Brief Operating Description: Longer Motor Life Starts with a Switch

For over 75 years, single-phase motors have utilized a mechanical centrifugal switch to switch the start circuit. Inherent characteristics of a mechanical device have made these switches prone to various problems, including tolerances, tolerance build-ups, mechanical fatigue, vibration and a host of others that can lead to switch failures and/or performance inconsistency.

Our challenge was to design a reliable solid-state switch to replace the mechanical switch and actuator mechanism that would duplicate the function of connecting and disconnecting the start circuit at particular speeds with the additional benefits of a solid-state device. After considerable research, we decided a successful electronic motor starting switch could be created by sensing the voltages present in the main and start windings.

Until the rotor of a single-phase motor begins to rotate, there is no coupling between its start winding and main winding. When the rotor begins to turn, the main winding induces flux in the rotor, which then induces a voltage in the start winding. The voltage induced in the start winding is directly proportional to motor speed.

In Stearns SINPAC Electronic Switches, the voltage across a motor’s main winding and the voltage across its start winding are sampled and fed to a comparator. The logic circuitry is designed so that the electronic switch interrupts the start circuit current after the motor has accelerated to the speed at which cut out voltage is developed, generally 75 to 80% of synchronous motor speed. The logic circuitry then shuts down the switch’s power stage, which consists of a triac or inverse parallel SCR’s. This function is referred to as “cut out.” When the start circuit is disconnected, the main winding field then drives the motor’s rotor to its running speed.

If the motor encounters an overload, and the motor speed falls to approximately 50% of its synchronous speed, the SINPAC Switch automatically reconnects the motor’s start circuit. This function is referred to as “cut in.” Cut in detection circuitry constantly monitors start winding voltage. When the motor’s speed falls to the cut in point, the detection circuit causes the control logic to energize the SINPAC Switch’s power output stage. The motor then goes through its normal startup procedure, with the start circuit being switched out at a motor speed approximately 75 to 80% of synchronous speed.

SINPAC Switches are potted and completely sealed, making it impervious to dust, dirt and moisture. The unique speed sensing circuit provides a universal design which allows a few switches to work on most standard motor designs regardless of manufacturer.

Acceptance by Motor Manufacturers

US and foreign motor manufacturers have tested and retested the SINPAC Switch for reliability and quality. Today, many of these manufacturers have begun installing SINPAC Switches on their standard motor lines with more companies ready to make the changeover.

UL Recognition

Many SINPAC Switches have already been recognized under the Component Program of Underwriters Laboratories, Inc. (E-71115). In addition, all switches have internal surge protection which is tested according to IEEE C62.41 – 1991 Category A3.
Typical Applications

Stearns SINPAC Switches are ideal for applications requiring reliable switching of the start circuit in single-phase motors.

Mechanical switches are prone to various problems including mechanical fatigue, tolerances, tolerance build-ups and vibration which can lead to performance inconsistency.

Electronic SINPAC Switches solve all those problems which reduce production downtime in hundreds of applications. Some of these applications are illustrated below:

Some additional applications include:
- Grain Dryers
- Water Equipment
- Power Tools
- Commercial Dryers
- Commercial Washing Machines
- Ice Makers
- Gas Pumps
- Floor Washers
- Bottle Washing Machines
- Floor Sanders
- Poultry Feeding Systems
- Fans, Blowers
- Grinding Machines
- Milking Machines
- Winches
- 50/60 Hz
- Hoists
- Paint Sprayers
- Vacuum Pumps
- Air Compressors
- Pressure Sprayers
- Vibrators
- Auger Drives
- Door Openers
- Sump Pumps
- Diaphragm Pumps
- Hermetic Motors
- Rotary Compressors
- Refrigeration Compressors
- Heat Pumps
- Jet Pumps
- Submersible Pumps
- Food Processing
Design Features

• **Speed Sensitive**
  SINPAC Switches duplicate mechanical switch performance. They cut out the start circuit at approximately 80% of synchronous speed*. This means no degradation in motor performance and no confusing and cumbersome time or current selection criteria to consider, since SINPAC Switches are not load sensitive. It also means there will be less stress on the starting capacitor due to over voltage.

• **Restart Capability**
  When motor speed drops below 50% of synchronous speed, the start circuit is reconnected to reinitiate starting torque.

• **Accepted by Motor Manufacturers**
  Stearns SINPAC Switches have been tested with favorable results and are available from most single-phase motor manufacturers.

• **Transient Protection**

• **Line Voltage Compensation**
  No modifications or changes are required for line voltage variations. SINPAC Switches will operate in areas susceptible to brown-outs or low voltage due to long wiring runs.

• **Electrically Protected Design**
  SINPAC Switches are designed to filter out electrical noise, so there is no concern of random switch malfunctions.

• **UL Recognition to US and Canadian Standards**
  Testing has been completed and approval has been obtained on most sizes and will be obtained on the balance of the product line. SINPAC Switches can be used with confidence in their safety and acceptance.

• **Completely Solid-State**
  With no moving parts, SINPAC Switches have no physical constraints to affect their operation. Can be used on new or existing motors.
  No wearing parts means high cycling. No shaft extension required. Not restricted by motor vibration or overspeed. No arcing contacts due to restart during motor coastdown.

• **Universal Design**
  SINPAC Switches will work on 2, 4, 6 or more pole motors of any manufacturer. This reduces motor manufacture and repair shop selection time and switch inventory. It also means that foreign and obsolete motors can be easily retrofitted with SINPAC Switches.

• **Environmentally Protected**
  SINPAC Switches are immune to moisture, dust, shock, vibration or overspeed. The switch will not limit motor performance due to environmental conditions.

• **Stearns Reliability**
  Years of experience in the motor industry, first with brakes and now with speed sensing switches, means you can depend on Stearns SINPAC Switches to solve switching problems.

• **Unlimited Mounting Locations**
  SINPAC Switches offer a variety of external and internal conduit box mountings and external endbell mountings. These mountings are not affected by the motor position (shaft up or shaft down). SINPAC Switches can also be mounted at locations remote from the motor.

• **Reduced Installation Time**
  Easy accessible terminals and mounting, reduce the amount of time required to install SINPAC Switches.

• **Integral Design**
  SINPAC Switches can reduce the length of the motor when designed as an integral part of the motor.

*Contact factory for questions on specific switch/motor performance.
Models

11 Style

12 Style

15 Style

Gasket
(available for 11 and 12 Styles)

Mounting Options
SINPAC Switch Ordering and Identification Information

SINPAC Electronic Switch Catalog Numbering System
CV-16-165 – Each stock electronic series switch is uniquely specified by an alphanumerical catalog number. For most standard SINPAC Electronic Switches, the catalog identifies a particular switch, including voltage, series, current rating, and cut out or cut in voltage. The first position indicates the start circuit voltage (blank equals 115 volts and 2 equals 230 volts). The next characters specify the series or type of motor on which the switch should be used. The next numeric characters specify the maximum current which the switch can handle. The next numeric grouping specifies cut out voltage for capacitor start, capacitor start/capacitor run, and instant reversing switches. The

<table>
<thead>
<tr>
<th>Start Winding Voltage</th>
<th>Cut Out Voltage</th>
<th>Maximum Current Rating</th>
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<tbody>
<tr>
<td>blank = 115, 2 = 230</td>
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</tbody>
</table>

Series
CV - Capacitor Start Only, VR = Capacitor Start/Capacitor Run Only, IR = Capacitor Start Instant Reverse, IVR = Capacitor Start/Capacitor Run Instant Reverse

Each Stearns SINPAC Electronic Switch is uniquely specified by a 12-digit alphanumeric part number. For most standard SINPAC Electronic Switches, the last 10 positions identify the specific switch, including series, voltage, option, current, enclosure, agency recognition, cut in or cut out voltages. For example, when ordering capacitor start, 16 amp SINPAC Electronic Switch, the switch would be specified as shown.

