USER MANUAL

PR2 Programmer

Encoder Programmer and Analyzer Tool



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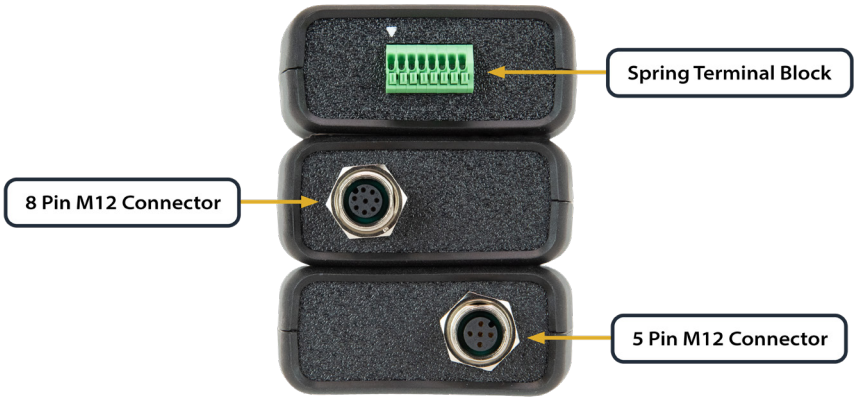
1. INTRODUCTION

The PR2 Programmer allows for quick and easy configuration of EPC encoders using the accompanying PR2 Software. The programmer also offers analysis and troubleshooting tools:

- Program the CPR to any resolution between 1-100,000
- Customizable output waveform - Choose from 40 options
- Teach index location
- Field calibration for better performance and accuracy*
- Easily restore factory configuration
- Check temperature and diagnostic data
- View device information

*This feature may not be available on all EPC products

The programmer is available with three connector options as shown below:



Explanation of Symbols

	**The IMPORTANT symbol is shown next to a section of text that describes a method for solving a particular problem or provides a useful tip for properly using the associated feature.**
	**The WARNING symbol indicates that the adjacent instructions must be observed to ensure correct use of the device and to protect the user against hazards.**

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2. WHAT'S INCLUDED

The PR2 Programmer is an accessory purchased separately for EPC programmable encoders and includes the following:

- PR2 Programmer device
- 2-meter (6 ½ feet) USB-C to USB-A adapter cable
- PR2 Software (downloadable from the EPC website)

The programmer supports the following EPC programmable encoders:

Encoder Type	Model
Programmable Wheeled Encoder	TRP Tru-TracPro™
Programmable Shafted, Thru-Bore, Hollow Bore Encoder	36RS, 36RT, 36RH

3. GETTING STARTED

3.1 PR2 Software

Before you begin, please download the accompanying PR2 Software. The software can be downloaded from the EPC website at the following link:

https://www.encoder.com/pr2-programmer

You can also scan the QR code found on the front of the programmer.

The software runs from a standalone .EXE file and does not require installation. It will run from the computer hard disk or a USB drive and does not require Administrator rights to execute. It is recommended that the software be placed in a dedicated folder since the folder will be a convenient location to save and later retrieve encoder configuration files.

Requirements:

- Windows 10 or greater
- 1GB of RAM recommended
- .NET Framework 4.6 or greater

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3.2 Device Connection

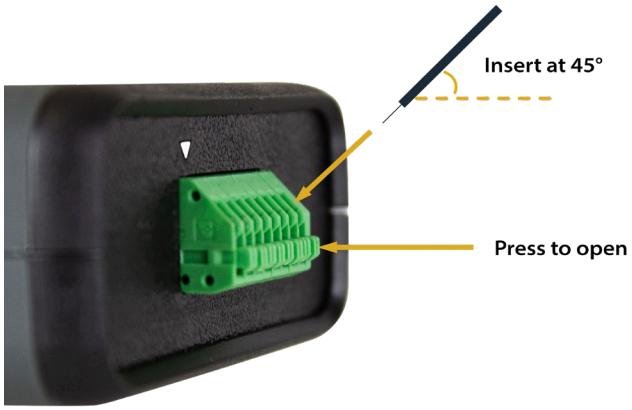
The PR2 Programmer connects to the computer using the USB-A to USB-C cable supplied with the unit. You may also use a compatible USB-A to USB-C cable or a USB-C to USB-C cable.

Warning: If supplying your own USB cable, ensure that it is capable of handling up to a 500mA supply current.

Connect the encoder to the PR2 Programmer using the connector at the bottom end of the unit. The PR2 Programmer is available with 3 different connection options as shown in Wiring Table 1.

When using the 8-pin terminal block option please refer to the Wiring Table 1 to ensure that the encoder is properly wired to prevent any damage to the encoder.

Note: When inserting the encoder wires into the spring terminal block insert at a 45 degree angle while pressing the appropriate spring tab. See picture below.



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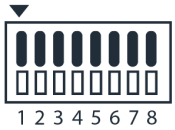
The M12 connector options can be directly connected without special wiring considerations. These connectors are configured to match the wiring of EPC's programmable encoders. M12 connector wiring is shown below in case you are using an adapter cable.

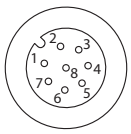
Wiring Table 1

PR2-001-T
8 Pin Spring Terminal Block



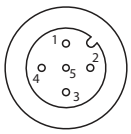
Pin	Function
1	COM
2	+VDC
3	CH. A
4	CH. B
5	CH. Z
6	n/c
7	n/c
8	SHIELD

PR2-001-K
8 Pin M12 Connector (female)



Pin	(8-Pin M12) Function
1	CH. A
2	+VDC
3	n/c
4	CH. B
5	n/c
6	CH. Z
7	COM
8	n/c

PR2-001-J
5 Pin M12 Connector (female)



Pin	(5-Pin M12) Function
1	+VDC
2	CH. B
3	COM
4	CH. A
5	CH. Z
6	n/a
7	n/a
8	n/a



Warning! When using the Spring Terminal Connector connect the wires from the encoder and then verify wiring is correct BEFORE making the PR2 Programmer USB connection to the computer to avoid potential damage to the encoder.

Also note:

- **Leave unused wires electrically unconnected during use.**
- **Do not terminate to COM, +VDC, or each other.**
- **Individually insulate each unused wire if possible.**
- **Ensure unused conductors do not come into contact with other pins, metal surfaces, or each other during PR2 use.**
- **Failure to properly isolate unused conductors may result in communication errors and/or damage.**

When the PR2 Programmer is connected to the PC for the first time, Windows will automatically load the correct driver for the USB device. The color of the LED next to the USB C connector on the PR2 indicates the status of the PR2 Programmer:

RED = Power is supplied to PR2, but Windows USB driver has not been loaded yet.

ORANGE = The Windows Driver is properly loaded and PR2 is enumerated on Windows.

GREEN = The PR2 software is running, and the computer is connected and communicating with the PR2 Programmer.

Once the PR2 Programmer is connected to the PC and an encoder is connected to the PR2, please proceed to the next section for details on how to use the PR2 Software.

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4. PR2 SOFTWARE GUIDE

The following sections describe the functions and features of the PR2 Software and how they can be used.

4.1 Device Connection

When launched the PR2 Software main screen will appear as shown in Figure 1 below and it will begin scanning for a connected PR2 Programmer.

