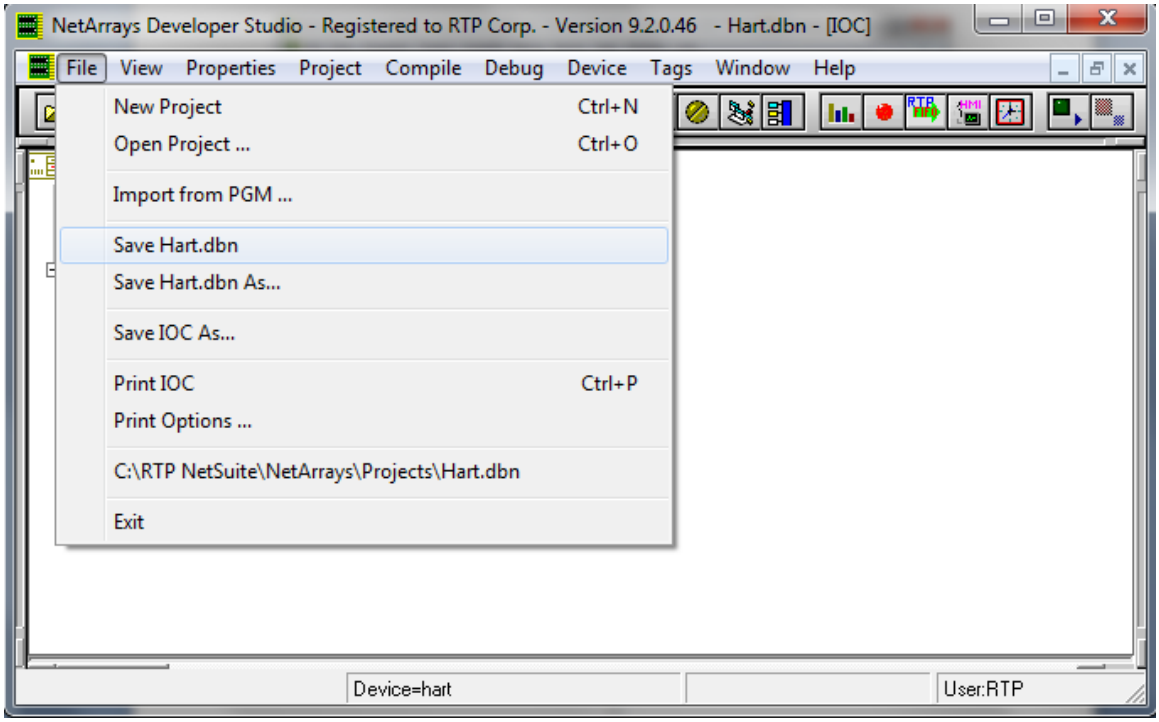
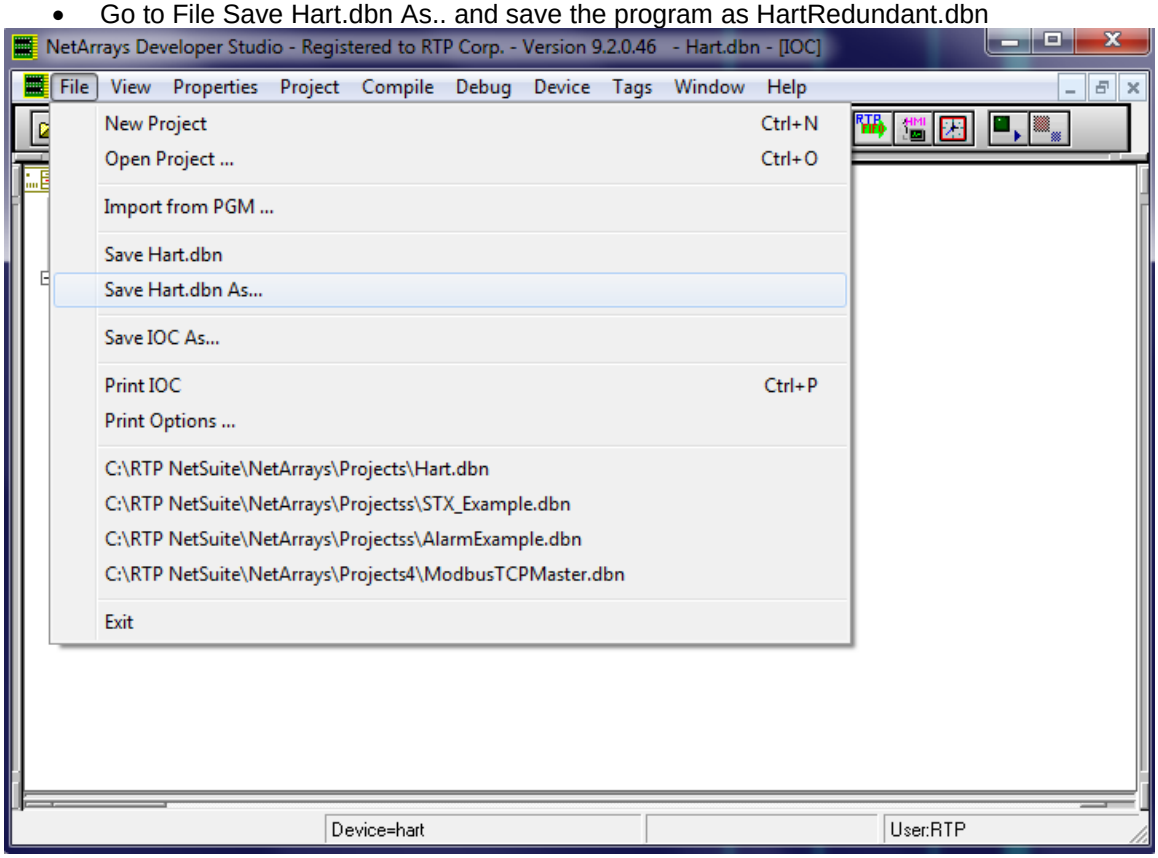
Redundant Card Configuration

