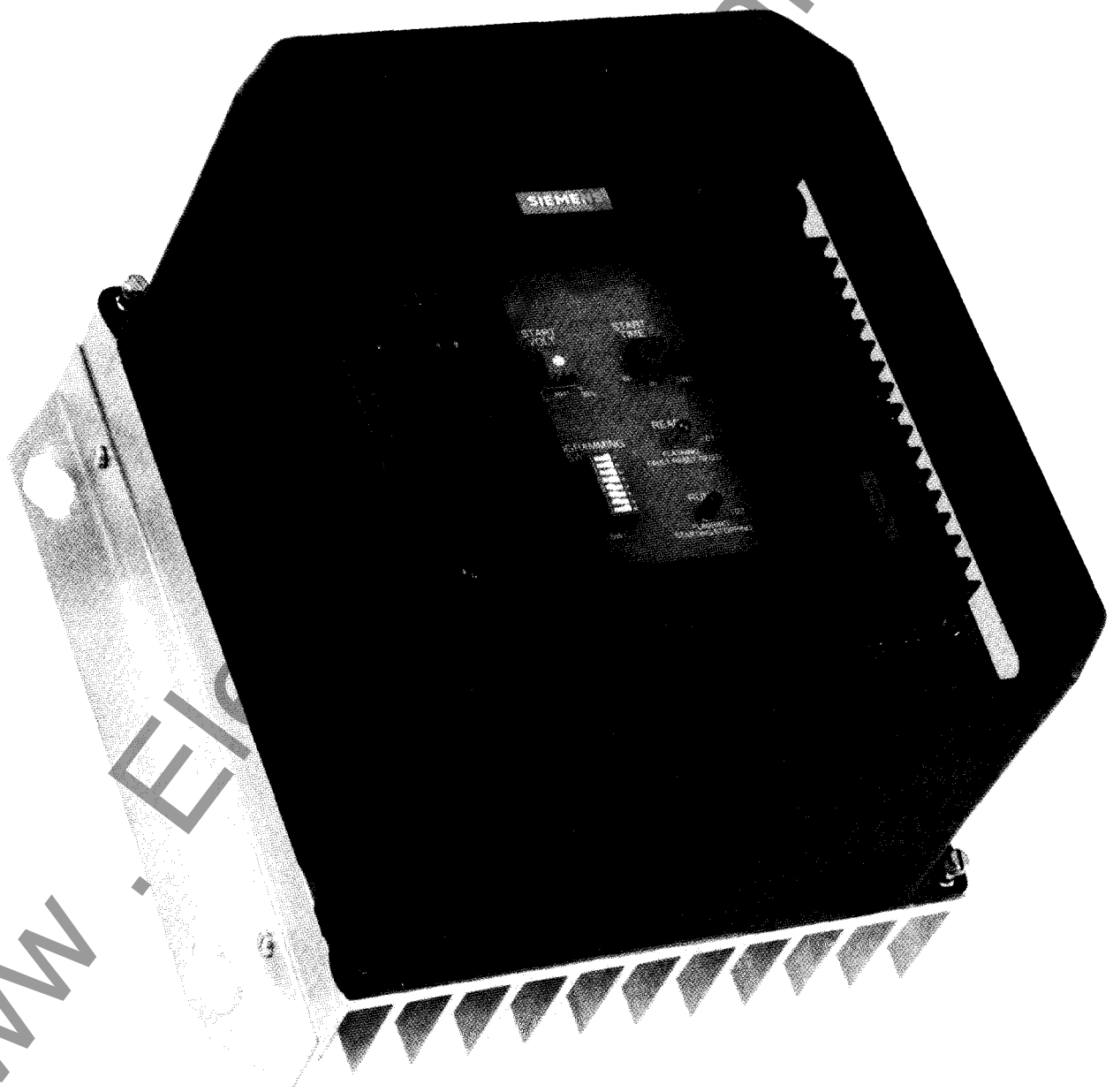
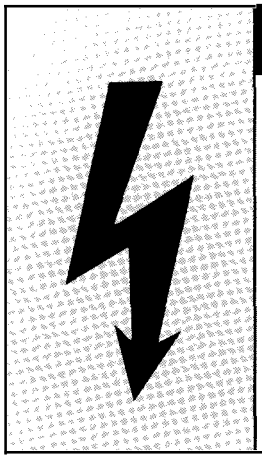
SIEMENS

Solid State Reduced Voltage Starters - 3RW2

Users Manual



Bulletin CP3280



⚠ DANGER

Hazardous voltages are present inside the enclosures or panels in which the circuit breakers are installed. Serious injury, electrocution, and/or equipment damage will result if circuit breakers are improperly applied or precaution is not used.