4–7–21016–11–U01

3 = Standard, K = Kit
115 V SINPAC Switch
A = 130 VCO, B = 147 VCO, 0 = 165 VCO
D = 180 VCO
L = 130 VCO 15 VCI
V = 210 VCO

230 V SINPAC Switch
C = 260 VCO, 0 = 310 VCO, E = 410 VCO
M = 340 VCO, S = 350 VCO
U = UL Recognized, N = Not UL

Package Style
11 = Metal Can 2.48 x 1.38 x .81
12 = Metal Can 2.67 x 1.78 x .86
15 = Capacitor Case 1.822 dia. x 3.372 long

*NOTE: For part numbers beginning with 473 (these are OEM specials), the remaining digits of this numbering system do not apply.
## Overview of Standard Product Offering

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<th>Series</th>
<th>Typical Max. Motor hp</th>
<th>Typical Full Load Motor Nameplate Current (amps)</th>
<th>Switch Rating &amp; Permissible Maximum Start Circuit Current (amps)</th>
<th>Start Circuit Voltage</th>
<th>Catalog Number</th>
<th>Part Number</th>
<th>Cut Out Voltage Typical</th>
<th>Cut In Voltage Typical</th>
<th>Pkg. Style</th>
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CV Series for 115 Vac or 115/230 Vac
Dual Voltage Capacitor Start Motors

Basic Operation
Capacitor start motor require a method to extract speed data from the voltage across the motor start winding. By comparing the start winding RPM-sensitive voltage with the main AC input voltage (which serves as a reference voltage), the switch determines when the start circuit should be energized. The electronic switch interrupts the start circuit current after the motor has accelerated to the cut out speed, and reconnects the start circuit whenever the motor speed has fallen to cut in speed (usually about 50% of synchronous motor speed).

1. **Electrically Protected.** Designed to filter out electrical noise, so there is no concern of random switch malfunction.

2. **Reduced Installation Time.** Easily accessible 1/4 inch terminals and mounting, reduce the amount of time required to install SINPAC Switches or to change out mechanical switches.

3. **Restart Capability.** When motor speed drops below 50% of synchronous speed, the start circuit is reconnected to reinitiate starting torque.

4. **Soldered Heat Sink.** High cycling.


6. **Universal Design.** 50/60 Hz operation. Will work on 2, 4 or 6 pole motors of any manufacturer. Reduced inventory.

7. **Line Voltage Compensation.** No modifications or changes are required for line voltage variations. SINPAC Switches will operate in areas susceptible to brownouts or low voltage due to long wiring runs. It also means there will be less stress on the starting capacitor due to over voltage.

**ADDITIONAL FEATURES**

- UL Recognition (E71115) to US and Canadian Standards
- Operating Temperature: -40°C to 65 °C [-40 °F to 149°F] [for operation between 65°C and 85°C (149°F and 185°F), consult factory.]
- Operating Voltage: 115 Vac SINPAC Switch: 90-130 Vac. For dual voltage motor equipped with center-tapped main winding: 90-130 Vac or 180-265 Vac.

Dimensions are for estimating only. Drawings for customer reference are available upon request.
### Selection

Motor hp ratings are typical. For an accurate selection procedure, measure start capacitor current during a normal start or at locked rotor and select a SINPAC Switch with higher maximum current rating than that measured.

1. Be sure switch series matches motor type.
2. Be sure switch voltage rating matches (start) circuit voltage rating.
3. Selection can be based on actual measurement of start capacitor current or two times the motor nameplate FLA rating.
4. Switch current rating must match or exceed the motor start capacitor current requirements. Always select a SINPAC Switch with the next higher current rating for:
   a) High cycling applications.
   b) Long acceleration time.
   c) High ambients: Greater than 55° C.
5. To assure proper motor operation, the voltage across the start winding must reach the SINPAC Switch cut out reference voltage between 70% to 85% of motors synchronous speed.

**Caution:** SINPAC Switches are line voltage compensated. Changes in the line voltage will not affect system operation unless an overload condition causes reduced running speed, along with reduced voltage across the start winding.

6. Higher current switches can be used in place of lower rated switches of the same series.

### Wiring Diagram

#### Catalog Number

**SINPAC Switch Rating**

- CV-16
- CV-25
- CV-40
- CV-50

**Connect to Capacitor Start Motors**

- Cs – Start Capacitor
- M – Motor main winding
- ST – Motor start winding

### Line Voltage Compensation Charts

Induced voltage across the start winding is directly proportional to motor speed and line voltage. All SINPAC Switches use this voltage to switch the start capacitor out of the circuit. Your motor with a SINPAC Switch must generate a voltage that is 20% greater than the switch cut out voltage to assure cut out of the start capacitor. Refer to charts below.

#### Typical Maximum Motor hp

<table>
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<tr>
<th>Typical Maximum Motor Nameplate Current Rating (amps)</th>
<th>Typical Full Load Motor Nameplate 115/230 Volts</th>
<th>Switch Rating and Permissible Maximum Start Capacitor Current (amps)</th>
<th>Start Circuit Voltage</th>
<th>Catalog Number</th>
<th>Part Number</th>
<th>Cut Out Voltage Typical</th>
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<td>12/6</td>
<td>25</td>
<td>115</td>
<td>CV-25-130</td>
<td>4-7-21025-11-UA3</td>
<td>130</td>
<td>30</td>
<td>11</td>
</tr>
<tr>
<td>1</td>
<td>12/6</td>
<td>25</td>
<td>115</td>
<td>CV-25-147</td>
<td>4-7-21025-11-UB3</td>
<td>147</td>
<td>37</td>
<td>11</td>
</tr>
<tr>
<td>1</td>
<td>12/6</td>
<td>25</td>
<td>115</td>
<td>CV-25-165</td>
<td>4-7-21025-11-U03</td>
<td>165</td>
<td>37</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>20/10</td>
<td>40</td>
<td>115</td>
<td>CV-40-130</td>
<td>4-7-21040-11-UA3</td>
<td>130</td>
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<td>11</td>
</tr>
<tr>
<td>2</td>
<td>20/10</td>
<td>40</td>
<td>115</td>
<td>CV-40-147</td>
<td>4-7-21040-11-UB3</td>
<td>147</td>
<td>37</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>20/10</td>
<td>40</td>
<td>115</td>
<td>CV-40-165</td>
<td>4-7-21040-11-U03</td>
<td>165</td>
<td>37</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>25/12.5</td>
<td>50</td>
<td>115</td>
<td>CV-50-130</td>
<td>4-7-21050-12-UA3</td>
<td>130</td>
<td>30</td>
<td>12</td>
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<tr>
<td>3</td>
<td>25/12.5</td>
<td>50</td>
<td>115</td>
<td>CV-50-147</td>
<td>4-7-21050-12-UB3</td>
<td>147</td>
<td>37</td>
<td>12</td>
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<tr>
<td>3</td>
<td>25/12.5</td>
<td>50</td>
<td>115</td>
<td>CV-50-165</td>
<td>4-7-21050-12-U03</td>
<td>165</td>
<td>37</td>
<td>12</td>
</tr>
</tbody>
</table>
Basic Operation

