

**Communication Driver CNS**

Driver for serial communication with devices using Control Net Slave protocol

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# 1 Introduction

The CNS driver enables communication between Studio system and some of the Allen-Bradley devices using their Control Net protocol, in accordance with the characteristics covered in this document.

This document contains 8 parts, as follow:

- Introduction: Provides an overview of the driver documentation.
  - General characteristics: Provides information necessary to identify all the required components (hardware and software) necessary to implement the communication and global characteristics about the communication.
  - Installation: Explains the procedures that must be followed to install the software and hardware required for the communication.
  - Driver configuration: Provides the required information to configure the communication driver such as the different permutations for configuration and its default values.
  - Execution: Explain the steps to test whether the driver was correctly installed and configured.
  - Troubleshooting: Supplies a list of the most common error codes for this protocol and the procedures to fix them.
  - Application Sample: Provides a sample application for testing the configuration the driver.
  - History of versions: Provides a log of all the modifications done in driver.
- ☞ Note: This document presumes that the user has read the chapter *Driver Configuration* of the Studio's Technical reference manual.

## 2 General Characteristics

### 2.1 Device Characteristics

- **Manufacturer:** Allen Bradley or any manufacturer of devices with ControlNet protocol and driver; Hilscher Gesellschaft für Systemautomation mbH.
- **Compatible Equipment**
  - Allen Bradley PLC-5 for ControlNet and Logix5550;
  - CIF 30-CNS (HILSCHER)
  - Any other equipment with ControlNet protocol and driver.
- **Programmer Softwares:** RSLogix 5 (for the PLC-5 family of processor), RSLogix 5000 Engineering Release R306i or higher (for the Logix 5000 family of processor), RSNetWorx for ControlNet version 1.5.

☞ Note: Please refers to section 2.4 to see the Equipment used in the standard conformance tests for this driver.

### 2.2 Link Characteristics

- **Device communication port:** ControlNet port of the ControlNet Bridge Module for the Logix5550 processor or ControlNet port for the PLC-5 processor
- **Physical/Logic protocol:** ControlNet
- **Device Runtime software:** None
- **Specific PC Board:** Communication Interface CIF-30-CNS (Hilscher) and ControlNet Communication Interface Card 1784-KTCX15 (Allen Bradley) for configuration
- **Cable Wiring:**
  - **Cable:** quad shield RG-6 coaxial cable
  - **Accessories:** 1786-XT ControlNet Terminator, 1786-TPS straight T-Tap;

## 2.3 Driver Characteristics

- **Operating System:**

- Windows 2000
- Windows NT
- Windows CE

☞ Note: Please refer to section 2.4 to see the Operating System used in the conformance tests for this driver.

The driver is composed of the following files:

- CNS.INI: Internal file of the driver, it should not be modified by the user.
- CNS.MSG: This file contains the error messages for each error code. It is an internal file of the driver, the user should not modify it.
- CNS.PDF: This document provides detailed documentation about the driver.
- CNS.DLL: This is the compiled library for the driver.

☞ Note: All the files above must to be in the subdirectory /DRV of the Studio's installation directory.

## **2.4 Information about conformance testing**

- **Equipment:**
  - Processors: Allen Bradley PLC-5 / 40C and Allen Bradley Logix5550 1756-L1/A;
  - Communication Card: ControlNet Bridge 1756-CNB/A for Logix5550, ControlNet Communication Interface Card 1784-KTCX15 for configuration workstation and Communication Interface CIF-30-CNS (Hilscher) for target device;
  - Accessories: 1786-XT ControlNet Terminator, 1786-TPS straight T-Tap;
- **Cable:** Quad shield RG-6 coaxial cable
- **Operating System (development):** Windows NT 4.0 + Service pack 3
- **Operating System (target):** Windows CE v2.11
- **Studio Version:** 3.0
- **Driver version:** 1.00

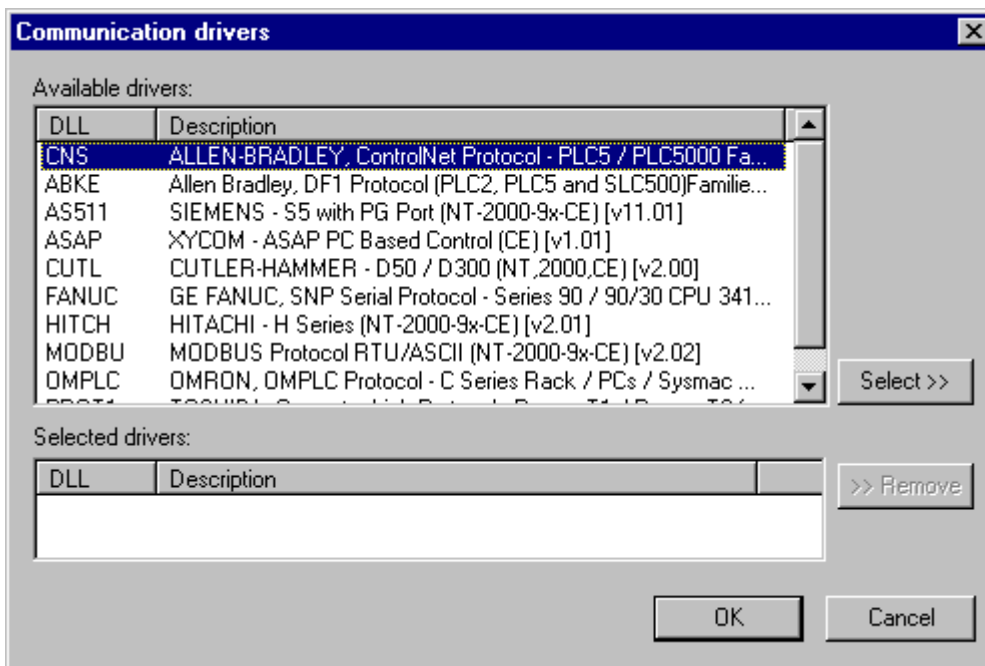
## 3 Installation

### 3.1 Installing the Driver

When you install the Studio v3.0 or higher, the communication drivers are already installed. You need now to select the driver at the applications where it will be used.

