Motor-Operated Circuits Using Sensors (optional)

EXERCISE OBJECTIVE

- Introduce the Reversible AC Motor;
- Determine the ability of the sensors of the training system to detect the presence of holes in three disks having different characteristics.

DISCUSSION OUTLINE

The Discussion of this exercise covers the following points:

- Reversible AC Motor characteristics
- Motor installation
- Disks
- Installation of a sensor on the Reversible AC Motor casing
  Installation of the limit switch on the reversible ac motor.

DISCUSSION

Reversible AC Motor characteristics

The Reversible AC Motor, model 3174-3, is a permanent split capacitor motor. The rotation direction is reversible and the output speed is 30 r/min. Other characteristics of the Reversible AC Motor, are shown in Table 13.

Table 13. Reversible AC Motor characteristics.

Parameter	Rating
Voltage	115 V, 60/50 Hz
Power rating (hp)	1/100
Full-load current (A)	0.28
Motor type	permanent split capacitor
Rotation	reversible
Enclosure type	open
Thermal protection	none
Gear ratio	99:1
Rotation speed (r/min)	30
Full load torque	0.84 n·m (7.5 lb·in)
Note: The ratings are based on 60 Hz operation.	

Motor installation

The Reversible AC Motor can be secured to the work surface by means of push-lock fasteners, or using the quick-lock knobs. Throughout this exercise, the motor is shown with push-lock fasteners.

Position the Reversible AC Motor on the work surface, as shown in Figure 32. (If you are using the system in a 8001 or 8006 EMS environment, place the motor on a standard table.) Align the push-lock fasteners with the perforations, then push on the fasteners.

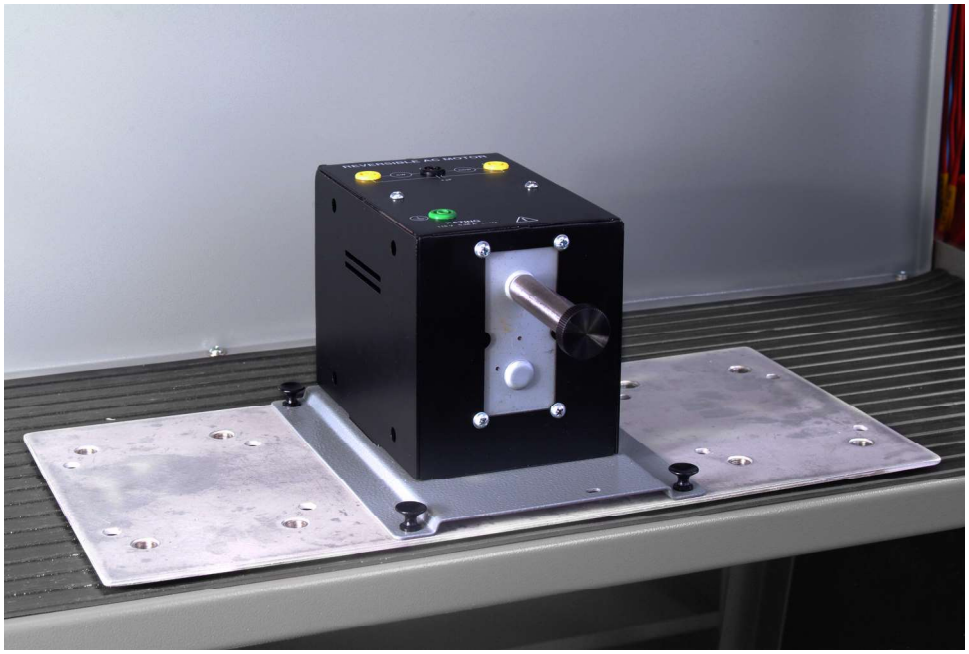


Figure 32. Installation of the Reversible AC Motor.

Disks

Three disks, provided with holes, and having different characteristics, are supplied with the Reversible AC Motor: a metallic disk, a transparent plastic disk, and a fiber disk.

To install a disk, install the bushing (supplied with the motor) on the motor shaft, and tighten the set screw. Be sure to tighten the set screw on the flat surface of the motor shaft.

Align the opening in the center of the disk to fit the end of the bushing, as shown in Figure 33. Fix the disk in place by tightening the knob. The knob must be provided with a rubber washer and a metallic flat washer. The rubber washer must be placed on the disk side.

