



APPLICATION NOTE

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Product Family: Hx-CTRIO

Number: AN-MISC-022

Subject: Addressing of CTRIO for PLCs, EBC/WinPLC, ERM/EBC, Modbus TCP/IP, and Kepdirect.

Date Issued: 3-20-10

Revision: Rev3

This application note is intended to explain the methods of determining the addressing of functions defined in the Hx-CTRIO modules in various platforms.

The CTRIO cards are available in many of the current product lines, specifically the CTRIOs can be installed in systems using; D2-240, D2-250-1, D2-260, D0-05, D0-06, and D4-450 PLCs as well as H2-EBC, H4-EBC, T1H-EBC, H2-EBC100, T1H-EBC100, either directly to a Think & Do PC or via the ERM expansion card from Directlogic PLCs. Additionally, the CTRIO can be used in a local WinPLC base. CTRIOs are also compatible with the Profibus cards, but that addressing will not be discussed in this application note.

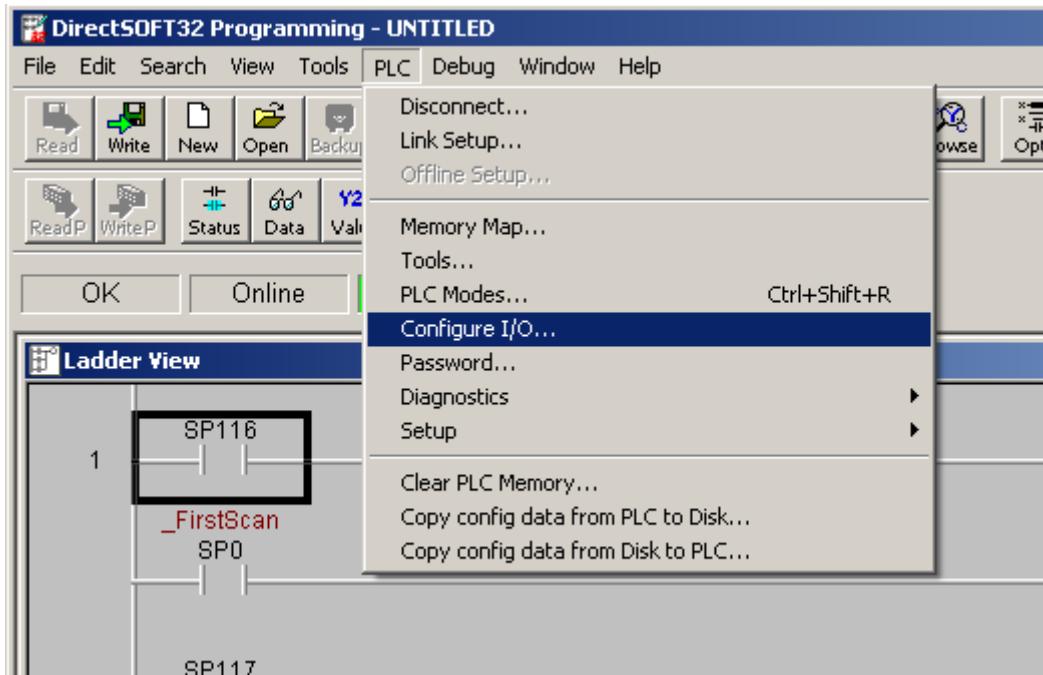


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PLC mapping

The CTRIO was originally developed for use with the PLCs, so we'll start with the addressing for them. So, let's say you have a CTRIO installed in your base, how do you know it is installed properly? The first place to look is in the IO Config menu in Directsoft. So get connected using DSlaunch and then select PLC, and CONFIG IO.

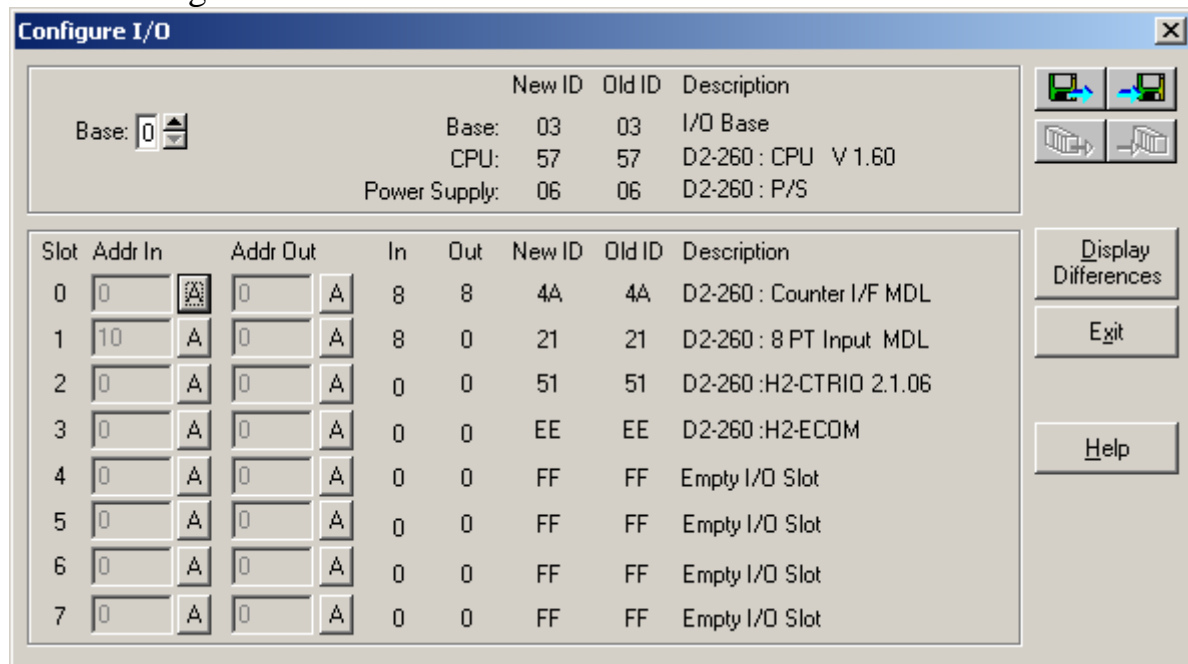




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You should get a screen that is similar to this one.



We can see that we have an H2-CTRIO in slot 2. Notice that it does not consume any IO, this is because the CTRIO publishes data based on its configuration in CTRIO workbench directly to the user memory locations specified in workbench. So there are no automatically assigned addresses for the CTRIO.

OK, so to set up the CTRIO addressing we will need to start CTRIO workbench. This utility installs automatically on new 4.x version of the Directsoft software, and can be downloaded separately for 3.x versions (build 72 or higher). There are various versions of workbench (WB) and newer versions of the software will want to update older firmware version CTRIOs when they are connected to them. Older software will show errors when connected to CTRIOs with newer firmware. Version 2.x CTRIO modules must be used with V2.x CTRIO WB. It is always best (and free!) to update to the latest WB and firmware versions.

