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MOTORTRONICS™

Solid State AC Motor Control

ABC Series

10 to 1000 Amp Models
Electronic Motor Brake

INSTALLATION & OPERATION MANUAL



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REV 11/13/12

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Your Role in Product Safety

This equipment is designed and manufactured to the highest standards to provide safe and reliable operation for its intended use. Only qualified personnel should install, maintain, and service this equipment, and only after reading and fully understanding all of the information in this manual. All instructions should be strictly followed. All Warnings, Cautions, and Notes must be taken into account for your particular installation. Users should consult Motortronics or a Motortronics distributor/service center if there are any questions.

All installation instructions may be superseded by applicable local, regional, or national electrical codes. Drawings, application information, and technical representations included in this manual are for typical installations, and should not in any way be considered specific to your application or conditions. Consult Motortronics for supplemental information if necessary.

Contents of this manual are believed to be correct at the time of printing. In following with our on-going commitment to meeting customer needs and developing our products to suit them, Motortronics reserves the right to change specifications of this product and/or the contents of this manual without notice. As a result, supplemental data sheets and/or drawings may be associated with this equipment. Please contact Motortronics and have the unit serial number available if you notice conflicts with what is depicted in the manual and what is installed in the field.

Phasetronics (dba Motortronics) accepts no liability for any consequences resulting from inappropriate, negligent, or incorrect installation, application, adjustment, or maintenance of this equipment.

Notice Label Explanation:



WARNING!
Warning labels such as this denotes specific concerns for life/ safety/damage issues associated with this area of the manual. These statements are intended to be followed without exception.



CAUTION!
Caution labels are intended to alert the user to specific issues that MAY cause damage or personnel risks under circumstances as described. These items are critical in some installations but not all. The user is responsible for identifying the applicable installation issues.

NOTE: Notice labels are intended to alert the user to issues that require particular attention with regard to the proper use and long term reliability of the equipment.

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1 About the Motortronics ABC Series

1.1 General

The ABC Series is a solid state DC injection brake for stopping three- phase AC induction motors. This full-wave DC brake design offers smooth, low peak level braking for quiet, steady operation and optimal performance. Designed to handle even high inertia loads, the ABC Series eliminates costly and potentially dangerous "coast-to- stop" times. A built-in microprocessor provides system supervision that includes digital timing control for jogging and braking.

The integral Operator Interface Module provides LED indication of the unit's operating status and easy adjustments for quick setup. Standard features include interlocks and mechanical brake release relays, a brake disable input and zero speed sensing with override. Installation involves simply wiring the device into the motor's starter circuit, which allows it to operate in parallel with the starter.

1.2 Theory of Operation

Incoming AC power is fed to terminals L1 and L2 directly from the line side of the motor starter terminals and is converted to DC within the ABC Series. Once the motor starter has been turned off (opened) and the residual energy in the motor has dissipated, the DC current from the ABC Series is applied (injected) to starter terminals T1 and T2 respectively. This creates a stationary magnetic field in the AC motor stator windings.

The braking torque will increase in proportion to the amount of current allowed to flow. The rotor continuously attempts to pull into alignment with this stationary field. This creates braking action which brings the load to a stop faster than if it coasted to a stop.

1.3 Brake Sizing and Selection

ABC Series brakes are suitable for use in most AC motor applications where coast-to-stop times are undesirable or unacceptable. The ABC Series is a current controlling brake, so various sizes of brake units can be applied to various motor sizes. Because DC injection means applying power to the AC motor after turning it "Off", motor heating (although minimal) will continue during the braking cycle and should be considered when selecting the motor. AC motor manufacturers recommend that each braking cycle over 100% FLA be considered as an additional starting cycle when calculating the starts- per-hour ratings for the selected motor.

If the selected ABC Series is sized to deliver 200% of motor rated current, consider each brake cycle to be 2 start cycles for these calculations (and 300% FLA = 3 "starts" per brake). Never size any DC injection brake to exceed 400% of the motor nameplate FLA without first consulting the motor manufacturer. Additional guidelines for applying ABC Series brakes follow:

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1.3.1 Standard Duty Sizing

Applying an ABC Series brake that is rated for ≤115% of the FLA (Full Load Amp) rating of the motor allows maximum length of braking time without exceeding the thermal capacity of the stator windings. Since current is controlled by the ABC Series throughout the braking cycle, braking torque will vary as the motor circuit impedance decreases with speed. Braking torque will be highest at the beginning of the cycle, and can be as much as 100% of the FLT (Full Load Torque) when set to motor FLA.

As the motor slows, the braking torque slowly decreases, reducing the mechanical stresses as much as possible. Sizing a brake in this manner is typically good for machine tools, saws, conveyors, lumber machinery, and most chippers where the coast-to-stop time does not exceed 5 minutes. Stop times vary greatly with load and friction, but can be expected to be 1/2 of the coast-to-stop time or less. Keep in mind that the maximum brake time is setting is 127 seconds. In heavily loaded, high inertia machines and long coast-to-stop times, the Standard Duty model may not stop the load. Consider using the Extra Duty rating instead.

1.3.2 Extra Duty Sizing

For heavier machine loads such as large chippers, punch presses and other flywheel based machines, selecting an ABC Series brake based on 200-250% of the motor nameplate FLA allows faster braking. The maximum developed braking torque can be as much as 200% of the motor rated Full Load Torque. In this case, the load can typically stop in twice the Across-the-Line starting time. Duty cycling of the motor is a much more important consideration in applications since additional thermal stresses due to higher current levels are applied to the motor.

1.3.3 Custom Sizing

Extreme loads (such as overhauling conveyors or large centrifuges), or short stop times (approaching the across-the-line starting time of the motor) may require sizing the ABC Series for 300% of the motor FLA or greater, and should be done with careful consideration of motor heating, duty cycle, and limitations of mechanical stress on the drive train components.

1.3.4 Emergency Stopping

An ABC Series brake used in conjunction with a mechanical brake can be considered if the stop times must be equal to or shorter than the across-the-line start time. Consider using and ABC Series brake in conjunction with a mechanical brake.

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1.4 Applications

The ABC Series electronic brake is ideal for machine and process equipment control applications. Benefits include, improved efficiency, increased safety, and reduced equipment maintenance costs.

Efficiency is improved because you no longer have to wait through long coast-to-stop times for blade changes, batch loading, or maintenance shutdowns. Productive time increases while overall operating costs decrease because the load stops much sooner. The ABC Series eliminates the common and dangerous practice of jamming the load to a stop which seriously reduces the life and effectiveness of saw blades, molding heads, and knives.

Safety is improved by eliminating the need to "jam-stop" equipment. This will prevent personnel injuries caused by kickbacks and broken blades. Use the ABC Series in conjunction with safety inter- lock devices to stop the motor as quickly as possible, reducing the risk of contact with dangerous machine elements. Prevent premature wear or component failure and eliminate the need for hasty repairs that can put maintenance personnel in potentially dangerous situations.

Reduce maintenance costs by using the ABC Series. The ABC series brakes can eliminate the need to plug-reverse a load and the associated damage to gear boxes and other power train components. The ABC Series can be used to stop or slow down the load in one direction before reversing to the other. On machines where mechanical brakes are used to stop or hold a load, use the ABC Series to stop it first, then set the mechanical brake as a "parking brake". This eliminates the normal wear and tear to the brake pads or shoes. On loads such as vibrating feeders, screens, or separators, damage from mechanical resonance that occur during coast-down can be eliminated by using an ABC Series. By not allowing the system to coast to a stop, the motor/load quickly pass through any dangerous speeds where resonance can occur and come to a controlled stop.

1.5 Where Mechanical Brakes should be used

Power loss during braking - The ABC Series, like all DC injection brakes, requires power to be applied during the braking cycle. If the incoming line power is lost, an upstream circuit protective device trips, or an emergency shutdown is initiated, no braking will take place. If braking is still necessary for safety reasons (even in the event of a power failure), consider using mechanical brakes as a backup device. Under normal operation conditions, the ABC Series stops the load and the mechanical brake holds it.

Regarding holding the load after it comes to a stop - All DC injection brakes inherently lose braking torque when the motor comes to a complete stop and therefore ***CANNOT BE USED AS HOLDING BRAKE***. If braking must be applied continuously while the load is at rest, mechanical "Parking Brakes" are required. The ABC Series includes a Mechanical Brake Release Relay to facilitate proper coordination of the mechanical brake in these applications.

Stop times shorter than start times - Like all DC injection brakes, the ABC Series waits for the residual motor energy to dissipate from the windings before DC current can be applied (otherwise damage to the brake or circuit devices may occur). The length of this "wait state" depends on the motor's residual magnetism and the motor frame size, but can be several seconds. This, combined with the limits on braking torque, makes DC injection braking ineffective if braking time must be shorter than the starting time (Across-the-Line).



WARNING!
DC Injection brakes cannot be used for holding a load after it comes to a stop. The ABC Series includes a Mechanical Brake Release Relay that can be used to coordinate the operation of a mechanical brake for use in these applications.

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1.6 ABC Series Model Number, Rating and Dimensions

ABC - 200 - [ ] - E

Max. Brake Amps
10 – 1000 A.

