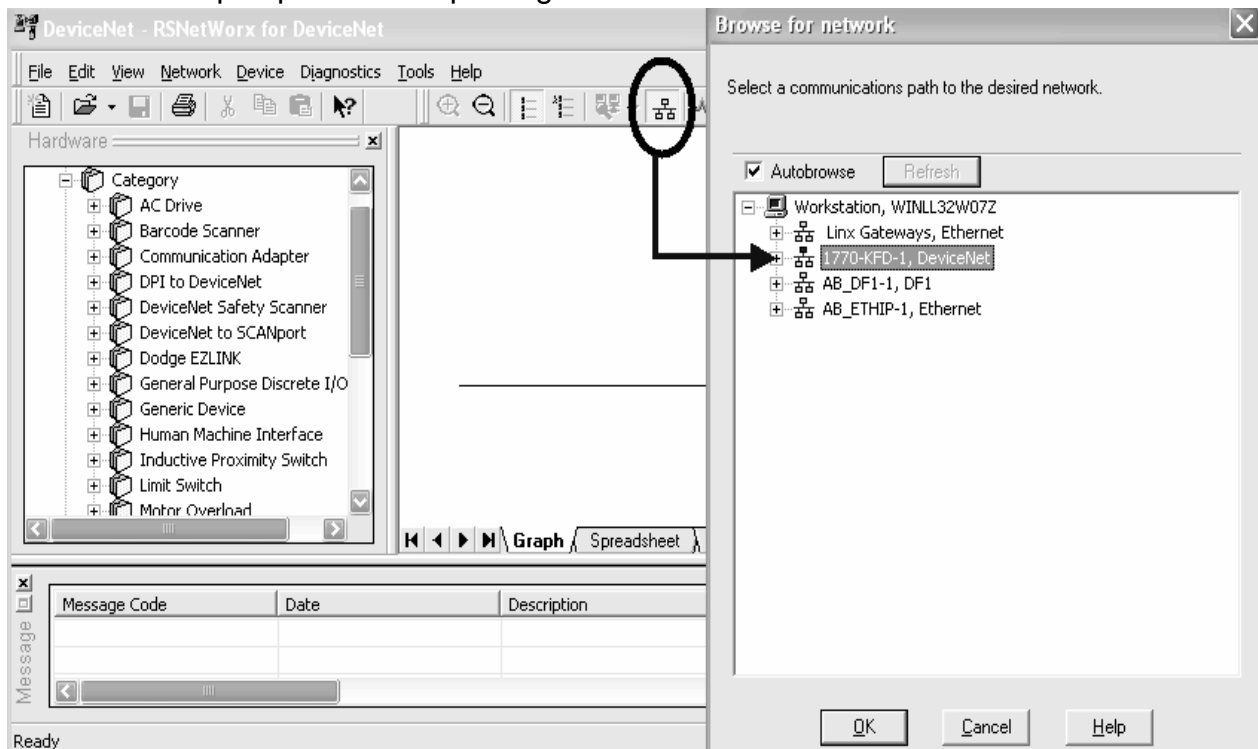


Configuring the RUI/Gateway on DeviceNet™ Using RSNetWorx

1. Prior to making the physical connections on the network setup the gateway DeviceNet™ communications parameters per your network requirements, i.e., baud rate and node address. If your not sure how to do this go to <http://www.watlow.com> and download the EZ-ZONE® PM Communications Manual and follow the procedure defined in the DeviceNet™ chapter.
2. Once the gateway communications parameters for DeviceNet™ are set according to your network requirements connect the gateway into the network and do the following:
 - a. Run RSLinx software and configure the driver of choice
 - b. Run RSNetWorx software.
3. As shown below (within RSNetWorx software), click on the online command from the tools toolbar and then select the appropriate communications path to browse the DeviceNet™ network. Set up in previous step using RSLinx software.

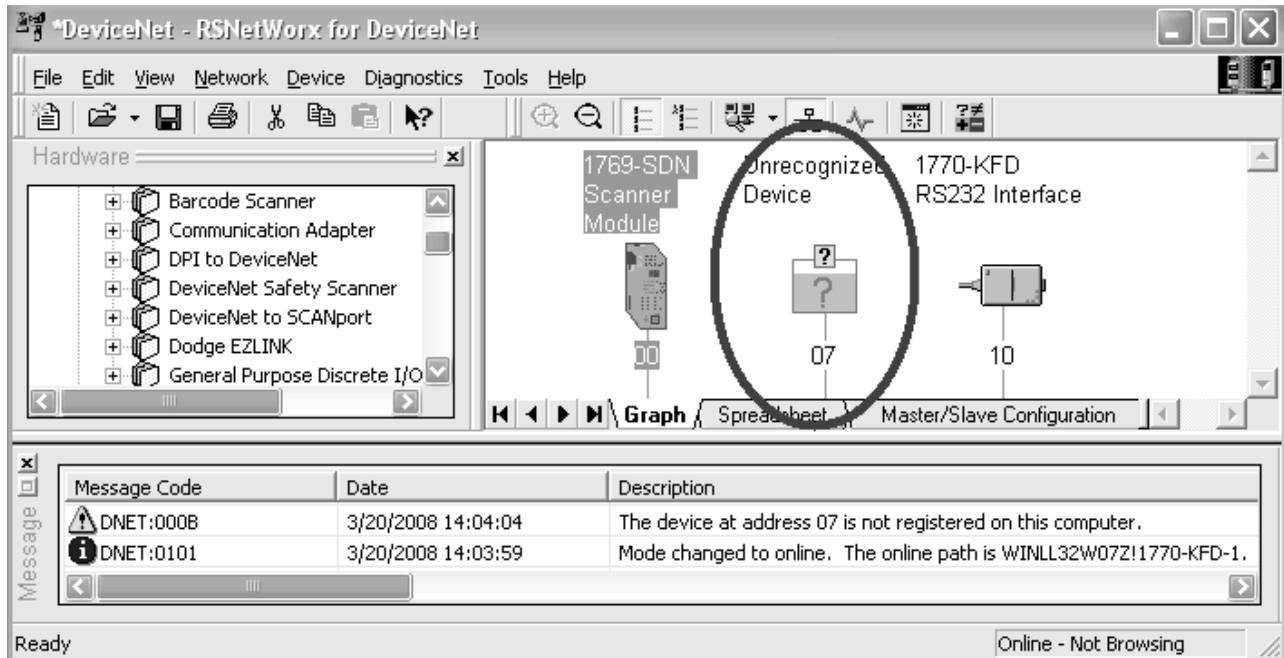


4. After successfully browsing the network all nodes on the network will appear in the graphical

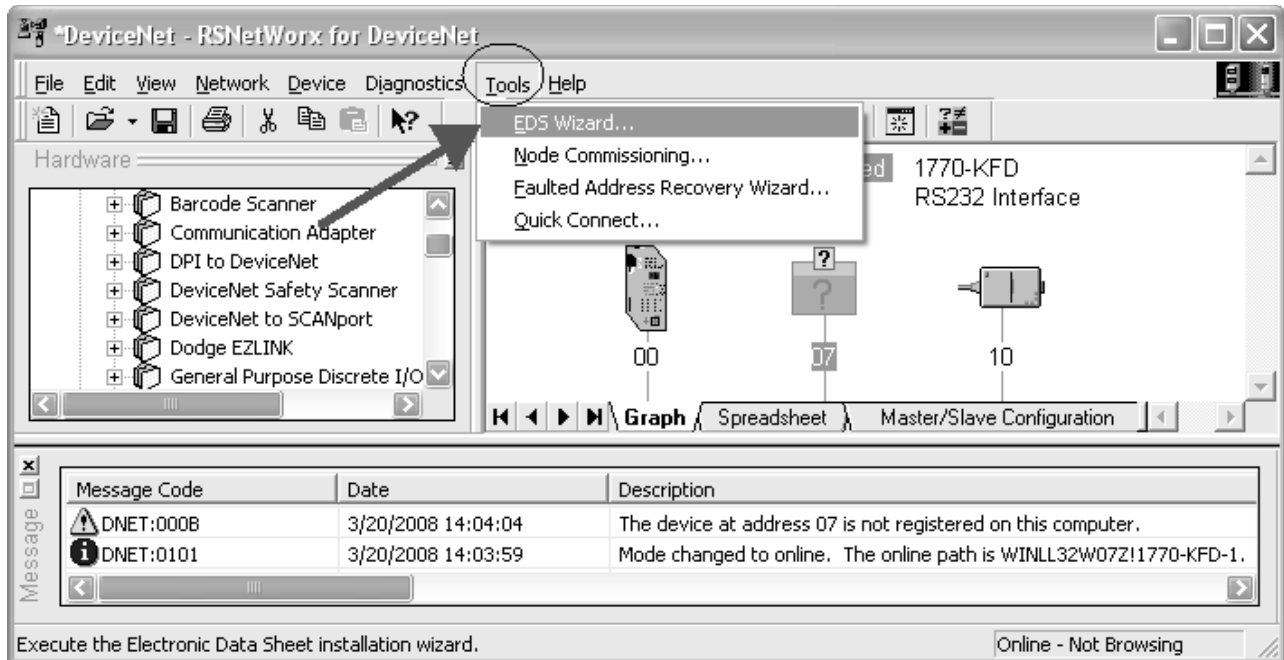


RUI/Gateway & DeviceNet™ Configuration & Ladder Logic Example Using an Allen-Bradley CompactLogix PLC

display as shown below. In this particular case, node 7 (RUI/Gateway) appears with a question mark because it has not yet been registered on the network.