WB link

http://www.hosteng.com/SW-Products/SP_Demo_Utilites.htm#CTRIOWorkbench

CTRIO firmware link

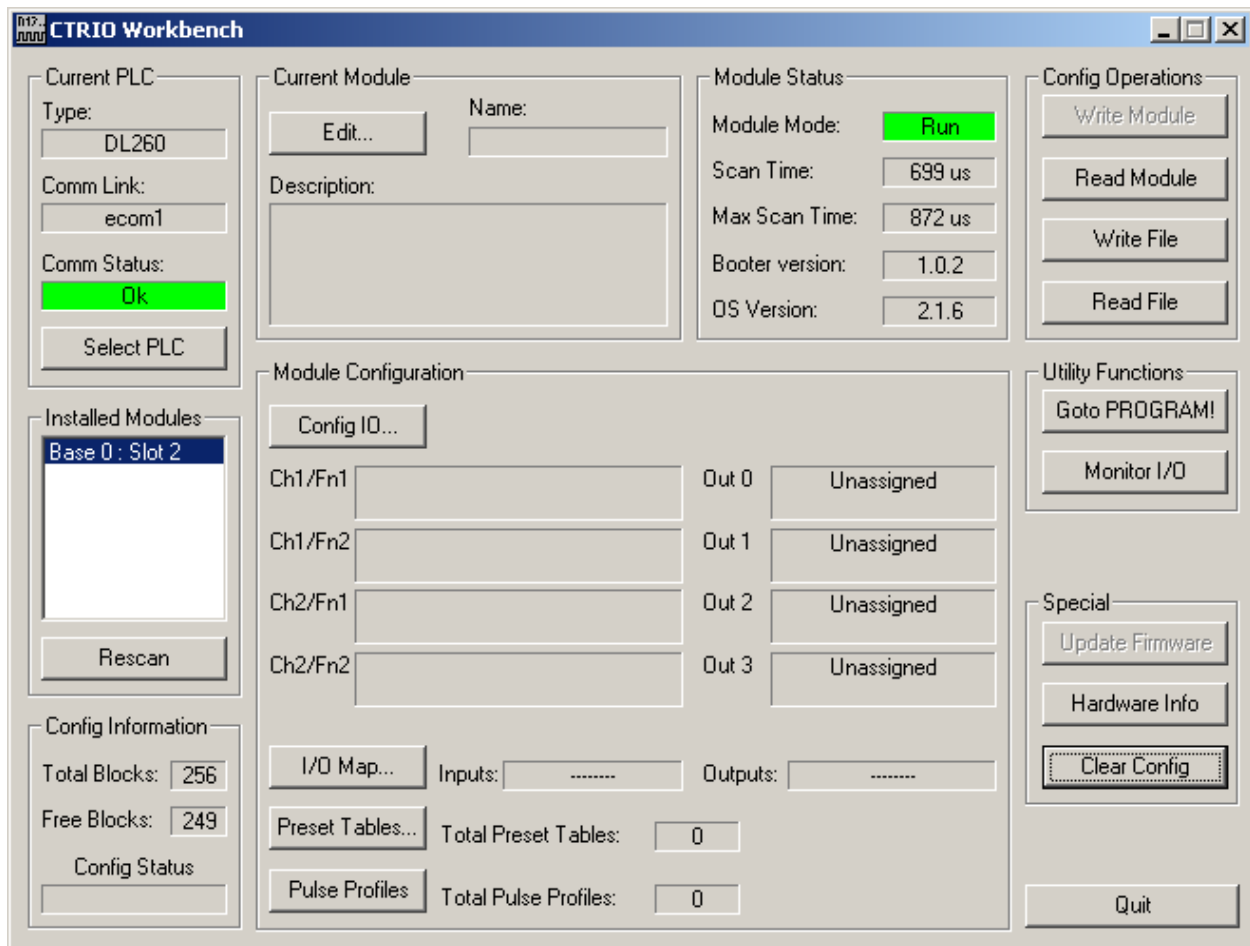
<http://www.hosteng.com/HW-Products/Firmware.htm>



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Here is the main CTRIO WB screen:



Now that's a lot of information, so let's talk about which pieces are important first. You can map your IO first, or, if you forget and configure your IO first the WB software will request that you map your IO upon leaving the configuration screens.

Here are the important steps for setting up the CTRIO for use with a Directlogic PLC:

- 1) Map IO
- 2) Configure the IO
- 3) Write to module
- 4) Save configuration to disk

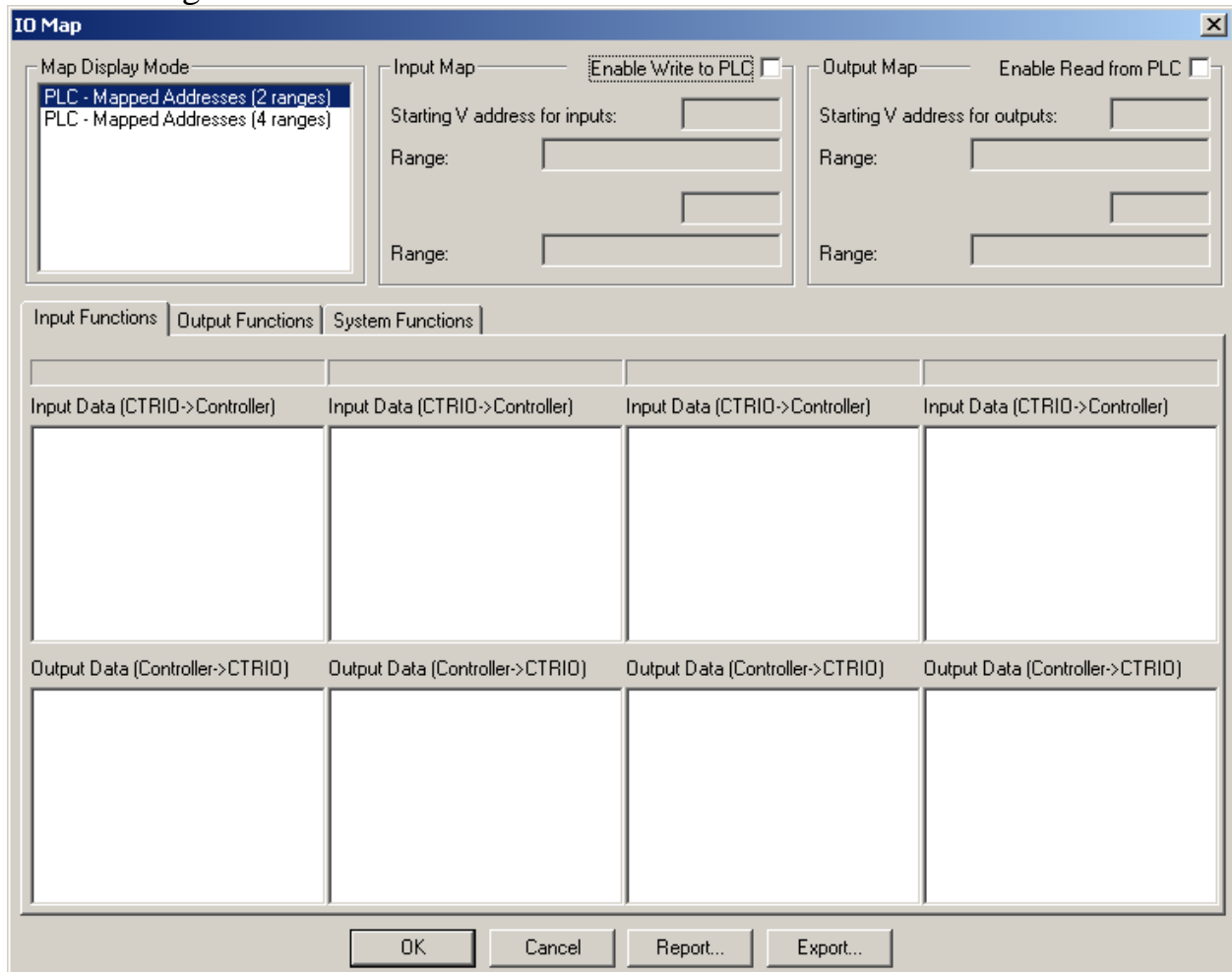
Step 1



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When you select the IO map button on the WB main screen, you will be allowed to select which addresses the CTRIO will publish data to in the PLC. We're very fond of using V2000 as the default user V memory location, but really any user memory range V locations will do. So select the IO map button, you should see the following screen:



Not much to look at yet. Now we need to select the 'Enable Write to PLC' checkbox in order to allow the CTRIO to write it's data points to the PLC. You'll notice when we do this the range for 'Starting V locations for inputs' will become active. Go ahead and enter V2000 for the input range. Notice that the WB now shows you that the inputs for the CTRIO will be using V2000 through V2025. **Make sure you do not use any of these locations for other purposes in your program.** Now select the 'Enable Read from PLC' checkbox and enter V2030 for the Starting V location for outputs. You should see WB display a range of V2030