Voltage
240 = 208 – 240V, ***400*** = 380 – 415V
480 = 440 – 480V, ***600*** = 575 – 600V

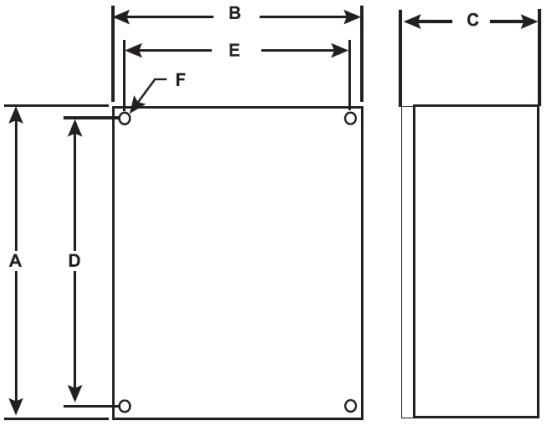
Enclosure
P = Panel Mount
E = NEMA 4/12 Sealed

ABC SERIES											
Model Number*	Max Amps	Typical Horsepower Usage								Dimensions	
		208 V		240V		480V		600V		Panel Dim Ref.#	NEMA 4/12 Dim Ref. #
		Std. Duty	Extra Duty	Std. Duty	Extra Duty	Std. Duty	Extra Duty	Std. Duty	Extra Duty		
ABC-10	**10**	5	5	10	5	15	10	25	10	2	7
ABC-24	**24**	10	5	15	7.5	20	15	30	20	2	7
ABC-50	**50**	15	7.5	20	10	40	25	50	30	2	7
ABC-100	**100**	30	20	40	25	75	50	100	60	2	7
ABC-200	**200**	75	40	75	50	150	100	200	125	3	8
ABC-300	**300**	100	60	125	75	250	150	300	200	4	9
ABC-400	**400**	150	75	150	100	350	200	400	250	4	9
ABC-550	**550**	250	125	200	150	500	300	600	350	5	10
ABC -800	**800**	350	200	350	200	700	450	900	500	5	10
ABC-1000	**1000**	400	250	400	300	900	500	1000	600	5	10

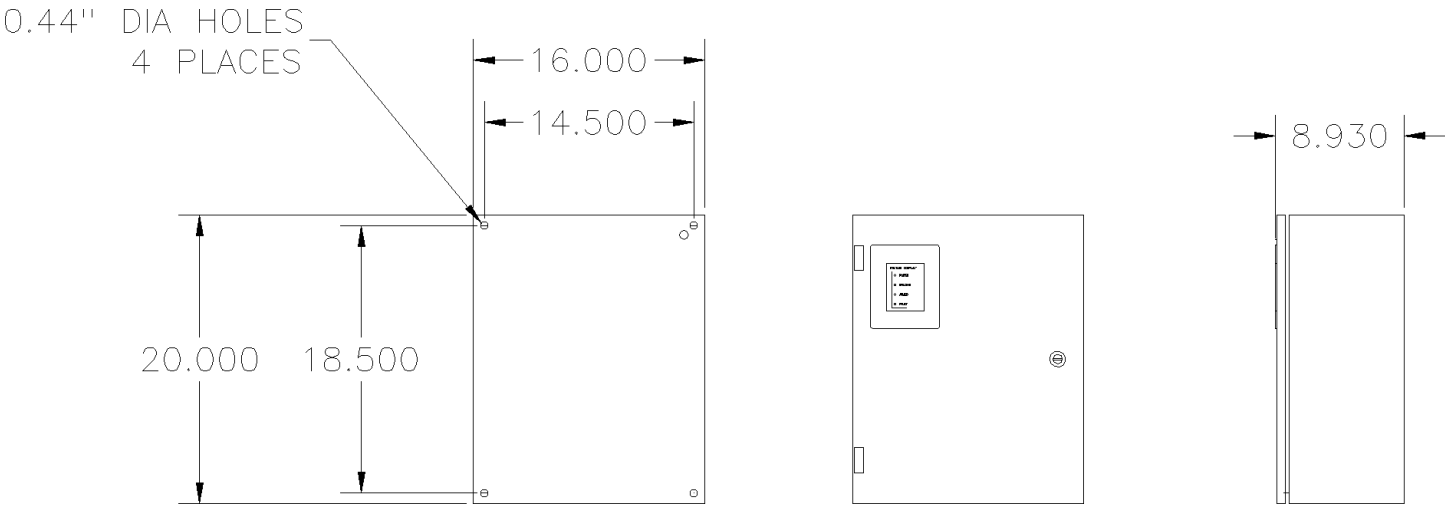
NOTES:

1. Never exceed the Full Load Amp rating of the motor without checking the motor manufacturer's data with regards to appropriateness of the application and duty cycle.
2. If duty cycle is not known, Motortronics recommends using the Extra Duty Brake since braking current can be adjusted down to meet the actual load requirements.

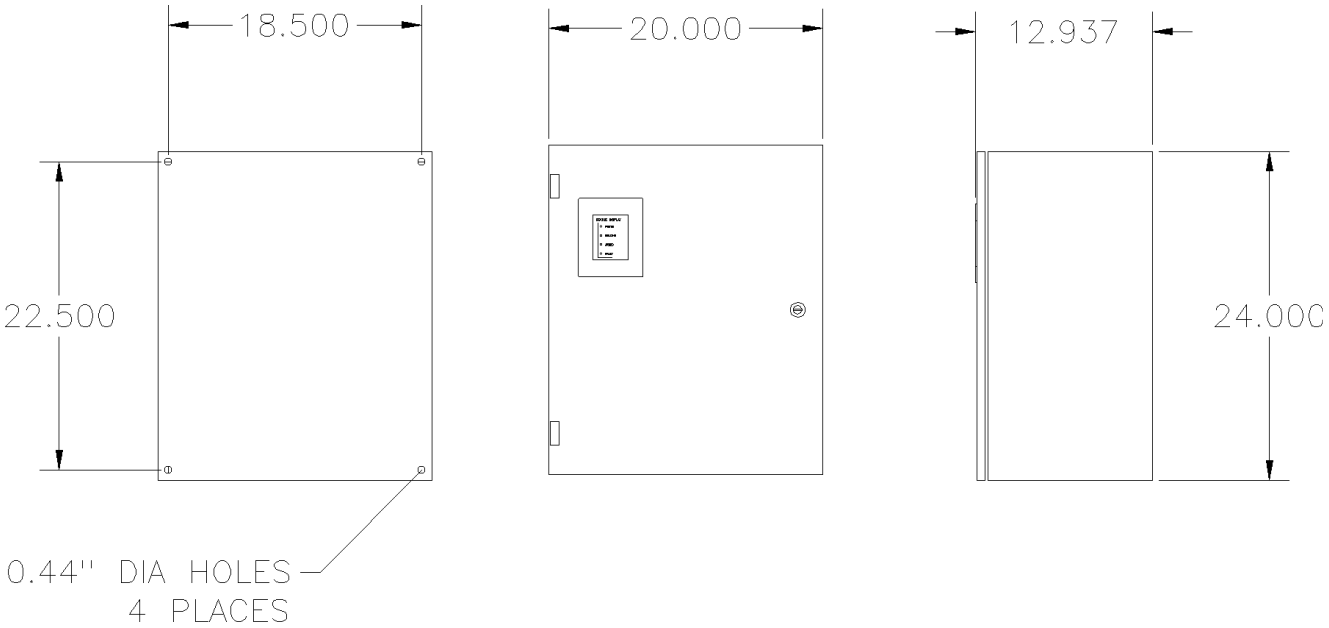
Dim Ref. #	Dimensions (Inches)					
	A	B	C	D	E	F
2	10.5	7.9	7.2	10	6.8	0.21
3	16.5	10	10	15.9	9	0.28
4	16	16	10	15	15	0.5
5	21	26	10.4	20	25	0.5
6	16	12	9	14.5	10.5	0.5
7	20	16	9	18.5	14.5	0.5
8	24	20	16	22.5	18.5	0.5
9	36	24	16	34.5	22.5	0.5
10	36	30	16	34.5	28.5	0.5



