

CTRIO WORKBENCH, CONFIGURING INPUTS



CHAPTER 5

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Configure I/O Dialog Overview

- ☒ DL
- ☒ Win
- ☒ NI

The **Configure I/O** dialog box is where input and output functions are assigned to the module. The choice of input and output function determine which options are available.

The input and output function boxes allow selections for supported functions. The configuration software disallows any unsupported selections.

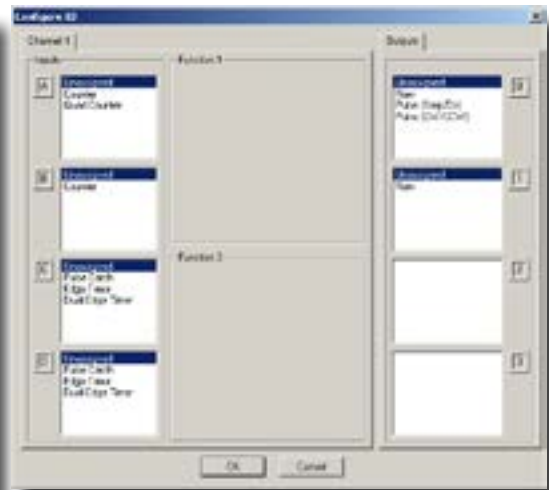
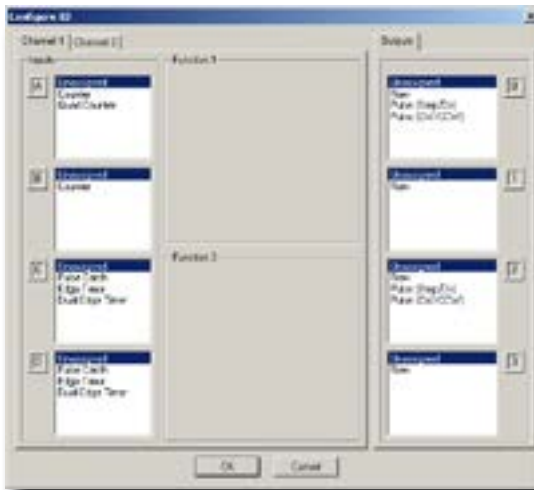
For *DirectLOGIC* users, click on the “**Config IO...**” button to arrive at a dialog box shown below. Notice that the window has a tab for each input Channel. The H0-CTRIO(2) only has one input channel.



NOTE: The *Configure IO* dialog box can be accessed without being in *PROGRAM* mode, however *PROGRAM* mode must be selected to write the configuration to the CTRIO(2) module.

H2, H4, T1H-CTRIO, H2-CTRIO2
Configure I/O Dialog

H0-CTRIO(2)
Configure I/O Dialog



- ☒ DL
- ☒ Win
- ☒ NI

The input options are listed by function. Four boxes labeled A, B, C, and D correspond to the input terminals on the face of the module (1A-1D or 2A-2D; A-D for the H0-CTRIO(2)). The Output functions are listed as 0, 1, 2, and 3. The numbers correspond to the markings beside the module’s output terminals (Y0-Y3; Y0-Y1 for the H0-CTRIO(2)).

Be sure to write the changes to the module from Workbench when the configuration is complete. For example, click on “Counter” in the “A” box, then OK to return to the main Workbench window. Then at the main window, click “**Write Module**” to save the configuration to the module, (The module will need to be in Program Mode to perform the **Write Module** operation). Without performing the **Write Module** operation (or a **Write File** operation) any configuration changes will be lost upon quitting Workbench. This applies to all changes to the module configuration.

Input Function Selections

The module supports five primary input functions:

- **Counter:** Supports up or down counting using single-ended encoders (or (other single-ended pulse sources) as inputs.
- **Quadrature Counter:** Supports quadrature counting using quadrature encoders as inputs.
- **Pulse Catch:** Allows a very short duration pulse to be qualified and lengthened to a time period long enough to guarantee that it is seen by the CPU scan.
- **Edge Timer:** Measures the time between edges on an input. This function is available on inputs C and D.
- **Dual Edge Timer:** Designed to measure from one incoming signal pulse edge to another incoming signal pulse edge. The user selects whether to measure between rising edges, falling edges, etc.



