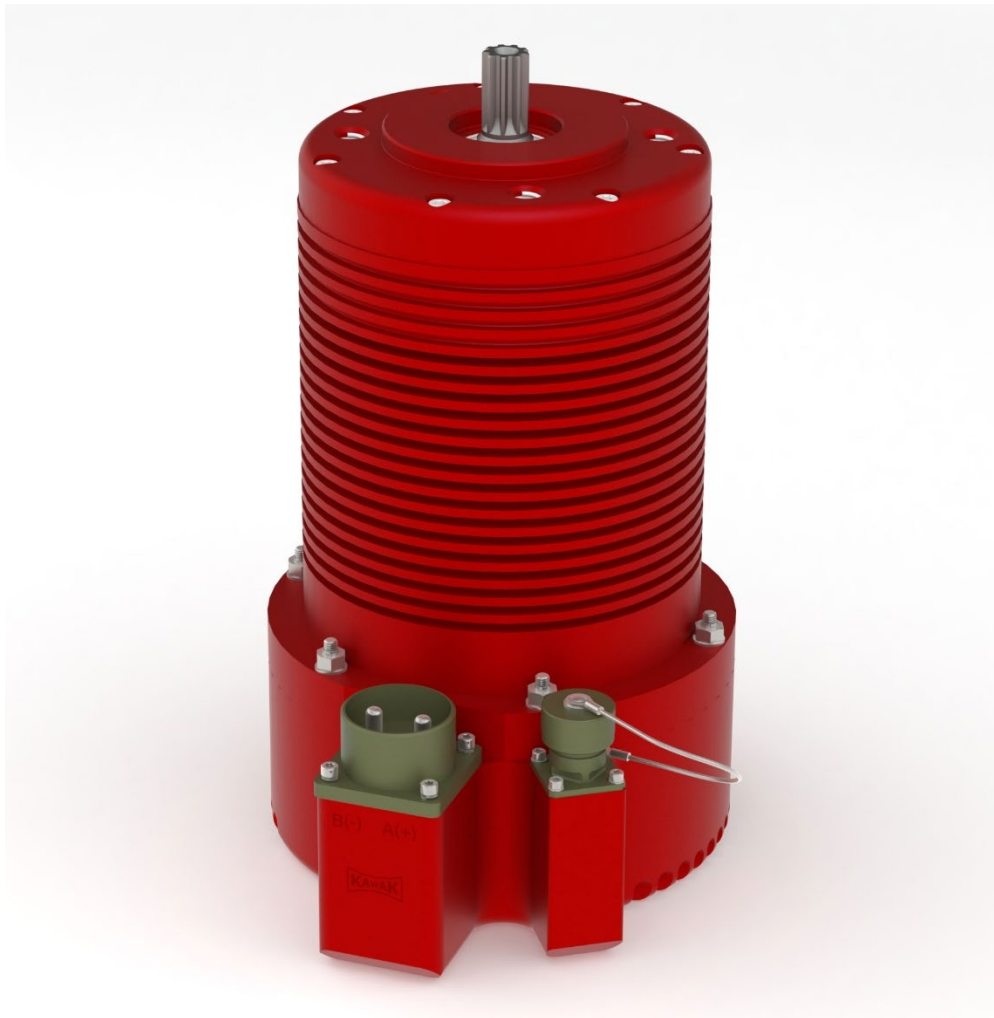


# PRODUCT MANUAL

## K-28

28VDC VARIABLE SPEED MOTOR

PN: 42394-0000 / 42395-000



**KAWAK AVIATION**  
TECHNOLOGIES

PROGRESS THROUGH INNOVATIVE THINKING

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# 1.0 SAFETY FIRST

## 1.1 Terminology

Warnings, cautions, and notes are used throughout this manual to emphasize important and critical instructions, and are used as follows:

TERM	DEFINITION
 <b>WARNING</b>	An operating procedure, practice, or etc., if not correctly followed, could result in personal injury or loss of life.
 <b>CAUTION</b>	An operating procedure, practice, or etc., if not strictly observed, could result in damage or destruction of equipment.
<b>**NOTE**</b>	An operating procedure, condition, which is essential to highlight.

## 1.2 Tips and Precautions

-  **CAUTION:** Double check your connector polarity before plugging in. ***\*If reverse polarity power is applied, this will destroy the controller.***
-  **WARNING:** Keep clothing and loose items clear of the motor shaft. Failure to do so could result in injury.
-  **WARNING:** Take care not to get burned. Motor housing can reach up to 100C when running under load.

# 2.0 GENERAL INFORMATION

## 2.1 The Company

**Kawak Aviation Technologies, Inc.**

20692 Carmen Loop, Suite 102  
Bend, Oregon 97702

Website: [kawakaviation.com](http://kawakaviation.com)  
Email: [support@kawakaviation.com](mailto:support@kawakaviation.com)  
Phone: 541.385.5051

## 2.2 This Document

The purpose of this manual is to provide instructions on how to safely install, operate, and maintain your Kawak K-28 Motor and accessories. The information contained within this manual is based upon data available at the time of publication and will be kept current by revision changes or service bulletins.

Carefully read and follow all instructions in this manual and any accompanying materials to prevent serious damage to your product. Failure to do so may result in physical harm to you and/or your product and will void the product warranty.

This manual contains information and procedures for the safe and effective installation, operation, and maintenance of the variable speed motor. It shall not be used as a substitute for sound judgment. Kawak reserves the right to make changes at any time without notice.

This document and any revisions made to it are available for download from the Kawak website. Revisions will carry a new revision letter and will be shown at the bottom of each page of the manual. Revisions supersede any previous revision levels of the manual. Operators and installers should check the Kawak website for the latest revision prior to installing/operating the motor.

Although this manual and any revisions are prepared as separate publications, they should be kept and used in conjunction with this maintenance manual.

### 2.2.1 Definitions

The following terms and abbreviations are used throughout this document. It is important that you understand their intended use:

TERM	DEFINITION
Shall	Used only when application of a procedure is <b>mandatory</b> .
Should	Used only when application of a procedure is <b>recommended</b> .
Will	Used only to indicate <b>futurity</b> , not used to indicate mandatory procedure.
Product	A complete assembly that is ready for sale.
Component	Parts or subassemblies of a product.
May / Need not	Used only when application of a procedure is <b>optional</b> .

## 2.3 The Product

The Kawak K-28 Motor is a 28VDC BRUSHLESS HIGH TORQUE ELECTRIC MOTOR that can be used in applications where either fixed or variable speed operation is required. The motor is a sealed unit capable of operating submerged or in other environmentally severe conditions. The unit consists of a built-in motor controller that interfaces with a software application that can be used to configure various operational parameters. Motor control settings will be factory set based upon customer specification at the time of sale however should a motor control setting need to be changed, a motor interface cable and software are used to adjust user defined settings in the field.

When using the motor in a variable speed application a potentiometer, a buffer, and a 5VDC power source, must be installed to provide manual remote speed control. The potentiometer and 5VDC power source are provided as part of the motor accessory kit. Detailed installation procedures are found in the installation section of this manual.

All measurements are in U.S. standard, unless otherwise specified.

### 2.3.1 Product Specifications

MOTOR PERFORMANCE		
Nominal Motor Voltage	28	VDC
No Load Current	5.5	A
Motor Max Speed (No load speed?)	3695	RPM
Rated Speed (At Rated Load)	3150	RPM
	330	RAD/SEC
Rated Current*	150	A
Voltage Constant	133.31	RPM/V
Torque Constant	0.073	Nm/A
Peak Torque	11	Nm
Power Usage	4	KW
	5.364	HP
Range of Operation	50% - 100% of rated speed	
Peak Efficiency	91	%
Number of Poles	8	-
Motor Connector	MS3102R24-9P	
Mating Connector	MS3106R24-9S	
Motor Connector – Variable Speed or K-Link Connection	D38999/20WB5SN	
Recommended Mating Connector	D38999/26WB5PN	
IP Rating	IP66	-
Weight	23.4	lbs
	10.6	kg
Motor Controller Max. Temperature**	105	°C
Default Current Limit***	120	A

\* Maximum continuous output with nominal airflow of 3.5 m/s

\*\* The motor has internal protections that will shut off motor if thermal limits are reached, allowing for cool down before restarting.