The steps to select the driver inside an application are:

1. Execute the Studio and select the proper application.
2. Select the menu *Insert + Driver...*
3. In the column **Available Drivers**, select the **CNS Driver** and push the button **ADD>>>** (the driver CNS must appear in the column **Selected Drivers**).
4. Press **OK**.



### 3.2 Other software requirements

To enable the communication between the Studio and the Device, is necessary to install and register two DLL files under target platform.

To do this,

1. Install and configure the CIF 30-CNS board into the target system according the hardware manufacturer documentation (see appendix to find out the jumper configuration of the board);
2. Copy the files **CIFCEDLL.dll** and **CIFISA.dll** to the Windows CE system directory (for example, \WINDOWS);
3. Copy **DRVSETUP.exe** and **CIFTEST.exe** to the target device;
4. Run **DRVSETUP.exe** to install registry entries and configure the ISA board:
  - 4.1. In the menu **Registry**, select **Create ISA default entries**, push button **Create ISA entries**. The status may show the message **ISA registry entries available**.
  - 4.2. In the menu **ISA bus**, select **Board Setup** and configure **Board 0** to **Memory Base Addr. = D0000** or according with the board hardware and **Memory Size = 2 Kbytes**.

- 4.3. Close **DRVSETUP.exe**.
5. Run **CIFTEST.exe** to check the new configuration:
  - 5.1. In the menu **Board select**, choose **Board 0**. If there is no error message, then the board was initialized.

☞ Note: Before to go ahead, pay attention in section about the ControlNet network setup to make sure that whole network is right configured.

☞ Note: Special precautions must be taken when installing the physical hardware. Refer to the hardware manufacturer documentation for specific instructions in this area.

## 4 Driver Configuration

After the driver is installed and selected in the Studio (see section 3.1), you should proceed to the driver configuration.

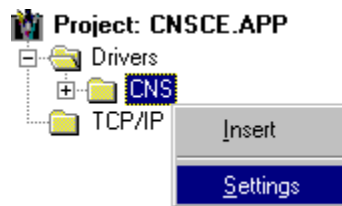
The driver configuration is two parts:

The Settings or Communication parameters, it is only one configuration to the whole driver, then you have the communication tables or Driver Worksheets, where the communication tags are defined.

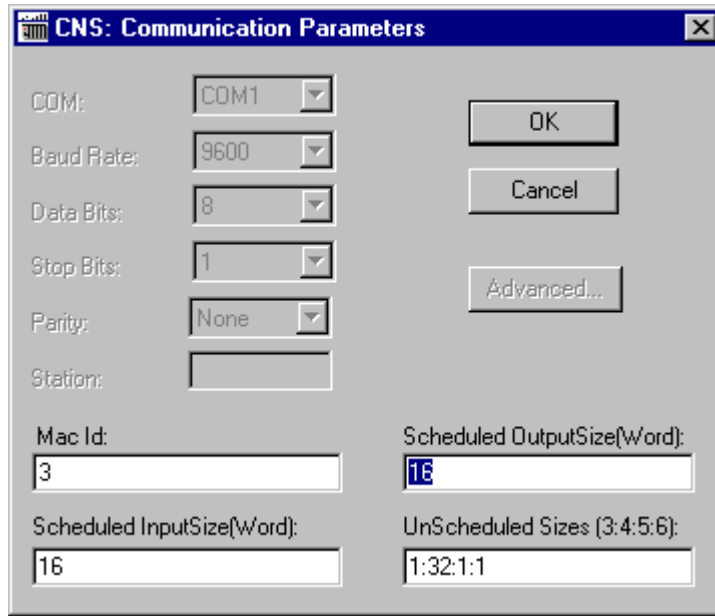
### 4.1 Settings - Communication Parameters

These parameters are valid for all driver worksheets configured in the system. To open the window for configuring the **Communication parameters**, follow these steps:

1. In the **Workspace** of the Studio environment, select the **Comm** table.
2. Expand the folder **Drivers** and select the subfolder **CNS**.
3. Right click on the **CNS** subfolder and select the option **Settings**.



When selecting the Settings, there is the following dialog to configure:



Parameter	Default Value	Valid values	Description
Mac Id	3	1 to 99	Medium Access Identifier
Scheduled Output Size	16	0 to 240	Length of the scheduled output data (in words)
Scheduled Input Size	16	0 to 240	Length of the scheduled input data (in words)
Unscheduled Sizes (3:4:5:6)	0:0:0:0	0 to 1000	Length of the unscheduled data file #3, #4, #5 and #6. The <b>total</b> length of all files can be up to 1000 words.

Others fields are disabled because for this driver they haven't effect.

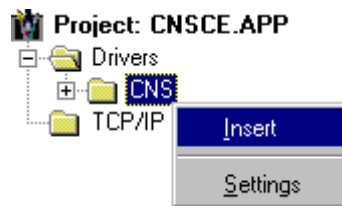
☞ Note: Make sure that the fields 'Scheduled Input / Output Sizes' and 'Unscheduled Sizes' MUST MATCH with the ControlNet network configuration. For more details, see the section ControlNet network setup.



## 4.2 Driver Worksheet

It is possible to configure many driver worksheets, each one will be composed of a Header and Body. To create a new driver worksheet, follow these steps:

1. In the **Workspace** of the Studio environment, select the table **Comm**.
2. Expand the folder **Drivers** and select the subfolder **CNS**.
3. Right click on the **CNS** subfolder and select the option **I**nsert.



Note: To optimize communication and ensure better performance for the system, it is important to tie the tags in different driver sheets according to the events that must trigger the communication of each group of tags and the periodicity for which each group of tags must be written or read. In addition, it is recommended to configure the addresses of communication in sequential blocks.

When creating a communication table, you have the following window:

	Tag Name	Address	Div	Add	
1	tag[1]	W0			
2	tag[2]	W1			
3	tag[3]	W2			
4	tag[4]	W3			

All entries at the Driver Worksheet, exception by the **Station**, **Header** and **Address** are standard to all communication drivers. You should refer to Studio Communication Driver documentation about the configuration of the standard fields. This document describes the Station, Header and Address fields, which are specific to each communication driver.