Making Selections

Each of the primary functions uses one or two input terminals for making connections to field devices (plus a common). Combinations of the listed functions are possible. The **Config I/O** dialog box disallows any unsupported configurations.

As a selection is made at Input box A, the assigned function is displayed under the Function 1 area. For Input box B the selected function is displayed under the Function 2 area (Selections in box B will be unavailable when Quad Counter is selected in box A). For input function boxes C and D, as selections are made, these are displayed as modifiers to their respective functions (A or B).

As an example, click on **Counter** from box A, the relevant parameters are displayed under Function 1 header (Up or Down Counter, Count In, Reset Value and a Ruler icon). Choosing a “modifier” from box C or D will add another parameter to the respective function area.



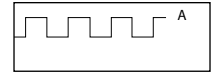
NOTE: Notice that the selection choices in the **Outputs** panel change based on selections made in the **Inputs** panel, congruently as selections are made in **Outputs** panel, available **Inputs** selections are changed.

The following pages describe the function selections available in the Config I/O dialog box.

Counter Function

- ☒ DL
- ☒ Win
- ☒ NI

The CTRIO(2) module supports up or down counting using single-ended encoders (or other single-ended pulse sources) as inputs. Encoders, proximity sensors, etc., can be connected to Input A and/or Input B on either channel or both channels. The C and D Inputs are available to modify the A and B Inputs such as Reset, Inhibit, or Capture. These functions are explained later in this chapter. The CTRIO(2) discrete output(s) can be assigned to the Counter function using the Preset Tables dialog box. Refer to Chapter 6, *Creating and Using the Output Preset Tables* (6-8), for details.



NOTE: To insure proper operation, the field device wiring and the configuration must be compatible. For wiring information see Chapter 3 "Installation and Field Wiring".

The module's four input terminals are represented by A, B, C, and D boxes on the left side of this dialog box. If wiring the counter input to terminal 1A, select the Channel 1 tab near the top of this window and click "**Counter**" (a) in box A.

At this point, four decisions are required to configure the input at 1A.

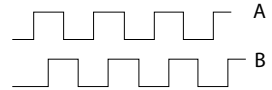
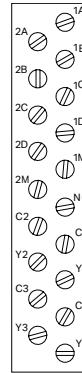
1. Select count Up or count Down in **Function 1** panel. Click the button labeled **Up** (or **Down**) (b) to view the opposite count value.
2. Each input pulse is counted. Designate whether the count is to register on the rising edge of the pulse, the falling edge, or both. The button with the graphical representation of a pulse (c) toggles between these options.
3. The Reset value is assigned by clicking in the data input field (d) and typing a value. This value is for hardwired resets. When the hardwired reset is activated, the count value returns to the reset value.
4. The last remaining decision to be made is about scaling. Clicking on the button (e) with the ruler symbol opens the Scaling Wizard. The Scaling Wizard is intelligent in that it offers scaling options that are appropriate for the input selections. The scaling wizard will be discussed later in this chapter.



Quadrature Counter

- ☒ DL
- ☒ Win
- ☒ NI

The CTRIO(2) module supports quadrature counting using quadrature encoders as inputs. Connect the encoder to input A and input B on either channel. A second quadrature encoder can be connected to the other channel. The C and D inputs are available to control the quadrature input counting. The C and D inputs can be used for Reset, Inhibit, or Capture. These functions are explained later in this chapter. The CTRIO(2) discrete output(s) can be assigned to the Quad Counter function using the Preset Tables dialog box. Refer to Chapter 6 *Creating and Using the Output Preset Tables* (6-8), for details.

