**Motor control circuit diagram forward reverse pdf**

GOALS: Discuss cautions that must be observed in reversing circuits. Explain how to reverse a three-phase motor. Discuss interlocking methods. Connect a forward-reverse motor control circuit. The direction of rotation of any three-phase motor can be reversed by changing any two motor T leads (Ill. 1). Since the motor is connected to the power line regardless of which direction it operates, a separate contactor is needed for each direction. If the reversing starters adhere to NEMA standards, T leads 1 and 3 will be changed (Ill. 2). Since only one motor is in operation, however, only one overload relay is needed to protect the motor. True reversing controllers contain two separate contactors and one over load relay. Some reversing starters will use one separate contactor and a starter with a built-in overload relay. Others use two separate contactors and a separate over load relay. A vertical reversing starter with overload re lay is shown in Ill. 3, and a horizontal reversing starter without overload relay is shown in Ill. 4. Ill. 1 The direction of rotation of any three-phase motor can be changed by reversing connection to any two motor T leads. Interlocking Interlocking prevents some action from taking place until some other action has been performed. In the case of reversing starters, interlocking is used to prevent both contactors from being energized at the same time. This would result in two of the three phase lines being shorted together. Interlocking forces one contactor to be de-energized before the other one can be energized. There are three methods that can be employed to assure interlocking. Many reversing controls use all three. Mechanical Interlocking Most reversing controllers contain mechanical interlocks as well as electrical interlocks. Mechanical interlocking is accomplished by using the contactors to operate a mechanical lever that prevents the other contactor from closing while one is energized. Mechanical interlocks are supplied by the manufacturer and are built into reversing starters. In a schematic diagram, mechanical interlocks are shown as dashed lines from each coil joining at a solid line (Ill. 5). Electrical Interlocking Two methods of electrical interlocking are avail able. One method is accomplished with the use of double acting push buttons (Ill. 6). The dashed lines drawn between the push buttons indicate that they are mechanically connected. Both push buttons will pushed at the same time. The normally closed part of the FORWARD push button is connected in series with R coil, and the normally closed part of the REVERSE push button is connected in series with F coil. If the motor should be running in the forward direction and the REVERSE push button is pressed, the normally closed part of the push button will open and disconnect F coil from the line before the normally open part closes to energize R coil. The normally closed section of either push button has the same effect on the circuit as pressing the STOP button. The second method of electrical interlocking is accomplished by connecting the normally closed auxiliary contacts on one contactor in series with the coil of the other contactor (Ill. 7). Assume that the FORWARD push button is pressed and F coil energizes. This causes all F contacts to change position. The three F load contacts close and connect the motor to the line. The normally open F auxiliary contact closes to maintain the circuit when the FORWARD push button is released, and the normally closed F auxiliary contact connected in series with R coil opens (Ill. 8). If the opposite direction of rotation is desired, the STOP button must be pressed first. If the REVERSE push button were to be pressed first, the now open F auxiliary contact connected in series with R coil would prevent a complete circuit from being established. Once the STOP button has been pressed, however, F coil de-energizes and all F contacts return to their normal position. The REVERSE push button can now be pressed to energize R coil (Ill. 9). When R coil energizes, all R contacts change position. The three R load contacts close and connect the motor to the line. Notice, however, that two of the motor T leads are connected to different lines. The normally closed R auxiliary contact opens to prevent the possibility of F coil being energized until R coil is de-energized. Ill. 2 Magnetic reversing starters generally change T leads 1 and 3 to reverse the motor. Developing a Wiring Diagram The same basic procedure is used to develop a wiring diagram from the schematic as was followed in the previous sections. The components needed to construct this circuit are shown in Ill. 10. In this example, assume that two contactors and a separate three-phase overload relay are to be used. The first step is to place wire numbers on the schematic diagram. A suggested numbering sequence is shown in Ill. 11. The next step is to place the wire numbers beside the corresponding components of the wiring diagram (Ill. 12). Reversing Single-Phase Split-Phase Motors To reverse the direction of rotation of a single-phase split-phase motor, either the starting winding leads or running winding leads, but not both, are inter changed. A schematic diagram of a forward-reverse control for a single-phase split-phase motor is shown in Ill. 13. Notice that the control section is the same as that used for reversing three-phase motors. In this example, run winding lead T1 will always be connected to L1, and T4 will always be connected to L2. The start winding leads, however, will be changed. When the forward contactor is energized, start winding