De-energize all incoming power prior to installation of circuit breakers or associated accessories.

Only qualified personnel should work on or around this equipment

Position of circuit breaker handles shown in this booklet is for illustration purposes only. Circuit breakers are to be installed in OFF or TRIPPED position only.

IMPORTANT

The information contained herein is general in nature and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. Siemens reserves the right to make changes in the specifications shown herein or to make improvements at any time without notice or obligations. Should a conflict arise between the general information contained in this publication and the contents of drawings or supplementary material, or both, the latter shall take precedence.

NOTE

***Authorized and qualified personnel—**
For the purpose of this manual a qualified person is one who is familiar with the installation, construction or operation of the equipment and the hazards involved. In addition, he has the following qualifications:

(a) **is trained and authorized** to de-energize, clear, ground, and tag circuits and equipment in accordance with established safety practices.
(b) **is trained** in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with established safety practices.
(c) **is trained** in rendering first aid.

SUMMARY

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local sales office, listed on the back of this instruction guide.

The contents of this instruction manual should not become part of or modify any prior or existing agreement, commitment, or relationship. The sales contract contains the entire obligation of Siemens Energy & Automation, Inc., The warranty contained in the contract between the parties is the sole warranty of Siemens Energy & Automation, Inc. Any statements contained herein do not create new warranties or modify the existing warranty.

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Introduction

This manual is an overview for installation, set-up and operation of the 3RW2 basic controller.

The 3RW2 combines microcomputer control and silicon controlled rectifier (SCR) technologies to provide optimum AC induction motor starting and operation. It provides soft start, energy savings, soft stop and added protective features.

The basic controller consists of electronic circuit boards stacked and linked via flat cable connectors. The main functions of the basic assembly are to monitor the operating parameters of the controller and to control the firing sequence of the SCR's. The power module (located below the basic controller) controls power to the motor. The incoming and motor load connections are made to terminal blocks located on the top and bottom of the power module.

The controllers are available either as open type or enclosed in NEMA type 1 or 12 enclosures. Units can be supplied with overload relays as complete starters, or as combination starters with fusible, non-fusible disconnect or thermal magnetic circuit breakers with or without shunt trip features. Additional options are also available.

3RW2 is designed to operate 3 phase AC induction motors at 208 to 575 volts and 35 to 420 amperes at 50 or 60 Hertz.

Operating Principle

The solid state motor controller uses silicon controlled rectifiers (SCR's) to control the voltage to the motor windings. Each SCR acts as a switch that can be turned on with an electronic trigger signal at any point on the voltage waveform and turns off when the current waveform crosses zero.

Two SCR's are used in a back-to-back arrangement in each phase to allow alternating current to pass to the motor.

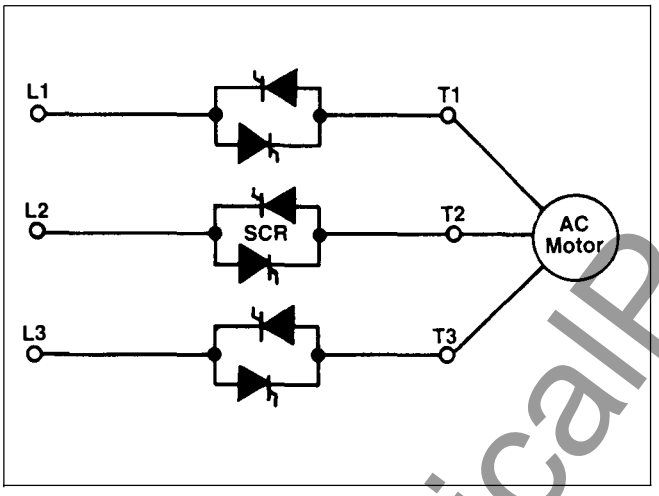


Figure 1. Three Phase Control Configuration

When SCR triggering is delayed, the voltage to the load is reduced. This phase-controlled operation provides soft starting with stepless acceleration.

Once the motor is running, voltage reduction can improve the motor's operating point at partial load, saving energy and lowering the reactive current.

