

endura^{PRO}™



Getting Started Guide

What do I need?

How do I run it?

How do I apply it?

How do I integrate it into my system?

General Specifications.

How do I integrate it into my manufacturing?

How to test and choose operating outputs

How to Program

How to Publish program for Production use.

Software

- ECM Toolbox (Elitelink)
- ECM License file (ECM engineering)

Hardware

- Programming kit (Elitelink)
- EnduraPro Programming Cable (Elitelink)

Help (Elitelink)

- Getting started
- EnduraPro Controller
- Programming tutorial
- Temperature rise spreadsheet
- Label editor quick reference
- 45 second off delay option
- Barcode field size

Motor and Programming Kit

The EnduraPro motor is a permanent magnet, three phase, brushless DC motor. A single phase drive is attached to the motor to control it for air over direct drive indoor blower applications. It is designed to operate in constant torque mode with up to five discrete tap settings for OEM applications. The EnduraPro is available in either a 115V or 208V-230V model in one of 4 horsepower ratings: $\frac{1}{3}$, $\frac{1}{2}$, $\frac{3}{4}$ and 1 HP.

In order to program the discrete tap settings, you will need a copy of the “*ECM Toolbox Software*”, a customer license file and an ECM programming interface module and EnduraPro specific cables.

ECM Programming
“Serial Box”
8794702AEG1

EnduraPro
Lab Programming/Dev Cable
8794707LC



EnduraPro Motor

Programming Interface & Cables

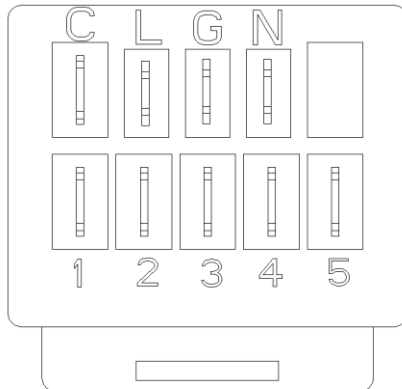


How do I run it?

Power Connection: Line 1 to L, Ground to G, Line 2 (for 208V-230V units) or Neutral (for 115V units) to N

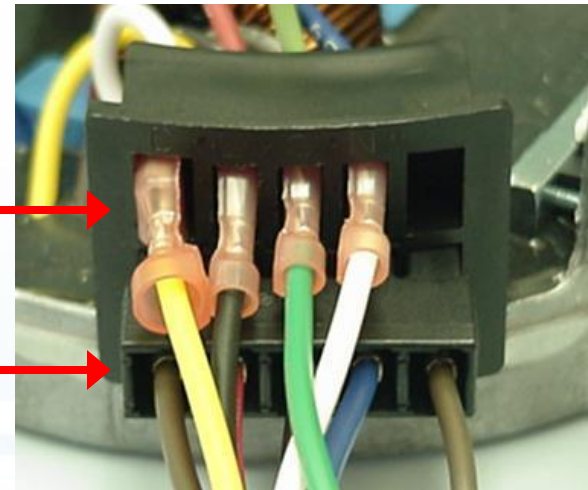
Signal Connection – Common to C, 24VAC to Taps #1-5

Once the motor has been programmed with torque values for each utilized tap, applying 24VAC power between the tap and common will signal the motor to run and regulate torque at the programmed level. In the event that more than one tap are energized at the same time, built in logic gives the highest tap number precedence (not necessarily the tap with the highest programmed torque). The tap input voltage must be in the range 12-33VAC (or 15-23VDC if desired). If DC voltage is used, not all taps are available for discrete operation.



Power Inputs

Tap Inputs



Line Power and Ground pins are 3/8" Male Quick Connects
Low volt "Signal Tap" inputs are 1/4" Male Quick Connects

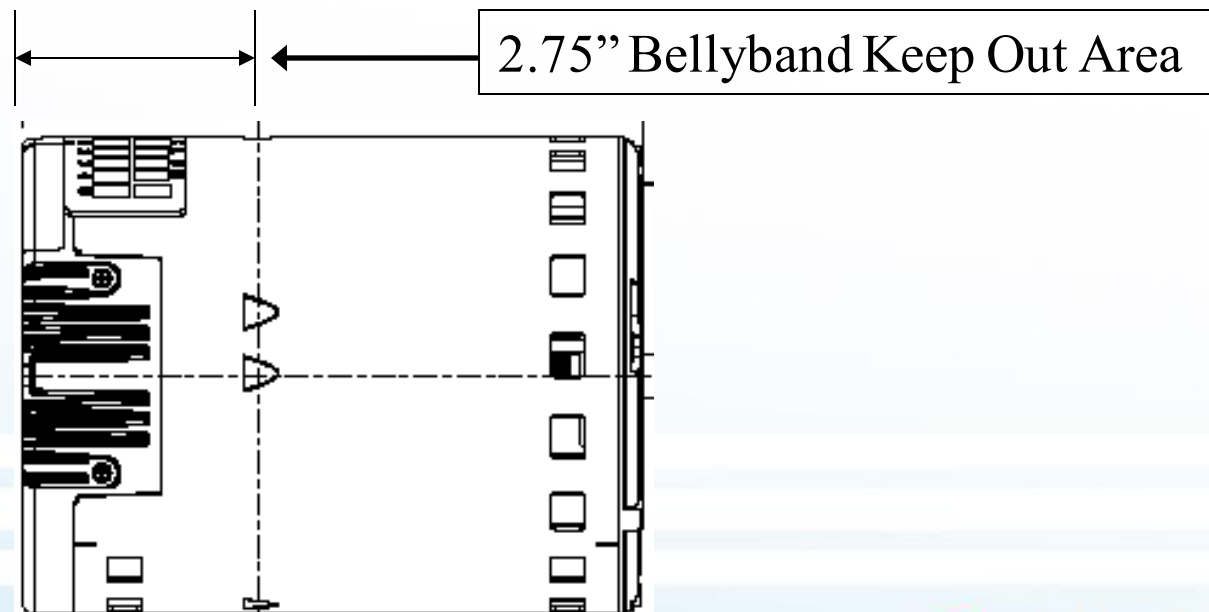


How do I apply it?