Capacitor start/capacitor run motors provide continuous voltage sensing information which can be used to extract speed data from the voltage across the motor start winding. By comparing this start winding RPM-sensitive voltage to the main AC input voltage (which serves as a reference voltage), the switch determines when the start circuit should be de-energized. The electronic switch interrupts the start circuit current after the motor has accelerated to the cut out voltage (speed), and reconnects the start circuit whenever the speed sensitive circuit senses the motor voltage (speed) has decreased to a preselected cut in voltage (RPM) level.

Capacitor start/capacitor run motors exhibit current transients and higher voltages across the start switch. These electrical stresses occur due to the switching of the two capacitors (start and run) that are connected in parallel during motor start and may have different voltages at time of restart. These stresses occur at restart with both mechanical and electronic start switches. The VR switch features circuitry designed to eliminate the effects of these conditions.

- **Bleeder Resistor.** Increases start capacitor life.
- **Electrically Protected.** Designed to filter out electrical noise, so there is no concern of random switch malfunction.
- **Reduced Installation Time.** Easily accessible 1/4 inch terminals and mounting, reduce the amount of time required to install SINPAC Switches or to change out mechanical switches.
- **Restart Capability.** When motor speed drops below 50% of synchronous speed, the start circuit is reconnected to reinitiate starting torque.
- **Soldered Heat Sink.** High cycling. (Not shown)
- **Transient Protection.** Transient protection tested per IEEE C62.41 - 1991 Category A3.
- **Universal Design.** 50/60 Hz operation. Will work on 2, 4 or 6 pole motors of any manufacturer. Reduced inventory.
- **Zero Voltage Detection Logic/Inductor.** Current spiking due to run capacitor no longer a problem.
- **Line Voltage Compensation.** No modifications or changes are required for line voltage variations. SINPAC Switches will operate in areas susceptible to brown-outs or low voltage due to long wiring runs. Line voltage compensation results in less stress on the starting capacitor due to overvoltage.

**ADDITIONAL FEATURES**

- **Environmentally Protected.** Immune to moisture, dust, dirt, shock and vibration.
- **UL Recognition (E71115) to US and Canadian Standards**
- **Completely Solid-State with No Moving Parts.** SINPAC Switches have no physical constraints to affect their operation. No wearing parts mean high cycling, no arcing contact. Low warranty.
- **Silent Operation** - no switch noise
- **Operating Temperature:** -40°C to 65°C (-40 °F to 149°F) [for operation between 65°C and 85°C (149°F and 185°F), consult factory.]
- **Operating Voltage:** 115 Vac SINPAC Switch: 90-130 Vac. For dual voltage motor equipped with center-tapped main winding: 90-130 Vac or 180-265 Vac.

Dimensions are for estimating only. Drawings for customer reference are available upon request.
Selection
Motor hp ratings are typical. For an accurate selection procedure, measure start capacitor current during a normal start or at locked rotor and select a SINPAC Switch with higher maximum current rating than that measured.
1. Be sure switch series matches motor type.
2. Be sure switch voltage rating matches auxiliary (start) circuit voltage rating.
3. Selection can be based on actual measurement of start capacitor current or two times the motor nameplate FLA rating.
4. Switch current rating must match or exceed the motor start capacitor current requirements. Always select a SINPAC Switch with the next higher current rating for:
a) High cycling applications.
b) Long acceleration time.
c) High ambients: Greater than 55° C.
5. To assure proper motor operation, the voltage across the start winding must reach the SINPAC Switch cut out reference voltage between 70% to 85% of motors synchronous speed.
SINPAC Switches are line voltage compensated. Changes in the line voltage will not effect system operation unless an overload condition causes reduced running speed, along with reduced voltage across the start winding.
6. Higher current switches can be used in place of lower rated switches of the same series.

Wiring Diagram

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>SINPAC Switch Rating</th>
<th>115 Volt 50/60 Hz Motor Operation</th>
<th>230 Volt 50/60 Hz Motor Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connect to Capacitor Start/ Capacitor Run Motors</td>
<td></td>
<td></td>
<td>115 V operation</td>
</tr>
</tbody>
</table>

Line Voltage Compensation Charts
Induced voltage across the start winding is directly proportional to motor speed and line voltage. All SINPAC Switches use this voltage to switch the start capacitor out of the circuit. Your motor with a SINPAC Switch must generate a voltage greater than the switch cut-out voltage to assure cut-out of the start capacitor. Refer to charts below.
2CV Series for 230 Vac Capacitor Start Motors and 2VR Series for 230 Vac Capacitor Start/Capacitor Run Motors

Basic Operation
Capacitor start/capacitor run motors and capacitor start motors provide continuous voltage sensing information which can be used to extract speed data from the voltage across the motor start (auxiliary) winding. By comparing this start (auxiliary) winding RPM-sensitive voltage to the main AC input voltage (which serves as a reference voltage), the switch determines when the start circuit should be de-energized. The electronic switch interrupts the start circuit current after the motor has accelerated to the cut out speed, and reconnects the start circuit whenever the motor speed has decreased to a preselected cut in RPM level.

Capacitor start/capacitor run motors exhibit current transients and higher voltages across the start switch. This electrical stress is due to the voltage differential which may exist between the start and run capacitors at the instant of switch closure. This stress phenomenon occurs with both mechanical and electronic type start switches. SINPAC Switches have voltage detection circuitry to minimize the effects of these conditions.

ADDITIONAL FEATURES

1. **Universal Design.** 50/60 Hz operation. Will work on 2, 4 or 6 pole motors of any manufacturer. Reduced inventory.
2. **Line Voltage Compensation** Operating voltage 190 to 260 Vac.
3. **Electrically Protected** Designed to filter out electrical noise, so there is no concern of random switch malfunction.
4. **Zero Crossing Logic** Current spiking due to run capacitor no longer a problem.
5. **Speed Sensitive**
6. **Soldered Heat Sink** High cycling.
7. **Environmentally Protected** Immune to moisture, dust, dirt, shock and vibration.
9. **Start Capacitor Discharge Resistor** Increase start capacitor life.

Operating Temperature: -40°C to 65 °C (-40 °F to 149°F) [for operation between 65°C and 85°C (149°F and 185°F), consult factory.]

**Operating Voltage:** 230 Vac SINPAC Switch: 190-255 Vac.

**UL Recognition (E71115) to US and Canadian Standards**

Dimensions are for estimating only. Drawings for customer reference are available upon request.
Selection
Motor hp ratings are typical. For an accurate selection procedure, measure start capacitor current during a normal start or at locked rotor and select a SINPAC Switch with higher maximum current rating than that measured.