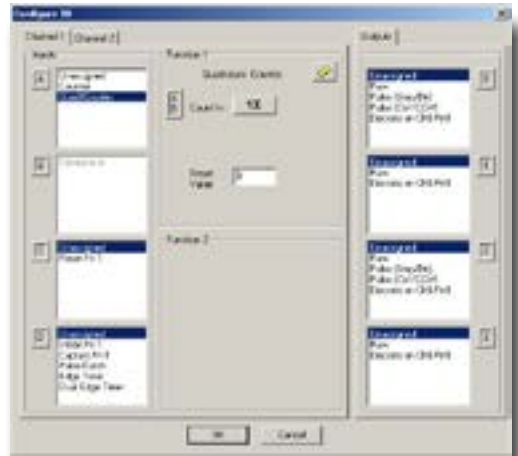


NOTE: To insure proper operation, the field device wiring and the configuration must be compatible. For wiring information see Chapter 3 "Installation and Field Wiring" topic.

Notice the A, B, C, and D boxes down the left side of this dialog box panel represent the module's four input terminals. If wiring quadrature counter inputs to terminal 1A and 1B, select **Channel 1** tab near the top of this window and click "Quad Counter" in box A. Notice that input B options are now grayed out and slaved to input A.

At this point, there are three decisions to make regarding quadrature input:

1. A multiplier can be applied to the quadrature input to increase its resolution. Select "1X", "2X", or "4X." (1X = pulses processed on leading edge of input A, 2X = pulses are processed on both edges of input A, 4X = pulses processed on both edges of input A and both edges of input B).
2. The "Reset Value" is assigned by clicking in the data input field and typing in a value. When the count is reset, using any of the reset methods, the count value returns to the Reset Value. The reset options are described in more detail later in this chapter.
3. The last remaining decision to be made is about scaling. Clicking the button with the ruler symbol starts the Scaling Wizard. The Scaling Wizard is intelligent in that it offers only those scaling options that are appropriate for the input selections. The scaling wizard is discussed in greater detail later in this chapter.



Pulse Catch

- ✓ DL
- ✓ Win
- ✓ NI

The Pulse Catch function allows a very short duration pulse to be qualified and lengthened to a time period long enough to guarantee that it is seen by the CPU scan. CPU scans necessarily vary with the length and complexity of the user's program. A scan frequency of several milliseconds is possible. On a conventional discrete input module, if a pulse is shorter than one scan time, there is a chance the CPU will not see the pulse.

The CTRIO(2) module's Pulse Catch function sees the fast incoming signal and holds its status in a status bit until the CPU can see it. A discrete output(s) can also be tied to follow the Pulse Catch input.

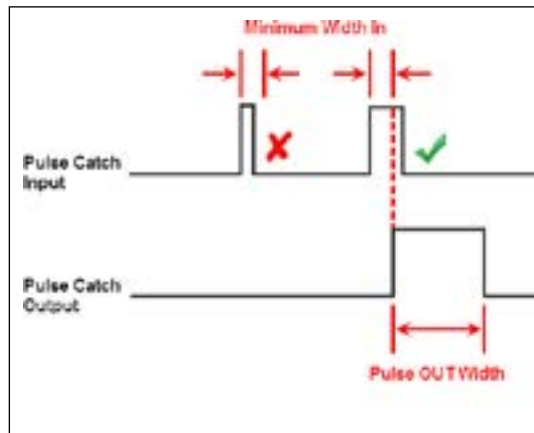
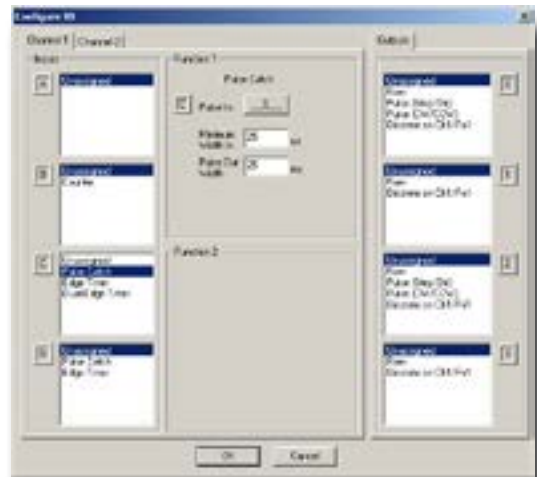


NOTE: To insure proper operation, the field device wiring and the configuration must be compatible. For wiring information see Chapter 3 "Installation and Field Wiring".

