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SUBJECT: How to wire a motor starter

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A motor starter is a combination of devices to allow an induction motor to start, run and stop according to commands by an operator or a controller. Typically an induction motor will run by a voltage of 230 Volt or 460 Volt, 3 phase 60 Hz in USA and be controlled by a control voltage of 115 Volt AC or 24 Volt DC. Several other combinations are possible in USA or other countries and are easily derived from the methods shown in this document.

The motor starter must have a contactor to open or close the flow of energy to the motor and an overload relay to protect the motor against thermal overload. Other devices for disconnecting and short-circuit protection are necessary, typically a circuit breaker or fuses. The short-circuit protection is not shown here.

The contactor is a switch with 3 poles whose poles are closed by the application of a control voltage to the coil. When the coil is energized the 3 poles are closed and are kept closed as long as the coil is energized. The contactor is a special relay specifically designed for motor control, but can be used for resistive loads; in the case of resistive loads it is possible to handle the thermal current, which is more than the current of a motor. Since the motor has inductance, the breaking of the current is more difficult and the contactor has to be derated.

The overload relay is a device that changes the status of a normally closed contact from ON to OFF when the current going thru any of the 3 phases increases above a set point. This device is designed to provide overcurrent protection to a motor.

This document shows step by step the process of wiring the FUJI series of contactors that ADC sells.

The main combinations are:

- a) Full voltage non reversible 3 phase motors.
- b) Full voltage reversing 3 phase motors
- c) Single phase motors
- d) Wye-delta open transition

We will show the basic circuit and in some cases pictures on how to connect the wiring. The pictures are shown here to teach the methods and are not intended to show how a panel is professionally wired. The examples show only one size of contactor with a coil of 24 VDC but the concept is valid for all the available sizes.

WARNING! Use the instructions of each specific device. Failure to do so may result in electric shock or damage.

This set of pictures shows a set of elements you will need:



Contactor



Overload relay



Auxiliary contact block

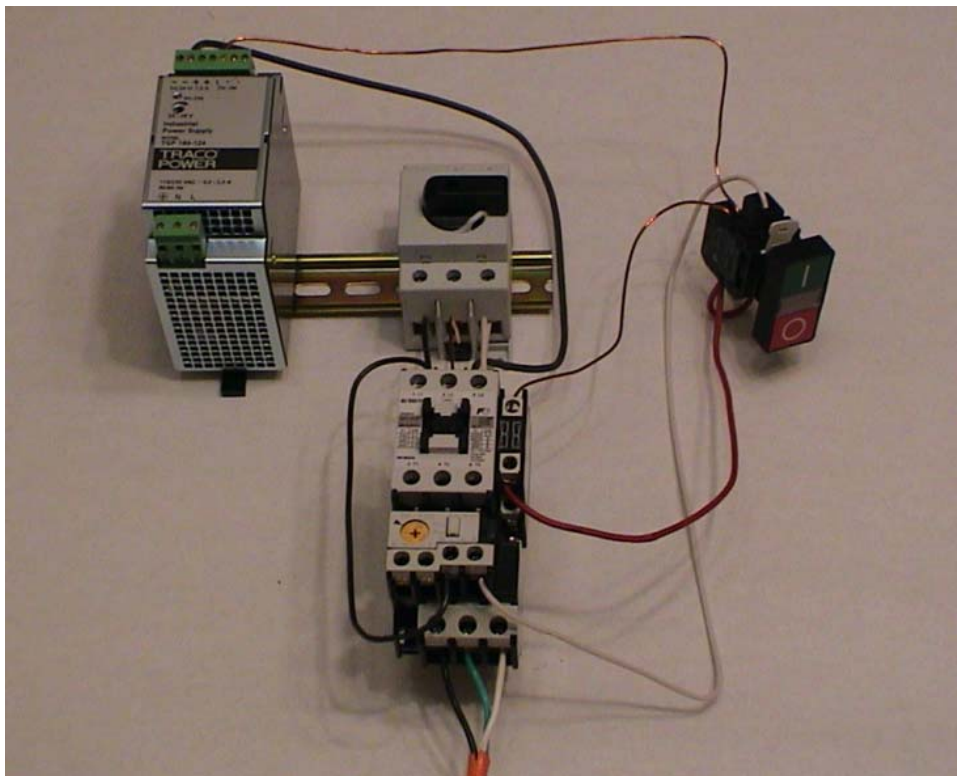
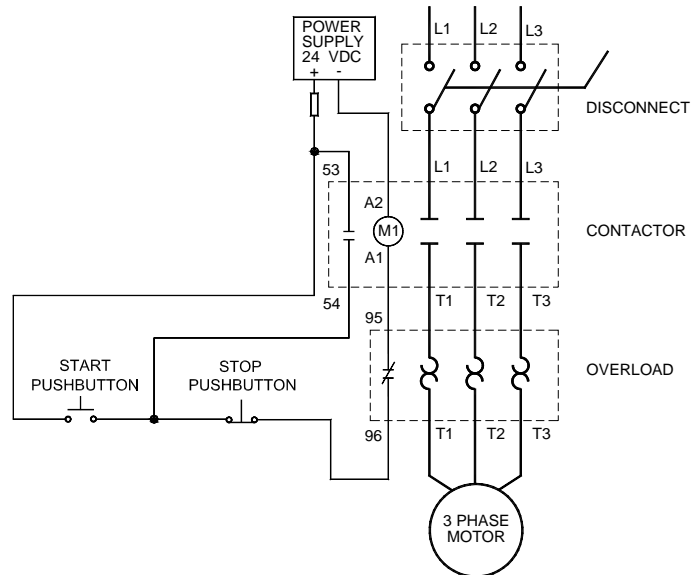