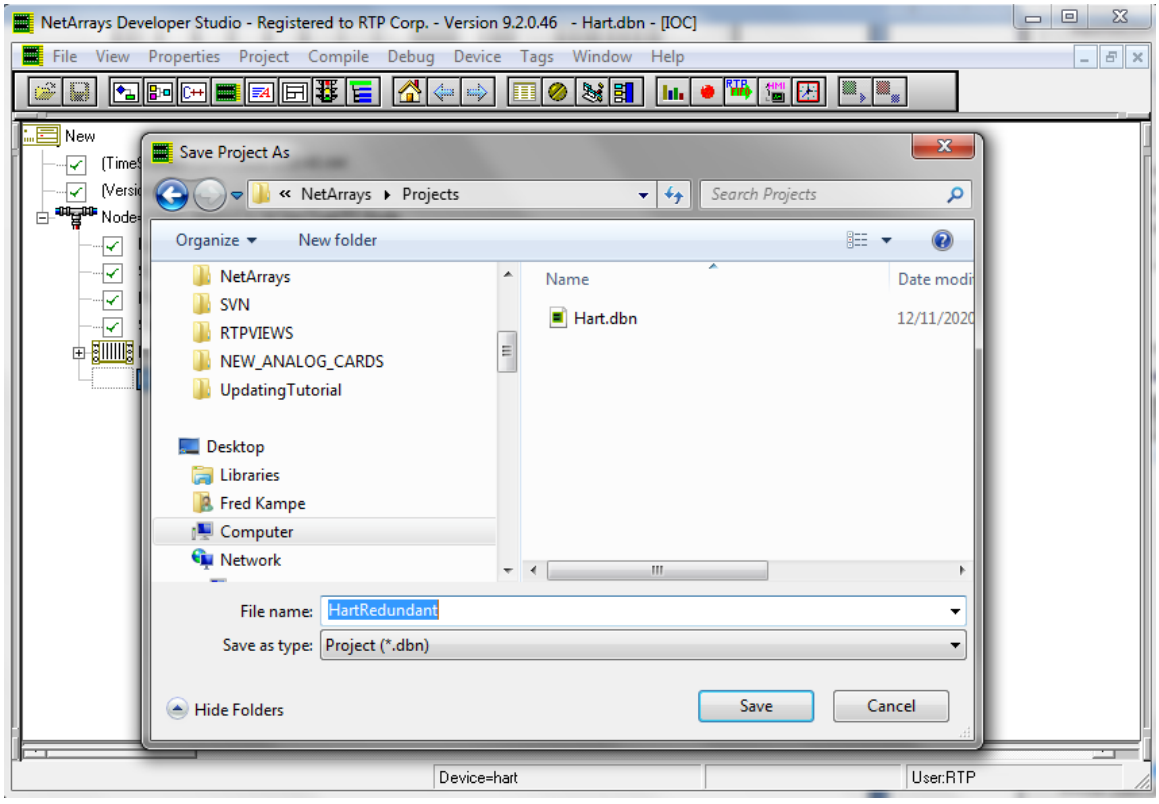
- At this point You have successfully completed the configuration and testing of a 3145 Analog Output Card with Hart.. Now, the next step of this example is to add a redundant card to the existing 3145 Analog Card.