Notice that the module's four input terminals are represented by the A, B, C, and D boxes along the left side of this dialog box. If wiring an input to terminal 1C, select the **Channel 1** tab near the top of this window and click Pulse Catch in box C.

Three selections must be made in conjunction with the Pulse Catch option.

1. First, a decision must be made whether to look for the rising edge of the pulse or the falling edge of the pulse. This is a critical decision. Careful attention should be paid to the type of output the field device generates. If the signal voltage is normally low, but a short duration pulse sends the signal to the ON state, use rising edge as trigger OFF, and falling edge as trigger ON for the reverse situation.
2. The second decision is the minimum pulse width to capture. Transients below this width will not be recorded. Set this value by typing the desired value in the "Minimum Width In" field.
3. The final decision to be made is the length of pulse the CTRIO(2) module should send in response to the input pulse. Make this setting by typing in the desired value in the "Pulse Out Width" field.



Edge Timer

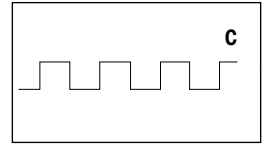
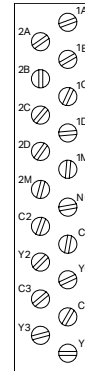


The Edge Timer measures the time between edges on an input. This function is available on inputs C and D. The CTRIO(2) discrete output(s) can be assigned to the timer function using the Preset Tables dialog box. Refer to Chapter 6 *Creating and Using the Output Preset Tables* (6-8) for details.

A scaling option is available with the Edge Timer to convert the time measured to a calculated rate, like flow or velocity.



NOTE: To insure proper operation, the field device wiring and the configuration must be compatible. For wiring information see Chapter 3 "Installation and Field Wiring".



Notice that the module's four input terminals are represented by the A, B, C, and D boxes down the left side of this dialog box. When wiring an input to terminal 1C, select the Channel 1 tab near the top of this window and click Edge Timer in box C.

At this point, four decisions must be made regarding the input at 1C.

- First, designate which edges to use. There are four options:
 - Rising edge to rising edge
 - Falling edge to falling edge
 - Rising edge to falling edge
 - Falling edge to rising edge



- The "Free Run" option is assigned by clicking in the appropriate box. If the application calls for velocity measurements to be taken at the commencement of some event, do not use Free Run. If the application calls for velocity measurement on a continuous (moving average) basis, choose Free Run.
- The "Enable Timeout" option is assigned by clicking in the appropriate box and specifying a Timeout period. Once the timer is enabled, the Timeout Bit is set if the time that it takes the CTRIO(2) to see the configured input edge exceeds the specified Timeout Period. Also, if the time before the CTRIO(2) sees the next configured edge exceeds the specified Timeout Period, the Timeout bit is set. More information about the Timeout function can be found in Chapter 6.
- The last remaining decision to be made is about scaling. Clicking the button with the tape measure symbol starts the Scaling Wizard. The Scaling Wizard is intelligent in that it offers scaling options that are appropriate for the chosen input selections. This will be discussed later in this chapter.

Dual Edge Timer

- ✓ DL
- ✓ Win
- ✓ NI

The Dual Edge Timer is designed to measure from a pulse edge on one incoming signal to a pulse edge on another incoming signal. The user selects whether to measure between rising edges, falling edges, etc. The choices are summarized in the tables below. The CTRIO(2) discrete output(s) can be assigned to the Dual Edge Timer function using the Preset Tables dialog box. Refer to *Creating and Using the Output Preset Tables* section (6-8), in Chapter 6 for details. A scaling option is available with the Dual Edge Timer to convert the time measured to a calculated rate, like flow or velocity.