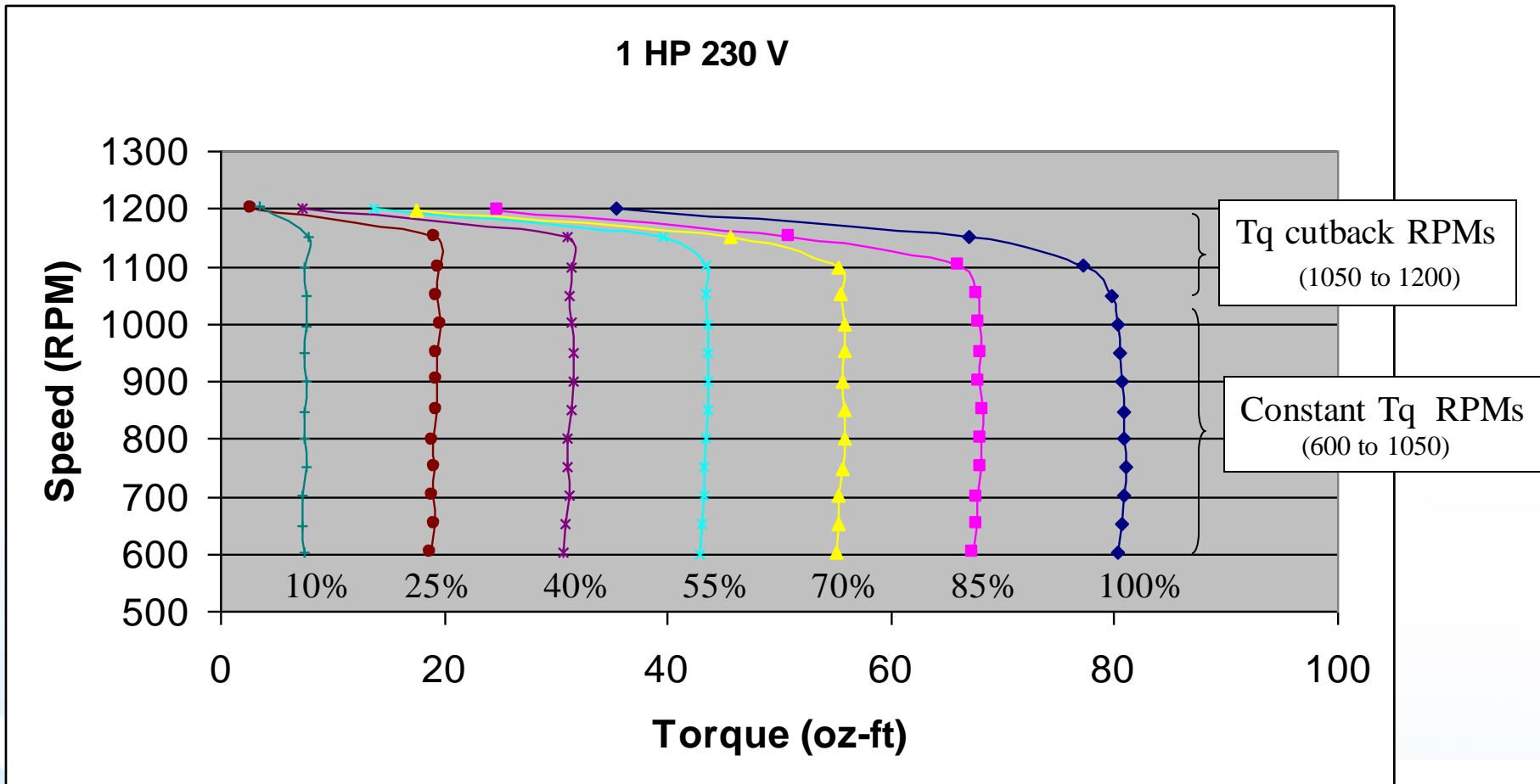
Initially you will run the sample using the “EnduraPro Controller” in the “ECM Toolbox” to dial in the correct airflow for the intended application. The dial in torques will then be saved and programmed to a specific tap number using the ECM Toolbox software. Additional help using the ECM Toolbox can be found in the “ECM Programming Tutorial”.

The following pages discuss the speed, torque, watts and cfm relationships that will be observed in application testing. The effect of low voltage, such as 208V vs 230V is also discussed.

When using a bellyband for mounting, the band should not be located in the area identified in the drawing below.



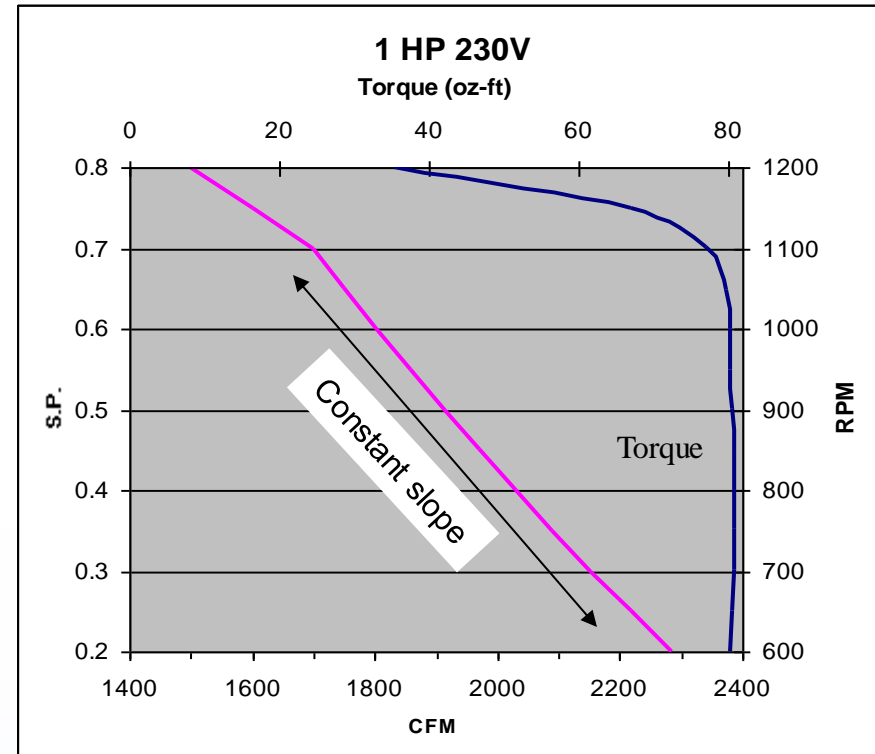
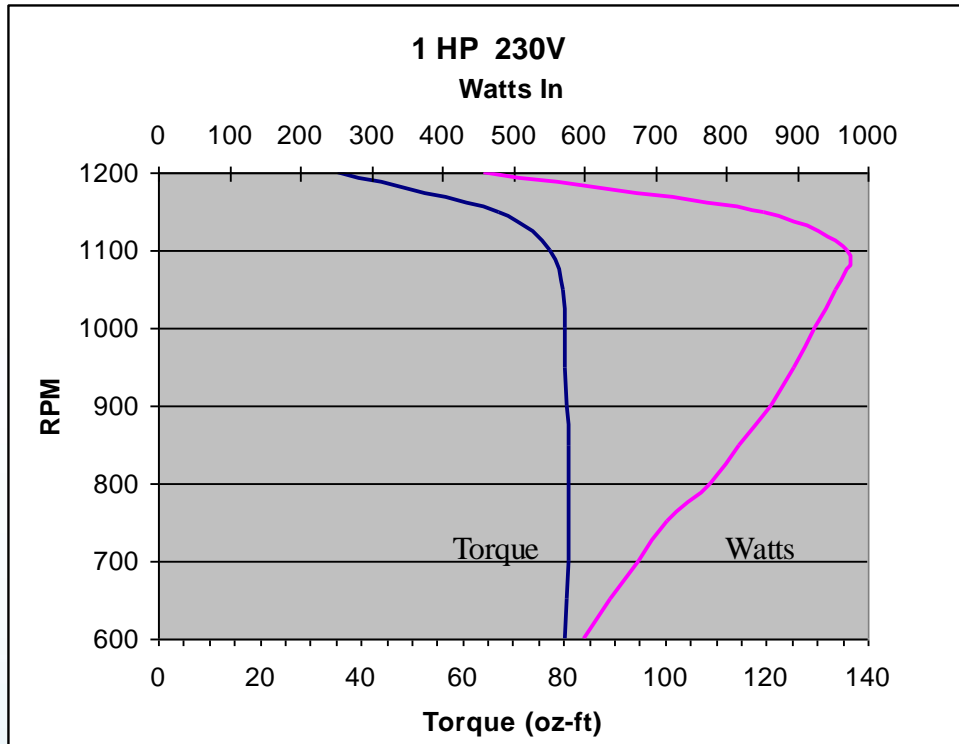
How do I apply it?