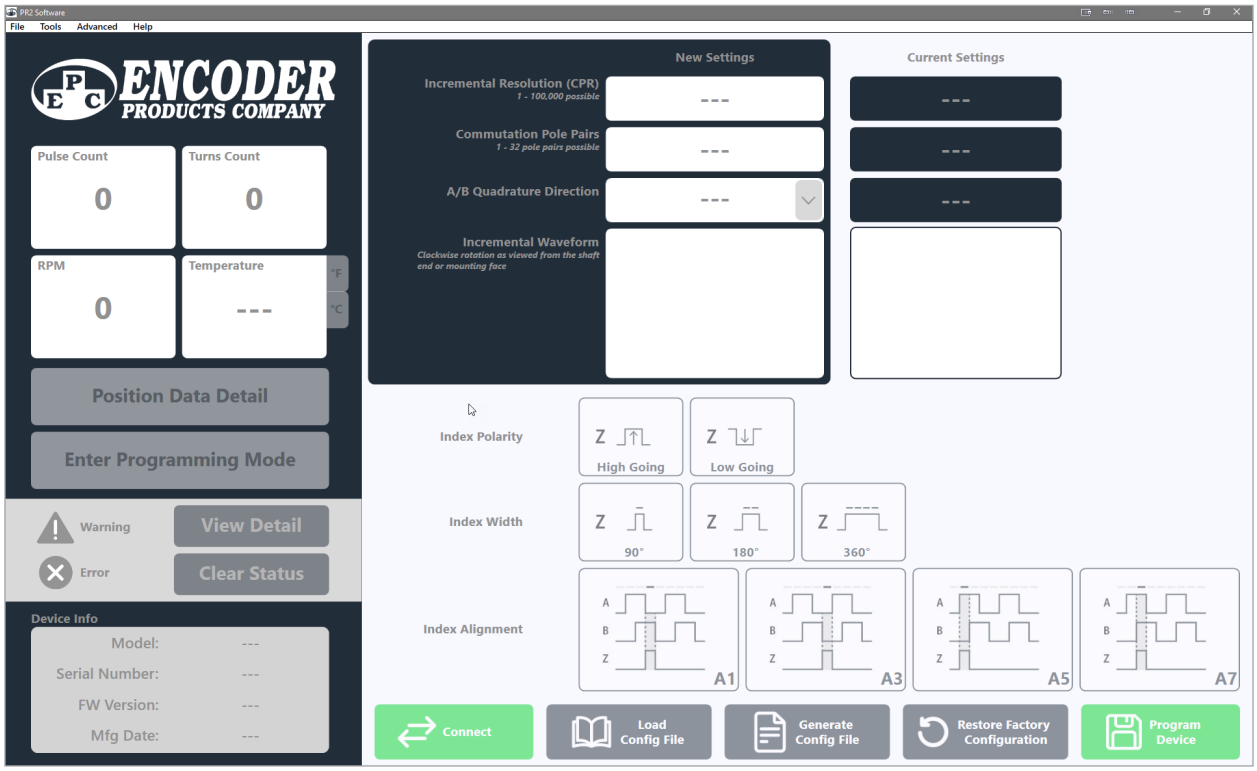

Figure 1: Software Start with No Hardware Connected

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If a PR2 Programmer is detected the **Connect** button will become selectable. See Figure 2.

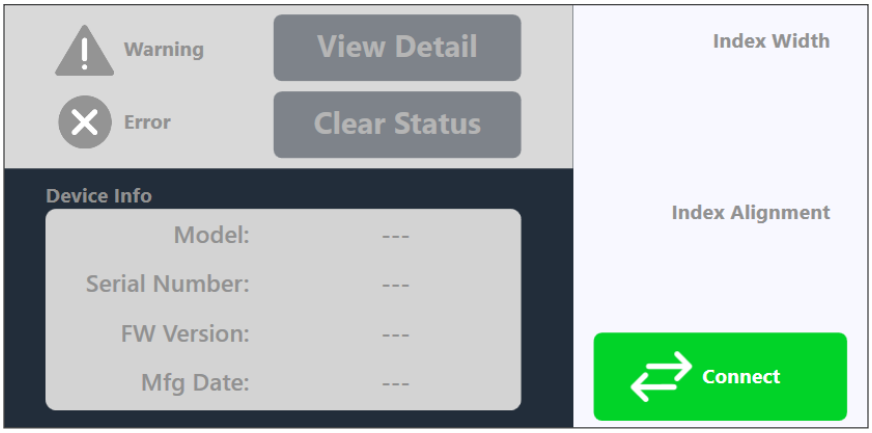

Figure 2: PR2 Detected, Encoder Not Yet Detected

The software will then check if an encoder is connected. If a supported encoder is connected, the software will automatically connect to the encoder. In this case it is not necessary to click the **Connect** button.

If an encoder is not connected, a connection error window will appear. See Figure 3.

Press **Ok**, ensure the encoder is properly connected, and then click on the **Connect** button.

Note: Allow sufficient time for the PR2 to connect to the encoder. Normal connection time is between 7 to 10 seconds. If an encoder is not found the PR2 will retry 3 times before giving the error message.

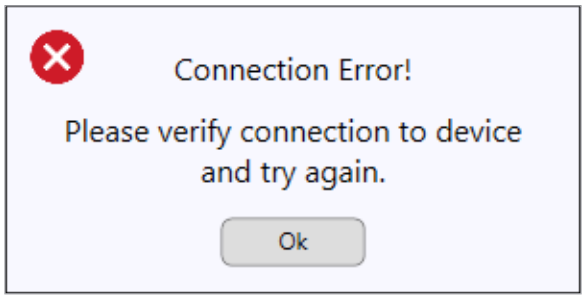

Figure 3: Connection Error Window

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Once the encoder is connected, the PR2 Software main screen will appear as shown in Figure 4. The **Connect** button will change to **Disconnect** as soon as the encoder is connected.

The software will display the Analyzer Information on the left side of screen. Device Information is at the bottom left and Current Settings are on the top right. The area under the **Current Settings** will be populated with current encoder configuration.

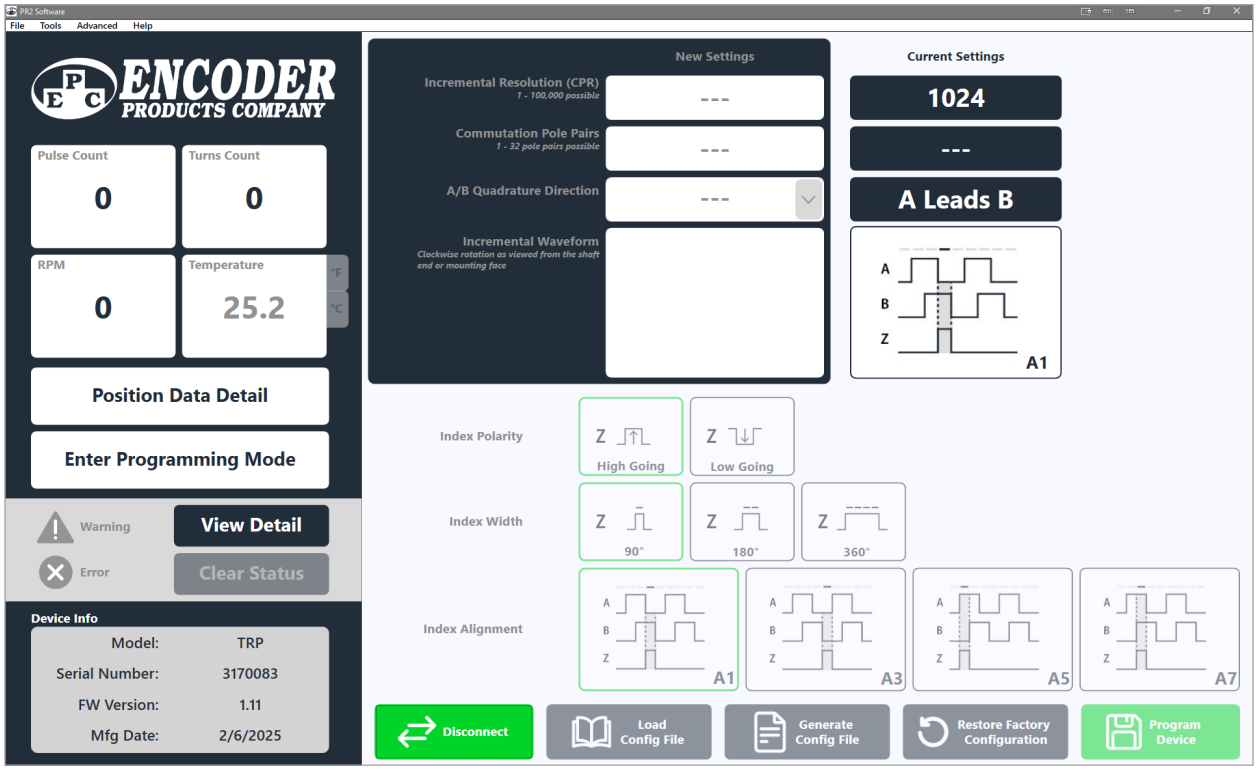

Figure 4: Encoder Connected, Analyzer Mode Enabled, and Device Information Populated

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4.2 Analyzer

The analyzer portion of the software includes the following sections starting from top to bottom:

- Count (Pulse & Turns)
- Speed (RPM)
- Temperature (°F & °C – Selectable when in Programming Mode)
- Tools Buttons (Position Detail & Programming Mode)
- Status section (Warnings & Errors)
- Device Information (Model, Serial Number, Firmware Version, Manufacturing Date)

The Count/Speed/Temperature section displays incremental count (pulse count and turns count), speed (rpm), and temperature (selectable °C or °F). See Section 4.2.1 for additional information.

