THE TECHNO WISE GROUP®

MOTORWISE® 15/3

MOTORWISE® 30/3 & 30/3 GEN

MOTORWISE® 50/3 & 50/3 GEN

MOTORWISE® 60/3 & 60/3 GEN

MOTORWISE® 100/3 & 100/3 GEN

Owner's Manual and Installation Instructions

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Safety

DANGER: RISK OF ELECTRIC SHOCK

Electric shock can result in injury or death. A qualified licensed electrician must observe best safety practices for all electrical connections. Installations must comply with all local electrical code requirements.

This MOTORWISE® unit might operate at 600 volts. Electric shock can cause serious or fatal injury. Only qualified personnel should install, calibrate, and troubleshoot the equipment. This unit may be connected to other machines with parts that rotate or are driven by this equipment. Improper operation or handling can cause severe injury, death, or property damage.

Make sure that electrical power is turned off before you touch the circuit board, power device or electrical connection. Make sure that no voltage is present from this equipment or other equipment to which it is connected. Electrical shock can cause serious or fatal injury.

Make sure that all equipment is grounded before you apply AC power. Electrical shock can cause serious or fatal injury.

Overview

Congratulations on your purchase of a MOTORWISE® energy-saving motor controller from The TECHNOWISE® Group. The MOTORWISE® products are thyristor-based motor controllers that manage and optimize the amount of energy consumed by AC induction three-phase motors operating under a variety of loads. By monitoring the applied voltage and current consumed by the motor, a MOTORWISE® unit is able to determine the load on the motor at any given point in time. When the motor is lightly loaded, it is operating inefficiently and consuming more power than it actually requires. **A MOTORWISE® unit identifies partial and intermittent loading conditions and reduces the voltage applied to the motor, thereby reducing the power consumed to the minimum required to maintain its optimal operation.** When the motor is fully loaded, a MOTORWISE® unit recognizes that the motor needs the full power available and does not attempt to reduce the voltage. The MOTORWISE® 15/3, MOTORWISE® 30/3 & 30/3 GEN, MOTORWISE® 50/3 & 50/3 GEN, MOTORWISE® 60/3 & 60/3 GEN, MOTORWISE® 100/3 & 100/3 GEN are designed for three-phase industrial motors.
This manual describes the installation procedures for a variety of applications.

These MOTORWISE® controllers are intended for use with three-phase systems operating at different phase-to-phase voltages depending on the motor's horsepower range, (please refer to the specifications on page 18). They support a variety of three-phase power distribution schemes, including wye, delta, and grounded-corner delta configurations. The controller does not require a neutral connection.

The MOTORWISE® controllers are described in the following table:

MOTORWISE® 15/3 (230V & 480V)	For three-phase motors not to exceed 15 hp in industrial applications such as oil wells, industrial motors, mining operations, crushers, saws and cutting tools, injection molding, material handling conveyors, belt and gear-driven machinery, elevators and moving walkways.
MOTORWISE® 30/3 & 30 GEN (230V & 480V)	For three-phase motors not to exceed 30 hp in industrial applications such as oil wells, industrial motors, mining operations, crushers, saws and cutting tools, injection molding, material handling conveyors, belt and gear-driven machinery, elevators and moving walkways. Additionally, for three-phase motors not to exceed 30 hp in applications where the system may occasionally or periodically cause the motor to generate electrical energy.
MOTORWISE® 50/3 & 50 GEN (230V)	For three-phase motors not to exceed 50 hp in industrial applications such as oil wells, industrial motors, mining operations, crushers, saws and cutting tools, injection molding, material handling conveyors, belt and gear-driven machinery, elevators and moving walkways. Additionally, for three-phase motors not to exceed 50 hp in applications where the system may occasionally or periodically cause the motor to generate electrical energy.
MOTORWISE® 60/3 & 60 GEN (480V)	For three-phase motors not to exceed 60 hp in industrial applications such as oil wells, industrial motors, mining operations, crushers, saws and cutting tools, injection molding, material handling conveyors, belt and gear-driven machinery, elevators and moving walkways. Additionally, for three-phase motors not to exceed 60 hp in applications where the system may occasionally or periodically cause the motor to generate electrical energy.
MOTORWISE® 100/3 & 100 GEN (480V)	For three-phase motors not to exceed 100 hp in industrial applications such as oil wells, industrial motors, mining operations, crushers, saws and cutting tools, injection molding, material handling conveyors, belt and gear-driven machinery, elevators and moving walkways. Additionally, for three-phase motors not to exceed 100 hp in applications where the system may occasionally or periodically cause the motor to generate electrical energy.

Introduction

The MOTORWISE® controller uses digital signal processing technology to operate. It reacts quickly to changes in the load on the AC motor and controls the voltage supplied to the motor to match the load. The controller reduces the voltage when the motor has a light load and reduces the energy consumption of the motor.

