APPLICATION NOTE

Product Family: All CTRIO modules

Number: AN-CTRIO-001

Subject: Use of CTRIO Workbench for programming CTRIO modules

Date Issued: 8-25-04

Revision: Original

PURPOSE

This application note is intended to give new users of CTRIO modules an introduction to the purpose and use of CTRIO WB for programming CTRIO modules.

EQUIPMENT NEEDED

1) Directlogic PLC with a correctly installed CTRIO module, Current version of Directsoft and CTRIO WB, programming cables.

or

2) CTRIO module installed in EBC, WINPLC, or Terminator base and current version of CTRIO WB.

Some suggestions before we begin:

- Make sure you have the latest versions of Directsoft and CTRIO WB before beginning.
- Make sure the PLC/EBC you are using has up to date firmware per the CTRIO manual
- If you are using a 205 PLC, be sure the CTRIO is not located in the slot adjacent to the PLC

Launching Workbench

The first thing we need to do is launch CTRIO Workbench. You can do this from the DSLaunch screen under 'Utilities' or by selecting START/All programs/Automation Direct Tools and then selecting CTRIO WB. Note that there are several different versions of WB to choose from. We'll go through each of these, skip to the section that covers the version you need.
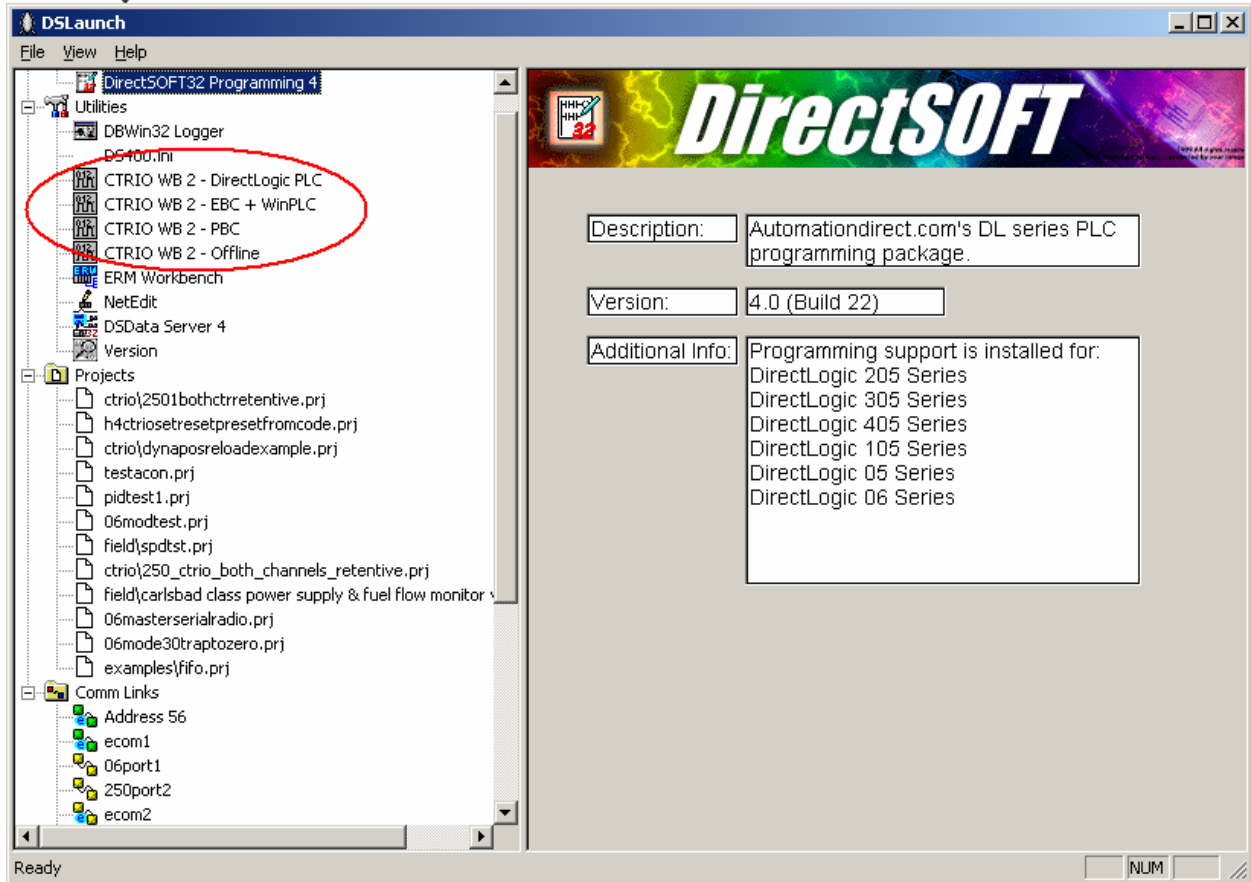
CTRIO WB – Directlogic PLC

