



Artisan Technology Group is your source for quality new and certified-used/pre-owned equipment

- FAST SHIPPING AND DELIVERY
- TENS OF THOUSANDS OF IN-STOCK ITEMS
- EQUIPMENT DEMOS
- HUNDREDS OF MANUFACTURERS SUPPORTED
- LEASING/MONTHLY RENTALS
- ITAR CERTIFIED SECURE ASSET SOLUTIONS

SERVICE CENTER REPAIRS

Experienced engineers and technicians on staff at our full-service, in-house repair center

*InstraView*SM REMOTE INSPECTION

Remotely inspect equipment before purchasing with our interactive website at www.instraview.com ↗

WE BUY USED EQUIPMENT

Sell your excess, underutilized, and idle used equipment. We also offer credit for buy-backs and trade-ins. www.artisanng.com/WeBuyEquipment ↗

LOOKING FOR MORE INFORMATION?

Visit us on the web at www.artisanng.com ↗ for more information on price quotations, drivers, technical specifications, manuals, and documentation

Contact us: (888) 88-SOURCE | sales@artisanng.com | www.artisanng.com

MANUFACTURER DATA SHEET

DC Motor Control

Manufacturer:

Danfoss

Model Number:

A2000

See www.geomartin.com for additional PDF datasheets

Martin Part Number: VendorPartNumber:

E-013796-01 Danfoss # 176B6014, 1/2-HP Drive

This page is intentionally left blank



Table of Contents

Control Features	2
Control Isolation Option	3
Operating Conditions	3
Control Ratings Chart	3
Application Data	4
Installation & Wiring	5
Mounting	6
Hook-Up Diagram/Standard	7
Schematic (Block Diagram)	8-9
Start-Up Procedure	11
Set-Up Procedure	11
Recommended Fuse Chart	14
Component Location/Standard	15
Trouble Shooting Guide	16



Control Features

These features are standard on all VariSpeed A2000 DC controls:

- Power supply uses control transformer and voltage regulator.
- Full wave bridge rectifier with free-wheeling diode.
- Full or half wave field supply for shunt wound motors.
- Continuous SCR firing insures low currents and extended speed.
- Run/Stop control from switch.
- Speed controlled by 5K potentiometer or 0-10V input signal.
- May be turned on and off via line switching.
- Signal terminal strip requires no wire lugs, plugs into PC board.
- Power terminal strips with saddle clamps.
- Operates on either 50 or 60 Hertz line without adjustments.
- Short circuit protected by line fuse on PC board.
- Transient protected by metal oxide varistor.
- Status LED's for power on, run, current limit.
- Armature or tachometer feedback.
- Wide operational speed range.
- Adjustable minimum speed.
- Adjustable maximum speed.
- Adjustable current (torque) limit.
- Adjustable IR compensation.
- Adjustable acceleration.
- Adjustable deceleration.
- Packaging flexibility – Chassis, NEMA 12 (can be field installed).
- Surface mount technology – reduces size, improves performance.
- 100% factory tested for assured reliability.
- Full two (2) year replacement warranty.
- Chassis units are UL approved for U.S. and Canada.
- Available in 120V, 1/8 to 1HP units and 240V, 1/8 to 3HP units.



Isolation Option Available:

Two Isolation Options, AGAO and AGBO, are available both featuring easy plug-on assembly to the A2000. Both options allow the use of non-isolated input command signals and 7V or 20.8V/ 1000 RPM tachometer feedbacks. The AGBO Isolation Option also provides a speed follower and current limit output indication.

Operating Conditions

- Elevation – Up to 3300 feet (1000 meters) without derating
- Ambient Temperature* – Chassis: 32 -131°F (0-55°C)
– NEMA 12: 32-104°F (0-40°C)
- AC Line Voltage Variation – Rated Voltage $\pm 10\%$
- AC Line Frequency – 48 to 62 Hz

* The Ambient Temperature specification is referring to the environment surrounding the A2000 printed circuit board, not necessarily the room temperature.