Optional Features

In addition to energy savings, the MOTORWISE® controller has many benefits to enhance the performance of the motor and its associated system. These features may be implemented for your application at the time the controller is initially set up.

Random Start

This optional feature is used to reduce the initial current surge in a facility especially when power is restored after a power failure. With many motors in a facility, the surge current can be very large as all the motors begin to operate simultaneously. A MOTORWISE® controller greatly reduces this surge by randomly starting each motor when power is restored. The controller has an internal random number generator. When AC power is restored, each one will wait the respective random number of seconds before applying power to the motor. This random number is different each time a MOTORWISE® controller powers up. The random turn on delay is limited to 20 seconds. After 20 seconds all the motors will be running. **This feature is not recommended at sites where there is a motor RPM monitor, such as an oil field pump-off controller in oil well applications.**

Soft Start

The MOTORWISE® controller provides a soft start option that gradually increases the voltage to the motor. The soft start feature allows a motor to go from rest to full speed in a controlled and managed fashion. The significant benefit of this feature is a reduction of the mechanical stresses that can result from a sudden application of power to the motor and attached equipment. This soft start feature may also help to reduce the penalties applied by the utility companies for high power demand charges (peak demand charges.) The time required for the increase is set during calibration.

Generated Energy

There are certain motor applications, such as reciprocating beam pumping units used in the oil industry that can cause a motor to rotate at a speed above its synchronous speed. When this happens, the motor behaves as a generator rather than a motor. Instead of consuming energy, it sends energy back to the supplier. Particularly in oil wells, the generation of energy can occur when the well is out of balance. This occurs for a number of reasons including but not limited to: 1) Varying compositions of oil, water and gas. 2) Improper set-up of the well balance at installation. 3) Improper set-up of the well balance after maintenance. The generated energy is passed through the meter in the opposite direction. The trend however is to disallow this credit with modern meters. While the motor is an efficient provider of mechanical energy to operate the well, it is a very inefficient generator in conjunction with the well mechanism and pump-rod string.

The MOTORWISE® GEN controller detects those times when the system generates energy and adapts and manages this behavior. By doing so, it reduces the corresponding energy consumption, saves money and reduces stresses on the entire system.

Installation

The following installation instructions are specific to MOTORWISE® units used with three-phase industrial motors. The MOTORWISE® controller typically operates with a contactor or starter cabinet. The typical starter cabinet is an enclosed housing consisting of a three-phase switch, fuses, overcurrent protection, contactor relays, a lighting arrester and a phase monitor. It is highly recommended that these electrical devices be inside the motor's cabinet for overvoltage and overcurrent protection.

NOTE: The MOTORWISE® controller does not provide lightning protection. The lightning arrester in the starter cabinet is expected to protect the controller.

Physical Installation

Properly locating the MOTORWISE® controller is important to the performance and normal operating life of the unit. A typical installation is shown in figures 1a and 1b.

- The unit should be installed in a location free from:

  Corrosive gases or liquids

  Excessive vibration

  Airborne metallic particles

- Install the MOTORWISE® controller so the front cover with the MOTORWISE® name and logo is vertical, with the text upright. Vertical mounting provides maximum ventilation of the device by natural convection. Do not install the device in a sealed space, an electrical cabinet or on the floor where there is no exchange of air. Do not put any item on top of the installed device. Nothing should impede the natural convection air flow.

- The cover must be accessible for easy removal.

- The unit must be mounted above the ground by a minimum of 2ft (61 cm) to be clear of standing water.

- The unit is intended to control the power passing between the starter cabinet and the motor. It should be mounted reasonably close to the starter cabinet.

- The provided mounting brackets may be used for installation on most surfaces. Alternate mounting means may be used, if necessary. The controller must be securely attached both at the top and bottom.

- Temperature De-rating: Up to 40°C, no de-rating required. Above 40°C, de-rate full load current by 2% per degree C.

- Altitude De-rating: Up to 3300ft (1000 meters) above sea level, no de-rating required. Above 3300ft, de-rate full load current by 2% for each additional 330ft to a maximum of 6600ft.

