BALDOR VS DRIVES APPLICATION NOTE

Document Reference: AN060001VS1

Contactor Installation

Required Equipment:

VS1SP Inverter
VS1GV Vector
VS1SD Servo

Introduction:
Semiconductor power switching motor controllers do not provide positive (by means of physically altering the switching device position) disconnecting means. Drives and soft starters use semiconductor solid state power devices and therefore do not provide positive or galvanic motor branch circuit isolation. Motor operated from soft starter or drive is not isolated from the power source when drive or soft start is in the “off” or “stopped” state.

Local electrical codes, occupational safety codes, specific industry requirements or specific application requirements may necessitate galvanic or positive isolation. Three pole electromechanically operated air contactors are the most common mean of electrical circuit isolation and switching. These contactors are used as drive output, drive input, multiple contactor bypass schemes or multiple motor applications. Electromechanical contactors use set of stationary contacts and set of moving contacts. These moving contacts assembled on the armature, which is pulled in by electromagnetic coils against the force of spring. When coil is energized magnetic force closes moves the armature to close the contacts. When coil is de-energized spring pushes the armature out and contacts open. There is an action and re-action of electromagnetic and spring mechanical forces and therefore there is balancing oscillations that cause contact to bounce when closing and opening. Bouncing may last for several electrical cycles result in opening and closing the contacts for several hundred of milliseconds. This bouncing action causes current interruption and arcing, acing results in voltage spikes, which in turn have a detrimental effect of semiconductors. Transistors and SCR (silicon controlled rectifiers) exposed to arcing voltage spikes will prematurely fail. Since bouncing is an inherent to electromechanical contactor and can not be prevented the proper procedure is to eliminate arcing by not having the current flow through a contactor when closing or opening the contacts. The proper contactor switching contactor must include time delay between energizing and de-energizing the contactor coil and starting and stopping the controller logic circuitry. Time delay depends on the type of electromagnetic contactor and semiconductor controller. NEMA rated contactors are larger and have heavier contacts then IEC rated contactors and therefore bounces longer with more oscillations. In general for all Baldor drives and all contactors we recommend 1 second time delay.

Procedure:

Contactor switching sequence must follow “first on, last off” principle. Follow the following rules.

Rule # 1.
When **energizing** the drive or starting the motor, the contactor must be energized at least 1 second before semiconductor device starts the motor by conducting the current to the motor.

Implementation:

For a drive or a soft starter, the input contactor control circuit must include the time “delay-on” relay logic circuit with 1 second delay for auxiliary normally open contact to close after contactor coil is energized. The recommended elementary diagram for this circuit is illustrated in Figure 1.

For a drive or a soft starter, the output contactor control circuit must include the time “delay-on” relay logic circuit with 1 second delay for auxiliary normally open contact to close after contactor coil is energized. The recommended elementary diagram for this circuit is illustrated in Figure 2.

Rule # 2.

When **de-energizing** the drive or stopping the motor, the contactor must be de-energized at least 0.5 second after semiconductor de-saturates and is no longer conducting the current. The timing of that “no current flow” condition is often dependent on the type of controller stopping or deceleration mode. Attention must be paid to the fact, whether the stopping is an uncontrolled coasting, a controlled deceleration or a forced (either through regeneration or dc injection) braking. This 0.5 second delay is longer then a typical three phase induction motor open circuit time constant. However a conservative 500ms delay should allow the decay of all residual magnetic flux and capacitive charge present in the motor, motor leads, and output devices such as reactors and filters.

Implementation:

For a drive or a soft starter, the output contactor control circuit includes the time “delay-off” relay logic circuit with 0.5 second delay for contactor coil to stay energized and keep contactor closed after motor is de-energized. The recommended elementary diagram for this circuit is illustrated in Figure 2.