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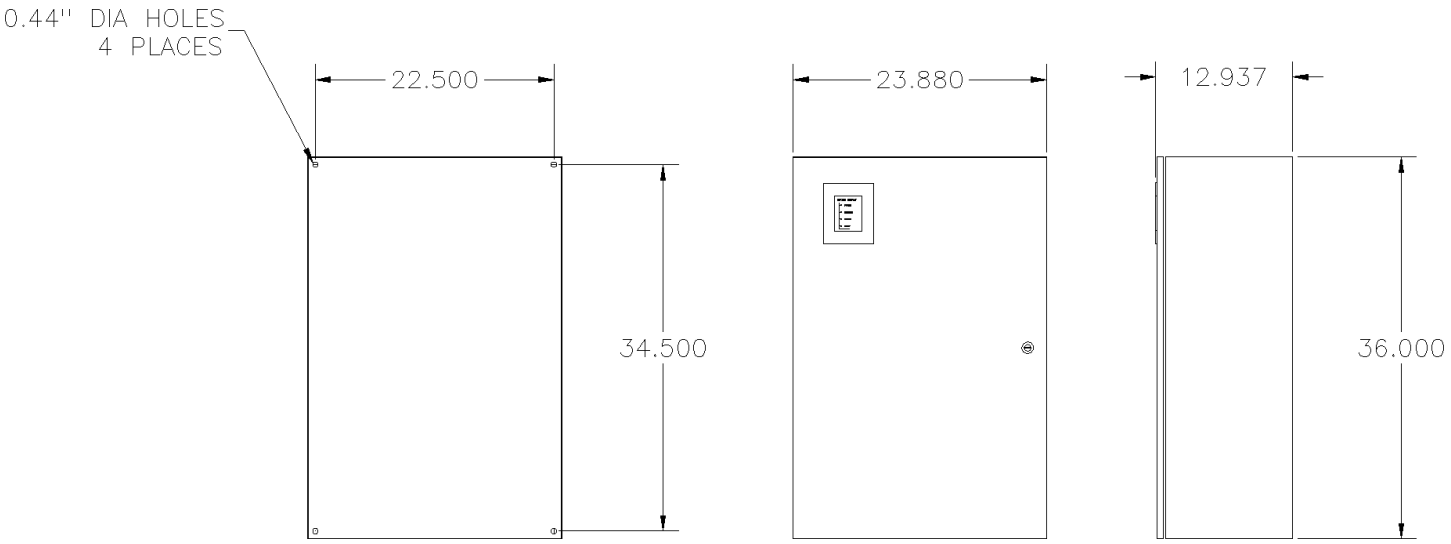


N4/12 Outline: ABC-10/24/50/100-E

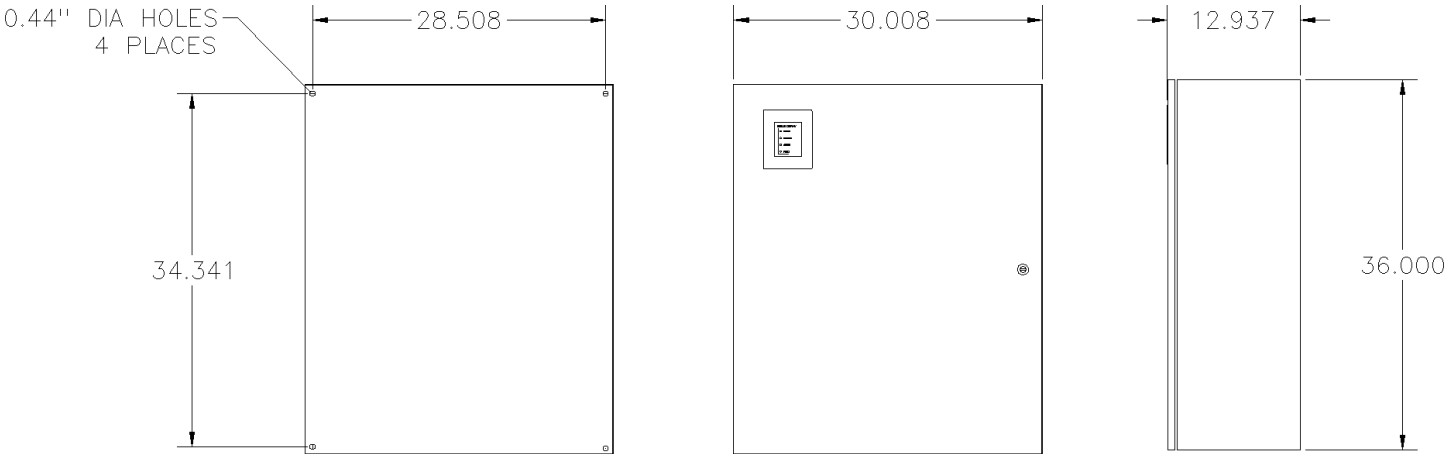


N4/12 Outline: ABC-200-E

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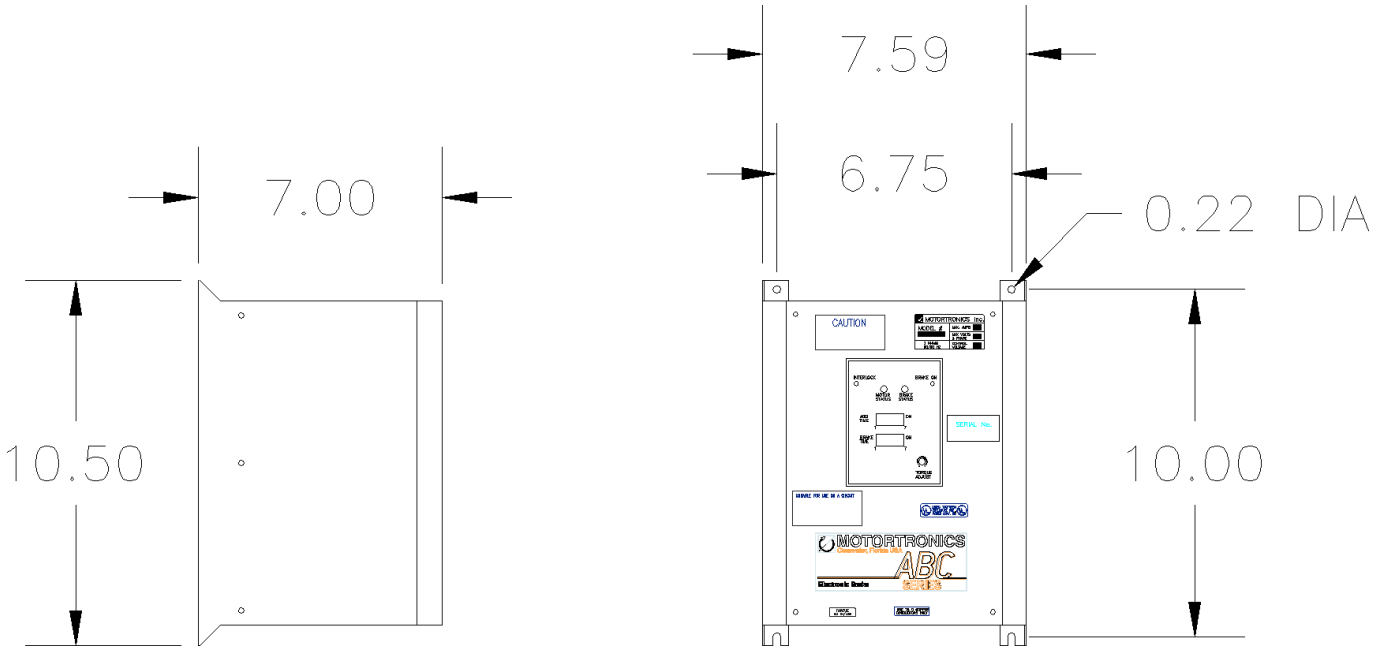