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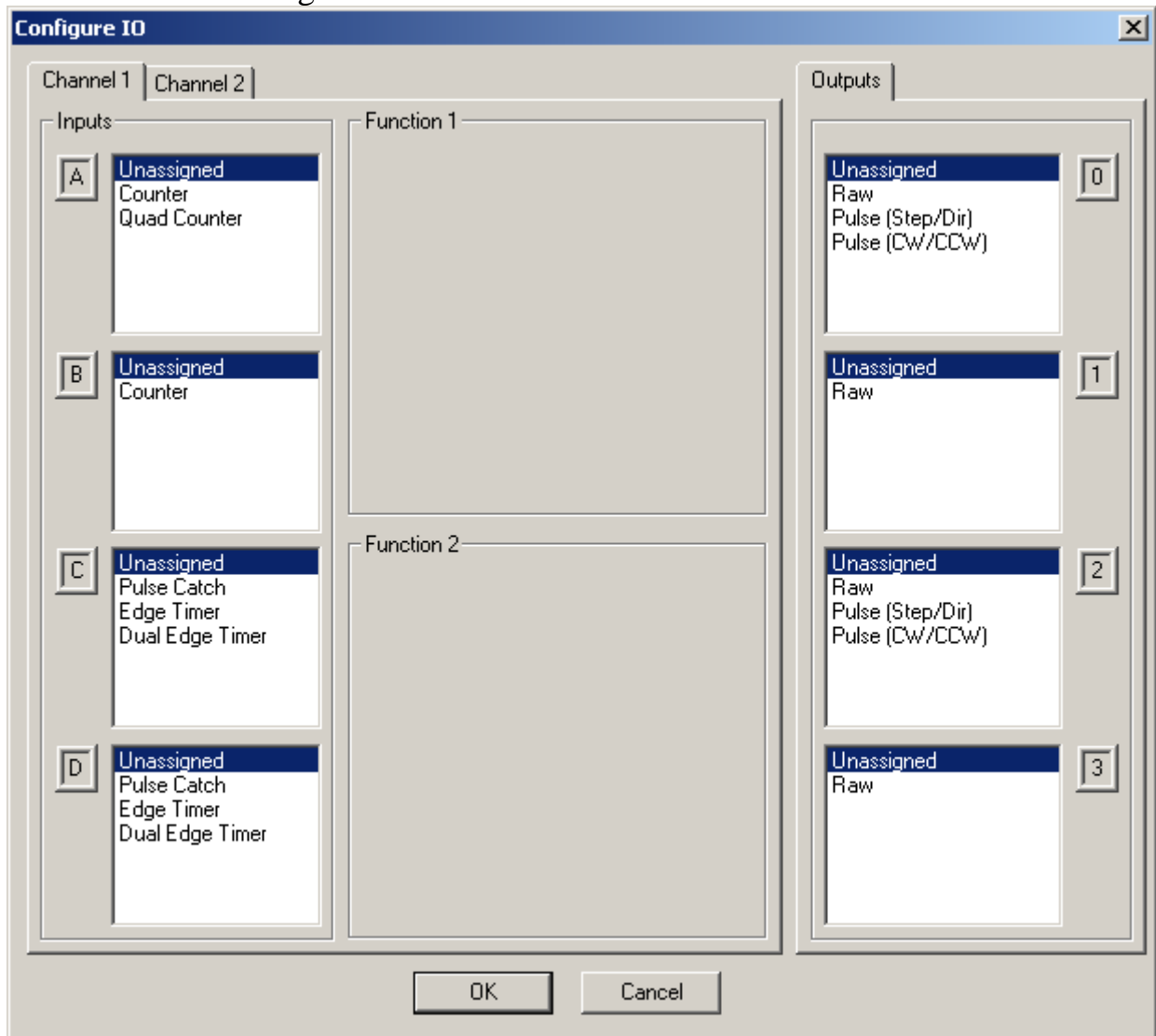
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through V2061. This method is called the ‘2 range’ method of addressing, and you can see that is what is selected in the upper corner of the IO map screen.

Now, let’s add some actual functionality to this CTRIO setup. So hit OK to exit the IO map screen. Notice that there is now a red flag in the lower left corner of the WB main screen. This flag is here to tell us that what we have selected on the screen has not yet been written to the CTRIO. Let’s just ignore it for now, as we need to make more changes to the setup anyway.

Step 2

Now select the Config IO button. You should see a screen that looks like this:



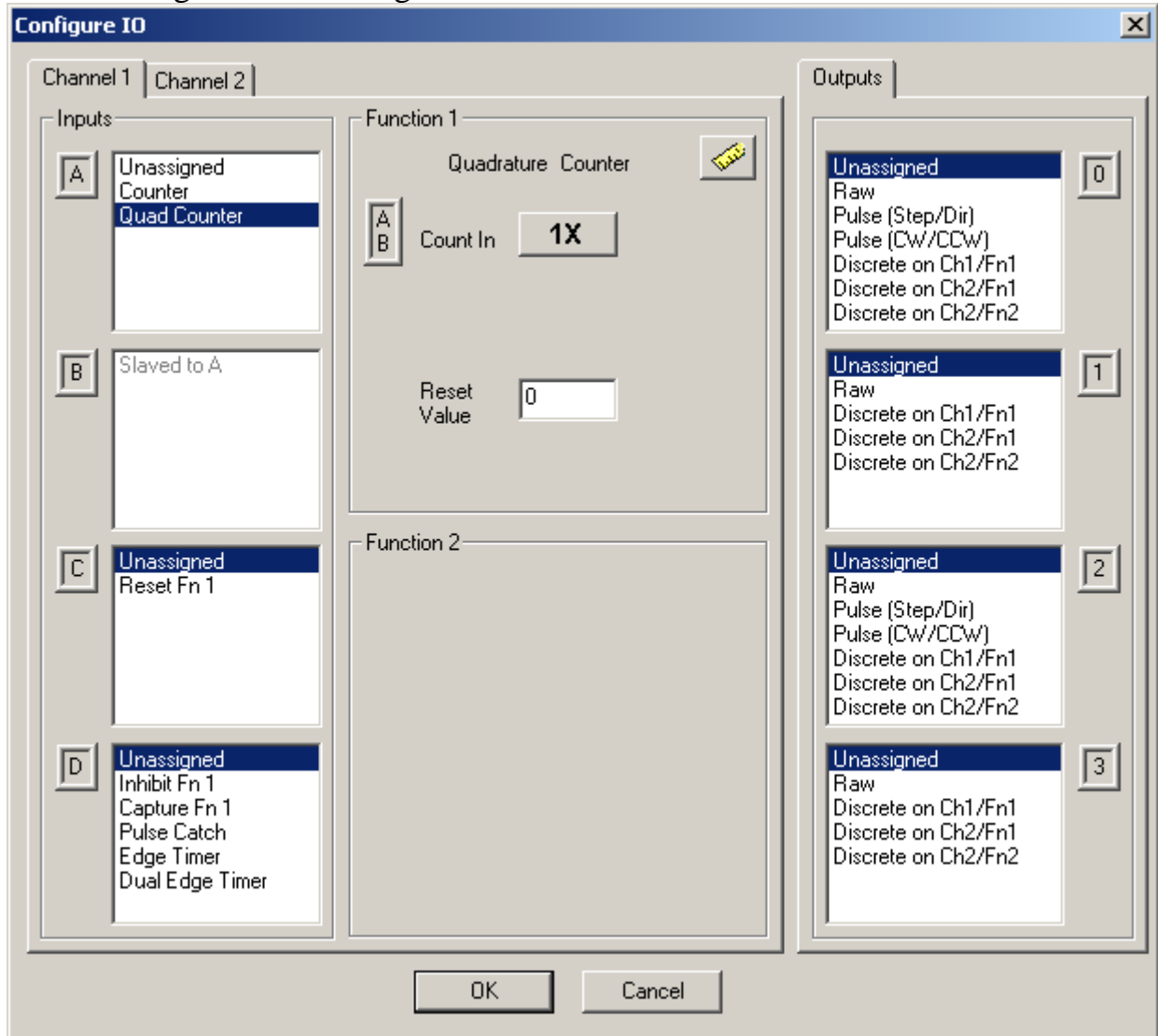


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Wow, nothing assigned. OK, let's setup channel 1 for a quadrature counter and channel 2 for two separate up counters.

You should get the following for channel 1:

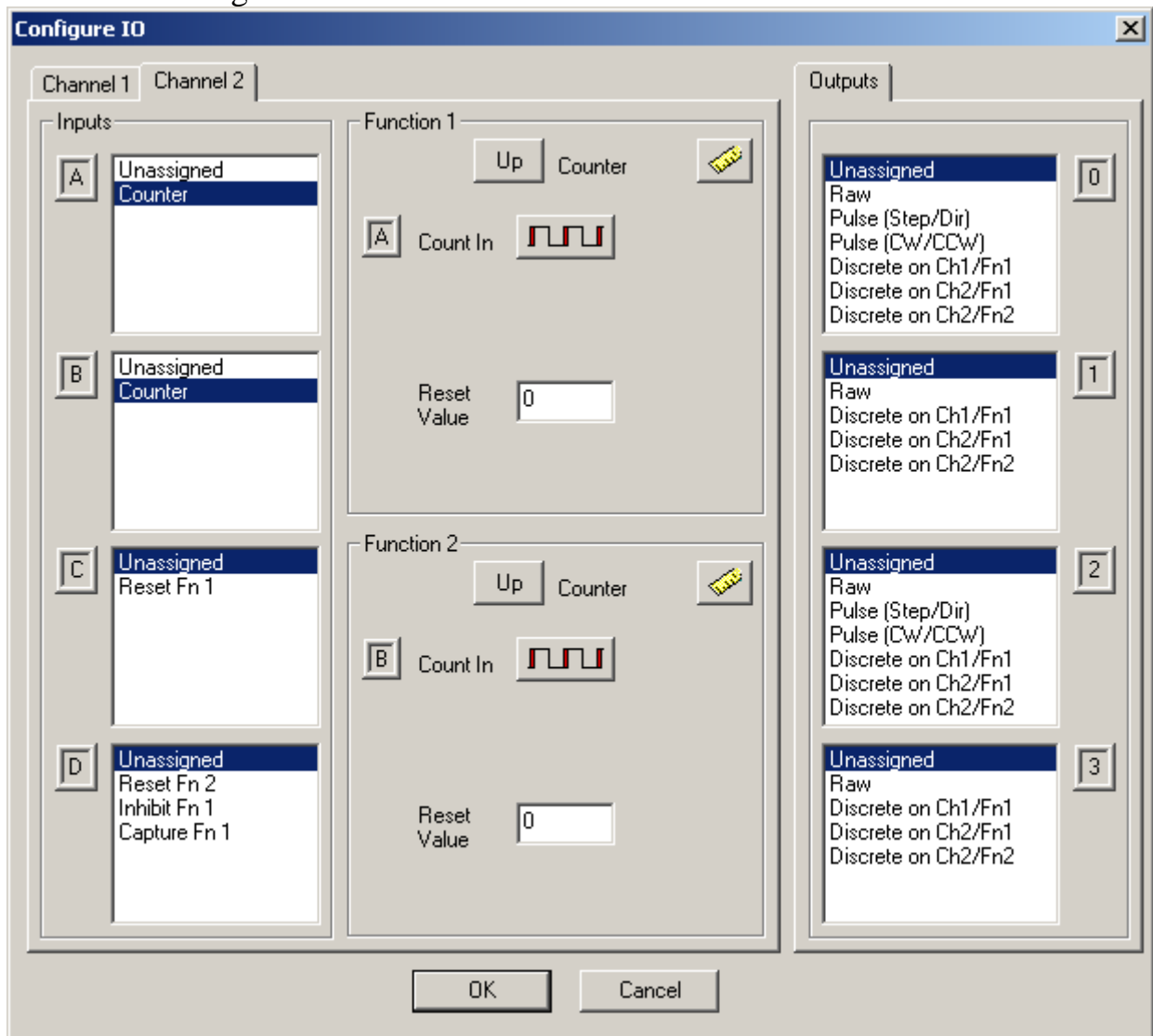




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and the following for channel 2:



Notice how the other options that were first available for each input disappeared as you made selections. CTRIO WB will not let you setup the card in an unworkable configuration.

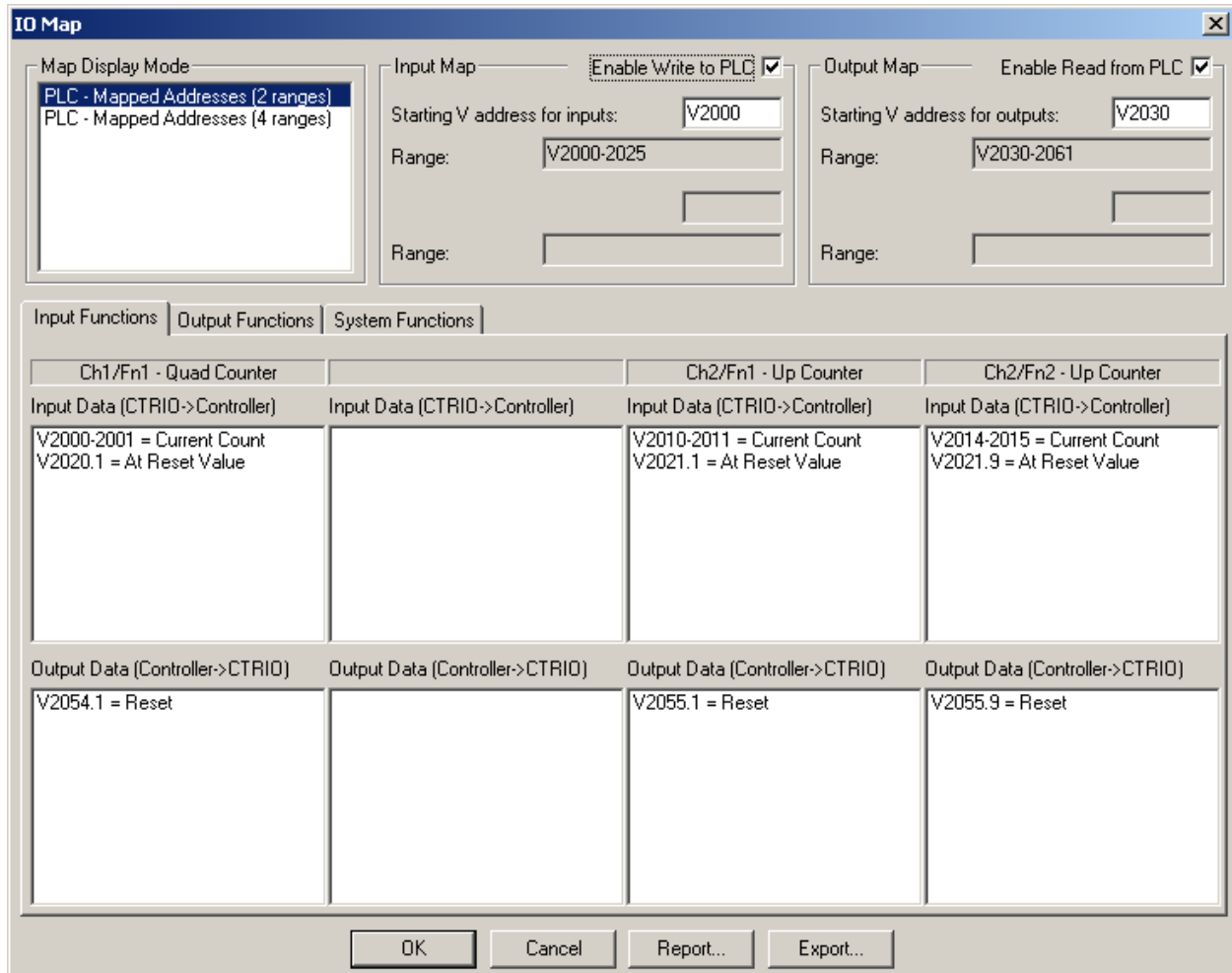
OK, go ahead and press the OK button. We should be back to the main screen again. Now press the IO map button to go back to our IO map. OK, now we're getting somewhere. We can now see which double word locations are going to be receiving the count information for each of our counters in the PLC memory range.



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Also, we can see the bits we would need to toggle to reset these timers from the ladder logic in the lower (or Output Data) window.



Now, these bits are showing up in what is called bit-of-word format. Not all of our PLCs support this format. So let's say we were using a D2-240 instead of the super-nice D2-260, how can we map CTRIO control bits to regular C bits for control purposes? This is the reason for the two IO modes. Look in the upper left window of the IO map screen and select the 'Four ranges' option. Notice that there are two new boxes for us to enter range selections in. Also, notice that the number of V locations required for the inputs has changed, this is because we will now be mapping the V locations that contain bit level data to a different range. Go to the 'Starting V address for bit inputs' entry and enter V40610. Notice that WB then tells us this will use a range of V40610.0-40615.15 for input bits. Now map the output bit range starting at V40616 and you will see a range of V40616.0-



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40623.15 for the output bits. More importantly, look at the lower mapping windows and you will see that the bits are now mapped directly to C bits. This can greatly reduce confusion when working in a D2-240 PLC where bit-of-word addressing is not available.

IO Map

Map Display Mode
 PLC - Mapped Addresses (2 ranges)
 PLC - Mapped Addresses (4 ranges)

Input Map Enable Write to PLC
 Starting V address for word inputs: V2000
 Range: V2000-2017
 Starting V address for bit inputs: V40610
 Range: V40610.0-40615.15

Output Map Enable Read from PLC
 Starting V address for word outputs: V2030
 Range: V2030-2053
 Starting V address for bit outputs: V40616
 Range: V40616.0-40623.15

Input Functions | Output Functions | System Functions

Ch1/Fn1 - Quad Counter		Ch2/Fn1 - Up Counter	Ch2/Fn2 - Up Counter
Input Data (CTR1D->Controller)	Input Data (CTR1D->Controller)	Input Data (CTR1D->Controller)	Input Data (CTR1D->Controller)
V2000-2001 = Current Count V40610.1 (C201) = At Reset Value		V2010-2011 = Current Count V40611.1 (C221) = At Reset Value	V2014-2015 = Current Count V40611.9 (C231) = At Reset Value
Output Data (Controller->CTR1D)	Output Data (Controller->CTR1D)	Output Data (Controller->CTR1D)	Output Data (Controller->CTR1D)
V40616.1 (C341) = Reset		V40617.1 (C361) = Reset	V40617.9 (C371) = Reset

OK Cancel Report... Export...



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Step 3

So now we have mapped our IO and configured our IO, so all we need to do now is write the configuration to the module. The 'Write module' button is only available if the CTRIO is in program mode. Go ahead and press the 'Write module' button. The red flag in the corner should turn blue and show 'same as module.'

Step 4

You don't have to save your configuration to disk, but if it is a complicated one you might want to. To save the configuration to disk press the 'Write file' button. The software will always default to a config.cwb filename. Since there can only be one of these, we recommend you name the file with the same project name as your directsoft project, but with the .cwb extension.