Note: Internal temperature of the encoder is read once during initial connection and then only updated while in programming mode.

The tools button section includes buttons to display additional position information as well as a button to switch between Analyzer and Programming modes. See Section 4.2.2 for additional information.

The status section displays images for active warnings and errors as well as buttons to open a window for more detailed status information or clearing the status flags.

Note: Status is read once during initial connection and then only updated while in programming mode. The Warning indicator will turn **YELLOW**, and the Error indicator will turn **RED** if there are any active warning/error flags set.

View Detail button may be clicked to view additional status information. This button can be selected while in Analyzer mode or Programming mode. However, if selected while in analyzer mode it will temporarily switch to program mode and then return to analyzer mode when detail window is closed. See Section 4.2.3 for additional information.

The **Device Info** section displays device information such as Model, Serial Number, Firmware Version, and Manufacturing Date of the connected encoder. See section 4.2.4 for additional information.

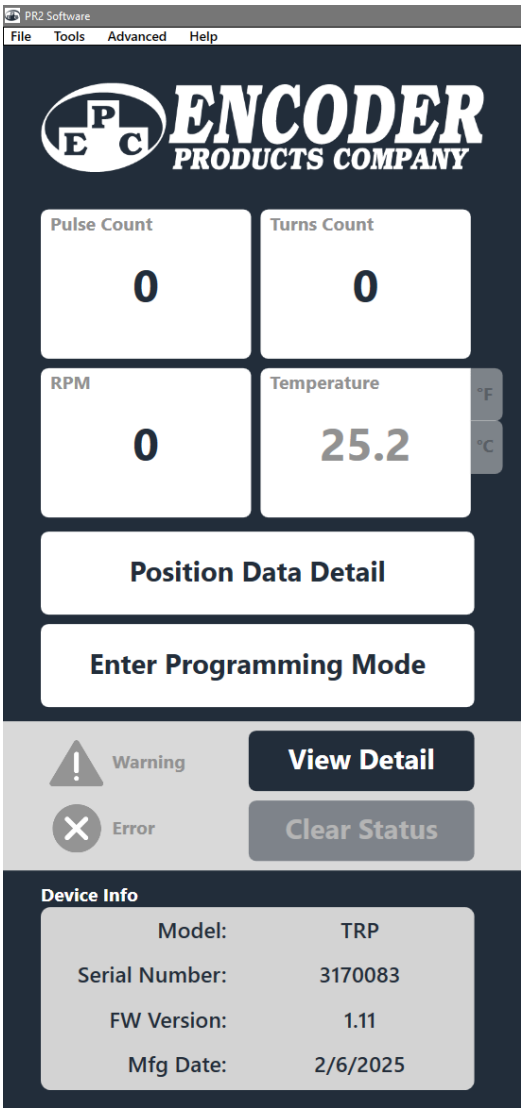

Figure 5: Analyzer Mode

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4.2.1 Pulse Count, Turns Count, RPM

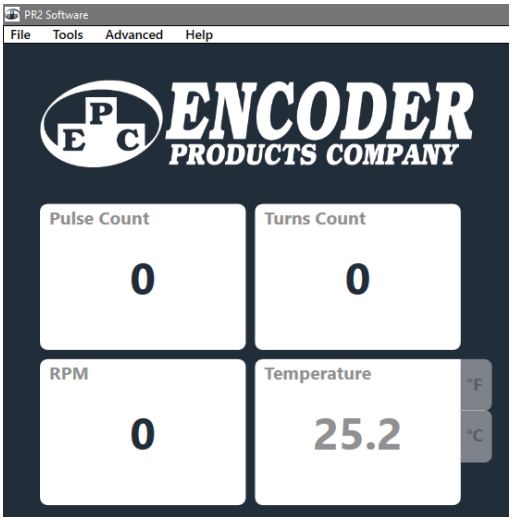

Figure 6: Pulse Count, Turns Count, RPM, and Temperature

Pulse Count displays the current incremental count, per revolution, of the connected encoder.

Incrementing values indicate forward direction with respect to quadrature direction setting.

e.g. Quadrature Direction set to **A Leads B**, clockwise rotation when looking at the encoder mounting face or shaft. See photos below.

Decrementing values indicate reverse direction with respect to quadrature direction setting.

e.g. Quadrature Direction set to **A Leads B**, counterclockwise rotation when looking at the encoder mounting face or shaft.

Values will be shown as negative if the **Turns Count** has been decremented to a value less than zero.

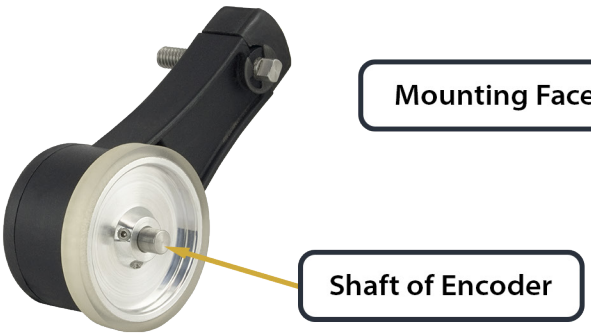

Photo 1: TRP and Encoder Shaft

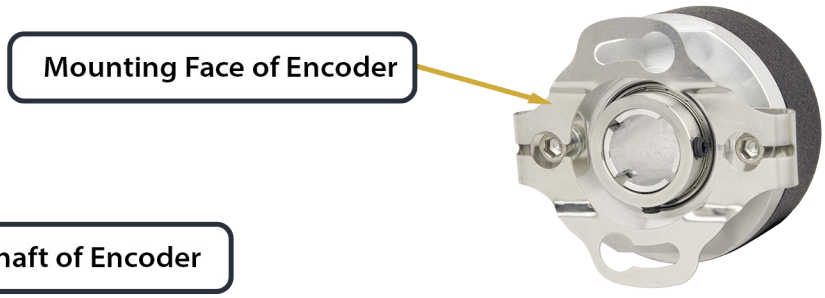

Photo 2: 36RT Mouning Face

An encoder with a single channel (A only) will always increment positively, regardless of direction.

Turns Count displays the current number of times the encoder has made a full revolution. An incrementing positive value indicates it is rotating in the forward direction. A decrementing value indicates it is rotating in the reverse direction. A negative value indicates it has rotated in the reverse direction beyond the value of 0.

RPM displays the current estimated speed of the encoder in revolutions per minute. Reported RPM is directional and is dependent on rotation and quadrature direction setting.

Accuracy of this measurement may be impacted by high speed or high CPR units.

Temperature is disabled while in Analyzer Mode. However, the temperature displayed is the initial or last read internal junction temperature of the encoder IC. See section 4.3 for additional information.

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4.2.2 Tools Buttons

The **Position Data Detail** button will open a window that displays additional position information such as resolution, count, and angular position of the currently connected encoder. See section 4.4 Additional Tools/Features for more information.

The **Enter Programming Mode** button switches the encoder to Programming Mode where it can be reconfigured.

Note: Analyzer Mode functions (i.e. counts and RPM) cannot be used while in Programming Mode.



Figure 7: Analyze Mode Tool Buttons Section

4.2.3 Status Section

The status section is disabled while in Analyzer Mode. However, the status is read once during initial connection and will activate Warning and Error flags in case of any active warning/error.