5. To register any given node on the network click on Tools and then EDS Wizard.

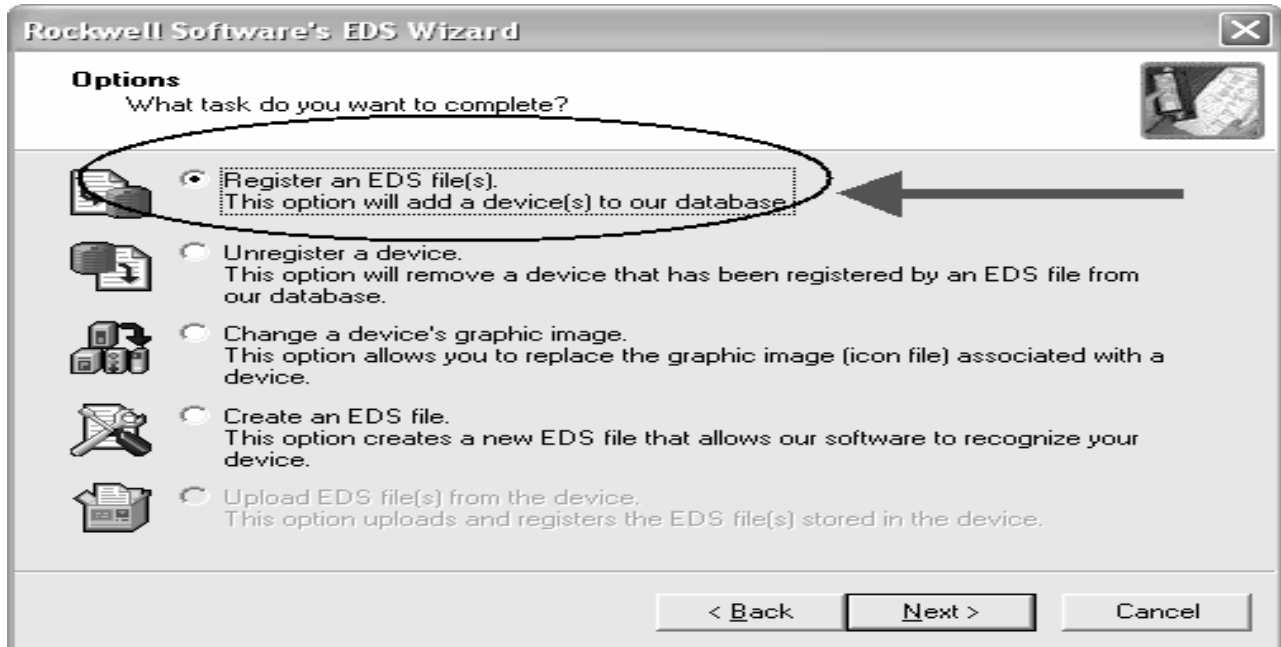


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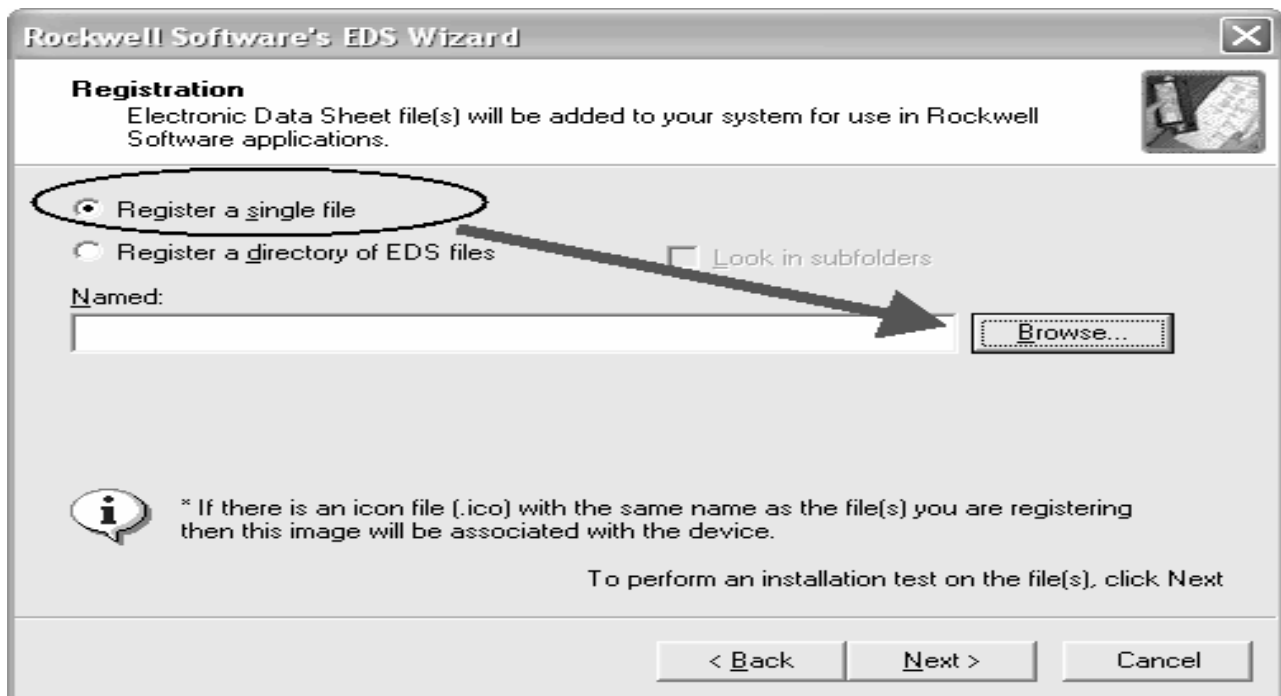


RUI/Gateway & DeviceNet™ Configuration & Ladder Logic Example Using an Allen-Bradley CompactLogix PLC

6. Select Register an EDS file.



7. Register a single file and then click browse to locate its location.

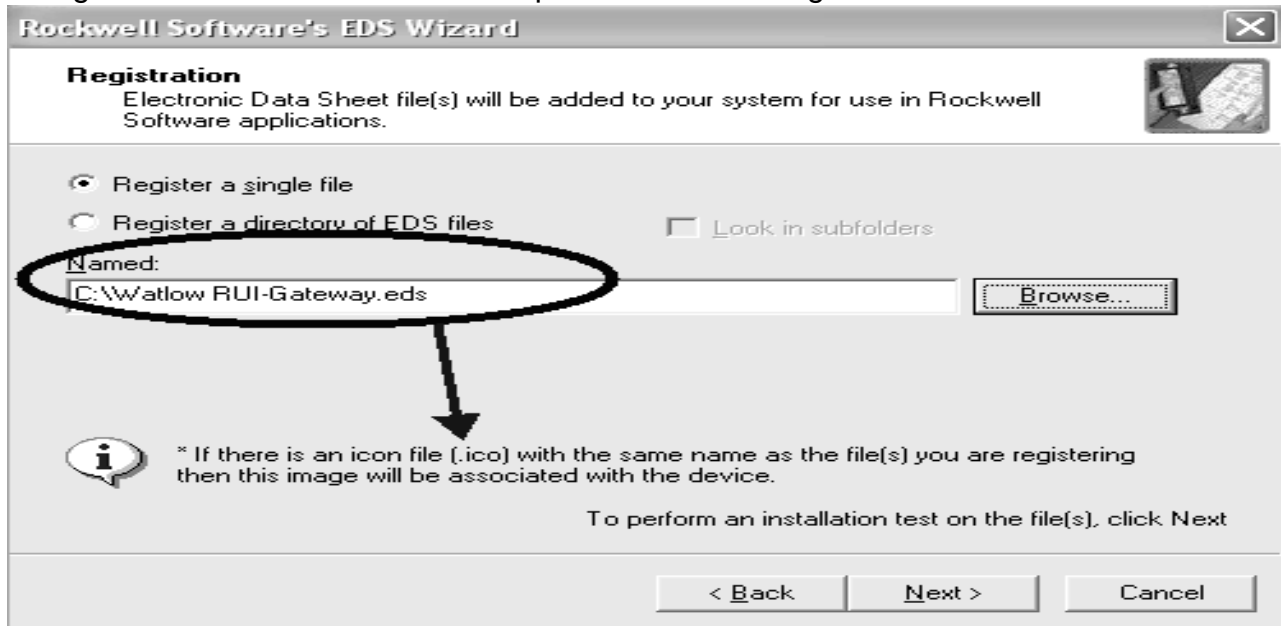


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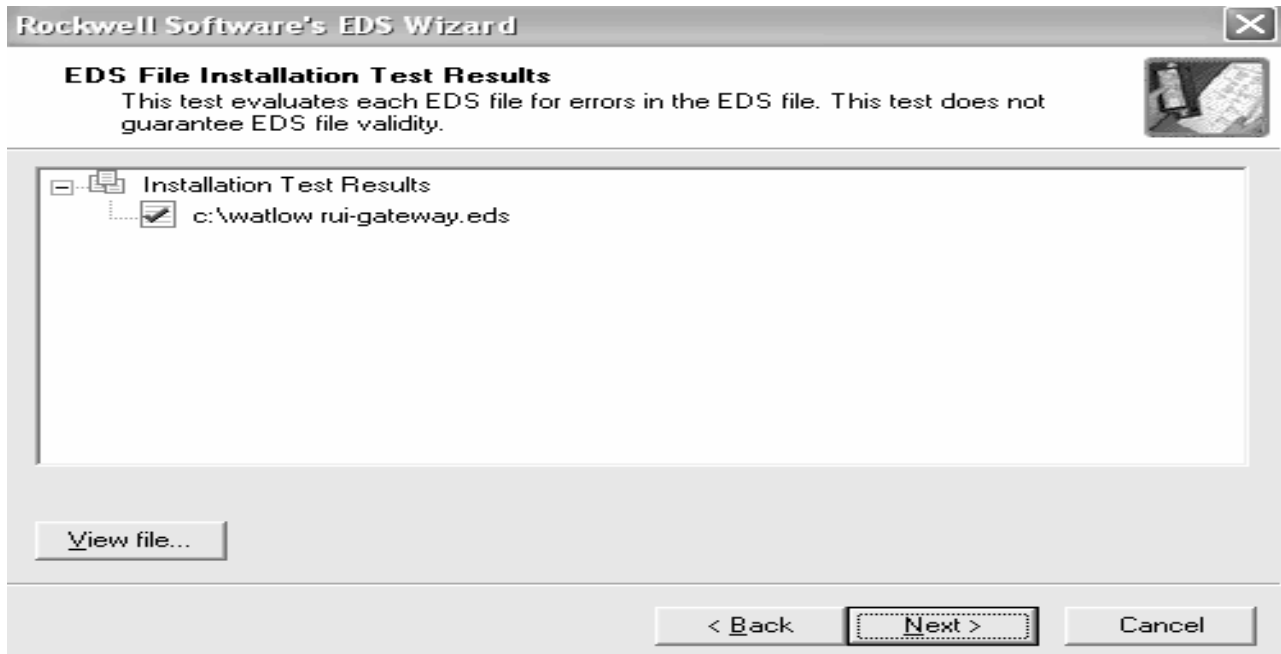


RUI/Gateway & DeviceNet™ Configuration & Ladder Logic Example Using an Allen-Bradley CompactLogix PLC

8. When found notice that if there is an icon with the same name the software will register it along with the EDS file. Click next to proceed with the registration.



9. The next step verifies that there are no errors in the EDS file; a green check should be displayed next to the file as shown below.