Dual Edge Timer at Function 1
Rising edge of C to rising edge of D
Rising edge of C to falling edge of D
Falling edge of C to rising edge of D
Falling edge of C to falling edge of D

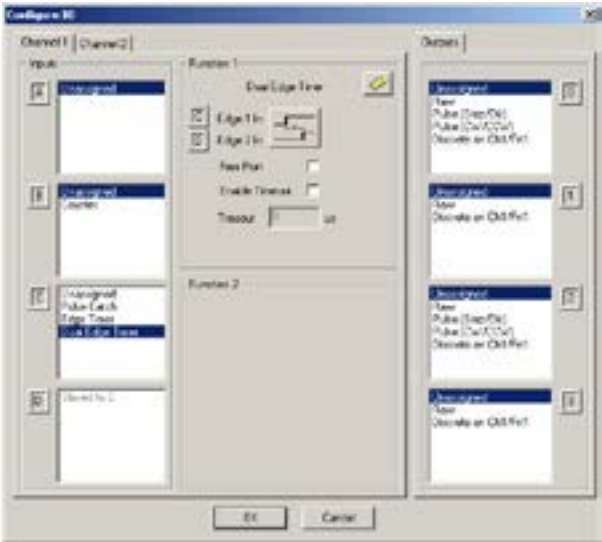


Dual Edge Timer at Function 2
Rising edge of D to rising edge of C
Rising edge of D to falling edge of C
Falling edge of D to rising edge of C
Falling edge of D to falling edge of C



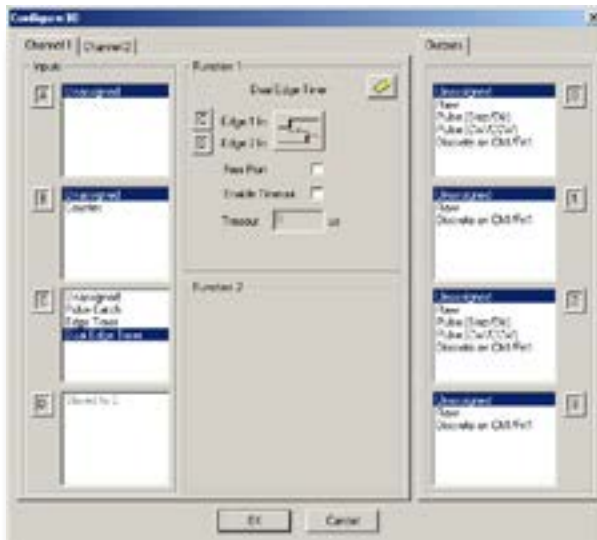
NOTE: To insure proper operation, the field device wiring and the configuration must be compatible. For wiring information see Chapter 3 "Installation and Field Wiring".

Notice the four boxes, A, B, C, and D, along the left side of this dialog panel represent input terminals on the module. If wiring inputs to terminals 1C and 1D, select the **Channel 1** tab near the top of this window and click "Dual Edge Timer" in box C or D.



At this point, four decisions must be made regarding the input at 1C or 1D.

1. First, designate the pulse edges to measure between.
2. If the application calls for velocity measurement on a continuous basis, choose Free Run. The “Free Run” option is assigned by clicking in the appropriate box. If the application calls for velocity measurements to be taken at the commencement of some event, do not use Free Run.
3. The “Enable Timeout” option is assigned by clicking in the appropriate box and specifying a Timeout period. Once the timer is enabled, the Timeout Bit is set if the time that it takes the CTRIO(2) to see the configured input edge exceeds the specified Timeout Period. Also, if the time elapsed before the CTRIO(2) sees the next configured edge exceeds the specified Timeout Period, the Timeout bit is set. More information about the Timeout function can be found in chapter 6.
4. The last remaining decision to be made is about scaling. Clicking the tape measure icon with opens the Scaling Wizard. The Scaling Wizard is intelligent in that it offers scaling options that are appropriate for selected input selections. The scaling wizard is discussed later in this chapter.