So, in review, when using the CTRIO with Directlogic PLCs, the CTRIO will publish data for whichever functions are defined in the 'Config IO' screen to whichever locations are selected in the 'IO map' screen.

ERM/EBC mapping

Now let's talk about how the mapping works if you are using the CTRIO in an EBC rack being controlled from an ERM module in the local PLC base. This is really just an extension of the same mapping tables, but there are important differences.

Here are the important steps for setting up the CTRIO for use with a Directlogic PLC using the CTRIO in an EBC base from an ERM module:

- 1) Configure the IO
- 2) Write to module
- 3) Save configuration to disk
- 4) Configure the ERM/EBC
- 5) Determine local mapping in PLC from ERM assigned addresses

Step 1

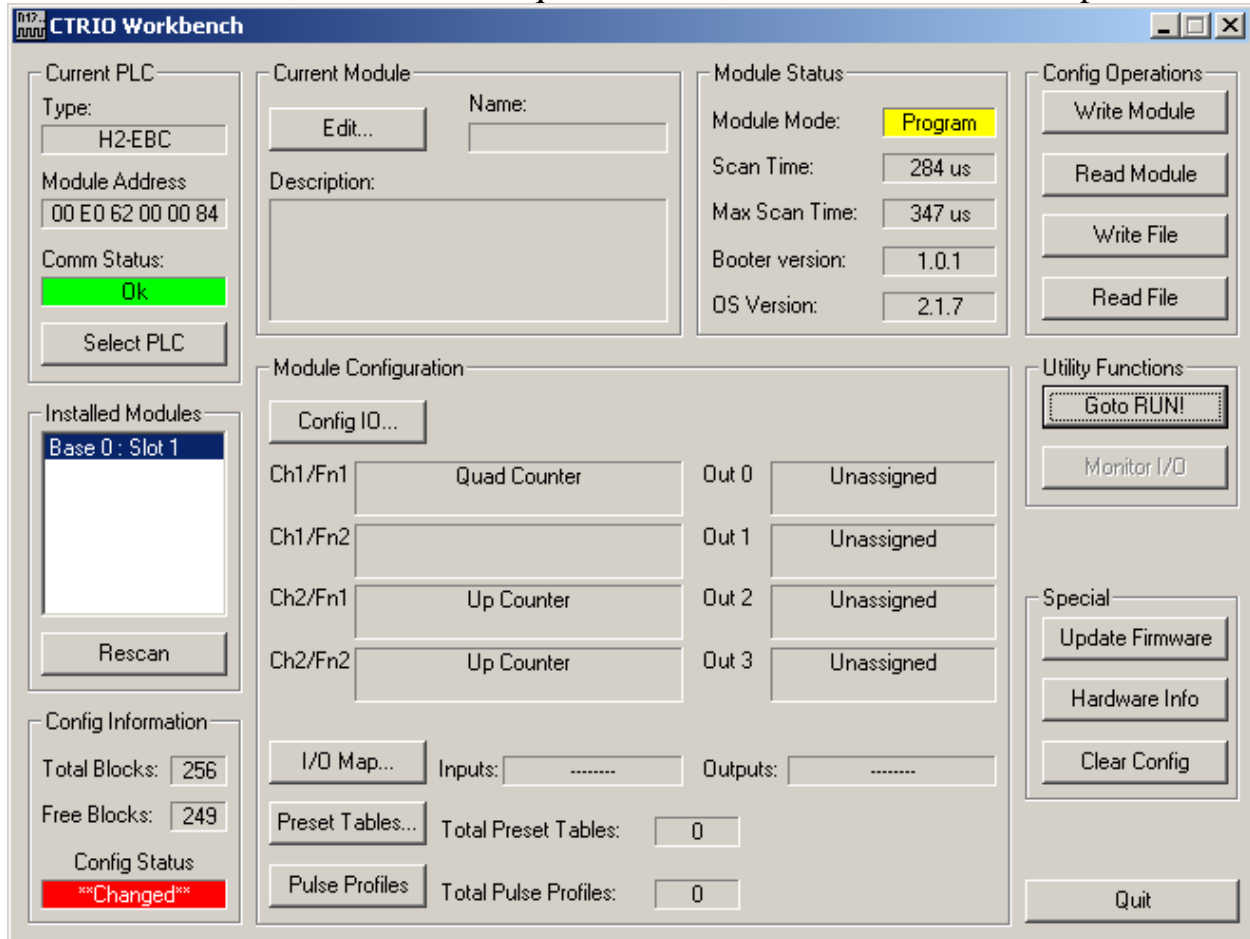
To configure a CTRIO in an EBC base we use the EBC + WinPLC version of CTRIO workbench (WB). This should show up in your DSlaunch screen under utilities. Looking at the main screen in the EBC version of WB, everything pretty much looks the same. The big difference is in how the IO gets mapped to the PLC.



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First, we need to set up the functions we want the CTRIO to use, let's use the same ones we did before; channel 1 as a quad counter, and channel 2 as two up counters.



Step 2

Now normally in a PLC we would go ahead and map IO so we could tell where the various CTRIO features are publishing data. Unfortunately, when using the ERM/EBC combination, we have to go ahead and map the ERM/EBC before we will know what addresses the ERM assigns to the CTRIO. So go ahead and write the configuration to the module and then shut CTRIO WB down.

Step 3

You might also want to save the configuration to disk.

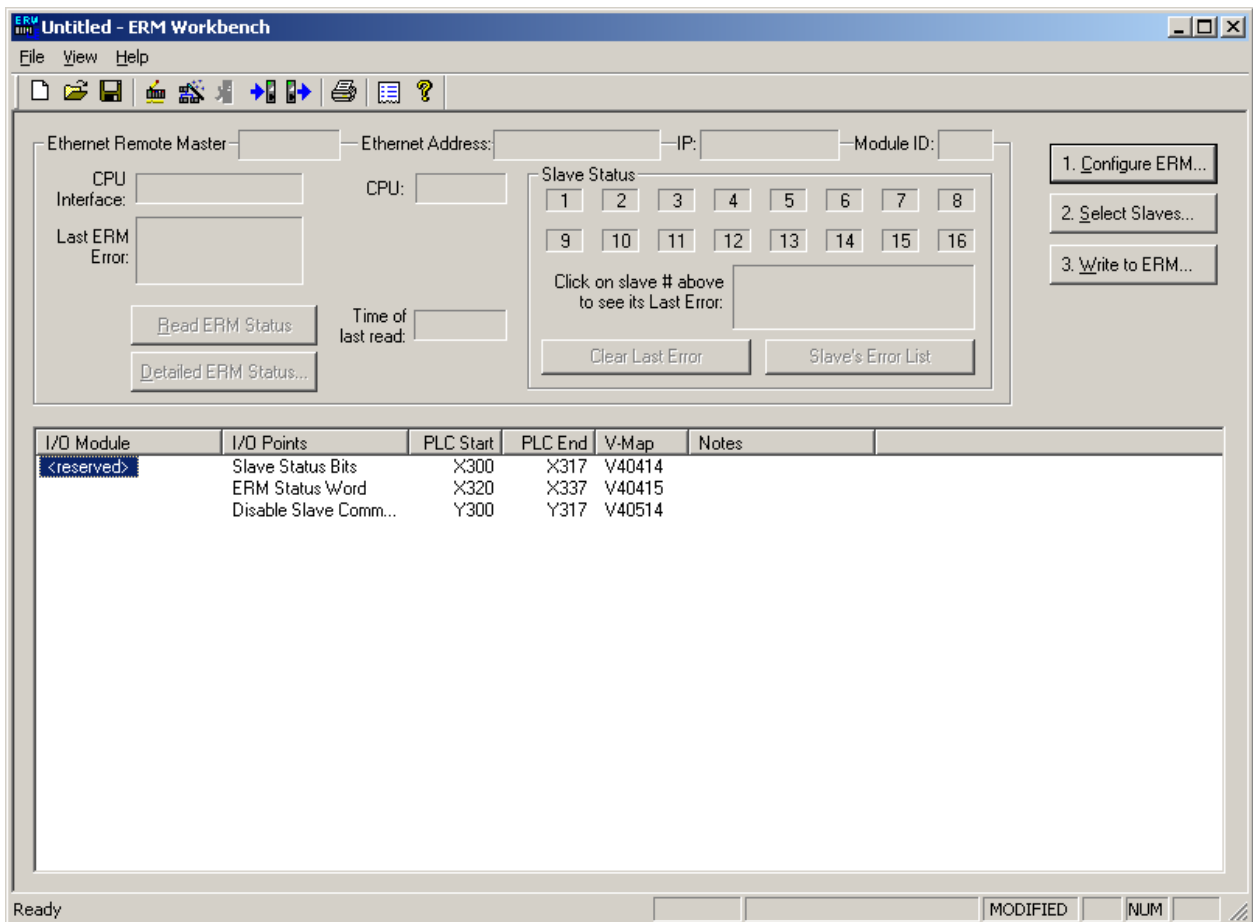


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Step 4

Now open ERM workbench (WB). There are several ways to configure ERM/EBCs with the ERM WB software, this app note will cover just one method. If you normally use a different method to configure your ERM/EBCs, by all means use that method. First of all you will need to be connected to both the ERM and the EBC via an ethernet hub or switch. Now, from the opening screen of ERM WB select the 'ERM Workbench' button in the bottom left corner. This should take you to the main ERM WB screen.