### 4.3 Station and Header configuration

Parameter	Default Value	Valid values	Description
Station	-	1 to 31	The ID (node) of the device (Unit name).
Header	-	Vide next table	Defines the type of the function to be performed by the device.

The parameter **Header** defines the type of the function that will be performed by the device. These functions can be read status, read parameters, read / write variables and reset command. After editing the field **Header**, the system will check if it is valid or not. If the syntax were incorrect, the system will prompt a window to show the error.

Depends on the type of the function in **Header**, the field **Address** must match with it.

Information regarding the parameter "Header"			
Type	Sample of syntax	Valid range of initial Address	Comment
COMMSTATUS	COMMSTATUS	-	This function reads the various status of the communication between the device and the Studio, beyond the board status.
COMMPARAM	COMMPARAM	-	This function reads the various parameters of the board like MacID, scheduled messages data size and

			unscheduled messages data size.
Scheduled Messages	0	Depends on the equipment but in general can be 0 to 240	Initial address of the variables to be read / written from / to the device (in words).
Unscheduled Messages	U:4:O U:4:I	Format : <b>U:F:I</b> or <b>E:F:O</b> Where F is the file number and can be 3 to 6	This function configure the driver worksheet to read / write unscheduled messages from / to the device from initial address 0. The option 'I' or 'O' tells which function to perform (read or write).

☞ Note: For **Read Unscheduled** worksheet, you just need to fill the field **Header**. The others fields like **Enable Read When Idle** and **Read Trigger** don't have any effect. You can use **Read Complete** and **Read Status** to see the status of the unscheduled communications.

For **Write Unscheduled** worksheet, all fields work like **write scheduled** worksheet.

#### 4.4 Address Configuration

The body of the driver worksheet allows you to associate each tag to its respective address in the device. In the column **Tag Name**, you must type the tag from your application database. This tag will receive or send values from or to an address on the device.

Information regarding the parameter "Address"				
Function in "Header"	Parameter in "Address"	Sample Syntax	Valid Range	Comment
COMMSTATUS	Type of Status	1	1 to 3	Read function that returns: <ul style="list-style-type: none"> <li>• Global event indication,</li> <li>• Board status, or</li> <li>• ControlNet network status depending on the value filled in the <b>Address</b>.</li> </ul>
COMMPARAM	Type of Parameter	1	1 to 8	Read function that returns: <ul style="list-style-type: none"> <li>• Mode (always 2),</li> <li>• MacID (1 to 99),</li> <li>• Scheduled Input Data Length,</li> <li>• Scheduled Output Data Length,</li> <li>• Unscheduled Data Length File #3,</li> <li>• Unscheduled Data Length File #4,</li> <li>• Unscheduled Data Length File #5,</li> <li>• Unscheduled Data Length File #6</li> </ul> depending on the value filled in the <b>Address</b> .

Scheduled Messages	Offset Address of the Variables and Type of Data RESET function	W0.2 B0.0 W7 B8 RESET.2	W0 to W239 Or B0 to B479 1 to 3 (RESET)	Offset address of the variables in relation to the initial address in <b>Header</b> . Can be in word or byte. If there is a '.', then it defines bit operation, i.e., only a bit of the whole value will be read or written. The bit number can be 0 to 15 for word data type or 0 to 7 for byte data type. For 'RESET' function, the field specifies the type of reset : <ul style="list-style-type: none"> <li>• 1 = COLDSTART</li> <li>• 2 = WARMSTART</li> <li>• 3 = BOOTSTART</li> </ul> This function works only in write events.
Unscheduled Messages	Offset Address of the Variables and Type of Data	W0 B7	W0 to W999 Or B0 to B1999	Offset address of the variables starting at 0. There is no bit operation for unscheduled messages

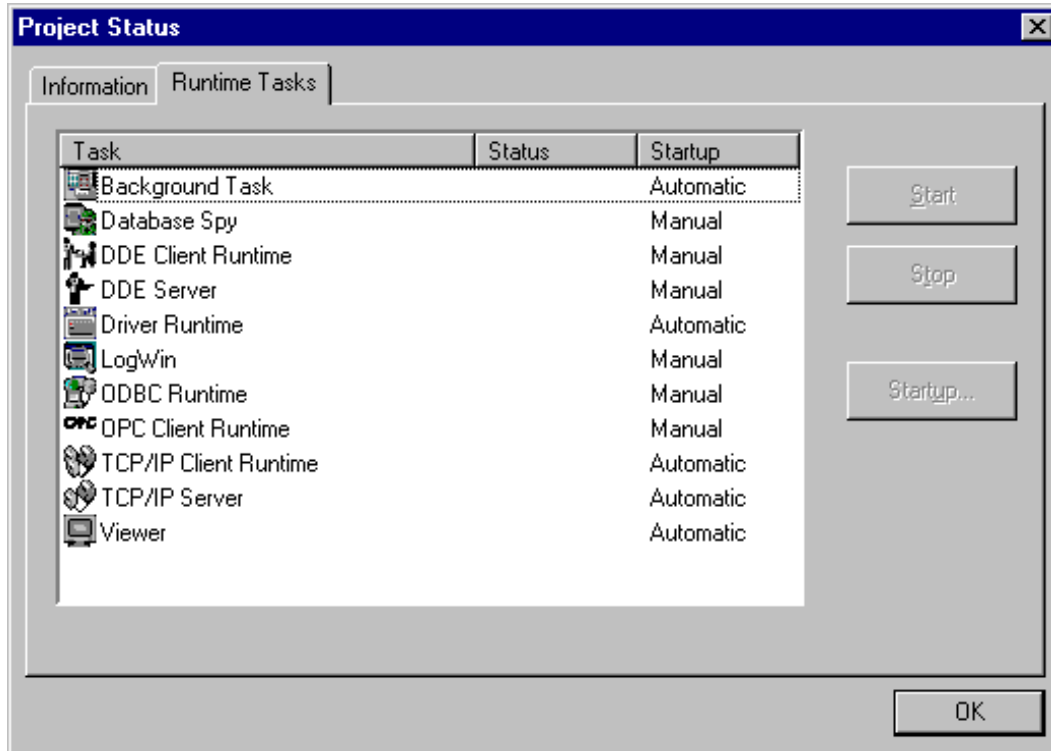
☞ Note: For the scheduled messages, the final address of the variables in the device is the sum of the **initial address** defined in the field **Header** and the **offset** defined in the field **Address**.

