Installation Instructions for SINPAC Switches

UL Recognition

Most SINPAC Switches are recognized under the component program of Underwriters Laboratories E-71115. In addition, all switches have an internal surge protection which meets UL-244A Specification and are tested to the requirement of IEEE C62.41-1991, Category A3.

Construction

SINPAC Switches are potted and completely sealed making them impervious to dust, dirt and moisture. It can be **immersed in electric grade oil** as used in submersible pumps. The unique speed sensing circuit provides a universal design which allows a few switches to work in most standard single-phase motor applications regardless of nature.

Operation

The Stearns SINPAC Switch samples the voltage across the motor start winding (terminals 1 and 4) then it is fed into a comparator. The SINPAC Switch interrupts the start capacitor current (between terminals 2 and 3) after the motor has accelerated to a speed in which the cut out voltage has been reached, generally 75% to 80% of synchronous motor speed. A triac or inverse parallel SCRs provides the function referred to as cut out. Once the start circuit is cut out the main winding accelerates the motor rotor up to its running speed. When an overload drops the motor speed to approximately 50% of synchronous speed the switch automatically reconnects the motor start circuit. The SINPAC Switch constantly monitors the start or auxiliary winding for cut in voltage and will reconnect the start circuit once cut in voltage is reached.

Selection Procedure

CAUTION: SINPAC Switches are line voltage compensated. Changes in the line voltage within ±10% of nominal 115 or 230 Vac will not affect system operation. Operation of the motor at line voltages less than -10% of nominal can result in reduced motor running speeds and failure of the SINPAC Switch to disconnect the start circuit.

1. Be sure switch series matches motor type.
2. Be sure switch voltage rating matches the motor start circuit voltage.
3. Selection should be based on actual measurement of start circuit current.
4. SINPAC Switch current rating must **meet or exceed** the motor start circuit current requirement. Always select a SINPAC Switch with the next higher current rating for:
   a) High cycling applications: Stop and start rates greater than 4 times/minute.
   b) Long acceleration times: Greater than 2 seconds.
   c) High ambients: Ambients greater than 55°C.

   Note: Higher rated current switches can be used in place of lower rated switches within the same series.
5. The motor must generate a voltage across the start or auxiliary winding that is 20% greater than the SINPAC Switch cut out/cut in voltage rating.

Capacitor Start and Capacitor Start/Capacitor Run Motors

To determine the most appropriate SINPAC Switch cut out voltage rating for the particular motor application, the voltage across the motor start or auxiliary winding must be measured. This may be accomplished in the following manner:

1. Prepare the motor wiring for connection of the SINPAC Switch as shown in the *Wiring Diagrams for SINPAC Switches* section of this publication. Secure the motor to a firm mounting surface.
2. Connect the lead wire that is to be connected to SINPAC Switch terminal #2 securely to the lead wire that is to be connected to SINPAC Switch terminal #3.
3. Connect an AC voltmeter across the lead wires that are to be connected to SINPAC Switch terminals #1 & #4.
4. Apply power to the motor. Observe and record the voltage across the motor start or auxiliary winding, as indicated by the AC voltmeter, with the motor operating near synchronous speed.

CAUTION: Measurement of the start or auxiliary winding voltage must be done quickly to prevent damage to the start capacitor, motor winding or SINPAC Switch!

5. Multiply the measured voltage by 0.8 (80%). Select a SINPAC Switch having a cut out voltage rating equal to or less than this number.

Capacitor Start and Capacitor Start/ Capacitor Run Motors

Measured Voltage	Voltage Across SINPAC Switch Terminals 1 & 2	Cut Out Voltage Rating
226V	115V	180V
200V-225V	115V	165V
176-200V	115V	147V
150-175V	115V	130V
<150V	115V	*
>492V	230V	410V
370-492V	230V	310V
300-369V	230V	260V
<300V	230V	*

*Consult factory

Caution: Application of 230 Vac to the line input terminals (1 and 2) of a 115 Vac rated SINPAC Switch will result in immediate switch failure. The switch may rupture and emit smoke.

Important

Please read these instructions carefully before installing, operating, or servicing your SINPAC Switch. Failure to comply with these instructions could cause injury to personnel and/or damage to property if the switch is installed or operated incorrectly. For definition of limited warranty/liability, contact Rexnord Industries, Inc, Stearns Division, 5150 S International Drive, Cudahy, Wisconsin 53110, (414) 272-1100.

Initial Inspection and Handling

Upon receipt, check for package damage. Note any signs of damage on appropriate shipper forms. Upon opening package, if concealed damage is found, immediately file a claim with carrier.

