AMBITECH
A TIE Company

STAR-BRAKE

Motor Starter • Electronic Brake

Ambi-Tech Brakes
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CAUTION

Disconnect and lock out power to Star-Brake Terminals 1, 2 and 3 before servicing.

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1. INTRODUCTION

The ***STAR-BRAKE*** serves as a complete motor control system for use with all single speed, single direction machines. Easy to install and adjust, it has no effect on normal machine performance, operation, or motor life.

- FEATURES -

- FRICTIONLESS BRAKING
- TORQUE IS FULLY ADJUSTABLE
- NO MECHANICAL CONNECTIONS
- INTERNAL FUSES FOR PROTECTION
- OVERLOAD PROTECTION

2. DESCRIPTION AND APPLICATIONS

The ***STAR-BRAKE*** combines an across-the-line magnetic starter with an electronic motor brake. The starter section includes adjustable thermal overload protection. The electronic brake permits rapid stopping of AC motors by DC injection. Braking action is smooth, adjustable and frictionless. Torque and Time adjustments permit matching the braking rate to almost any machine requirement.

The ***STAR-BRAKE*** works with most AC motors where there is a need for a starter and brake combination. Installation for the standard units simply involves the connection of six power wires and three control wires.

Standard units are completely satisfactory for most applications. Ideal for woodworking and metalworking machines such as saws, lathes, grinders, sanders, etc.

Electronic brakes are useful where coasting is either a production or a safety problem. However, since electronic brakes require power to operate and do not provide holding, they cannot be used as "fail-safe" brakes.

3. SAFETY NOTES

LOCK TOOL OR BLADE SECURELY. Saws and grinders are often fastened with left-hand thread devices, which tend to loosen when the machine is stopped too quickly. Use double nuts, or other positive locking methods to prevent such loosening. Test for safe operation during braking and check locking from time to time.

DON'T TAMPER WITH WIRING. Once installed and adjusted, the ***STAR-BRAKE*** box cover should be closed securely. Tampering with the internal parts or manually operating the magnetic contactors is dangerous, and can cause damage not covered by the warranty.

POWER LINE INTERRUPTION. The ***STAR-BRAKE*** uses AC line power to achieve its braking action. Thus a power failure or disconnect, or the opening of a fuse, will simply let the motor coast to a stop without braking. Do not use the ***STAR-BRAKE*** where failure to provide braking will be a hazard.

HOLDING AGAINST A LOAD. The ***STAR-BRAKE*** cannot be used as a positive brake against overhauling loads after the motor stops. In such applications, a positive lock, a pin, or a separate mechanical brake must be used to provide for holding at rest. Call the factory for information on other models if holding is needed.

4. LIMITATIONS

The ***STAR-BRAKE*** cannot be used with forward/reverse or multiple speed systems. It will not work with Universal Motors, Wound Rotor Motors, Drum Switch Controls, and Electronic Drive Controllers. For these applications consult the factory for the appropriate AMBI-TECH product.

MOTOR HEATING. The heat generated during braking can be considered equivalent to adding another start cycle, if the TORQUE control is set very high. Therefore, high cycle operations may require fan cooling at the motor. (The ***STAR-BRAKE*** itself generates very little heat.)

Although motor heating is rarely a problem, it may be minimized by using the lowest torque setting that gives acceptable operation.

IT IS UP TO THE USER TO MAKE SURE THAT THE MOTOR WILL BE PROTECTED FROM EXCESSIVE HEAT RISE, WHETHER FROM EXTREMES OF RUNNING, STARTING OR BRAKING.

POWER OR FUSE FAILURE. Loss of power means loss of braking, regardless of whether power is disconnected by a switch, line or internal fuse, circuit breaker, etc. This also applies to fuses internal to the ***STAR-BRAKE***, where the fuses are intended for the protection of internal components.

POWER FACTOR CAPACITORS. Power factor capacitors may NOT be used across a LOAD controlled by the ***STAR-BRAKE***. Move any such capacitors to the LINE side.

DON'T OPEN POWER TO TERMINALS L1-L2-L3. If power is removed from these power input terminals during braking, the brake contactor will open under load which may damage the ***STAR-BRAKE***, and the motor will coast to a stop.

5. RATINGS

The ***STAR-BRAKE*** should be used at its published horsepower rating. The protective overload is sized for the nominal motor current, and may not protect a motor of lower horsepower. For overload rating, see section 7.2.1.

Any application requiring frequent or severe braking, or operation more often than two stops per minute, may require a different model ***STAR-BRAKE***.