#### 4.5 Device Configuration

Since there are several equipment that uses the ControlNet protocol, it is impossible for us to define a standard device configuration. You can use as example the configuration in the section ControlNet network setup.

## 5 Execution

- When installing the driver, it is automatically selected to execute when you start-up the Runtime Environment. To verify the if the driver is correctly enabled to start, use the menu option **Project + Status...**, and verify the task Driver Runtime



## 6 Troubleshooting

After each attempt to communicate using this driver, the tag configured in the field **Read Status** or **Write Status** will receive the error code regarding the kind of failure that occurred. The error messages are:

Error Code	Description (*)	Possible causes	Procedure to solve
0	OK	Communication without problems	-
2	Invalid Header	Invalid Header typed in the driver worksheet	Type a valid header
3	Invalid Address	Invalid Address typed in the driver worksheet	Type a valid address
4	Error of Block Size	Number of bytes to read exceed 480 bytes	Correct the number of bytes to read
5	Error of Protocol	Some data read from device not match with the protocol. This is because noise, device that isn't compatible with the protocol.	Check if the device/cable are in a high noise environment. Check if the device is compatible with the protocol.
6	Error of CheckSum	CheckSum read from device not match with the protocol. This is because noise or device that isn't compatible with the protocol.	Check if the device/cable are in a high noise environment. Check if the device is compatible with the protocol.
7	Error While Opening the Driver	Miss some DLL's or the board can not be initialized	Check if CIFCEDLL.DLL and CIFISA.DLL were copied to the system directory of the Windows. Check if the board is OK
8	Error While Sending the Message	The driver cannot send data to the specified device	Check if the cable and the device are OK
9	Error While Receiving the Message	The driver sent some data but the device is not returning the answer	Check if the cable and the device are OK
15	Invalid File Number	The file number of the unscheduled worksheet is invalid	Retype a valid file number, i.e., 3 to 6
16	Invalid Offset	The initial address specified in the Header field exceed the maximum	Retype a initial address (max. 239)
17	Invalid File Type	The file is neither input nor output	Enter valid file type ( I = Input, O = Output)
20	Invalid Function COMMSTATUS Parameters	The specified parameter in Address is invalid	Enter valid parameter, i.e., 1 to 3
21	Invalid Function COMMPARAM Parameters	The specified parameter in Address is invalid	Enter valid parameter, i.e., 1 to 8
22	Invalid Function RESET Parameters	The specified parameter in Address is invalid	Enter valid parameter, i.e., 1 to 3
23	Invalid Unscheduled Messages Parameter	The offset specified in the Address field exceed the maximum	Enter new values (max. 1999 for bytes or 479 for words)
24	Invalid Scheduled Messages Parameter	The offset specified in the Address field exceed the maximum	Enter new values (max. 999 for bytes or 239 for words)
25	Invalid Bit Address (Word)	The specified bit number is invalid	Enter a valid bit number ( 0 to 15)
26	Invalid Bit Address (Byte)	The specified bit number is invalid	Enter a valid bit number (

			0 to 7)
27	Invalid Bit Operation in Unscheduled Worksheet	The bit operation is not allowed in unscheduled worksheet	Do not use bit operation in unscheduled operation
28	Invalid Scheduled Messages File Length	The typed value exceed the maximum allowed	Enter a valid value (max. 240 words)
-15	Timeout waiting start a message.	<ul style="list-style-type: none"> <li>- Disconnected cables</li> <li>- PLC turned off, or in Stop or error mode</li> <li>- Wrong Station number</li> <li>- Wrong RTS/CTS control settings.</li> </ul>	<ul style="list-style-type: none"> <li>- Check the cable wiring</li> <li>- Check the PLC state. It must be RUN</li> <li>- Check the station number.</li> <li>- Check the right configuration. See on the section 2.2 the different RTS/CTS valid configurations.</li> </ul>
-17	Timeout between rx char.	<ul style="list-style-type: none"> <li>- PLC in stop or error mode</li> <li>- Wrong station number</li> <li>- Wrong parity</li> <li>- Wrong RTS/CTS configuration settings</li> </ul>	<ul style="list-style-type: none"> <li>- Check the cable wiring</li> <li>- Check the PLC state. It must be RUN</li> <li>- Check the station number.</li> <li>- Check the right configuration. See on the section 2.2 the different RTS/CTS valid configurations.</li> </ul>

☞ Note: The results of the communication may be verified in the **output** Window of the Studio's environment. To set a log of events for **Field Read Commands**, **Field Write Commands** and **Serial Communication** click with the right button of the mouse on the output window and chose the option setting to select these log events. When testing under a Windows CE target, you can enable the log at the unit (Tools/Logwin) and verify the file celog.txt created at the target unit.

When you are not able to establish the communication with the PLC, you should first of all establish the communication between the PLC Programming Tool and the PLC. Very frequently the communication it is not possible due to a hardware or cable problem, or due an error or lack of configuration at the PLC. Only after the communication between the PLC Programming Software and the PLC is working fine, you can test again the supervisory.

When testing the communication with the Studio, you should first use the application sample described at item 7, instead of the new application that you are creating.

If is required to contact technical support, please have the following information available:

- Operating System (type and version): To find this information use the Tools/System Information option
- Project information: It is displayed using the option Project/Status from the Studio menu
- Driver version and communication log: Available from Studio Output when running the driver
- Device model and boards: please refer to hardware manufacture's documentation

## 7 Application Sample

The Studio contains a configured project to test the driver. It is strongly recommended to do some tests with this application before beginning the configuration of the customized project, for the follow reasons:

- To understand better the information covered in section 4 of this document.
- To verify that your configuration is working.
- To certify that the hardware used in the test (device + adapter + cable + PC) is in working conditions before beginning the configuration of the applications.