\*\*\* Adjustable by request. Actual maximum current lags behind configured current limit setting, this can be correct by adding an offset of:  $((0.0975 * \text{desired current limit setting}) + 2.7)$  to the desired current limit setting.

CONTROL VOLTAGE		
Input Voltage	0 – 5	VDC
Transition Time When Changing Speed	1.45	sec
Aux. Connector Part Number	JD38999/26WB5PN	
Control Hysteresis	0.2	V
Active Range	0.35 – 4.5	VDC
RPM Output Signal Available On Request		

## 2.3.2 Physical Connections

### Shaft Connections

The motor is available with either a 5/8"-9 SAE splined shaft or 3/4" keyed shaft as shown in Figure 1.

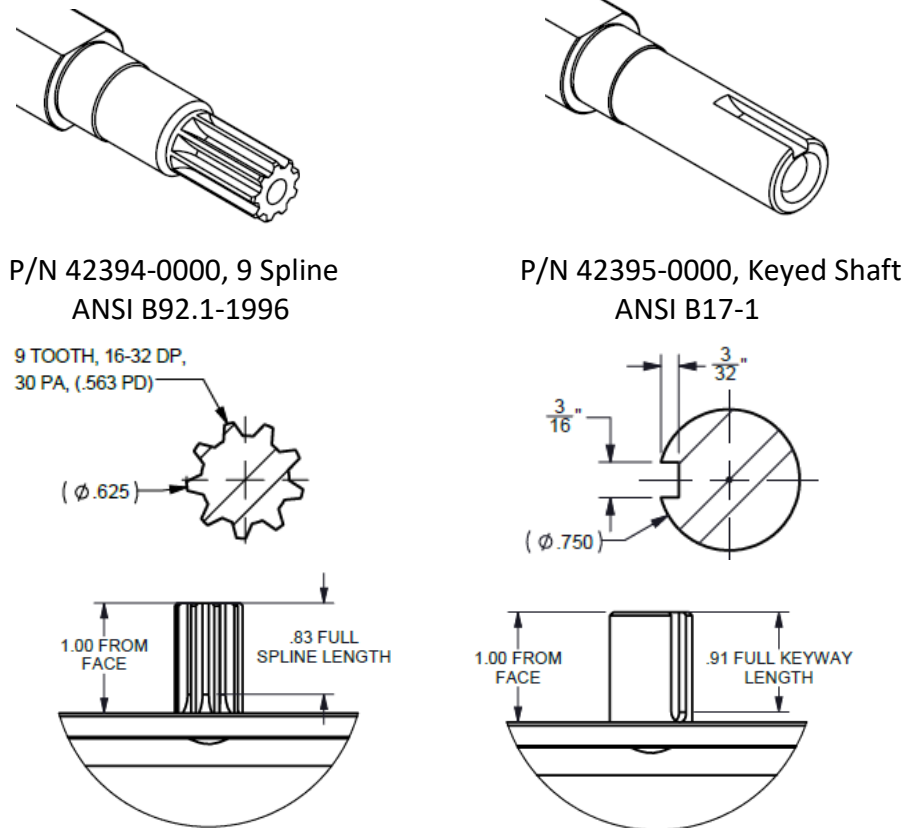


Figure 1: Standard Shaft Connections

### Mounting Features

Figure 2 shows the motor's mounting features. There are four 3/8"-16 threaded holes on the face for mounting. A 3.25"-diameter pilot on the motor face provides for shaft alignment if needed.

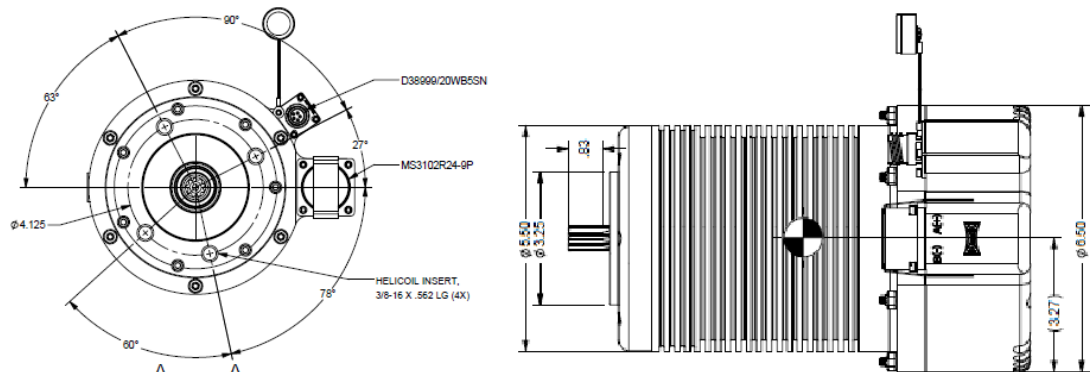


Figure 2: Motor mounting dimensions

### Shaft Side Loads

If the intended application for the motor involves side loading of the shaft as would be the case with some pulley/belt drives, Kawak offers overhung load adapters to accommodate excessive side loads. Contact Kawak Customer Support for special applications.

## 3.0 UNBOXING YOUR ORDER

### 3.1 What's In the Box

The following parts are included in your order:

- One (1) K-28 (28 VDC Variable Speed) Motor
- Owner's Manual (includes motor drawing)
- Optional Accessories (see packing list for included accessories)

### 3.2 Unpacking

Inspect the product for damage prior to installation. Verify that the motor shaft moves freely and there is no visible damage to the motor body or connectors. Contact Kawak Aviation if any issues are discovered.

### 3.3 Product Labels and Markings

#### 3.3.1 Warning Labels



#### 3.3.2 Product Markings







### 3.3.3 Serial Markings



### 3.4 Tools You Will Need

The following tools are required to complete the installation:

5/16" Hex Key Wrench	
Safety Wire Pliers	
Size W Drill Bit (See Section 4.2.2 for application)	
Standard USB 2.0 A-Male to Micro B Cable (Motor Control)	

## 4.0 INSTALLATION

### 4.1 General Information

When integrating the motor to a particular device, the motor may be oriented in any direction. The below diagram (Figure 3) of the motor shaft face, indicates mounting hole locations and size, and connector part numbers. Use the dimensional information on the drawing for constructing a bracket or for prepping for mounting the motor.

**\*\*NOTE\*\*:** The mounting hole locations are on the same bolt circle but are NOT symmetrically spaced.

Additional mounting brackets may be affixed to the fasteners attaching the motor control (end cap) to the motor body. If the motor application requires the side loading of the output shaft, it is important to be mindful of the shaft side load limitation described earlier in this manual.

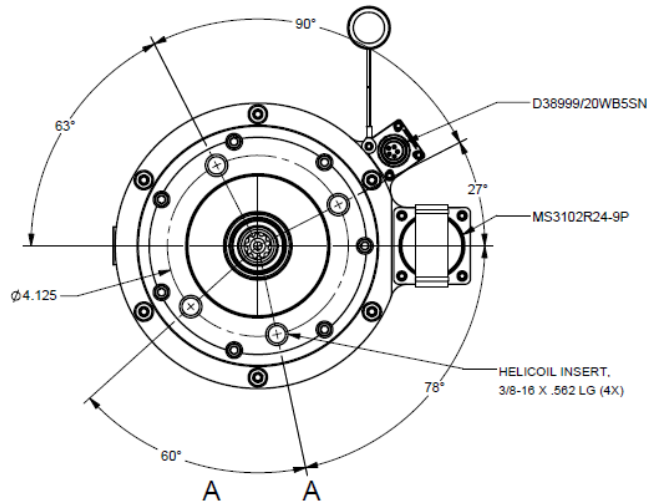


Figure 3: Motor Shaft Face

## 4.2 Installation Instructions

### 4.2.1 Mounting the Motor

Prior to installation, verify mounting hole alignment by holding motor up to mounting location.