Start/stop pushbutton

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a) **Full voltage non reversible 3 phase motors.**

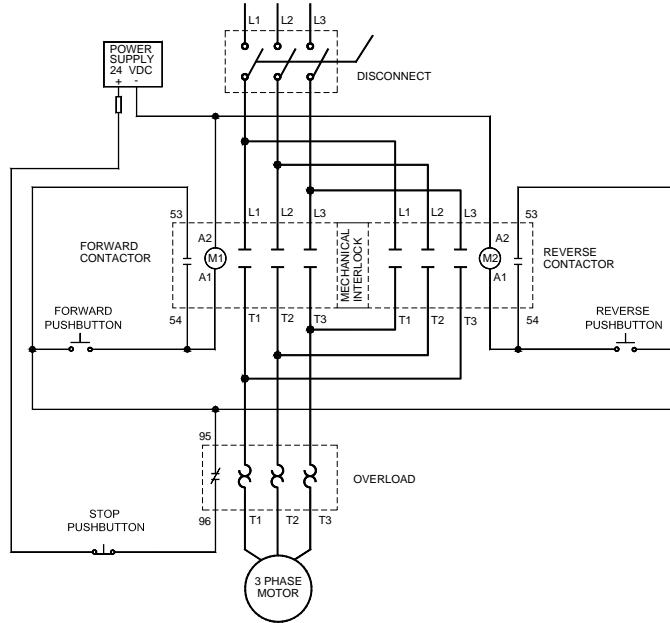
The following diagram is shown for a 3-wire control with 24 VDC control voltage: The picture shows the same arrangement. We need a contactor, an auxiliary contact block, an overload relay, a normally open start pushbutton, a normally closed stop pushbutton and a power supply with a fuse (Not shown on the picture).



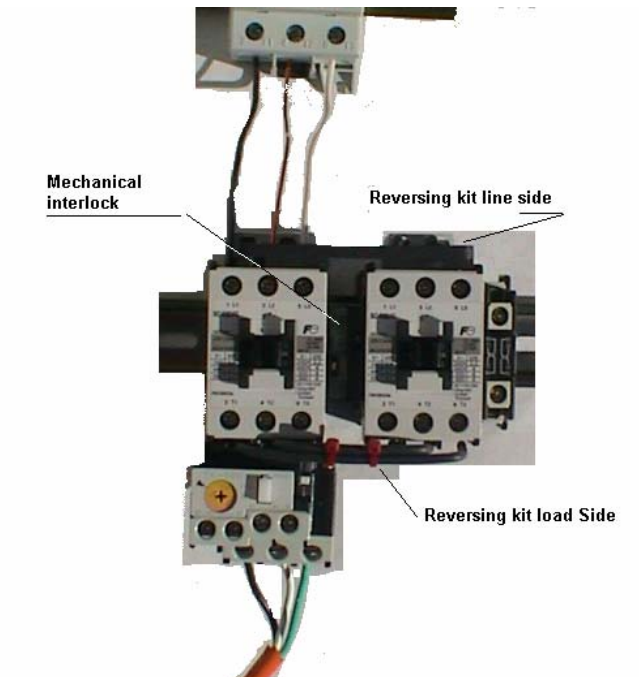
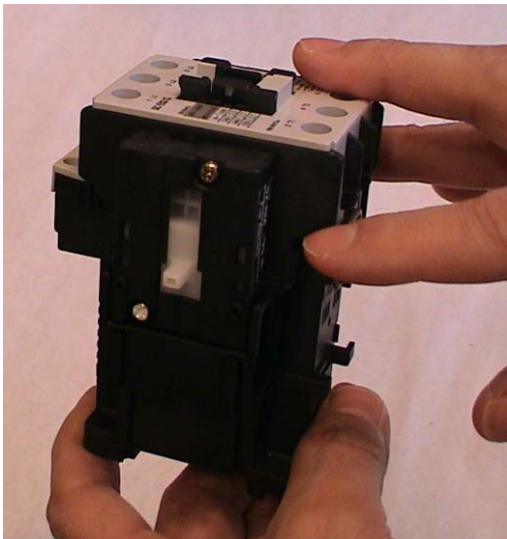
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b) Full voltage reversible 3 phase motors.