Control Ratings Chart

Control Rating HP/V	Rated AC Line Amps*	Input KVA	DC Armature Voltage**	Rated Armature Current Amps	Field Voltage	Field Current Amps
0.5/120	10	1.0	0-90	6.8	50/100	1
0.75/120	15	1.5	0-90	9.6	50/100	1
1.0/120	20	2.0	0-90	12.2	50/100	1
1.0/240	10	2.0	0-180	6.1	100/200	1
1.5/240	15	2.5	0-180	8.3	100/200	1
2.0/240	20	4.0	0-180	10.8	100/200	1
3.0/240	23	5.0	0-180	16.0	100/200	1

* Does not include motor field current where used.

** 15% extended voltage capability standard.



Application Data:

- Service Factor – 1.0
- Duty – Continuous
- Overload Capability – 150% for 1 minute
- Speed Regulation – Armature Feedback
±2% Base Speed (for 95% Load Change)
– Tachometer Feedback
±1/2% Set Speed (for 95% Load Change)
- Speed Range – Armature Feedback
50:1 @ Full Torque
– Tachometer Feedback
200:1 @ Full Torque
(Continuous firing of SCR allows for extended speed where required.)
- Potentiometers – 5K Ohm, 1W potentiometer supplied with each control
- Process Signal Input – 0-10V
- Adjustments – Min. Speed (0-50% of motor base speed)
– Max. Spd. (50-100% of motor base speed)
– IR Comp. (0-25% of rated output)
– Current Lim. (10-150% of Cntrl. Rating)
– Acceleration (1/2-5 Seconds)
– Deceleration (1/2-5 Seconds)
- Isolated Input (Optional) – Full isolation of ON/OFF signal and input signal through snap-on and plug-in printed circuit board. Provided with integral Minimum Speed (0-50%) adjust and Range adjust (0-115%).
Usable signals are:
Potentiometer, 0-10VDC, 1-5VDC, 4-20mA (with external shunts)
Isolated inputs for 20.8V/1000 RPM or 7V/1000 RPM tachometer feedback.
Isolated outputs for 0-10VDC spd. follower and NPN Current Lim indication on AGBO.



Installation and Wiring

Motor overload protection must be provided by the equipment manufacturer or person installing controls per National Electrical Code (NEC) and local codes.

This equipment should be installed, adjusted and serviced by qualified electrical maintenance personnel familiar with the construction and operation of this type of equipment and the hazards involved. It is the responsibility of the equipment manufacturer or person installing the controller to take diligent care. Read all warnings and notes before proceeding to install or operate this control.

WARNING: Improper installation of motor and controller may cause equipment failure or serious personal injury. Follow instruction manual, local, state and national safety codes for proper installation. Always disconnect power to the controller before making any wiring changes or before inspecting equipment.