To install the motor:

1. Hold motor to mounting face.
2. Align mounting holes with the motor mounting holes.
3. Insert the 3/8-16 NC fasteners (4) and tighten to secure.
4. Torque fasteners. Maximum of 50 lb/ft or as limited by the fastener type.

### 4.2.2 Electrical Installation

The K-28 motor is rated at 28VDC nominal. If other voltages are applied, it will operate with adjusted performance. See performance data (Appendix A) for more details.

The motor has been tested through the range of 20-30VDC. **Operation outside of this range is not recommended.**

The motor can be used as variable speed with remote speed control, or as fixed RPM. The electrical installation will differ depending on application. Additional electrical components will differ depending on the type of equipment installed on or used with the motor, if this is a new installation, or if the motor is replacing an existing. The below schematics (Figures 6 & 7) show typical electrical configurations for variable and fixed speed installations.

The main power for the motor is typically supplied by a current limiting device, such as: a fuse, circuit breaker, or current limiter; and a contactor/relay. The current rating should be at least 150 amps. When installing the K-28 motor as a retrofit to an existing system (e.g., helicopter agricultural or firefighting), the current limit setting on

the motor control must correspond to the component and electrical limitations of the existing system.

If this is a new application, please consult Kawak Customer Support regarding the need for any required ancillary electrical equipment.

**\*\*NOTE\*\*** When connecting motor/pump system to aircraft, all power transmission wiring is to be **4 AWG** or larger and supporting wiring shall be **20 AWG**. Control connector contacts can accommodate 20-24 AWG wire.

#### *Variable Speed Applications*

When configuring the installation for variable speed motor operation, there are a several options for managing the motor on/off control. The first option is to simply use the main power contactor to turn the motor on and off. Alternatively, a switch can be installed in the 0-5v control circuit as when the control voltage is zero, the motor will turn off. Utilizing the 0-5v control circuit versus opening and closing the main power contactor will significantly increase the life of the contactor. Figure 7 is a typical schematic for variable speed motor operation.

#### *Potentiometer Installation (Variable Speed Applications Only)*

A pre-wired potentiometer (motor speed control) with associated harness and controls (P/N 42394-1007) is available from Kawak.

To install the potentiometer assembly:

1. Determine mounting location for potentiometer. Keep in mind that it should be place where the pilot or equipment operator can easily make adjustments.
2. Using a **Size W Drill Bit**, drill a 0.386" hole in the selected location (e.g. instrument panel, console).
3. Deburr the hole, as necessary.
4. Insert the spindle of the potentiometer into the hole from the back of the panel.
5. Secure the potentiometer into position with the provided nut and lock washer.
6. Note the clocking of the potentiometer once mounted. Loosen nut and re-clock potentiometer, if needed.
7. Install the adjustment knob onto the stem of the potentiometer using the supplied hex wrench supplied with the knob.

### 4.2.3 Variable Speed Control Connection

A pre-wired electrical harness is an available accessory for the motor when utilizing the variable speed option. The harness has the motor connector populated with 10' of wire. Contact Kawak if longer harness lengths are necessary. The harness is intended to be trimmed to length based upon routing and the location of the potentiometer. Below is a pinout diagram (Figure 4) of the auxiliary connector on the motor when using variable speed or connecting the programming harness.

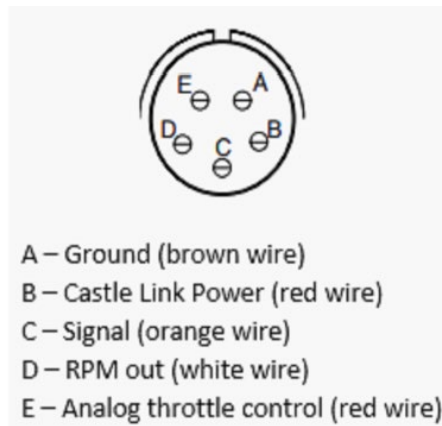


Figure 4: Mating Face Pinout Diagram

**⚠ CAUTION:** In the above pin configuration, it is critical that the origin of the DC return, of the source of the 5V input signal, is isolated from the motor controller DC return. A form of isolation must be installed to avoid a ground loop condition that can result in damage to the motor during operation. The required isolation is confirmed by taking a resistance continuity reading between pin A on the auxiliary connector plug (while disconnected from the motor), and the aircraft DC return bus. There should be no continuity when this measurement is taken if the necessary isolation is present. This should be addressed before operating the motor.

The auxiliary interface connector has a cap on a lanyard (Figure 5) that must be installed on the connector when not in use.

**⚠ CAUTION:** The cap should be tightened securely to prevent moisture intrusion.



Figure 5: Aux. Interface Connector with Cap

### Isolated Control Voltage Input

The below diagram (Figure 6) is of a basic isolated control voltage input that is controlled by a potentiometer that modulates input voltage manually.

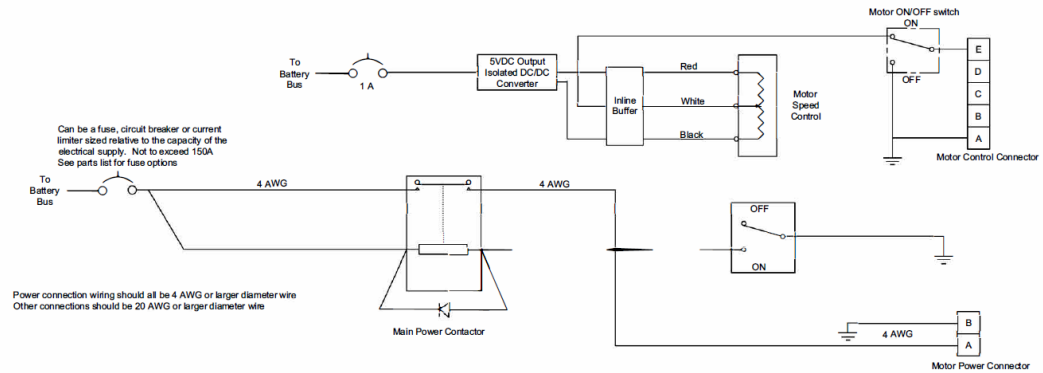


Figure 6: Circuit Diagram, Manual

If other control device interface, is needed, a switch can be added between auto and manual control modes, as shown in Figure 7. This allows for switching between the manually operated potentiometer and the external control system, as desired. The external control system input must be 0-5V. The system must be conditioned if the system interfacing with the motor does not have the correctly formatted output. If 0-5V signal is unavailable, contact Kawak for further instruction.