N4/12 Outline: ABC-300/400-E

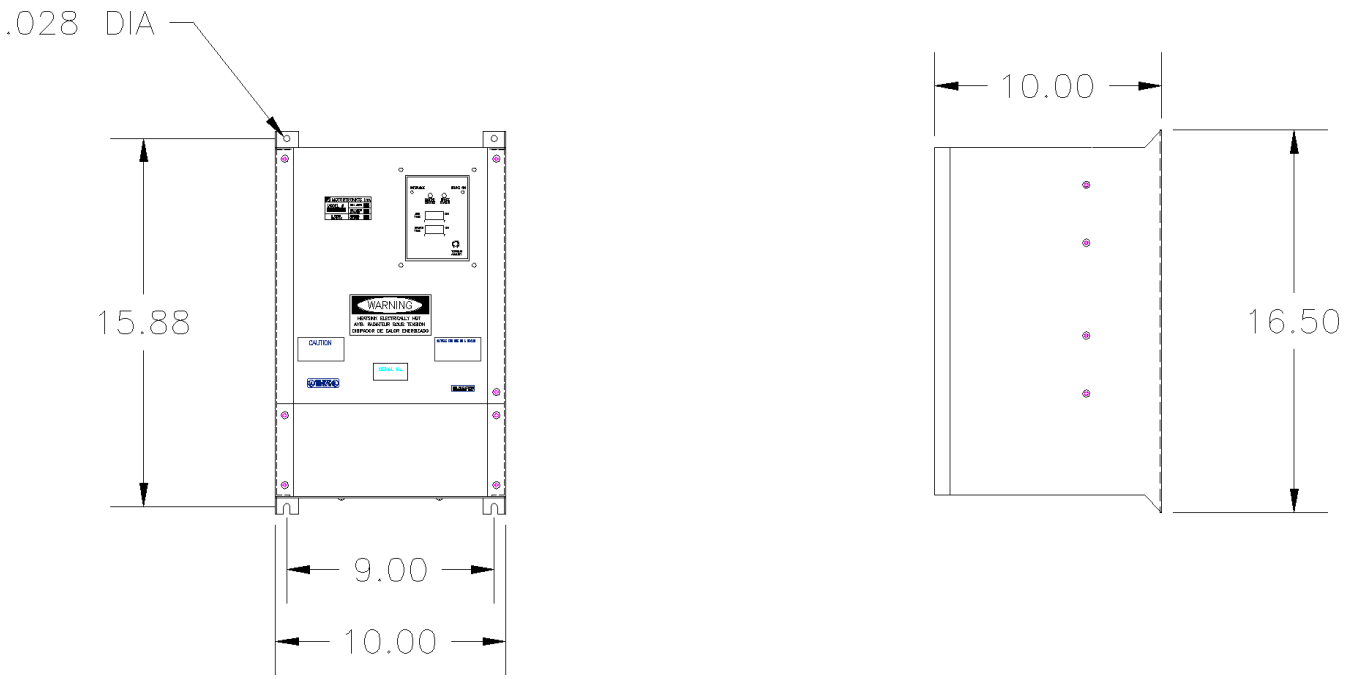


N4/12 Outline: ABC-550/800-E

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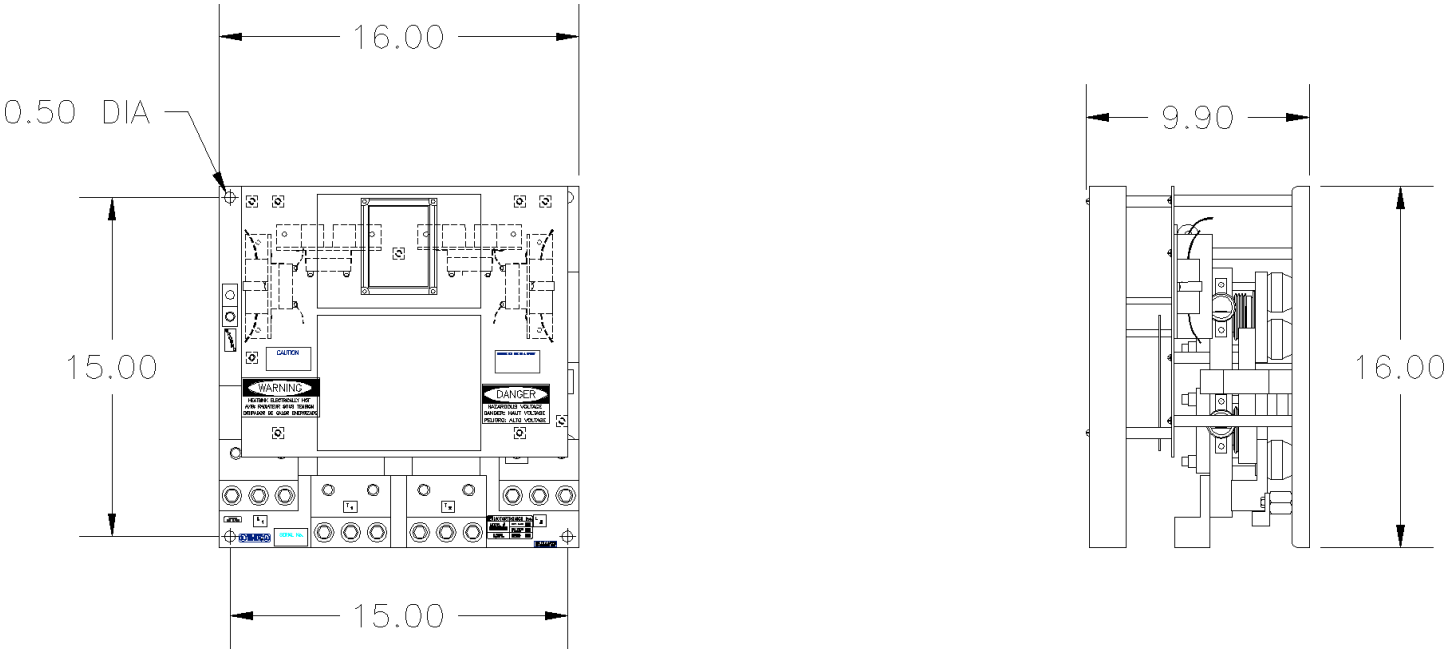


