

## Operating Instructions for ECM 1 HP Shelf stock motor.

Please contact us with any questions at: <a href="mailto:techsupport@pcbstator.com">techsupport@pcbstator.com</a>

Please read all instructions completely before proceeding to ensure all steps are understood. Ensure that the motor is safely and rigidly mounted before operating.

- 1. Download and Install X-CUBE-MCSDK 6.2.1 software package from <u>https://www.st.com/en/embedded-software/x-cube-mcsdk.html</u>
- 2. Open Motor Pilot 6.2.1



- 3. Click "Load UI" and select the provided file named "ECM\_GUI\_2\_0\_0.qml".
- 4. Connect the provided USB-C cable between your PC and USB-C port in controller cover.
- 5. Connect 87VDC to the removable 2 pin screw connector (color and markings may vary). V+ = right side. V- = left side as shown.



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6. Select appropriate COM port, set the speed to 115200, and click "Connect" button.

ST Motor Pilot V1.2.5 - ECM_	PROFILER_GUI		
iUI Configuration Help Lang	juage		
Board Connection	Graph & Record		
UART ~ Port COM7 ~ C Speed 115200 ~ Connect O Polling X No Connection			
Application Regions Log	s A		
-	<b></b>		
Status			
IDLE	Application Review		
Errors:			
Over Voltage Oliver Voltage			
O Over Heat		VBUS TEMP POWER	Piotors: -
Start Up Fallure Start Up Fallure	-1000 1000	90-	MC Configuration
O Over Current	-2000 2000	32 80 8-	Power Stage : -
Solware Error Driver Protection		24 60 6	Max Readable Current: NaN A
	-3000 300	0 16 50 4 16 40 4	Nominal Current: Nam A Nominal Voltage: - V
			Primary speed sensor: -
			Aux speed sensor: Current sensing topology:
			FOC rate: - PWM frequency: - Hz
			Medium frequency: - Hz
	Target Speed - 1500 + RP		E-Circuit Motor, Inc.
	Duration 1000 me		

7. Acknowledge any startup faults.

Connection	Speed 115200 V Disconnect	Polling 🥑 ST MCSDK 6.2.1	Graph & Record	
cation Registers Lo	35			
IDLE	Application Rev-up			
OrS: DC Duration	Speed Control	Measures	Global Configuration	
ver Voltage nder Voltage	-250 0 250	VBUS TEMP POWER 90 - 100 - 4000 -	Motors: 1 MCP over UARTA [10]	
er Heet art Up Fallure	-500 500 -750 750	90	MC Configuration	
eed Foodback er Current	-1000 10	70 70 70 70 70 70 70 70 70 70 70 70 70 7	Power Stage: ~ECM JC 4 Max App Speed: 1800 RPM	
ovare Emar	-1500 12	500 36 50 100 100 100 100 100 100 100 100 100	Max Readable Current: 37.500 A Nominal Current: 20.000 A Nominal Voltage: 87 V Centrol Tama EOC	
Ack Faults	-2000 2000 RPM	18 20 800	Primary speed sensor: STO+PLL Aux speed sensor: No sensor	
PEED -	Mechanical Speed: 0 RP	M 41 V 24 deg W	POC rate: 2 PWM frequency: 3000 Hz	
		Speed: 0 RPM Id: 0.00 A	VBus Sensing: Enable Temperature Sensing: Enable On The Fiv: Enable	
Stop ramp	Speed Reference: 600	Iq: 0.00 A	Motor Configuration	
nfiguration		Debug / DAC	Name: ECM 1.0HP Shelfstock	
dvanced Configuration	Duration 1000 1 n	DAC 1 LA	Company Info	
	Execute Speed Ramp	DAC 2 LA	E-Circuit Motor, Inc. 10 Charles St.	
Load: 0.0 % reset			Needham Helghts, MA 02494 +1 (617) 340-3241	

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8. Type in the desired operating point speed here and press "Execute Speed Ramp". (Operating point speed is 1800 RPM, duration should be set to 10,000). It is important that you do this every time you restart the software, power-cycle the motor, or change the speed or ramp duration.