Reset FN1 and Reset FN2 (Hard Resets for Counters Only)

- ☒ DL
- ☒ Win
- ☒ NI

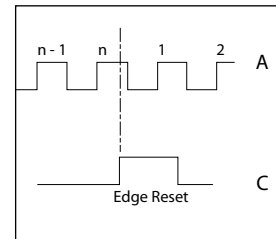
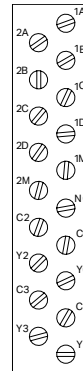
Reset FN1 is available only if a Counter or Quad Counter is selected as the primary function. For example, if either counter function is chosen on terminal 1A, (single-ended or quadrature) terminal 1C may be selected for a hard reset signal. Other options are available on terminal 1D such as Capture and Inhibit (see next page).



Reset FN2 is available if terminal 1B is chosen for a counter input. Reset FN2 will reset the counter connected to terminal 1B.

Two distinct types of hard resets are available. One is an edge reset. The other is a level reset. The **Edge Reset** sets the current count to zero on the specified edge (rising or falling) of the reset pulse (see upper example). The **Level Reset** resets the count to zero (as long as the reset pulse is held high (or low) depending on configuration. When the reset pulse disappears, the count resumes (see lower example).

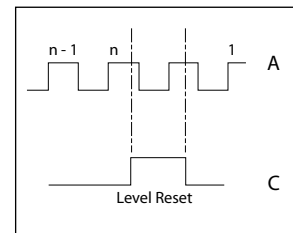
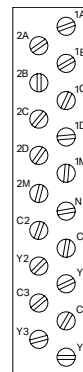
If the Reset options are not available in the **Configure I/O** dialog box, then the selected input functions do not use the reset modifier.



NOTE: Reset FN1 and Reset FN2 represent hard-wired inputs to terminal C or D. An appropriate field device must be connected to the designated terminal to perform the reset function.

Soft Resets

Soft resets are available by turning on the appropriate control bit in the control program (Counters only) or by using the **Reset Count** function within a Discrete Output Preset Table configuration (Counters/ Timers). Counter control bit resets are always level resets, meaning they hold the count at zero until the reset bit is turned off.



Capture FN1

- ☒ **DL**
- ☒ **Win**
- ☒ **NI**

Capture FN1 is available only if a Counter or Quad Counter is selected as the primary function. For example, if either counter function on terminal 1A is selected, then the option of using terminal 1D for a capture signal is presented.

Capture FN1 “snapshots” the current count into the 2nd DWord register (Parameter 2). The Capture feature is available with a single-ended Counter on input A or a Quad Counter on inputs A and B.



NOTE: Capture FN1 represents a hard-wired input to terminal D. An appropriate field device must be connected to the designated terminal to perform the capture function.

Inhibit FN1

Inhibit FN1 is available only if a Counter or Quad Counter is selected as the primary function. For example, if either counter function is chosen on terminal 1A, then an option of using terminal 1D for an inhibit signal is presented.

The Inhibit FN1 signal prevents the CTRIO(2) from counting pulses. The Inhibit feature is available with the “A” Counter or Quad Counter on each channel.



NOTE: Inhibit FN1 represents a hard-wired input to terminal D. An appropriate field device must be connected to the designated terminal to perform the inhibit function.

Limit Out

Limit Out is used for monitoring a discrete input for position feedback while homing an output.

If using a CTRIO2 module, **Trapezoid with Limits** will nearly always be a better profile option than using a Home Search profile to find the home position. Refer to **Home an Output** earlier in this manual for a comparison of the available options.

Limit Out on terminals 1C and 1D is only available if an output is configured as **Pulse**.