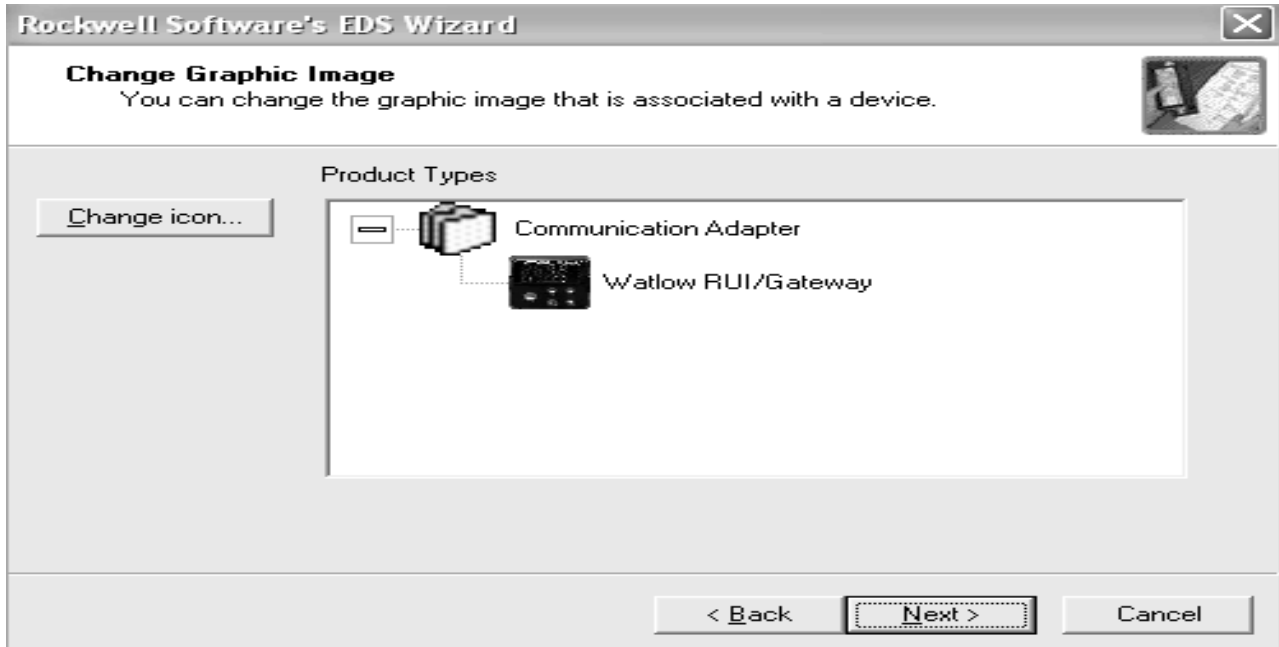


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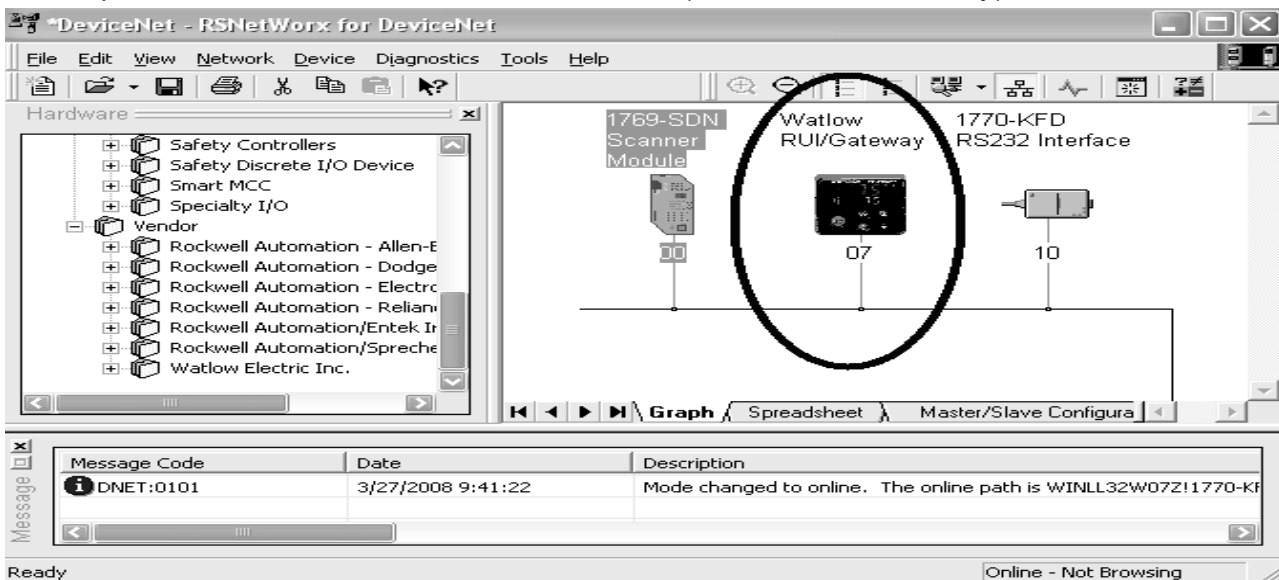


RUI/Gateway & DeviceNet™ Configuration & Ladder Logic Example Using an Allen-Bradley CompactLogix PLC

10. After clicking next above, the software will associate an icon to this device, if there was none found in the previous step it will use a default icon to graphically represent this node. Click next to proceed.



11. Clicking next above completes the registration process where the question mark is removed and replaced with the icon of choice for node 7 (Watlow RUI/Gateway).

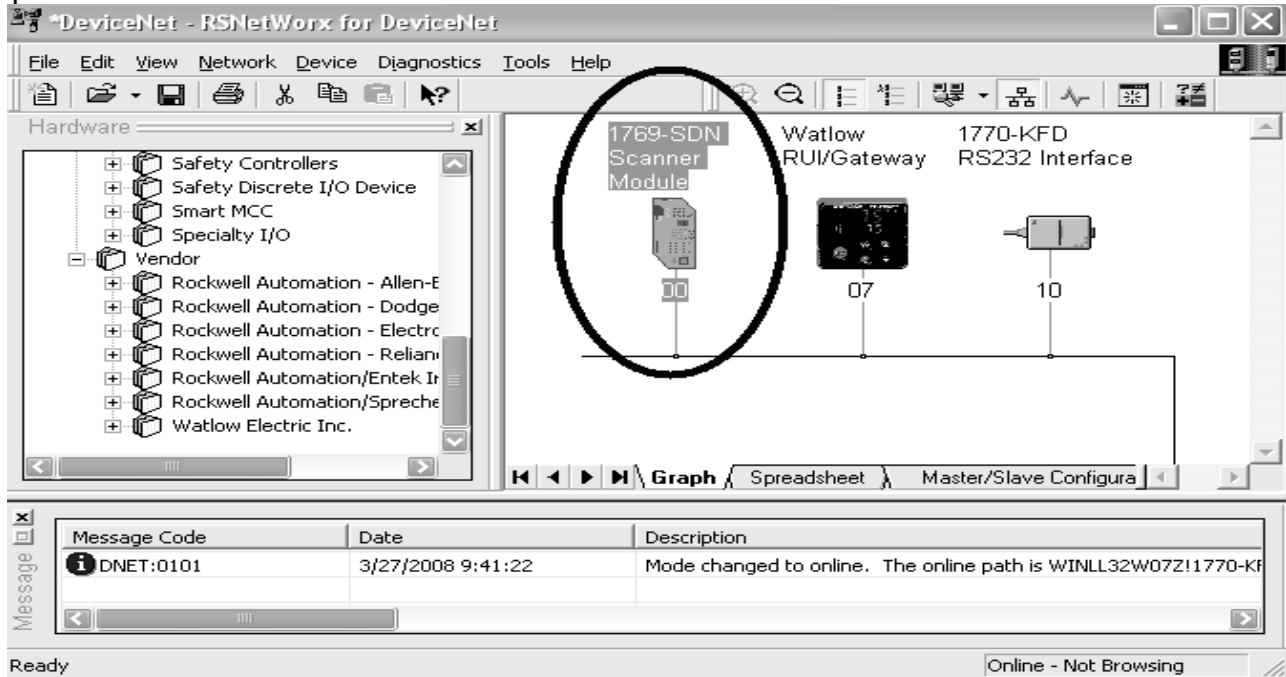


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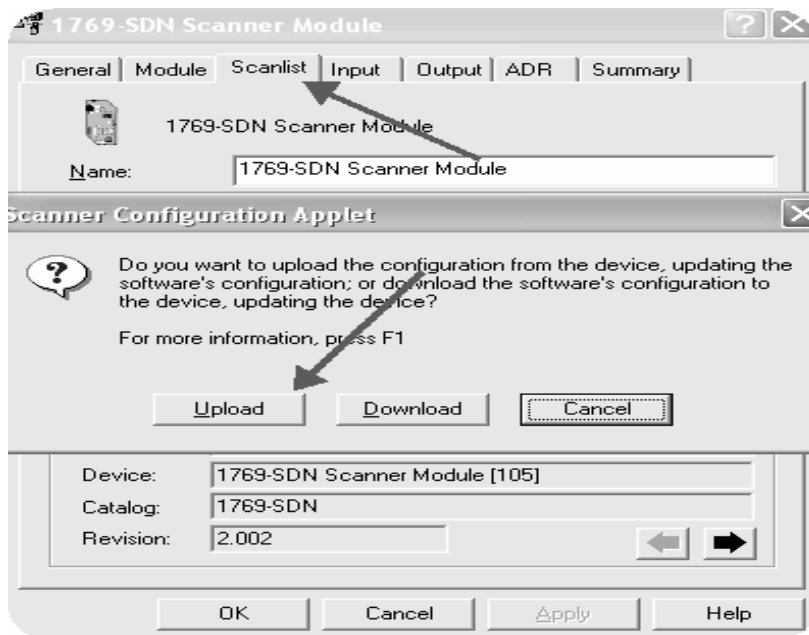


RUI/Gateway & DeviceNet™ Configuration & Ladder Logic Example Using an Allen-Bradley CompactLogix PLC

12. The next series of steps involves mapping the available RUI/Gateway input (84) and output (80) bytes via the scanner into the PLC memory. Double click on the scanner module to proceed.



13. Click on the scanlist tab where the next dialogue will suggest an upload or a download. Click on the upload button to allow the scanner to see what is available on the network.