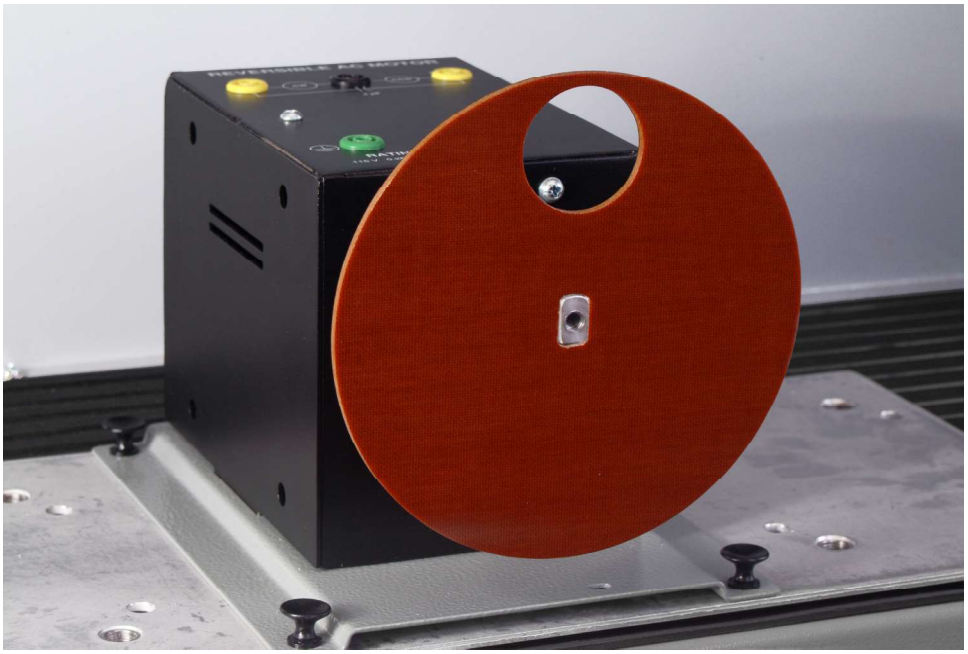


Figure 33. Align the opening in the center of the disk to fit the end of the bushing.

Installation of a sensor on the Reversible AC Motor casing

Position the sensor on the Reversible AC Motor casing, as shown in Figure 34. Align the push-lock fasteners with the perforations, then push on the fasteners.

Position the sensing face as required.

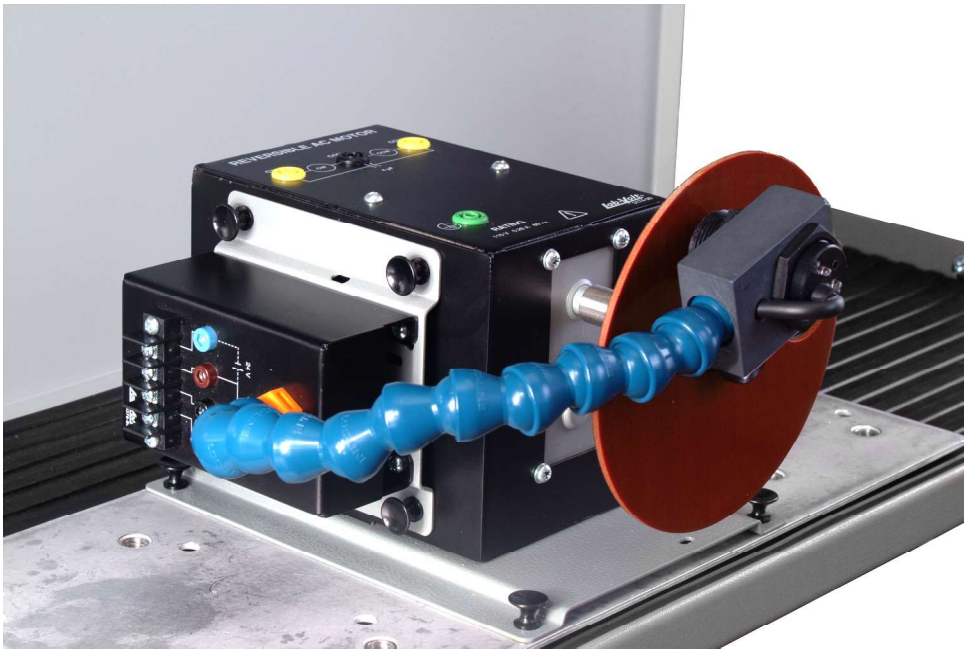


Figure 34. Installation of a sensor on the Reversible AC Motor casing.

Installation of the limit switch on the reversible ac motor

Install the Limit Switch on the Reversible AC Motor casing.

Install and position the metallic disk off-center, as shown in Figure 35.

Position the Limit Switch so the roller at the extremity of the lever is slightly in contact with the edge of the metallic disk when facing the slot. As Figure 35 shows, the lever must not be bent in this position. Fix the Limit Switch by tightening the knob.