Check the label to verify that data conforms to specifications of ordered switch and the connection diagram agrees with labeling.

Caution

1. Installation and servicing must be made in compliance with all local safety codes including Occupational safety and Health Act (OSHA). All wiring and electrical connections must comply with the National Electric Code (NEC) and local electric codes in effect.
2. To prevent an electrical hazard, disconnect power source before working on the motor. If power disconnect point is out of sight, lock

Installation Instructions for SINPAC Switches Continued

disconnect in the *off* position and tag to prevent accidental application of power.

3. Make certain power source conforms to the requirements specified on the SINPAC Switch nameplate.
4. Installation and servicing should be performed only by qualified personnel familiar with the operation of the SINPAC Switch.
5. Determine what type of start switch the motor presently has:
   a) Externally mounted electronic switch – go to Step 6.
   b) Internally mounted electronic switch – go to Step 6.
   c) Externally or internally mounted mechanical switch – it is not necessary to remove the existing centrifugal switch actuating mechanism, but if feasible, it should be removed as it is no longer needed, and can cause future mechanical problems in the motor should the mechanism fail. Follow the manufacturers recommendation when removing the shaft end bearing, if necessary, to take off the centrifugal actuator.
6. Remove the existing electronic switch. Determine the existing wiring diagram. Mark the existing wires and determine which wires can be reused for installation of the SINPAC Switch. Select a location in the motor conduit box or endbell for mounting the SINPAC Switch.

   If a metal enclosure version of SINPAC Switch is being used, the switch with SINPAC Switch gasket may be mounted on an external mounting surface such as the exterior of the conduit box. Plastic enclosure versions of the SINPAC Switch should be mounted internally, within the conduit box, or externally, under a capacitor housing.

   IMPORTANT: SINPAC Switch in a metal enclosure must have the metal enclosure grounded.

   The temperature at the mounting location should not exceed 65°C (149°F).

   TEFC/TENV motors require external mounting of SINPAC Switch.
7. Refer to motor manufacturer's wiring diagram to aid in identifying terminal locations for the start winding switch, start winding, start and run capacitors (if needed) and AC line.
8 Connect the SINPAC circuit per the connection diagram (on Pages 18-19 or 20-21) using insulated terminals. If the connections are made incorrectly, the result will be no starting torque and possible damage to the circuit and/or motor.

   CAUTION: Be sure that appropriate insulation is used between the terminals of the switch and the body of the motor or conduit box.

   If mounted external to motor, always use gasket supplied with kit.
9. DO NOT USE a Variac to gradually increase the voltage to the motor starting circuit when SINPAC Switch is installed.
10. Reassemble the motor with SINPAC Switch installed, so as to not damage lead wires.
11. If the motor fails to start or the start winding does not cut out properly, see *Troubleshooting Guide* (Page 29).
12. Hipot test procedures:

   Motors 250 Volts or Less and 1/2 Horsepower or Less

   The motor, equipped with SINPAC Switch, shall be tested for dielectric withstand (hipot), by the application of a 1200 volt sinusoidal potential, in the range of 40-70 Hz, for 1 second. During the test, each lead of the primary motor wiring, accessible at the connection board or conduit box, are to be connected together and to one terminal of the test equipment, and the second test equipment terminal is to be connected to the accessible dead metal.

   Motors 250 Volts or Less and More Than 1/2 Horsepower

   The motor, equipped with SINPAC Switch, shall be tested for dielectric withstand (hipot), by the application of an 1800 volt sinusoidal potential, in the range of 40-70 Hz, for 1 second. During the test, each lead of the primary motor wiring, accessible at the connection board or conduit box, are to be connected together and to one terminal of the test equipment, and the second test equipment terminal is to be connected to the accessible dead metal.
13. **CAUTION**: The terminals of the SINPAC Switch should not be used as the junction for this field wiring.