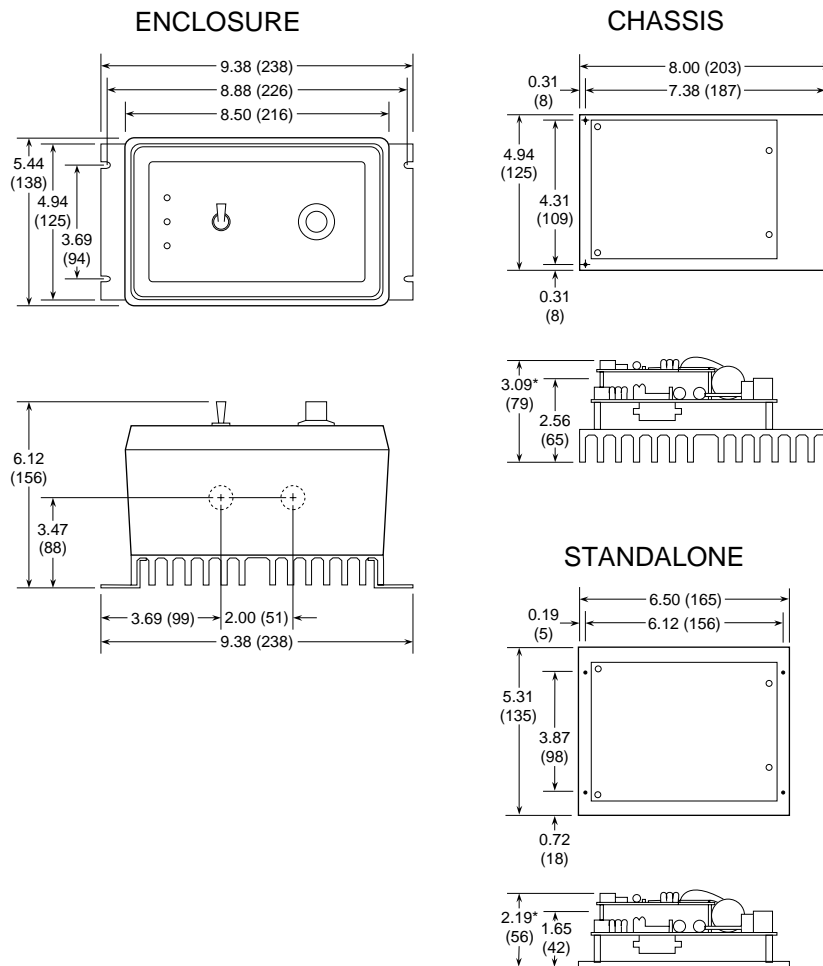
1. Shielded cable recommended but not required.
2. Be certain that a ground wire from the incoming AC power line is properly connected to the chassis ground terminal provided.
Failure to observe this precaution could result in serious injury.
NOTE: On Stand Alone units ground connection should be made at bare metal mounting hole.
3. The National Electrical Code requires a separate fused disconnect or circuit breaker be installed in the incoming AC power line. See Ratings Chart and Fuse Chart for proper sizing.
4. All components on the printed circuit board are at line potential. Extreme caution should be exercised when working on unit. Power should always be disconnected from the unit, except where required for set-up, before any work is attempted.
5. DO NOT apply AC line voltage to any terminal except L1 and L2. Failure to comply will cause permanent damage to the control.
6. Automatic restart of the control will occur if line power has been temporarily lost. Caution should be exercised under such circumstances.



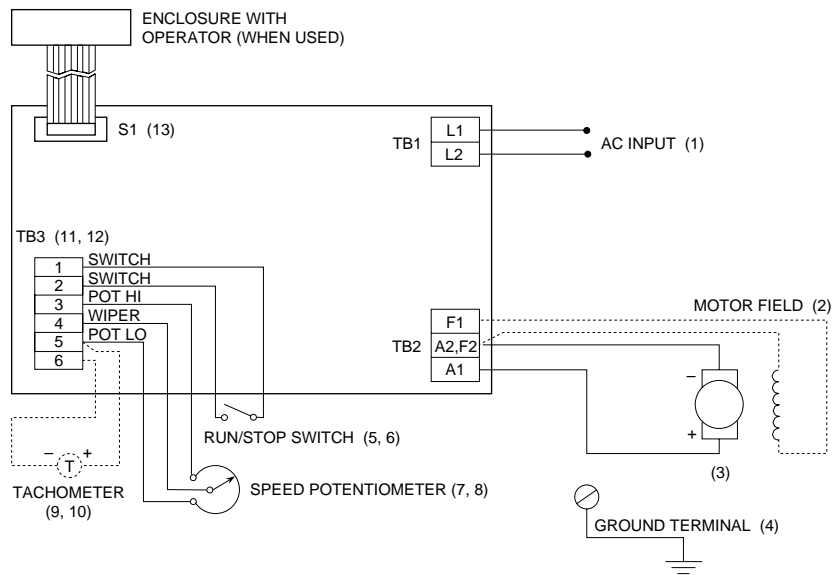
Mounting

The VariSpeed A2000 should be mounted horizontally in order to insure maximum heatsink efficiency. With plate mounted units, plate should either be mounted directly against a metal panel, or minimum of 1/2" space should be allowed between plate and mounting surface for convective cooling.