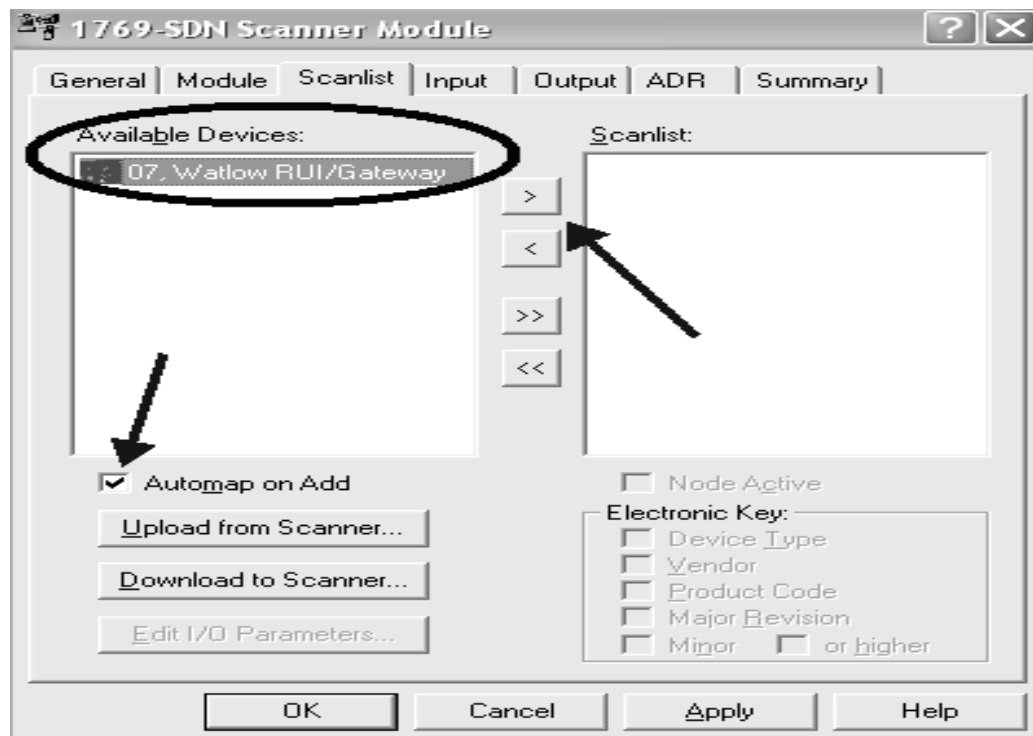
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RUI/Gateway & DeviceNet™ Configuration & Ladder Logic Example Using an Allen-Bradley CompactLogix PLC

14. After the scanner recognizes the RUI/Gateway on the network it will then appear as an Available Device as shown below. Before clicking on the right arrow to add it in the scanners scan list consider the effect of the Automap on Add check box. If this box is checked and there are other currently existing nodes on the network where they may not be using complete words (less than 32 bits) the scanner will not consider word boundaries when adding a new node and will attempt to utilize every available bit in the PLC. As an example, if a given device has only 9 bytes of information it will use $2\frac{1}{4}$ 32 bit words (3 bytes not used in the last word). Now, when adding a new node like the RU/Gateway that utilizes 80 bytes (20-32 bit words with each being a separate entity, i.e., 32 bit Set Point) $\frac{3}{4}$ of the first word will be placed in the last word of the node mentioned above. The impact of this action would then break up all of the 20 words sent to and received from the RUI/Gateway in a convoluted way. For this reason, it is suggested that this box be **unchecked** (if there are other devices on the network) allowing the individual doing the configuration to select the appropriate word boundaries manually.

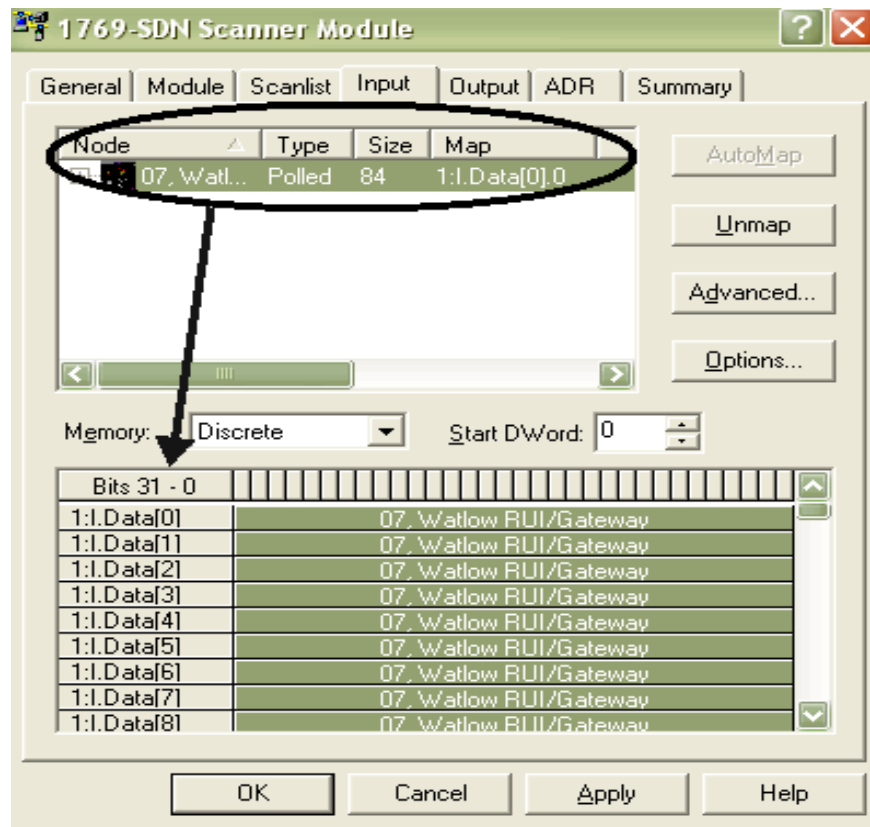
In this case, there are no other devices on the network so leaving the Automap on Add box checked will not have a negative impact on the gateway configuration.





RUI/Gateway & DeviceNet™ Configuration & Ladder Logic Example Using an Allen-Bradley CompactLogix PLC

15. Once the available device (RUI/Gateway in this case) is moved over to the Scanlist the next step will be to map the RUI/Gateway input and output bytes to PLC addresses; first the inputs. In this particular case the Automap on Add box was checked and the result of that now becomes apparent. Since there were no other devices on the network the software simply took all of the available RUI/Gateway input bytes (84) and allocated them to the first available PLC input bytes. Although we can't see in the graphic below all of the addresses assigned you can trust that what was assigned are addresses 1:I.Data[0] through 1:I.Data[20]. If there were other devices on the network and the Automap on Add box *was not checked* the address field below would not be populated. Clicking on the Advanced button would then allow for manual configuration.



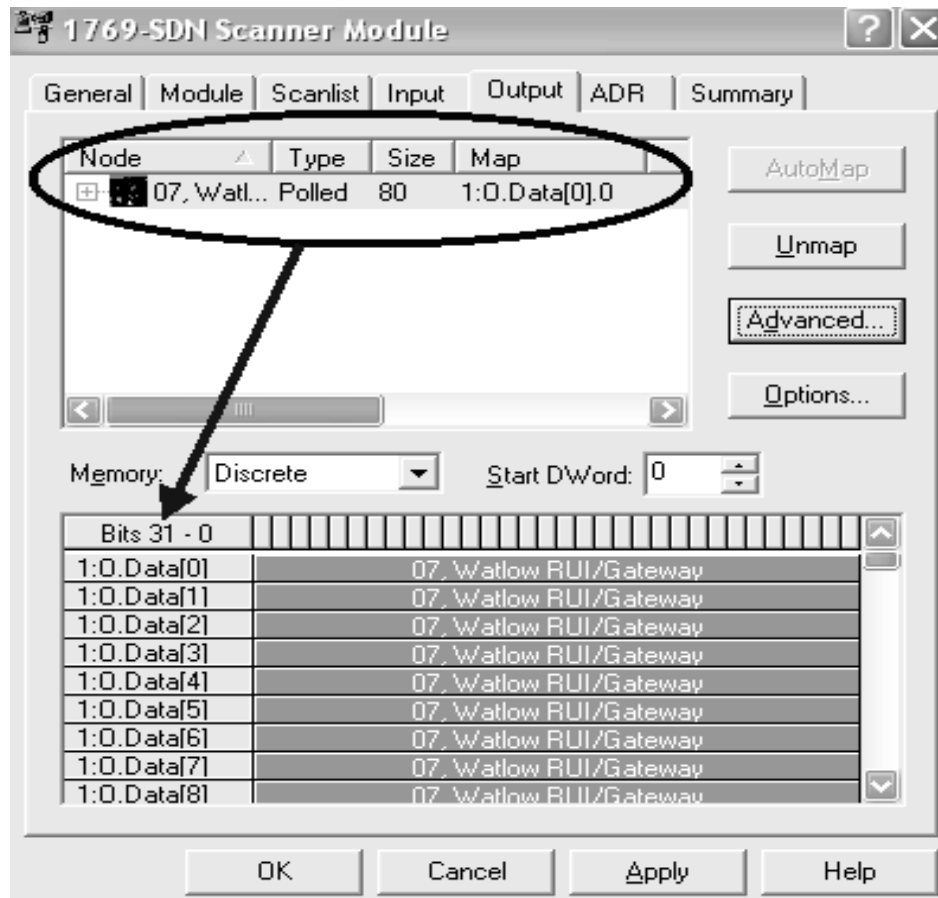
16. Likewise, all of what was said above regarding the inputs also applies to the outputs as well. Notice in the graphic below that for the outputs the size changes to 80 bytes or 20-32 bit words and addresses given would be 1:O.Data[0] through 1:O.Data[19]. Click on the OK button where you will then be prompted to write this configuration to the scanner memory.

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RUI/Gateway & DeviceNet™ Configuration & Ladder Logic Example Using an Allen-Bradley CompactLogix PLC

The PLC will need to be in the program or remote program mode for this to occur. When written this completes the configuration of the RUI/Gateway using RSNetWorx.



Configuration of the RUI/Gateway

17. Prior to looking at the PLC side of things let's first take a look at a possible network configuration. The graphic below depicts a network consisting of an RUI/ Gateway with a PLC on one side talking DeviceNet™ where on the other side of the gateway we see four EZ-ZONE® PM controls talking Standard Bus. Now, seeing the network layout, the next step is to configure the RUI/Gateway.