☞ Note: The Application Sample is not available for all drivers.

The Studio application is in the directory: `\COMMUNICATION EXAMPLES\<Driver Name>`

To perform the test, you need to follow these steps:

- Configure the device communication parameters using manufacturer programmer software..
- Open the application `\COMMUNICATION EXAMPLES\<Driver Name>`
- Execute the application
- To display the following screen with some information about the communication, please execute the Viewer module in the Studio.

☞ Note: The application for testing may be used like a maintenance screen for the custom application.



## 8 History of Versions

Version	By	Date	Description of changes
1.00	Sérgio A. Poon	01-Sep-1999	<ul style="list-style-type: none"><li>▪ Conformance version of the driver</li><li>▪ The driver has been released for Windows CE</li></ul>
1.10	Sérgio A. Poon	19-Nov-1999	<ul style="list-style-type: none"><li>▪ Modified Unscheduled Messages Procedures</li><li>▪ Modified Unscheduled Messages Header</li></ul>

## Appendix A – Hardware Setup of the CIF 30-CNS board

This appendix shows the jumper setup of the CIF 30-CNS board used to the test.  
This board is from HILSCHER.

- Jumper J3
- None

- Jumper J4



- Rotate Switch
- 00

## Appendix B – ControlNet Network Setup

The objective of this appendix is describe how to configure the ControlNet network to work appropriately with the Studio System and CIF 30-CNS board.

Basically, to configure the ControlNet network with Studio System involve three steps:

1. Configure the target device where the Studio System will be running;
2. Configure Device with which the target device will communicate;
3. Save the configuration in the ControlNet network.

The first step was explained in details in previous section. Now, we will explain in maximum details about how to configure the Device and the ControlNet network using two different kinds of devices :

- PLC-5 processor family and
  - Logix5550 processor
- both from Allen Bradley.

### Requirements

For the configuration described here following components are required:

<b>Hardware:</b>	<ul style="list-style-type: none"> <li>- Communication Interface CIF 30-CNS (Hilscher)</li> <li>- ControlNet PLC-5/40C Programmable Controller (Allen Bradley)</li> <li>- Logix5550 Programmable Controller 1756-L1/A (Allen Bradley)</li> <li>- ControlNet Bridge 1756-CNB/A (Allen Bradley)</li> <li>- ControlNet Communication Interface Card 1784-KTCX15 (Allen Bradley)</li> <li>- Cable, terminators, tabs.</li> </ul>
<b>Software:</b>	<ul style="list-style-type: none"> <li>- Windows NT/95 (Microsoft Corporation)</li> <li>- RSLogix 5 for ControlNet PLC-5 (Rockwell Software)</li> <li>- RSLogix 5000 for Logix5550 Engineering Release R306i(Rockwell Software)</li> <li>- RSNetWorx for ControlNet V1.5 (Rockwell Software)</li> <li>- Hilscher.hwx file (HILSCHER)</li> </ul>

### Prepare the Configurator RSNetWorx

For a proper configuration it is necessary to register the CIF 30-CNS for RSNetWorx using the hilscher.hwx file:

1. Shutdown RSNetWorx if it is running;
2. Copy the hilscher.hwx file to the directory:  
“...\Program Files\Rockwell Software\RSCCommon”;
3. At a command prompt (that is, a DOS window running within Windows NT/95), issue the command:  
“regsvr32 hilscher.hwx”.  
if it worked you should see a message that says ‘successful’;
4. Reboot your PC. The device should now appear in the RSNetWorx hardware tab.

For more details about this installation, see in “Protocol Manual – ControlNet Adapter” section 6.2 from HILSCHER.

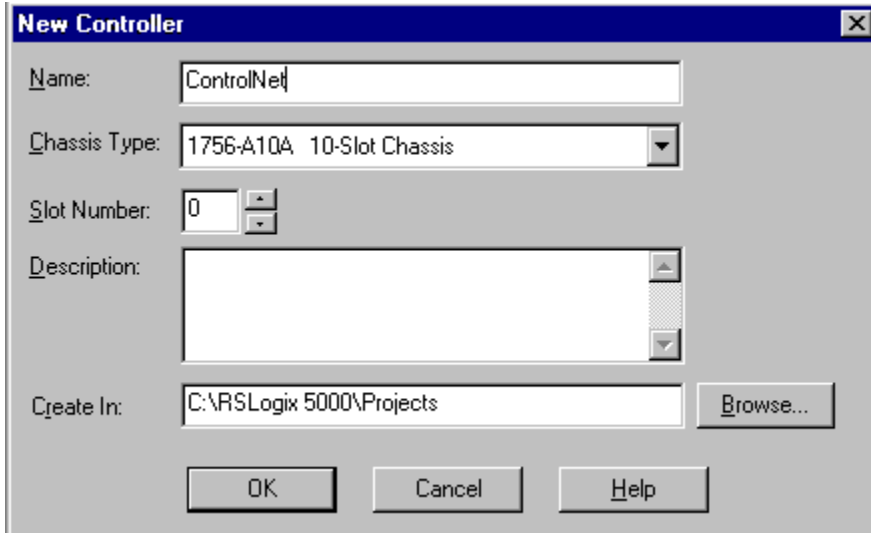
### Configuring ControlNet Network with PLC-5

To configure the ControlNet network with PLC-5, you can follow the instructions in the “Protocol Manual – ControlNet Adapter” section 6.4 from HILSCHER.