The speed-torque characteristics of the EnduraPro are shown above. Note that the operating rpm range is 600-1200 rpm. The torque, as a percentage of maximum output, is held constant up to 1050 rpm or slightly above before it is automatically reduced to zero at 1200 (similar to a psc motor).



How do I apply it?



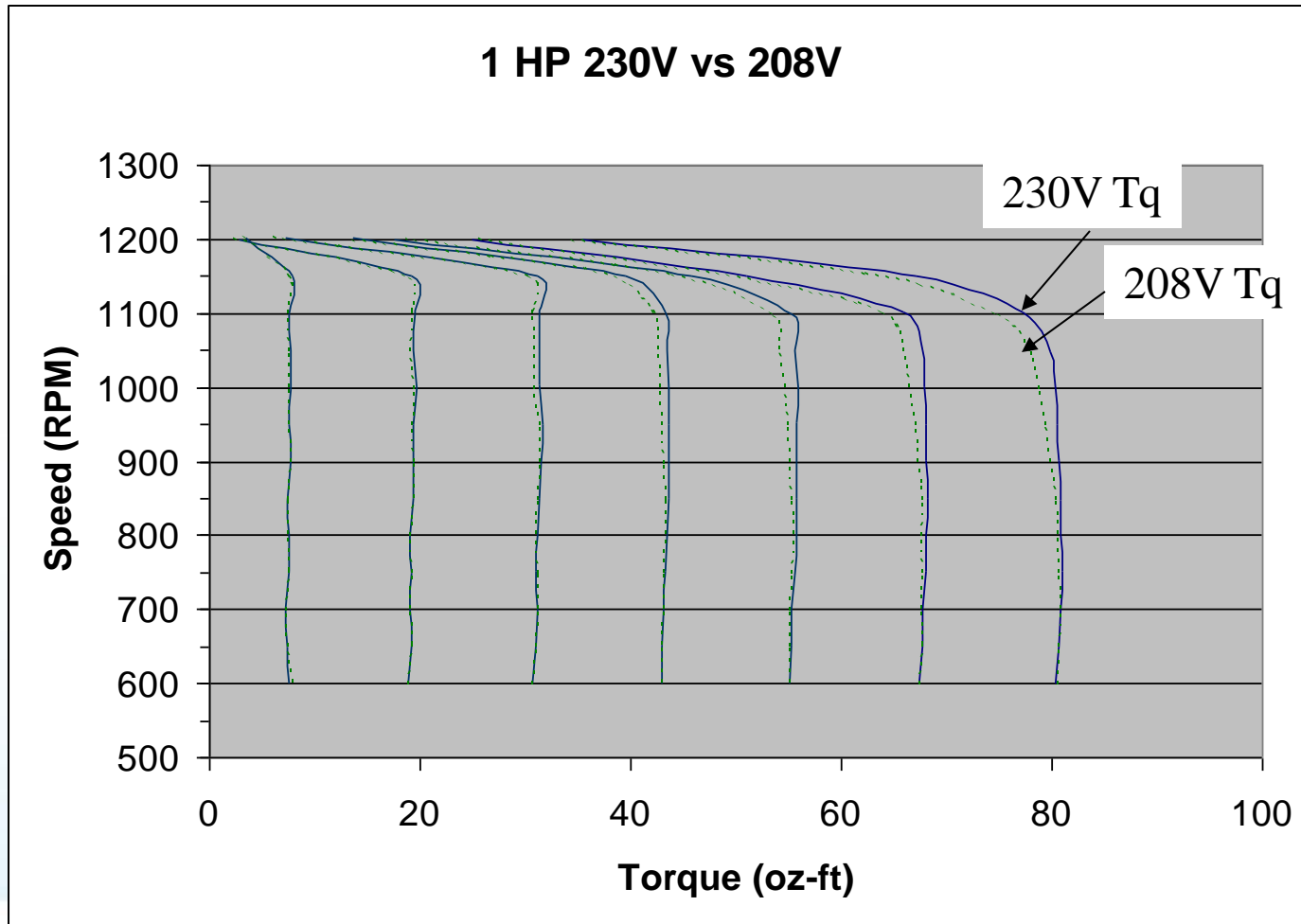
The graph on the left shows the Watts In characteristics of the EnduraPro. As rpm increases, as it does for increasing static pressure, watts will increase until cutback rpm is reached. Above this rpm, torque and thus watts will decrease up to 1200 rpm.

The impact of regulating torque on airflow can be seen on the right. The slope of the cfm curve is relatively constant along the rpm range where torque is constant, only falling off as the static load drives the operating rpm above the cutback speed.

The results are less variation over the operating static pressure range vs a psc motor as well as a significant watts reduction due to the high motor efficiency.