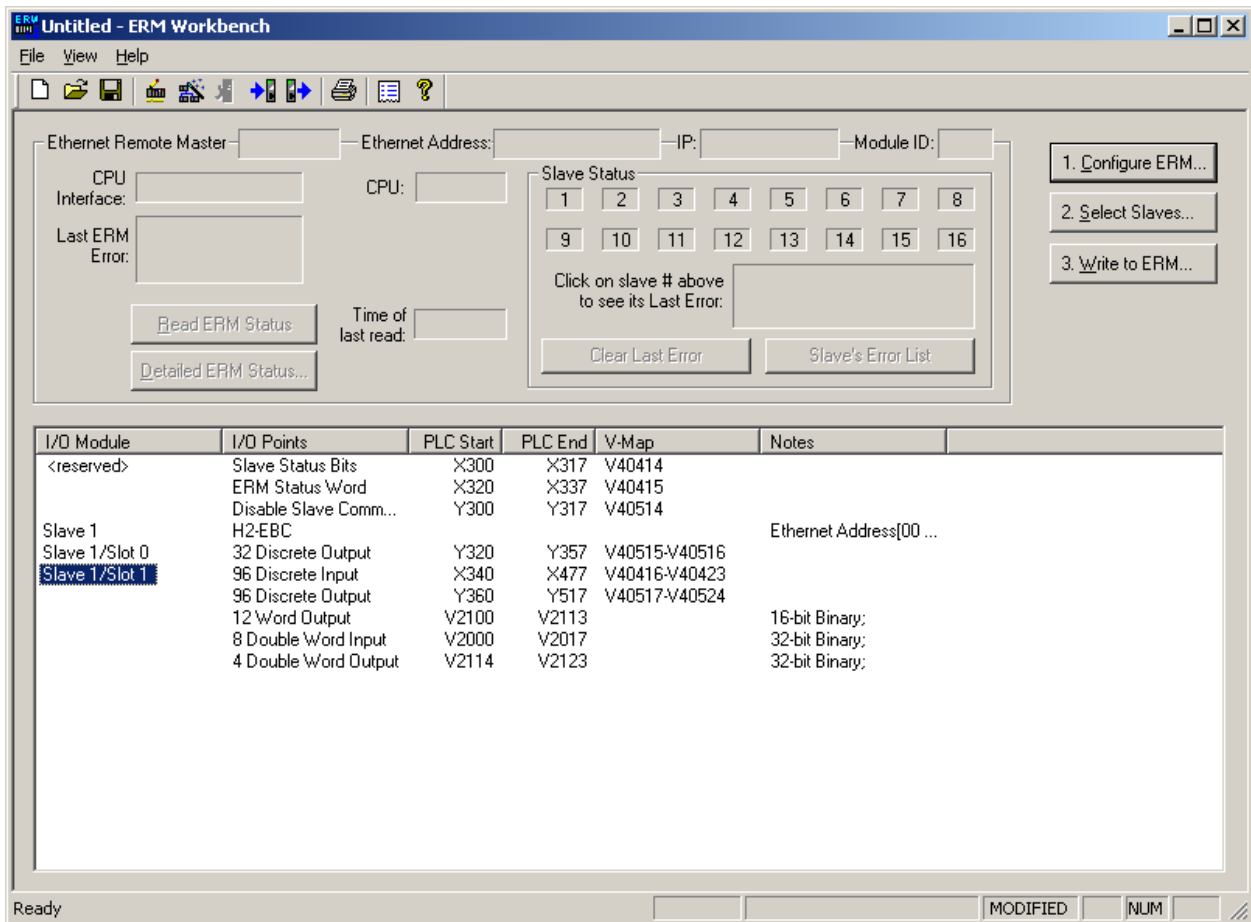
From here we need to select 'Configure ERM' and select 'PLC.' This is also where we tell the ERM what starting addresses to use for the IO in the EBC bases. Make sure the starting addresses here do not overlap any code you have written or any local IO locations. Select OK to return to the main ERM WB screen when done.



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Now select the 'Select Slaves' button, you will get a pop-up asking you to be sure that you are connected to your ERM/EBCs, just hit OK. At this point you should see a screen with one or more slaves shown in the left window and no slaves in the right window. Select the slave in the left window, press the 'Add to slave list' and press the OK button. There are actually a whole lot of fun things that can be done on that screen, but none of it should affect us just now. OK, we should have a main screen with mapping for the slave EBC now, something like this:



I have the CTRIO highlighted, it is in slave 1/slot 1. Now look at what we get as far as mapping goes for the IO for the CTRIO. Wow! Look at all those registers and bits, so which ones are for our counters?



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Step 5

Let's go back to CTRIO WB to find out. So open CTRIO WB for the EBC + WinPLC again. Now go to the 'IO map' screen. The WB defaults to the native addressing for Think&Do software via EBCs. We don't want that right now, so select 'EBC - mapped to PLC through ERM' instead. OK, now we see some familiar boxes. Now we need to enter some information we got from ERM WB into these boxes. Looking back to ERM WB we see that the starting V location for inputs was V2000, so we place this in the appropriate box. The starting output range starts at v2100. Starting locations for input bits and output bits are V40416 and V40517 respectively. And now we finally have real IO mapped to our CTRIO functions. Don't forget to use the 'Report' button to print this list out and you might also want to save this configuration now that it is complete.

Ch1/Fn1 - Quad Counter	Input Data (CTRIO->Controller)	Ch2/Fn1 - Up Counter	Ch2/Fn2 - Up Counter
	V2000-2001 = Current Count V40416.1 (X341) = At Reset Value	V2010-2011 = Current Count V40417.1 (X361) = At Reset Value	V2014-2015 = Current Count V40417.9 (X371) = At Reset Value
	V40517.1 (Y361) = Reset	V40520.1 (Y401) = Reset	V40520.9 (Y411) = Reset



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Modbus TCP/IP H2-EBC100 / T1HEBC100 mapping

Now let's talk about how the mapping works if you are using the CTRIO in an EBC100 rack being controlled from a Modbus TCP client device. This method requires that the Modbus TCP client device control all the communications to the EBC100 server device. Again, this is really just an extension of the same mapping tables, but there are important differences.

Here are the important steps for setting up the CTRIO for use with a Directlogic PLC using the CTRIO in an EBC100 base from any Modbus TCP client device:

- 1) Configure the IO
- 2) Write to module
- 3) Save configuration to disk
- 4) Use the NetEdit3 utility to obtain the EBC100 Modbus TCP mapping
- 5) Write the Modbus mapping in EBC100 to the I/O Map and print the mapping

Step 1

To configure a CTRIO in an EBC base we use the EBC + WinPLC version of CTRIO workbench (WB). This should show up in your DSlaunch screen under utilities. Looking at the main screen in the EBC version of WB, everything pretty much looks the same. The big difference is in how the IO gets mapped to the PLC.