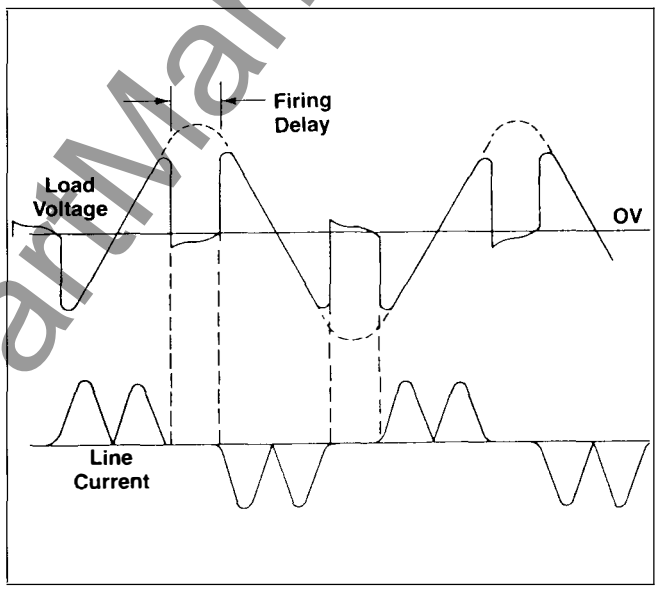


Figure 2. Phase Control

The controller consists of a power module, electronic circuit boards, and a cover.

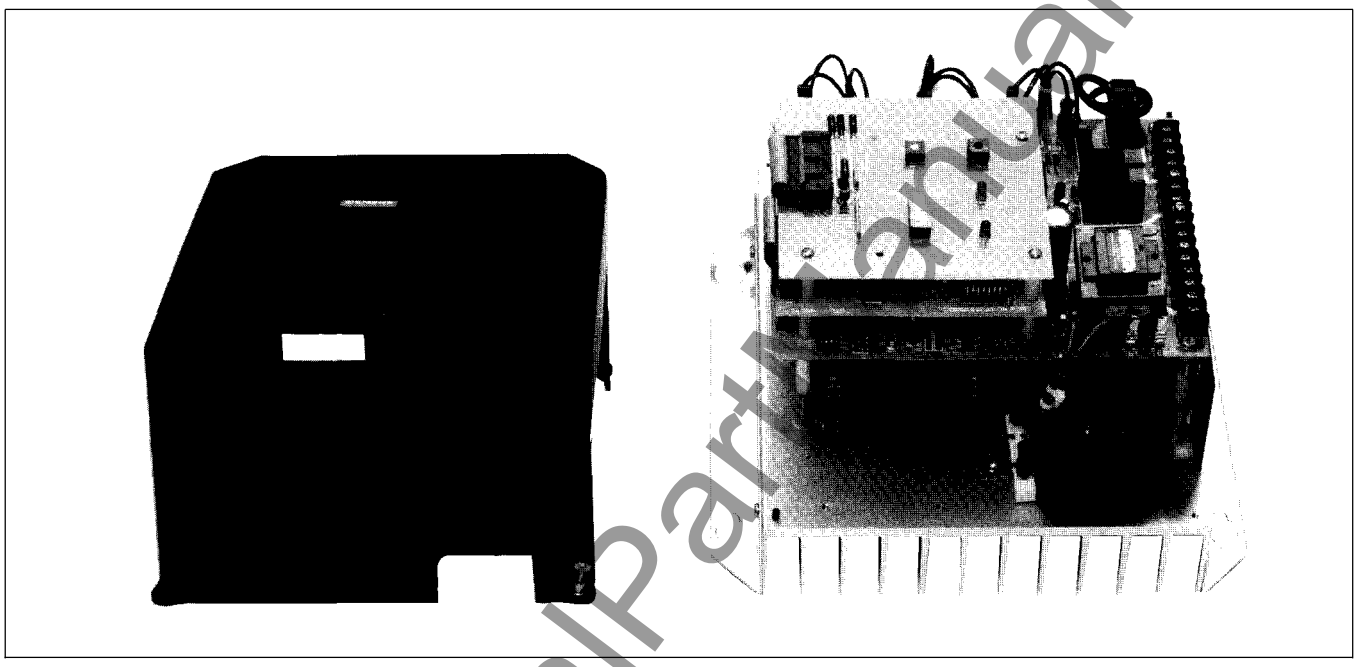


Figure 3. Controller

Power Module

The power module consists of an aluminum heat sink, SCR's, power terminals, and rating ID resistor. Larger ratings include a forced cooling fan with fan transformer and fuse protection as well as snubbers and MOV's for transient protection.