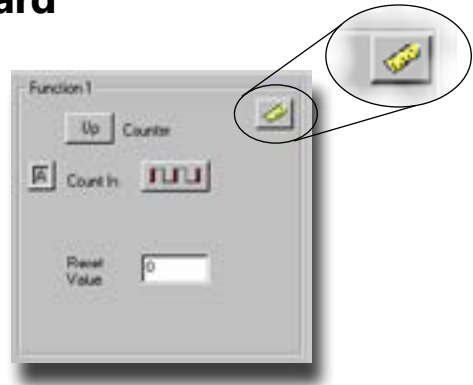
Introduction to the Scaling Wizard

- ☒ DL
- ☒ Win
- ☒ NI

Scaling raw signals to engineering units is accomplished using the Scaling Wizard. Start the Scaling Wizard by clicking the ruler button on the Configure IO dialog box. This button appears only after one of the Counter or Timer functions is selected.

The Scaling Wizard options are different for the Counter functions as compared with the Timer functions. “Position” and “Rate” scaling are available when a Counter function is selected. “Interval” scaling is available when selecting a Timing function.

The following text steps through the dialogs used for each scaling type. Substitute appropriate values to set up scaling for the application.



Scaling Wizard Examples for Counter Functions

On the Scaling Wizard select the appropriate scaling type:

- None, Position, or Rate. No scaling is accomplished if the None button is selected.
- Position scaling is appropriate for measuring distance, position, or size.
- Rate scaling is appropriate for velocity, RPM, flow, or similar rate based measurements.



Read the Notes and other information on this panel before leaving this window.



NOTE: If the input pulse rate is always slower than 5kHz, consider using Interval scaling on a Timer input instead of Rate scaling on a Counter input.

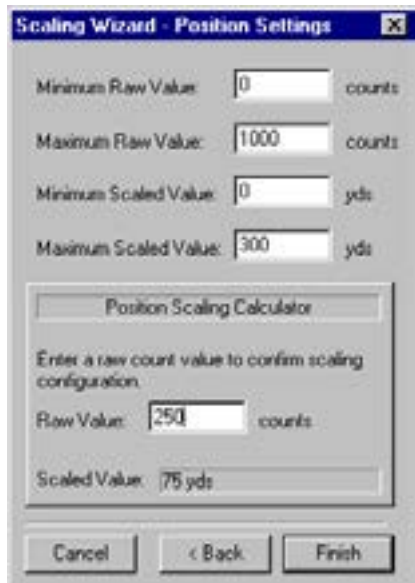
Position Scaling (Counter)

To select Position Scaling, click the radio button beside the word **Position**. Click **Next** to move to the Output Settings dialog box.

Notice on the Output Settings dialog box the field for engineering units. Enter an appropriate value for Position Scaling, for example yards, feet, meters, cubic inches, etc. Seven data types are available including BCD (to make values more easily used by *Direct*LOGIC PLCs).

Click **Next**, to open the **Scaling Wizard Position Settings** dialog box. It is here that the span of raw counts that equates to a span of engineering units is entered.

This window contains a calculator to double check the meaning of selected **Position Settings**. Enter a value into the **Raw Value** field to see the equivalent value in engineering units.



The **Scaling Wizard - Position Settings** dialog box contains the following fields and controls:

- Minimum Raw Value:** 0 counts
- Maximum Raw Value:** 1000 counts
- Minimum Scaled Value:** 0 yds
- Maximum Scaled Value:** 300 yds
- Position Scaling Calculator:**
 - Enter a raw count value to confirm scaling configuration.
 - Raw Value:** 250 counts
 - Scaled Value:** 75 yds
- Buttons: **Cancel**, **< Back**, **Finish**



The **Scaling Wizard - Output Settings** dialog box contains the following fields and controls:

- Engineering Units:** yds (up to 4 characters)
- Output Format:**
 - ☐ Floating Point
 - ☒ Integer (rounded)
 - ☐ Integer x10 (1 implied decimal place)
 - ☐ Integer x100 (2 implied decimal places)
 - ☐ BCD (rounded)
 - ☐ BCD x10 (1 implied decimal place)
 - ☐ BCD x100 (2 implied decimal places)
- Buttons: **Cancel**, **< Back**, **Next >**

Rate Scaling (Counter)

To select Rate Scaling, click the radio button beside the word Rate. Click **Next** to move to the **Scaling Wizard - Output Settings** dialog box.