Panels Outline: ABC-10/24/50/100

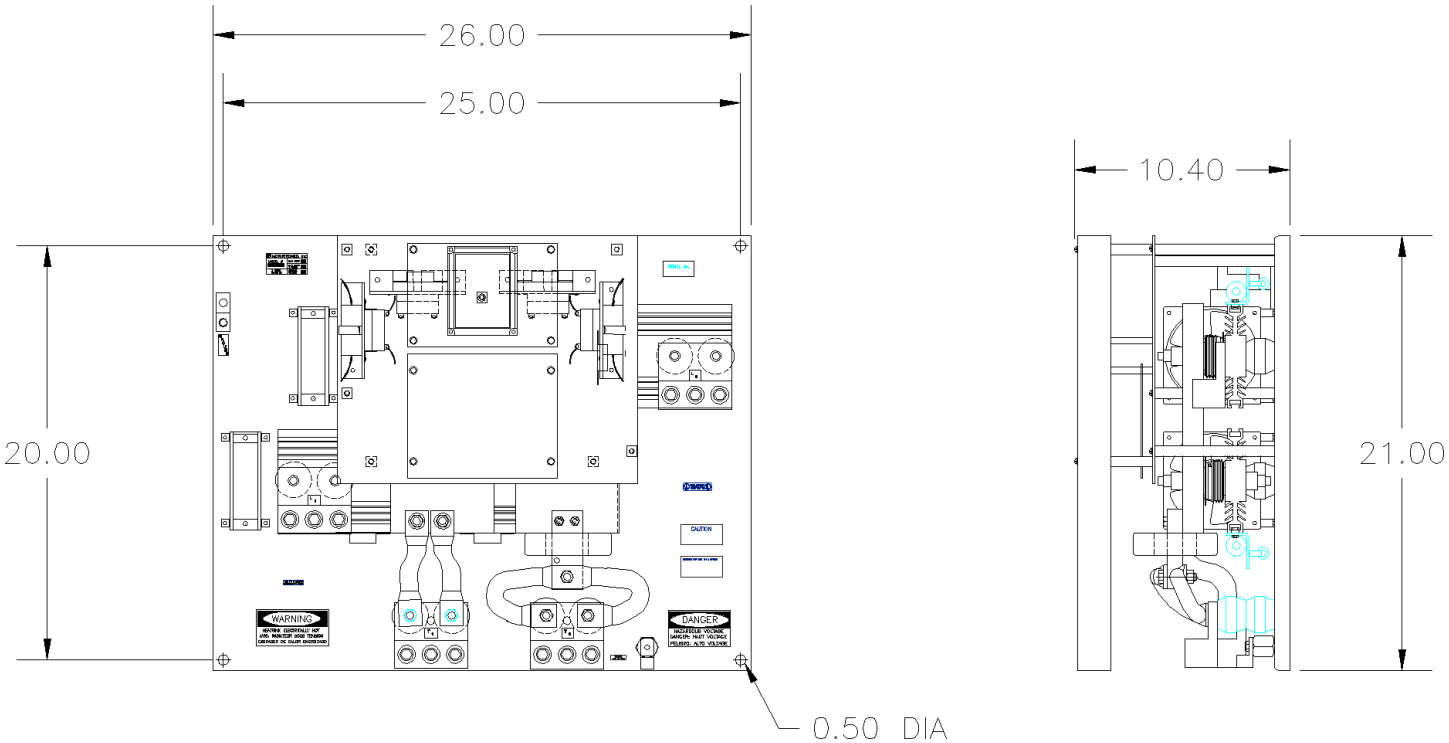


Panels Outline: ABC-200

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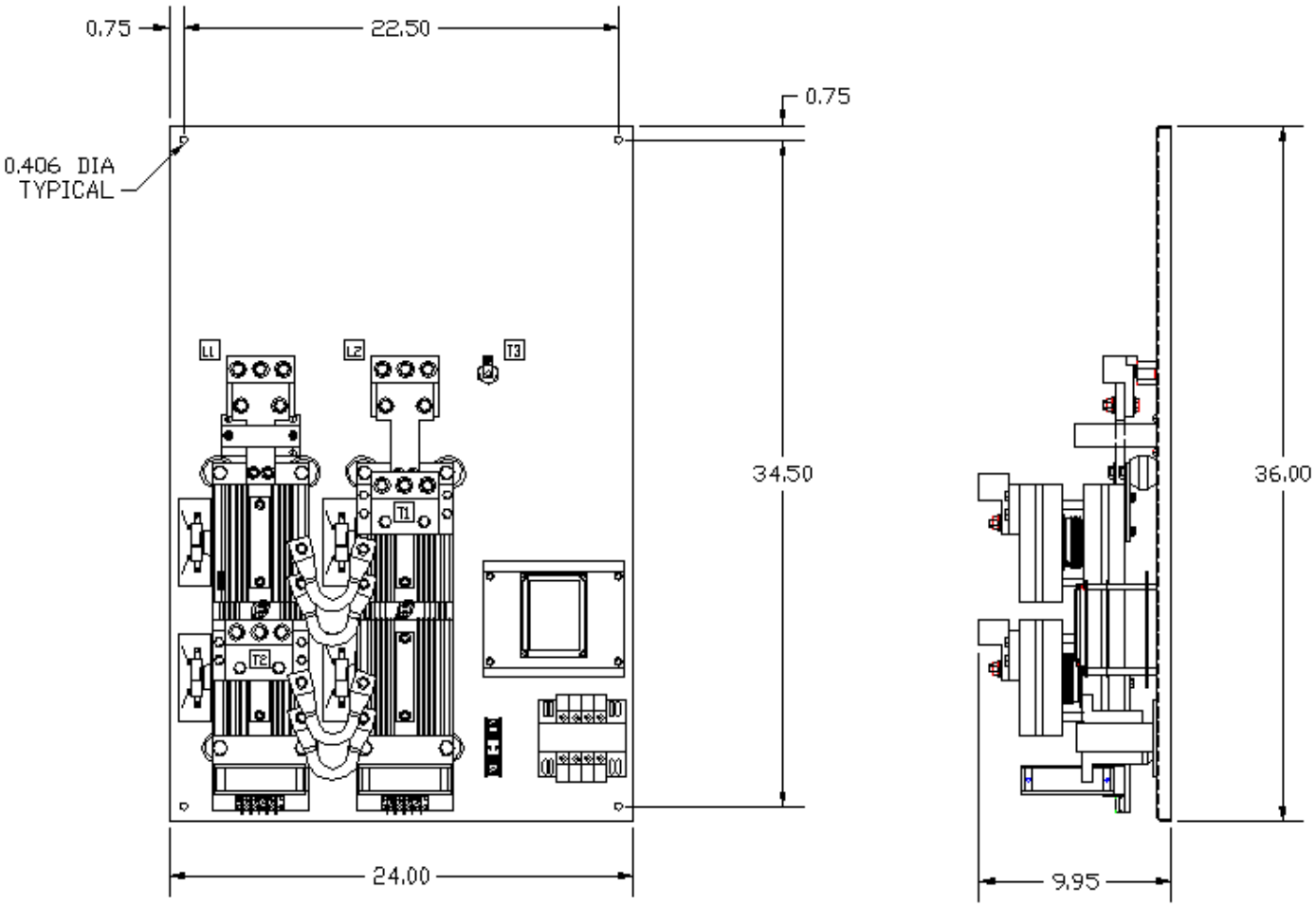


Panels Outline: ABC-300/400



Panels Outline: ABC-550/800

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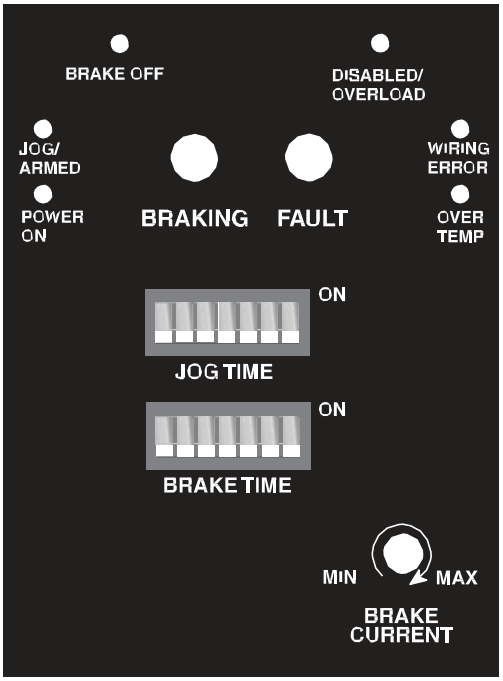
Panels Outline: ABC-1000

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2 Operation

2.1 Sequence of Operation

The ABC Series brake becomes "Armed" when the motor starter turns "On" and then braking occurs when the starter is turned "Off". An Operator Interface Module has two large LEDs to indicate "Braking" or "Fault" condition, plus six smaller LEDs to indicate the following modes of operation:



2.1.1 "Power On"

The ABC Series brake is self-powered from the available motor branch circuit from Terminals L1 and L2. If fuses are used, this LED will indicate a blown fuse condition in either of these circuits by being off when power is applied to the starter (see section 4.2.1). This LED does **NOT** indicate motor starter or ABC Series brake unit operational status.

2.1.2 Jog / Armed

The ABC Series monitors an input wired to the motor starter which indicates the starter status (see section 4.3.1). The ABC Series can be programmed to wait a specific amount of motor run time before going into the "Armed" mode by using the "Jog" feature. This feature allows for user setup and testing of systems during the jog time without the braking cycle interfering. (The "Jog" time is set via the "Jog Time" dip switches.) This LED will flash once per second until the end of the jog time. If the Motor Starter is turned off while the ABC Series is still in the "Jog" mode, the brake will **NOT** arm and DC injection will not take place (setting this time to zero will turn off this feature). If the motor is run longer than the "Jog Time" and the "Jog Time" expires, the ABC Series will enter the "Armed" mode (indicated when the JOG/ARMED LED illuminates in a steady state). The ABC Series is now ready to begin DC injection braking the next time the motor starter is turned off. The "Armed" mode has no time limit and will be maintained for the duration of the motor run time.

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2.1.3 "Braking"

After the ABC is "Armed" and the motor starter is given a STOP Commend, the ABC Series will enter the "Braking" mode (see "JOG / ARMED" above). To prevent damaging current spikes, the ABC monitors the motor until the stator magnetic field decays before DC is applied (see section 5.1). Immediately upon the motor starter opening and throughout the "BRAKING" mode, a set of N.C. interlock contacts change state (open) and disable the motor starter control circuit during the braking cycle (see section 4.2.2).

The ABC Series begins injecting a True RMS regulated DC braking current and simultaneously digitally times, controls the Interlock Relay and monitors the Zero Speed Sense Circuit. Braking will continue until the first one of three events occurs: 1) the Zero Speed Sense circuit determines the motor has stopped, 2) the "Brake Time" expires, or 3) the unit receives a "Brake Disable" signal input. When braking is complete, the ABC Series releases the Interlock Relay and enters the "Brake Off" mode ready for another cycle.

2.1.4 Brake OFF

This LED illuminates whenever the ABC Series is not actively braking (either because the motor is on or the previous braking cycle has been completed). The ABC Series provides a built-in, closed-loop sensing circuit that accurately determines when the motor has stopped based on the subtle signals received from the unused motor winding. If the Zero Speed Sensing circuit determines that the motor has come to a stop before the Brake Time has expired, it will override the brake time setting and shut the ABC Series off. The "BRAKE OFF" LED will then illuminate. NOTE: Since the Brake Time may expire prior to the Zero Speed override coming into play, this circuit should not be used as a true Zero Speed indicator.



WARNING!
The ABC Series DC Injection Brake requires AC power for braking. Power loss before or during braking will result in the loss of braking ability, which can be hazardous to personnel and/or equipment. If braking to a stop is critical regardless of the availability of electrical power, mechanical braking should be provided as a backup system. The ABC Series brake offers a Mechanical Brake Release Relay specifically for this purpose.

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2.2 Fault Conditions

The “FAULT” LED will illuminate when any of the following conditions occur:

2.2.1 “Disabled”

The "DISABLED" mode is activated when the ABC Series receives a command on the Brake Disable input (a N.O. dry contact at TB1) (see section 4.3.2). This mode can be used to remove the electronic brake from the system, and is useful in applications that only require braking at certain times during the process and during system setup. It can also be used to cancel a "Braking" cycle that is already in progress. Note: The ABC Series is a "smart brake" and will sense a running motor and automatically arm itself if released from the "DISABLED" mode. Under these circumstances, the ABC Series will go through the "JOG" and "ARMED" sequence again. If the unit has determined the motor is stopped, the brake will return to the normal ready state.

NOTE: The ABC Series Mechanical Brake Release Relay will set the mechanical brake if the ABC Series brake unit is disabled during the braking mode. Some interface wiring may be needed depending on the voltage and current rating of the mechanical brake coil.

2.2.2 “Wiring Error”

The ABC Series unit will recognize when the interface connections or monitored signals are not correct with respect to the proper operation sequence. If the brake detects a miswire or an improper sequence of events, it will "self-disable" to prevent any conflicts with the existing systems and indicate "WIRING ERROR". If this occurs, the "Fault" LED and "Wiring Error" LEDs will illuminate. Once the miswire or wrong sequence is corrected, the brake will automatically enable itself and resume normal operation.

2.2.3 “Over Temp”

The ABC Series has thermal sensors built into the heat sink assembly. If the heat sink approaches temperatures too high for the SCRs, the sensors will cause a Fault, shut down the brake and illuminate the "Fault" and "Over Temp" LEDs.

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2.3 Mechanical Brake Control

The ABC Series includes a Mechanical Brake Release Relay that can be utilized to control an electro-mechanical brake coil. This relay has a Form “A” contact (1 N.O.) that changes state as follows (see section 4.3.4):

OPERATION	RELAY STATUS
Power On	No Change (de-energized)
Jog / Armed	Energizes, follows motor starter (Closes)
Braking	Remains energized (Closed)
Braking Time Completed / Zero Speed Override	De-energizes (Opens)
Disabled – Before or During Jog / Armed	Follows motor starter
Disabled – During Braking	De-energizes (Opens)
Fault	De-energizes (Opens)

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3 Installation

3.1 Receiving and Unpacking

Upon receipt of the product you should immediately do the following:

- Carefully unpack the unit from the shipping carton and inspect it for shipping damage.
- Verify that the model number on the unit matches your purchase order.
- Check all electrical terminals to be sure no connections were damaged during shipping.