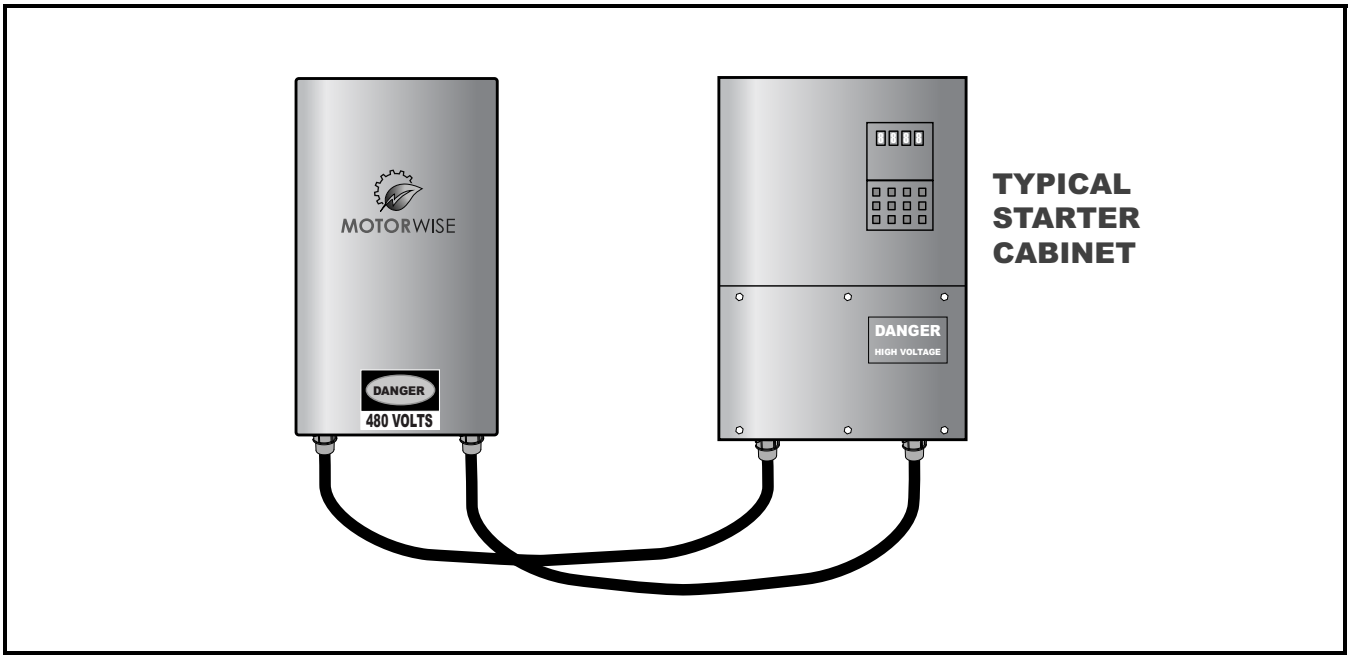

Figure 1a. Typical Industrial Installation

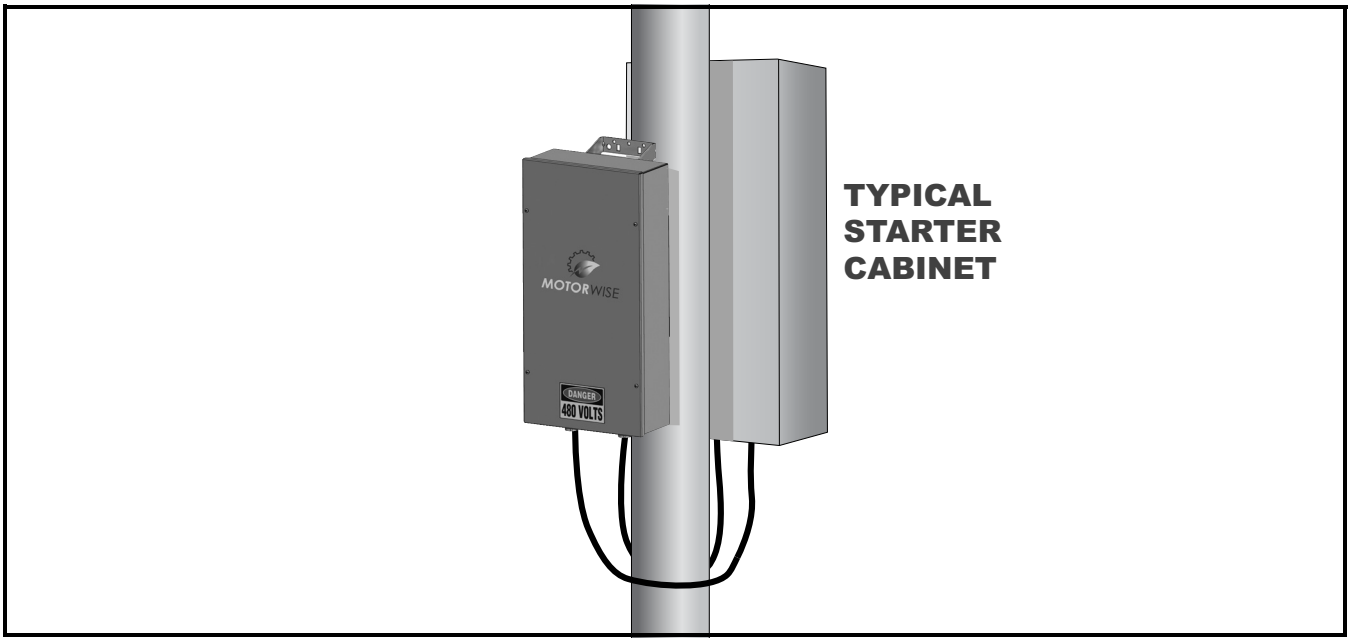

Figure 1b. Typical Oil Field Installation

In Figure 1a, the MOTORWISE® controller is installed next to the starter cabinet. Power enters the controller through the connection at the lower left. Power returns to the starter cabinet from the lower right of the controller.