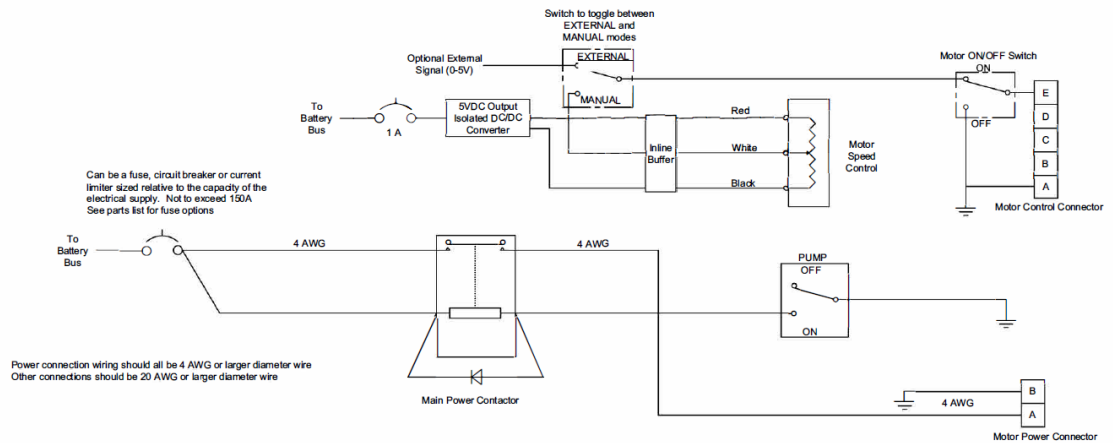


Figure 7: Circuit Diagram, Auto and Manual

The interface circuit from an external control system is detailed below. The output of the interface circuit is what would connect to the AUTO input of the switch in the diagram above. If the user does not have an external control system and will only be operating in MANUAL mode, the switch can be omitted, and the potentiometer output can go directly to Pin E, at the motor, as shown in the image below.

**\*\*NOTE\*\*** In order to interface with the various control systems available on the market, signal conditioning will likely be necessary to feed a 0-5VDC signal to the motor via the AUTO input. Contact Kawak for the specifics on how to condition the signal from a specific system.

#### 4.2.4 DC/DC Converter Installation

To install the DC/DC Converter:

1. Select a suitable location to mount the DC/DC converter that facilitates connection to the potentiometer harness connector.
2. Use #4 size fasteners of the appropriate length to mount the converter.
3. Connect the converter output harness to the potentiometer harness and secure the wire appropriately.

## 5.0 OPERATION - MOTOR

### 5.1 Fixed Speed

ACTION	CONTROL	POSITION
Turn Motor On	Motor Contactor Power Switch	ON
Turn Motor Off	Motor Contactor Power Switch	OFF

### 5.2 Variable Speed (Two Switch Configuration)

- Motor Contactor Power Switch and the Motor Control Switch – OFF
- Motor Speed Control (Potentiometer) – Rotate full travel counterclockwise.
- Motor Contactor Power Switch – ON
- Motor Control Switch – ON
- Motor Speed Control – To turn motor ON - ROTATE CLOCKWISE
- Motor Speed Control – Adjust speed control to achieve desired motor speed.
- Note – The throttling range of the motor speed control is 50-100%.
- Once the motor speed has been adjusted to the desired setting, the motor can be switched OFF and back ON via the Motor Control Switch and the motor will return to the speed setting of the Motor Speed Control.

**NOTE:** If turning on the motor by increasing the throttle control voltage starting from 0 volts, the rate of increase of throttle control voltage is critical. If the rate of increase of voltage is too slow, when the voltage threshold to turn the motor on is reached, the motor may stall depending on motor load conditions when this occurs. It is recommended that the throttle control voltage be set to the desired voltage setting and remain there while turning the motor on/off with the optional shutoff switch. Using the optional shutoff switch will turn the motor on/off by grounding the control voltage input to turn off the motor while reducing the number of cycles on the high current power contactor that delivers power to the motor. This practice should extend the lifetime of the high current power contactor used with the motor.

The control voltage input has a 0.2V hysteresis. This prevents the motor from being too sensitive to changes in the control voltage.

If the control voltage increases, the motor speed will increase linearly with the input signal.

To decrease the motor speed after the initial increase, the control voltage must be decreased by 0.2V before observable motor speed decrease will occur. When this happens, the decrease will be linear with the control voltage.

Once voltage is decreased, to increase the motor speed the control voltage must increase by 0.2V before observable motor speed increase.

**⚠ CAUTION:** The analog throttle control input (Pin E) has a narrow window of operation (-2V to +6V). Using voltage outside of this range to Pin E will damage this input and render the motor inoperable. Always verify voltages and their polarity on mating connector before making connections. **Failures of this kind are not covered by the warranty.**

### 5.3 Electrical Controls – Variable Speed

The auxiliary interface connector pinout has five pins.

PIN	USE
B (K-Link Power)	Interfacing with computer to modify settings and operational parameters.
C (K-Link Signal)	
A (DC Return)	
E (Analog Throttle Control)	Input a 0-5 VDC analog signal to control motor speed.
D (RPM Output)	Indicates the RPM of the motor (Optional)

#### *Optional Motor RPM Output Signal*

To determine the RPM of the motor from this signal measure the frequency of the square wave pulses present at the pin, and use the following formula:

$$\text{RPM} = 15 * (\text{frequency measured})$$

## 6.0 PROGRAMMING

Kawak has included a motor drawing with pre-programmed motor settings. To make changes to these settings or to update the firmware, after receipt, the following items will be needed:

- K-Link Interface Cable (P/N 42394-1000)
- K-Link Interface Module (P/N 011-0007-00)
- K-Link Software Application

**STOP!** If this is your first time using the K-Link application, it is advised that you contact Customer Support prior to programming.

### 6.1 Connection to Motor



#### 6.1.1 Computer Interface

The K-Link Interface Cable (P/N-42394-1000) enables the motor to interface with a computer to adjust operational parameters, such as: operating mode; direction; and

current limit. The product is shipped with an initial configuration; however, these settings can be adjusted in the field:

1. Remove the control harness connector or cap from the motor.
2. Connect the P/N 42394-1000 K-Link Interface Cable to the motor connector.
3. Link a standard USB 2.0 A-Male to Micro B cable (Figure 8) between the computer and K-Link Interface module (P/N – 011-0007-00).



**Figure 8: USB 2.0 A-Male to Micro B cable**

4. Plug the interface module into the 3-wire ribbon cable that is part of the motor interface cable.
5. Do not apply power to the main power connector of the motor when programming the motor control.

## 6.2 Software Interface

The K-Link application is used to manipulate the operational parameters of the 28 VDC Variable Speed Motor.

1. Download the K-Link Software Application provided by Kawak. Contact Support for link to software.
2. Run the K-Link application on the computer once connected to manipulate the operational parameters. Contact Kawak Customer Support for additional information on the K-Link Software Application.
3. Open the K-Link software using the link in the Start Menu or from the Desktop.