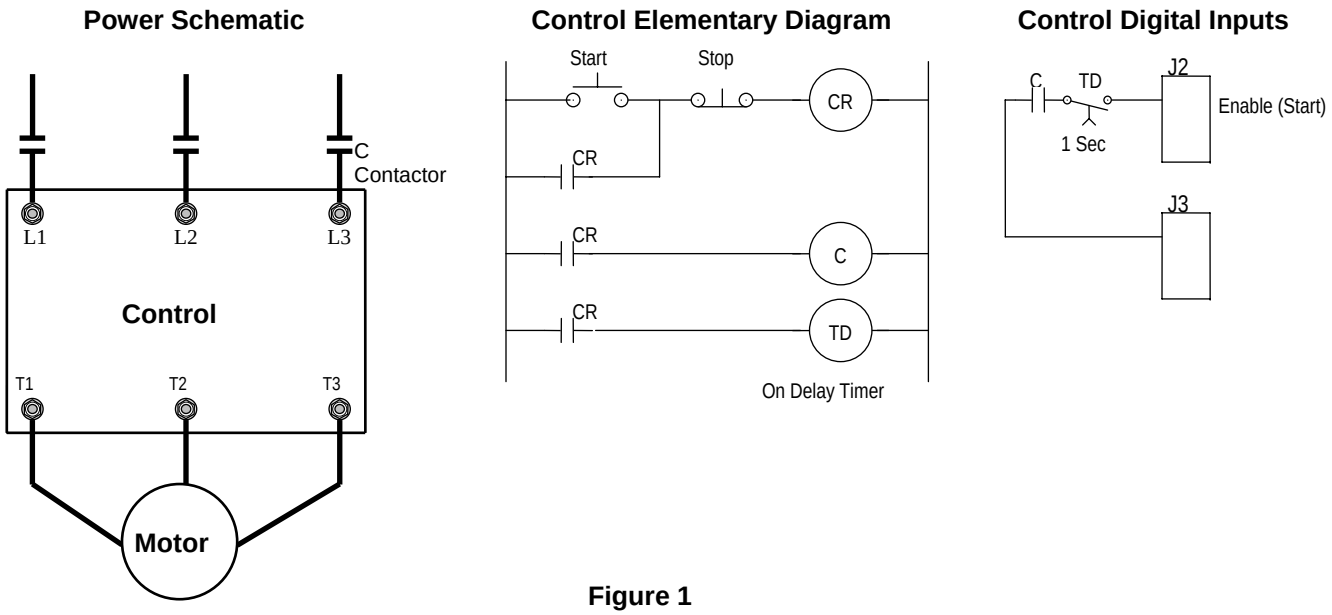

Figure 1

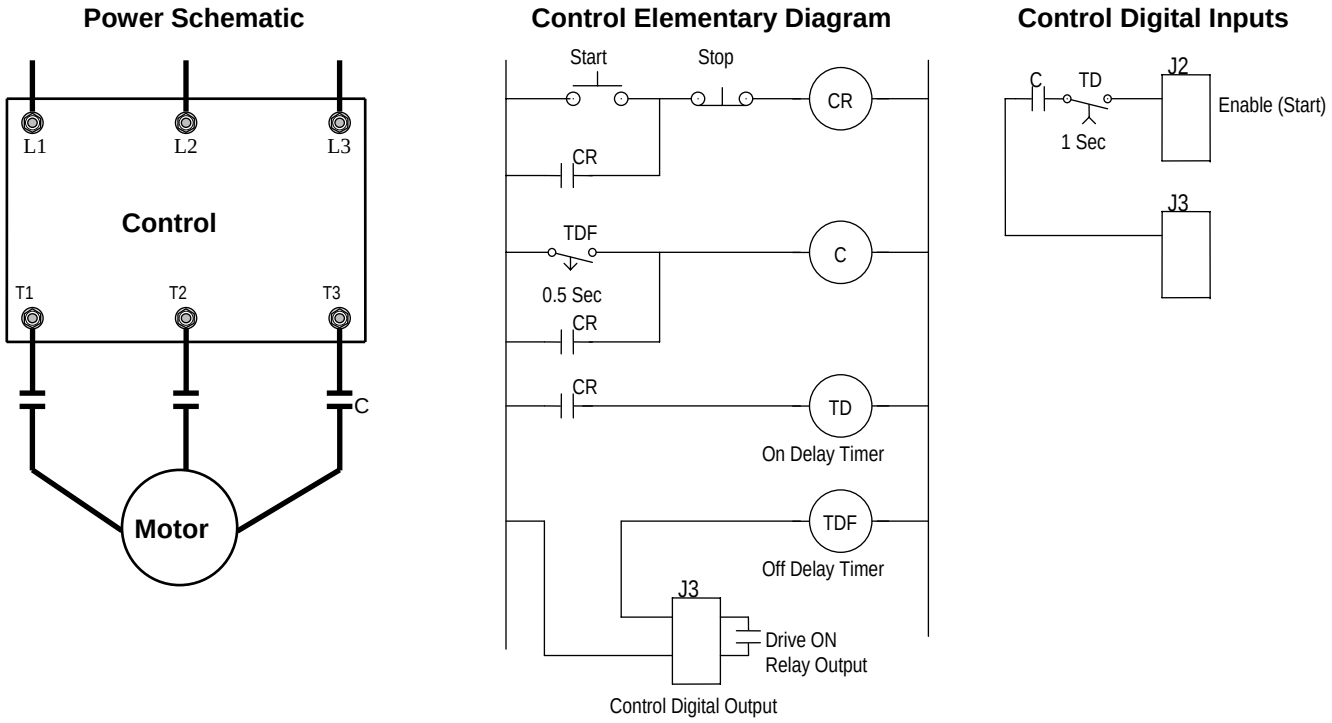

Figure 2