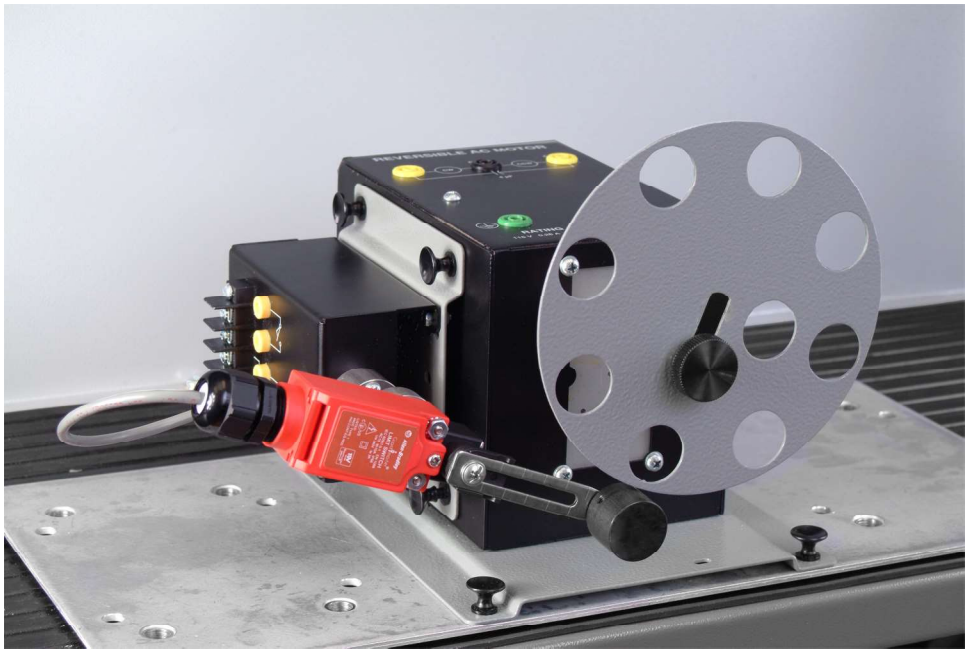


Figure 35. Install and position the metallic disk off-center.

PROCEDURE OUTLINE

The Procedure is divided into the following sections:

- Set up and connections
- Equipment required
- Characteristics

PROCEDURE

Set up and connections

In this exercise, you will check the ability of the sensors of your training system to detect the presence of holes in three disks having different characteristics. The disks will be mounted to the Reversible AC Motor shaft.

Equipment required

Refer to the Equipment Utilization Chart in Appendix A to obtain the list of equipment required to perform this exercise.

Characteristics

1. Referring to what has been seen in the previous exercises, identify the disks for which the sensors will detect the presence of holes in the position shown in Figure 36. Enter your answers in Table 14.

Table 14. Disk holes detected by the sensors.

Sensor type	Disk type		
	Metallic	Transparent plastic	Fiber
Background Suppression Photoelectric Switch			
Polarized Retroreflective Photoelectric Switch			
Capacitive Proximity Switch			
Inductive Proximity Switch			

2. Set up the circuit shown in Figure 36.

3. Install the metallic disk (centered).

4. Perform the Energizing procedure.

   Validate your predictions for each sensor.

   Do your observations confirm your predictions?

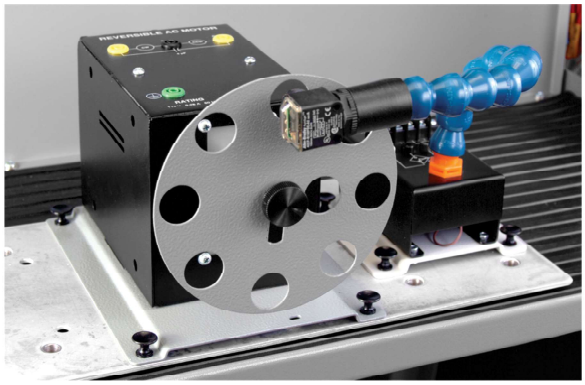
   ❑ Yes ❑ No

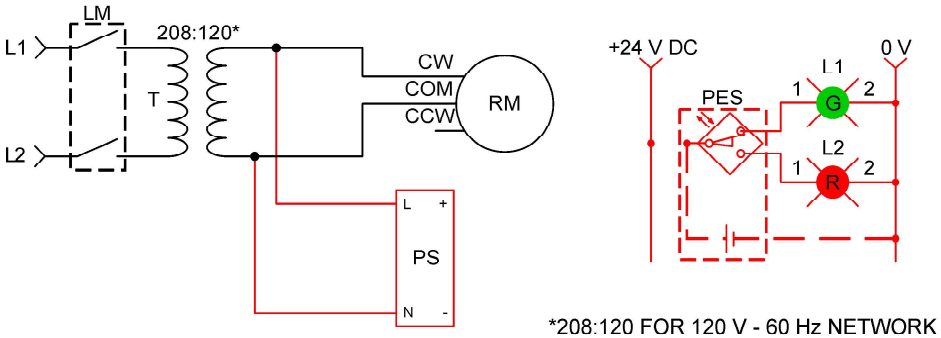
5. Turn off the Lockout Module.