- Save the current Netarray project by clicking on File and Save Hart.dbn

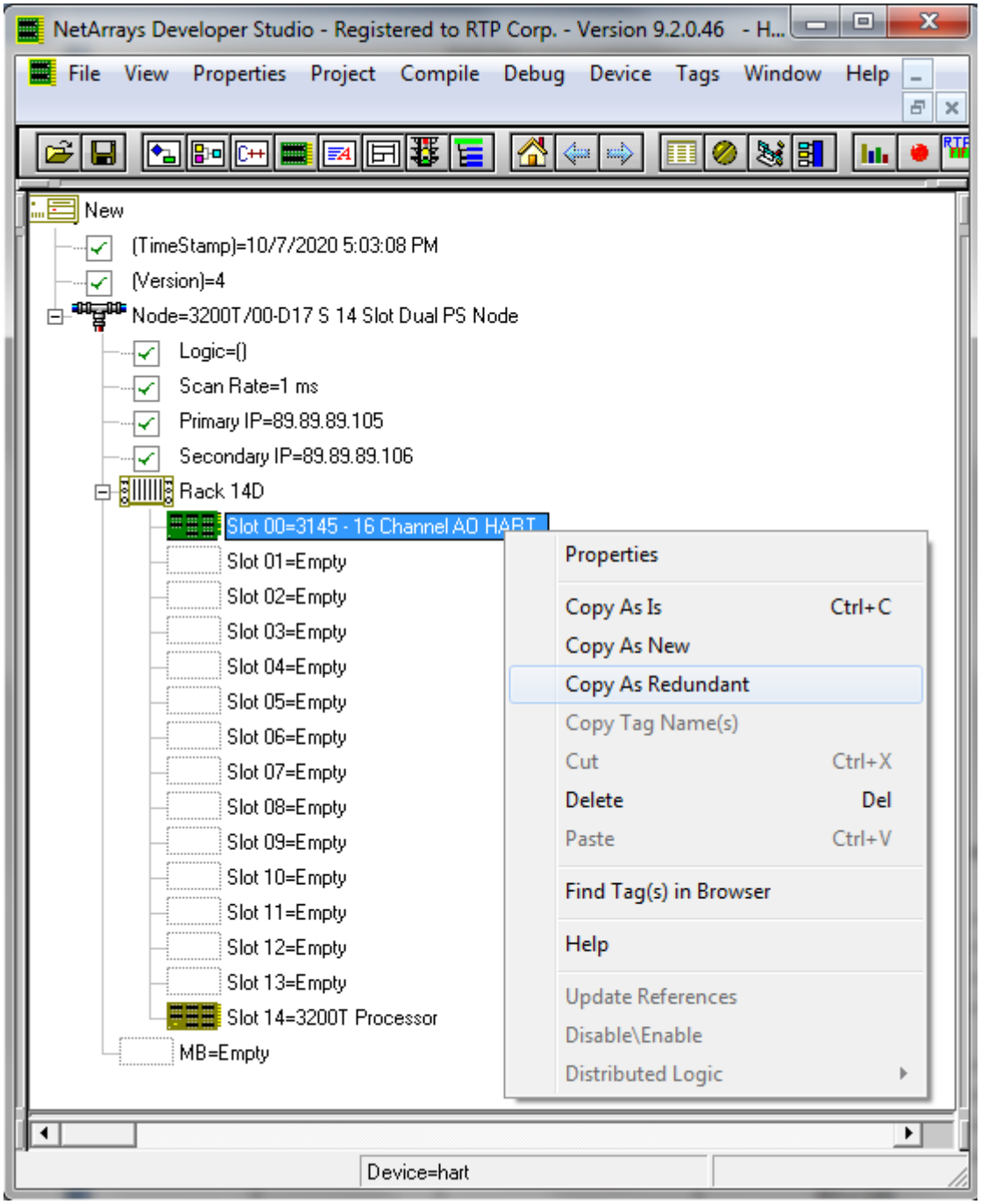


- Go to File Save Hart.dbn As.. and save the program as HartRedundant.dbn

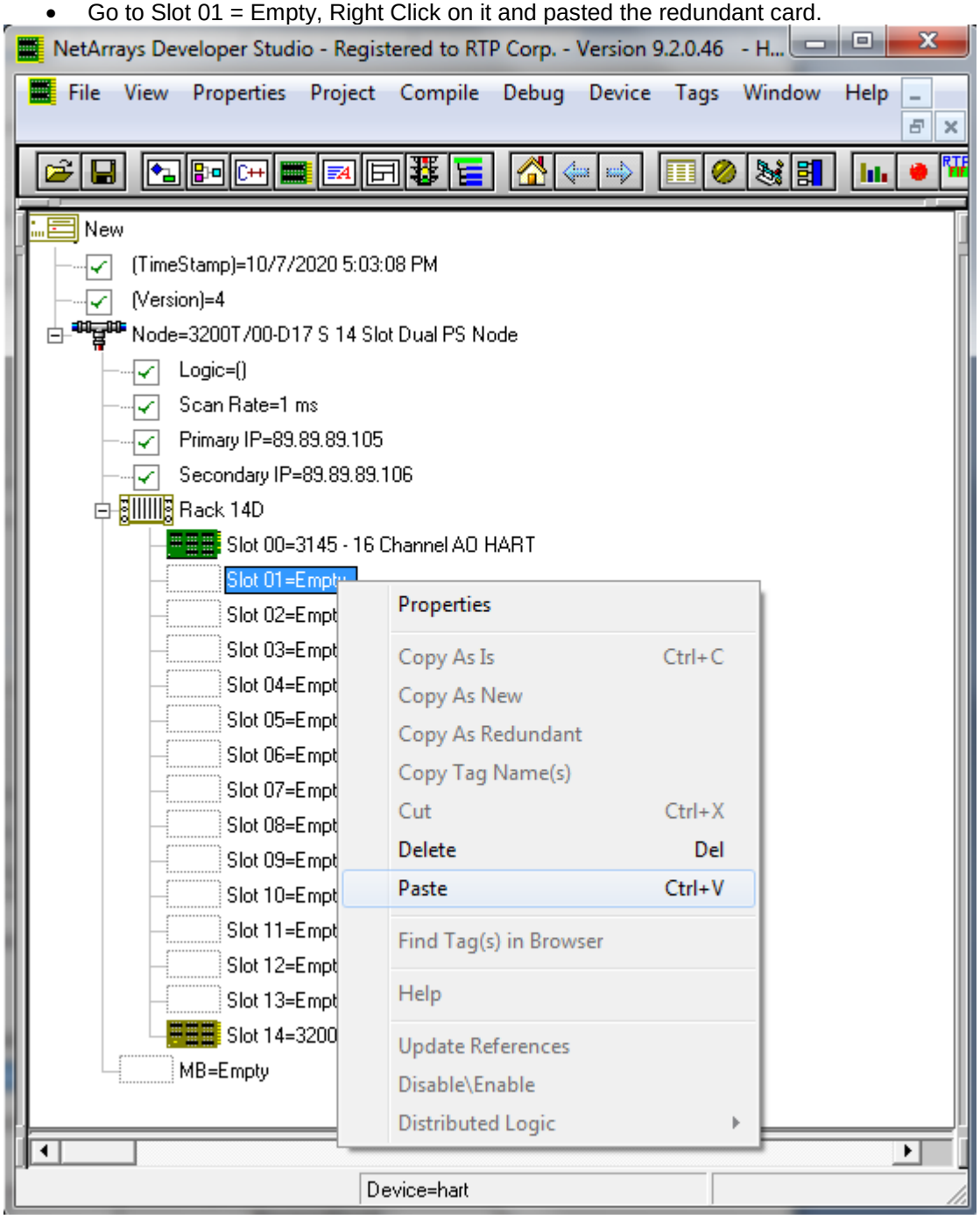




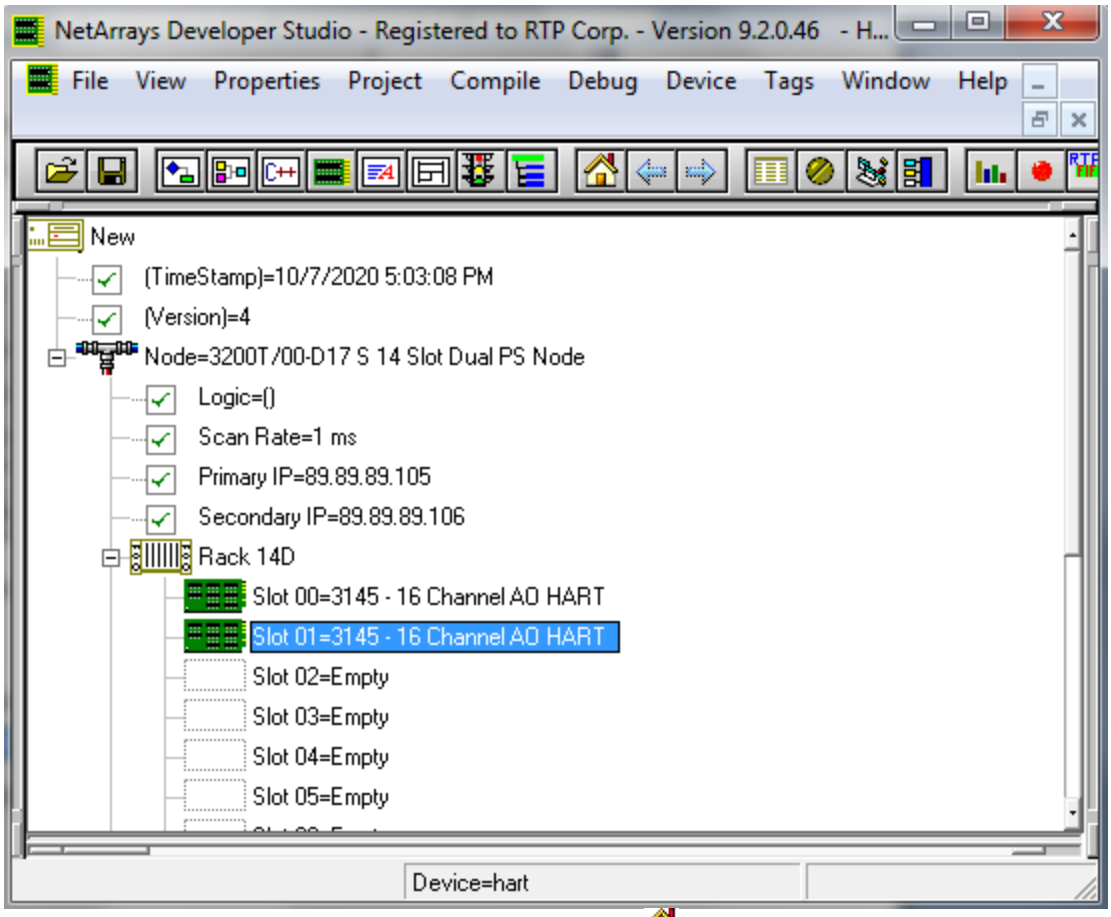
- Go to the configuration panel and expand the Rack 14D as shown in the figure below and then, Right Click on Slot 00=3145 – 16 Channel AO HART and select Copy As Redundant.