3.2 Initial Unit Inspection

Complete a visual check of the unit for damage which may have occurred during shipping and handling. Report any damage immediately and file a claim with the freight carrier within 15 days of receipt. Do not attempt to continue installation.



CAUTION!
Do not operate or install the ABC Series Brake if it appears to be damaged or visually defective. Doing so may result in personnel injury or equipment damage.

3.3 Location

Proper location of the ABC Series is necessary to achieve specified performance and normal operation lifetime. The unit should always be installed in an area where the following conditions exist:

- Ambient operating temperature:

  Ventilated Enclosure: 0 to 50°C (32 to 122°F)

  Non-Ventilated Enclosure: 0 to 40°C (32 to 104°F)
- Humidity: 5 to 95% non-condensing
- Free from metallic particles, conductive dust and corrosive gas
- Free from excessive vibration (below 0.5G)
- Open panel units must be mounted in the appropriate type of enclosure. Enclosure size and type must be suitable for environmental conditions and heat dissipated by the unit. Contact factory for details.

3.4 Mounting and Cleaning

The unit is air cooled and must be properly mounted to allow for unrestricted airflow across the heat sink. The unit must be mounted with the heat sink fins in a vertical plane, with a minimum of five (5) inches (127mm) of free space around the unit for adequate ventilation. The ambient air should be free of any contaminants which can clog louvers or coat the unit. As with all electrical equipment, the unit must be protected from water and condensing humidity to prevent possible damage. In damp or cold environments, space heaters may be required.



WARNING!
Remove All Sources of Power Before Cleaning the Unit. In dirty or contaminated atmospheres the unit should be cleaned on a regular basis to ensure proper cooling. Do not use any chemicals to clean the unit. To remove surface dust, use 80 to 100 psi clean, dry compressed air only. A three inch, high quality, dry paint brush is helpful to loosen up the dust prior to using compressed air on the unit.

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4 Wiring

4.1 Introduction

- Installation of the brake unit should be done by properly qualified personnel.
- Check local and other applicable codes to ensure that all installation requirements are met prior to operation.
- Prior to beginning the installation, verify that the motor and brake unit have the same voltage ratings.
- Check the unit to verify that it is rated for the appropriate current (approximately equal to the motor FLA if sized for Standard Duty - see section 1.3).



WARNING!
Do not service equipment with voltage applied! Unit can be source of fatal electrical shocks! To avoid shock hazard, disconnect main power before working on the unit. Warning labels must be attached to terminals, enclosure and control panel to meet local codes.

4.2 Line and Load Connections

Power conductors for the Brake Line and Load connections should be, at a minimum, sized at 125% of the current rating. Brake sizing and duty cycling should be considered when determining if conductors should be oversized for your application. For example, high torque, fast stop applications with maximum duty cycle may require conductors sized for the maximum output capability of the ABC Series, and motor lead wires should match.

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4.2.1 Line Power Connections

Connect the line leads to the input terminals L1 and L2 provided on the unit. The line power must be supplied from a source with suitable Short Circuit Protective Devices (SCPD) conforming to local and national electric codes.

Additional fusing is necessary only when the motor circuit is fused at a level too high to protect the ABC Series per code. Recommendations for commonly available SCPDs are as follows:

Unit	Circuit Breaker	Time Delay Fuse Class RK5	Non-Time Delay Fuse Class J
ABC-10	-	50A	50A
ABC-24	-	50A	50A
ABC-50	-	225A	225A
ABC-100	-	225A	225A
ABC-200	-	300A	300A
ABC-300	1200A	1600A	900A
ABC-400	1200A	1600A	900A
ABC-550	150% of Max. Unit Rating	150% of Max. Unit Rating	200% of Max. Unit Rating
ABC-800	150% of Max. Unit Rating	150% of Max. Unit Rating	200% of Max. Unit Rating
ABC-1000	150% of Max. Unit Rating	150% of Max. Unit Rating	200% of Max. Unit Rating

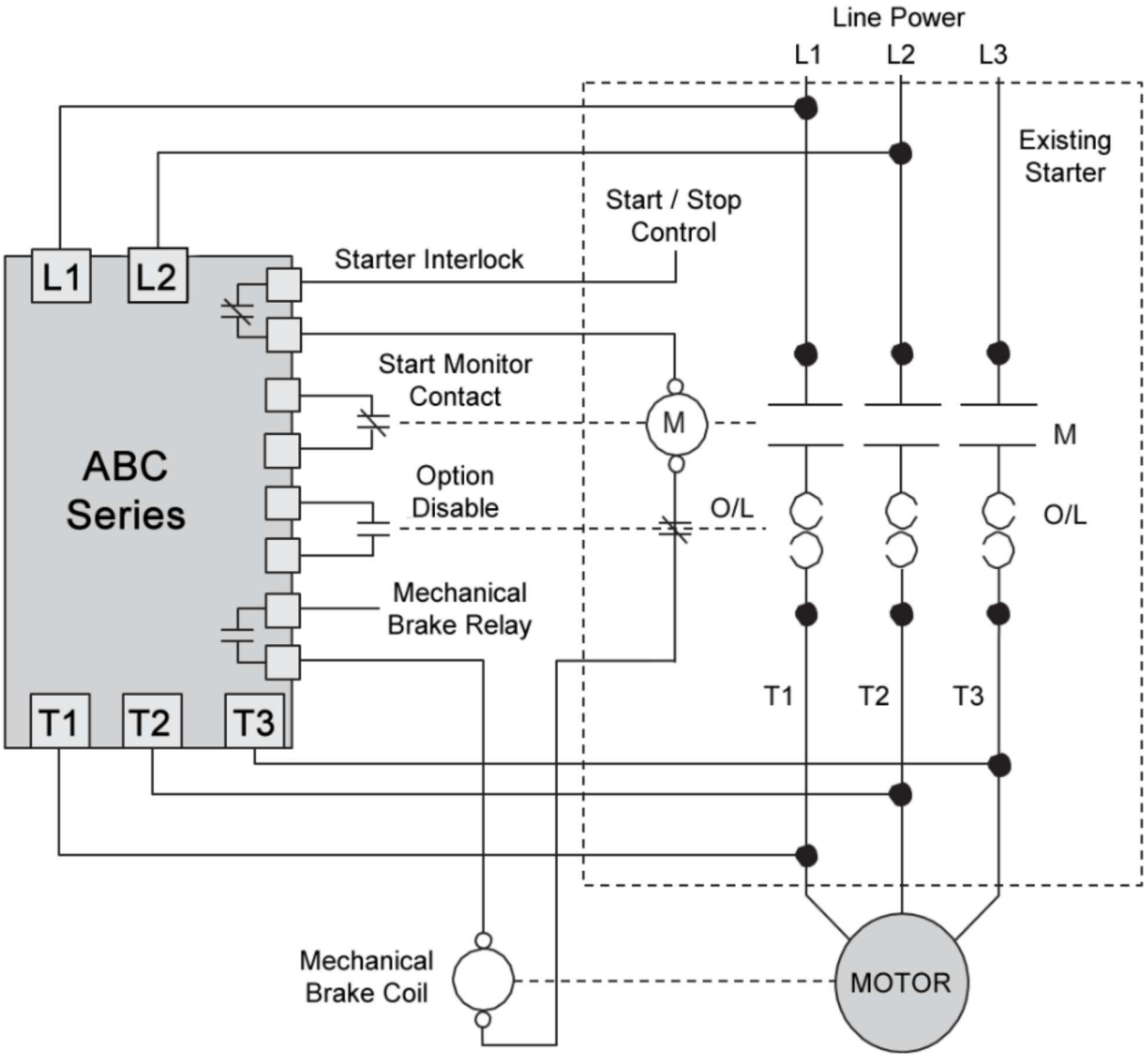


WARNING!
Many motor safety disconnect switches are not rated to interrupt DC current. Replace any load side safety disconnect switch with one that is rated for DC voltage at the motor line voltage rating or greater. As an alternative, disconnect incoming line power before opening any load side disconnect switches in the motor circuit during braking, and post warning labels at all affected devices. Failure to observe this precaution may result in damage to the disconnect and /or bodily injury

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4.2.2 Power Connections

The ABC Series unit will operate on either a Wye or a Delta connected motor.
Connect the brakes L1 & L2 input terminals to the L1 & L2 terminals on the motor starter.
Connect the T1 and T2 brake output terminals to the T1 and T2 terminals on the Motor starter.
An additional sensing wire must be run from T3 (W) terminal of the starter to the voltage sensing circuit of the ABC Series labeled T3. This terminal carries very little current so a #14 wire can be used. Proper fuse protection for the field wiring must be provided per code.
NOTE: If the ABC Series brake is being used with 2-speed, Wye- Delta or Reduced Voltage starter, consult factory for additional load connection information.



CAUTION!
Power Factor Correction Capacitors should NOT be connected to the load side of the motor starter when used with an ABC Series brake. PFC Capacitors should only be connected to the line side and must include a separate isolation contactor.