This version of CTRIO WB is for use when using a CTRIO with any Directlogic PLCs. When first launched, this tool will ask you to select a link to use to find the CTRIO. Just like Directsoft, you can add a new link if necessary or simply select an existing link. In some cases, using Directsoft software at the same time as WB over the same serial link can cause communication issues, this should be avoided if possible.
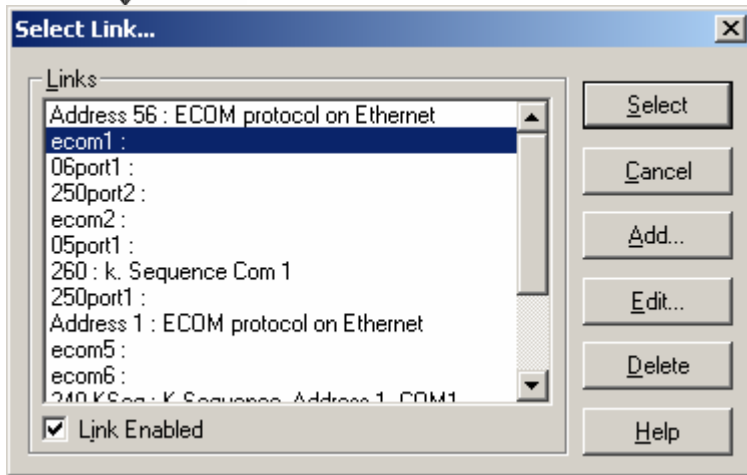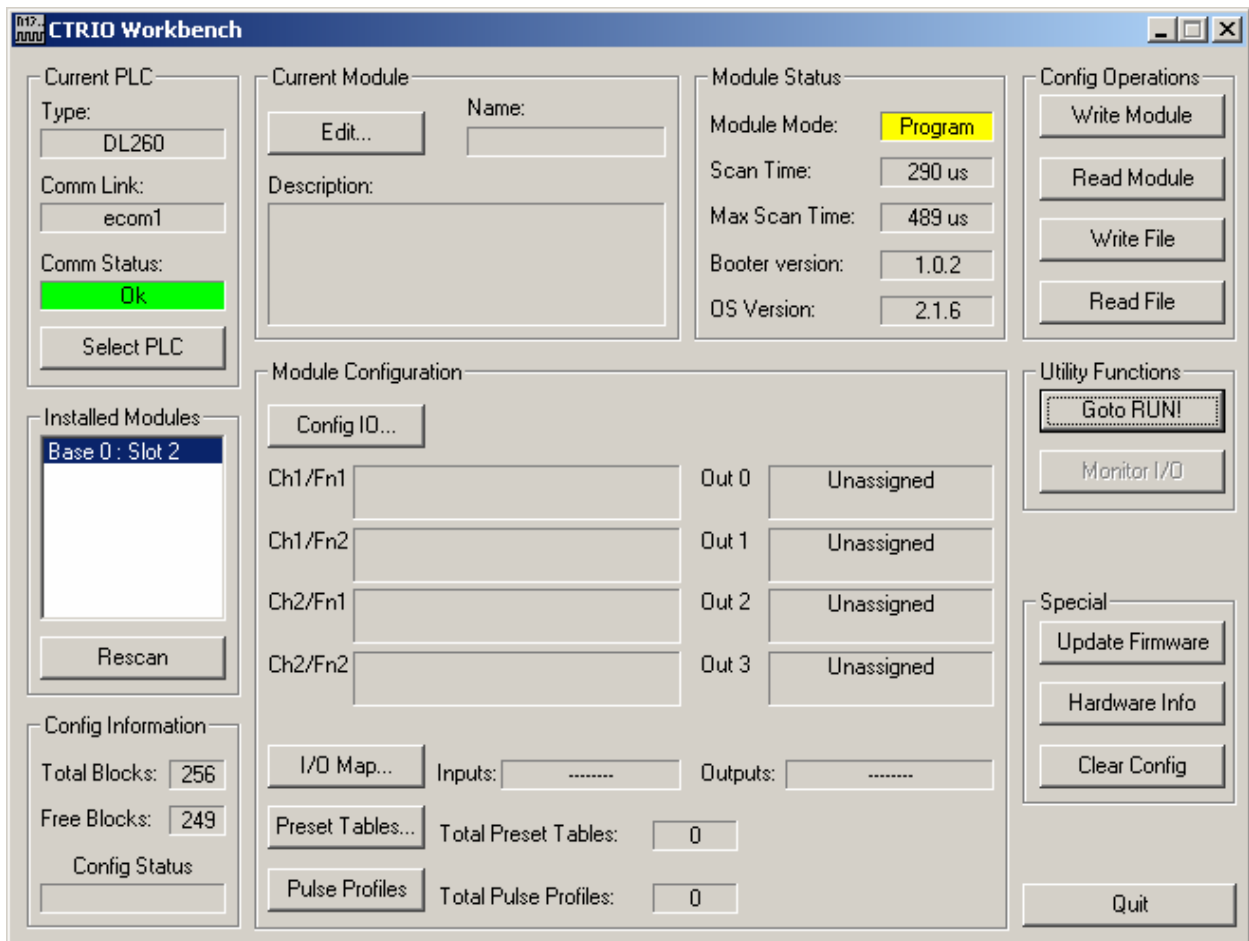
Once you have selected a valid link, you should get the main CTRIO WB screen.