1. Be sure switch series matches motor type.
2. Be sure switch voltage rating matches auxiliary (start) circuit voltage rating.
3. Selection can be based on actual measurement of start capacitor current or two times the motor nameplate FLA rating.
4. Switch current rating must match or exceed the motor start capacitor current requirements. Always select a SINPAC Switch with the next higher current rating for:
   a) High cycling applications.
   b) Long acceleration time.
   c) High ambients: Greater than 55°C.
5. To assure proper motor operation, the voltage across the start winding must reach the SINPAC Switch cut out reference voltage between 70% to 85% of motors synchronous speed.

Caution: SINPAC Switches are line voltage compensated. Changes in the line voltage will not effect system operation unless an overload condition causes reduced running speed, along with reduced voltage on the start winding.

6. Higher current switches can be used in place of lower rated switches of the same series.

Wiring Diagram

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>SINPAC Switch Rating</th>
<th>115 Volt 50/60 Hz Motor Operation</th>
<th>230 Volt 50/60 Hz Motor Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2CV-35, 2CV-50 Connect to Capacitor Start Motors</td>
<td>Not Applicable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>230 Volts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2VR-35, 2VR-50 Connect to Capacitor Start/ Capacitor Run Motors</td>
<td>Not Applicable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CS – Start capacitor, M – Motor main winding, CR – Run capacitor, ST – Motor start winding

Line Voltage Compensation Charts
Induced voltage across the start winding is directly proportional to motor speed and line voltage. All SINPAC Switches use this voltage to switch the start capacitor out of the circuit. Your motor with a SINPAC Switch must generate a voltage greater than the switch cut out voltage to assure cut out of the start capacitor. Refer to charts below.
Instant Reversing 115 Vac or 115/230 Vac Dual Voltage Motors
IR Series for Capacitor Start Motors and
IVR Series for Capacitor Start/Capacitor Run Motors

Basic Operation
Bidirectional motors - those that can rotate in either direction - are of two classes: 1. Reversing motors, which can change from full speed in one direction to full speed in the opposite direction. 2. Reversible motors, which can be reversed only when the motor is not running, or is running below cut out speed. Some motor manufacturers distinguish between quick reversing and instant reversing. A quick reversing motor requires a time delay of approximately 1/25th of a second or more for the switching circuitry to react. An instant reversing motor requires absolutely no time delay. The standard SINPAC Switch can be used on reversible and reversing motors. The SINPAC IR Series Switch provides the function of a direction sensing centrifugal switch and makes a reversible capacitor start motor into an instant reversing motor.

In order to reverse a single-phase motor, it is necessary to reverse the polarity of either the start or main winding, but not both at the same time. The reversal of the winding is accomplished with an external reversing switch or contactor that is not part of the SINPAC Switch. SINPAC Instant Reverse Switch is not dependent upon how quickly the user operates the reversing switch, but only that the reversing switch did change states, i.e., forward to reverse, or vice versa. The SINPAC Switch detects the change in the phase shift between the main and start windings, and the logic circuit instantly actuates the starting switch, causing the start circuit to be reconnected to line voltage. This connection causes the motor to decelerate and then reaccelerate in the opposite direction. The SINPAC IR and IVR Series switches interrupt the start circuit current after the motor has accelerated to the cut out speed, and reconnect the start circuit whenever the circuit senses the motor speed has fallen to cut in speed (usually about 50% of synchronous motor speed).

ADDITIONAL FEATURES
- Electrically Protected. Designed to filter out electrical noise, so there is no concern of random switch malfunction.
- Universal Design
  50/60 Hz operation. Will work on 2, 4 or 6 pole motors of any manufacturer. Reduced inventory.
- Line Voltage Compensation
  No modifications or changes are required for line voltage variations. SINPAC Switches will operate in areas susceptible to brown-outs or low voltage due to long wiring runs. It also means there will be less stress on the starting capacitor due to over voltage.
- Reduced Installation Time. Easily accessible 1/4 inch terminals and mounting, reduce the amount of time required to install SINPAC Switches or to change out mechanical switches.
- Transient Protection
  Transient protection tested per IEEE C62.41 - 1991 Category A3.
- Soldered Heat Sink
  High cycling.
- Phase Comparator Logic:
  Allows Instant Reverse operation (no time delay).
- Restart Capability
  When motor speed drops below 50% of synchronous speed, the start circuit is reconnected to reinitiate starting torque.
- Environmentally Protected
  Immune to moisture, dust, dirt, shock and vibration.

Dimensions are for estimating only. Drawings for customer reference are available upon request.
Selection

Motor hp ratings are typical. For an accurate selection procedure, measure start circuit current during a normal start or at locked rotor and select a SINPAC Switch with higher maximum current rating than that measured.

1. Be sure switch series matches motor type.
2. Be sure switch voltage rating matches (start) circuit voltage rating.
3. Selection can be based on actual measurement of start capacitor current or two times the motor nameplate FLA rating.
4. Switch current rating must match or exceed the motor start capacitor current requirements. Always select a SINPAC Switch with the next higher current rating for:
   a) High cycling applications.
   b) Long acceleration time.
   c) High ambients: Greater than 55° C.

5. To assure proper motor operation, the voltage across the start winding must reach the SINPAC Switch cut out voltage reference between 70% to 85% of motors synchronous speed.

Caution: SINPAC Switches are line voltage compensated. Changes in the line voltage will not effect system operation unless an overload condition causes reduced running speed, along with reduced voltage on the start winding.

6. Higher current switches can be used in place of lower rated switches of the same series.

Line Voltage Compensation Charts

Induced voltage across the start winding is directly proportional to motor speed and line voltage. All SINPAC Switches use this voltage to switch the start capacitor out of the circuit. Your motor with a SINPAC Switch must generate a voltage that is 20% greater than the switch cut out voltage to assure cut out of the start capacitor. Refer to charts below.

<table>
<thead>
<tr>
<th>Motor Type</th>
<th>Typical Maximum Motor hp</th>
<th>Typical Full Load Motor Nameplate Current Rating (amps)</th>
<th>Switch Rating and Permissible Maximum Start Capacitor Current (amps)</th>
<th>Start Circuit Voltage</th>
<th>Catalog Number</th>
<th>Part Number</th>
<th>Cut Out Voltage Typical</th>
<th>Cut In Voltage Typical</th>
<th>Package Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>1/2</td>
<td>12/12/6</td>
<td>25</td>
<td>115</td>
<td>IR-25-130</td>
<td>4-7-51025-15-UA3</td>
<td>130</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>1/2</td>
<td>1/2</td>
<td>12/12/6</td>
<td>25</td>
<td>115</td>
<td>IR-25-147</td>
<td>4-7-51025-15-UB3</td>
<td>147</td>
<td>33</td>
<td>15</td>
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<tr>
<td>1/2</td>
<td>1/2</td>
<td>12/12/6</td>
<td>25</td>
<td>115</td>
<td>IR-25-165</td>
<td>4-7-51025-15-U03</td>
<td>165</td>
<td>37</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>20/20/10</td>
<td>40</td>
<td>115</td>
<td>IR-40-130</td>
<td>4-7-51040-15-UA3</td>
<td>130</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>20/20/10</td>
<td>40</td>
<td>115</td>
<td>IR-40-147</td>
<td>4-7-51040-15-UB3</td>
<td>147</td>
<td>33</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>20/20/10</td>
<td>40</td>
<td>115</td>
<td>IR-40-165</td>
<td>4-7-51040-15-U03</td>
<td>165</td>
<td>37</td>
<td>15</td>
</tr>
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</table>