The **Warning** indicator is grey when no warnings are present and YELLOW when there is an active warning flag. The **Error** indicator is GREY when there is no error present and RED when there is an active error.

Clicking the **View Detail** button will open the Diagnostic Window that provides additional information about the Warnings and Errors. This button is active while in Analyzer Mode or Programming Mode. However, if pressed while in Analyzer Mode the software will temporarily switch to Programming Mode to allow updated reads of the status and return to Analyzer Mode upon closing the Diagnostic Window. See section 4.4 Additional Tools/Features for additional information.

The **Clear Status** button is disabled while in Analyzer Mode.

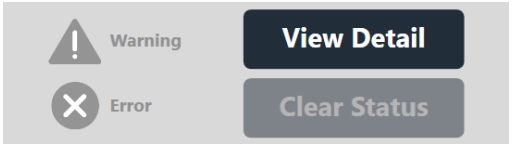

Figure 8: Status Section

4.2.4 Device Info

This section provides information about the connected encoder. Model, Serial Number, Firmware (FW) Version, and Manufacture (Mfg.) Date are read from the encoder registers and displayed here to verify the connected device.

When the mouse cursor is hovered over the model number (TRP in this example) a tool tip appears that will display the entire factory order guide code.

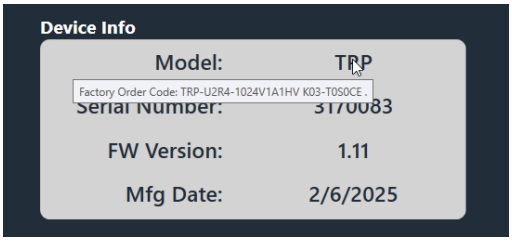

Figure 9: Device Info Section

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4.3 Programmer

Clicking the **Enter Programming Mode** button will switch the software to programming mode by activating the **New Settings** in the center of the screen. This will enable or disable certain functions of the Analyzer Mode. See Figure 10.

The **Enter Programming Mode** button will change to **Exit Programming Mode** while in Programming Mode and can be used to exit Programming Mode and return to Analyzer Mode.

While in **Programming Mode** the encoder status, including temperature, will be polled and updated regularly. The internal device IC temperature display will be shown in Celsius by default but can be changed to Fahrenheit by pressing the **°F** tab next to the temperature display.

> **Note: The temperature reported is the junction temperature of the sensor IC. The junction temperature will be higher than the encoder temperature but can be an indicator for conditions generating excessive heat. The acceptable junction temperature is between -40°C to +140°C.**

The programming portion of the software includes the following sections starting from top to bottom, left to right:

- New Settings
- Current Settings
- Waveform Selection
- Tools Buttons

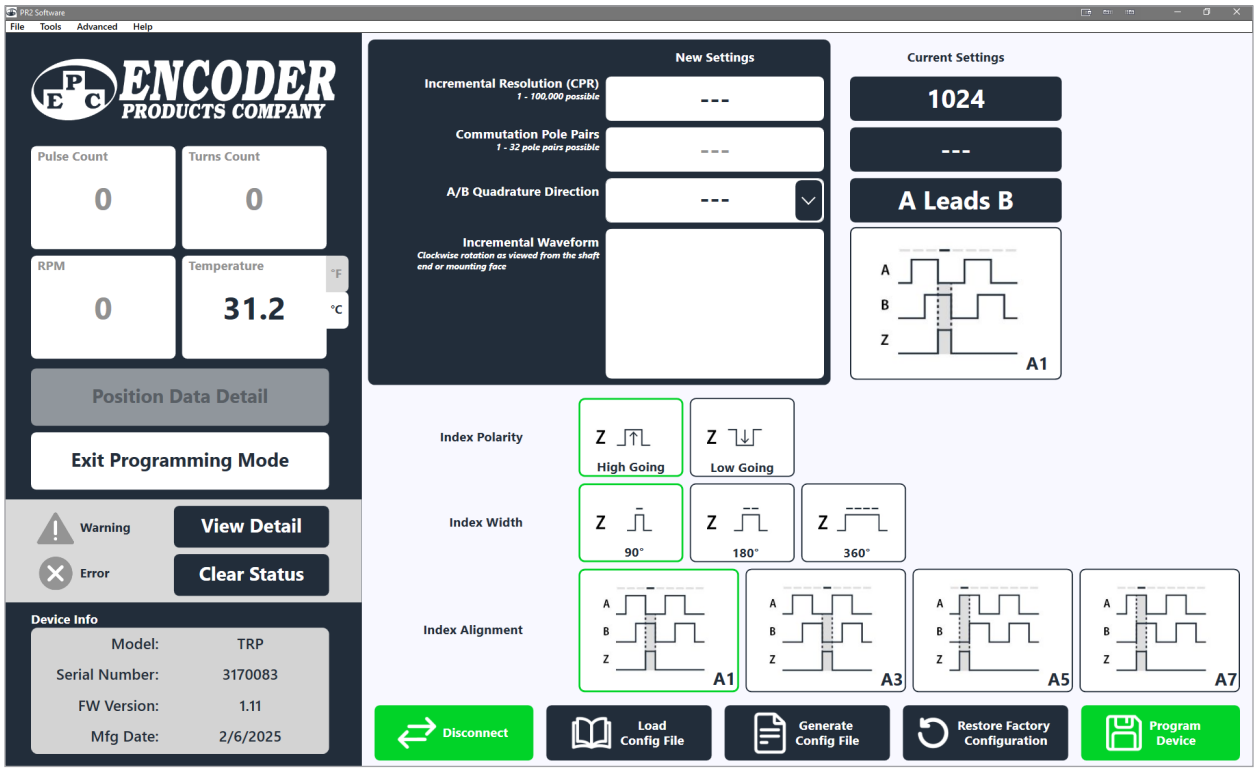

Figure 10: Programming Mode Enabled

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4.3.1 New Settings

This area is used to enter the desired **Incremental Resolution**, **Commutation Pole Pairs** (if applicable), and select **A/B Quadrature Direction**. This area will also display an image of the desired new waveform after it has been selected. See Figure 11.

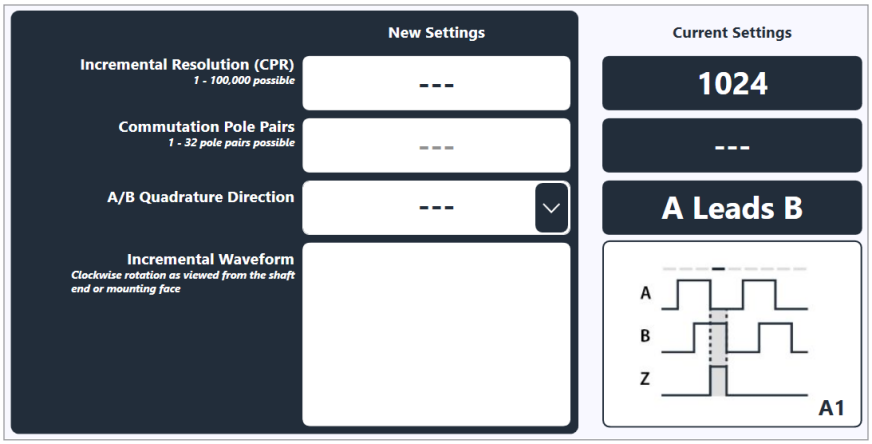

Figure 11: New and Current Settings

The **Incremental Resolution** field is used to enter the desired new resolution, in cycles per revolution (CPR). The value entered must be a whole number ranging from 1 – 100,000.

The **Commutation Pole Pairs** field is used to enter the desired number of pole pairs for commutation signal output, when applicable to the connected encoder. The value entered must be a whole number ranging from 1 – 32. This field will be unavailable if commutation cannot be selected on the connected encoder.

The **A/B Quadrature Direction** is selectable from a dropdown when applicable to the connected encoder. A/B Quadrature Direction selection options are A Leads B or B Leads A. Quadrature direction is determined in clockwise rotation as viewed from the shaft end or mounting face of the encoder device. See Photos 1 & 2 for reference.