How do I apply it?



The rated output is at nominal voltage, either 115 or 230 VAC. Operation at reduced voltages will result in some output decrease. The graph illustrates the performance change from 230 to 208 V. Airflow (temperature rise) should be verified at low voltage conditions in the application.



How do I apply it?

ECM Thermal Performance Evaluation in Variable Speed Systems (REV-1 10/27/2014)

The blower system is evaluated at selected operating conditions of maximum thermal stress and ambient temperature. The thermal performance evaluation below determines the thermal suitability of the design by comparing temperature measurements on selected parts of the motor to predefined temperature limits.

When tests are not performed at the expected ambient temperature, suitability is **estimated based on an expected max ambient temperature. **

Company Name:	
Project Name:	
Customer contact:	
Date:	
Test Type:	Temp. Rise
Max. Ambient Temp.	113
Test Temperature	

System Data	
Unit Model #	
Unit Size	
Motor P/N	
Unit Condition	

Motor Data *You must use a thermo-coupled motor of an adequate power level.	
Model Number	
Control Serial #	
Program	
Horsepower	
Motor Rating	
Motor Rotation	

Test Conditions					PE Phase A Winding	PE Phase B Winding	PE Phase C Winding	CE Phase A Winding	CE Phase B Winding	CE Phase C Winding	Top of Bulk Capacitor	Top Center of IGBT Module	Bridge Rectifier	Internal Control Ambient	Internal Cabinet Ambient	Room Ambient
Maximum Temperature (Deg F)					257	257	257	257	257	257	194	185	248	185	113	113
Points of Max. T.Stress	Speed (RPM)	Pin (W)	Vin (V)	Iin (A)	T1 (F)	T2 (F)	T3 (F)	T4 (F)	T5 (F)	T6 (F)	T7 (F)	T8 (F)	T9 (F)	T10 (F)	T11 (F)	T12 (F)
P1																
P2																
P3																
P4																
Max. Temperatures@Test amb					0	0	0	0	0	0	0	0	0	0	0	0
Expected Temp at Max ambient Temp:					113	113	113	113	113	113	113	113	113	113	113	113
Margin Temperature					144	144	144	144	144	144	81	72	135	72	0	0

If the design margin temperature is not suitable, the following options are available:

- 1.) Modify the design to supply more air over the motor,
- 2.) Reduce the operating power (less airflow or less pressure).
- 3.) Reduce the operating maximum ambient temperature.

A thermocoupled motor/control should be used to verify the thermal performance in the unit. Thermocoupled readings should be entered into the “*ECM Temp Rise spreadsheet*” for comparison to winding and electrical component limits.



How do I integrate it into my system?

Proper integration into an HVAC system requires an understanding of the EnduraPro input characteristics, specifications and connections.

The signal input lines, or taps, are rated as follows:

Min on voltage greater than	12VAC or 15VDC
Maximum voltage	33VAC or 23VDC
Min off voltage less than	5.5VAC or 8VDC
Minimum frequency	47 Hz
Nominal frequency	50 or 60 Hz
Maximum frequency	126 Hz
Min current draw	2 mA
Nominal current draw	6 mA
Maximum current draw	12 mA

**special relay contact (gold, silver) may be required

Connection Identification

CONNECTOR ID	DESCRIPTION	OPERATING MODE	PROGRAMMING MODE
C	SIGNAL COMMON	SIGNAL COMMON	SIGNAL COMMON
L	LINE	LINE	LINE
G	GROUND	GROUND	GROUND
N	NEUTRAL	NEUTRAL	NEUTRAL
1	TAP 1	TORQUE PT 1 (IF APPLICABLE)	DATA IN
2	TAP 2	TORQUE PT 2 (IF APPLICABLE)	
3	TAP 3	TORQUE PT 3 (IF APPLICABLE)	
4	TAP 4	TORQUE PT 4 (IF APPLICABLE)	DATA OUT
5	TAP 5	TORQUE PT 5 (IF APPLICABLE)	+12VDC

For the power input lines:

Inrush current – worst case for 230VAC is 300 A peak
decaying to zero in 2-4 milliseconds
worst case for 115VAC is 150 A peak
decaying to zero in 2-4 milliseconds

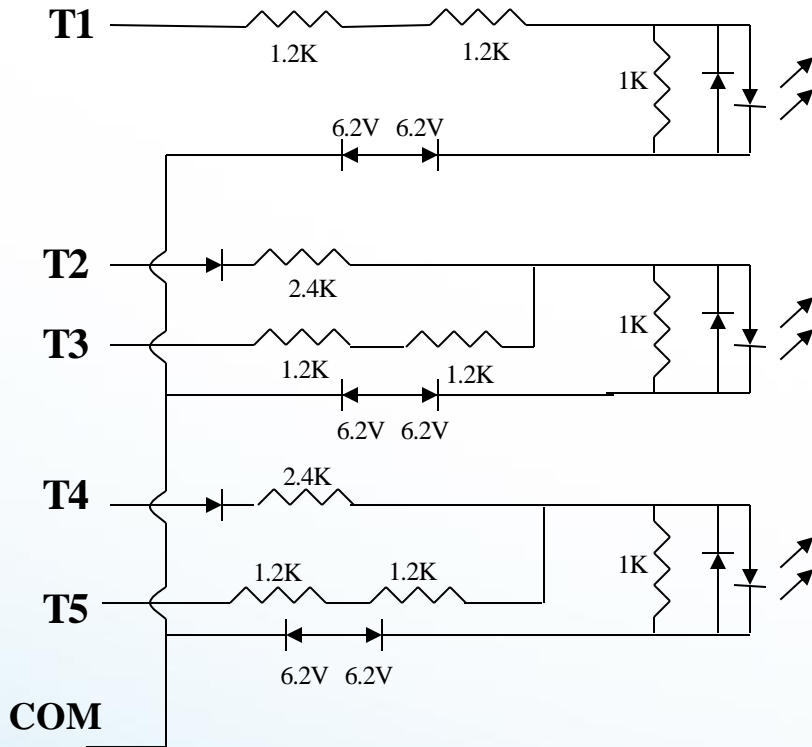
115V ¾ HP motor requires 2 mH choke

115V 1 HP motor requires 2 mH choke



How do I integrate it into my system?

EnduraPro I/O



The signal input lines, or taps, are rated as follows:

Min on voltage greater than	12VAC or 15VDC
Maximum voltage	33VAC or 23VDC
Min off voltage less than	5.5VAC or 8VDC
Minimum frequency	47 Hz
Nominal frequency	50 or 60 Hz
Maximum frequency	126 Hz
Min current draw	2 mA
Nominal current draw	6 mA **
Maximum current draw	12 mA

**special relay contact (gold, silver) may be required

How do I integrate it into my system?