lead T5 will be connected to L1, and T8 will be connected to L2. When the reverse contactor is energized, start winding lead T5 will be connected to L2, and T8 will be connected to L1. Ill. 3 Vertical reversing starter with overload relay. Ill. 4 Horizontal reversing starter. Ill. 5 Mechanical interlocks are indicated by dashed lines extending from each coil. Ill. 6 Interlocking with double acting push buttons. Ill. 7 Electrical interlocking is also accomplished with normally closed auxiliary contacts. Ill. 8 Motor operating in the forward direction. Ill. 9 Motor operating in the reverse direction. Ill. 10 Components needed to construct a reversing control. Ill. 11 Placing numbers on the schematic. Ill. 12 Components needed to construct a reversing control circuit. Ill. 13 Reversing a single-phase split-phase motor. QUIZ: 1. How can the direction of rotation of a three-phase motor be changed? 2. What is interlocking? 3. Referring to the schematic shown in Ill. 7, how would the circuit operate if the normally closed R contact connected in series with F coil were connected normally open? 4. What would be the danger, if any, if the circuit were wired as stated in question 3? 5. How would the circuit operate if the normally closed auxiliary contacts were connected so that F contact was connected in series with F coil, and R contact was connected in series with R coil, Ill. 7? 6. Assume that the circuit shown in Ill. 7 were to be connected as shown in Ill. 14. In what way would the operation of the circuit be different, if at all? Ill. 14 The position of the holding contacts has been changed from that in Ill. 7. Abbreviations:O/L = Over Load RelayNO = Normally OpenNC = Normally CloseREV = Reverse FOR = Forward REV / FOR Three-Phase Motor Connection Power & Control Diagram REV / FOR Three-Phase Motor Connection  Power diagramPower Diagram:  REV / FOR Three-Phase Motor Connection  Control diagram Control Diagram: Check more diagrams like these here: Three Phase Motor & Control Installation wiring diagrams Related Articles If a three-phase motor is to be driven in only one direction, and upon its initial energization it is found to be rotating opposite to what is desired, all that is needed is to interchange any two of the three line leads feeding the motor. This can be done at the or at the motor itself. Three-phase motor rotation Once two of the lines have been switched, the direction of the magnetic fields created in the motor will now cause the shaft to spin in the opposite direction. This is known as reversing the . Reversing Magnetic Starters If a motor is to be driven in two directions, then it will require a Forward / Reverse motor starter, which has two three-pole horsepower-rated contactors rather than just one as in the conventional starter. Each of the two different motor starters powers the motor with a different phase rotation. When the forward contactor is energized, power contacts connect line L1 to T1, line L2 to T2 and line L3 to T3 at the motor. When the reverse contactor is energized, the power contacts connect line L1 to T3, line L2 to T2 and line L3 to T1 at the motor. Forward/Reverse power circuit Since the two motor starters control only one motor, only one set of overload relay heaters need be used. The return paths for both starter coils connect in with the of the so that if an overload occurs in either direction, the starter coils will be de-energized and the motor will come to a stop. Note that the two contactors must be and so that they cannot be energized simultaneously. If both starter coils became energized simultaneously, a short circuit will occur with potentially hazardous results. Forward / reverse starters will come with two sets of normally open to act as holding contacts in each direction. They will also come with two sets of normally closed auxiliary contacts to act as electrical interlocks. Mechanical Interlocks Forward / reverse starters must never close their power contacts simultaneously. The best way to provide this is through electrical interlocks, which prevent the one coil from being energized if the other is engaged. A failure in electrical interlocking can cause both coils to be energized at the same time. If both become energized, some form of mechanical interlock is required to prevent both from pulling in. Represented on as a dotted line between the two coils, a mechanical interlock is a physical barrier that is pushed into the path of one coil’s armature by the movement of the adjacent coil. This means that even if both coils are energized, only one armature will be able to pull in fully. The coil that is prevented from pulling in will make a terrible chattering sound as it tries to complete the magnetic circuit. Mechanical interlocks should be relied on as a last resort for protection. Electrical Interlocks Electrical interlocking is accomplished by installing the normally closed contact of one direction’s coil in series with the opposite direction’s coil, and vice versa. This ensures that when the forward coil is energized, pushing the reverse will not energize the reverse coil. The same situation is in effect when the reverse coil is energized. In both situations the stop button will need to be pressed to de-energize the running coil and return all its auxiliary contacts back to their original state. Then the opposite direction coil can be engaged. Reversing Control Circuit Forward/Reverse control circuit When designing the control schematic for forward / reverse circuits, we start with the standard , add a second normally open pushbutton, and add a holding contact branch for the second coil. A single stop button is sufficient