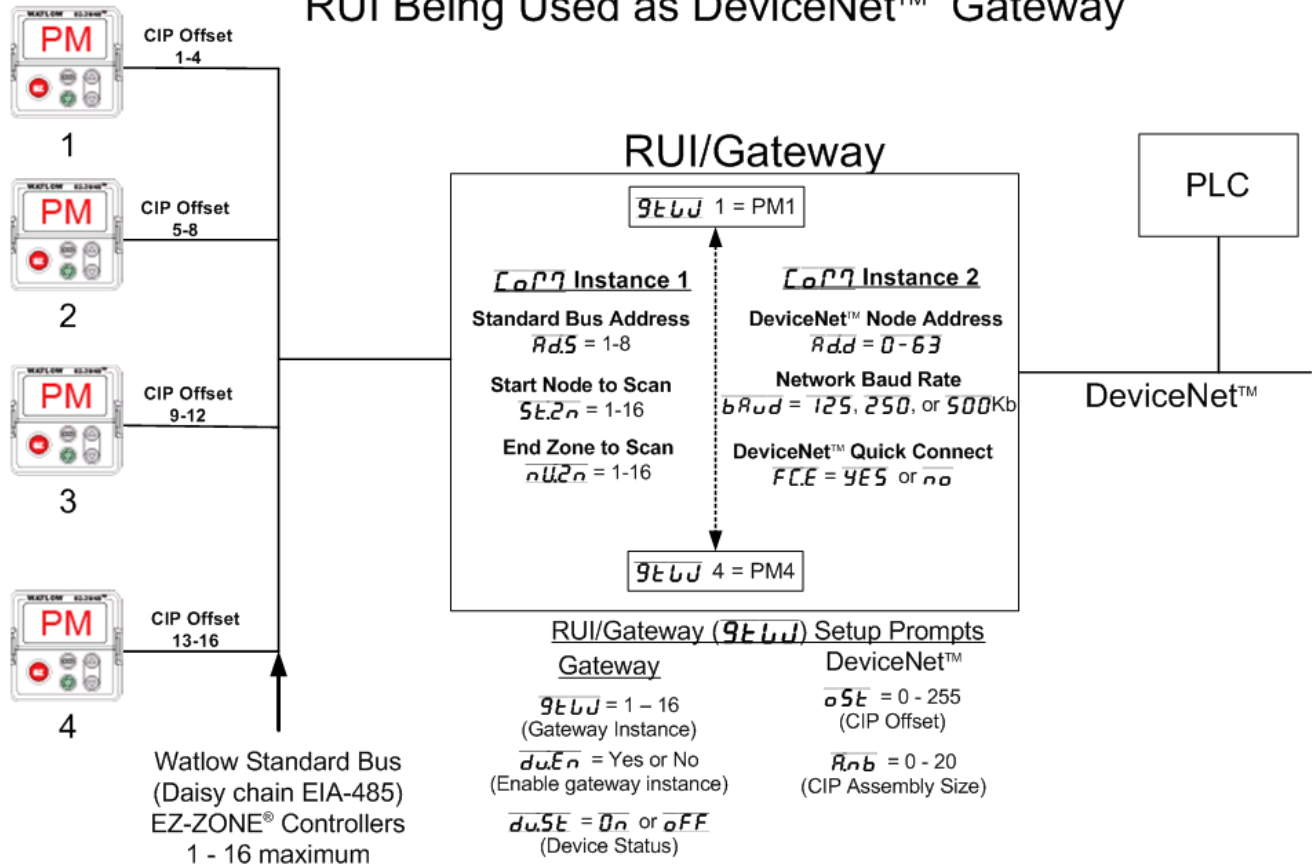


RUI/Gateway & DeviceNet™

Configuration & Ladder Logic Example

Using an Allen-Bradley CompactLogix PLC

RUI Being Used as DeviceNet™ Gateway



18. The table below does not represent all of the RUI/Gateway prompts that need configuration but they do represent those that are pertinent to this discussion. (For further information on the RUI/Gateway configuration go to the Watlow website and download the RUI/Gateway User Manual)

Gateway Instance	Enable Gateway Instance	CIP Offset
$9E6J = 1$	$duEn = \text{Yes}$	$o5t = 0$
$9E6J = 2$	$duEn = \text{Yes}$	$o5t = 4$
$9E6J = 3$	$duEn = \text{Yes}$	$o5t = 8$
$9E6J = 4$	$duEn = \text{Yes}$	$o5t = 12$

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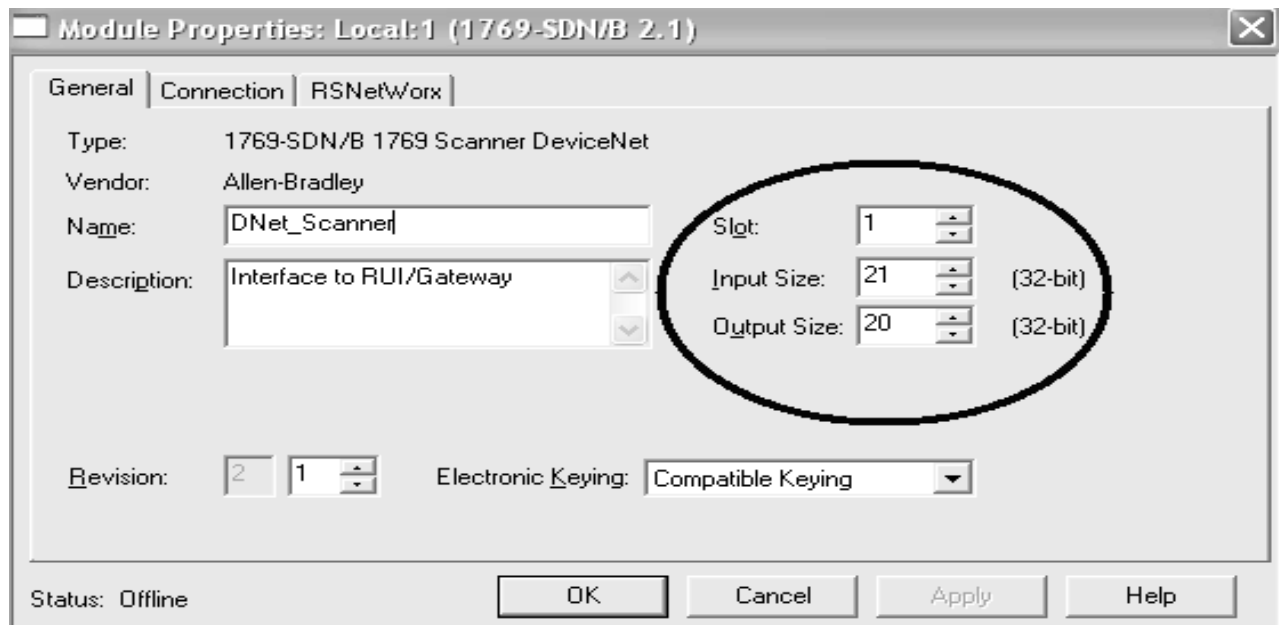
RUI/Gateway & DeviceNet™ Configuration & Ladder Logic Example Using an Allen-Bradley CompactLogix PLC

19. The gateway instance represents the EZ-ZONE® control, in this case, PM 1-4. The enable gateway instance simply turns on that particular gateway where there is a direct correlation between gateway instance 1 and EZ-ZONE® PM controller 1. Likewise, that relationship continues through gateway instance 16 and EZ-ZONE® PM controller 16. The gateway instance will always equate to the Standard Bus controller with the same address 1-16.

The CIP offset allows for the PLC or any master on the DeviceNet™ side to read or write the same member from any of the four controllers on the Standard Bus network via an explicit message.

Configuring the DeviceNet™ Scanner (1769-SDN) Using RSLogix 5000

20. In the examples that follow please note that the PLC being used is a CompactLogix L32E. If using other PLCs the steps will vary slightly but the overall concepts will be the same. As you might guess some configuration is required on the PLC side prior to getting started with the programming.
21. Insert a DeviceNet™ scanner into the I/O structure of the PLC. Notice below the input and output size correlates directly to what was configured in RSNetWorx (step 15).





RUI/Gateway & DeviceNet™ Configuration & Ladder Logic Example Using an Allen-Bradley CompactLogix PLC

22. Notice too, the slot number, in this case “1”. This is the physical slot in which the scanner resides. After the scanner is configured two tags will be automatically generated reflecting the existence of the scanner in slot 1 of the I/O structure. These tags will be used to move the implicit input and output assemblies (more on this to follow) to and from the RUI/Gateway and then ultimately to the destination EZ-ZONE® PM controls that exist on Standard Bus.

	Name	Δ	Data Type
▶	[-] Local:1:I		AB:1769_SDN_220Bytes:I:0
	[+] Local:1:I.Fault		DINT
	[+] Local:1:I.Status		AB:1769_SDN_Status_Struct:I:0
	[+] Local:1:I.StatusRegister		AB:1769_SDN_StatusRegister:I:0
	[+] Local:1:I.Data		DINT[21]
	[-] Local:1:O		AB:1769_SDN_84Bytes:O:0
	[+] Local:1:O.CommandRegister		AB:1769_SDN_CommandRegister:O:0
	[+] Local:1:O.Data		DINT[20]