Wow, look at all those settings, parameters, and buttons! Don't panic! We'll go through all these from easiest to most complicated.

"All I need to do is measure XYZ on the inputs."

If all you need to do is measure data into the CTRIO, then programming is really quite simple. For this reason we will start with how to set the card up to read counts into channel 1.

First we need to get into the 'Config IO' screen from the main workbench screen.
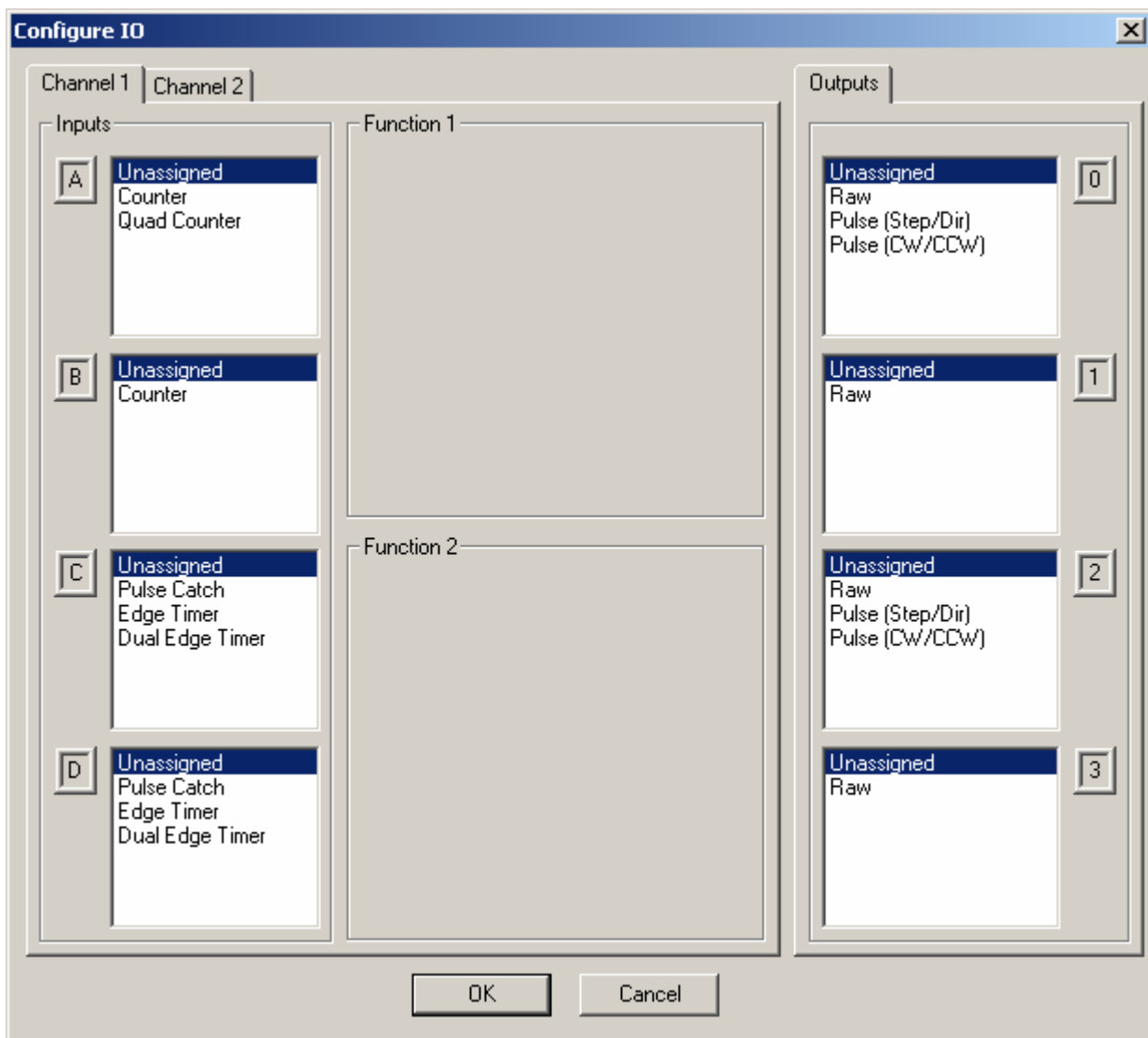
Now select 'Counter' for input A.