Connectors:

Mating connectors for both the power + common terminals and for the tap terminals are available.

<u>Part# / Description</u>	<u>Supplier</u>	<u>Contact</u>
8794732MY / Power Housing Top	Wheelock Mfg. Inc.	C. Patrick (Pat) Wheelock, President (219) 283-1111
8794732NB / Power Housing Bottom	Wheelock Mfg. Inc.	C. Patrick (Pat) Wheelock, President (219) 283-1111
63609-2.25" / Female term.	Tyco	
63475-2.187" / Female term.	Tyco	
521781-1 / Power Housing Top	Tyco	(Positive Lock Connectors)
521780-1 / Signal Housing Bottom	Tyco	(Positive Lock Connectors)
8794723CK / Tap Housing	NTI	Walter York, General Mgr. (440) 349-5862 x100
8794723CL / Tap Housing Terminal	NTI	Walter York, General Mgr. (440) 349-5862 x100



General Specifications

HP	Motor+Control	End to End	Max Ratings @ Nom V, 1050 RPM		
	Weight (lbs)	Length	Torque (oz-ft)	Watts In (45C)	Watts In (55C)
1/3	9.2	5.275"	27	350	350
1/2	10.6	5.785"	40	530	530
3/4	15.2	6.535"	60	780	680
1	19.0	7.285"	80	1050	875

HP	Full load amps 115V 1050 RPM		Full load amps 208-230V 1050 RPM		Full load amps 277V 1050 RPM	
1/3	4.8		2.8		2.6	
1/2	6.8		4.1		3.6	
3/4	8.4		6.0		4.9	
1	10.9		7.6		6.6	

UL File: E100625 Vol. 9 for Motor, Vol. 7 Sect. 14 for Control
 CSA File: LR80176

Thermal protection: Motor is electronically protected.

Locked Rotor Amps: If motor speed decreases below a programmed stall speed, the motor will shut down and after a delay period, the control will attempt to restart the motor. Starting current is limited to significantly less than full load current.



How do I integrate it into my manufacturing?

If factory programming of the EnduraPro will be done in your plant, you will need to install the “*ECM Factory Programming Software*” on the computer to be used. In addition, your custom label information needs to be created in the motor program using the “*ECM Toolbox Software*”. Helpful user information can be found in the “*ECM Factory Programming Quick Reference Guide*” and the “*ECM Label Editor Quick Reference Guide*”. Factory programming will also require the robust connector shown below.

Hipot testing is recommended to be done with an DC voltage of 2500V for 1 second. The voltage ramp rate should not exceed 1000V/sec. The X13 motor and control leakage current is approximately 1mA.

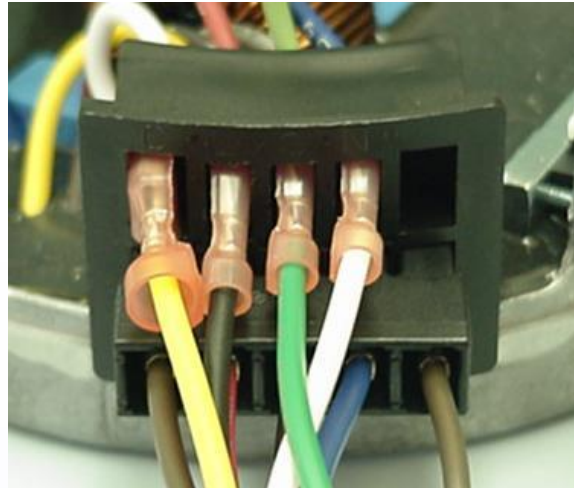
EnduraPro
Factory Programming Cable
8794700GBG01
Head Only
8794707GHH01



EnduraPro Factory Programming Connector



How to Test using ECMToolbox and determine operating outputs to program.