CAUTION: Over tightening cover screws can damage mountings and cover gasket. (Torque specs. 8-12 in. lbs.)



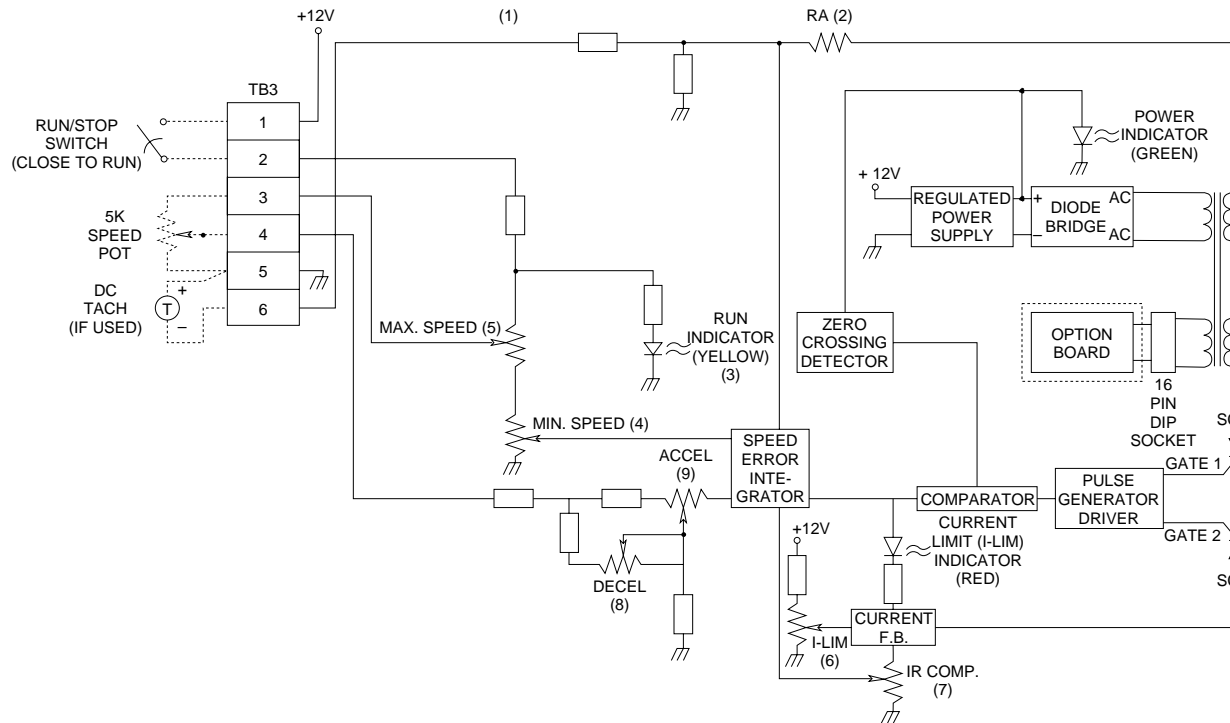
Hook-Up Diagram (Standard and Enclosed Units)



Motor overload protection must be provided by the equipment manufacturer or person installing controls per National Electrical Code.