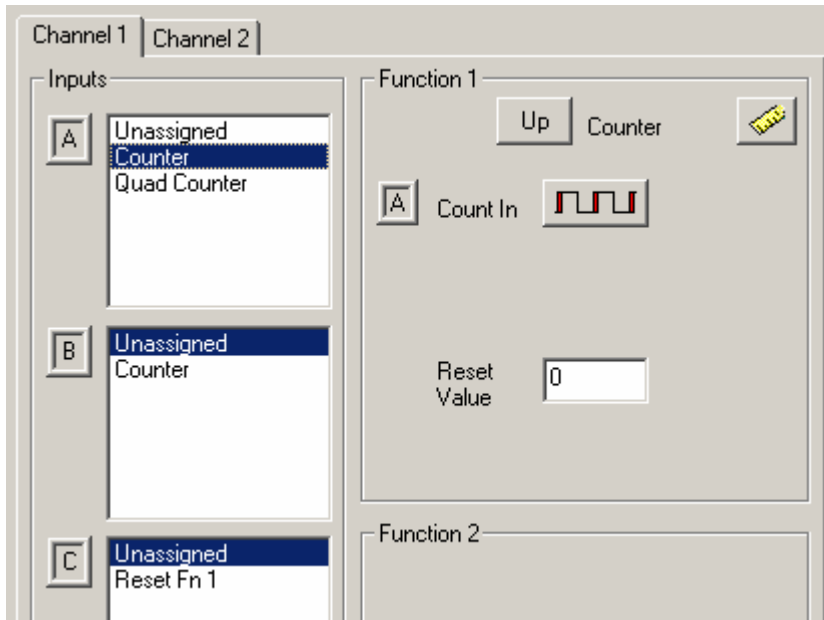Notice that the available choices for Input C change when we select a counter for Input A? This is an important feature of the CTRIO WB software, as you make selections for your input output assignments WB will remove choices for other inputs/outputs that are no longer available due to your previous selection(s). This keeps you from selecting an illegal configuration.

OK, I promised this would be easy so lets finish this up. So hit the 'OK' button to return to the main WB screen. Notice that our status bar in the lower left corner now says 'Changed.'
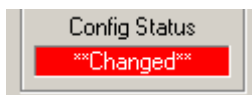
This will happen any time we change anything that requires the configuration be re-written to the module. At this point we have some more configuration we need to do before we are done anyway, so we'll wait until we are finished to write the configuration to the CTRIO.