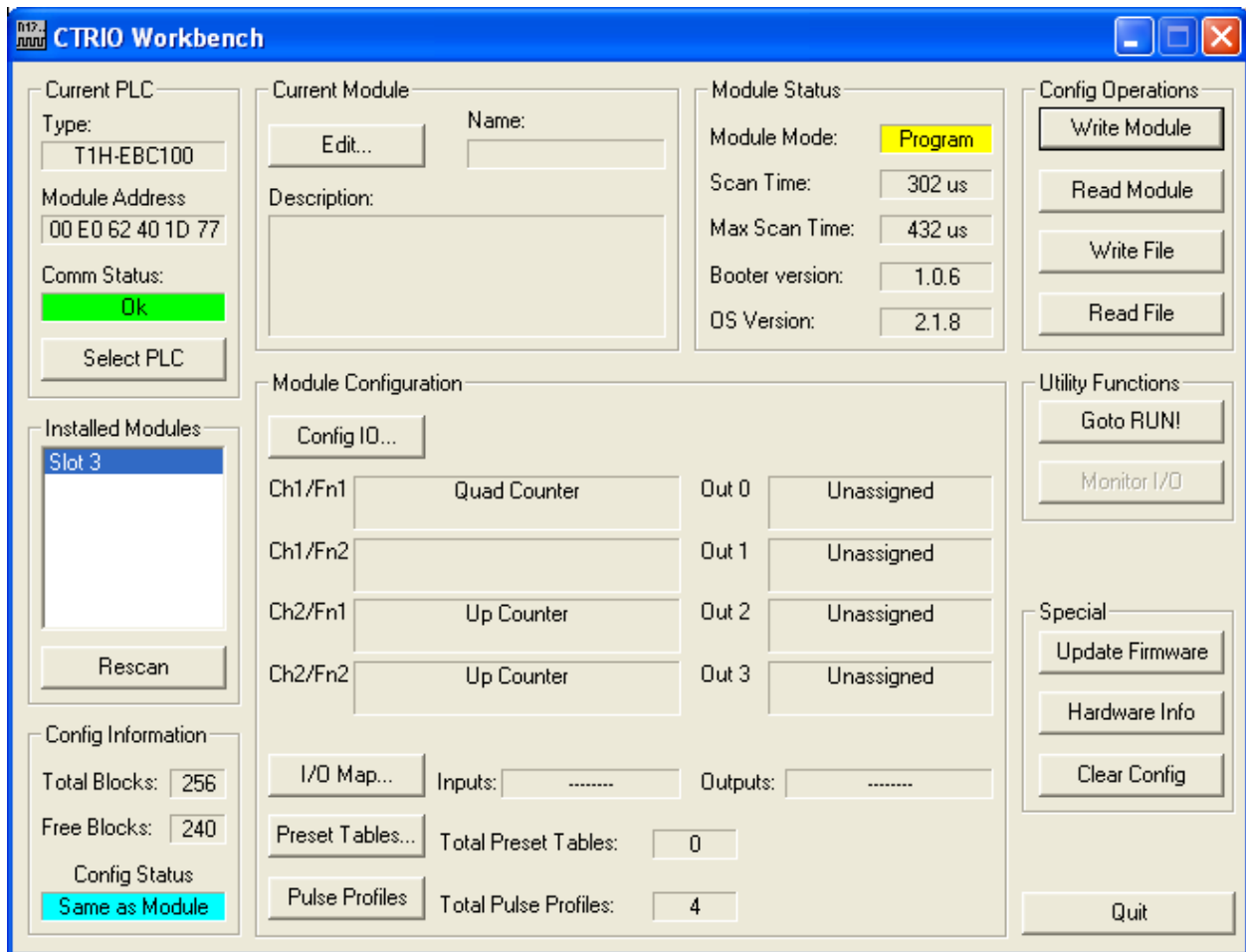
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First, we need to set up the functions we want the CTRIO to use, let's use the same ones we did before; channel 1 as a quad counter and channel 2 as two up counters.

Step 2

Then use the Write Module option to write the I/O configuration to the CTRIO module.



Step 3

It is also possible to save the CTRIO Configuration to disk using the Write File option. This will create a .cwb file of the CTRIO module configuration.

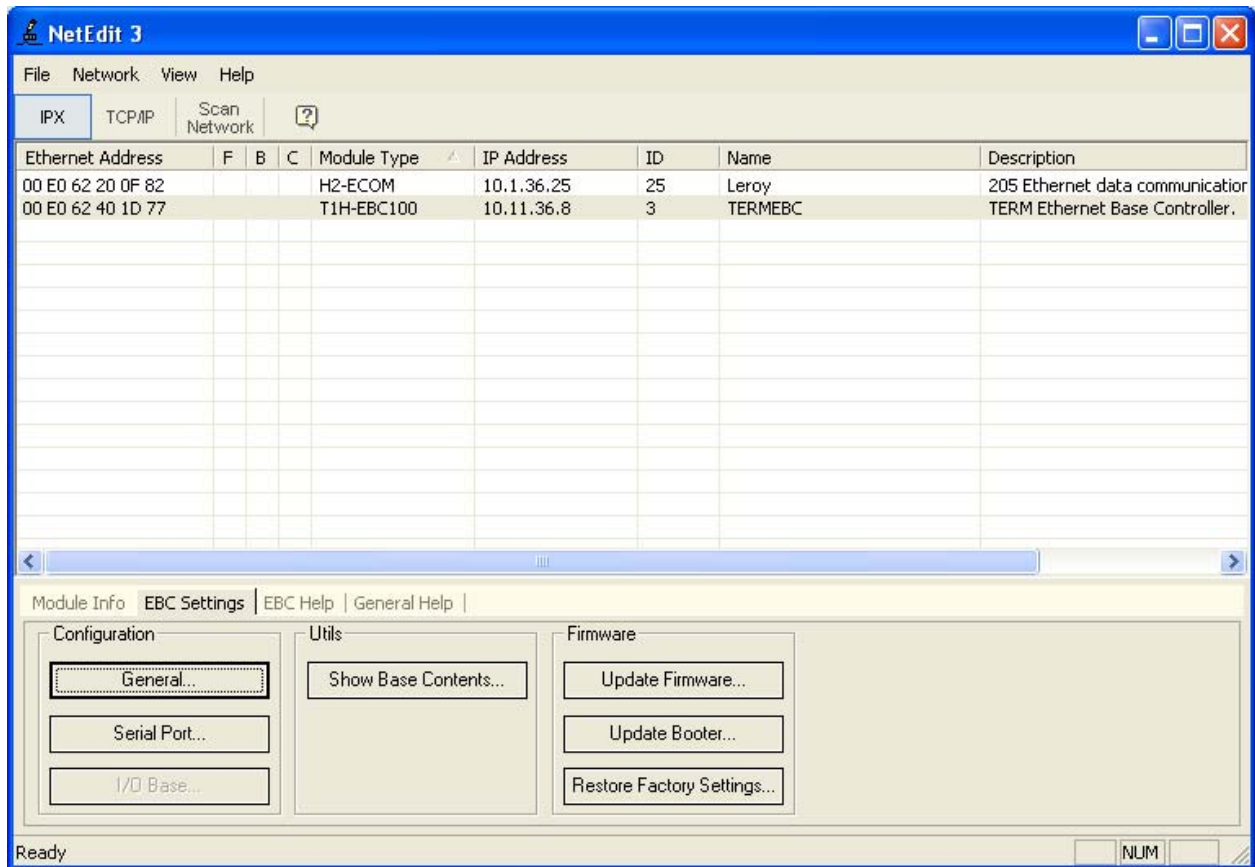


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Step 4

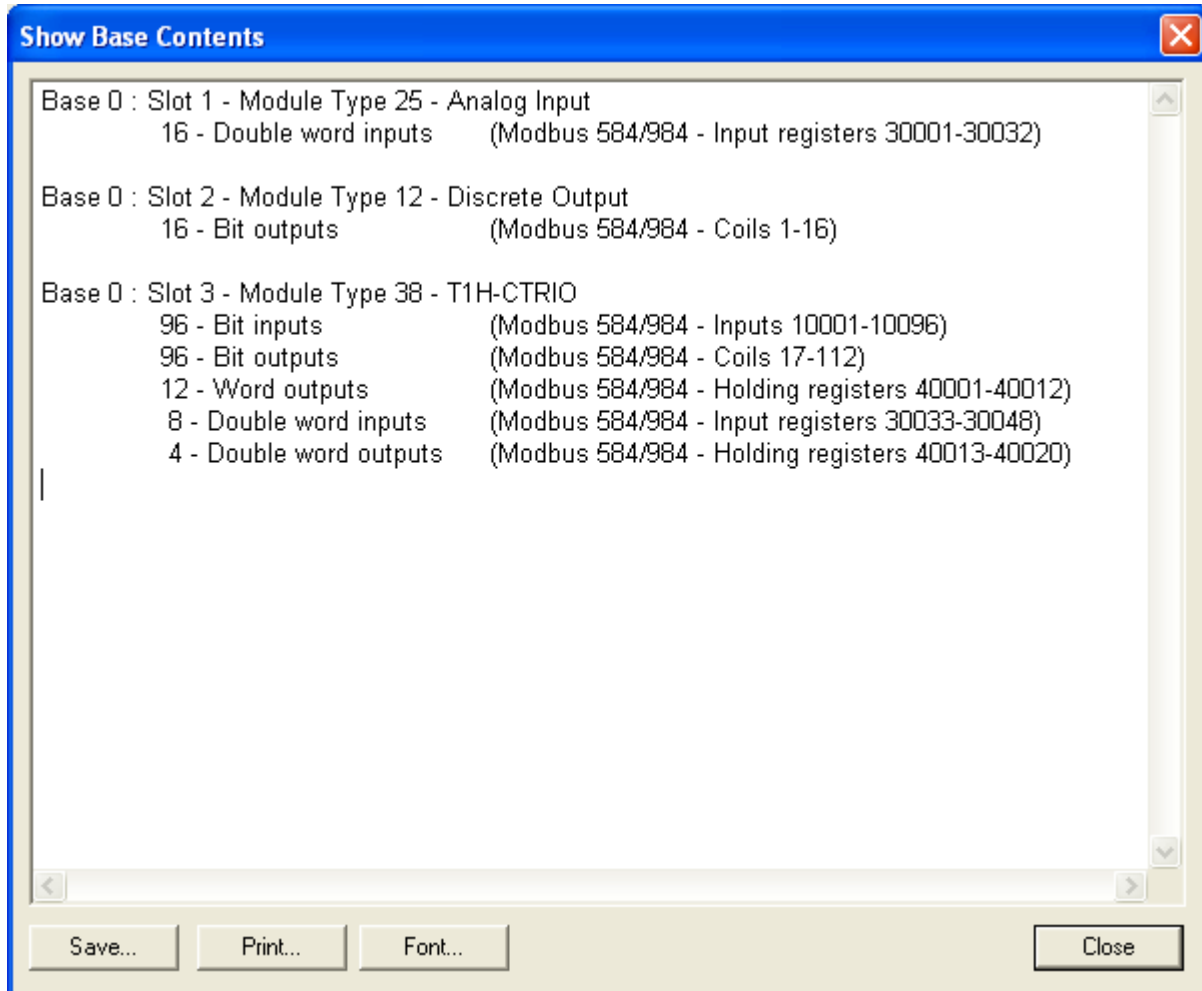
Now normally in a PLC we would go ahead and map IO so we could tell where the various CTRIO features are publishing data. Unfortunately, when using the EBC100 with Modbus/TCP, we have to go ahead and find the Modbus mapping for the base with the EBC100 installed before we will know what Modbus addresses the EBC100 assigns to the CTRIO. So, we will use the NetEdit3 utility to find the Modbus Addresses by selecting the EBC100 module and then selecting the EBC Settings Tab and the Show Base Contents button. The NetEdit3 utility can be found in the DSLaunch screen under the Utilities section in DirectSoft programming software.