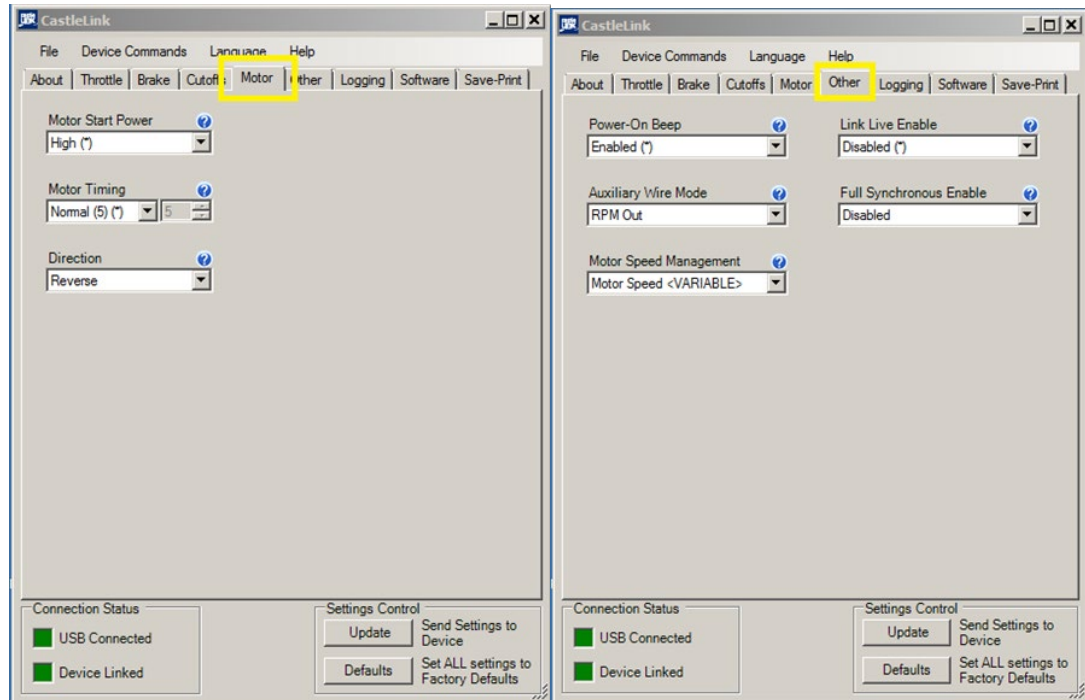


Figure 9: Software Interface Screens

4. Figure 9 displays the most commonly modified settings. Contact Kawak Customer Support for information before modifying any of the optional settings.

- The below table describes the common modifications from Figure 9:

SETTING	DESCRIPTION
Motor Start Power	Dictates whether the motor ramps up quick or slow. Can be set to <b>low</b> , <b>medium</b> , or <b>high</b> .
Direction	Determines the rotational direction of the motor shaft. Can be set to <b>forward</b> (clockwise rotation) or <b>reverse</b> (counterclockwise rotation). Shaft direction is viewed from the shaft as it comes out of the motor face.
Auxiliary Wire Mode	Enables the RPM signal coming out of Pin D on the auxiliary connector.
Motor Speed Management	Determines whether the motor will run in fixed mode, at full throttle, consistently, or, whether it will respond to changes in the control voltage.

## 7.0 CARE AND MAINTENANCE

The operating environment and duty cycle of the motor will affect its maintenance requirements. Intermittent duty applications will require less frequent inspections and lubrication. Shaft sideload conditions and continuous duty operation will equate to more frequent inspections and bearing replacement. Bearing life can be estimated using the formulas provided earlier in this document. When estimating bearing life, it is recommended to use conservative replacement

intervals since if the bearings fail and the rotor makes contact with the motor stator, the motor is rendered unusable.

**Bearing replacement** is not considered something that is field serviceable, and the motor must be sent to Kawak for maintenance. The magnets on the rotor are extremely strong and require special tooling for the removal or installation of the rotor into the stator. Do not attempt to remove or install a stator without the correct equipment as injury and motor damage will likely occur.

If the motor is configured with a spline shaft and the coupling to the driven accessory is a direct spline to spline connection, it is recommended that the **splines** be **inspected and relubricated** at a minimum of every 100 hrs. of operation with a high-pressure wide temperature range grease such as MIL-PRF-81322G grease. If the motor and driven device utilizes an elastomeric shaft coupling, spline lubrication is not required.

Should motor control board or the electrical connectors on the end cap get damaged, the **end cap of the motor** can be **replaced in the field**. To do so, remove the electrical harness(s) from the connectors on the end cap. Remove the six socket head cap screws attaching the end cap to the motor body. Carefully rotate the end cap back and forth to work the end cap out of the motor body. Once the end cap is free of the motor, remove the shrink tubing on the three conductors between the end cap and the motor. Make sure to mark what wires on the motor correspond the colors on the end cap (red, black, white). Pull apart the connectors.

Prior to the installation of a new end cap, if the end cap is not pre-programmed relative to the application, program the end cap per the instructions in this manual.

To **install a new end cap**, slide new pieces of appropriately sized shrink tube over the three wires and push together the connections. Ensure that the wire connections are exactly the same as the previous end cap or the end cap will be destroyed when applying power. Slide the shrink tube over the connections and shrink with a heat gun.

Prior to re-installing the end cap, apply a small amount of O-ring lubricant to the O-ring seals on the end cap as well as the corresponding register in the motor housing. Orient the end cap with the motor housing and insert the pilot of the end cap into the motor housing. As the O-rings make contact with the motor housing work the end cap back and forth while applying pressure to the end cap. Be extremely careful as the O-rings enter the motor housing to ensure that the O-rings are not damaged. If a piece shears off the top of either O-ring, the O-ring must be replaced. Once the end cap has been successfully seated, orient the mounting holes to the motor housing and install the socket head cap screws with washers and new lock nuts. Use either a lubricated nut or stainless lubricant to prevent galling of the threads. Torque fasteners appropriately.

For any questions regarding motor maintenance, please contact Kawak Customer Support.

## 8.0 TROUBLESHOOTING

**Motor not working at variable speed:** If motor is not working in variable speed mode, verify voltage and polarity are correct at throttle control input and verify 28V is present at the power connector. You may need to remove connector back-shells to do this.

If all of this appears to be in good order, use the K-link software to change the motor configuration to FIXED operation. This will ignore the throttle input voltage and run (if it can) when power is applied. If it runs in FIXED mode and not in VARIABLE mode, then there is likely an issue with the throttle control input and the endcap will likely need to be replaced.

**Motor randomly shuts off:** If motor is randomly shutting off during operation, this could be due to power interruptions or overheating. If this occurs, verify power connections are good and stable. If the motor is too hot to touch when it turns off, the motor may have entered thermal shutdown. It will turn itself off to protect itself from getting to temperatures that will start to damage internal components. Once the motor cools off enough, it will resume normal operation. If this happens repeatedly, then you are likely not getting enough airflow over the motor body to cool the motor off sufficiently. The larger the load, the faster the motor will heat up.

**Motor stalls or growls at start up:** If the motor appears to be stalling (or growling) at start up while in variable speed mode, try increasing the throttle control voltage slightly and then restart the motor. If the motor is pre-loaded before it turns on, the motor throttle control voltage may be instructing the motor to start without enough force to overcome this preload which will result in the motor stalling.

**Motor not running and smells:** If the motor will not run and smells burnt, open the endcap and inspect the inside. If there are obvious signs of burning/overheating, contact Kawak customer support as one or more of the components are likely damaged and will need to be replaced.

**Can I run a data log?:** There is a data logging function implemented in the motor. If the motor was not completely fried at the time of failure, records can be extracted from the motor for analysis. If the endcap has catastrophically failed though, we will be unable to recover that data.

## 9.0 ACCESSORIES

### 9.1 Connector Kits

The 28 VDC motor has several connector kits and pre-wired harnesses available that are relative to the motor application. The ancillary electrical components necessary to connect the motor can be customer supplied or are available from Kawak. Some connector/harness assemblies have the wires installed in the connector with flying leads that are to be cut to length and terminated by the installer. For variable speed operation, pre-wired potentiometers and power supplies facilitate fewer connections during installation. The connector/harness assemblies and their interconnections are shown in the following graphic.