EZ-ZONE® EEPROM

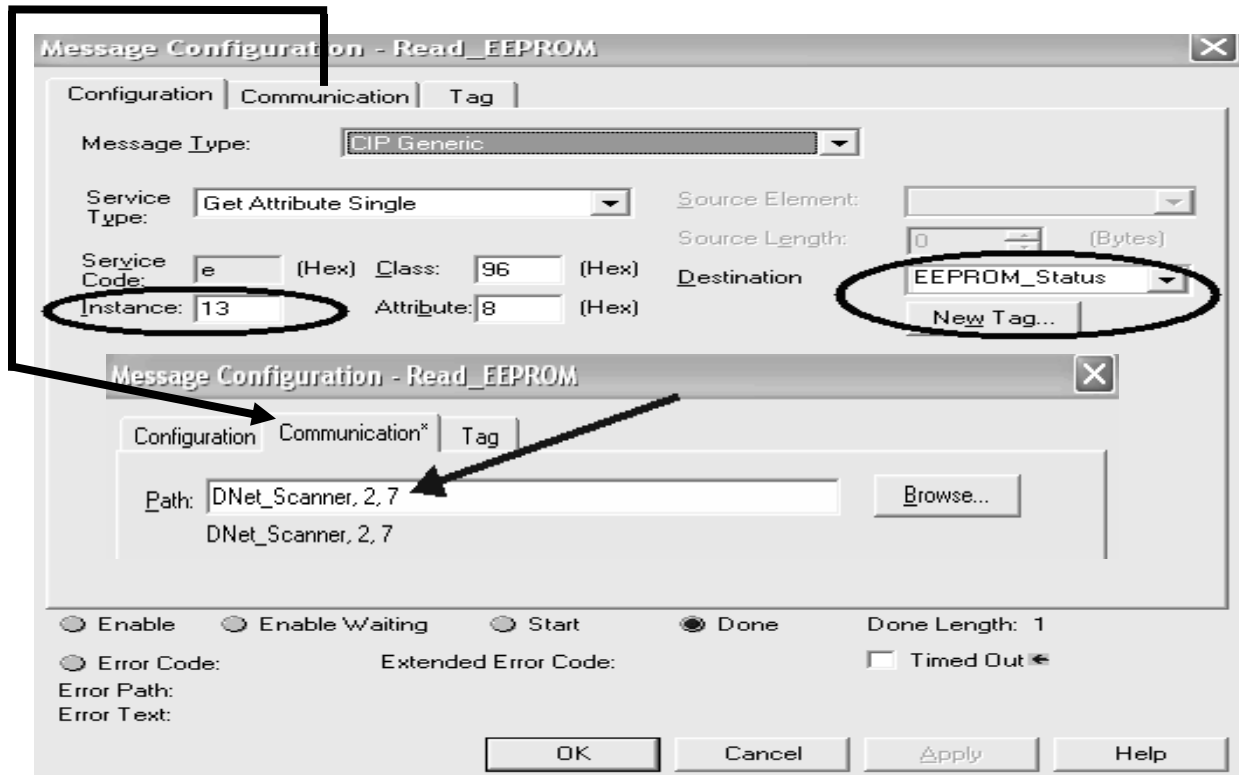
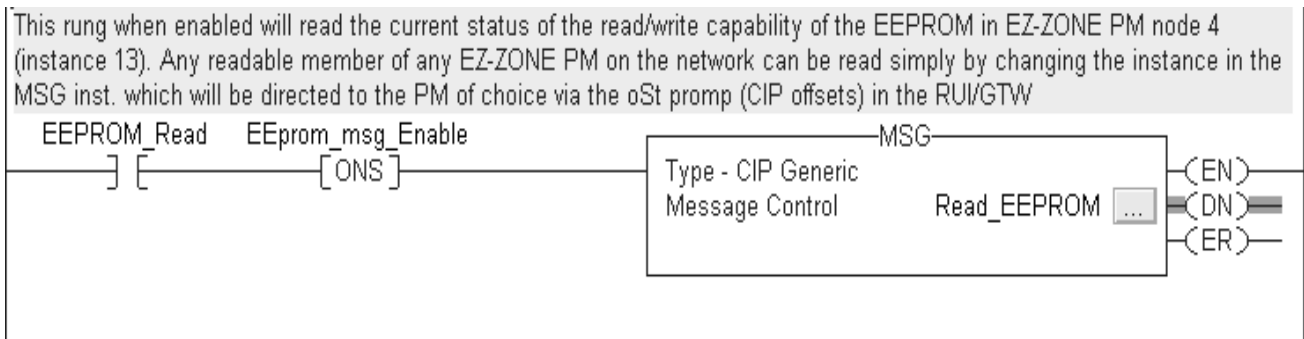
23. Before we get started with the programming examples it is important to note that the EZ-ZONE® family of controls has an on-board EEPROM to back up user settings in the event of a power loss. By default, the non-volatile save parameter is enabled, therefore changes made over the network as well as any changes made from the RUI are saved to the EEPROM. If the implicit output (PLC to EZ-ZONE® Control) assembly is in use, where information is exchanged implicitly (continuously after the connection is established) the rate at which writes to EEPROM occur could be very fast. With this being said, it should be considered carefully as to whether or not this parameter should remain enabled. To avoid premature EEPROM failure (~1,000,000 writes) it is recommended that the user disable the non-volatile write parameter in the destination nodes residing on the Standard Bus side of the RUI/Gateway. An example will follow showing how to read and write to this parameter.



RUI/Gateway & DeviceNet™ Configuration & Ladder Logic Example Using an Allen-Bradley CompactLogix PLC

Reading and Writing to/from RUI/Gateway Using RSLogix 5000

24. The rung of logic below when enabled, will execute an explicit message sent to the gateway where it will then be routed out over Standard Bus to the EZ-ZONE® PM control defined by the instance (oSt prompt). Because the CIP offset is set to 12 for gateway instance 4 this message will be routed to PM4. When done, the destination tag identified under the configuration tab “EEPROM_Status” (see below) will contain the value of either 106 being enabled or 59 being disabled.





RUI/Gateway & DeviceNet™ Configuration & Ladder Logic Example Using an Allen-Bradley CompactLogix PLC

25. Notice above that there are screen shots for the configuration and communication tabs. Within the configuration, the programmer will need to specify whether this is a read (Get) or a write (Set) operation as well as the class, instance, and attribute (CIA) of interest. The CIA for all PM controls is 150, 2, 8 respectively. The CIA shown above in hexadecimal represents the Non-Volatile Save parameter for node 4 going through the RUI/Gateway (see step 24 for explanation). The communication tab allows the programmer to select a configured I/O module to send or receive the message where the port number and node address need to be identified. Again, as can be seen above the module is defined in the I/O structure as DNet_Scanner.
26. If it is desired to write a new value to the member above simply change the service type to set attribute and define the source element with the new value.

Note:

If attempting to read or write to this parameter (Non-Volatile Save) in the EZ-ZONE® ST the class, instance, and attribute is different from what is shown above in step 24. For the ST, the Class = 117, Instance = 1, Attribute = 51. The numbers shown are in decimal where the class and the attribute will need to be converted to hexadecimal for the message instruction.

27. As another example of explicit messaging, to read a specific member such as PV1 of PM1 as shown in the graphic above (step 17) the MSG instruction in the PLC would be configured with the class equal to 104, instance would be 1, and the attribute would be 1 as found in the EZ-ZONE® PM Communications Manual under the Operations Page. On the other end of the network, if it were desired to read the same member from PM3, the MSG instruction would be configured with the class equal to 104, instance would be 9, and the attribute would be 1. Because the CIP offset is equal to 8 for gateway instance 3 the gateway will route the message to PM3, retrieve the first instance of the Analog Input in this case PV1, and then send it back out to the PLC.
28. As stated in step 22 the RUI/Gateway is equipped with implicit I/O assemblies. The graphics below represent the I/O default assemblies as shipped from the factory. The T to O input assembly (Target - Gateway) to (Originator - PLC) consists of twenty one members and the O to T (Originator - PLC) to (Target - Gateway) consists of twenty members. Again, these graphics represent the factory defaults for the implicit I/O assemblies. **With one exception**, any of the individual members in either assembly can be user programmed. The exception can be found as the first member of the T to O assembly "Device Status" (more on this to follow).



RUI/Gateway & DeviceNet™

Configuration & Ladder Logic Example

Using an Allen-Bradley CompactLogix PLC

Default Target to Originator (T to O) Assembly

Name	Data Type	Style	Description
Device_Status	DINT	Binary	Gateway Device Status
PV1	REAL	Float	Process Variable Input 1
IE_Status1	DINT	Decimal	Input Error Status
PV2	REAL	Float	Process Variable Input 2
IE_Status2	DINT	Decimal	Input Error Status
AS_1	DINT	Decimal	Alarm 1 Status
AS_2	DINT	Decimal	Alarm 2 Status
AS_3	DINT	Decimal	Alarm 3 Status
AS_4	DINT	Decimal	Alarm 4 Status
DI5_State	DINT	Decimal	Digital Input 5 Status
DI6_State	DINT	Decimal	Digital Input 6 Status
CMA	DINT	Decimal	Control Mode Active
H_Power	REAL	Float	Heat Power Output
C_Power	REAL	Float	Cool Power Output
LS	DINT	Decimal	Limit State
PS	DINT	Decimal	Profile Start
PAR	DINT	Decimal	Profile Action Request
PAF	DINT	Decimal	Profile Active File
PAS	DINT	Decimal	Profile Active Step
PASP	REAL	Float	Profile Active Set Point
PSTR	REAL	Float	Profile Step Time Remaining

Default Originator to Target (O to T) Assembly

Name	Data Type	Style	Description
LCM	DINT	Decimal	Loop_Control_Mode
CLSP	REAL	Float	Closed Loop Set Point
OLSP	REAL	Float	Open Loop Set Point
Alm1_H_SP	REAL	Float	Alarm 1 High Set Point
Alm1_L_SP	REAL	Float	Alarm 1 Low Set Point
Alm2_H_SP	REAL	Float	Alarm 2 High Set Point
Alm2_L_SP	REAL	Float	Alarm 2 Low Set Point
Alm3_H_SP	REAL	Float	Alarm 3 High Set Point
Alm3_L_SP	REAL	Float	Alarm 3 Low Set Point
Alm4_H_SP	REAL	Float	Alarm 4 High Set Point
Alm4_L_SP	REAL	Float	Alarm 4 Low Set Point
PAR	DINT	Decimal	Profile Action Request
PS	DINT	Decimal	Profile Start
H_PB	REAL	Float	Heat Proportional Band
C_PB	REAL	Float	Cool Proportional Band
Ti	REAL	Float	Time Integral
Td	REAL	Float	Time Derivative
H_H	REAL	Float	Heat Hysteresis
C_H	REAL	Float	Cool Hysteresis
Db	REAL	Float	Deadband

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RUI/Gateway & DeviceNet™

Configuration & Ladder Logic Example

Using an Allen-Bradley CompactLogix PLC

29. Each of the members shown above are passed implicitly to and from the gateway to the PLC with little to no programming.

Note:

If you are interested in learning more about how to change either of the implicit assemblies download the PM Communications manual from the Watlow website. Refer to step one for the link to Watlow's website.

30. For ease in programming it is suggested (but not necessary) that two user defined data types be created reflecting the default assembly structures (or the user defined structure) as shown below. In the examples that follow two user defined data types will be used which correspond with the network architecture as shown in step 17 for both T to O and O to T assemblies.