Note: Making changes to this selection will automatically update the Index Alignment options to select from.

4.3.2 Current Settings

The Current Settings area displays the current settings for the connected encoder: **Incremental Resolution**, **Commutation Pole Pairs**, **A/B Quadrature Direction**, and **Incremental Waveform**. See Figure 11.

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4.3.3 Waveform Selection

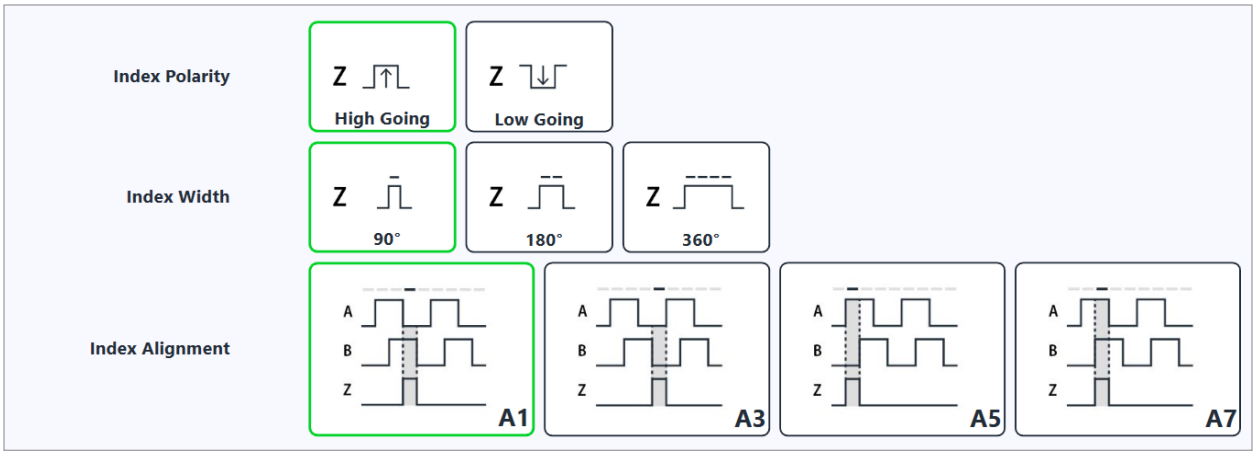

Figure 12: Waveform Selection

The **Waveform Selection** section contains 3 subsections for selecting the desired **Index Polarity**, **Index Width**, and **Index Alignment**. The options listed in Index Alignment are dependent on A/B Quadrature Direction, Index Polarity, and Index Width that are selected. Currently selected options are surrounded by a green border. See Figure 12.

Index Polarity can be selected to be High Going (Z pulse high) or Low Going (Z pulse low).

Index Width can be selected to be 90° Degrees, 180° Degrees, or 360° Degrees with respect to A/B channels.

The **Index Alignment** will display up to four available options to choose from depending on selection of A/B Quadrature Direction, Index Polarity, and Index Width.

Any combination that includes an Index Width of 90° Degrees or 180° Degrees will provide four options.

Any combination that includes an Index Width of 360° Degrees will provide two options.

Selecting the Index Alignment will determine the waveform code desired to program the encoder to.

Note: The encoder is only programmed to these new settings after clicking the **Program Device** button. A Programming Successful! confirmation will be given after it is programmed.

Note: An **Index Alignment** must be selected, as shown with a green border, before clicking **Program Device**.

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4.3.4 Tools Buttons

The Tools Buttons section includes buttons for Connect/Disconnect, Load Config File, Generate Config File, Restore Factory Configuration, and Program Device. See Figure 13.

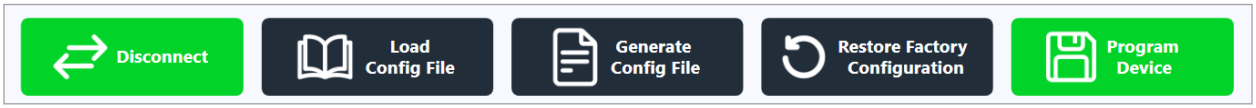

Figure 13: Tools Buttons

The **Connect/Disconnect** button will be available after the PR2 Programmer is connected and can be used to Connect/Disconnect the programmable encoder from the PR2 Programmer.

Warning! Always press the Disconnect button to safely remove power from the encoder prior to physically disconnecting the encoder from the PR2 Programmer. This will prevent potential damage to the encoder.

Load Config File is used to load a previously saved file that will update all programmable settings based on the file loaded. Note: **Generate Config File** or **Save Configuration File** must be performed first before attempting to load a configuration file. This feature is also available by selecting **File** and then **Load Configuration File** from the top menu bar. If configurations have been saved during the current application session, select **File** and then **Load Recent Configuration** from the top menu bar.

Once a Config File is loaded, the New Settings fields will be populated to match the configuration from the file loaded. To program these settings, confirm the New Settings fields are as intended and click the **Program Device** button.

Generate Config File allows you to save the configuration currently shown in Current Settings as an XML file that can be loaded later. Clicking the Generate Config File button will display a Windows file dialogue. Use the dialogue prompt to select the desired location and name of file to be saved. This feature is also available by selecting **File** and then **Save Configuration File** from the top menu bar.

Restore Factory Configuration is used to restore the connected encoder back to all factory settings. A warning dialogue will appear to show the original factory settings. Click **Restore Configuration** to confirm or **Cancel** to abort. See Figure 14.

Warning! Using this feature will restore all factory settings including CPR, Commutation Pole Pairs (if applicable), A/B Quadrature Direction, Incremental Waveform, all Calibration Settings, and index position will return to zero. Any previous changes to customizable settings will be lost.

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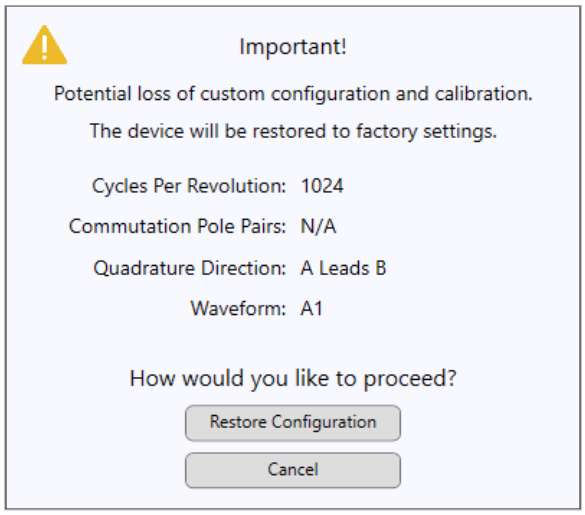

Figure 14: Restore Factory Configuration Warning

Program Device button is used to program the connected encoder with all the new settings and the selected Incremental Waveform. When programming is successful the **Current Settings** section will be updated with the newly programmed values and a Programming Successful! dialogue will appear. If an invalid configuration (eg. Index Alignment not selected) is attempted a Programming Error! window will appear. Click Ok, make appropriate selections, and try again.

If the **Exit Programming Mode** button is clicked it will switch the software to Analyzer Mode to allow the user to verify counts. Pressing the **Continue Programming** button will cause the software to remain in programming mode. See Figure 15.

Note: If CPR has been changed the counter will reset to zero.

If programming is not successful, a Programming Error! Dialogue will appear. Press Ok and try again.

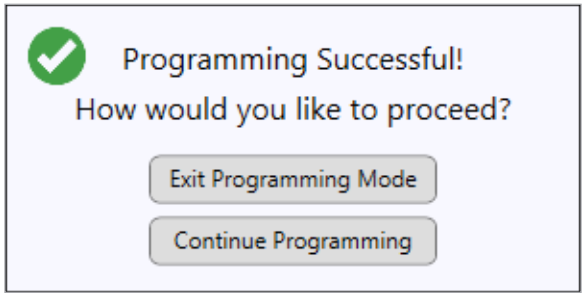

Figure 15: Programming Successful Dialogue

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4.4 Additional Tools/Features

The PR2 Software has additional features for viewing encoder information and optimizing encoder performance. The **Tools** menu drop down includes **Position Data Detail**, **Diagnostic Detail**, **Calculator**, and **Generate Report**. The Advanced menu drop down includes **Calibration**,**Teach Index**, and **Commutation Settings**.