Wiring diagrams on following page
Instant Reversing 115 Vac or 115/230 Vac Dual Voltage Motors
IR Series for Capacitor Start Motors and
IVR Series for Capacitor Start/Capacitor Run Motors
Wiring Diagrams

IR Series for Capacitor Start Motors

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>SINPAC Switch Rating</th>
<th>115 Volt 50/60 Hz Motor Operation</th>
<th>230 Volt 50/60 Hz Motor Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR-25</td>
<td>115 Volts</td>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
<tr>
<td>IR-40</td>
<td></td>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
</tbody>
</table>

SINPAC Switch Rating

- Drum switch is not part of SINPAC Switch.
- Reversing contacts are not part of SINPAC Switch.

CS – Start capacitor, M – Motor main winding, ST – Motor start winding, F – Forward, R – Reverse

IVR Series for Capacitor Start/Capacitor Run Motors

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>SINPAC Switch Rating</th>
<th>115 Volt 50/60 Hz Motor Operation</th>
<th>230 Volt 50/60 Hz Motor Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVR-40</td>
<td>115 Volts</td>
<td><img src="image5" alt="Diagram" /></td>
<td><img src="image6" alt="Diagram" /></td>
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</tbody>
</table>

SINPAC Switch Rating

- Drum switch is not part of SINPAC Switch.
- Reversing contacts are not part of SINPAC Switch.

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

<table>
<thead>
<tr>
<th>Measured Voltage</th>
<th>Voltage Across SINPAC Switch Terminals 1 &amp; 2</th>
<th>Cut Out Voltage Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>226V</td>
<td>115V</td>
<td>180V</td>
</tr>
<tr>
<td>200V-225V</td>
<td>115V</td>
<td>165V</td>
</tr>
<tr>
<td>176-200V</td>
<td>115V</td>
<td>147V</td>
</tr>
<tr>
<td>150-175V</td>
<td>115V</td>
<td>130V</td>
</tr>
<tr>
<td>&lt;150V</td>
<td>115V</td>
<td>*</td>
</tr>
<tr>
<td>&gt;492V</td>
<td>230V</td>
<td>410V</td>
</tr>
<tr>
<td>370-492V</td>
<td>230V</td>
<td>310V</td>
</tr>
<tr>
<td>300-369V</td>
<td>230V</td>
<td>260V</td>
</tr>
<tr>
<td>&lt;300V</td>
<td>230V</td>
<td>*</td>
</tr>
</tbody>
</table>

*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...
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:
   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.
### Wiring Diagrams for SINPAC Switches

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>SINPAC Switch Rating</th>
<th>115 Volt 50/60 Hz Motor Operation</th>
<th>230 Volt 50/60 Hz Motor Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV-16</td>
<td>115 Volts</td>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
<tr>
<td>CV-25</td>
<td>115 Volts</td>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
<tr>
<td>CV-40</td>
<td>115 Volts</td>
<td><img src="image5" alt="Diagram" /></td>
<td><img src="image6" alt="Diagram" /></td>
</tr>
<tr>
<td>CV-50</td>
<td>115 Volts</td>
<td><img src="image7" alt="Diagram" /></td>
<td><img src="image8" alt="Diagram" /></td>
</tr>
<tr>
<td>Connect to Capacitor Start Motors Only</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| VR-16          | 115 Volts             | ![Diagram](image9)               | ![Diagram](image10)              |
| VR-40          | 115 Volts             | ![Diagram](image11)              | ![Diagram](image12)              |
| VR-50          | 115 Volts             | ![Diagram](image13)              | ![Diagram](image14)              |
| Connect to Capacitor Start/ Capacitor Run Motors |

| 2CV-35         | 230 Volts             | ![Diagram](image15)               | ![Diagram](image16)              |
| 2CV-50         | 230 Volts             | ![Diagram](image17)               | ![Diagram](image18)              |
| Connect to Capacitor Start Motors Only |

| 2VR-35         | 230 Volts             | ![Diagram](image19)               | ![Diagram](image20)              |
| 2VR-50         | 230 Volts             | ![Diagram](image21)               | ![Diagram](image22)              |
| Connect to Capacitor Start/ Capacitor Run Motors |

CS – Start Capacitor, M – Motor Main Winding, CR – run Capacitor, ST – Motor Start Winding
<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>SINPAC Switch Rating</th>
<th>115 Volt 50/60 Hz Motor Operation</th>
<th>230 Volt 50/60 Hz Motor Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR-25, IR-40</td>
<td>115 Volts</td>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reversing contacts are not part of SINPAC Switch.</td>
<td>Reversing contacts are not part of SINPAC Switch.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Drum switch is not part of SINPAC Switch.</td>
<td>Reversing contacts are not part of SINPAC Switch.</td>
</tr>
<tr>
<td>IVR-40</td>
<td>115 Volts</td>
<td><img src="image5" alt="Diagram" /></td>
<td><img src="image6" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reversing contacts are not part of SINPAC Switch.</td>
<td>Reversing contacts are not part of SINPAC Switch.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><img src="image7" alt="Diagram" /></td>
<td><img src="image8" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Drum switch is not part of SINPAC Switch.</td>
<td>Reversing contacts are not part of SINPAC Switch.</td>
</tr>
</tbody>
</table>

C<sub>S</sub> – Start Capacitor, M – Motor Main Winding, C<sub>R</sub> – run Capacitor, ST – Motor Start Winding
# Wiring Diagrams

## EASY STEPS

**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

## WIRING OF MOTOR EQUIPPED WITH MECHANICAL SWITCH

**Single Voltage with Thermal Protection**

- **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)

## EASY WIRING OF MOTOR EQUIPPED WITH SINPAC ELECTRONIC SWITCH

**MOTOR LEAD WIRE NUMBERING**

<table>
<thead>
<tr>
<th>L1</th>
<th>L2</th>
<th>Join</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>T4, T5</td>
<td>T1, T8</td>
</tr>
<tr>
<td>Clockwise rotation</td>
<td>P1</td>
<td>T4, T8</td>
</tr>
</tbody>
</table>

**Clockwise rotation**

<table>
<thead>
<tr>
<th>L1</th>
<th>L2</th>
<th>Join</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1, T5</td>
<td>T4, T8</td>
<td></td>
</tr>
</tbody>
</table>

**Lower name-plate voltage**

<table>
<thead>
<tr>
<th>L1</th>
<th>L2</th>
<th>Join</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>T2, T3 &amp; T5</td>
<td>P2, T3 &amp; T8</td>
</tr>
<tr>
<td>Clockwise rotation</td>
<td>P1</td>
<td>T2, T8</td>
</tr>
</tbody>
</table>