- Go to Slot 01 = Empty, Right Click on it and pasted the redundant card.



The configuration will look similar as the picture below.



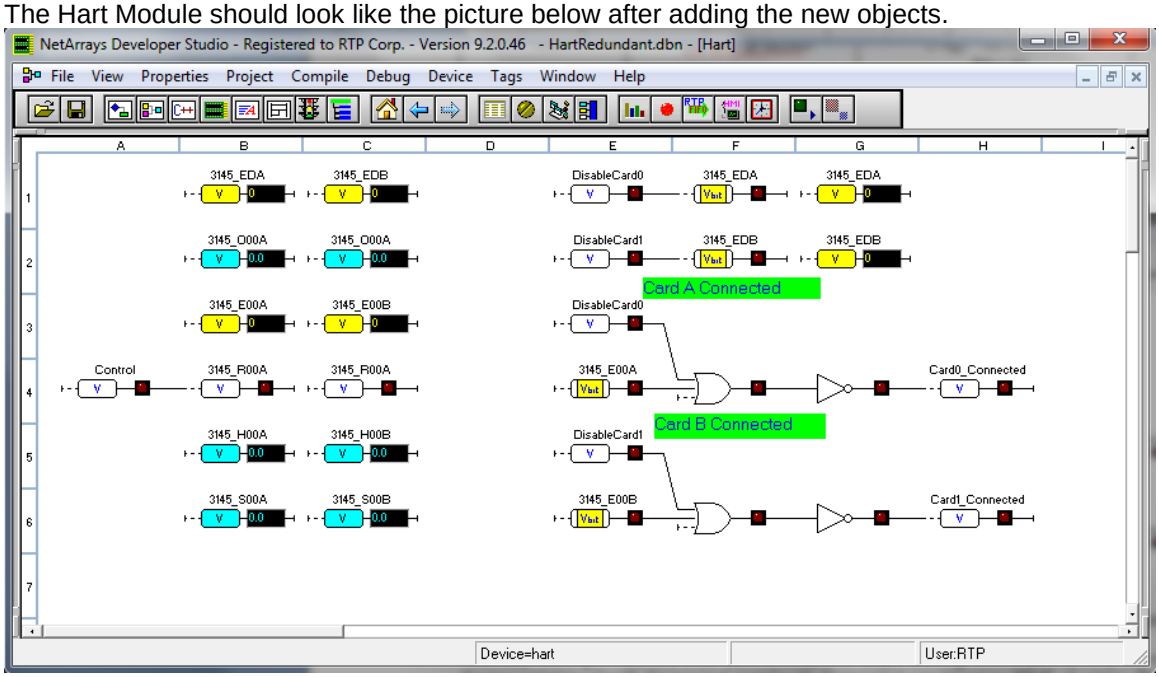
- Return to the Main Form by clicking on the button in the Main Toolbar and double click on the Integer Module.

Modify the original Hart Module as shown in the Table below.

Cell	Object	Properties
C1	Int Variable	(Tag) = 3145_EDB
E1	Bool Variable	(Tag) = DisableCard0
F1	Int BitVariable	(Tag) = 3145_EDA Bit = 14
G1	Int Variable	(Tag) = 3145_EDA
C2	Float Variable	(Tag) = 3145_O00A
E2	Bool Variable	(Tag) = DisableCard1
F2	Int BitVariable	(Tag) = 3145_EDB Bit = 14
G2	Int Variable	(Tag) = 3145_EDB
C3	Int Variable	(Tag) = 3145_E00B
E3	Bool Variable	(Tag) = DisableCard0
C4	Bool Variable	(Tag) = 3145_R00A
E4	Int BitVariable	(Tag) = 3145_E00A Bit = 3

F4	Bool Or	
G4	Bool Inverter	
H4	Bool Variable	(Tag) = Card0_Connected
C5	Float Variable	(Tag) = 3145_H00B
E5	Bool Variable	(Tag) = DisableCard1
C6	Float Variable	(Tag) = 3145_S00B
E6	Int BitVariable	(Tag) = 3145_E00B Bit = 3
F6	Bool Or	
G6	Bool Inverter	
H6	Bool Variable	(Tag) = Card1_Connected

The Hart Module should look like the picture below after adding the new objects.