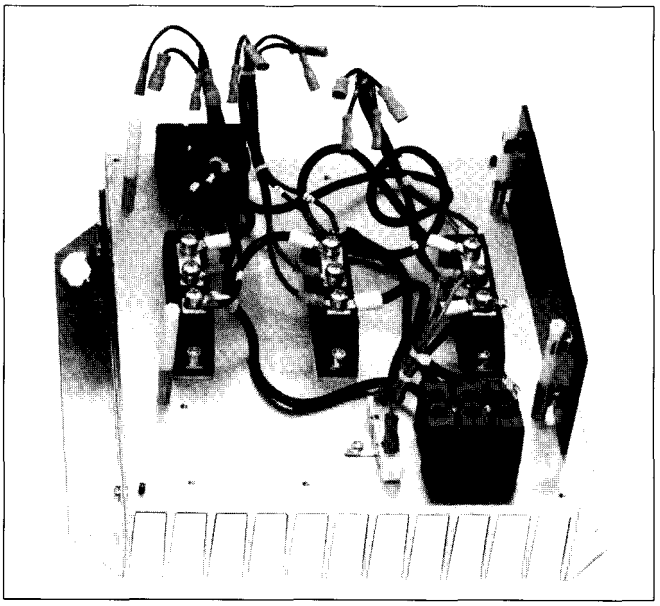


Figure 4. Power Module

Circuit Boards

There are three electronic circuit boards.

1. The main board contains a power supply, current transformer, triggering devices, input/output devices, and customer terminals.

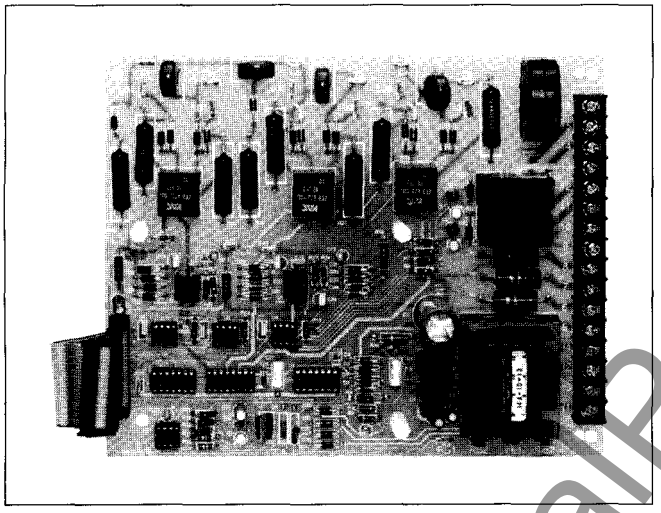


Figure 5. Main Board

2. The central processing unit board (CPU) includes a microprocessor, memory, and support circuitry.

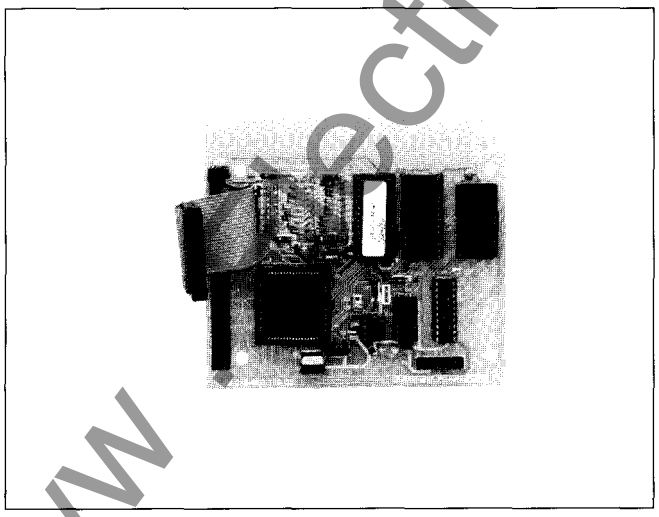


Figure 6. CPU Board

3. The basic input board provides customer settings, selection of operating mode, and status indication.

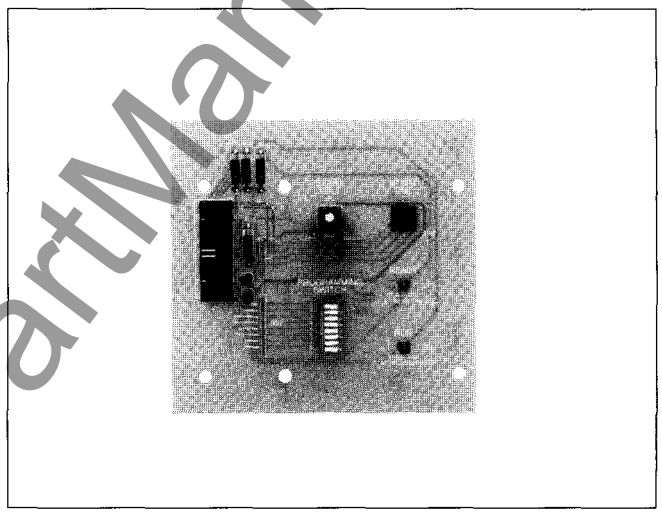


Figure 7. Basic Input Board

Motor Starting Modes

There are four different modes of starting AC induction motors, using the 3RW2 reduced voltage starter.