Mapping IO to/from the CTRIO

The next thing we need to do is map IO for the CTRIO to use in the PLC. The CTRIO is actually a co-processor (which means it is running its own code) that publishes data to the PLC and reads data from the PLC. Understanding this relationship is helpful to performing operations that require the PLC to make changes to the CTRIO from ladder logic. We'll cover this later in detail, but for now understand that the PLC cannot directly manipulate data in the CTRIO. All it
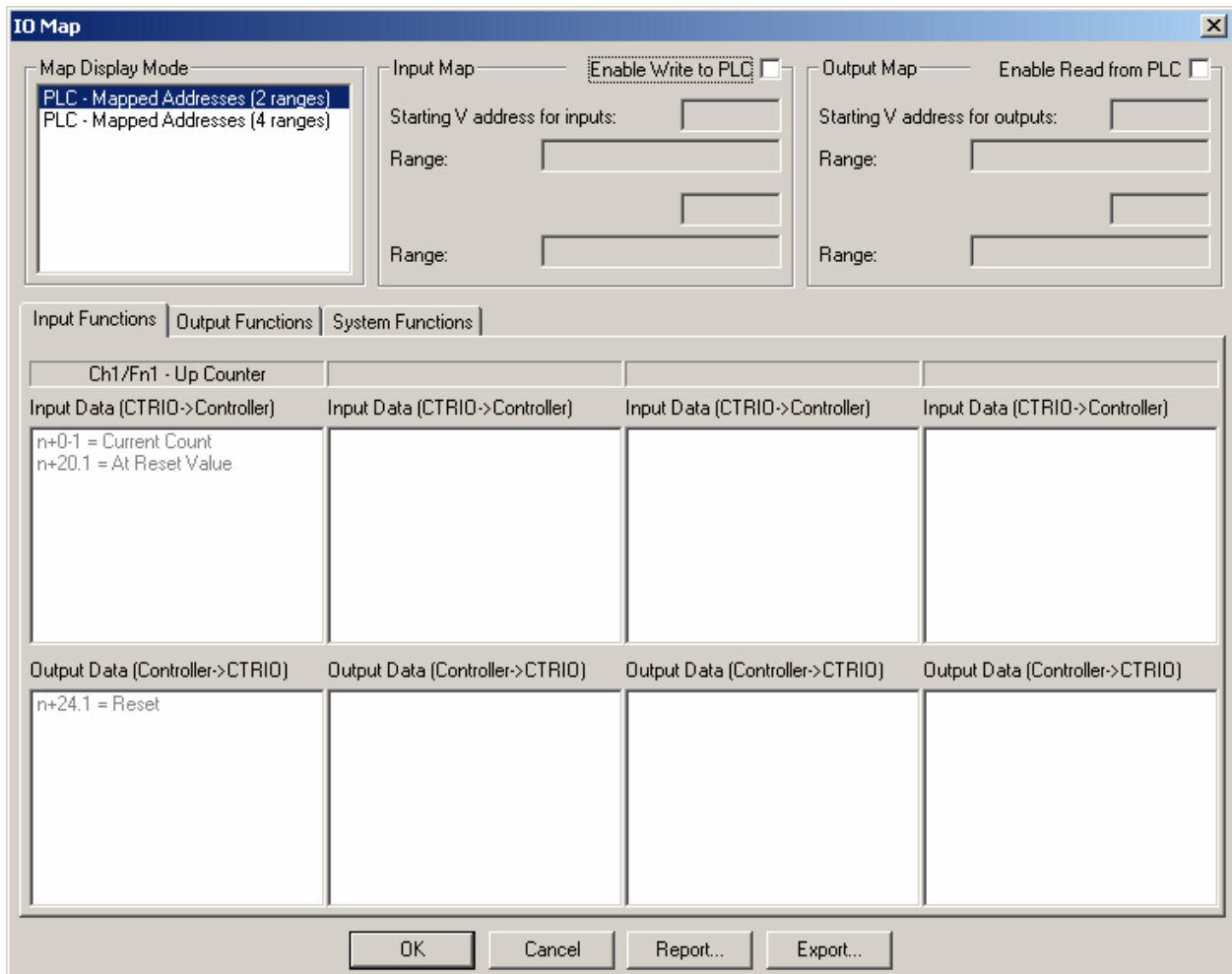
can do is make requests to the CTRIO by turning on specific bits and placing appropriate data in specific registers.

So let's map IO for our simple counter application. Select the 'IO map' button from the main CTRIO WB screen.

Not much here really. Let's go over some of these windows. At the top we have a 'Map Display Mode' window. This lets us choose between the 2 range and 4 range mapping methods. The 4 range method is SOLELY for use with the D2-240 PLC. There is no advantage to using it with any of the other PLCs. It allows the bits the CTRIO requires to be mapped to C bits in a D2-240 as the D2-240 does not support bit-of-word.

To the right we have the check boxes for input and output mapping. If all you need are inputs, you may not have to map any outputs at all. As we discussed though, any data sent to the CTRIO from the PLC is viewed as output data and will require an output data range be mapped. Look at the lower windows, specifically notice that the upper windows are labeled 'Input Data

(CTRIO>Controller)' and the lower windows are labeled 'Output Data (Controller>CTRIO).'
The upper windows here show any data the CTRIO is publishing to the PLC for the selected
function. The lower window shows any data items that can be written to the CTRIO from the
PLC.

In this case notice the upper window has the count value, and a bit to tell the PLC the count is at
the reset value. The lower window shows only a reset bit for the PLC to use to reset the count
for counter 1 from the ladder code. This means if we want to be able to reset the counter from
our code we MUST map outputs for this CTRIO configuration.

So click on the 'Enable write to PLC' checkbox and enter V2000 for the starting V address for
inputs. Notice that the WB tells us at this point how many registers it is going to allocate to the
CTRIO. It is important to not use any of the registers in this range for any other purposes in the
ladder code. We also need to click the 'Enable read from PLC' checkbox and enter a starting V
location for outputs. Since the inputs are taking up V2000-V2025, and since it is easier to start
ranges on '10' boundaries, we will enter V2030 for the starting V location for outputs (this is
also the default input and output range used in the CTRIO manual, which makes it a good first
time choice). Of course you are free to use any user V memory for the CTRIO mapping, just be
sure the V locations are not used for other purposes in your code or in another specialty module
and that the input and output ranges do not overlap.