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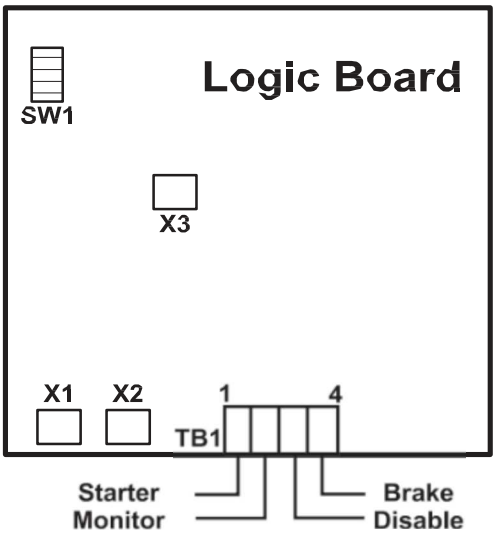
4.3 Control Connections

Control wire should be twisted, shielded cables and run in a separate conduit from power lines. Whenever possible, conduits containing control and power conductors should cross at right angles to each other. Control connections are made at terminal blocks mounted on the printed circuit boards inside the unit case. TB1 is on the Logic Board with the terminals for the Starter Monitor (Brake Command) and Brake Disable inputs. TB2 is located on the Power Board, and provides terminals for the Interlock Contacts and Mechanical Brake Relay.

WARNING!
The motor starter must never be operated manually when the brake unit is connected. Blown fuses and/or damage to the unit may result.

4.3.1 Starter Monitor Input

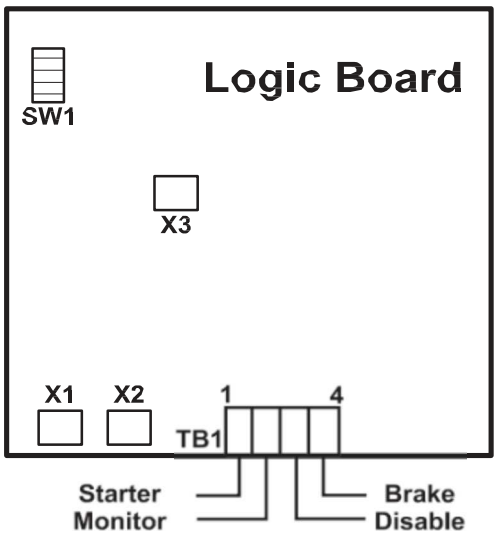
Provides a status signal from the motor starter to the CPU (refer to sections 2.1.2 & 2.1.3). Connect either the normally open, or normally closed (user preference) dry auxiliary contact on the motor starter to TB1, terminals 1 and 2 on the logic board. To utilize a normally closed contact select Jumper X1 (factory default). For a normally open contact, move the Jumper to X2. For reversing starters, use 2 N.O. contacts in parallel or 2 N.C. contacts in series (1 from each contactor) to this input. Circuit voltage potential: 15VDC maximum.



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4.3.2 Brake Disable Input

Disables electronic braking functions before, during, or after operation (refer to section 2.2.1). To utilize this feature, wire a N.O. dry contact to TB1 terminals 3 and 4 on the logic board. The disable feature will activate as long as the contact is closed, and will resume operation sequence only when the disable command is released (i.e. the contact is opened). Once the ABC Series has resumed operation, it will evaluate the status of the motor starter, re-enter the "JOG" mode and "ARM" if conditions are correct. Circuit voltage potential: 15VDC maximum.

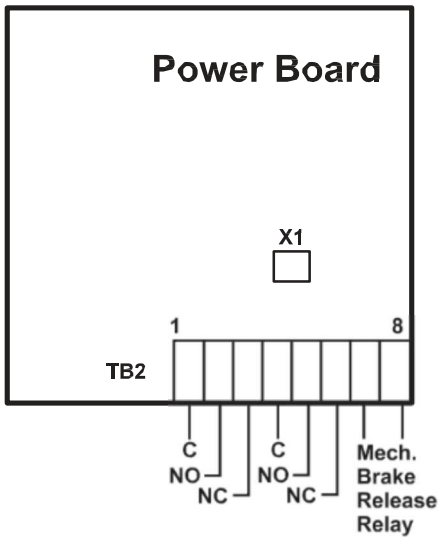


Note: The Brake Disable can and should be used to disable the ABC Series brake in the event of a motor thermal overload by wiring normally open contacts from the overload relay to these terminals. This will prevent the brake from operating if a motor over- load trip condition occurs.

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4.3.3 Interlock Contacts

The ABC Series unit MUST be interlocked with the motor starter coil circuit to disable the motor starter during the braking cycle for proper operation (refer to 2.1.3). Two sets of "FORM C" contacts are provided on TB2 on power board to interlock the motor starter with the brake. Terminals 1, 2, and 3 are the first set and terminals 4, 5, and 6 are the second. Use both sets for reversing starters, each in one of the contactor coil circuits. The second set may be used as a status indicator in non-reversing starter applications. Never connect the interlock contacts parallel to the contactor coil or across the power line. Circuit voltage potential: same as starter control circuit, 240VAC maximum.



WARNING!
If this wiring is done incorrectly or not at all, severe damage to the unit may occur and the warranty on the unit may be voided.

4.3.4 Mechanical Brake Release Relay

The ABC Series brake unit can work in conjunction with a mechanical brake by interfacing with the motor and allowing for mechanical brake control. The ABC Series brake can be used for stopping, and the mechanical brake for holding. The Mechanical Brake Release contacts are N.O. relay contacts rated for 5A, 250VAC and are located at terminals 7 and 8 of TB2 on the Power Board (see section 2.3 for additional operating details).

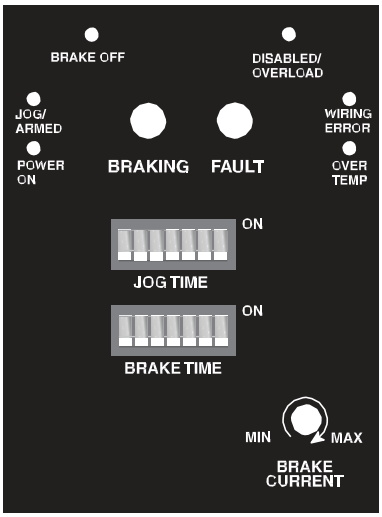
The unit will detect the motor start command and release the mechanical brake. When the stop command is given, the ABC Series brake unit will continue to keep the mechanical brake released, proceed with the DC injection braking sequence, then engage the mechanical brake at the end of the braking cycle. If the disable feature is engaged while in "BRAKING" mode, the ABC Series will automatically set the mechanical brake.

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5 Adjustments

5.1 Time Adjustment Procedures

Time settings for "Jog Time" and "Brake Time" are adjusted by use of dip switches on the front mounted Operator Interface Module. Time settings are in seconds (set in binary code). Each switch denotes a binary digit from 1 - 7 positions, totalling 127 seconds maximum when all are switched to the "On" position.



Operator Interface Module

5.2 Jog Time Adjustment

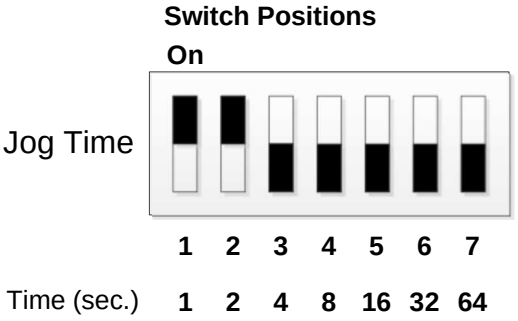
Factory Setting: 3 seconds

The jog time is adjustable from 0-127 seconds and is made using the 7 position dip switch SW2, labeled "Jog Time". Set the switches according to the jog time required. Setting all the switches to the "Off" position (Jog Time = 0) will disable this function.

Example:

Setting dip switch positions 1, and 2 to “ON” = 1+2

= 3 seconds total jog time.



CAUTION!

Damage to the motor, equipment, brake and/or electrical circuit may occur if this adjustment is not correct. Setting this switch to less than the factory setting may involve risk to the equipment and affect normal operations. Setting the jog time too long may result in equipment operating without the benefit of the DC injection brake. The jog time should typically be set to equal the time it takes the motor to accelerate the load to full speed (across- the-line) plus approximately two seconds.

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5.3 Brake Time Adjustment

Factory Setting: 7 seconds

The brake time is programmable from 1 to 127 seconds. Set the switches marked "Brake Time" to the brake time required. Typical brake time settings should be 1/2 of the load's coast-to-stop time or less, as necessary. Each dip switch represents a binary time value. Add the times together for the final brake time setting

Example:

Setting dip switch positions 1, 2, and 3 to "ON" = 1+2+4

= 7 seconds total brake time.

Brake Time

Switch Positions

On



	1	2	3	4	5	6	7
Time (sec.)	1	2	4	8	16	32	64

NOTE: Stop times shorter than 4 seconds will not allow enough time for the Zero Speed Sensing circuit to accurately sense that the motor has stopped. For stopping times shorter than 4 seconds, Brake Time must be used to turn the ABC Series off to insure proper stopping.