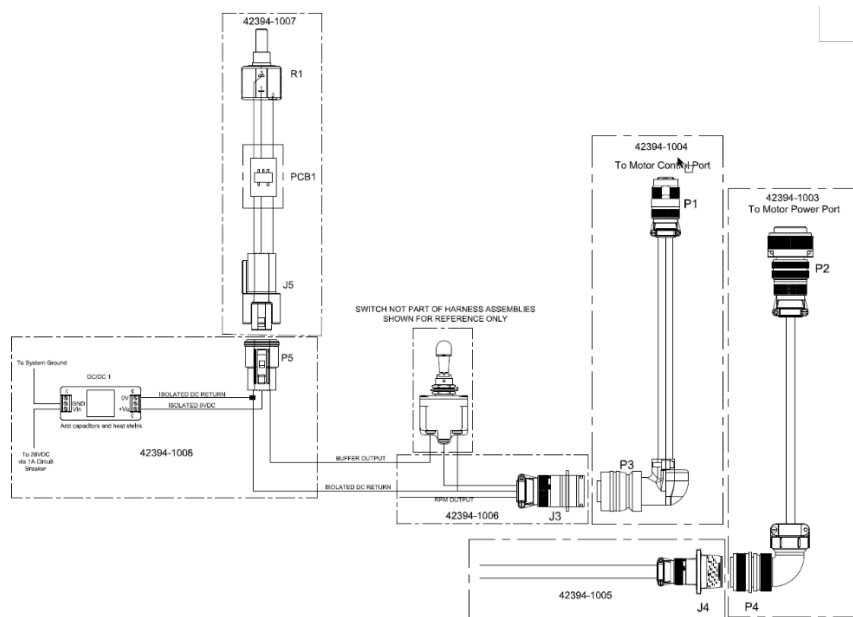


Figure 10: Connector/Harness Assemblies (P/N 42394-1009)

The following provides part number information for the mating connectors, harnesses, and miscellaneous components.

#### 9.1.1 Power Connector Kit - Motor connection with Flying Leads (P/N: 42394-1003)

Kit Includes:

PART NUMBER	DESCRIPTION
MS3106F24-9S	Circular Connector Connector Backshell (included with MS3106F24-9S)
MS3420-16	Rubber Bushing

### 9.1.2 Control Connector Kit (Motor connection with Flying Leads)

(P/N: 42394-1004)

Kit Includes:

PART NUMBER	DESCRIPTION
D38999/26WB5PN	Circular Connector
M85049/38-11W	Backshell
MS3420-4	Rubber Bushing

### 9.1.3 Power Connector Kit with Flying Leads

(P/N: 42394-1005)

Kit Includes:

PART NUMBER	DESCRIPTION
MS3100F24-9S	Circular Connector, Wall Mount
MS3420-4	Rubber Bushing

### 9.1.4 Control Connector Kit with Flying Leads

(P/N: 42394-1006)

Kit Includes:

PART NUMBER	DESCRIPTION
MS3470W10-06S	Circular Connector, Wall Mount

### 9.1.5 DC/DC Converter/Harness with Connector

(P/N: 42394-1008)

Kit Includes:

PART NUMBER	DESCRIPTION
PQDE6W-Q24-S5-T	DC/DC Converter
DT04-3P-COMPLETE	3 Pin Deutsch Connector
106RSS050M	Capacitor - Output
107KXM050M	Capacitor - Input

### 9.1.6 Potentiometer/Harness with Connector

(P/N: 42394-1007)

Kit Includes:

<b>PART NUMBER</b>	<b>DESCRIPTION</b>
83H7575	Potentiometer
PA0086/LMV321IDBVR	ProtoBoard/Voltage Buffer
DT06-3S-COMPLETE	3 Pin Deutsch Connector
46M2503	Knob, 3 Turn Counting

### 9.1.7 K-Link Motor Programming Harness

(P/N 42394-1000)

Kit Includes:

<b>PART NUMBER</b>	<b>DESCRIPTION</b>
D38999/26WB5PN	Connector
IDSS-03-D-18.00	Connector, IDC w/ribbon cable
011-0119-00	K-Link Programming Dongle

## 9.2 Miscellaneous Hardware

<b>PART NUMBER</b>	<b>DESCRIPTION</b>
MS3100F24-9S	Connector, Wall Mount
MS3420-16	Rubber Bushing
10-101960-103	Cap w/Lanyard - Control
10-329392-24	Cap w/Lanyard - Power
MS3420-4	Rubber Bushing
1TL1-3	Switch, Toggle

## 10.0 THE WARRANTY

*Kawak Aviation Technologies, Inc. (KATI) warrants products manufactured by KATI to be free of defects in materials and workmanship for a period of six hundred (600) hours of operation or 12 months, whichever comes first, when operated under normal use and service. This warranty shall not apply to any product that has been misused, mishandled, disassembled, repaired, or modified subsequent to its manufacture. The product or article must be and has been maintained and operated in accordance with the manufacturers or KATI's approved operating and maintenance instructions and manuals.*

*All parts, components or assemblies eligible for warranty must be returned to KATI's facility with transportation charges prepaid and are subject to the conditions of KATI's RMA policy. Warranty claims can be completed and submitted via Kawak's website, <http://kawakaviation.com>*

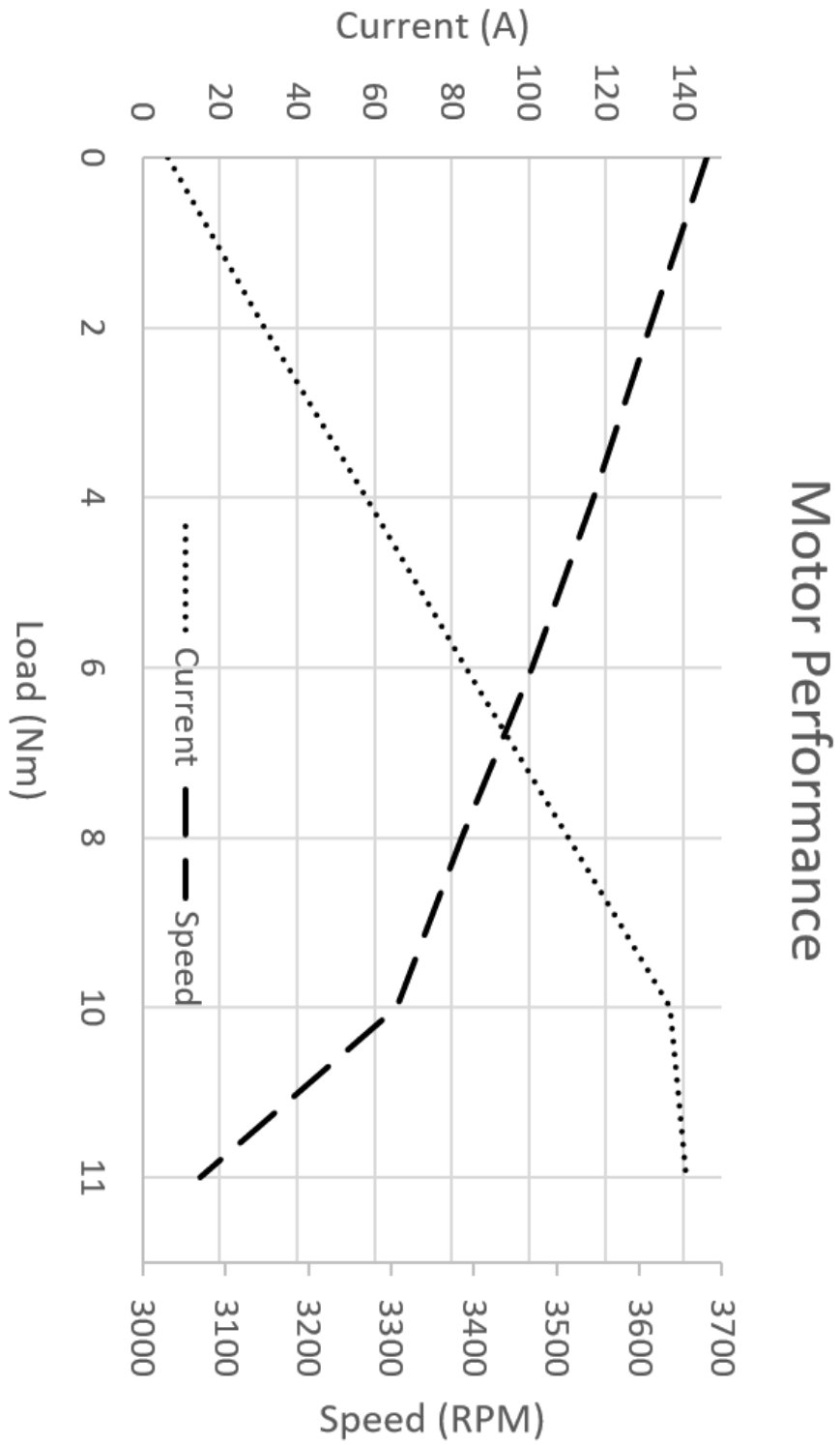
*This is the exclusive warranty made by KATI expressed or implied. The exclusive and sole remedies of the Purchaser and the obligations and liability of KATI is limited to the repair or replacement of any component, part or assembly that, after inspection and/or test by KATI, is proven to be defective. This warranty does not extend beyond the repair or replacement of the defective part nor does it extend to any costs as a result of the part being defective. KATI shall not be liable, whether in contract, tort, or otherwise for special, consequential, incidental, or indirect arising out of workmanship or materials supplied by KATI. KATI reserves the sole right to determine the validity of the warranty claim, and the sole right to determine which of the above alternatives shall be exercised to satisfy a valid claim.*