In Figure 1b, the MOTORWISE® controller is installed behind the starter cabinet. Power enters through the lower left of the controller. Power returns to the starter cabinet from the lower right of the controller. The return conductor connects to the motor leads inside the starter cabinet.

Electrical Installation

WARNING

Ensure that power to the starter cabinet is turned off before electrical connections are made. Only a qualified electrician observing the best safety practices must perform all electrical connections. Installations must comply with all local electrical code requirements

Grounding

The MOTORWISE® controller chassis is to be grounded by using a bare copper wire (typically #6 gauge) securely fastened to the threaded stud at the lower-rear of the chassis (labeled with the Ground symbol), and connected to a grounded copper rod. An existing copper rod may be used if present.

NOTE: The connections between the MOTORWISE® controller and the starter cabinet should be clear of ground water.

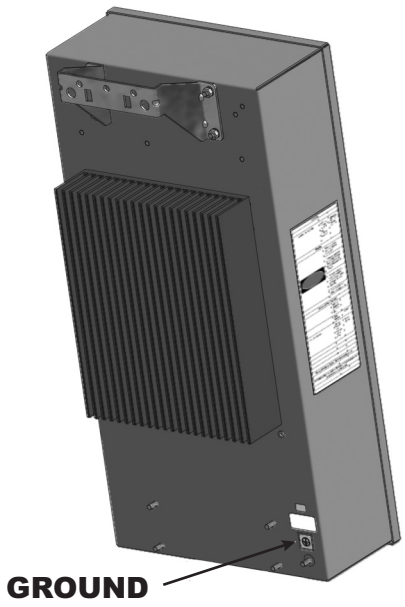

Figure 2. Ground Connection on Rear of Controller

General Wiring Considerations

- The voltage and current limits of the controller are given in the specification section.
- Use 600 V vinyl-sheathed wire or equivalent
- **Current carrying capacity needs to be considered in determining wire size.**
- Wire used and all field wiring terminals must be rated for 70° C, (158° F).
- Wires fastened to the controller are connected to a terminal strip inside the enclosure.
- Never allow bare wire to contact the metal surfaces.
- Never connect AC main power to the output terminals

Power Connections

- Remove the front cover of the controller. **Do not remove the clear shield inside the unit.**
- Power connections to the controller consist of three-phase power, plus ground to the input and three-phase power, plus ground, from the output. The gauge of wire selected should be appropriate for the motor in use.
- A strain-relief watertight connector, (CGB or Sealtight, for example), should be used in the input and output holes of the controller as well as in the input and output holes in the starter cabinet.
- The connections between the controller and the starter cabinet should be kept short to be clear of water that may be on the ground.

Phase Rotation

To ensure that the motor and its associated system continue to rotate in the same direction as before, **extreme care must be taken when connecting the phases to and from the controller.** As an additional requirement, the controller must receive power at its inputs with a clockwise phase rotation. Before making any connections, the existing phase rotation must be recorded using a phase rotation meter, as shown in Figure 3. The phase rotation meter reports the phase rotation as either clockwise or counter-clockwise.