Applications involving exceptionally high inertia, such as press flywheels, extractors, etc., may require models with longer than the standard 15-second maximum braking time. For information on applications such as these, please consult the factory or your local sales representative.

All ***STAR-BRAKE*** units may be used in normal ambient temperatures. The maximum temperature at the hottest part of the heat sink should not exceed 50 degrees C. At temperatures below 0 degrees C, braking levels may decrease.

STAR-BRAKE units have internal fuses. These are special, fast-acting, semiconductor fuses. They must be replaced with the same type as originally supplied.

THE USE OF IMPROPER FUSES IN THE *STAR-BRAKE* WILL VOID THE WARRANTY!!!!

6. INSTALLATION

6.1 Mounting

The ***STAR-BRAKE*** may be mounted in any convenient location, and in any orientation, although vertical is preferable. Keep it away from sources of vibration, dust, dirt and extremes of temperature. Once mounted, it normally needs no maintenance.

6.2 Wiring

- **ALL WIRING SHOULD CONFORM WITH NATIONAL AND LOCAL ELECTRICAL CODES.**
- **BE CERTAIN THAT POWER IS TURNED OFF AND LOCKED OUT, BEFORE PROCEEDING WITH ANY WIRING!!!**

All wiring to the ***STAR-BRAKE*** is done to terminals provided. In general, the wires connected to terminals L1, L2, L3, T1, T2, T3 must be able to carry the full motor starting and running current. Wires connected to S1, S2, S3 may be "control wire" gauge.

6.3 Control Wiring

1. Connect a dry, momentary, normally closed (Stop) pushbutton between Terminals S1 and S2.

2. Connect a dry, momentary, normally open (Start) pushbutton between Terminals S2 and S3.

Note: If a programmable controller is used to control the Start and Stop function, relay type output modules must be employed. See section 9.4.

6.4 Power Wiring

WARNING ON THE USE OF POWER FACTOR CAPACITORS

The STAR-BRAKE will be damaged if power factor or other capacitors are present across the motor leads. If capacitors are used, they must be placed on the LINE side.

6.4.1 Three Phase Motor

INPUT (LINE POWER) SIDE: Terminal L1, L2, L3
OUTPUT (MOTOR) SIDE: Terminal T1, T2, T3

Be sure to check if the MOTOR IS ROTATING IN THE PROPER DIRECTION before operating the machine. If it is not, interchange the wires connected to Terminals T1 and T3.

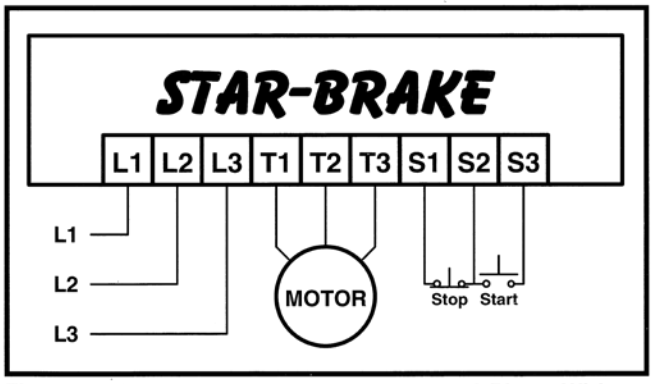

Figure 6.4.1 **3 Phase Wiring**

6.4.2 Single Phase Motor

Input (Line Power) Side: Terminal L1, Terminal L2
Output (Motor) Side: Terminal T1, Terminal T2

*Note that for a given voltage and horsepower rating, a single phase machine will draw greater current than the three-phase equivalent. Be sure not to exceed **either** the horsepower or current rating of the **STAR-BRAKE**.*

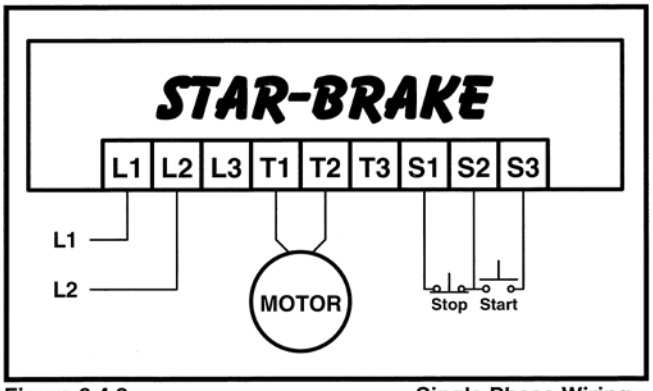

Figure 6.4.2 **Single Phase Wiring**

7. ADJUSTMENTS

7.1 Description of the Adjustments

Three adjustment controls are provided within the ***STAR-BRAKE***. One, a "Dial" type, is located on the overload relay, and sets the overload trip current.