6. Repeat your observations with the transparent plastic, and fiber disks.

   Do your observations confirm your predictions?

   ❑ Yes ❑ No





*208:120 FOR 120 V - 60 Hz NETWORK
380:110 FOR 220 V - 50 Hz NETWORK
415:110 FOR 240 V - 50 Hz NETWORK
380:120 FOR 220 V - 60 Hz NETWORK

LEGEND

L1	=	PILOT LIGHT (GREEN)
L2	=	PILOT LIGHT (RED)
LM	=	LOCKOUT MODULE
PES	=	PHOTOELECTRIC SWITCH
PS	=	DC POWER SUPPLY
RM	=	REVERSIBLE MOTOR (SINGLE PHASE)
T	=	CONTROL VOLTAGE TRANSFORMER

Figure 36. Circuit used to detect the presence of hole(s) in the disks.

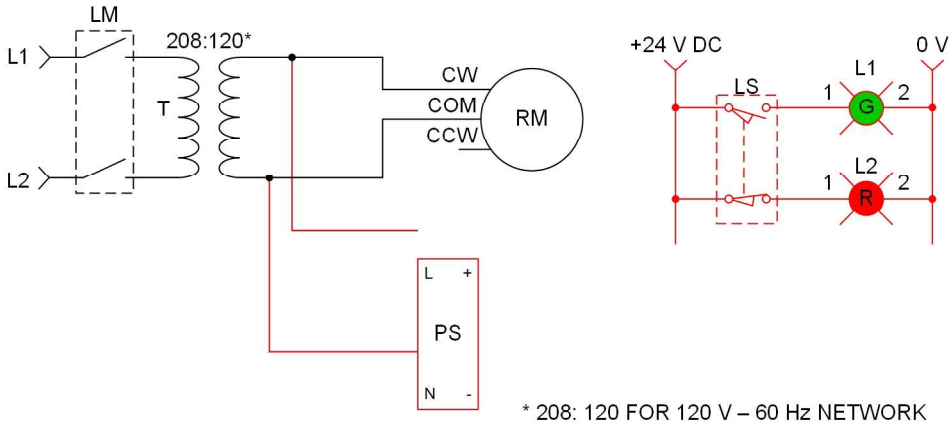
7. What should be done for the Polarized Retroreflective Photoelectric Switch to detect the holes in the disks?

8. Validate your answer by setting and testing the circuit.

9. Turn off the Lockout Module.

10. Install the Limit Switch as described in the Discussion.

Set up the circuit shown in Figure 37.



LEGEND

L1	=	PILOT LIGHT (GREEN)
L2	=	PILOT LIGHT (RED)
LM	=	LOCKOUT MODULE
LS	=	LIMIT SWITCH
PS	=	DC POWER SUPPLY
RM	=	REVERSIBLE MOTOR (SINGLE PHASE)
T	=	CONTROL VOLTAGE TRANSFORMER

* 208: 120 FOR 120 V – 60 Hz NETWORK
380: 110 FOR 220 V – 50 Hz NETWORK
415: 110 FOR 240 V – 50 Hz NETWORK
380: 120 FOR 220 V – 60 Hz NETWORK

Figure 37. Circuit used to detect the presence of hole(s) in the disks.

11. Turn on the Lockout Module.

12. Does the green pilot light turn on and the red pilot light turn off when the Limit Switch is activated?

❑ Yes ❑ No

13. Does this confirm the operation of the contacts shown on the faceplate of the Limit Switch module?

❑ Yes ❑ No

14. Turn the individual power switch of the AC Power Supply off, disconnect the circuit, and return the equipment to the storage location.

CONCLUSION

In this exercise, you observed the ability of the sensors supplied with your training system to detect the presence of holes in three disks having different characteristics.

You also became familiar with the operation of the Limit Switch by using a disk mounted on the Reversible AC Motor shaft.

REVIEW QUESTIONS

1. What is the direction of rotation of the Reversible AC Motor?

2. The Inductive Proximity Switch is not capable of detecting holes in the fiber disk.

   ❑ True ❑ False

3. The Capacitive Proximity Switch is capable of detecting holes in the transparent plastic disk.

   ❑ True ❑ False

4. The Background Suppression Photoelectric Switch is not capable of detecting holes in the fiber disk.

   ❑ True ❑ False

5. The Polarized Retroreflective Photoelectric Switchs is not capable of detecting holes in the metallic disk if a depolarizing retroreflective surface is present behind the holes.

   ❑ True ❑ False