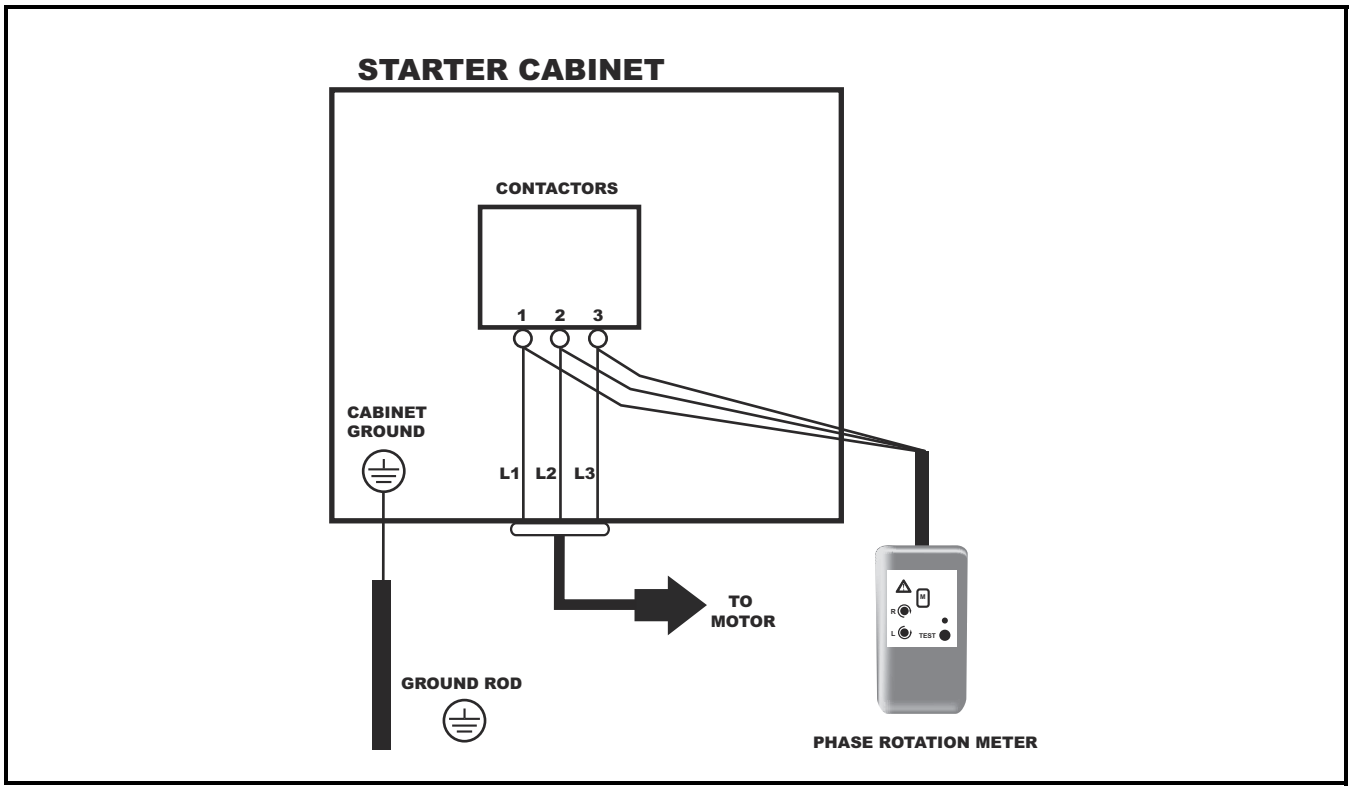

Figure 3. Phase Rotation Meter

Connections Based on Phase Rotation

Refer to Figures 4a (clockwise) and 4b (counter-clockwise) for the proper connections to meet the phase rotation requirements. Notice the difference in the L1/L3 and T1/T3 connections to the controller between Figures 4a and 4b. The connections to the input side of the controller come directly from the outputs of the three-phase contactors in the starter cabinet. The connections from the output side of the controller to the motor leads are normally made inside the starter cabinet with appropriate wire connectors/couplers.