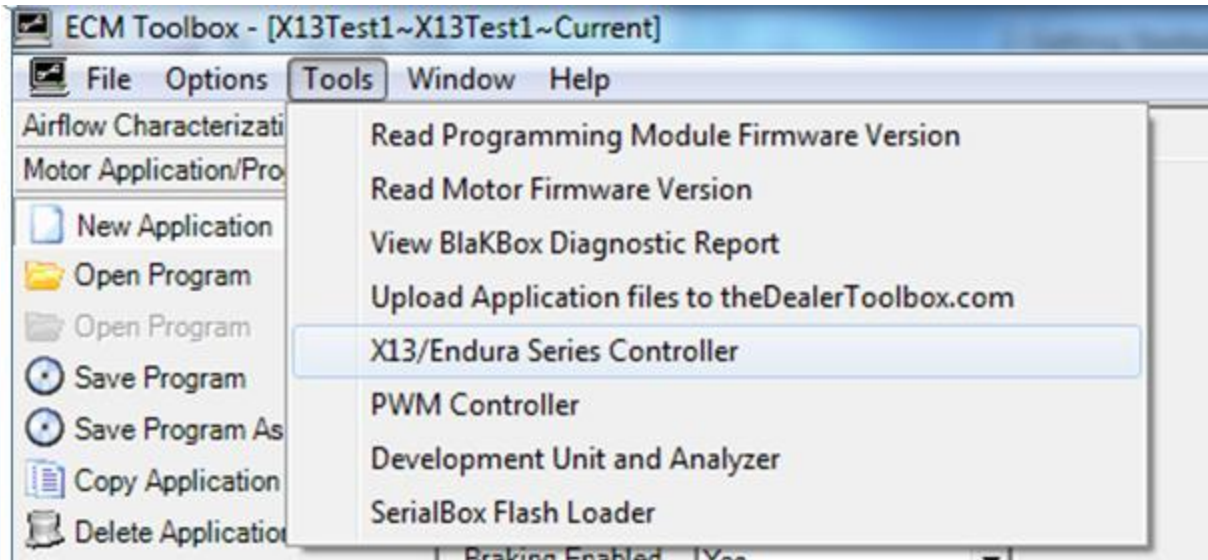


8794707LC	Endura Connector (flying leads for power, integrated connector for signal)	Cable from ECM Programming Module to Endura motor. 5 taps in one connector with flying leads to common and power. Ideal for lab development. Ability to supply outside power for use with Endura Controller tool in ECM Toolbox.
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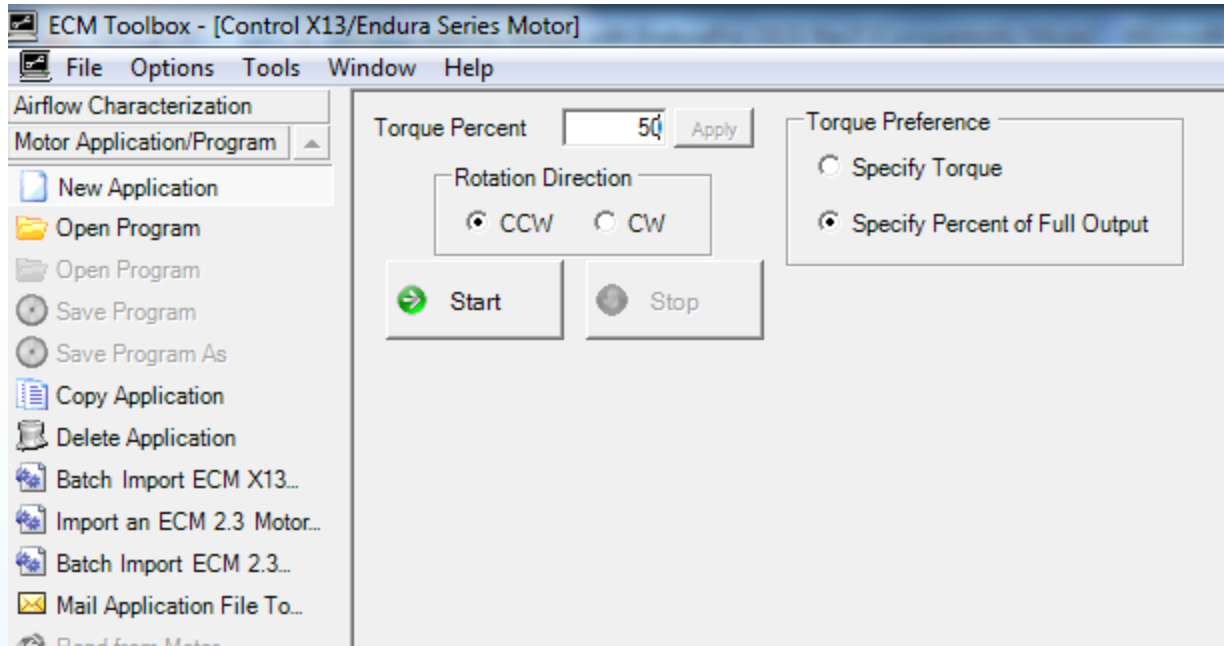
You can test the motor with your power and this connector thru ECM Toolbox to develop what % Torque levels you need in your program