Notice that the lower windows now show the count will be published to V2000/V2001 (it is a
32-bit decimal value) and that the reset bit is V2054.1 (which is the second bit of V2054).
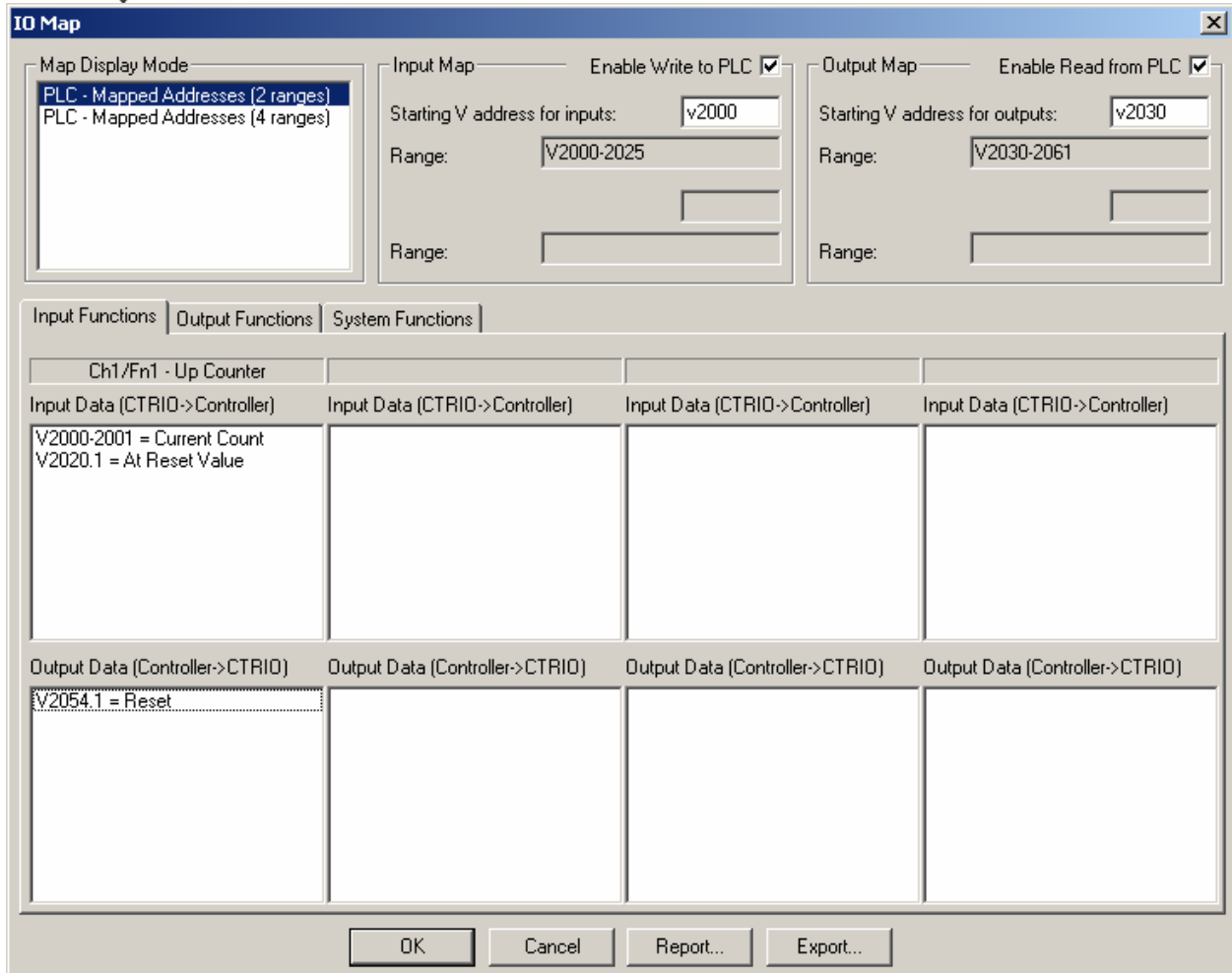
We're pretty much done here, but before we leave this screen…notice the 'Report' button at the bottom of the screen. Pressing that will allow you to print out all the currently mapped IO points. That would not be a lot of data right now, but for more complicated applications it may be. It is a good idea to print this out once your configuration is done.