**Higher name-plate voltage**

<table>
<thead>
<tr>
<th>L1</th>
<th>L2</th>
<th>Join</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>T2, T3 &amp; T5</td>
<td>P2, T3 &amp; T8</td>
</tr>
<tr>
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<td>T2, T8</td>
</tr>
</tbody>
</table>

**Counterclockwise rotation**

<table>
<thead>
<tr>
<th>L1</th>
<th>L2</th>
<th>Join</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4, T8</td>
<td>T1, T5</td>
<td></td>
</tr>
</tbody>
</table>

**Clockwise rotation**

<table>
<thead>
<tr>
<th>L1</th>
<th>L2</th>
<th>Join</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4, T8</td>
<td>T1, T5</td>
<td></td>
</tr>
</tbody>
</table>

**Lower name-plate voltage**

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<th>L2</th>
<th>Join</th>
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</thead>
<tbody>
<tr>
<td>T1, T3 &amp; T8</td>
<td>T2, T4 &amp; T5</td>
<td></td>
</tr>
<tr>
<td>Counterclockwise rotation</td>
<td>T1, T8</td>
<td>T2, T4 &amp; T5</td>
</tr>
</tbody>
</table>

**Higher name-plate voltage**

<table>
<thead>
<tr>
<th>L1</th>
<th>L2</th>
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</tr>
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<tbody>
<tr>
<td>T1, T3 &amp; T8</td>
<td>T2, T4 &amp; T5</td>
<td></td>
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<td>Counterclockwise rotation</td>
<td>T1, T8</td>
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<th>Join</th>
</tr>
</thead>
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<tr>
<td>T1, T5</td>
<td>T4, T8</td>
<td></td>
</tr>
</tbody>
</table>
### 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

### Wiring Diagrams Continued

#### Easy Steps

<table>
<thead>
<tr>
<th>Easy Steps</th>
<th>Wiring of Motor Equipped with Mechanical Switch</th>
<th>Easy Wiring of Motor Equipped with SINPAC Electronic Switch</th>
<th>Motor Lead Wire Numbering</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capacitor Start/ Capacitor Run Motors</strong></td>
<td><img src="image1" alt="Wiring Diagram" /></td>
<td><img src="image2" alt="Wiring Diagram" /></td>
<td><strong>L1</strong></td>
</tr>
<tr>
<td>1. Disconnect the mechanical switch lead (CS1) which is connected to the start capacitor and reconnect this lead to SINPAC Switch terminal three (3).</td>
<td><strong>Single Voltage with Thermal Protection</strong></td>
<td><strong>Single Voltage with Thermal Protection</strong></td>
<td>Clockwise rotation</td>
</tr>
<tr>
<td>2. Disconnect other mechanical switch lead marked T5 and reconnect this lead to SINPAC Switch terminal two (2).</td>
<td></td>
<td></td>
<td>Counterclockwise rotation</td>
</tr>
<tr>
<td>3. Join SINPAC Switch terminal one (1) with motor lead T8.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Make sure the other side of the run capacitor is connected to the motor lead T5 along with SINPAC Switch terminal two (2).</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Use on only the following model series:**
- VR-16
- VR-40
- VR-50
- 2VR-35
- 2VR-50
- IVR-40

**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)
Procedure for Checking SINPAC Switches

1. Disconnect the SINPAC Switch from the motor and measure the resistance between terminals 2 and 3. If the resistance is less than 500K, the SINPAC Switch has been shorted or damaged, and must be replaced. If the resistance is infinite, the switch may not be damaged.

   **CAUTION:** Do not use megger to test motor circuit with SINPAC Switch.

2. If resistance across SINPAC terminal 2 and 3 is greater than 500K and you have a capacitor start, instant reverse, or capacitor start/capacitor run SINPAC Switch, use Diagram 1.

   **Diagram 1**

   115 V SINPAC Switch – 115 V incandescent light (L) (at least 25 watts) and 115 Vac power source.
   230 V SINPAC Switch – 230 V incandescent light (L) or two 115 V incandescent light (L) (at least 25 watts) in series and 230 Vac power source.

   a) Connect one line of AC power to terminal 1 through a line switch.
   b) Connect incandescent light (L) between terminals 1 and 3 of SINPAC Switch.
   c) Jumper terminals 1 and 4 of SINPAC Switch.
   d) Connect other line of AC power to terminal 2 of SINPAC Switch.

   **Note 1:** Apply rated AC voltage to the SINPAC Switch.
   **Note 2:** If the incandescent light (L) begins to blink after 1/2 second, the SINPAC Switch is operable.
   **Note 3:** If the incandescent light (L) fails to illuminate or stays illuminated, the SINPAC Switch has been damaged and must be replaced. Both test must be performed and passed to indicate a minimally good switch.
   **Note 4:** Turn off power and disconnect the SINPAC Switch.

3. If resistance across SINPAC terminal 2 and 3 is greater than 500K and you have a split phase SINPAC Switch, use Diagram 2.

   **Diagram 2**

   a) Connect one line of AC power to terminal 1 through a line switch.
   b) Connect a (25 watt) incandescent light (L) between terminals 1 and 3 of SINPAC Switch.
   c) Connect other line of AC power to terminal 2 of SINPAC Switch.