4.4.1 Position Data Detail

Position Data Detail is a window that displays encoder resolution, count, and angular position. Count/Position is displayed using a radial gauge or optional graph. See Figure 16 and Figure 17.



Figure 16: Position Data Detail w/ Radial Gauge

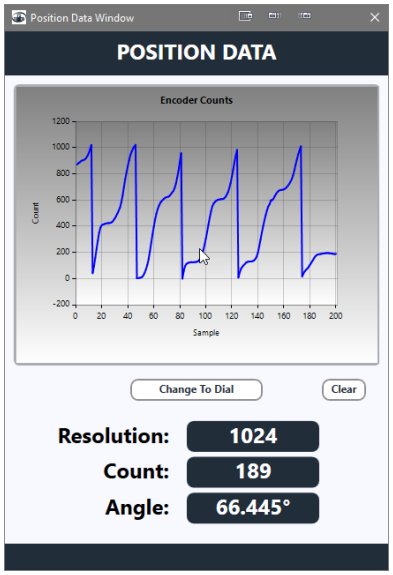

Figure 17: Position Data Detail w/Graph

Click the **Change to Graph** button to display the graph. This feature is only available while in Analyzer Mode and can be displayed using the **Position Data Detail** button or by selecting **Tools** and then **Position Data Window** in the top menu bar. If the connected encoder has an index, up to one full rotation may be required to synchronize the zero position of the encoder with the radial gauge.

The graph also has zoom capability. It is possible to zoom into an area of the graph by a left click and hold of mouse and drag cursor around the area to zoom in. To zoom out or return to a full graph double click any area of the graph.

Note: While this window is open the main screen will be disabled. You must close this window before resuming use of software. If window is hidden, check taskbar.

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4.4.2 Diagnostic Detail

Diagnostic Detail displays additional information about warnings and error flags.

- GREY Warning/Error icons indicate the warning/error is NOT active
- YELLOW warning icons indicates an active warning
- RED warning icons indicate an active error

The **Clear Status** button can be used to clear all active warnings/errors. The **Generate Report** button can be used to generate a compressed file that contains screen shots of software windows and device files used for troubleshooting. See Figure 18.

The **Diagnostic Window** can be displayed by clicking **View Detail** in the analyzer section or by selecting **Tools** then **Diagnostic** in the top menu bar.

Note: While this window is open the main screen will be disabled. You must close this window before resuming use of software. If window is hidden, check taskbar.

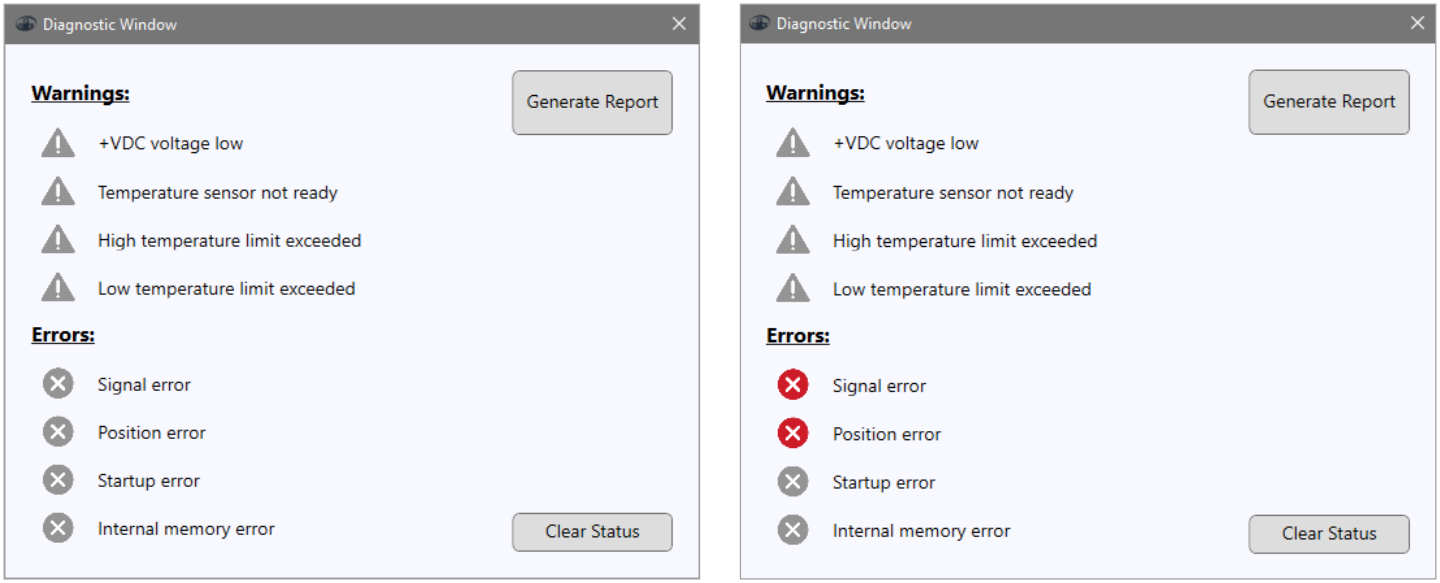

Figure 18: Diagnostic Detail

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4.4.3 Encoder Calculator

Calculator may be selected from **Tools** then **Calculator** in the top menu bar. This calculator tool contains three separate calculators that are specific to encoder related parameters and can be used for determining the desired values for optimal system performance or encoder operation.

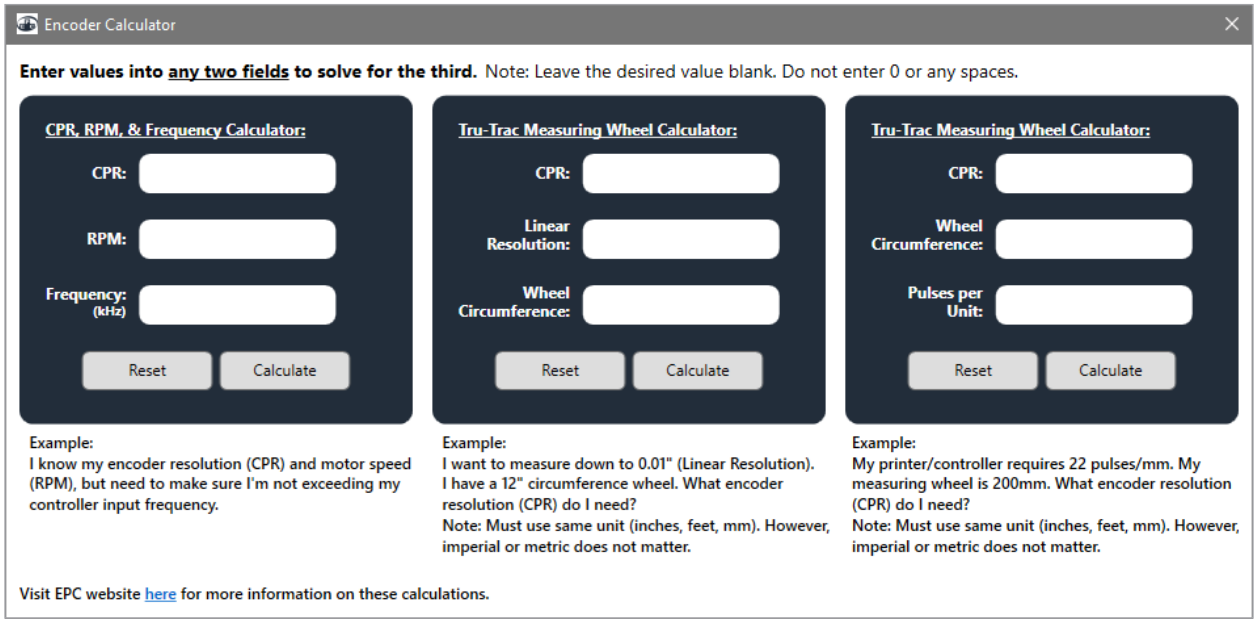

Figure 19: Encoder Calculator

Note: For each calculator, enter only two parameters at a time to determine the third parameter. After clicking the **Calculate** button, the calculator will need to be reset, by clicking the **Reset** button, to use again. See Figure 19.