Wiring Diagrams for SINPAC Switches

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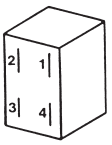
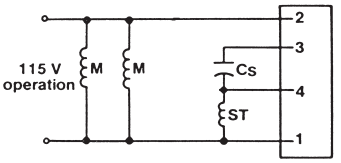
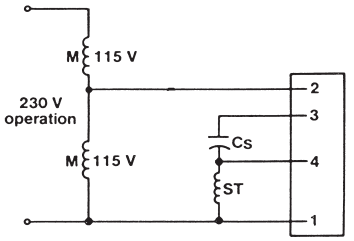
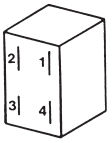
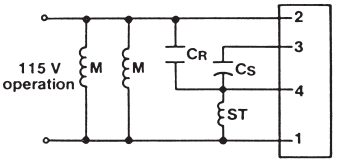
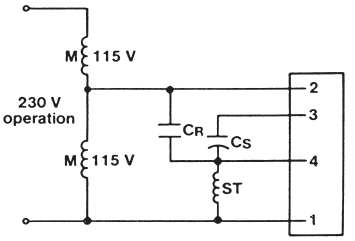
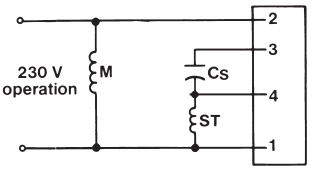
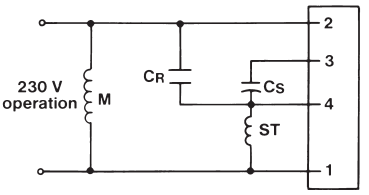
Catalog Number	SINPAC Switch Rating	115 Volt 50/60 Hz Motor Operation	230 Volt 50/60 Hz Motor Operation
CV-16 **CV-25** **CV-40** **CV-50** *Connect to Capacitor Start Motors Only*	115 Volts 		
VR-16 **VR-40** **VR-50** *Connect to Capacitor Start/ Capacitor Run Motors*	115 Volts 		
2CV-35 **2CV-50** *Connect to Capacitor Start Motors Only*	230 Volts 	*Not Applicable*	
2VR-35 **2VR-50** *Connect to Capacitor Start/ Capacitor Run Motors*	230 Volts 	*Not Applicable*	

C_S – Start Capacitor, **M** – Motor Main Winding, **C_R** – run Capacitor, **ST** – Motor Start Winding

Wiring Diagrams for SINPAC Switches Continued

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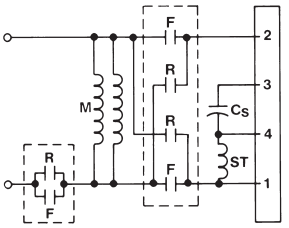
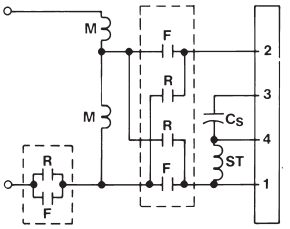
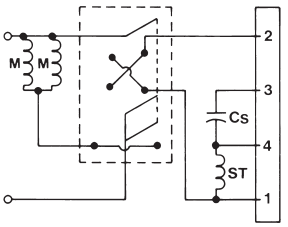
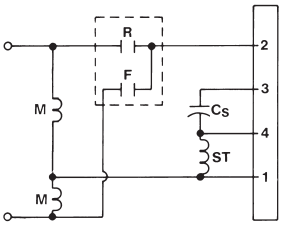
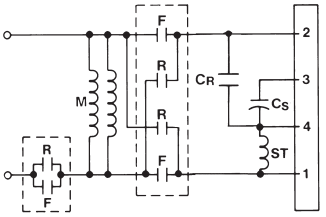
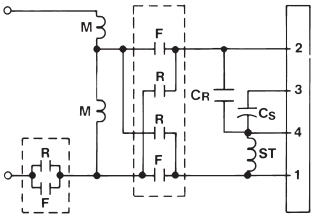
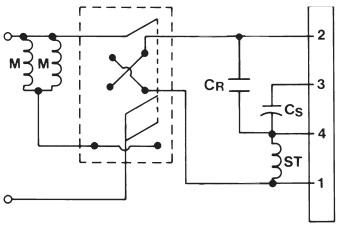
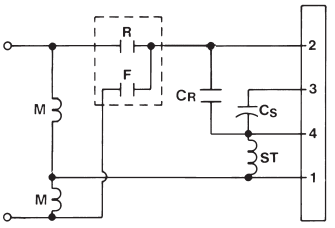
Catalog Number	SINPAC Switch Rating	115 Volt 50/60 Hz Motor Operation	230 Volt 50/60 Hz Motor Operation
IR-25 **IR-40** *Connect to Instant Reverse Capacitor Start Motors Only*	115 Volts 	**115 Volt Operation Dual Voltage Motor Using Two Full Voltage 2 or 3 Pole Single-Phase Reversing Contactors with Mechanical Interlock** *(Electrical Interlock Optional)*  Reversing contacts are not part of SINPAC Switch.	**230 Volt Operation Dual Voltage Motor Using Two Full Voltage 2 or 3 Pole Single-Phase Reversing Contactors with Mechanical Interlock** *(Electrical Interlock Optional)*  Reversing contacts are not part of SINPAC Switch.
		 Drum switch is not part of SINPAC Switch.	 Reversing contacts are not part of SINPAC Switch.
IVR-40 *Connect to Instant Reverse Capacitor Start/ Capacitor Run Motors Only*	115 Volts 	**115 Volt Operation Dual Voltage Motor Using Two Full Voltage 2 or 3 Pole Single-Phase Reversing Contactors with Mechanical Interlock** *(Electrical Interlock Optional)*  Reversing contacts are not part of SINPAC Switch.	**230 Volt Operation Dual Voltage Motor Using Two Full Voltage 2 or 3 Pole Single-Phase Reversing Contactors with Mechanical Interlock** *(Electrical Interlock Optional)*  Reversing contacts are not part of SINPAC Switch.
		 Drum switch is not part of SINPAC Switch.	 Reversing contacts are not part of SINPAC Switch.