## Configuring ControlNet Network with RSLogix 5000

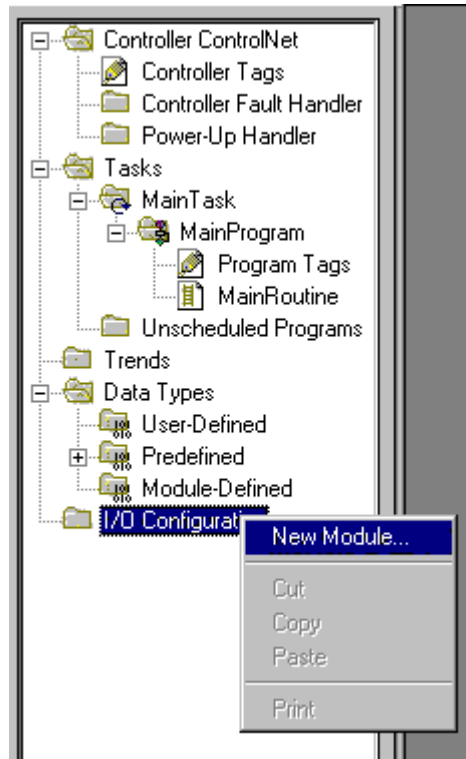
As mentioned before, first we may configure the device and then save the configuration in the network. In this section we will explain how to configure the device Logix5550. Follow the steps:

1. Run RSLogix 5000 Engineering Release R306I;
2. Start new project in the menu “File” and choose “New”;

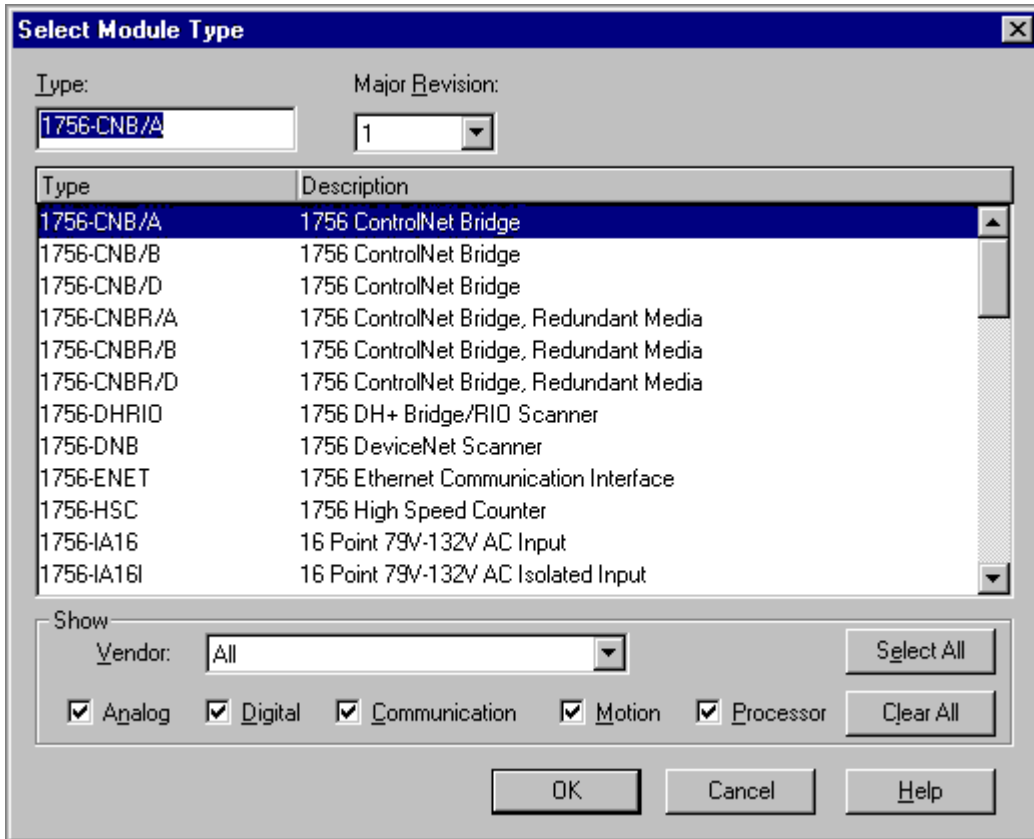


Fill the field ‘Name’ with a name of the project and choose ‘Chassis Type’ as figure above. Push the button “OK”.

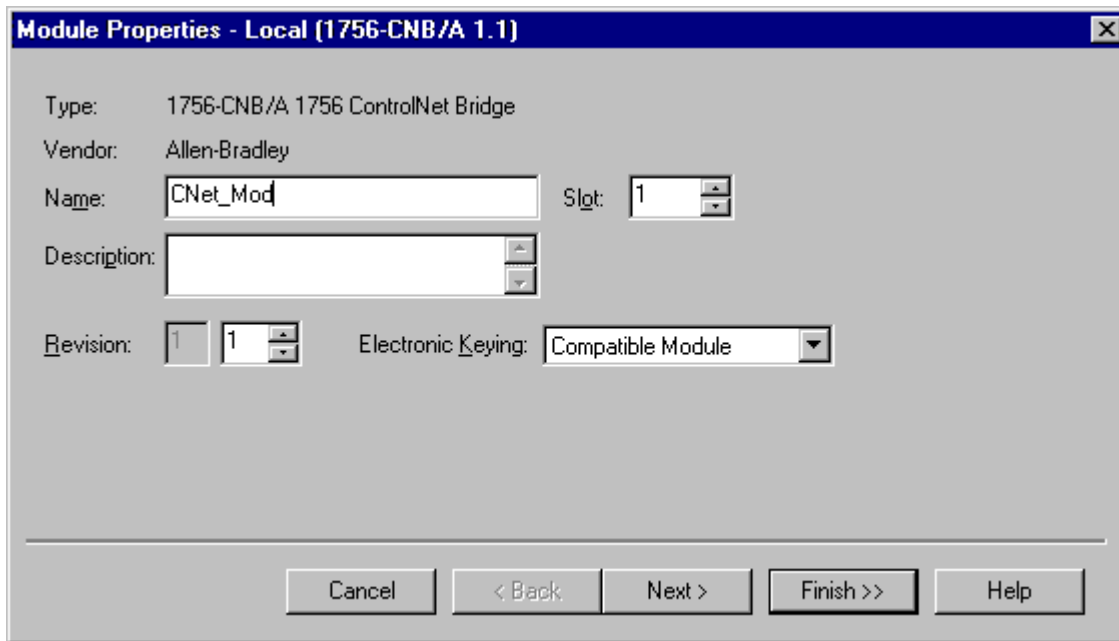
The follow workspace will appear:



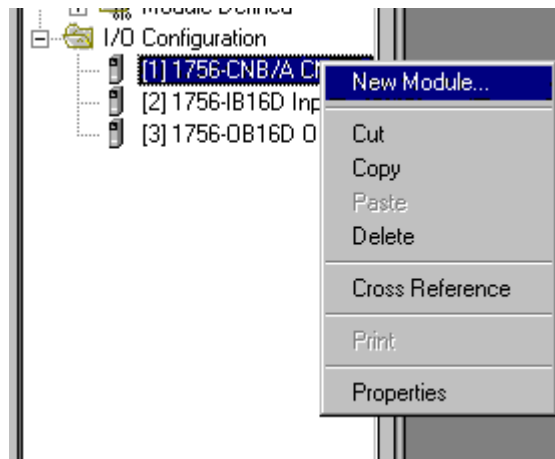
3. Click the right button of the mouse on the ‘I/O Configuration’ icon and choose ‘New Module’. The follow window will appear:



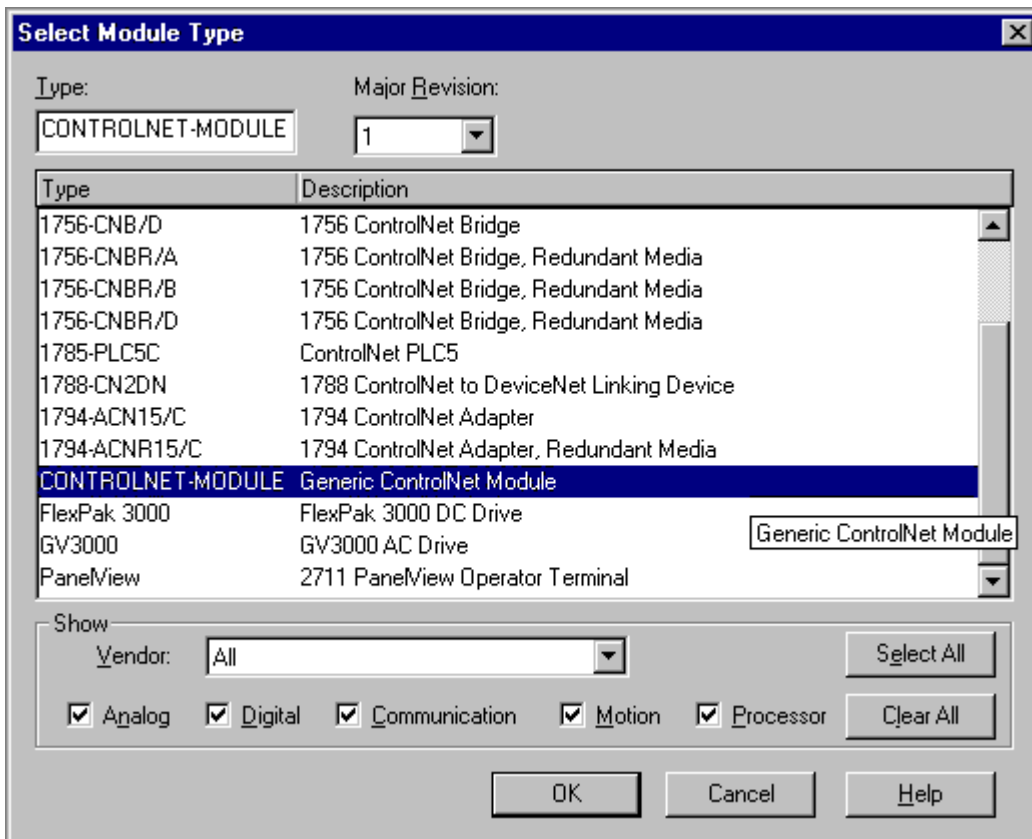
4. Select the module 1756-CNB/A ControlNet Bridge and fill the field 'Name', choose the appropriate slot number and set 'Node' equal 1. Push the button "Finish";



5. Select and configure all others modules that you have in the Logix5550 chassis as same way;
6. After you configured the I/O, you can now configure the communication card. So click the right button of the mouse on the ControlNet Bridge and choose 'New Module';