Endura Series Controller

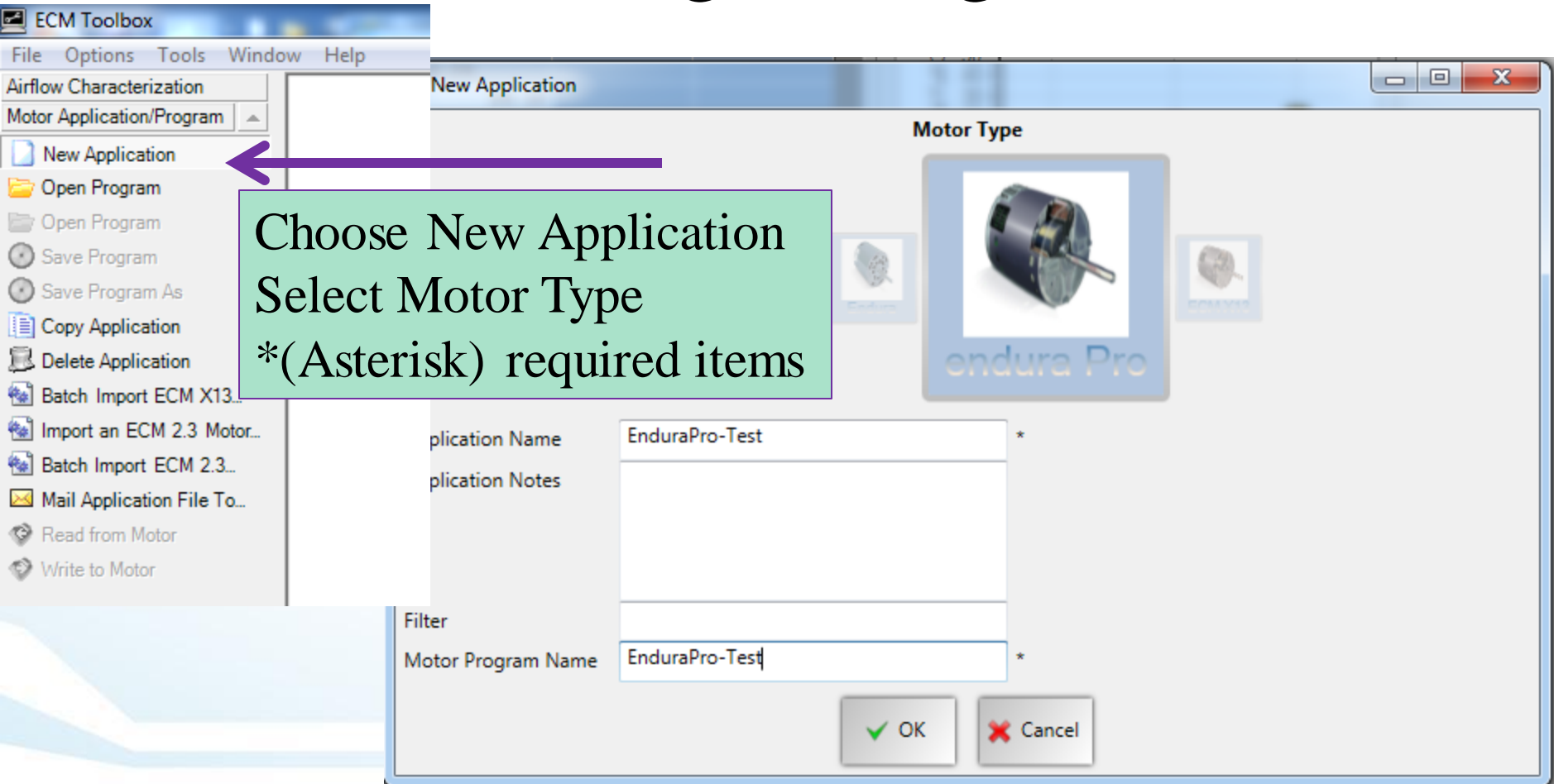


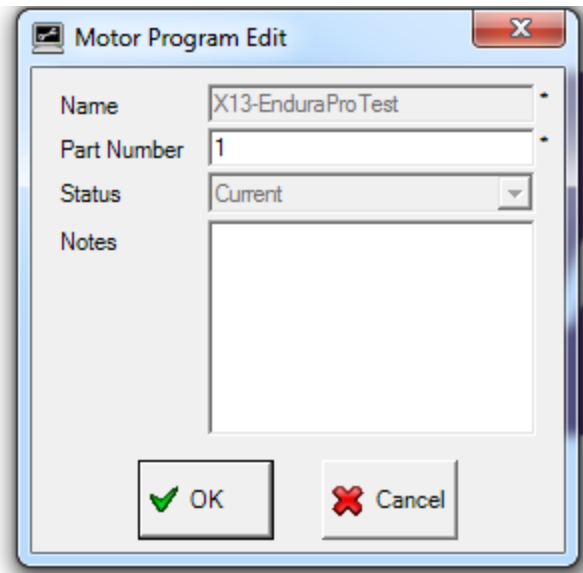
Endura Series Controller



- *Choose Torque output you want to Run and Motor Rotation
- *Then Click Start.
- *Change Torque by typing a new number in and clicking Apply.
- *Record the outputs that give you the airflow you need

Creating a Program





Here you can put in your Part Number if desired or just a 1. The notes are for your information possibly what unit used on.

STATUS: Current means the program is still editable and not released (Published)

Creating a New Program

The user will input the desired tap parameters.

Drop down menus will be used to make some selections.

Off delay and torque values will be entered directly in the grid boxes.

Configure | Label Editor

Voltage: 115v
Horsepower: 1/2
Num. Taps: 3
Dir. of Rotation: CCW
Input Type: AC
Braking Enabled: No

Torque Preference
 Specify Torque
 Specify Percent of Full Output

Parameter	Tap 1	Tap 2	Tap 3	Tap 4	Tap 5
Off Delay (secs)	0	0	0		
Torque (oz-ft)	5.96	8.00	10.04		
% of Full Output (%)	14.90	20.00	25.10		

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Legend: Tap 1 (blue), Tap 2 (purple), Tap 3 (orange)

Creating a New Program

Configure | Label Editor

Voltage: 230v
Horsepower: 1
Num. Taps: 3
Dir. of Rotation: CCW
Input Type: AC
Braking Enabled: No

Torque Preference
 Specify Torque
 Specify Percent of Full Output

endura Pro

Parameter	Tap 1	Tap 2	Tap 3	Tap 4	Tap 5
Off Delay (secs)	0	0	45		
Torque (oz-ft)	16.00	32.00	48.00		
% of Full Output (%)	20.00	40.00	60.00		

Select the number of discrete speeds for the motor.

Legend: Tap 1 (blue), Tap 2 (purple), Tap 3 (gold)

As an example, a program is created for a 1 HP motor using 3 AC input taps.

Note: If using DC inputs there is a Max of 3 taps.

The white boxes in the grid require user input.

The gray boxes in the grid can not be changed by the user.

Creating a New Program

The Off Delay is selected from the drop down menu choices for each Tap.

Configure | Label Editor

Voltage: 230v
Horsepower: 1
Num. Taps: 3
Dir. of Rotation: CCW
Input Type: AC
Braking Enabled: No

Torque Preference
 Specify Torque
 Specify Percent of Full Output

Parameter	Tap 1	Tap 2	Tap 3	Tap 4	Tap 5
Off Delay (secs)	0	0	45		
Torque (oz-ft)	0	32.00	48.00		
% of Full Output (%)	30	40.00	60.00		

Off delay is the time that the motor continues to run at the specified torque after receiving an off command.

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% of Full Output (%)

Programmed Speed

Legend
Tap 1 Tap 2 Tap 3

Creating a New Program

Configure | Label Editor

Voltage: 230v
Horsepower: 1
Num. Taps: 3
Dir. of Rotation: CCW
Input Type: AC
Braking Enabled: No

Torque Preference
 Specify Torque
 Specify Percent of Full Output

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Parameter	Tap 1	Tap 2	Tap 3	Tap 4	Tap 5
Off Delay (secs)	0	0	45		
Torque (oz-ft)	16.00	32.00	48.00		
% of Full Output (%)	20.00	40.00	60.00		

Select the number of discrete speeds for the motor.

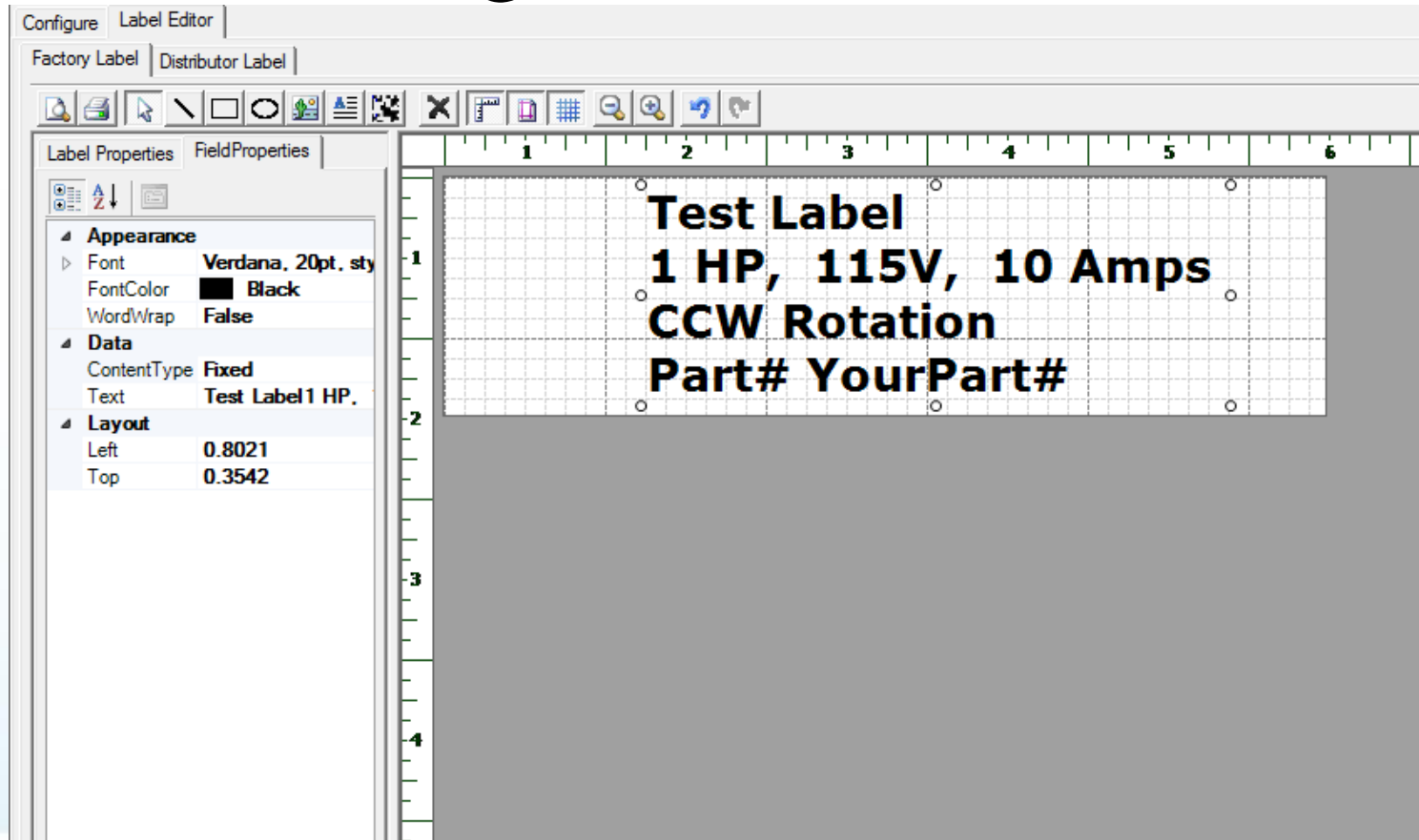
The Torque Preference radio button is selected to enter torque values as a percent of full output in this example.