4.4.4 Generate Report

The **Generate Report** tool may be used to generate a file necessary for troubleshooting the encoder or software in case of undesired operation. This feature is typically reserved for situations that require technical assistance from Encoder Products Company.

This feature is available by selecting from **Tools** then **Generate Report** in the top menu bar or by pressing **Generate Report** button within the Diagnostic Window.

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4.4.5 Calibration

Calibration may be selected from **Advanced** then **Calibration** in the top menu bar. Although factory calibration is performed at the time of manufacture, field calibration may be useful in some installations to improve encoder performance after being installed.

Performing calibration requires that the encoder is rotating at a constant velocity and must meet minimum RPM requirements of the desired calibration type. Upon opening the **Calibration Window**, the default calibration type is **Run All**. The software will automatically begin monitoring the rpm to determine if the minimum rpm requirement has been met, as indicated by Wait… under the progress bar. See Figure 20.

Note: The calibration feature is not available for the TRP encoder

Note: While this window is open the main screen will be disabled. You must close this window before resuming use of software. If window is hidden, check taskbar.

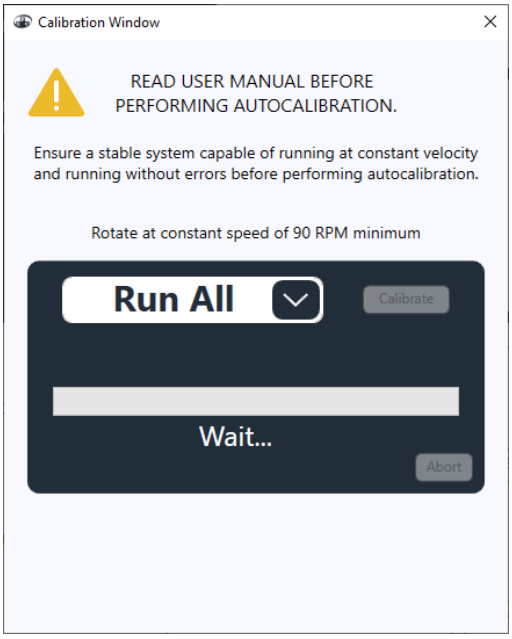

Figure 20: Calibration Wait Status

Note: Maintaining constant velocity during calibration is of utmost importance. If constant velocity cannot be maintained, calibration may degrade encoder performance. If this happens, either re-calibrate when constant velocity can be achieved or restore factory defaults to return to original factory calibration.

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The dropdown menu can be used to select the desired calibration type. See Figure 21. The Calibration types and minimum RPM are listed below:

Run All – Runs all three calibration types: Analog, Digital, and Eccentricity. 90 RPM, minimum.

Analog – Optimizes analog signal quality from encoder IC. Typically used to compensate for temperature. 75 RPM, minimum.

Digital – Optimizes digital signal quality from encoder IC. Typically used to compensate for mechanical misalignment within the encoder optical system. 90 RPM, minimum.

Eccentricity – Adjusts for position error over a full revolution. Typically used to compensate for disk run-out but it may also be beneficial to compensate for system runout. 30 RPM minimum.

The time required to complete calibration depends on the speed of the rotation. Higher RPM will result in a faster calibration. Due to the amount of sampling required for eccentricity compensation, Eccentricity Calibration may take significantly longer to complete than analog and digital calibration.

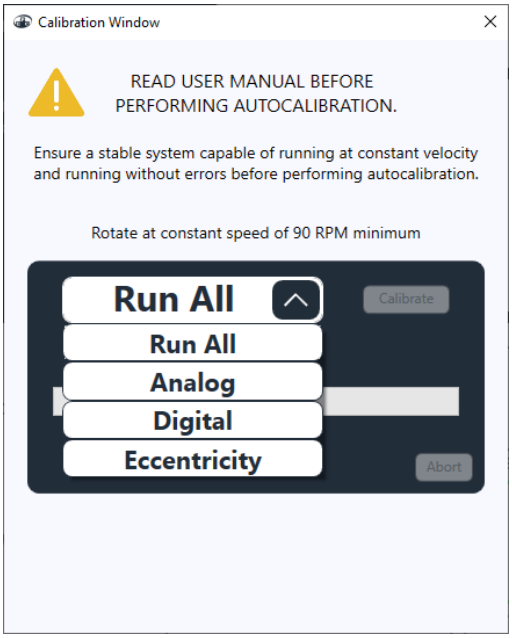

Figure 21: Calibration Dropdown Menu

When minimum RPM requirements have been met for the desired calibration type the status will change to **Ready!** And the **Calibrate** button will turn green. Click **Calibrate** to begin. See Figure 22.

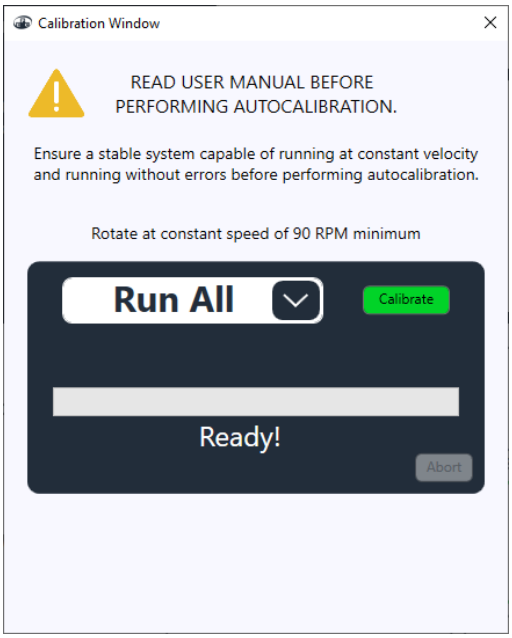

Figure 22: Calibration Ready Status

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After selecting calibration type and pressing Calibrate button the status will change to **Running** and progress bar will display current progress of the task. See Figure 23.

During calibration the abort button may be pressed to abort calibration. Calibration values will not be written to the encoder, and all progress will be eliminated. Please allow sufficient time for the software to abort the calibration process.

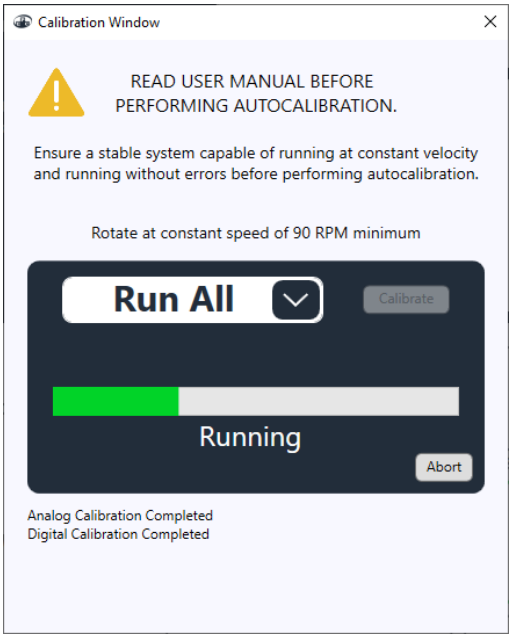

Figure 23: Calibration Running Status

After calibration is complete the status will change to **Complete!** And completed calibrations will be logged in the bottom left of the window. See Figure 24.