OK, go ahead and press the OK button to accept this configuration and return to the main screen. We're done with this configuration, so make sure you are in 'Program' mode and press the 'Write Module' button. Once the write is complete you should see a light blue 'Same as Module' in the 'Config Status' window.

This configuration isn't particularly complicated, but we still encourage customers to save their configurations. Just press the 'Write File' button and then give the configuration a filename and location. Be aware that CTRIO WB always defaults the output filename to config.cwb, obviously you can only have one file with that name, so we suggest you rename CTRIO configurations with 'your_project_name.cwb' and also save them to the same subdirectory as the project is saved to.

That's it, you're done!

That is it for the setup for our simple counter example. Let's see if it works. From the main
CTRIO WB screen select the 'Monitor IO' button. This button is only active if the CTRIO is in
RUN mode. You should get a pop-up screen asking you if you want to suspend output reads.
What this really means is the WB tool is asking if you want to temporarily ignore any commands
the PLC may be issuing via the ladder logic. Most of the time the answer will be YES. Press
YES. Now we should see the Monitor IO screen.
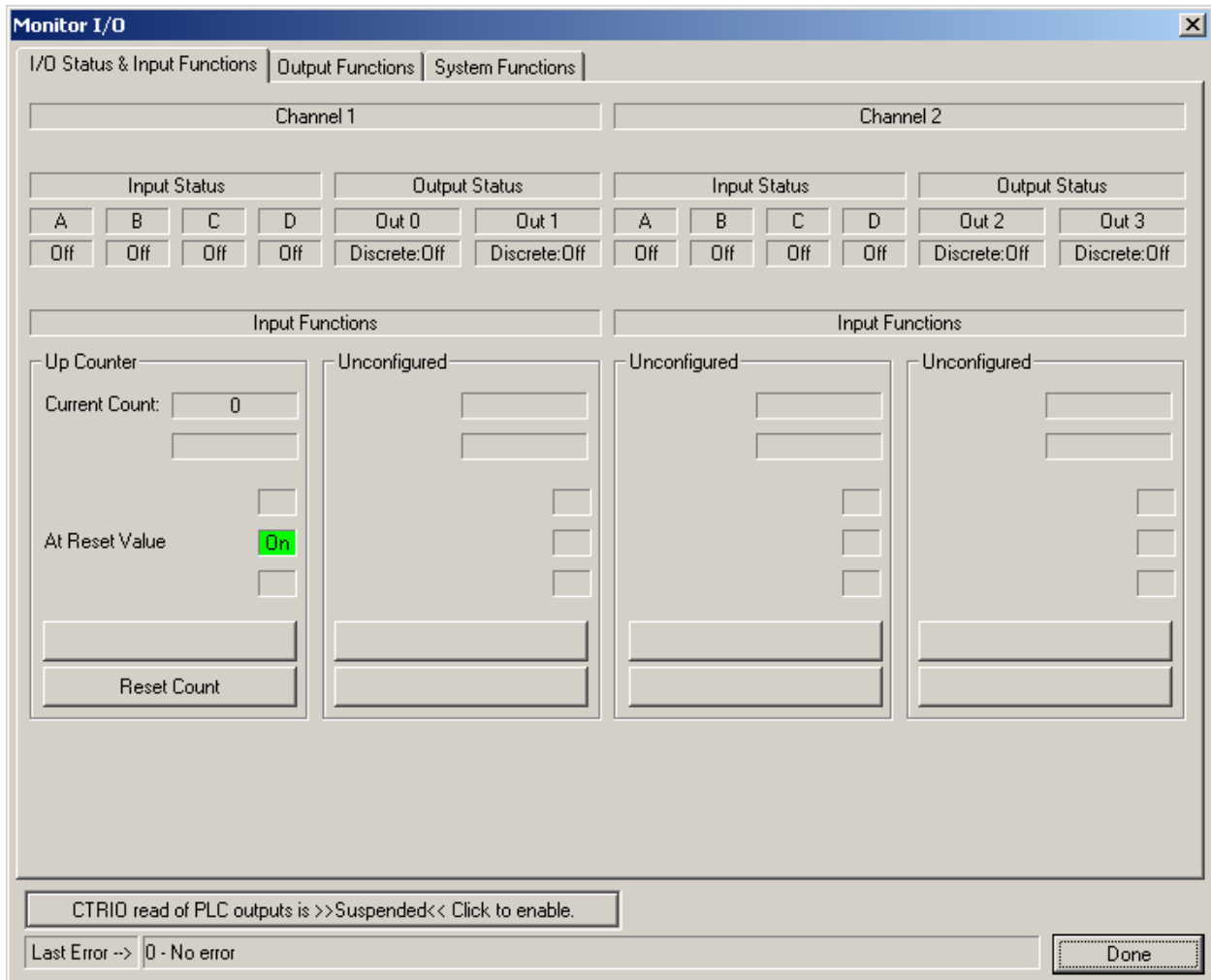
Turn your connected encoder and you should see the input A status change. If you are using a
quadrature encoder you will see both A and B inputs changing state. If you turn the quadrature
encoder slowly you should be able to see that the inputs are 90 degrees out of phase. We are
currently set up for a single up counter, so whether you have a single or quad encoder you should
be counting up no matter which way you turn the encoder.