The diagram is shown on the following figure for a 3-wire reversing control with 24 VDC control voltage: The picture shows the same arrangement. We need here two contactors, two auxiliary contact blocks, an overload relay, a mechanical interlock, two normally open start pushbuttons, a normally closed stop pushbutton and a power supply with a fuse (Not shown on the picture)



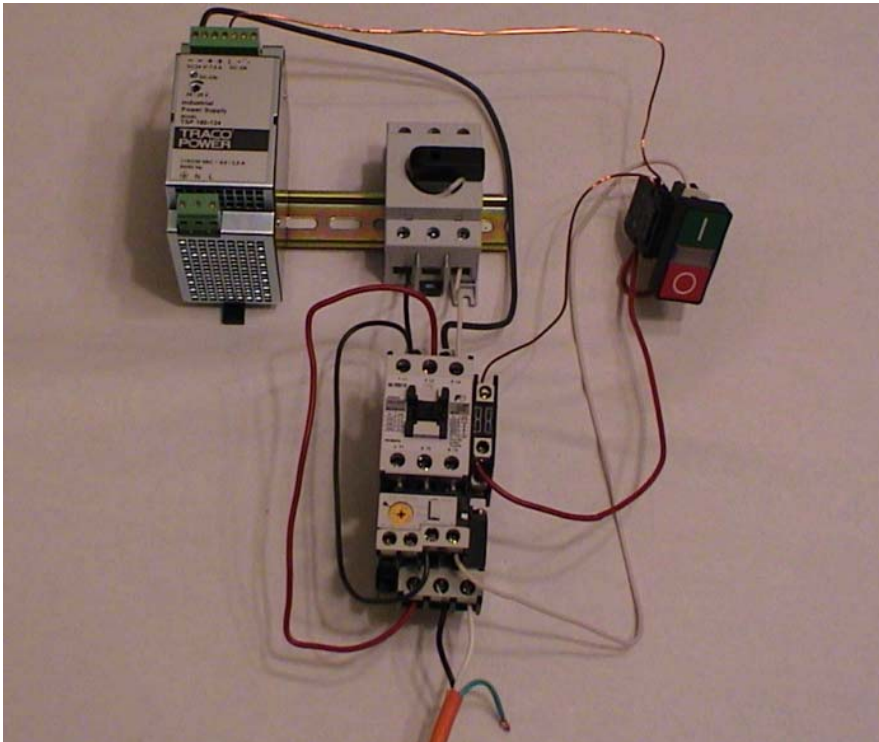
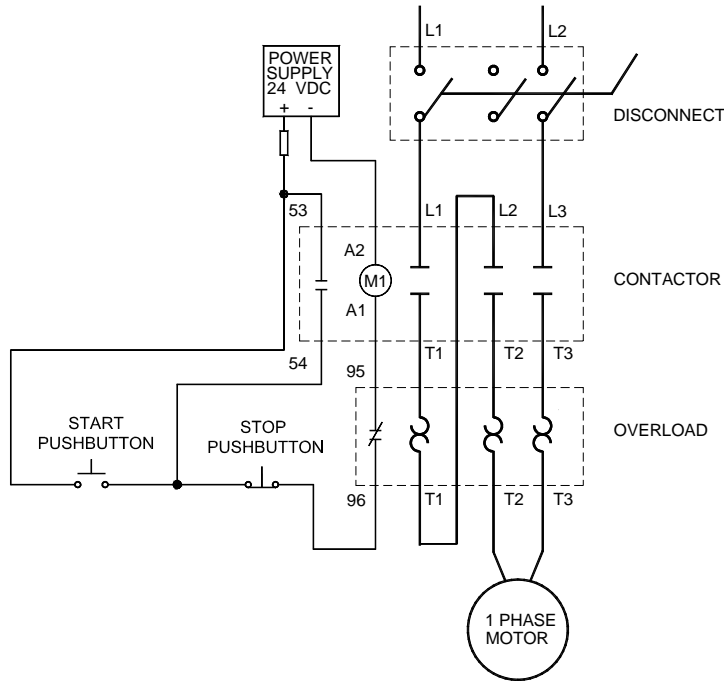
Mechanical interlock shown mounted on the side of contactor



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c) Full voltage single phase motors.

The diagram is shown on the following figure for a 3-wire control: The picture shows the same arrangement. . We need here a contactor, an overload relay, one auxiliary contact block, a normally open start pushbutton, a normally closed stop pushbutton and a power supply with a fuse (Not shown on the picture)



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d) Wye-delta open transition 3-phase motors.

The following diagram is shown for a 3-wire control of a delta-star connection: We need here three contactors, an overload relay, one auxiliary contact block, a normally open start pushbutton, a normally closed stop pushbutton, a on delay timer of 0-20 second and a power supply with a fuse