*KATI makes no warranty with regard to engines, propellers, and trade accessories that are warranted separately by their respective manufacturers. KATI however will support and process any warranty terms offered by the manufacturers of the supportive components that KATI supplies as part of its systems and products when they have been used within the design limitations as set by KATI or the manufacturer. KATI will abide by the manufacturers' decision as to the acceptability of the warranty claim against their product.*

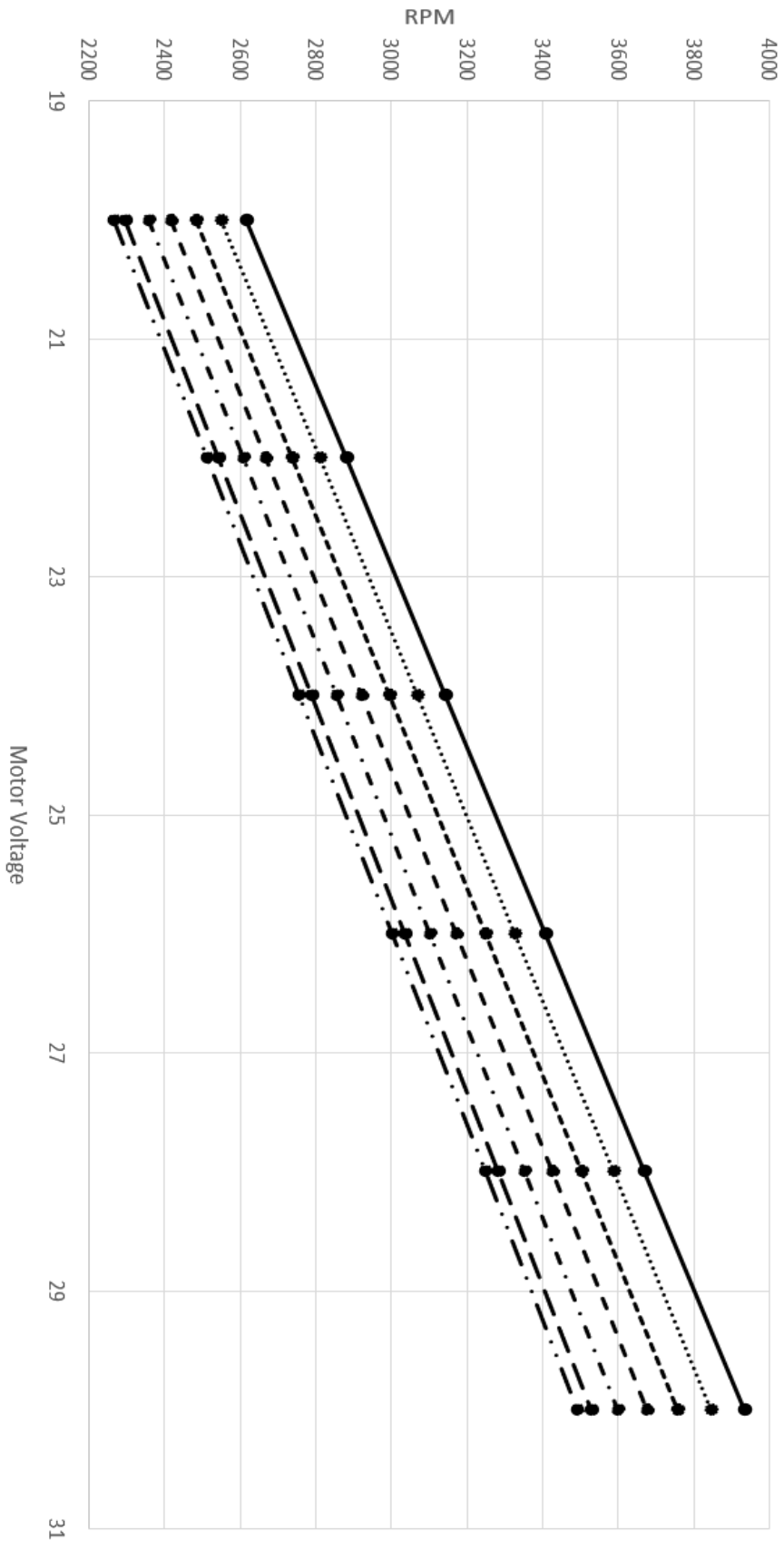
*This warranty is given by KATI and the purchaser, by acceptance of delivery and use of the product, has accepted this warranty in place of, and hereby waves all other express and implied warranties, including merchantability and fitness for particular purpose and obligation, liability, right, claim, or remedy in contract or in tort including product liability based upon strict liability or negligence actual or imputed.*