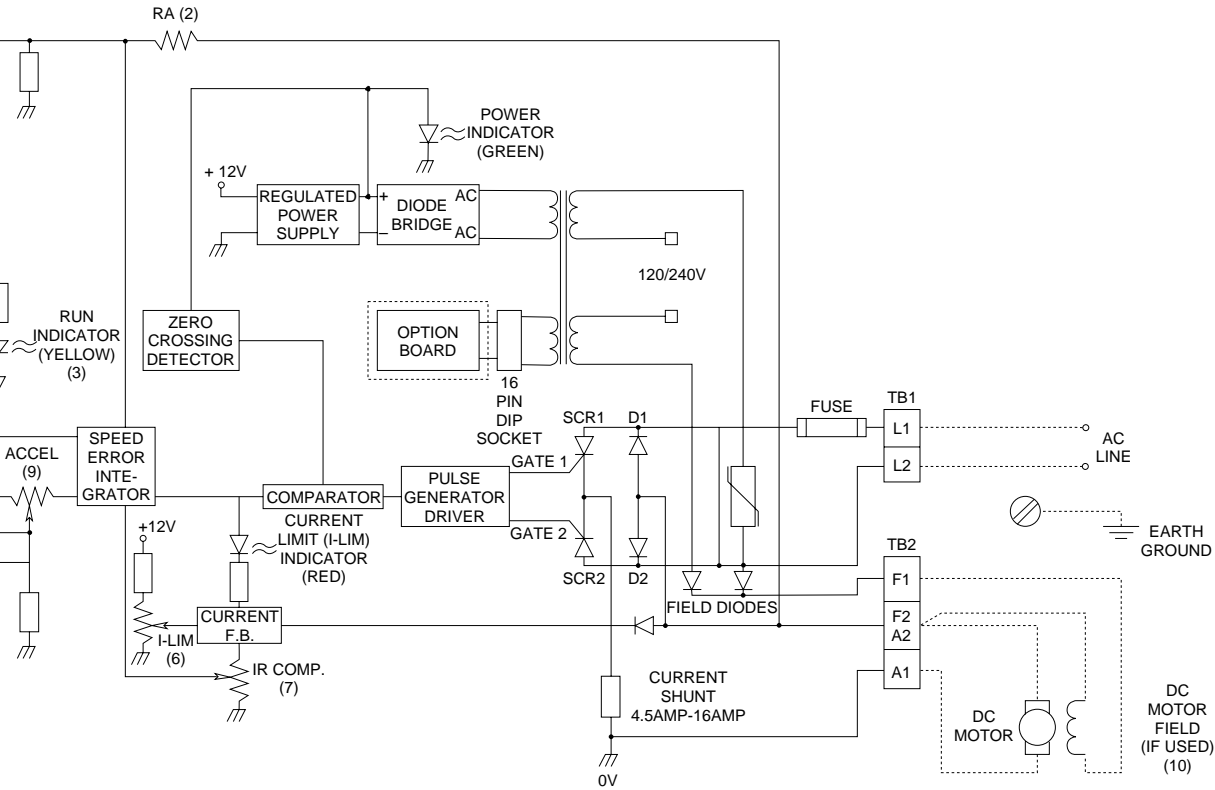
1. Refer to Rating Chart for incoming line current and KVA. It is the responsibility of the user or person installing the controller to provide branch circuit protection according to NEC and local codes. On controllers using 120 VAC input, be sure that the incoming hot lead is connected to L1 and common is connected to L2.
2. A full wave field is provided for use with shunt wound motors when required. Field voltage on 120VAC line is 100VDC. If the motor requires a 50VDC (half wave) field voltage, connect field windings from F1 to F2. Field voltage on 240VAC line is 200VDC. If the motor requires a 100VDC field, follow the procedure outlined above.

(continued on page 10)



NOTES:

1. Refer to Installation Instructions, and Hook-Up Instructions for further information.
2. Must be removed for tachometer feedback.
3. When optional isolation is used the RUN LED will light on the isolation board.
4. Factory set at 0VDC.
5. Factory set for 90VDC for 120V controllers, and 180VDC for 240V controllers.
6. Factory set for 100% of controller rating.
7. Factory set for zero compensation.
8. Factory set for 1/2 second.
9. factory set for 1/2 second.
10. If half wave field is required, connect between F1 and L2.
11. Shielded cable recommended but not required.



her information.

ation board.

controllers.



(continued from page 7)

3. Be sure that rated motor current and voltage do not exceed the ratings label on the control. If using a motor with a lower rating than the control, see Recommended Fuse chart for fuse size.
4. A chassis ground terminal has been provided to facilitate grounding of the controller.

WARNING: Be certain that a ground wire from the incoming AC power line is properly connected to the provided terminal. Failure to do this could result in serious injury, equipment failure, or both. Conduit to enclosed units cannot be used for grounding purposes since the enclosure is not metal.