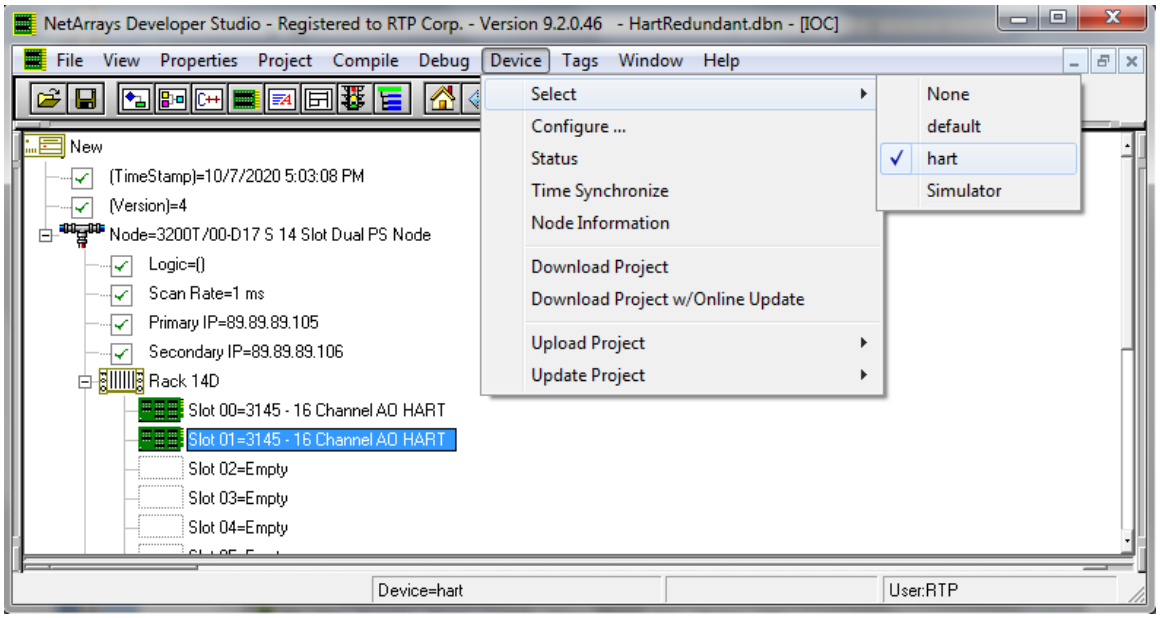


It is important to mention that the hart device can only be connected to one of the card at a time. This means that one of the cards is connected to the Hart device, the second card is on "Standby" waiting in case the other card is disable or stops working. Consequently, only one of the two variables Card0_Connected and Card1_Connected can be set to TRUE at a time. The logic below defines the signal validation mechanism of the Hart Device when it is connected redundantly. The Card Status and Channel Status are used to determine which of the two cards are connected to validate the source of the incoming signal value.

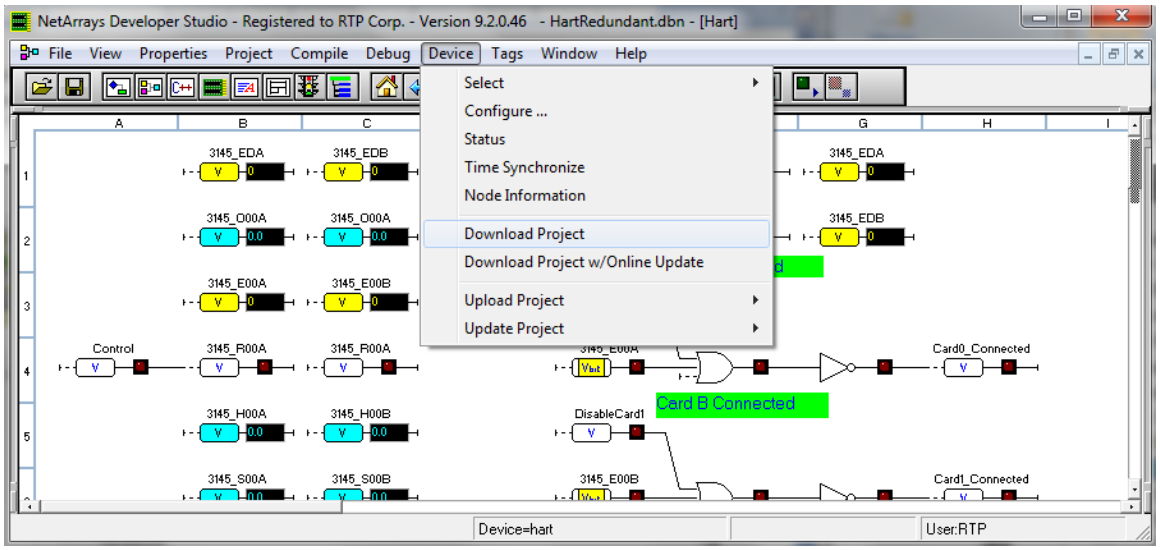
Verification

Downloading the Program

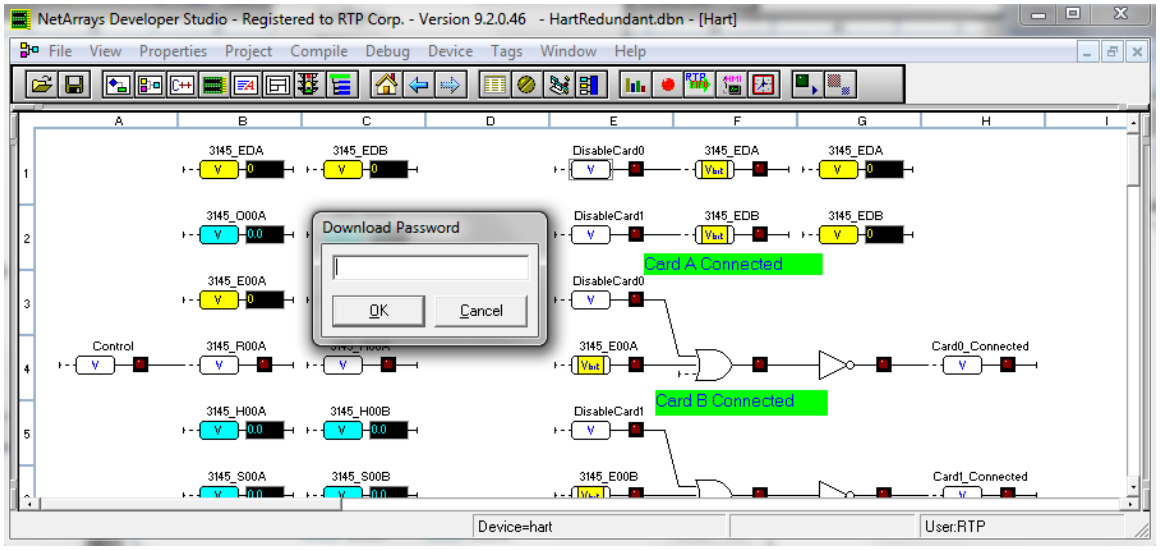
- Make sure that the 3145 Analog Cards are installed and connected to the Hart Device
- In NetArrays, select the target node containing the HART Cards from the **Device ▸ Select** menu.