1. Voltage Ramp

   The initial application of power to the 3 motor phases is sequenced to eliminate starting transients. During this sequence the current is constantly monitored. If the current exceeds 1.5 times the full load current (FLA) rating of the unit, the triggering of the SCR is stopped, indicating overcurrent. This protects the controller and load in case of a short circuit condition.

   After an initial test for bolted faults (50 ms), the selected starting voltage is applied and voltage ramp begins.

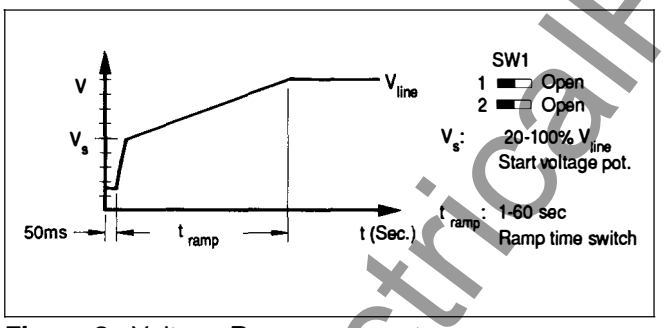


Figure 8. Voltage Ramp

2. Voltage Ramp With Impulse

   Impulse start can be selected to provide additional intital torque to break static friction. The impulse has a duration of 1 second maximum and has adjustable voltage from 20 - 100% of line voltage.

   After impulse the ramp resumes. Voltage is increased to full voltage within the pre-selected time. Voltage ramp with impulse can be selected for specific applications requiring additional initial torque such as ball and hammer mills.

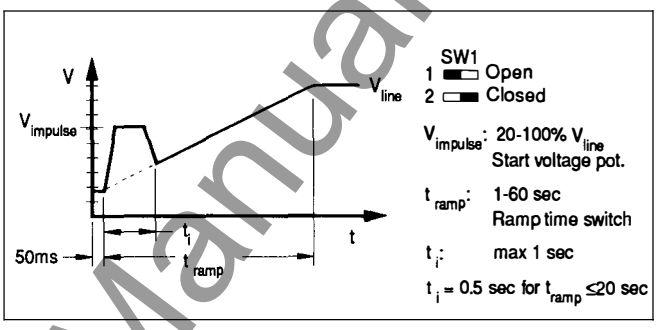


Figure 9. Voltage Ramp With Impulse

3. Limited Voltage (Current Limit)

   The voltage limit starting method allows selection of a fixed percent voltage until the motor has started. During this time the current will be limited by the fixed voltage. This method is similar to autotransformer starting.

   Limited voltage starting is used for applications requiring limited current on starting to meet power company or system restrictions.

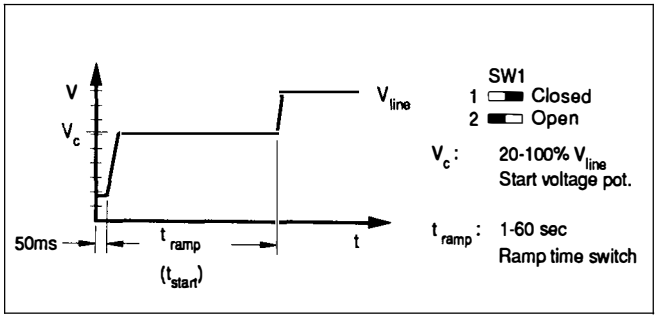


Figure 10. Limited Voltage

4. Emergency Start

   Emergency start allows the motor to start with one shorted SCR pair. The voltage ramp starts automatically at a higher voltage than other methods of starting (approximately 60% of

line voltage). The full line voltage is reached in the selected ramp time. If emergency start method is selected, energy savings is disabled.

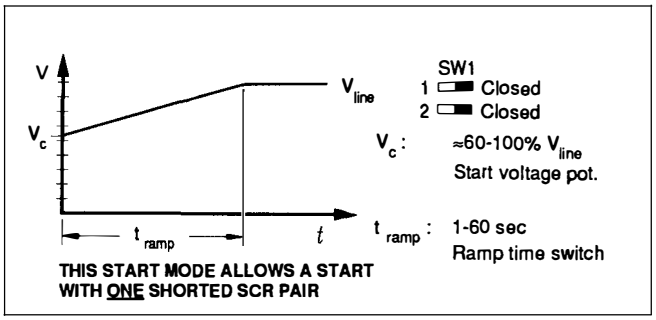


Figure 11. Emergency Start

Motor Running Modes

1. Full Voltage Run

   The motor will receive full voltage during the run mode, regardless of load. The SCR's are fully on during run mode, which eliminates harmonics and minimizes heat losses.