5. On enclosed models, switch provided is RUN/STOP/JOG. Jog speed is determined by speed pot setting.

WARNING: RUN/STOP/JOG switch is for signal switching only. Be certain, before working on either the controller or machine, that AC power is disconnected from L1 and L2 terminals failure to do so could result in serious injury.

6. A speed potentiometer is provided with each controller (on chassis and stand alone versions a knob and dial plate is also provided) rated at 5K Ohm, 1 Watt.
7. An isolated process signal (0-10V) may be used instead of a potentiometer by connecting signal leads between terminals 4 and 5 on TB3 with positive to terminal 4.

Be sure that the signal is isolated from ground, or the control will be damaged. For signals with a grounded leg, the optional input signal isolator board must be used.

8. For those applications requiring it, tachometer feedback is provided. Tachometer should be rated for 21VDC per 1000 RPM.
9. When tach feedback is used, the RA resistor (see Component Location drawing) must be removed.
NOTE: 120VAC units have two RA resistors.
10. S1 socket is provided for use with optional enclosures with operators. Be sure that the ribbon cable is oriented as shown, or equipment failure may result.



11. The TB3 terminal strip will accept wire sizes between #16 and #24 AWG.

WARNING: All terminals of TB3 are at line potential and can be extremely hazardous. Power must be removed from unit before any wires are connected, or before terminal strip is attached or removed. Wires connected to TB3 must be isolated from ground. Failure to comply may result in injury, equipment failure, or both.

Start-up Procedure

Use caution during these procedures because line voltage will be present on the power and motor terminals as well as on the printed circuit board when the power is on.

NOTE: If, at any stage of this procedure, the control does not act as indicated, refer to Troubleshooting section.

1. With AC power off, recheck to be sure that all power and control connections are properly secured and connected according to the hook-up instructions.
2. With enclosed units, be sure that the ribbon cable from the cover is plugged into S1 on the A2000 PC board (or, if used, S3 on the Isolation Option PC board).
3. Set the speed pot to minimum speed (CCW) and place the ON/OFF switch in the OFF position.
4. Apply power to the control and confirm that the POWER ON (green) LED glows. If the LED does not glow refer to the Troubleshooting section.
5. Place ON/OFF switch in the ON position. The RUN (yellow) LED should glow, but the motor should not turn.
6. Slowly rotate speed pot in a clockwise direction. Motor should begin turning. Continue to rotate speed pot until desired motor speed is achieved.

Set-up Procedures

The VariSpeed A2000 has been set up at the factory to satisfy most application needs. You may, however, wish to tailor your control specifically to your application requirements. If so, use the following instructions for proper set-up.



NOTE: Before making any adjustments, start control and run motor fully loaded for at least 30 minutes so that motor temperature will stabilize. (Motor speed will increase as temperature increases unless tachometer feedback is used.)

Factory Settings

Min. Speed	- Zero Volts
Max. Speed	- 90VDC Output for 120VAC Line - 180VDC Output for 240VAC Line
IR Compensation	- 100% of Control Rating
Accel	- 1/2 Second
Decel	- 1/2 Second

Minimum Speed Adjust (MIN)

(Clockwise increases minimum speed)

MIN SPEED may be adjusted from 0 to 50% of motor base speed.

1. Turn speed pot fully counter-clockwise (CCW).
2. Turn MAX SPEED trimpot fully CCW.
3. Adjust MIN SPEED trimpot until desired minimum speed is set. If desired minimum speed is zero, adjust trimpot so that motor barely stops turning. (This will give the best motor speed linearity.)
NOTE: If unit will not obtain 0V output with MIN SPEED trimpot fully CCW, turn THRESHOLD trimpot CCW.
4. Reset MAX SPEED ADJUSTMENT (see below).

Maximum Speed Adjustment (MAX)

(Clockwise increases maximum speed)

MAX SPEED may be adjusted from 50% of motor base speed to approximately 115% of base speed. Caution should be taken not to exceed maximum motor nameplate speed rating.