The other two controls (located on the printed circuit board) determine the amount of braking power applied to the motor (TORQUE), and the length of time this power is applied (TIME). The controls are single turn and can be set by means of a small screwdriver. (An insulated screwdriver is recommended.) Both controls are at their minimum when set fully counter-clockwise. **DO NOT FORCE THE ADJUSTMENT PAST THE END STOPS!**

Once set for a particular application, the controls should not have to be re-adjusted.

CAUTION

With high torque settings, this brake can loosen tools by rapid stopping.

Be certain that tool is keyed, double nutted or locked very tightly.

Test for safe operation during braking, and check locking from time to time.

7.2 Setting the Adjustments

7.2.1 Starter Overload

THE OVERLOAD ADJUSTMENT HAS BEEN SET TO A NOMINAL FULL LOAD MOTOR AMPERAGE. IT MAY BE RE-ADJUSTED IF NECESSARY. THE OVERLOAD WILL TRIP WHEN THE MOTOR CURRENT EXCEEDS THE DIAL SETTING WITHIN A RANGE OF 5 TO 20 PERCENT OVER THE SETTING. IF THE OVERLOAD TRIPS, WAIT 7 MINUTES AND RESET IT.

7.2.2 Brake Adjustment

NOTE: A red LED indicator on the circuit board is illuminated during braking.

1. Set TIME control to mid-range
2. Set TORQUE control to minimum without forcing (Full counter- clockwise.)
3. Turn main power ON
4. Turn motor ON. After full speed is reached, turn motor OFF.
5. Adjust TORQUE control in 1/8 turn steps to reach desired safe braking rate. Braking action is indicated by a slight hum of the motor as well as the red LED being lit.
6. Adjust TIME control so that braking hum stops (and LED goes out) after the motor stops. Note: As the motor heats up, the winding resistance will increase. This may require a longer application of the braking current. Therefore, set the time control either with the motor hot, or so as to "hang on" for about a second after stopping a cold motor.
7. Repeat steps 4 to 6 above, until a satisfactory stopping time is reached. The maximum tolerable stopping time should be used.

Applying the brake for a longer time than necessary serves only to increase motor heating.

8. DESCRIPTION OF BRAKING FUNCTION

8.1 Basic Concept

The principle used by the ***STAR-BRAKE*** is the injection of a controlled amount of DC (Direct Current) into an AC motor to achieve braking. The effect in stopping can be considered completely analogous to that at motor startup. The DC current in the motor stator sets up a stationary magnetic field in which the rotor is turning. The interaction between the rotor and the magnetic field tries to align the rotor with the stator field. Thus the ***STAR-BRAKE*** actually drives the rotor to zero speed.

A further feature is that the retarding torque is proportional to the field strength, and hence to the braking current. The braking strength can be set to any desired value by adjusting the Torque control.

Other parts of the ***STAR-BRAKE*** serve to control and coordinate the action of the braking current, to form a complete braking system. These are described in the balance of this section.

8.2 Detail Description

8.2.1 Sensing

This is the part of the system that determines when braking is required. It consists of circuitry which detects when the motor is ON by sensing the current flowing through the internal interlock to the starter contactor. When this current is removed (starter contactor is disengaged) the brake is activated.

Note: leakage current in the magnetic starter control loop when the starter is disengaged may be interpreted by the sensor as a motor run condition, not allowing the brake to pull in.

8.2.2 Interlock

Once an "OFF" condition is determined by the sensor, the interlock is opened. This prevents the motor from being re-started while the braking function is in progress. The interlock will not be re-established until braking has been completed.

8.2.3 Logic and Timing

This section initiates the flow of DC power after the braking contactor has been closed; removes the DC power and opens the braking contactor at the end of braking; and re-closes the interlock as the last item in the braking cycle, restoring control to the motor starter.

8.2.4 DC Power and Control

Under control of the Timing section, this block has the function of setting up the path for the flow of DC current to the motor, and for rectifying power from the AC input supply for DC braking.

Rectification is done by means of a "Controlled Rectifier," or SCR. This device conducts for a controllable part of each AC power line cycle. By setting the phase angle allowed for conduction via the Torque pot, the amount of DC current produced for braking can be controlled.