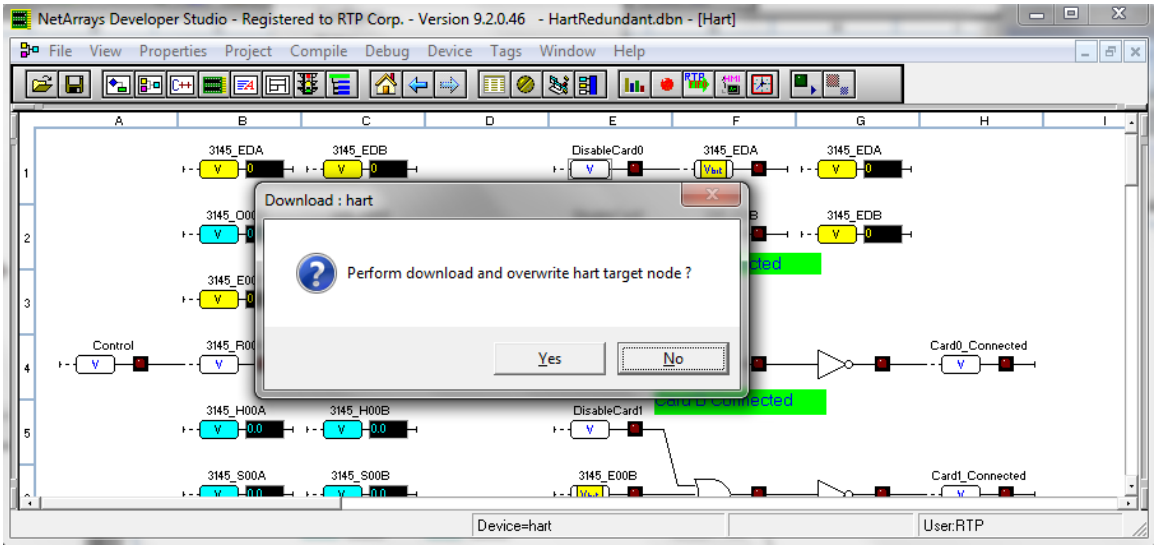
- Select **Device** and **Download Project** to download the project.



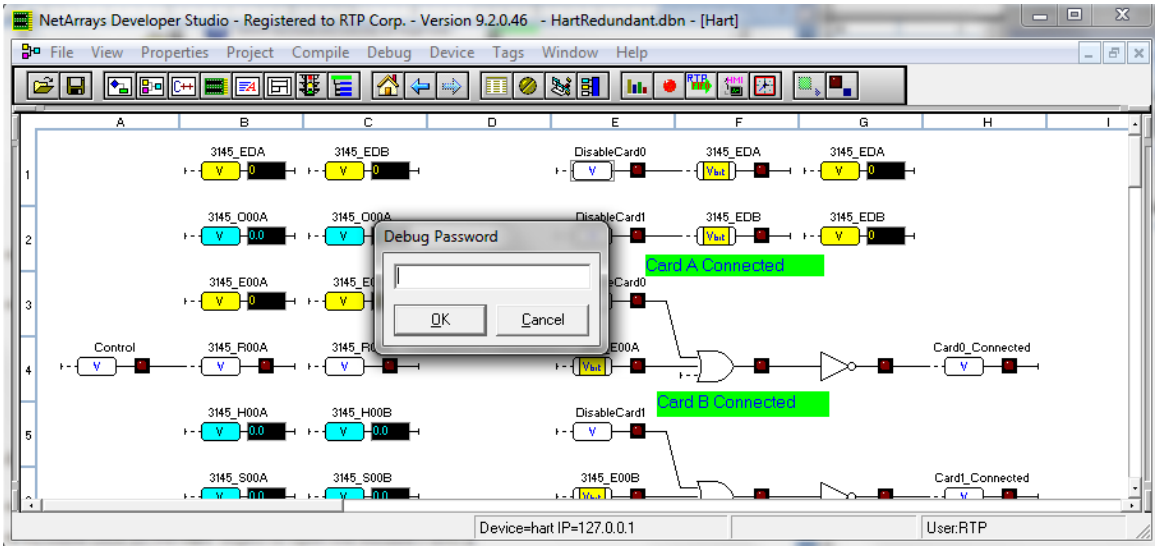
- Enter the Download Password, we use **rtp**, and select **OK**.



- Click "**Yes**" to overwrite to the current Target Node.