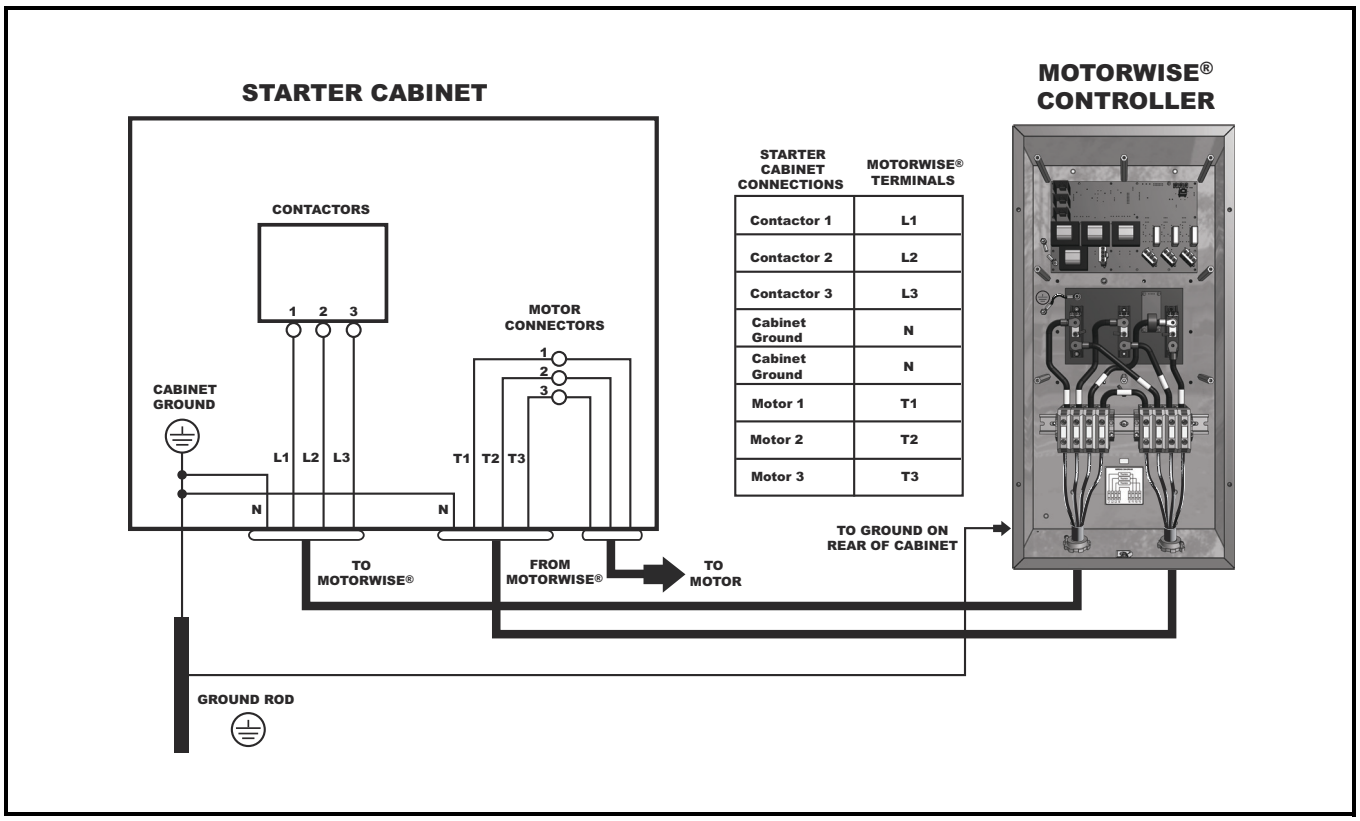

Figure 4a.

MOTORWISE® Controller Connections for a Clockwise Phase Rotation

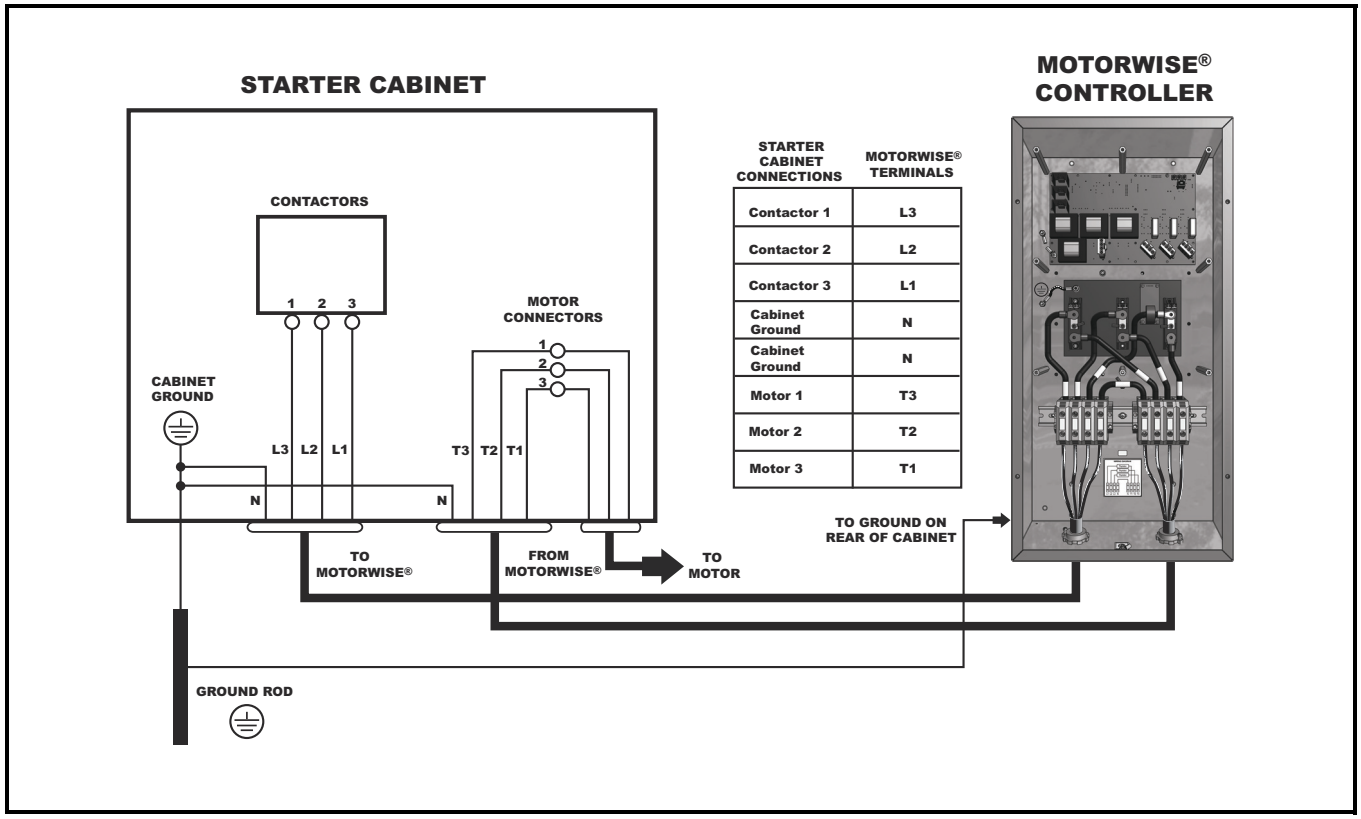

Figure 4b.