to disable the motor in both directions. The two coils are mechanically interlocked and the normally closed instantaneous contacts provide electrical interlocking. If the forward pushbutton is pressed, as long as the reverse coil is not engaged, current will find a path through the normally closed reverse contact and energize the forward coil, causing all associated with that coil to change their state. The will close and the normally closed electrical interlock will open. If the reverse pushbutton is pressed while the forward coil is engaged, current will not be able to get past the forward normally closed contact, and nothing will happen. In order to send the motor in the reverse direction, the forward coil must be de-energized. To do this, the stop button must be pressed, then the reverse pushbutton will be able to energize the reverse coil. Regardless of the direction the motor is spinning in, this circuit will operate as a standard three-wire circuit providing low-voltage protection (LVP) until either the stop button is pressed, or an occurs. Pushbutton Interlocks Forward/Reverse pushbutton interlock Pushbutton interlocking requires the use of four-contact momentary push buttons with each pushbutton having a set of normally open and normally closed contacts. To achieve pushbutton interlocking, simply wire the normally closed contacts of one pushbutton in series with the normally open contacts of the other pushbutton, and the holding contacts will be connected in with the appropriate button’s normally open contacts. This circuit still requires the installation of electrical interlocks. Pushbutton interlocking doesn’t require the motor coils to be disengaged before reversing direction because the normally closed forward contacts are in series with the normally open reverse contacts, and vice-versa. Pushing one button simultaneously disengages one coil while starting the other. This sudden reversal () can be hard on the motor, but if quick reversal of the motor is required, this circuit can be a solution. A device that controls the flow of electrical power to a motor. It is designed to safely start and stop a motor, and provide overload protection. The direction that a three-phase motor spins is determined by the phase sequence of the voltage impressed upon it. To reverse the direction of the motor we simple reverse the phase sequence by switching any to line leads. In electrical terms, refers to a connection where current has only one path to flow. Loads connected in series will have the the same value of current flowing through them, and share the total voltage between them. Switches and overcurrent equipment is connected in series with equipment to control and protect it. A contact that under normal conditions has continuity through it. When the contact changes its state it interrupts the flow of current by opening its contacts. Can be associated with pushbuttons, pilot devices or magnetic contactors. A heater element paired with normally-closed contacts that open once the heater gets too hot. Two types of relays are the bimetallic strip and the melting solder pot. Normally-closed contacts used in forward/reverse control circuits that prevent both directions coils from being energized at the same time. A physical barrier that is pushed into the path of one coil's armature by the movement of the adjacent coil in a forward/reversing motor starter. Contacts on a magnetic starter that are not Horsepower rated. Can come as either normally-open or normally-closed and can be used as maintaining contacts, electrical interlocks or control for pilot lights. With respect to magnetic contactors, the armature or plunger is the movable part of the magnetic circuit. When a coil is energized the armature is pulled in, opening and/or closing a set or sets of contacts. A diagram that shows how a circuit works logically and electrically. It uses symbols to identify components and interconnecting lines to display the electrical continuity of a circuit. It is often used for troubleshooting purposes. Also known as a ladder diagram. A momentary contact device that has a built in spring to return the button to its normal position once release. Available with either normally-open, normally-closed or both sets of contacts. In motor control terminology, a three-wire circuit utilizes a magnetic motor starter with a holding contact, along with momentary contact pushbuttons. A three-wire circuit provides low-voltage-protection. The conducting part of a switch that makes or breaks a circuit. Also known as a "maintaining" contact, these are the normally open contacts of a magnetic starter that are connected in parallel with the start button in a three-wire control circuit. When using the conventional NEMA numbering system, they get wire numbers "2" and "3." Circuits with low-voltage protection will not automatically turn back on when voltage is restored following a power outage. Examples include the microwave or power tools. A moderate and gradual rise in the value of current over a relatively long period of time that is caused by excessive amounts of current drawn by a motor due to too much load being put on the motor. In electrical terms, refers to a connection where current has more than one path to flow. Loads connected in parallel will experience the same potential difference (voltage), but may draw different values of current depending upon their individual resistance. When a motor is spinning in one direction and is stopped and suddenly re-energized in the opposite direction before the shaft of the motor has time to come to a complete stop.

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