1. With motor operating at full load, and the speed pot turned all the way to maximum, adjust the MAX SPEED trimpot until desired speed is set. (Note: Extended motor speed can be achieved with the trimpot.)
2. Check MIN SPEED adjustment, as there may be some interaction.

Current (Torque) Limit Adjust (I-LIM)

(Clockwise increases current)

I-LIM may be adjusted from 0 to 150% of control rating. There are two methods for adjusting I-LIM.



Method One:

1. Start the machine and apply maximum load to the motor, and turn I-LIM trimpot fully clockwise.
2. Turn the I-LIM trimpot counter-clockwise until the I-LIM LED (red) lights, and the machine starts to slow down.
3. Turn the I-LIM trimpot clockwise until the I-LIM LED just turns off.

Method Two:

1. Turn off AC power.
2. Lock up the motor shaft, taking care not to cause damage.
3. Connect a DC ammeter in series with the motor armature.
4. Turn I-LIM trimpot fully counter-clockwise.
5. Turn speed pot fully counter-clockwise.
6. Turn on AC power and start control (red LED should be on).
7. Turn speed pot clockwise to about 1/3 speed setting.
8. Adjust I-LIM trimpot clockwise for desired motor current.
(Do not set for current greater than either the motor or control nameplate rating.)
9. Turn off AC power, disconnect ammeter, and unlock motor shaft.

IR Compensation Adjust (IR)

(Clockwise increases compensation)

If tachometer feedback is used, be sure that this adjustment is set fully counter-clockwise (IR Compensation is never used with tachometer feedback).

This adjustment is provided to overcome the motor's natural tendency to slow down with increasing load. If improved load/speed performance is required, this adjustment may be used.

NOTE: In order to optimize performance with this adjustment, some means of determining motor shaft speed is required. (i.e., hand held tachometer).

1. Set motor speed to 1/2 of base speed rating.
2. Load motor to 100% nameplate rating.
3. Turn IR clockwise until motor returns to original unloaded RPM.
4. Turn off load and notice if RPM increases beyond original setting.
If so, adjust trimpot while changing from no load to full load to give minimum RPM change for each.

NOTE: Setting IR adjust too high can create motor instability, Turn IR pot counter-clock wise until motor speed stability is achieved.



Acceleration (ACCEL) / Deceleration DECEL Adjustments

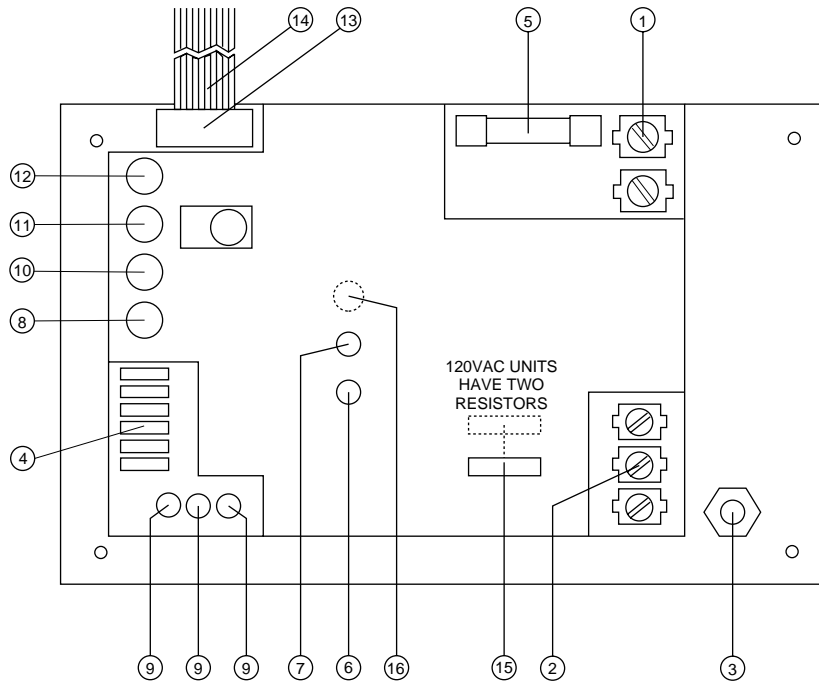
Set these two trim pots for desired times. Both ACCEL and DECEL trim pots adjust from 1/2 to 5 seconds. Acceleration time may be extended with I-LIM if reflected inertia is high. DECEL may be longer if reflected inertia is high.