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Step 5

You will then need to choose the EBC- Mapped to MODBUS/TCP option from the CTRIO Workbench and enter the Modbus Starting addresses Input Words and Bits, then do the same for Output Starting Addresses.



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Ch1/Fn1 - Quad Counter	Ch2/Fn1 - Up Counter	Ch2/Fn2 - Up Counter
Input Data (CTRIO->Controller) 30033-30034 = Current Count 10002 = At Reset Value	Input Data (CTRIO->Controller) 30041-30042 = Current Count 10018 = At Reset Value	Input Data (CTRIO->Controller) 30045-30046 = Current Count 10026 = At Reset Value
Output Data (Controller->CTRIO) 18 = Reset	Output Data (Controller->CTRIO) 34 = Reset	Output Data (Controller->CTRIO) 42 = Reset

You can also choose the Report button, then choose the Print button to get a print out of the Modbus TCP I/O Map once you have entered the Starting addresses into the I/O Map screen since the CTRIO Workbench software will not retain this information.



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WinPLC and Think&Do/EBC mapping

When using the WinPLC and a CTRIO, the CTRIO will need to be located in the local base with the WinPLC. Mapping will be done using the EBC + WinPLC version of the CTRIO WB just like we used for the ERM/EBC. However, for the WinPLC mapping we need only select the 'EBC/WinPLC – Native Addresses' option. There is also an option for 'EBC/WinPLC – Native T&D Addresses,' but this option is should not be used for any mapping.

There are 4 steps to configure the CTRIO for use with a WinPLC or EBC:

- 1) Configure the IO
- 2) Write to module
- 3) Save configuration
- 4) Map IO in IOview/Connectivity center

Step 1

Setup the IO configuration you want in WB using the 'Config IO' button. For this example just use the same configuration we used before, channel 1 is a quadrature counter and channel 2 has 2 up counters.

Step 2

Again, there is no IO mapping for the CTRIO with a WinPLC, as this is done in the IOview or Connectivity center screen in the T&D software. So you can go ahead and write the configuration to the CTRIO module as soon as you have it set up.

Step 3

You can save your configuration to disk also. This is a particularly good idea for complicated or repetitive configurations.



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When using the CTRIO in an EBC base being controlled from Think&Do, the mapping is also done from the EBC + WinPLC version of CTRIO WB. Again, select the 'EBC/WinPLC – Native Addresses' option.

The screenshot shows the 'IO Map' window with the following configuration:

- Map Display Mode:** EBC/WinPLC - Native Addresses (selected), EBC/WinPLC - Native T&D Addresses, EBC - Mapped to PLC through ERM.
- Input Map:** Two 'Range:' labels with empty input fields.
- Output Map:** Two 'Range:' labels with empty input fields.
- Input Functions:**
 - Ch1/Fn1 - Quad Counter: dwX0 = Current Count, bX1 = At Reset Value.
 - Ch2/Fn1 - Up Counter: dwX4 = Current Count, bX17 = At Reset Value.
 - Ch2/Fn2 - Up Counter: dwX6 = Current Count, bX25 = At Reset Value.
- Output Functions:**
 - bY1 = Reset.
 - bY17 = Reset.
 - bY25 = Reset.

Buttons at the bottom: OK, Cancel, Report..., Export...



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The addressing shown should closely match the addressing for the CTRIO module as shown in the IO view or Connectivity center screens in Live or Studio.

The screenshot shows the 'I/O View' software interface. The main window displays a hardware rack configuration with an 'Ethernet Base Controller' and an 'H2-CTRIO' module in Slot #1. The 'I/O Map' dialog box is open, showing the mapping of digital words to the controller. The 'Input Functions' tab is selected, and the 'dwX0 = Current Count' entry is highlighted in red. The 'I/O Device Description' table below shows the following data:

	I/O Device Description	Data Type	Logical ID	Tag
193	Eth_Base02_Slot1o_wY0	Number		
194	Eth_Base02_Slot1o_wY1	Number		
195	Eth_Base02_Slot1o_wY2	Number		
196	Eth_Base02_Slot1o_wY3	Number		
197	Eth_Base02_Slot1o_wY4	Number		
198	Eth_Base02_Slot1o_wY5	Number		
199	Eth_Base02_Slot1o_wY6	Number		
200	Eth_Base02_Slot1o_wY7	Number		
201	Eth_Base02_Slot1o_wY8	Number		
202	Eth_Base02_Slot1o_wY9	Number		
203	Eth_Base02_Slot1o_wY10	Number		
204	Eth_Base02_Slot1o_wY11	Number		
205	Eth_Base02_Slot1i_dwX0	Number		
206	Eth_Base02_Slot1i_dwX1	Number		

The 'I/O Map' dialog box shows the following mapping:

Map Display Mode	Input Map
EBC/WinPLC - Native Addresses	Range: []
EBC/WinPLC - Native T&D Addresses	Range: []
EBC - Mapped to PLC through ERM	Range: []

The 'Input Functions' section shows:

Ch1/Fn1 - Quad Counter	Input Data (CTRIO->Controller)	Ch2/Fn1 - Up Co
dwX0 = Current Count bX1 = At Reset Value		dwX4 = Current Count bX17 = At Reset Value

The 'Output Data' section shows:

Output Data (Controller->CTRIO)	Output Data (Controller->CTRIO)	Output Data (Controller->CTRIO)
bY1 = Reset		bY17 = Reset



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CTRIO addressing in Kepdirect

The same mapping is used for Kepdirect when using a CTRIO via an EBC. But the mapping in Kepdirect is not as clear. Here is an example for the configuration we have mapped:

The screenshot shows the OPC Quick Client interface. The top window displays a table of data points for 'AutomationDirect.KEPDirectServer'. The table has columns for Item ID, Data Type, Value, Timestamp, and Quality. Several items are circled in red, including 'Channel1.Device1.SLOT_01.S1_DW10_DWORD' (Value: 59) and 'Channel1.Device1.SLOT_01.S1_DW16_DWORD' (Value: 60). Below the table is an 'IO Map' window. The 'Map Display Mode' is set to 'EBC/vinPLC - Native Addresses'. The 'Input Map' section shows 'Range:' fields. The 'Input Functions' tab is active, showing four counter configurations: 'Ch1/Fn1 - Quad Counter', 'Ch2/Fn1 - Up Counter', 'Ch2/Fn2 - Up Counter', and 'Ch2/Fn2 - Up Counter'. Each configuration has 'Input Data (CTRIO->Controller)' and 'Output Data (Controller->CTRIO)' fields. The 'Input Data' fields are circled in red and contain the text: 'dw*0 = Current Count', 'bx1 = At Reset Value', 'dw*4 = Current Count', 'bx17 = At Reset Value', and 'dw*6 = Current Count', 'bx25 = At Reset Value'. The 'Output Data' fields contain 'by1 = Reset' and 'by17 = Reset'.

As in the WinPLC/EBC setup, the only steps necessary to configure the CTRIO for use with Kepdirect are:

- 1) Configure the IO
- 2) Write to module
- 3) Save configuration

Technical

Assistance: If you have questions regarding this Application Note, please contact us at 770-844-4200 for further assistance.