7. Select the module “ControlNet – Module – Generic ControlNet Module”;

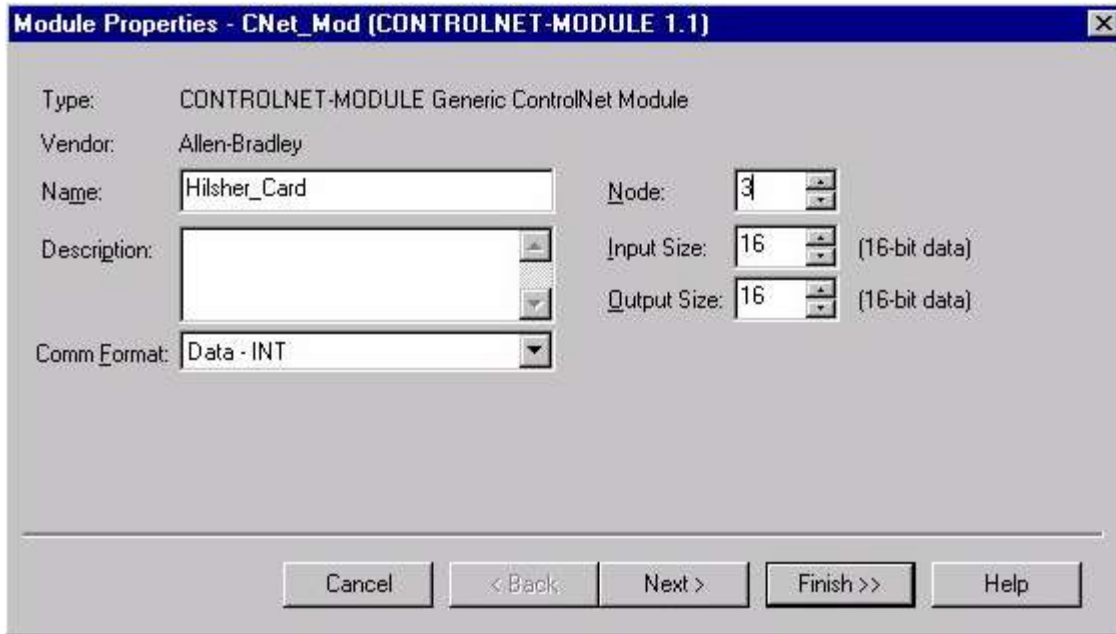


8. Configure the new module filling the fields:

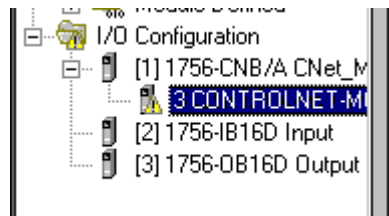
- ‘Name’;
- ‘Comm Format’ = Data – INT;
- ‘Node’ with the MacID of the CIF 30-CNS board;
- ‘Input Size’ with the scheduled input data length of the CIF 30-CNS board;
- ‘Output Size’ with the scheduled output data length of the CIF 30-CNS board.

Note: The latest values must match with the values assigned in the “Communication Parameter” of the driver (see section IV.1.1 for more details)

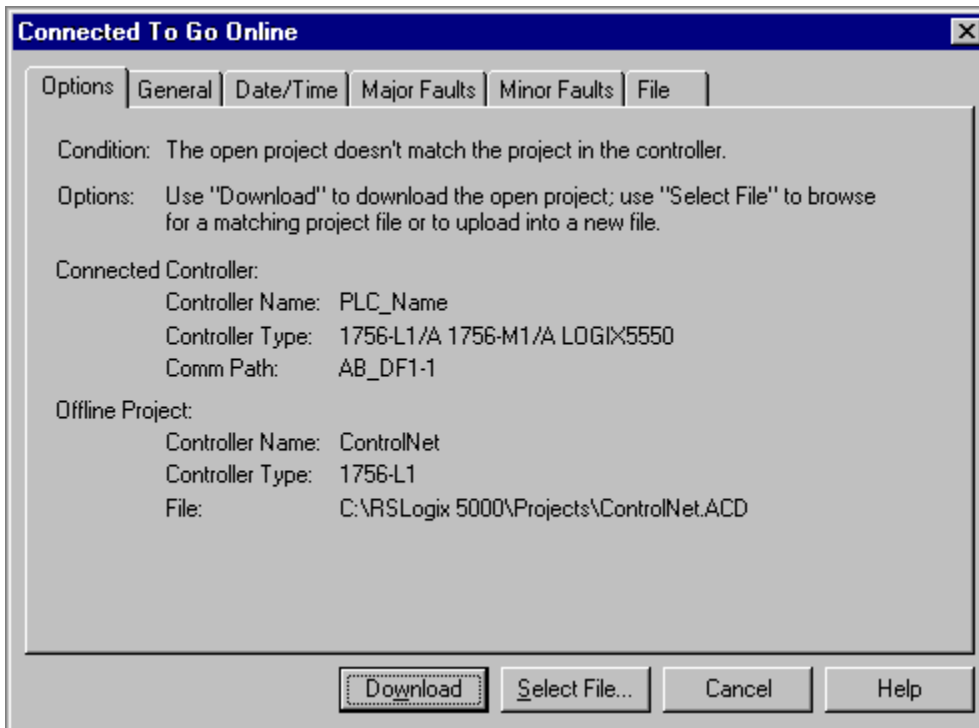
Push the button “Next>”;



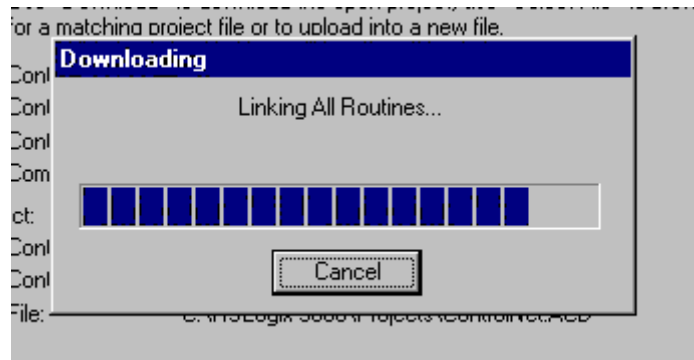
- In this new window, you must configure the parameter “Requested Packet Interval (RPI)” with values between 10 to 1000 ms. Push the button “Finish>>”. After this setup, a new yellow icon will appear below the ControlNet Bridge icon;



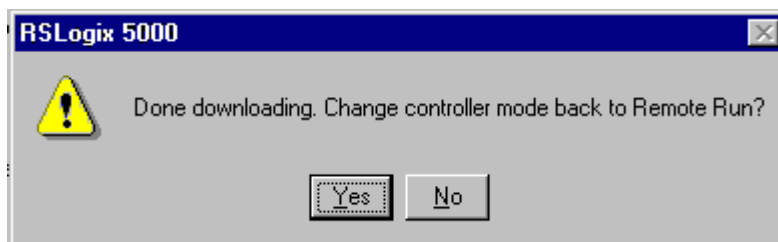
- Now, you may download the new configuration in the Logix5550 processor. To do this, in the menu “Communication” choose the item “Go Online” and the follow window will appear.



Push the button “Download” and confirm to change the controller to the “Remote Program” mode. The new configuration will be downloaded in the controller.



11. At the end of the download, a window will ask to return the controller to the “Remote Run” mode. Choose “Yes”;



At this point, the controller is configured with the ControlNet devices. Now we must configure the whole ControlNet network and save the configuration in the network. This is done as same way for the PLC-5 described in the “Protocol Manual – ControlNet Adapter” section 6.4 from HILSCHER.