Custom T to O Data Type

Name	Data Type	Style	Description
Device_Status	DINT	Binary	Gateway Device Status
PM1_PV1	REAL	Float	PM1 Process Variable Input 1
PM1_Input_Error_Status1	DINT	Decimal	PM1 Input Error Status
PM1_PV2	REAL	Float	PM1 Process Variable Input 2
PM1_Input_Error_Status2	DINT	Decimal	PM1 Input Error Status
PM2_PV1	REAL	Float	PM2 Process Variable Input 1
PM2_Input_Error_Status1	DINT	Decimal	PM2 Input Error Status
PM2_PV2	REAL	Float	PM2 Process Variable Input 2
PM2_Input_Error_Status2	DINT	Decimal	PM2 Input Error Status
PM2_Alarm1_State	DINT	Decimal	PM2 Alarm 1 Status
PM2_Alarm2_State	DINT	Decimal	PM2 Alarm 2 Status
PM2_Alarm3_State	DINT	Decimal	PM2 Alarm 3 Status
PM2_Alarm4_State	DINT	Decimal	PM2 Alarm 4 Status
PM2_DI5_State	DINT	Decimal	PM2 Digital Input 5 Status
PM2_DI6_State	DINT	Decimal	PM2 Digital Input 6 Status
PM3_PV1	REAL	Float	PM3 Process Variable Input 1
PM3_Input_Error_Status1	DINT	Decimal	PM3 Input Error Status
PM4_PV1	REAL	Float	PM4 Process Variable Input 1
PM4_Input_Error_Status1	DINT	Decimal	PM4 Input Error Status
PM4_PV2	REAL	Float	PM4 Process Variable Input 2
PM4_Input_Error_Status2	DINT	Decimal	PM4 Input Error Status

Custom O to T Data Type

Name	Data Type	Style	Description
PM1_User_Control_Mode	DINT	Decimal	PM1 Off=62, Auto=10, Manual
PM1_Closed_Loop_SP	REAL	Float	PM1 Closed Loop Set Point
PM1_Open_Loop_SP	REAL	Float	PM1 Open Loop Set Point
PM1_Alarm1H_SP	REAL	Float	PM1 Alarm 1 High Set Point
PM2_User_Control_Mode	DINT	Decimal	PM2 Off=62, Auto=10, Manual
PM2_Closed_Loop_SP	REAL	Float	PM2 Closed Loop Set Point
PM2_Open_Loop_SP	REAL	Float	PM2 Open Loop Set Point
PM2_Alarm1H_SP	REAL	Float	PM2 Alarm 1 High Set Point
PM2_Alarm1L_SP	REAL	Float	PM2 Alarm 1 Low Set Point
PM2_Alarm2H_SP	REAL	Float	PM2 Alarm 2 High Set Point
PM2_Alarm2L_SP	REAL	Float	PM2 Alarm 2 Low Set Point
PM2_Alarm3H_SP	REAL	Float	PM2 Alarm 3 High Set Point
PM2_Alarm3L_SP	REAL	Float	PM2 Alarm 3 Low Set Point
PM2_Alarm4H_SP	REAL	Float	PM2 Alarm 4 High Set Point
PM3_User_Control_Mode	DINT	Decimal	PM3 Off=62, Auto=10, Manual
PM3_Closed_Loop_SP	REAL	Float	PM3 Closed Loop Set Point
PM4_User_Control_Mode	DINT	Decimal	PM4 Off=62, Auto=10, Manual
PM4_Closed_Loop_SP	REAL	Float	PM4 Closed Loop Set Point
PM4_Open_Loop_SP	REAL	Float	PM4 Open Loop Set Point
PM4_Alarm1H_SP	REAL	Float	PM4 Alarm 1 High Set Point

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RUI/Gateway & DeviceNet™

Configuration & Ladder Logic Example

Using an Allen-Bradley CompactLogix PLC

31. Once the user defined data types have been created for the T to O and O to T assemblies right click on the controller tags folder and add new tags using the T to O and O to T data types just created; in this case, “Custom_GTW_T_to_O” and “Custom_GTW_O_to_T”.

Controller Tag (T to O)			Controller Tag (O to T)		
[-] GTW_Inputs	Custom_GTW_T_to_O	Gateway Device Status	[-] GTW_Outputs	Custom_GTW_O_to_T	PM1 Off=62, Auto=10, Manual=54
[+] GTW_Inputs.Device_Status	DINT	Gateway Device Status	[+] GTW_Outputs.PM1_User_Control	DINT	PM1 Off=62, Auto=10, Manual=54
[-] GTW_Inputs.PM1_PV1	REAL	PM1 Process Variable Input 1	[-] GTW_Outputs.PM1_Closed_Loop_Set_Point	REAL	PM1 Closed Loop Set Point
[+] GTW_Inputs.PM1_Input_Error_Status	DINT	PM1 Input Error Status	[-] GTW_Outputs.PM1_Open_Loop_Set_Point	REAL	PM1 Open Loop Set Point
[-] GTW_Inputs.PM1_PV2	REAL	PM1 Process Variable Input 2	[-] GTW_Outputs.PM1_Alarm1H_SP	REAL	PM1 Alarm 1 High Set Point
[+] GTW_Inputs.PM1_Input_Error_Status	DINT	PM1 Input Error Status	[+] GTW_Outputs.PM2_User_Control	DINT	PM2 Off=62, Auto=10, Manual=54
[-] GTW_Inputs.PM2_PV1	REAL	PM2 Process Variable Input 1	[-] GTW_Outputs.PM2_Closed_Loop_Set_Point	REAL	PM2 Closed Loop Set Point
[+] GTW_Inputs.PM2_Input_Error_Status	DINT	PM2 Input Error Status	[-] GTW_Outputs.PM2_Open_Loop_Set_Point	REAL	PM2 Open Loop Set Point
[-] GTW_Inputs.PM2_PV2	REAL	PM2 Process Variable Input 2	[-] GTW_Outputs.PM2_Alarm1H_SP	REAL	PM2 Alarm 1 High Set Point
[+] GTW_Inputs.PM2_Input_Error_Status	DINT	PM2 Input Error Status	[-] GTW_Outputs.PM2_Alarm1L_SP	REAL	PM2 Alarm 1 Low Set Point
[+] GTW_Inputs.PM2_Alarm1_State	DINT	PM2 Alarm 1 Status	[-] GTW_Outputs.PM2_Alarm2H_SP	REAL	PM2 Alarm 2 High Set Point
[+] GTW_Inputs.PM2_Alarm2_State	DINT	PM2 Alarm 2 Status	[-] GTW_Outputs.PM2_Alarm2L_SP	REAL	PM2 Alarm 2 Low Set Point
[+] GTW_Inputs.PM2_Alarm3_State	DINT	PM2 Alarm 3 Status	[-] GTW_Outputs.PM2_Alarm3H_SP	REAL	PM2 Alarm 3 High Set Point
[+] GTW_Inputs.PM2_Alarm4_State	DINT	PM2 Alarm 4 Status	[-] GTW_Outputs.PM2_Alarm3L_SP	REAL	PM2 Alarm 3 Low Set Point
[+] GTW_Inputs.PM2_DI5_State	DINT	PM2 Digital Input 5 Status	[-] GTW_Outputs.PM2_Alarm4H_SP	REAL	PM2 Alarm 4 High Set Point
[+] GTW_Inputs.PM2_DI6_State	DINT	PM2 Digital Input 6 Status	[+] GTW_Outputs.PM3_User_Control	DINT	PM3 Off=62, Auto=10, Manual=54
[-] GTW_Inputs.PM3_PV1	REAL	PM3 Process Variable Input 1	[-] GTW_Outputs.PM3_Closed_Loop_Set_Point	REAL	PM3 Closed Loop Set Point
[+] GTW_Inputs.PM3_Input_Error_Status	DINT	PM3 Input Error Status	[+] GTW_Outputs.PM4_User_Control	DINT	PM4 Off=62, Auto=10, Manual=54
[-] GTW_Inputs.PM4_PV1	REAL	PM4 Process Variable Input 1	[-] GTW_Outputs.PM4_Closed_Loop_Set_Point	REAL	PM4 Closed Loop Set Point
[+] GTW_Inputs.PM4_Input_Error_Status	DINT	PM4 Input Error Status	[-] GTW_Outputs.PM4_Open_Loop_Set_Point	REAL	PM4 Open Loop Set Point
[-] GTW_Inputs.PM4_PV2	REAL	PM4 Process Variable Input 2	[-] GTW_Outputs.PM4_Alarm1H_SP	REAL	PM4 Alarm 1 High Set Point
[+] GTW_Inputs.PM4_Input_Error_Status	DINT	PM4 Input Error Status			

32. Using the same network architecture as shown in step 17, let’s look closer at the use of these implicit assemblies. As can be seen above the available 20 members for inputs and outputs are being distributed across PM1 - PM4 *disproportionally*. Keep in mind, that the maximum number of modifiable members for the T to O and O to T assemblies is 20 where the user can dedicate all of them to one EZ-ZONE® PM (*ST excluded) control or distribute them in any manner across the network. The distribution of the assemblies is determined by the CIP Assembly size R,nb prompt within the RUI.

* The EZ-ZONE® ST allows for explicit messaging only, it **does not** allow for implicit messaging (communications via the I/O assemblies).

33. Look closely at the names and the descriptions of the assemblies in step 31; the assembly distribution across the four controls on Standard Bus can be seen clearly. Hopefully it is now clear as to why it is recommended that user defined data types be created and then the controller tags to utilize those data types. Simply stated, the purpose is to enable easier

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transfer of data to and from the PLC and EZ-ZONE® controllers via simple copy instructions in the PLC. The copy instruction also works nicely when all of the data types are not the same such as when working with 8 bit, 16 bit, and 32 bit members. The copy instruction copies the source to the destination byte for byte so there is no further conversion needed.

34. Because there are 4 entries for PM1 in the custom T to O and O to T assemblies above, that must mean that the CIP Assembly Size for gateway instance 1 is equal to four. Using the same logic, PM2 has 10 entries so the Assembly Size must be equal to 10, etc...

Gateway Instance	CIP Assembly Size
$\overline{9tLJ} = 1$	$\overline{Rnb} = 4$
$\overline{9tLJ} = 2$	$\overline{Rnb} = 10$
$\overline{9tLJ} = 3$	$\overline{Rnb} = 2$
$\overline{9tLJ} = 4$	$\overline{Rnb} = 4$

As can be seen above, *unless changed*, the members that occupy any one of the 20 member locations (or wherever the gateway instance changes) will be according to the factory defaults. So, the first member of the T to O for any given gateway instance will always be PV1 regardless of where it is placed in the assembly.

35. The first member of the T to O assembly above is identified as “Device Status “. This member will always be present and explains why in step 15 that the input assembly size is shown as 84 bytes (21-32 bit words) different from the output assembly being 80 bytes (20-32 bit words).

```
+ GTW_Inputs.Device_Status      2#0000_0000_0000_1111_0001_0000_0000_0000
```

To better understand the above status word a couple of important facts related to Standard Bus addressing must be explained. Lets first look at valid addresses (physical & logical) for computers, RUIs, Communication cards (Masters, 0-15), and lastly, EZ-ZONE® controllers (Slaves, 16-31). The logical addresses are set by the user. Look at the table below.