On the Output Settings dialog panel, notice the field for engineering units. Enter an appropriate value for Rate Scaling, RPM, fps, flow, etc. Seven data types are available including BCD (to make values more easily used by *DirectLOGIC* PLCs).



Click **Next**, to open the **Scaling Wizard - Rate Settings** dialog box. On this panel enter the counts per unit of time and the time base. A scale offset is also provided to adjust the result by a constant amount.

This window contains a calculator to double check the Rate Settings. Enter a value into the Raw Value field to see the equivalent value in engineering units.

As an example, with a 1000 pulse/revolution encoder used to measure RPM (of the encoder shaft), enter 1000 for the **Counts/unit** and “minutes” as the Time Base. A check using the calculator (over a sample time of 1000 ms = 1 second) reveals that 5000 counts equals 300RPM.



5000 counts/1000 counts per rev = 5 revolutions;

5 revolutions/1 sec x 60 sec= 300 RPM

Data Smoothing allows rolling averages to be taken to calculate a value. Min = 1 sample, max = 25 samples in the rolling average.

Calc Interval – This tells the CTRIO how often to calculate the rate. Choose a Calc Interval larger than the slowest rate at which pulses will usually arrive.



NOTE: If the input pulse rate is always slower than 5kHz, consider using Interval scaling on a Timer input instead of Rate scaling on a Counter input.

Using the Scaling Wizard with Timer Functions

Scaling raw signals to engineering units is accomplished using the Scaling Wizard. Start the Scaling Wizard by clicking the “ruler button” (a) on the Configure IO dialog panel. This button appears only after selecting one of the Timer functions.



Interval Scaling (Timer)

To select Interval Scaling, click the radio button beside the word Interval. Now, click Next to move to the **Scaling Wizard - Output Settings** dialog box.



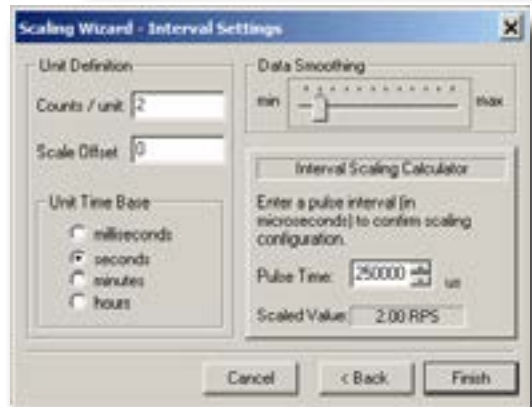
On the Output Settings dialog box notice the field for engineering units. Enter an appropriate value for Interval Scaling, RPM, fps, flow, etc. Seven data types are available including BCD (to make values more easily used by *DirectLOGIC* PLCs). Click Next, to open the **Scaling Wizard Interval Settings** dialog box.



In the counts/unit field, enter how many pulses should pass in one unit of time (in the time base of the engineering units) for the engineering units to equal 1 unit of measure. Then, select the unit time base (of the engineering units).

For example, use interval scaling to determine the revolutions per second (RPS) of a rotating object with pickups every 180°. At 1 RPS, two pulses will pass in 1s (seconds is time base of engineering units), so enter ‘2’ in counts/unit and select seconds for Unit Time Base.

To verify, enter the time between pulses in the calculator. If the device were rotating at 2 RPS, a pulse would occur every 250,000µs.



Data Smoothing - This is a slider adjustment that has 10 positions from min to max. Moving the slider toward max increases the number of samples that are averaged together. This provides a smoothing affect in the rate scale value, i.e., so that it doesn’t jump around. The positions from min to max represent 1, 2, 3, 5, 7, 10, 13, 17, 21 and 25 samples.