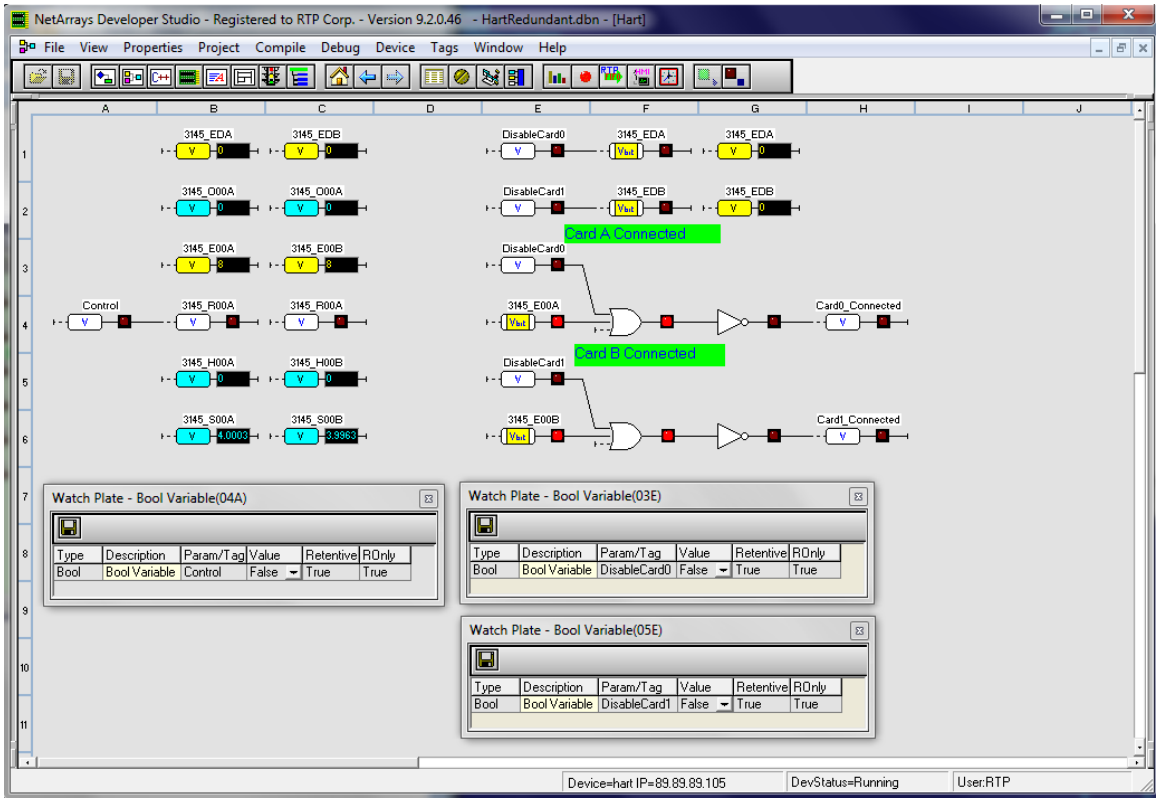


- Run the project in Debug mode by clicking on the **Run** button  in the Main Toolbar.
- Enter the Debug Password, we use **rtp**, and select **OK**.

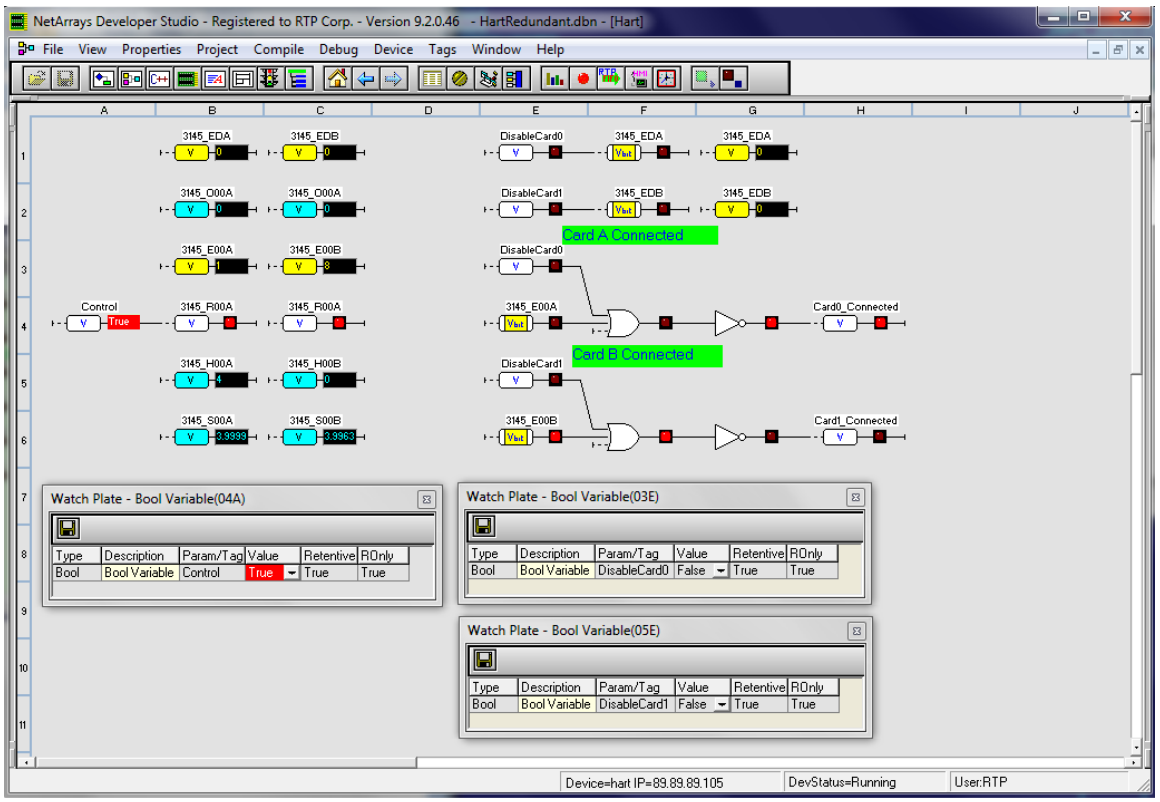


Verify Integer Module Form

- Return to the Main Form by clicking on the  button in the Main Toolbar.
- Double-click on the **Hart** object to open the Module Form.
- Right click once on the light of the Boolean Control variable as shown below. This will prompt Watch Plate Window that allows changing the value of the control variable.
- Right click once on the light of the Boolean DisableCard0 variable as shown below. This will prompt Watch Plate Window that allows enabling the redundant 3145 Analog Output card in slot 0.
- Right click once on the light of the Boolean DisableCard1 variable as shown below. This will prompt Watch Plate Window that allows enabling the redundant 3145 Analog Output card in slot 1.