2. Energy Savings

   When the motor is lightly loaded, the controller automatically reduces the voltage to optimize the power factor and reduce the power consumption by the motor. As the load increases, the controller increases the voltage to the motor to maintain full speed. After the motor has started, the phase angle between the motor voltage and current is measured each cycle. The energy savings program continually adjusts the motor voltage to maintain the most efficient operating conditions.

Motor Stopping Modes

1. Immediate Stop

   In the normal mode (input 6 & 7 are not energized) the controller will automatically select the immediate stop mode. The motor will coast to stop based on load and inertia.

2. Soft Stop

   When soft stop is selected the controller will ramp the motor down in a similar fashion to the ramp up. For example, if the selected ramp up (start time) is 6 seconds the ramp down time will also be 6 seconds. If impulse start is selected the stop ramp will be completed at 40% voltage and then the controller will shut off.

   Soft stop is initiated by de-energizing input 6 while input 7 is energized.

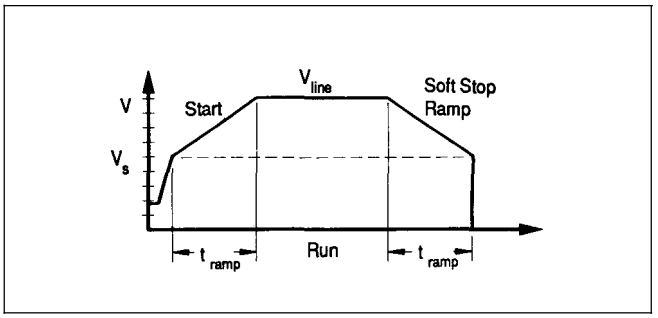


Figure 12. Soft Stop

Overload

Each cycle the 3RW2 monitors the line conditions for possible faults. The heat sink temperature and load current is monitored every 0.1 seconds. If the controller detects an abnormal condition, it will shut down and the green light will flash, indicating fault. If the K2 relay is programmed for the specific fault condition it will operate.

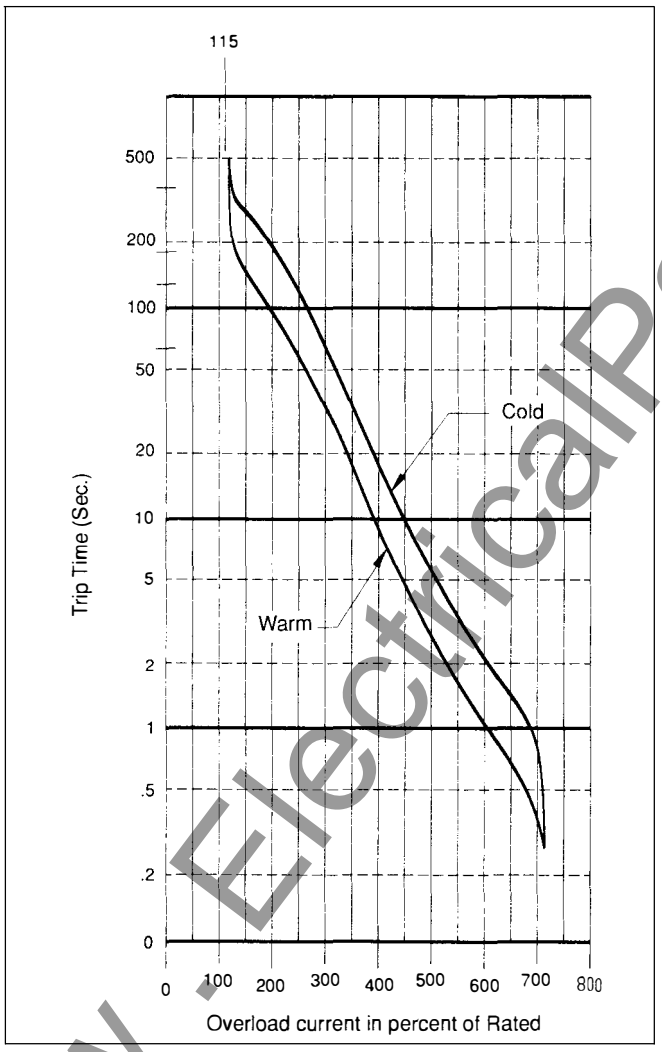


Figure 13. Overload Curve

Load Loss

Loss of connections to one or more load terminals will cause the controller to shut down while starting, running, or stopping.