The Controlled Rectifier is not turned ON until after the braking contactor has closed. It is turned OFF before this contactor is allowed to open. In this way, the contactor is never called on to switch under load, and the contacts therefore experience no wear or arcing - even though they are carrying DC. This is why it is imperative that the braking cycle be allowed to run to completion in the normal way.

9. IF YOU HAVE A PROBLEM

9.1 Preliminary Checks

Check for possible damage in shipping, if so, notify the **freight carrier**.

No adjustments are provided or required other than those described in Section 7.

Should a system fail to perform properly, be sure to check the wiring first. Also, be certain that the power line voltage is present and correct. (For instance, there should be equal voltages between any two leads of a three phase power line, and these should be in the correct nominal range for the ***STAR-BRAKE***.)

If the system has previously been operating properly, it is also a good idea to check the fuses, and that the adjustments of the three controls, TIME, TORQUE and OVERLOAD have not been tampered with. Note: 230 volt units operated from 208 volts will produce somewhat lower torque. Consult the factory if this is a problem.

If there is a problem on initial installation, or if the brake should fail to function properly, the following checks should be made:

9.2 Motor Will Not Start

1. Verify that there is normal line voltage across Terminals L1, L2, L3. Note: 230 volt units operated from a 208 volt line may not allow the starter to engage. (208 volt Models are available.)

2. Verify that the START and STOP switches are wired properly. AC control voltage should be present across START switch. When the switch is pressed you should read ZERO volts. When the START button and the STOP button are pressed simultaneously, you should read AC control voltage across the STOP switch.

3. Make sure that the overload has not tripped. In case the overload has tripped, wait 3 to 7 minutes and then push the reset button located on the top of the overload. NOTE: Frequent starting and stopping, (especially with high inertia motor loads) can cause nuisance tripping of the overloads and fuses.

4. Make sure that the overload adjustment has not been tampered with.

9.3 No Braking When Motor is Turned OFF: Braking Contactor Pulls In

1. Verify that the unit is installed and wired correctly.

2. Check that the TIME and TORQUE adjustments are not set too low.

3. Check for blown fuses in the STAR-BRAKE.

9.4 No Braking When Motor is Turned OFF: Braking Contactor Does Not Pull In

Leakage current may be present in the magnetic starter control loop. This is common when a programmable controller with a solid-state output module is used to control the Start/Stop function. Replace the output modules with relay types, or call the factory for assistance.

9.5 Brake Fuse(s) Blow

1. Replace fuses, and try operating at lower braking torque. If fuses do not blow until torque is turned up, the STAR-BRAKE chosen was probably too small for the application.

   NOTE: Fuses in the STAR-BRAKE are designed to protect the internal components. They are of a special fast-acting semiconductor-protecting type, and MUST be replaced with the same type of equal or lower current rating. THE USE OF INCORRECT REPLACEMENT FUSES WILL VOID THE WARRANTY, AND MAY RESULT IN FURTHER DAMAGE TO THE EQUIPMENT.

2. Power factor capacitors, if used, MUST NOT be across the load.

If there is still a problem, the unit may need factory service.

9.6 BEFORE RETURNING ANY UNIT TO THE FACTORY:

1. Measure and document the voltage across Terminals L1, L2, L3.

2. Measure and document the voltage across Terminals T1, T2, T3.

3. Document the motor operating voltage, current and horsepower.

4. Specify all the above, plus the type of application or use, and the number of phases involved. Be sure to supply the unit Serial Number and Model Number from the nameplate, and to list all options provided.

5. PACK THE UNIT CAREFULLY, so that there will be no further damage during shipment.

6. Be sure to include your name, address, telephone number, purchase order number and the address to which the repaired unit is to be sent.

7. When returning any unit include a brief description of the difficulty you are having, as well as the results of any tests you have made on it.

8. **Collect shipments will not be accepted.**

10. LIMITED WARRANTY

Each ***STAR-BRAKE*** is warranted by the factory for one year to be free from defects in materials and workmanship. Repairs will be made at the factory, on products which are returned prepaid to the factory.

The warranty is VOID if the unit has been tampered with without express permission; if fuses of an incorrect type or rating have been used, or for any other type of misuse.

Aside from the above statement of warranty, AMBI-TECH INDUSTRIES, Inc., its agents, employees, dealers and distributors assume NO LIABILITY, AND SPECIFICALLY ASSUME NO LIABILITY FOR ANY CONSEQUENTIAL DAMAGE due to malfunction, failure to function, improper application, or improper operation of these products.

No allowance can be made for removal or installation costs, machine down-time, transportation, etc.

THE USER ASSUMES FULL APPLICATIONS RESPONSIBILITY.