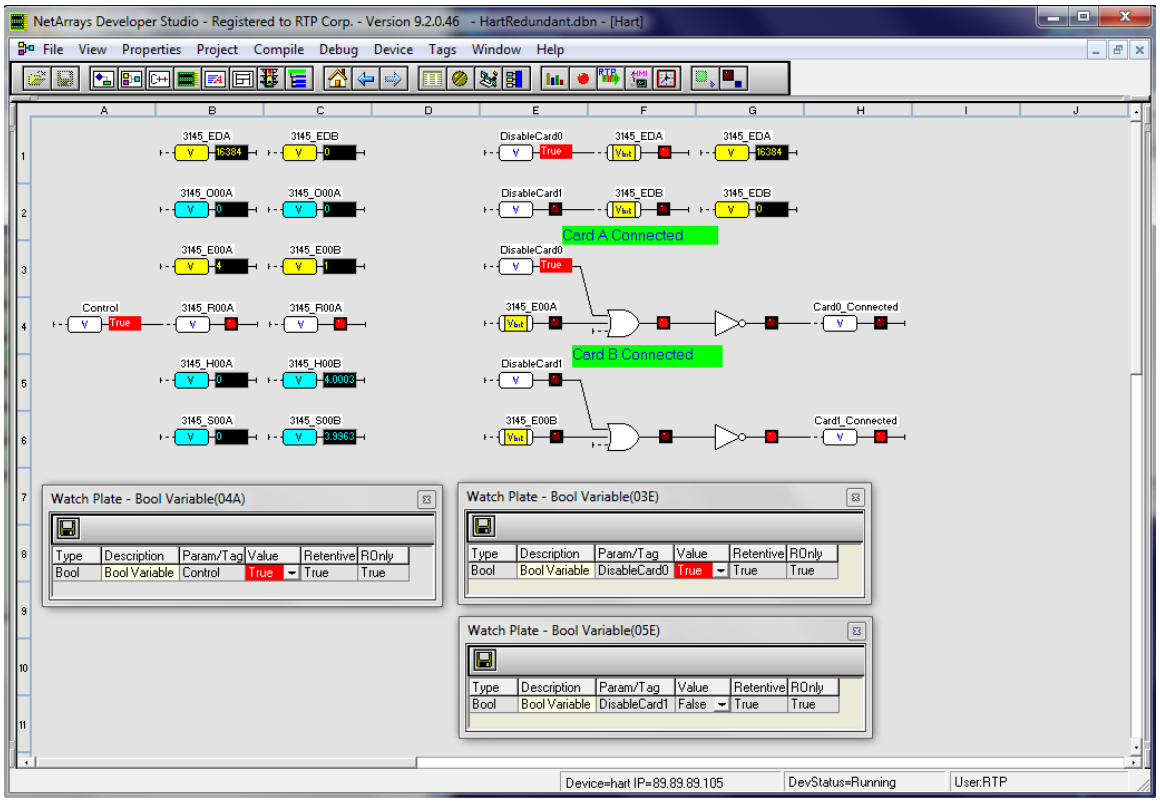


- Change the value Control Variable to True. This action activates the HART communication in the channel 0- of the 3145 Analog Output Card.



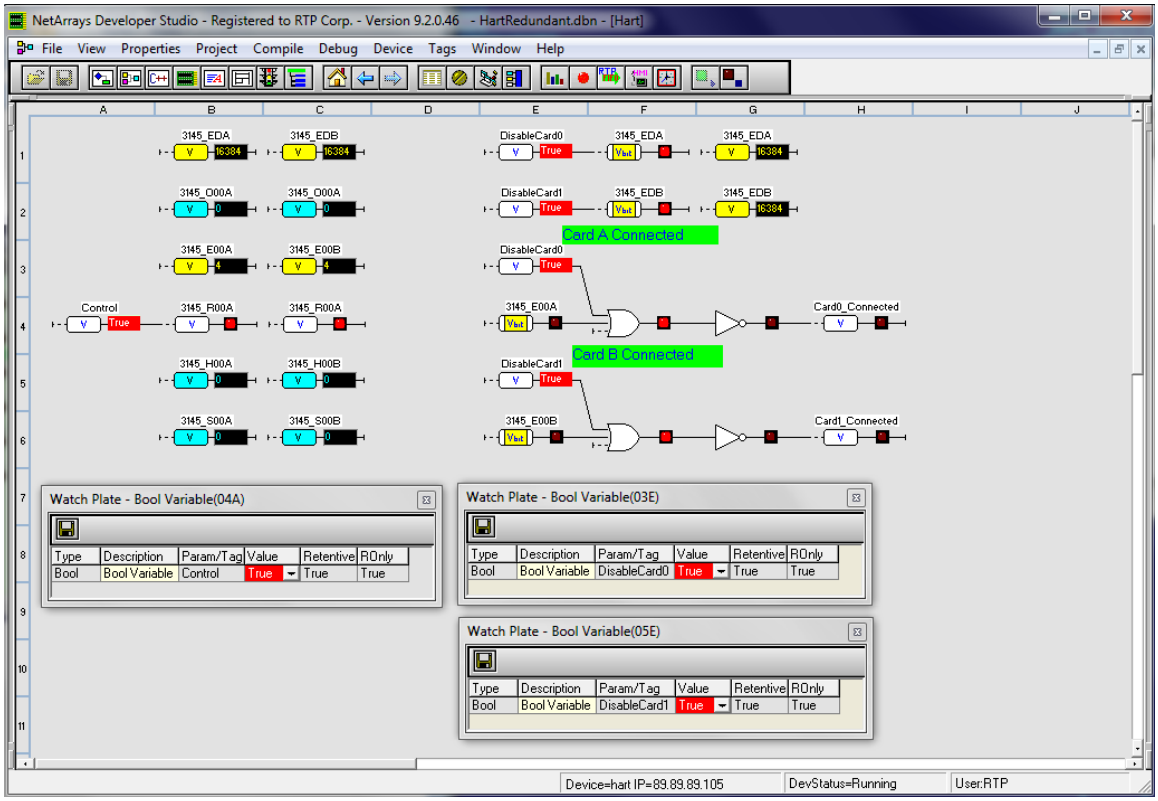
- Observe that the value of the variable 3145_H00A is changing because the Boolean value of 3145_R00A is TRUE. In addition, the card status indicates that the card is connected to the hart device because the Card0_Connected variable is set to TRUE. The 3145 Card is receiving data from the Hart Device.

- If the input 3145_H00A is not changing after the Boolean variable 3145_R00A is set to TRUE, carefully check the configuration of the HART Communications Card and connection to the Hart device.
- Go to the Watch Plate for the Boolean DisableCard0 Variable and change it to True.
- This action disables the 3145 Card on slot 0.



- ● Observe that the value of the variable 3145_H00B is changing because the second card (3145 Analog Output Card on the slot 01) has taken control over the hart device. In addition, the card status indicates that the card is connected to the hart device because the Card0_Connected variable is set to TRUE.

- Go to the Watch Plate for the Boolean DisableCard1 Variable and change it to True.
- This action disables the 3145 Card on slot 1. Now, both cards have been disabled.



- ● Observe that the value of the variable 3145_H00A and 3145_H00B is equal to zero because neither of the two cards are connected to the hart device.

Status Window

The Status Window should show the RTP3200T Node's **Device Status: = "Running"**. The bottom panel should only show a message indicating that the 3145 Card on slot 0 is offline because at the end of the testing the card has been disabled. The status window indicates the system has no errors during initialization. In addition, the logs show that the variables Control, DisableCard1 and DisableCard0 have been changed to TRUE.