Overhauling Load

When the load forces the motor to rotate at higher than synchronous speed, the controller detects overhauling by the phase angle and applies full line voltage to the motor. This provides maximum breaking torque to the load.

Shorted SCR

If one SCR is shorted during the starting, running or stopping period, the controller will shut the motor off within four cycles. If desired, the motor can still be started with Emergency start mode.

If 2 or more SCR's are shorted during start or run, the controller will shut off, and if provided with shunt trip, the main circuit breaker will trip out.

Phase Reversal

The controller can be selected to be phase rotation sensitive. However, if the line reversing mode is selected, the controller can not be sensitive to phase rotation. If load reversing is selected, the controller is not sensitive to the incoming phase rotation.

Under/Over Voltage

The controller will trip off the line if control voltage is out of the normal operating range.

Phase Loss

The controller will trip off the line if one or more phases are lost.

Electrical Specifications

Voltage: 3-phase 50/60 Hz ±5%

ACV: 208, 230, 460, 575, +10, -15%

Current Ratings: 20 - 420 Amps

Horsepower Ratings:
Up to 400 at 575 V
Up to 350 at 460 V
Up to 150 at 230 V
Up to 150 at 208 V

Controller During Start & Run 115% for open or NEMA 1 types

	Cold	Hot
250%	120 sec.	60 sec.
300%	60 sec.	30 sec.
450%	10 sec.	5 sec.
600%	2 sec.	1 sec.

SCR Voltage Rating:
1200 V for 460 V ratings
1600 V for 575 V ratings

Snubbers: RC network protects against false firing due to DV/DT (larger sizes)

Voltage Suppression: MOV for SCR protection against voltage spikes

Temperature Sensor: Heat sink temperature

Current Sensor: Load Current (CT)

Operating Temperature: 0 to 40° C (enclosed)

Voltage Start: 20-99% adjustable

Start-Stop Time: 0 - 60 seconds adjustable

Phase Reversal: Selectable with dip switch

Energy Savings: Selectable with dip switch

Relay Output: 2 output relays with 1NO/1NC form C contacts rated at 5 Amps 240 Vac. Selectable relay functions.

Indicator LEDs:

Green	on steady	power on/ready
	flashing	reset required - fault indication
Red	on steady	motor run
	flashing	starting/stopping
Both	on steady	power up - lamp test

NOTE

Installation and service must be performed by qualified electricians. All wiring must conform to national and local electrical codes.

1. Unpack, remove blocking and wrapping materials and inspect equipment for shipping damage. File appropriate claims with carrier if damaged.

   NOTE: Packaging is suitable for dry location indoor storage only. Condensation and moisture must be avoided.

2. Secure enclosures to wall or floor such that the air flow through power unit fins is vertical.

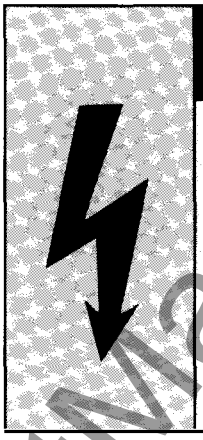
3. Power units must be enclosed or guarded for personnel protection. Refer to National Electrical Code. Keep doors and covers closed for protection against dust and hazards.

4. Adequate cooling is essential for proper operation of the control, clearance above and below the power unit must be provided to allow unimpeded convection or fan air flow. Equipment ambient temperature rating is 40 ° C.

5. Enclosures must be properly sized or ventilated to provide cooling for the continuous power dissipation in the semiconductors, approximately 3 watts per ampere of continuous rating. The following ventilation areas are required for customer furnished NEMA 1 enclosures, motor control centers, etc.

Vent Area	Continuous Amp	
not req'd	up to 80 Amp	(60 HP at 460 V)
20' x 58"	up to 130 Amp	(100HP at 460 V)
40' x 38"	up to 250 Amp	(200HP at 460 V)
80' x 58"	up to 420 Amp	(350HP at 460 V)

   Located front ventilation air inlet area at 3" below the bottom edge of the enclosure. Outlet air vent area at least 6" above power unit top edge.



⚠ WARNING

Hazardous voltage can cause personal injury, death, or equipment damage.

This controller MUST be wired with branch circuit protection since the controller does not provide electrical isolation to the motor when the motor is OFF.

   Air filters impede air circulation and may not be used. For NEMA 12 enclosures use by-pass contactors or heat exchange devices to maintain ratings.

6. Connect input terminals of controller assembly to proper capacity three phase 50/60 Hz voltage source.

   Caution: Do not connect units to voltage sources above rated unit name plate.

   Torque incoming connections as required. Minimum transformer source is 2 times motor horsepower. Incoming motor feeder or motor branch circuit conductors must be properly sized per applicable NEC sections. Power feed shall have disconnect means and be protected against overcurrent ground and short circuit faults per NEC.