of Connection				Crank & Record		
UART < Port COM7 < 3 Speed 115200 < Disconnect O Polling ST MCSDK 6.2.1						
plication Registers Lo	ogs					
Status						
IDLE	Application Rev-up					
irrors: PFOC Dutation	Speed Control	Measures		Global Configuration		
0 Over Voltage 0 Under Voltage	-250 0 250	VBUS	TEMP POW	R Motors: 1 MCP over UARTA [10]		
Over Heat Start Up Failure	-500 50 -750	750	90 - 3200	MC Configuration		
rSpeed Feedback	-1000	1000		Power Stage: ~ECM JC 4		
Sotware Emar	-1250	1250		Max App Speed: 1800 RPM Max Readable Current: 37.500 A		
Uniter Protection	-1750	1750	40 1600	Nominal Voltage: 87 V Control Type: FOC		
Ack Faults	-2000 21	18-	20 800	Primary speed sensor: STO+PLL		
ontrol	RPM		0-0	Current sensing topology: 3 Shunt		
SPEED -	Mechanical Speed: 0	RPM 41 V	26 deg	W PWM frequency: 30000 Hz Medium frequency: 1000 Hz		
		Speed: 0	RPM	VBus Sensing: Enable Temperature Sensing: Enable		
	Speed Reference: 600	RPM IQ:	0.00 A	On The Fly: Enable		
	Speed Ramp			Motor Configuration		
onfiguration	Target Speed - 1500	+ RPM	с	Name: ECM 1.0HP Shelfstock		
Advanced Configuration	Duration - 1000	+ ms		Company Info		
	Execute Speed Ramp	DAC 2		E-Circuit Motor, Inc. 10 Charles St.		
PU Load: 0.0 % recet				Needham Heights, MA 02494 +1 (617) 340-3241		
4						
-						

9. Click "Start Motor" to start the motor. The motor will accelerate to the speed set in step 8.



10. It is strongly recommended to use the speed ramp for ALL speed changes. Deceleration should be limited to 100 RPM/second or less.





- 11. Continue testing as needed and click "Stop Motor" when finished. Note that "Stop Motor" disables the motor drive and allows the motor to coast to a stop.
- 12. Turn off the power supply.

The standard method for motor testing was as follows.

- 1. Motor is attached to a test stand containing a dynamometer.
- 2. The motor is run up to desired test speed.
- 3. Load is applied via dynamometer.
- 4. Power into the motor is measured via a power analyzer.
- 5. Power out of motor is measured by the dynamometer.
- 6. Motor performance is determined using the 2 measurements.

ECM measures motor performance at the leads of the motor to determine motor only performance. This means the controller system and any losses associated are not included in the reported motor performance.

## Thermal Information Disclaimer

This model motor was determined to have a thermal resistance of ~2.83 W/°C. Meaning that for each 2.83W of power loss there should be a 1°C delta between the housing temperature and the peak stator temperature at steady state. The performance at the expected operating point, based on a sample motor in the lab, is shown in the table below. Individual motor performance may vary. Housing temperature must be monitored during testing.

Speed	Torque	Power	Efficiency	Power Loss	Delta Expected (°C)	Max Housing Temperature for
(RPM)	(Nm)	Out (W)	(%)	(W)		100°C Stator Limit
1800	4.0	753.7	87.5	107.9	38.2	61.8

The motor can run at increased temperatures, but the lifetime of the machine will be affected an unknown amount. ECM cannot predict the lifetime effect of increased temperature as this is largely dependent on the final installation and environmental conditions experienced while in use. The motor should be ok to run up to 120°C stator temperature without too much risk to the motor, however, as with all motors when running to higher temperatures, it is likely motor performance will change and should be monitored.

It is necessary to monitor performance to ensure it is not in a thermal run-away situation. Preventing a thermal runaway is not something unique to ECM. This means there are already a variety of established solutions. Solutions such as a thermal shut off switch mounted to housing, software limits on current, directly monitoring stator temp with sensors, etc.

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