C_S – Start Capacitor, **M** – Motor Main Winding, **C_R** – run Capacitor, **ST** – Motor Start Winding

Wiring Diagrams

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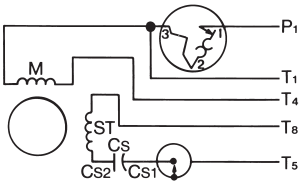
Capacitor Start Motors

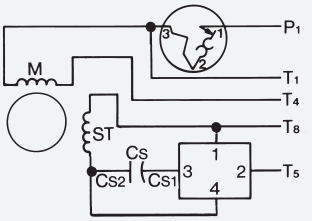
1. Disconnect the mechanical switch lead (CS1) which is connected to the start capacitor and reconnect this lead to SINPAC Switch terminal three (3).
2. Disconnect other mechanical switch lead marked T5 and reconnect this lead to SINPAC Switch terminal two (2).
3. Join SINPAC Switch terminal one (1) with motor lead T8.
4. Join SINPAC Switch terminal four (4) with the lead off the start winding and start capacitor. (Labeled in the connection diagram as CS2.)

Use on only the following model series:

CV-16
CV-25
CV-40
CV-50
VR-16
VR-40
VR-50
IR-25
IR-40
2CV-35
2CV-50

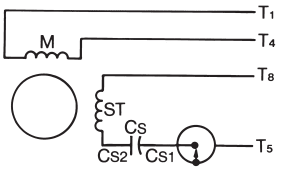
Single Voltage with Thermal Protection

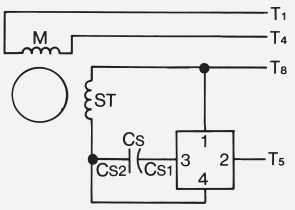




	L1	L2	Join
Counterclockwise rotation	P1	T4, T5	T1, T8
Clockwise rotation	P1	T4, T8	T1, T5

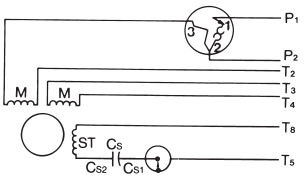
Single Voltage without Thermal Protection

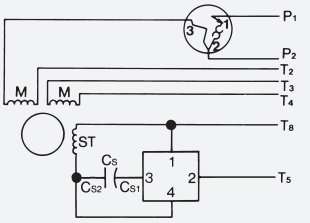




	L1	L2
Counterclockwise rotation	T1, T8	T4, T5
Clockwise rotation	T1, T5	T4, T8

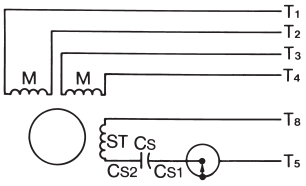
Dual Voltage with Thermal Protection

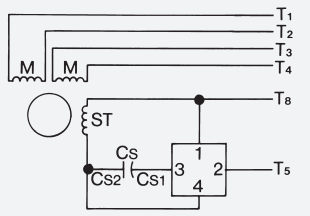




		L1	L2	Join	Join
Higher name-plate voltage	Counterclock-wise rotation	P1	T4	P2,T8	T2,T3 & T5
	Clockwise rotation	P1	T4	P2,T5	T2,T3 & T8
Lower name-plate voltage	Counterclock-wise rotation	P1	T2,T4 & T5	P2,T3 & T8	–
	Clockwise rotation	P1	T2,T4 & T8	P2,T3 & T5	–

Dual Voltage without Thermal Protection





		L1	L2	Join
Higher name-plate voltage	Counterclock-wise rotation	T1	T4,T5	T2,T3 & T8
	Clockwise rotation	T1	T4,T8	T2,T3 & T5
Lower name-plate voltage	Counterclock-wise rotation	T1,T3 & T8	T2,T4 & T5	–
	Clockwise rotation	T1,T3 & T5	T2,T4 & T8	–