MOTORWISE® Controller Connections for a Counter-Clockwise Phase Rotation

Completing the Installation

1. Ensure that the **On/Bypass** switch on the surface of the clear shield is set to Bypass (the down position). Bypass disables the energy-saving features prior to calibration.
2. Replace the cover of the MOTORWISE® controller.
3. Apply power to the starter cabinet.
4. Verify normal system operation.
5. Make sure that the system associated to the motor rotates in the correct original direction.
6. When the installation is complete, please contact a service representative to schedule a calibration appointment.

NOTE: The MOTORWISE® controller is not in energy-saving mode at this time.

Required Materials

- Four-conductor wire of an appropriate gauge for the motor in use
- A bare copper wire to ground the MOTORWISE® controller chassis
- A copper grounding rod, if necessary
- Grounding lugs, if necessary
- Four strain-relief watertight connectors (CGB or Sealtight, for example) of a size based on the four-conductor wire selected.
- Mounting hardware, if other than the supplied mounting brackets are required.
- Three wire connectors to connect from the MOTORWISE® controller outputs to the motor leads.

NOTE: The motor and its starter cabinet/contactor cabinet must be grounded according to local electrical regulations.

WARNING	**The clear protective shield located inside the unit is to remain in place at all times. All installation connections are to be made without removing this shield**.

WARNING	**Power to the starter cabinet must be turned off before the installation connections are made.**

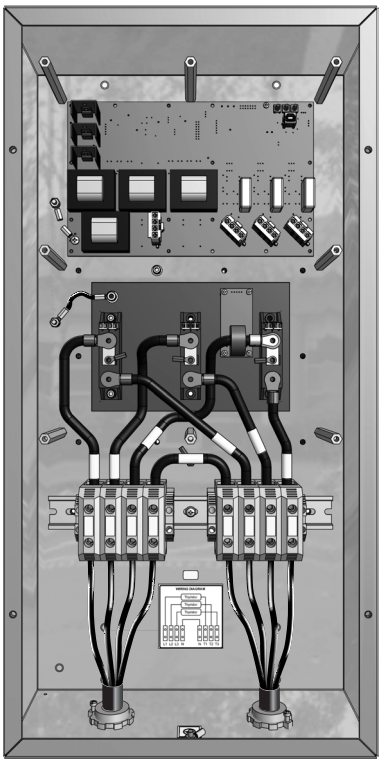

Figure 5. Wiring for the MOTORWISE® Controller

Power connections to the MOTORWISE® controller are made through the four-conductor bundle connected after the contactors. The returned power connections are made directly to the motor leads. Optionally, spliced connections may be used.

Power is applied to the MOTORWISE® controller by making the respective connections to the four terminal blocks on the left. Power is returned from the MOTORWISE® controller through the four terminal blocks on the right.The two terminal blocks at the center, labeled N, are to be connected to the ground wires of the input and output bundles.

Servicing and Troubleshooting

The MOTORWISE® controller is calibrated after installation by a qualified service technician. Once calibrated, there is no additional requirement for periodic servicing of the unit.

Modifications after Installation

In the event that the customer makes modifications to the system after the installation of the MOTORWISE® controller, a service call is required or recommended, as indicated below:

- The MOTORWISE® controller requires a clockwise phase rotation in the supply voltage applied to its input terminals. The installer makes the input and output connections accordingly. Any change to the power supply or motor connections will require a service call.
- The MOTORWISE® controller is calibrated for the motor in use at the time of installation. Replacement of this motor will require a service call.
- **The motor size must not exceed the horsepower specified in the overview section.**
- In the case of the oil industry, the MOTORWISE® controller can adapt to changes in the loading caused by fluid level variations. For extreme changes in the load profile, such as stroke length, pumping speed, or rod-string design, a service call is recommended to optimize energy savings.

Troubleshooting at the Site Where the MOTORWISE® Controller Is Installed

A malfunction may take the form of a complete loss of motor operation or rough, inconsistent operation. Possible causes include the following:

Full or Partial Loss of Power

Troubleshooting the power connections should be performed only by a qualified electrician who observes standard safety practices.

Make sure that three-phase power is received at the input terminals of the MOTORWISE® controller. The phase-to-phase voltage between phases in each pair of phases (A-B, B-C, and C-A) must be either 230V or 480V RMS depending on the horsepower of the motor and controller being used. If correct voltages are not measured, troubleshoot other components in the starter cabinet, such as the fuses and contactors, etc.