# 11.0 APPENDIX / ADDENDUM

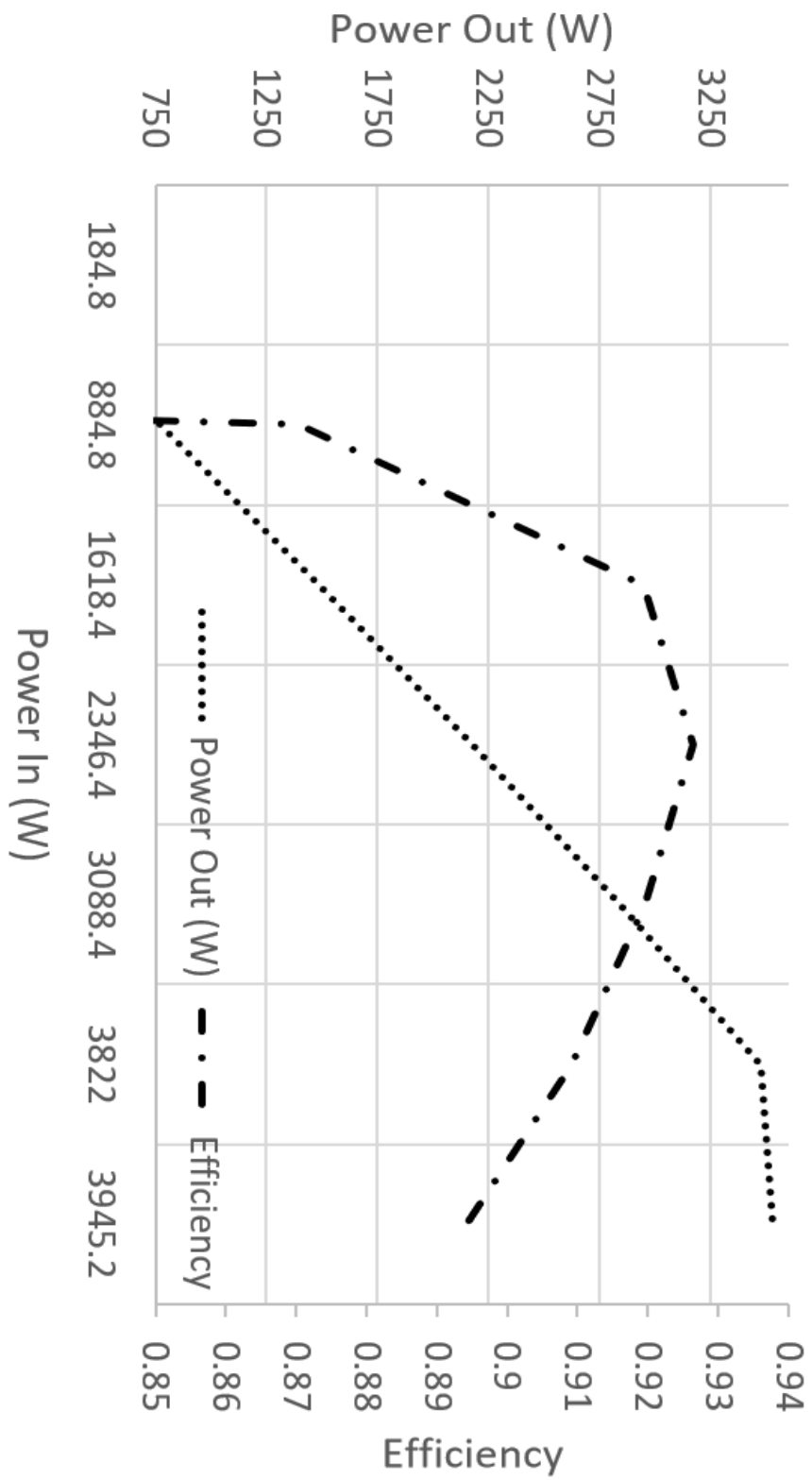
## A. PERFORMANCE DATA

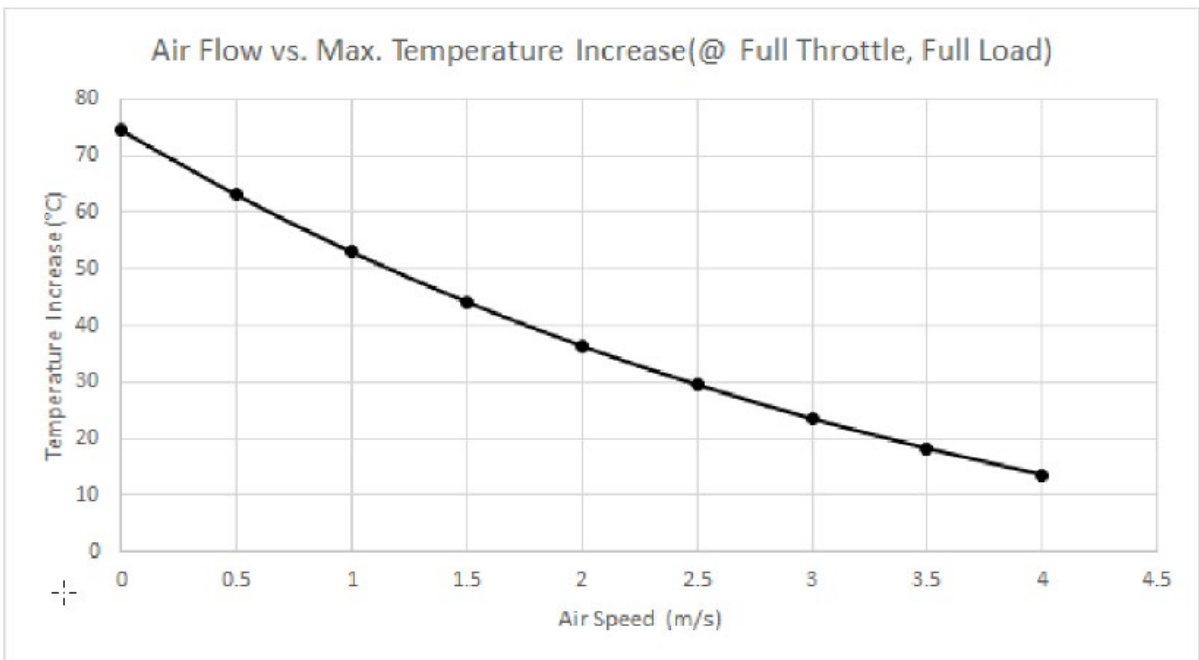
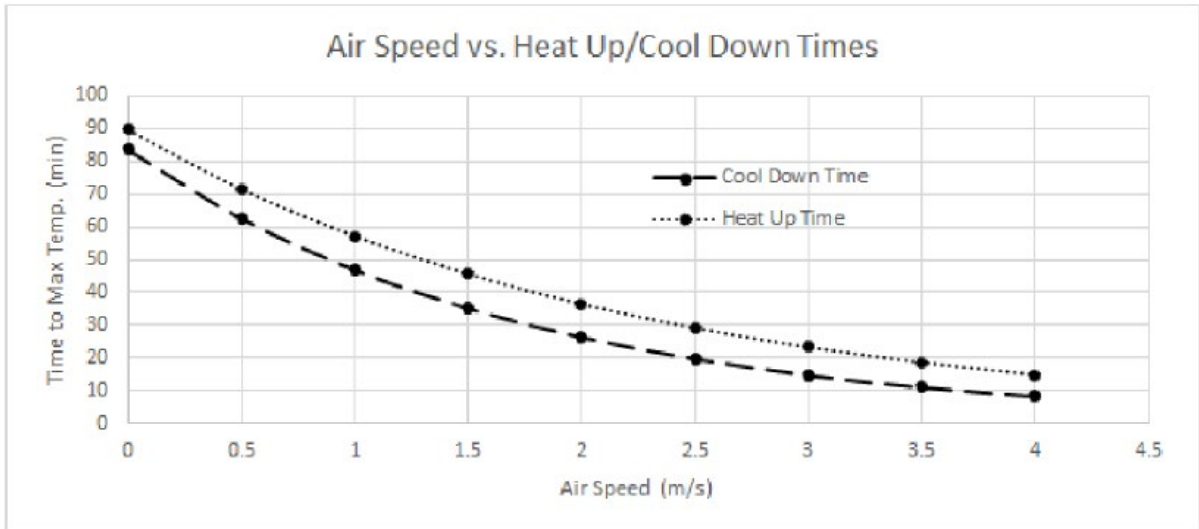


# RPM vs. Motor Voltage

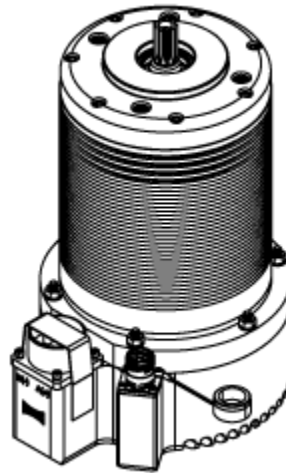


# Motor Efficiency





B. PARTS LIST: MOTOR ONLY



PART NUMBER	DESCRIPTION
42394-0000	Motor Assy, 28V BLDC, 5/8-9T Spline Shaft
92196A284	18-8 Stainless SHCS, 10-32, 3-1/2" Long
MS21043-3	10-32 Nut, Stainless
NAS1149 F 0332 R	Washer, Stainless
35214-401	End Cap Control
42394-0000	Motor Assy, 28V BLDC, 3/4" Keyed Shaft

END OF DOCUMENT

RECORD OF REVISIONS

REV LEVEL	DESCRIPTION OF CHANGES	AUTHOR	CHECKED BY	APPROVED BY	APPROVED DATE
A	Initial Release	E.Clifford			