Control from the ladder logic

Now that we have made sure the CTRIO function we have defined is functional in WB via monitor IO, we can go about writing some ladder logic to use this data in the PLC. In this case we will simply monitor the count and reset the counter at a certain count. From the report we generated from the IO map screen we can see our raw count data is being written to V2000 and V2001 and that the bit we need to turn on in the PLC to reset the counter is V2054.1, so we will use these in our code.

Make sure you have exited Monitor IO mode and be sure you re-enabled PLC reads when asked if you wanted to.
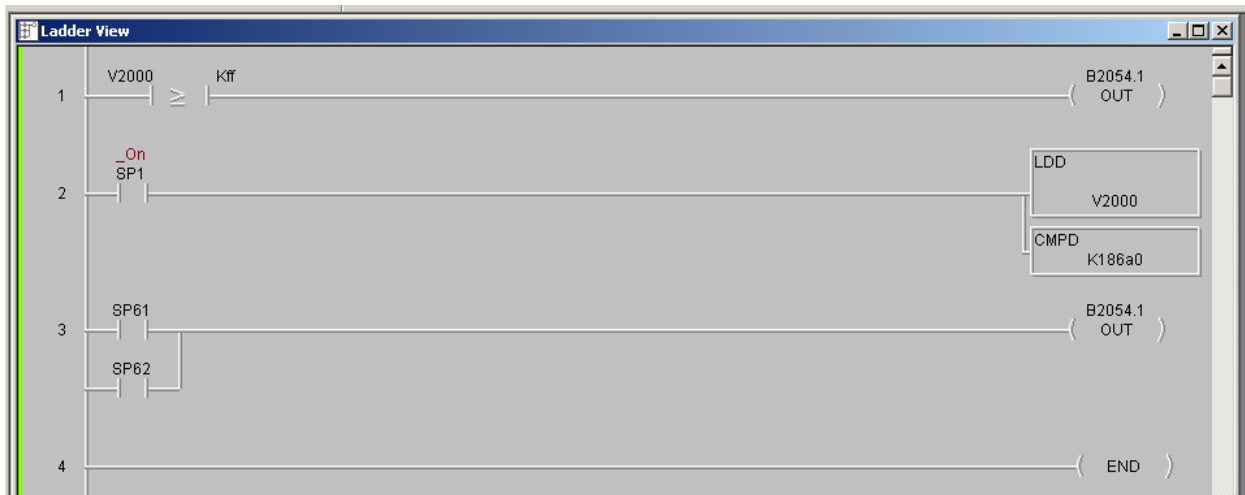
The above code shows two different methods for resetting the counter above a particular count value. Rung 1 is less complicated, but does have some restrictions. Note that the K value is FF, this would be 255 decimal. Remember the CTRIO publishes raw count data in decimal format. Actually it is 32-bit signed decimal. So you must convert the decimal number you wish to compare to to Hex if using this method. Of course if you were using a V location instead of the K value you would simply need to be sure the data in that V location was in decimal. The other restriction for rung 1 is that you can only compare to values up to 65535, the maximum decimal number available in a 16-bit word.

If you need to compare to larger numbers, like say 100000, then the only option is to use the CMPD instruction. This requires two rungs as shown. Again, if comparing against a K constant, be sure to convert your decimal number to Hex. 100000 decimal is 186A0 Hex for instance. The Windows calculator will do this conversion in scientific mode.

The prior discussion covers how the CTRIO is set up and how it interfaces to the PLC. More complicated applications will require more setup and more data to be manipulated from the ladder logic, but the process is the same.

1) Connect to CTRIO
2) Configure your required IO functions
3) Map the functions to IO in the PLC
4) Test your application using Monitor IO
5) Write your ladder logic

Following these steps in order will simplify the process and keep you from becoming confused or disorganized when troubleshooting your application.

Here are some links to other CTRIO related application notes:

Pulse output command quick start
http://support.automationdirect.com/docs/ctrio_pulse_output_commands.pdf

Addressing of CTRIO for PLCs, EBC/WinPLC, ERM/EBC, and KepDirect
http://support.automationdirect.com/docs/an-misc-022.pdf

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