Recommended AC Line Protection (Fuse Chart)

AC Line Voltage	Motor Horsepower	Dual Element Fuse Amps
120	1/8	2.5
	1/4	4
	1/3	5
	1/2	10
	3/4	15
	1	20
240	1/8	1.5
	1/4	2
	1/3	2.5
	1/2	4
	3/4	5
	1	10
	1-1/2	15
	2	20
	3	25

240VAC line requires protection in both AC lines

Component Location



- | | |
|--------------------------------|--------------------------|
| ① Input (Line) Terminals | ⑨ Indicator LED's |
| ② Output (Motor) Terminals | ⑩ IR Compensation Adjust |
| ③ Chassis Ground Terminal | ⑪ Acceleration Adjust |
| ④ Control Terminal Strip | ⑫ Deceleration Adjust |
| ⑤ Input (Line Fuse) | ⑬ S1 Socket |
| ⑥ Minimum Speed Adjust | ⑭ Enclosure Ribbon cable |
| ⑦ Maximum Speed Adjust | ⑮ RA Resistor(s) |
| ⑧ Current Limit (I-LIM) Adjust | ⑯ Threshold Adjustment |



Troubleshooting Guide

Motor Will Not Run:

1. Make sure power LED is lit. If not, make sure disconnect fuses or circuit breaker in line are okay.
2. Check line fuse. If open, replace (see Fuse Chart).
3. Make sure RUN switch is on (RUN LED should be lit).
4. Be sure speed pot is not set to zero.
5. Unit is in current (torque limit). Check I-LIM LED (if lit, this indicates that I-LIM pot is set too low, or motor is overloaded).
6. With power removed from unit and motor leads disconnected, check for worn or improperly seated brushes.
7. Defective control.

Fuse Blowing:

1. Improper wiring
2. Motor brushes worn or improperly seated.
3. Motor load is too heavy. Check for machine "jam-up", or excessive load.
4. Defective control.

No Speed Control:

1. Speed pot or wiring defective.
2. Control not set up properly (see Set-up Procedures).
3. Defective control.

Motor Will Not Run at 1725 RPM:

1. Improper setting of MAX speed trim pot (Range trim pot with isolated units). Rotate trim pot clockwise to increase speed.
2. Unit is in current (torque) limit. Check I-LIM LED (if lit, this indicates that I-LIM pot is set too low, or motor is overloaded).
3. Low line voltage.

If additional assistance is required, please contact your local distributor, manufacturer's representative, or the factory by calling 1-800-432-6367.



Artisan Technology Group is your source for quality new and certified-used/pre-owned equipment

- FAST SHIPPING AND DELIVERY
- TENS OF THOUSANDS OF IN-STOCK ITEMS
- EQUIPMENT DEMOS
- HUNDREDS OF MANUFACTURERS SUPPORTED
- LEASING/MONTHLY RENTALS
- ITAR CERTIFIED SECURE ASSET SOLUTIONS

SERVICE CENTER REPAIRS

Experienced engineers and technicians on staff at our full-service, in-house repair center

*InstraView*SM REMOTE INSPECTION

Remotely inspect equipment before purchasing with our interactive website at www.instraview.com ↗

WE BUY USED EQUIPMENT

Sell your excess, underutilized, and idle used equipment. We also offer credit for buy-backs and trade-ins. www.artisanng.com/WeBuyEquipment ↗

LOOKING FOR MORE INFORMATION?

Visit us on the web at www.artisanng.com ↗ for more information on price quotations, drivers, technical specifications, manuals, and documentation

Contact us: (888) 88-SOURCE | sales@artisanng.com | www.artisanng.com