The percent full output is entered in the white boxes and the actual torque (oz-ft) is calculated and filled in the gray boxes.

The user has the option to enter torque in oz-ft by selecting the Specify Torque radio button.

Note that some torque values may be adjusted slightly by the software as only certain discrete values are permitted.

Creating a Motor Label

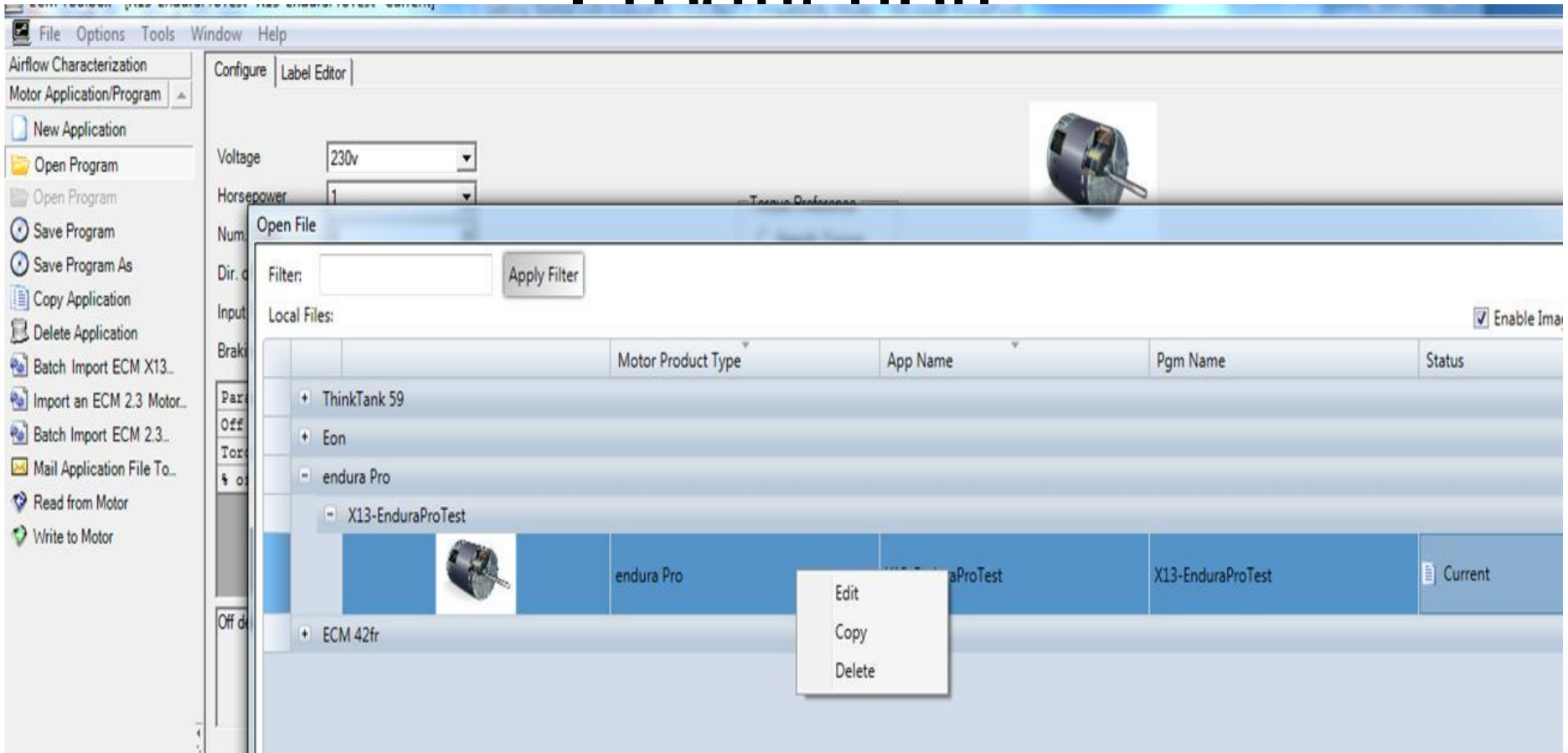


Click on Label Editor Tab

Make sure you know your label size and input this into Label Properties



Publishing Program for Production



Click Open Program, Then find Program and Right Click.
Choose Edit



Publishing your Program

The image shows a software interface with two overlapping windows. The background window is titled 'Open File' and displays a list of files under 'Local Files:'. The list has columns for 'Motor Product Type' and 'App Name'. The file 'X13-EnduraProTest' is selected, and a small image of a motor is visible next to it. The foreground window is titled 'Motor Program Edit' and contains the following fields:

Name	X13-EnduraProTest	*
Part Number	1	*
Status	Current	▼
Notes	Current	
	Published	
	Deleted	

At the bottom of the 'Motor Program Edit' window are 'OK' and 'Cancel' buttons. A green text box is overlaid on the bottom left of the screenshot.

Choose Published.
Now your program is ready to
Use with ECM Factory Programmer
On Production Line to program motors.