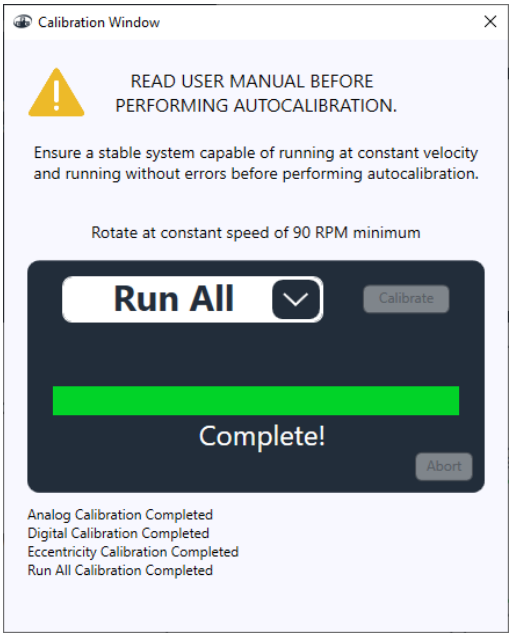

Figure 24: Calibration Complete Status

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4.4.6 Teach Index

Teach Index may be selected from **Advanced** then **Teach Index** in the top menu bar. This feature allows for the index to be reprogrammed to the current encoder position. Before attempting to teach index ensure the encoder is in the exact position desired for the new index position and free from any rotation/motion.

After selecting **Teach Index** from the **Advanced** menu option a warning dialog will appear to notify that the current position will be set to zero. Click **Teach Index** button to confirm or **Cancel** button to abort. See Figure 25.

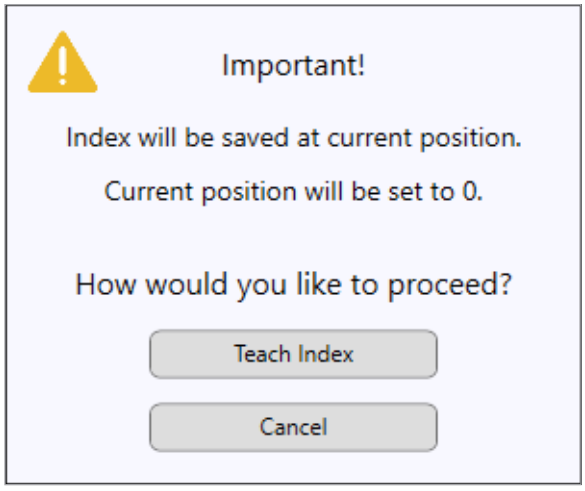

Figure 25: Teach Index Warning

After successfully completing **Teach Index** a confirmation dialog will appear. Click **Ok** to continue. See Fig 26.

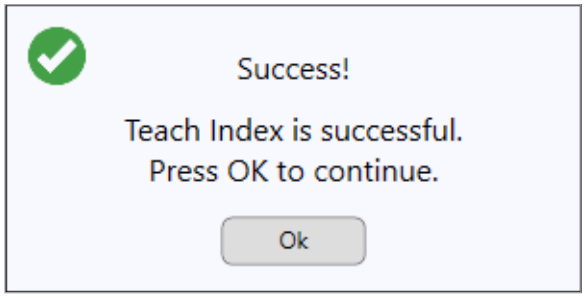

Figure 26: Teach Index Success

If **Teach Index** is not successful, an error message will appear. Click **Ok** and try again.

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4.4.7 Commutation Settings

While in programming mode **Commutation Settings** may be selected from **Advanced** then **Commutation Settings** from the top menu bar.

This feature allows for changing commutation signal direction and polarity. Devices ordered with commutation will be factory configured to have normal direction (UVW) and standard polarity (active high). The commutation settings window provides the option of programming the device to have commutation signals with reversed direction (WVU) or inverted polarity (active low).

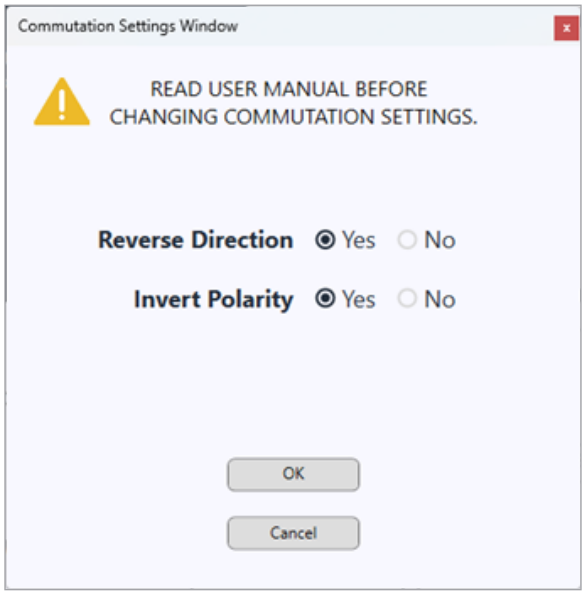

Figure 27: Commutation Settings Window

Clicking **OK** accepts the settings and automatically programs the selections into the device. Clicking Cancel closes the **Commutation Settings Window** with no changes made to the device.

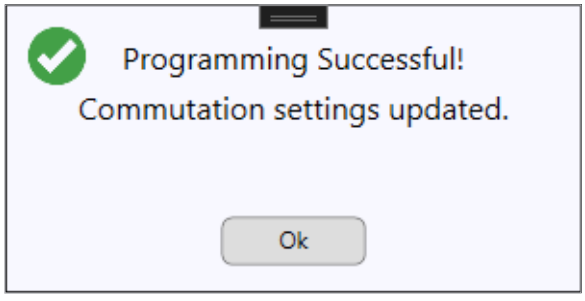

Figure 27: Commutation Settings Confirmation

Clicking **OK** closes both the confirmation window and the **Commutation Settings Window**.

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5. TECHNICAL SPECIFICATIONS

Connectors		
Computer Side	USB-A	Compatible with USB 2.0 and higher
Note: Supplied with 2-meter USB-A to USB-C cable. USB-A port required unless an appropriate USB-C to USB-C cable is supplied.		
Encoder Side	8-Pin Spring Terminal	See wiring diagrams below
	8-Pin M12	
	5-Pin M12	

Electrical Specifications		
USB Input Current	Capable of drawing up to 500mA (< 200mA typical)	
Encoder Voltage Supplied	5-9 VDC, variable Controlled and supplied by PR2 ⚠ **Do not connect 5V-only encoders !!**	
Encoder Current Supplied	See encoder datasheet Can meet demands of all compatible EPC encoders	
Encoder Signals Accepted	Incremental A, B, and Z channels	
Encoder Output Type Accepted	All EPC output types supported	
Max A/B Input Frequency	HV / PP Output	1 MHz
	PU Output	75 kHz
	OC Output	100 kHz

Mechanical Specifications	
Enclosure Material	ABS with soft plastic overmold

Environmental Specifications	
Rated Temperature	0°C - 70°C
EMC / CE Standards	EN 55032:2015 A11:2020 A1 2020

Software	
OS Requirements	Windows 10 or greater .NET Framework 4.6 or greater
Memory	≥ 1GB of RAM recommended

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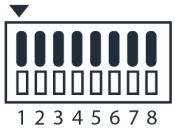
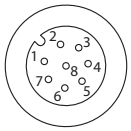
Wiring Table 1

PR2-001-T
8 Pin Spring Terminal Block



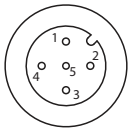
Pin	Function
1	COM
2	+VDC
3	CH. A
4	CH. B
5	CH. Z
6	n/c
7	n/c
8	SHIELD

PR2-001-K
8 Pin M12 Connector (female)



Pin	(8-Pin M12) Function
1	CH. A
2	+VDC
3	n/c
4	CH. B
5	n/c
6	CH. Z
7	COM
8	n/c

PR2-001-J
5 Pin M12 Connector (female)



Pin	(5-Pin M12) Function
1	+VDC
2	CH. B
3	COM
4	CH. A
5	CH. Z
6	n/a
7	n/a
8	n/a



Warning! When using the Spring Terminal Connector connect the wires from the encoder and then verify wiring is correct BEFORE making the PR2 Programmer USB connection to the computer to avoid potential damage to the encoder.

Also note:

- **Leave unused wires electrically unconnected during use.**
- **Do not terminate to COM, +VDC, or each other.**
- **Individually insulate each unused wire if possible.**
- **Ensure unused conductors do not come into contact with other pins, metal surfaces, or each other during PR2 use.**
- **Failure to properly isolate unused conductors may result in communication errors and/or damage.**

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