   **Note 1:** Apply rated AC voltage to the SINPAC Switch.
   **Note 2:** If the incandescent light (L) begins to blink after 1/2 second, the SINPAC Switch is operable.
   **Note 3:** If the incandescent light (L) fails to illuminate or stays illuminated, the SINPAC Switch has been damaged and must be replaced. Both test must be performed and passed to indicate a minimally good switch.
   **Note 4:** Turn off power and disconnect the SINPAC Switch.
<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause</th>
<th>Procedure for Checking</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor fails to start.</td>
<td>Incorrect connection of SINPAC Switch.</td>
<td>De-energize. Check the wiring and connection diagram.</td>
<td>Reconnect properly.</td>
</tr>
<tr>
<td>Start capacitor open or shorted.</td>
<td></td>
<td>De-energize motor, discharge, and check capacitor.</td>
<td>Replace capacitor.</td>
</tr>
<tr>
<td>Motor not free to rotate.</td>
<td></td>
<td>Check for jam or obstruction.</td>
<td>Remove obstruction.</td>
</tr>
<tr>
<td>AC line voltage too low.</td>
<td></td>
<td>Measure line voltage at the motor terminals.</td>
<td>Increase voltage.</td>
</tr>
<tr>
<td>No line voltage.</td>
<td></td>
<td>De-energize, check AC line fuses. Check wiring and connection diagram.</td>
<td>Replace fuses as required and apply AC line voltage.</td>
</tr>
<tr>
<td>Start winding open.</td>
<td></td>
<td>De-energize and disconnect. Measure the resistance of the start winding.</td>
<td>Check the start winding. Motor may have to be rewound. Infinite resistance would show an open winding or loose connection.</td>
</tr>
<tr>
<td>Motor hipot tested with switch installed without motor and SINPAC Switch leads tied together.</td>
<td></td>
<td>See Procedure to check SINPAC Switch (Page 28).</td>
<td>Replace switch and hipot motor, with installed SINPAC Switch, by tying all motor and SINPAC Switch leads together.</td>
</tr>
<tr>
<td>SINPAC Switch damaged (open circuit).</td>
<td></td>
<td>See Procedure to check SINPAC Switch (Page 28).</td>
<td>Replace SINPAC Switch after checking all of the above possible causes.</td>
</tr>
<tr>
<td>SINPAC Switch, if it has a metal enclosure, is not grounded.</td>
<td></td>
<td>Check continuity between SINPAC Switch metal case and ground.</td>
<td>Ground metal case.</td>
</tr>
<tr>
<td>Motor starts, but switch fails to cut out when cut out speed is reached.</td>
<td>Current in the start winding is above rating of SINPAC Switch.</td>
<td>Remove switch and check the current of the start winding. See Procedure to check SINPAC Switch (Page 28).</td>
<td>Replace SINPAC Switch, if damaged.</td>
</tr>
<tr>
<td>Wrong series SINPAC Switch installed — 115 V SINPAC Switch connected to 230 V start winding.</td>
<td></td>
<td>Consult selection chart — Measure voltage across wires connected to terminals 1 and 2.</td>
<td>Change switch — Check SINPAC Switch for damage and replace with correct switch.</td>
</tr>
<tr>
<td>Start capacitor shorted.</td>
<td></td>
<td>De-energize motor, discharge and check the capacitor.</td>
<td>Replace capacitor.</td>
</tr>
<tr>
<td>Start winding induced voltage is too low when motor reaches desired cut out speed. The voltage is due to the low winding-ratio of certain old style motors, foreign motors, converted motors, and special motor designs.</td>
<td></td>
<td>Perform SINPAC Switch Selection Procedure as described on Page 28.</td>
<td>Select proper SINPAC Switch.</td>
</tr>
<tr>
<td>AC line voltage too low.</td>
<td></td>
<td>Measure the AC line voltage across the motor terminals.</td>
<td>Increase the AC line voltage.</td>
</tr>
<tr>
<td>Start winding damaged.</td>
<td></td>
<td>De-energize and check the start winding.</td>
<td>Rewind motor.</td>
</tr>
<tr>
<td>Incorrect connection of SINPAC Switch for capacitor start motors.</td>
<td></td>
<td>De-energize and check the connection diagram. Be sure that terminal 4 of switch is connected to the junction of the start capacitor and start winding (Pages 24-27).</td>
<td>Correct wiring.</td>
</tr>
<tr>
<td>Damaged SINPAC Switch.</td>
<td></td>
<td>See Procedure to check SINPAC Switch (Page 28).</td>
<td>Replace SINPAC Switch after checking all of above possible causes.</td>
</tr>
<tr>
<td>SINPAC Switch exposed to excessive temperature.</td>
<td></td>
<td>Check the operating ambient temperature of SINPAC Switch. It should be less than 80°C (185°F).</td>
<td>Change mounting location of switch. SINPAC Switches can be remotely mounted.</td>
</tr>
<tr>
<td>Upon overload, the start winding is not reenergized (no cut in)</td>
<td>Wrong switch installed.</td>
<td>Consult selection chart.</td>
<td>Install correct switch.</td>
</tr>
<tr>
<td>Motor worked properly for many cycles of operations (days, weeks, months, years), then failed.</td>
<td>Start capacitor failure on capacitor start or cap. start/cap. run motors.</td>
<td>De-energize motor and check capacitor and SINPAC Switch.</td>
<td>Replace start capacitor and SINPAC Switch as appropriate.</td>
</tr>
<tr>
<td>Switch failure.</td>
<td></td>
<td>See Procedure to check SINPAC Switch. Also check start capacitor (Page 28).</td>
<td>Replace switch.</td>
</tr>
<tr>
<td>Premature start capacitor failures.</td>
<td>High cycle rate. Excessive motor temperature.</td>
<td>De-energize motor and check start capacitor and SINPAC Switch.</td>
<td>Connect a 15,000 ohm, 2 watt bleeder resistor across the start capacitor(s). If a single start capacitor was originally installed, replace with two start capacitors of twice the capacitance valve and same voltage rating as the original and connected in series.</td>
</tr>
<tr>
<td>Instant reverse motor, upon rapid reverse, will not reverse direction.</td>
<td>Wrong switch installed. CV or VR Series installed instead of instant reverse SINPAC Switch.</td>
<td>Ensure that instant reverse SINPAC Switch was installed to replace any mechanical instant reversing switch.</td>
<td>Install SINPAC instant reverse switch.</td>
</tr>
</tbody>
</table>
Distributors of SINPAC® Switches

Essex/Brownell Electro, Inc.
(800) 774-4643

E.I.S
Atlanta, GA (800) 447-0135
Birmingham, AL (800) 829-8642
Bluefield, VA (800) 959-5424
Charlotte, NC (800) 235-9491
Chicago, IL (800) 347-8511
Cleveland, OH (800) 347-8991
Dallas, TX (800) 786-7033
Denver, CO (303) 286-4500
Detroit, MI (800) 347-8511
Houston, TX (800) 223-7321
Kansas City, KS (800) 377-5717
Los Angeles, CA (800) 347-9601
Memphis, TN (800) 766-7666
Miami, FL (800) 524-0180
Minneapolis, MN (800) 328-4662
Oklahoma City, OK (800) 654-6631
Philadelphia, PA (800) 367-1212
Phoenix, AZ (800) 347-2740
Puerto Rico (787) 757-6565
San Francisco, CA (800) 347-9611

Torq Corporation
Bedford, OH (440) 232-4100 / (800) 899-5533

Electric Motor Warehouse
Corunna, MI (810) 744-1240 / (877) 986-6867

CANADA
Acme Electric, Ltd.
Port Hope, Ontario
Canada L1A 3W3
(905) 885-2469
Fax: (905) 885-7617

B & B Dynamo and Armature, Ltd
Winnipeg, Manitoba
Canada R2J 0S5
(204) 273-6066

C.B.S. Electric Insulation Materials, Ltd.
Calgary-AB
Canada T2G 4C8
(403) 243-1934
Fax: (403) 243-9409

Coquitlam-BC
Canada V3K 6A9
(604) 945-3634
Fax: (604) 945-3684

Edmonton-AB
Canada T5G 4C8
(780) 423-4301
Fax: (780) 424-7127
Email: cbs4234301@aol.com

Puerto Rico
Prowire, Inc.
San Juan, Puerto Rico 00919-3383
(787) 648-1725
Fax: (787) 763-4844

Performance Parameters and Limited Warranty

The performance of Stearns brakes, clutches, clutch-brake combinations, solenoids and controls depends upon the proper application of the product, adequate run in, installation and maintenance procedures, and reasonable care in operation.

All torque values listed in our bulletins are nominal and are subject to the variations normally associated with friction devices. The purchaser should also take into consideration all variables shown in the applicable specification sheets.

Although our application engineers are available for consultation, final selection and performance assurance on the purchaser’s machine is the responsibility of the purchaser. Careful purchaser selection, adequate testing at time of installation, operation and maintenance of all products of Rexnord Corporation, Stearns Division are required to obtain effective performance.