- Check the connections from the contactors to the MOTORWISE® controller.
- Make sure that three-phase power is received at the motor terminals.
- Remove the front cover of the MOTORWISE® controller and put the On/Bypass switch in the Bypass (down) position. This action disables the energy-saving mode of the MOTORWISE® controller

- Measure the phase-to-phase voltages between phases in each pair of phases at the output terminals of the MOTORWISE® controller. These voltages should be identical to those measured at the input terminals. If not, a malfunction of the MOTORWISE® controller may be the cause. **Please turn off the power at the starter cabinet. Please contact a service representative to schedule a service call.**

- If the voltages at the output terminals of the MOTORWISE® controller are correct, then measure the phase-to-phase voltages between each pair of phases at the motor terminals.

- If the voltages are not relatively identical to those measured at the input terminals of the controller, check the connections from the output terminals of the controller to the motor.

Rough or Inconsistent Operation

If rough or inconsistent operation is observed only when the On/Bypass switch is in the On position (up), a malfunction of the controller may be the cause. Please open the cover, put the On/Bypass switch in the Bypass position and close the cover. Doing so will allow continued operation of the pumping system or a similar application, although without the energy-saving normally provided by the MOTORWISE® controller. **Please contact a service representative to schedule a service call.**

Malfunctions

If a malfunction occurs despite correct voltages at the motor leads while the On/Bypass switch is in the Bypass position, a malfunction in the motor or its associated system can be the cause. Please consult a specialist for the particular motor in use.

Technical Specifications

	MOTORWISE® 15/3	MOTORWISE® 30/3 & MOTORWISE® 30/3 GEN	MOTORWISE® 50/3 & MOTORWISE® 50/3 GEN	MOTORWISE® 60/3 & MOTORWISE® 60/3 GEN	MOTORWISE® 100/3 & MOTORWISE® 100/3 GEN
Horsepower Range	5-15hp Max	15-30hp Max	15-50hp Max	30-60hp Max	60-100hp Max
Operating Input Voltage Range	220V to 510V RMS phase-to-phase	220V to 510V RMS phase-to-phase	220V to 440V RMS phase-to-phase	440V to 510V RMS phase-to-phase	440V to 510V RMS phase-to-phase
Short-term Surge Currrent	600 amps for 300 ms, per phase	600 amps for 300 ms, per phase	600 amps for 300 ms, per phase	600 amps for 300 ms, per phase	600 amps for 300 ms, per phase
Continuous Rated RMS Current	40 amps per phase at 230V 19 amps per phase at 480V	77 amps per phase at 230V 40 amps per phase at 480V	124 amps per phase at 230V	77 amps per phase at 480V	124 amps per phase at 480V
Phase	Three-Phase	Three-Phase	Three-Phase	Three-Phase	Three-Phase
Operating Frequency	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Generation Compliant	Yes	Yes	Yes	Yes	Yes
Weight	30 lb (13.6 kg)	30 lb (13.6 kg)	30 lb (13.6 kg)	30 lb (13.6 kg)	30 lb (13.6 kg)
Dimensions (H x W x D)	18 x 13 x 6 in (46 x 32 x 15 cm)	26 x 13.25 x 9.20 in (66 x 33.6 x 23.4 cm)	26 x 13.25 x 9.20 in (66 x 33.6 x 23.4 cm)	26 x 13.25 x 9.20 in (66 x 33.6 x 23.4 cm)	26 x 13.25 x 9.20 in (66 x 33.6 x 23.4 cm)
Operating Temperature	-40 °C to 50 °C	-40 °C to 50 °C	-40 °C to 50 °C	-40 °C to 50 °C	-40 °C to 50 °C
Storage Temperature	-50 °C to 60 °C	-50 °C to 60 °C	-50 °C to 60 °C	-50 °C to 60 °C	-50 °C to 60 °C
Safety Standards	ETL Listed: Conforms to UL Standard 508	ETL Listed: Conforms to UL Standard 508	ETL Listed: Conforms to UL Standard 508	ETL Listed: Conforms to UL Standard 508	ETL Listed: Conforms to UL Standard 508

Warranty Information

The TECHNOWISE Group® warrants for a period of one year from the date of shipment that this product will be free from defects in material and workmanship and will meet published specifications for this product at the time of shipment, assuming normal use and normal operating conditions. THIS WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY GIVEN BY THE TECHNOWISE GROUP® WITH RESPECT TO THIS PRODUCT AND IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, ARISING BY OPERATION OF LAW OR OTHERWISE, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR PURPOSE, WHETHER OR NOT THE PURPOSE OR USE HAS BEEN DISCLOSED TO THE TECHNOWISE GROUP® IN SPECIFICATIONS, DRAWINGS OR OTHERWISE, AND WHETHER OR NOT THIS PRODUCT HAS BEEN SPECIFICALLY DESIGNED AND/OR MANUFACTURED BY THE TECHNOWISE GROUP® FOR A SPECIFIC USE OR PURPOSE OF BUYER/USER.

Limitation of Liability

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