5.4 Brake Current Adjustment

Factory Setting: 50% of Unit Rating

It is strongly recommended that you try the factory settings first before making any adjustments. First determine if adjustments are necessary by verifying the motor came to a stop during the braking cycle. If not, first increase the Brake Time setting and repeat the test. If after increasing the Brake Time setting to the desired maximum the motor still does not come to a stop during braking, increasing the Brake Current may be necessary. To do so, a "True" RMS AC clamp-on ammeter is needed to measure the current supplied to the motor while braking. To monitor the current, place the meter on one of the ABC Series' input power lines. Start the motor by energizing the motor starter contactor. Allow the motor to come up to full speed with the normal load. Engage the brake by de-energizing (stopping) the motor starter contactor. Then, measure the brake current. If necessary, slowly adjust the brake torque potentiometer (P1) (located in the Operation Interface Module) clockwise to increase the braking current. The braking Current and Time Settings should be adjusted so that the braking time expires at the same time the motor stops. Adjust the brake Time and/or Current until acceptable. Start and stop the motor several times to verify proper operation.



WARNING!

Never exceed the RMS full load current rating of the motor without first checking with the motor manufacturer for the maximum allowable amount of DC current that can be supplied to the motor during braking application.

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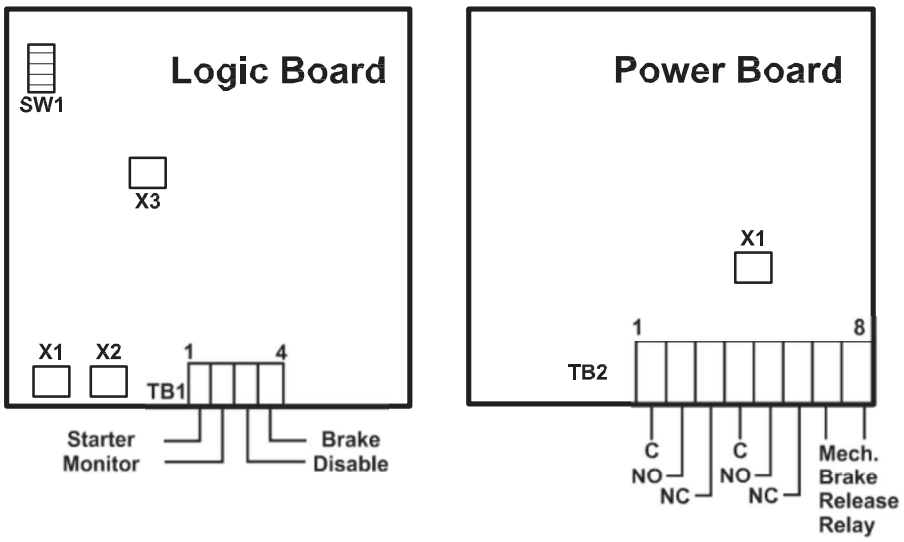
Application Specific Adjustments

CAUTION!
These settings are factory preset to provide optimum performance in a wide variety of applications, and should not be changed unless the user is specifically aware of the risks and consequences (contact factory for details). Disconnect all incoming power and observe anti-static control measures when making any of the following configuration changes.

Brake On Delay (Switch SW1)
This DIP switch controls the amount of time the ABC Series brake waits prior to applying DC current to the motor windings. It is Factory Configured for the Automatic Mode in order to allow the stator magnetic field to decay. The rate of decay varies with motor size, so this SHOULD NOT BE CHANGED. Changing this setting could result in damage to the ABC Series components and circuit protective devices. If your application requires a specific delay time, please contact the factory for assistance.

Zero Speed Sensing Disable (Jumper X3)
If for some reason you need to disable the Zero Speed Sensing, remove this jumper. The ABC Series will then continue braking for the entire Brake Time setting, even if the motor has already come to a complete stop. DO NOT disconnect the sensing lead to the "T3" terminal as that will cause a "Wiring Error" fault disabling the brake. Therefore this should not be used as a means of disabling the Zero Speed Sense circuit.

50 Hz Operation (Power Board Jumper X1)
Remove this jumper on units required to operate at 50 Hz.



CAUTION!
Some adjustments and devices visible on the ABC Series boards are preset at the factory and should NOT be field adjusted without specific instructions from factory authorized service personnel. These devices include: P1 and P2 potentiometers, and push button PB1. Tampering or altering these devices may void your warranty.

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6 Start-up

6.1 Start-up Check List

- Verify that the supply voltage matches the supply voltage of the ABC Series brake.
- Confirm that the power lines are attached to the input terminals.
- Verify that the output leads are connected to the output terminals.
- Complete the appropriate control and interlock connections.
- Clear the area of people and extra parts before start up.

NOTE: For 50 Hz operation, be sure that jumper X1 on the Power Board is removed.

6.2 Equipment

The following equipment will be needed for start-up:

- A "true" RMS AC clamp-on ammeter to check braking current.
- A small screw driver to adjust braking torque (if necessary).
- A digital volt meter.
- Stop watch or other means of measuring time.

6.3 Setup Sequence

- Start the motor by energizing the motor starter.
- Allow the programmed jog time to expire. (Factory set for 3 sec.)
- De-energize the motor starter to initiate brake mode.
- Monitor the input current to the ABC Series unit on any one of its input leads with the "true" RMS AC clamp-on ammeter.
- Adjust the brake current if necessary.
- If the brake times out before the motor stops, increase the value of the brake time switch, or increase the brake current (Note: Never exceed the RMS rating of the motor without checking with the motor manufacturer).
- If the Zero Speed Sense option engages and turns off the brake before the programmed brake time expires, adjust the brake time dip switch for approximately two (2) seconds longer than the actual stop time.

6.4 Check Normal Sequence of Operation

Apply power to the system. The "Power On" LED should indicate that the line power is correct. Both the "Power On" and the "Brake Off" LED should be illuminated.

- Start the motor. The "Jog / Armed" LED should flash once per second to indicate programmed Jog Time.
- Allow the motor to run until the "Jog / Armed" LED should light solid.
- Initiate the motor stop command. The "Brake Off" LED should go out and the "Brake On" LED should illuminate. The unit should begin braking and continue braking, until the motor comes to a stop or the programmed brake time expires.

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APPENDIX A: Technical Specifications

Voltage Rating:	Models rated from 208 – 600 +/- 10%
Line Frequency:	Selectable for 50 / 60 Hz + 2Hz
Current Ratings:	10 – 1000A 10, 24, 50, 100, 200, 300, 400, 550, 800, 1000A
Output Capacity:	25% duty cycle at 100% unit rating. 10A-400A are UL duty cycles. 10& 24A = 100% 50 thru 200A = 25% 300A thru 800A = 15% 1000A = 25%
Power Circuit:	Full wave bridge, 4 SCRs, designed for use without isolation contactors.
Transient Protection:	RC snubber dv/dt circuit on each SCR device.
Fusing:	Refer to section 4.2.1 for branch circuit protection requirements.
Control Circuit:	Self-powered directly from line terminals. No separate control voltage required.
Control Method:	Microprocessor unit control sequencing, I/O monitoring and status annunciation. Braking current is adjustable via true RMS regulated control using phase angle firing of SCRs.
Operator Adjustments:	Brake Time and Jog Time = 7 position binary dip-switch. Brake Current = potentiometer
Adjustment Ranges:	Brake Jog Time = 0 – 127 seconds in 1 sec. increments. Brake Current = Up to 100% of unit rating.
Inputs:	Starter Monitor = Dry input for auxiliary contact from motor starter. Jumper selectable for N.O. or N.C. contact.
Inputs:	Brake Disable = Dry input for N.O. contact to disable braking before or during operation. Can be wired to the starter thermal overload N.O. auxiliary contact to prevent braking of overloaded motor. Motor Power Sensor (T3) = Voltage input used for sensing motor power presence in sequencing / status circuit and for zero speed sensing during braking.

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Outputs:	Starter Coil Interlock = Two sets of FORM “C” relay contacts for use in interlocking the starter coil and/or other devices to prevent energizing while the braking power is applied. Mechanical brake Release = N.O. relay contact for use in controlling electro-mechanical brake as a holding brake. When the ABC Series is “disabled”, this circuit controls the mechanical brake normally as if it is the only brake in the system.
Aux. Contact Ratings:	5 Amps, 250 VAC max.
LED Status Indicators:	Large LEDs: braking = green; Fault = Red Small LEDs: Power On, Jog/Armed, Brake Off, Disabled, Over Temp and Wiring Error.
Operating Design Temperature:	32ºF – 122ºF / 0ºC to 50ºC
Storage Temperature:	-4ºF – 176ºF / -20ºC to 80ºC
Ambient Conditions:	5% to 95% relative humidity 0 – 3300ft (1000m) elevation
Approval:	UL, cUL Listed

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Warranty information

Motortronics warrants its products to be free from defects in material and/or workmanship for a period of one year from the date of installation, to a maximum of 18 months from the date of shipment as indicated by the unit's date code. The Company reserves the right to repair or replace any mal- functioning units under warranty at their option. All warranty repairs must be performed by the Company factory or on site by factory authorized service firms or personnel approved by the Company.

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