SYMBOL KEY: M = Main winding, ST = Start winding, CS = Start capacitor, CR = Run capacitor, CS1 = Lead between SINPAC Switch terminal three (3) and start capacitor (CS), CS2 = Lead between SINPAC Switch terminal four (4), start capacitor (CS) and start winding (ST)

Wiring Diagrams Continued

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Capacitor Start/ Capacitor Run Motors

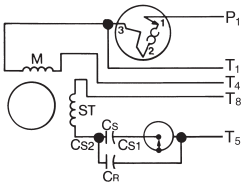
1. Disconnect the mechanical switch lead (CS1) which is connected to the start capacitor and reconnect this lead to SINPAC Switch terminal three (3).
2. Disconnect other mechanical switch lead marked T5 and reconnect this lead to SINPAC Switch terminal two (2).
3. Join SINPAC Switch terminal one (1) with motor lead T8.
4. Join SINPAC Switch terminal four (4) with the lead off the start winding, start capacitor and run capacitor. (Labeled in the connection diagram as CS2.)
5. Make sure the other side of the run capacitor is connected to the motor lead T5 along with SINPAC Switch terminal two (2).

Use on only the following model series:

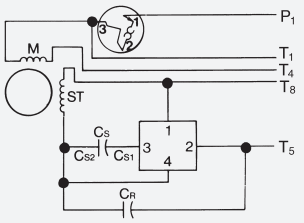
VR-16
VR-40
VR-50
2VR-35
2VR-50
IVR-40

Single Voltage with Thermal Protection

WIRING OF MOTOR EQUIPPED WITH MECHANICAL SWITCH



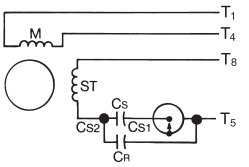
EASY WIRING OF MOTOR EQUIPPED WITH SINPAC ELECTRONIC SWITCH

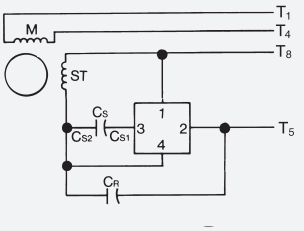


MOTOR LEAD WIRE NUMBERING

	L1	L2	Join
Counterclockwise rotation	P1	T4, T5	T1, T8
Clockwise rotation	P1	T4, T8	T1, T5

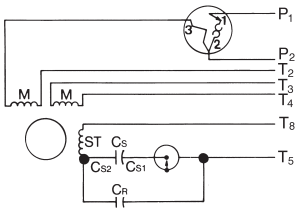
Single Voltage without Thermal Protection

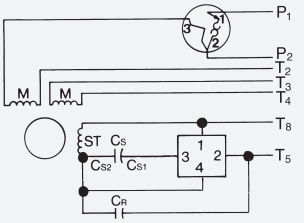




	L1	L2
Counterclockwise rotation	T1, T8	T4, T5
Clockwise rotation	T1, T5	T4, T8

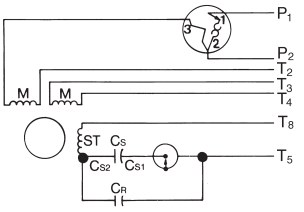
Dual Voltage with Thermal Protection

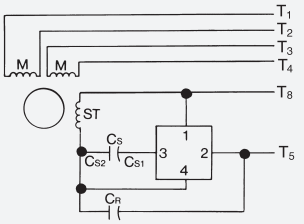




		L1	L2	Join	Join
Higher name-plate voltage	Counterclock-wise rotation	P1	T4	P2,T8	T2,T3 & T5
	Clockwise rotation	P1	T4	P2,T5	T2,T3 & T8
Lower name-plate voltage	Counterclock-wise rotation	P1	T2,T4 & T5	P2,T3 & T8	–
	Clockwise rotation	P1	T2,T4 & T8	P2,T3 & T5	–

Dual Voltage without Thermal Protection





		L1	L2	Join
Higher name-plate voltage	Counterclock-wise rotation	T1	T4,T5	T2,T3 & T8
	Clockwise rotation	T1	T4,T8	T2,T3 & T5
Lower name-plate voltage	Counterclock-wise rotation	T1,T3 & T8	T2,T4 & T5	–
	Clockwise rotation	T1,T3 & T5	T2,T4 & T8	–

SYMBOL KEY: M = Main winding, ST = Start winding, CS = Start capacitor, CR = Run capacitor, CS1 = Lead between SINPAC Switch terminal three (3) and start capacitor (CS), CS2 = Lead between SINPAC Switch terminal four (4), start capacitor (CS) and start winding (ST)