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Device	Physical Address	Logical Address (Set by User)
Personal Computers	0-3	1-4
RUI	4-11	1-8
Communication Cards	12-15	1-4 (indirectly set by user)
EZ-ZONE® Controllers	16-31	1-16

The first graphic in step 35 shows the first member of the custom T to O assembly “GTW_Inputs.Device_Status”. Interpreting the bits...bit 0 is shown on the far right where bit 31 is on the far left. The bits that are shown as being set to a “1” represent those devices that the RUI/Gateway is enabled to speak to (Gateway instance). So, bit 16 through 19 represents the PM controls on the Standard Bus side of the RUI/Gateway (1 - 4, as seen in step 17) where bit 12 represents the physical address for the DeviceNet™ card in the RUI/Gateway. Each of these bits can be monitored in the PLC where an alarm can be driven if communications with any enabled PM control fails.

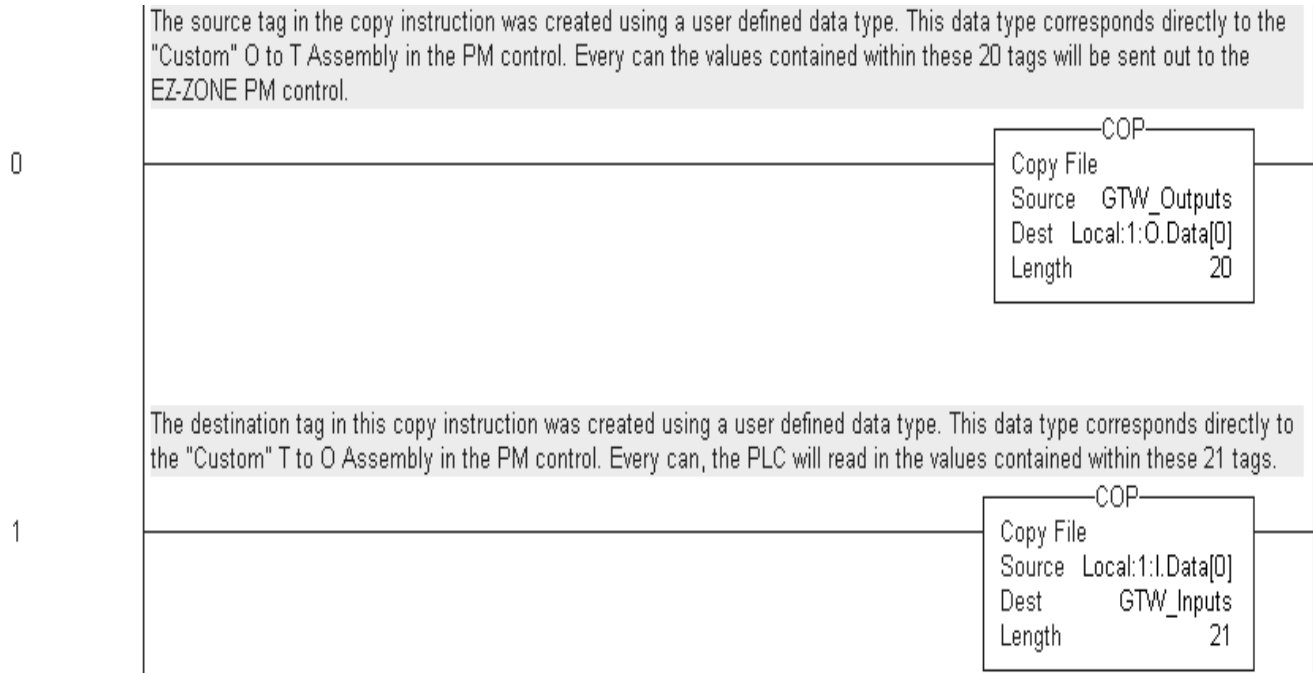
36. Note that in the table above (step 35) showing both logical and physical addresses (logical addresses are set by the user) that the communications card addressing is not set directly by the user. To relieve the burden of having to set multiple Standard Bus addresses in the RUI/Gateway the communication card picks up its address through the RUI/Gateway firmware. If the RUI/Gateway Standard Bus address (with a comms card installed) is set to logical address 1 the communications card Standard Bus physical address will automatically be set 12. See table below for valid communications card addressing. As can be seen below, if the communications card is to be given a valid address the RUI/Gateway logical address must be set to a value ranging from 1-4.

RUI/Gateway Addressing		Communications Card
Standard Bus Physical Address	Logical Address (Set by User)	Physical Address
4	1	12
5	2	13
6	3	14
7	4	15
8	5	Not Valid
9	6	Not Valid
10	7	Not Valid
11	8	Not Valid



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37. In step 30 it was suggested that the user may want to create user defined data types. Likewise, in step 31 it was also suggested that the user should create controller tags utilizing those same user defined data types. The reasoning for this may become more obvious in the following example. Below, two copy instructions are programmed to send and receive the implicit assemblies to/from the PLC to the desired EZ-ZONE® controls.



38. As can be seen above the controller tags created for inputs from the EZ-ZONE® controls to the PLC was defined as "GTW_Inputs" where the tag created for the outputs from PLC to EZ-ZONE® controls was named "GTW_Outputs". The ease in programming should now be apparent. Due to the fact that the user defined data types for both T to O and O to T assemblies were defined to correlate directly to the specific EZ-ZONE® members of choice the transfer of data between EZ-ZONE® controls and the PLC is done without a lot of effort. Below the two graphics represent both the T to O and O to T assemblies with live data.



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Custom T to O Assembly

[-] GTW_Inputs	{...}	Custom_GTW_T_to_O	
+ GTW_Inputs.Device_Status	2#0000_0000_0000_1111_0001_0000_0000_0000	DINT	Gateway Device Status
- GTW_Inputs.PM1_PV1	83.365654	REAL	PM1 Process Variable Input 1
+ GTW_Inputs.PM1_Input_Error_Stat...	61	DINT	PM1 Input Error Status
- GTW_Inputs.PM1_PV2	86.95642	REAL	PM1 Process Variable Input 2
+ GTW_Inputs.PM1_Input_Error_Stat...	61	DINT	PM1 Input Error Status
- GTW_Inputs.PM2_PV1	85.377174	REAL	PM2 Process Variable Input 1
+ GTW_Inputs.PM2_Input_Error_Stat...	61	DINT	PM2 Input Error Status
- GTW_Inputs.PM2_PV2	91.9586	REAL	PM2 Process Variable Input 2
+ GTW_Inputs.PM2_Input_Error_Stat...	61	DINT	PM2 Input Error Status
+ GTW_Inputs.PM2_Alarm1_State	88	DINT	PM2 Alarm 1 Status
+ GTW_Inputs.PM2_Alarm2_State	88	DINT	PM2 Alarm 2 Status
+ GTW_Inputs.PM2_Alarm3_State	88	DINT	PM2 Alarm 3 Status
+ GTW_Inputs.PM2_Alarm4_State	88	DINT	PM2 Alarm 4 Status
+ GTW_Inputs.PM2_DI5_State	41	DINT	PM2 Digital Input 5 Status
+ GTW_Inputs.PM2_DI6_State	41	DINT	PM2 Digital Input 6 Status
- GTW_Inputs.PM3_PV1	282.24875	REAL	PM3 Process Variable Input 1
+ GTW_Inputs.PM3_Input_Error_Stat...	61	DINT	PM3 Input Error Status
- GTW_Inputs.PM4_PV1	78.22603	REAL	PM4 Process Variable Input 1
+ GTW_Inputs.PM4_Input_Error_Stat...	61	DINT	PM4 Input Error Status
- GTW_Inputs.PM4_PV2	88.20486	REAL	PM4 Process Variable Input 2
+ GTW_Inputs.PM4_Input_Error_Stat...	61	DINT	PM4 Input Error Status

Custom O to T Assembly

[-] GTW_Outputs	{...}	Custom_GTW_O_to_T	
+ GTW_Outputs.PM1_User_Control_...	10	DINT	PM1 Off=62, Auto=10, Manual=54
- GTW_Outputs.PM1_Closed_Loop_SP	222.0	REAL	PM1 Closed Loop Set Point
- GTW_Outputs.PM1_Open_Loop_SP	25.0	REAL	PM1 Open Loop Set Point
- GTW_Outputs.PM1_Alarm1H_SP	175.0	REAL	PM1 Alarm 1 High Set Point
+ GTW_Outputs.PM2_User_Control_...	10	DINT	PM2 Off=62, Auto=10, Manual=54
- GTW_Outputs.PM2_Closed_Loop_SP	275.0	REAL	PM2 Closed Loop Set Point
- GTW_Outputs.PM2_Open_Loop_SP	75.0	REAL	PM2 Open Loop Set Point
- GTW_Outputs.PM2_Alarm1H_SP	300.0	REAL	PM2 Alarm 1 High Set Point
- GTW_Outputs.PM2_Alarm1L_SP	200.0	REAL	PM2 Alarm 1 Low Set Point
- GTW_Outputs.PM2_Alarm2H_SP	200.0	REAL	PM2 Alarm 2 High Set Point
- GTW_Outputs.PM2_Alarm2L_SP	100.0	REAL	PM2 Alarm 2 Low Set Point
- GTW_Outputs.PM2_Alarm3H_SP	400.0	REAL	PM2 Alarm 3 High Set Point
- GTW_Outputs.PM2_Alarm3L_SP	300.0	REAL	PM2 Alarm 3 Low Set Point
- GTW_Outputs.PM2_Alarm4H_SP	110.0	REAL	PM2 Alarm 4 High Set Point
+ GTW_Outputs.PM3_User_Control_...	10	DINT	PM3 Off=62, Auto=10, Manual=54
- GTW_Outputs.PM3_Closed_Loop_SP	525.0	REAL	PM3 Closed Loop Set Point
+ GTW_Outputs.PM4_User_Control_...	10	DINT	PM4 Off=62, Auto=10, Manual=54
- GTW_Outputs.PM4_Closed_Loop_SP	200.0	REAL	PM4 Closed Loop Set Point
- GTW_Outputs.PM4_Open_Loop_SP	40.0	REAL	PM4 Open Loop Set Point
- GTW_Outputs.PM4_Alarm1H_SP	250.0	REAL	PM4 Alarm 1 High Set Point

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