Stearns warrants to its purchasers that all its products will be free from defects in material and workmanship at the time of shipment to the purchaser for a period of one (1) year from the date of shipment. All warranty claims must be submitted in writing to Stearns within the warranty period, or shall be deemed waived. As to products or parts thereof which Stearns finds to have been defective at the time of shiment, its sole responsibility hereunder shall be to repair, correct or replace (whichever Stearns deems advisable) such defective products or parts without charge, FOB Stearns factory. In the alternative, Stearns may, at its option, either before or after attempting a different remedy, refund the purchase price upon return of the product or parts.

This warranty shall not apply to any product which has been subjected to misuse; misapplication; neglect (including but not limited to improper maintenance and storage); accident; improper installation; modification (including but not limited to use of other than genuine Stearns replacement parts or attachments); adjustment; or repair.

THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING THAT OF MERCHANTABILITY AND OF FITNESS FOR A PARTICULAR PURPOSE, AND OF ANY OTHER OBLIGATION OR LIABILITY ON OUR PART OF ANY KIND OR NATURE WHATSOEVER.

No Stearns representative has any authority to waive, alter, vary or add to the terms hereof without prior approval in writing, to our purchaser, signed by an officer of Rexnord Corporation.

Stearns liability for its products, whether for breach of contract, negligence, strict liability in tort, or otherwise shall be limited to the repair, correction, or replacement of the products or parts thereof, or to the refund of the purchase price of such products or parts. Stearns will not be liable for any other injury, loss, damage or expense, whether direct or consequential, including but not limited to loss of use, income, profit or production, or increased cost of operation, or spoilage of or damage to material, arising in connection with the sale, installation, use of, inability to use, or the repair or replacement of, or late delivery of, Stearns products.

Any cause of action for breach of the foregoing warranty must be brought within one (1) year from the date the alleged breach occurs.
### Worldwide Sales and Service

#### District Sales Offices

**CINCINNATI DISTRICT**  
*(Please contact factory)*  
5150 S. International Drive  
Cudahy, WI 53110  
Telephone: (414) 272-1100  
Fax: (414) 277-4364

**FLORIDA DISTRICT**  
Taylor Industrial Sales  
6362 Harney Road - Suite E  
Tampa, FL 33610  
Telephone: (813) 663-9111  
Fax: (813) 663-9104  
bill@tiscotampa.com

**INTERMOUNTAIN DISTRICT**  
*(Please contact factory)*  
5150 S. International Drive  
Cudahy, WI 53110  
Telephone: (414) 272-1100  
Fax: (414) 277-4364

**LOS ANGELES DISTRICT**  
Foxco Equipment Sales, Inc.  
7071 Warner Avenue - Suite F751  
PO Box 2148  
Huntington Beach, CA 92647-2148  
Telephone: (714) 596-3600  
Fax: (616) 426-9857  
foxcoinfo@foxcoequipment.com

**MICHIGAN DISTRICT**  
Ganco Industrial, Inc.  
2960 S. Wilson Court NW - Suite B  
Grand Rapids, MI 49534  
Telephone: (616) 249-8430  
Fax: (616) 249-8628  
gnorris@gancoindustrial.com

**MID-ATLANTIC DISTRICT**  
N.O. Holder & Associates, Inc.  
P.O. Box 25603  
Greenville, SC 29616  
4109 East North Street, Suite 400 (29615)  
Telephone: (864) 244-8854  
Fax: (864) 244-2355  
jay@noholder.com

**NEW ENGLAND DISTRICT**  
*(Please contact factory)*  
5150 S. International Drive  
Cudahy, WI 53110  
Telephone: (414) 272-1100  
Fax: (414) 277-4364

**NEW YORK DISTRICT**  
*(Please contact factory)*  
5150 S. International Drive  
Cudahy, WI 53110  
Telephone: (414) 272-1100  
Fax: (414) 277-4364

**PHILADELPHIA DISTRICT**  
Brisbane Industrial Drives Company, Inc.  
1432 State Route 903  
Jim Thorpe, PA 18229  
Telephone: (570) 325-3684  
Fax: (570) 325-3870  
dchrisb@brisbaneindustrial.com

**ST. LOUIS DISTRICT**  
Scott Peterson  
345 Laduemont Drive  
St. Louis, MO 63141  
Telephone: (314) 453-1600  
Fax: (314) 453-1601  
scott.peterson@rexnord.com

**SOUTHEAST DISTRICT**  
Power & Motion Industrial  
3440 Blue Springs Road-Suite 103  
Kennesaw, GA 30144  
Telephone: (770) 529-0418  
Fax: (770) 529-0768  
ed@powerandmotion.com

**TENNESSEE DISTRICT**  
Conveying & Power Transmission Solutions  
PO Box 146  
1199 E. Main Street  
Itasca, TX 76055  
Telephone: (800) 383-5918  
Fax: (254) 687-2205  
sales@c-pts.com

**TEXAS DISTRICT**  
Conveying & Power Transmission Solutions  
1033 N. Hwy. 77  
Schulenburg, TX 78956  
Telephone: (979) 581-6907  
Fax: (979) 743-3208  
shollis@msn.com

**WISCONSIN DISTRICT**  
Randy Sprink  
P.O. Box 100640  
5150 S. International Drive  
Cudahy, WI 53110-6111  
Telephone: (414) 277-4368  
Fax: (414) 277-4364  
randall.sprink@rexnord.com

### International

**AUSTRALIA:**  
Rexnord Australia Pty. Ltd.  
25 Henry Street  
P.O. Box 620  
Picton, New South Wales 2571  
Australia  
Telephone: 61-2-4677-3811  
Fax: 61-2-4677-3812

**BRAZIL:**  
Rexnord Correntes Ltda.  
Rua Alferes Magalhaes, 92 - Cj. 96  
02034-006 - Sau Paulo - SP  
Brazil  
Telephone: 55-11-6221-2283  
Fax: 55-11-6221-6745

**EUROPE:**  
Rexnord Belgium NV/SA  
Dellingstraat 55  
B-2800 Mechelen  
Belgium  
Telephone: 32-15-443811  
Fax: 32-15-443860

**LATIN AMERICA (Miami):**  
Rexnord International Inc.  
7200 NW 19th Street  
Suite 202  
Miami, FL 33126, USA  
Telephone: 305/592-4367  
Fax: 305/592-5384

**SINGAPORE:**  
Rexnord International Inc.  
36 Purvis Street  
Singapore 188613  
Telephone: 65-6338-5622  
Fax: 65-6338-5422

**ST. LOUIS DISTRICT**  
Scott Peterson  
345 Laduemont Drive  
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Fax: (314) 453-1601  
scott.peterson@rexnord.com

**SOUTHEAST DISTRICT**  
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Kennesaw, GA 30144  
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Fax: (770) 529-0768  
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Telephone: (800) 383-5918  
Fax: (254) 687-2205  
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### Canada

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**BRITISH COLUMBIA:**  
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Abbotsford, British Columbia  
V2T 2Y3  
Telephone: 604/852-9545  
Fax: 604/852-9693

**ONTARIO:**  
81 Maybrooke Drive  
Scarborough, Ontario  
M1V 3Z2  
Telephone: 416/297-6868  
Fax: 416/297-6873

**QUEBEC:**  
6039 Thimens Boul.  
Ville St-Laurent, Quebec  
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Fax: 514/337-2615