7. Connect load terminals to motor terminals and size conductors per NEC. Torque connections as required.

   Refer to motor name plate for proper motor connections.

   The 3RW2 starter can be used with a part winding or wye delta motors in place of the electro-mechanical starter. Motors must be connected in full voltage run configuration.

For multispeed application the 3RW2 reduced voltage starter can be used with the electro-mechanical starter to provide soft start. The controller output must be connected to the line input of the multispeed starter. Speed changes must not be made during starting or stopping.

8. Connect equipment and enclosure grounds.

9. Connect 120 Volt separate power source for control power supply unless control power is provided from the fan control power transformer.

10. Motor overload protection must be provided via separate device. Class 10, Siemens 3UA series overload relays are recommended.

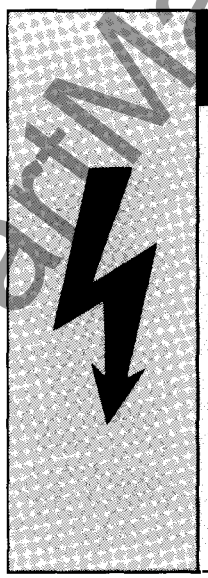
11. Connect control circuit pilot devices per appropriate diagram or install auto start jumpers.

12. Check for secureness of all wiring and power connections and check tightness of all equipment mounting bolts. Remove all wire cuttings, installation particles, metal chips and debris before engaging.

13. Shut enclosure doors to protect equipment from dust.

POWER FACTOR CORRECTION CAPACITORS

When power factor correcting capacitators are used, they must be installed on the line side of the controller. Connecting capacitors to the load side of the controller will result in improper operation and may cause motor damage.



⚠ DANGER

Hazardous voltage will cause severe injury, death, or property damage.

High voltage is present on all controller components except heatsinks, current transformers, and the basic control board. All bus bars, terminals, snubber boards and the SCR's are energized at rated voltage. Use established safety procedures to avoid injury.

Customer Selection

1. Select Soft Stop or Reverse:

A. Soft Stop:

If reverse mode has not been selected, soft stop may be enabled by energizing input terminal 7. Note: Start, and stop functions are controlled by input terminal 6.

B. Reversing:

Line reversing is selected on SW1 sections 6, 7 & 8 open; input terminal 7 must be energized from control signal. Load reversing can be accomplished by installing reversing contactors between the load terminals of the 3RW2 and the motor. SW1 sections 6, 7, & 8 are not a factor, nor does input terminal 7 require a signal.

2. Select Reset/Hold Ramp:

A. Reset: (SW1 section 4 open)

System fault reset occurs when momentary voltage signal is applied to input terminal 8. (Reset can also be accomplished by turning control power off and back on).

B. Hold Ramp: (SW1 section 4 closed)

Hold ramp is used to limit inrush current or torque to motors. During the voltage ramp starting period, motor voltage is held at the existing value when a momentary input signal is applied to terminal 8.

3. Selected Output Function for Relays:

A. Relay K1

1. Start & Run (SW1 section 5 open)

Relay K1 is energized during starting, running and soft stop. It may by used as a sealing contact for start stop push button control.

2. Run (SW1 section 5 closed)

Relay K1 is energized only in the run mode after starting time has elapsed and the motor is at full voltage. It may be used for run indication or actuating loading/unloading devices.

B. Relay K2

1. Run (SW1 sections 6, 7 & 8 closed)

Relay K2 is energized after starting time is complete and during running. It is de-energized during soft stop. It may be used for Run output function if K1 is used for start seal function.

2. Reverse Mode Line Side (SW1, 6, 7 & 8 open)

Relay K2 is energized during start and run in reverse direction.

3. Faults (Relay K2 Fault Functions)

a. General Fault (SW1 sections 6 & 8 open, section 7 closed)

Relay K2 is energized for any one, or combination of faults. (Over-temperature, shorted SCR, over voltage, under voltage, phase loss, overload, firing circuit fault, load loss or load short.

b. Over-temperature (SW1 sections 6 & 7 closed, section 8 open)

Relay K2 is only energized for heat sink over-temperature condition.

c. Phase loss or one shorted SCR (SW1 section 6 open, section 7 & 8 closed)

Relay K2 is only energized on either phase loss or one shorted SCR.

d. Two shorted SCR's (SW1 sections 6 & 7 open, section 8 closed)

   Relay K2 is only energized when 2 SCR's are shorted and stop pushbutton is actuated. It may be used as shunt trip actuation on an input circuit breaker to interrupt current.

e. Incorrect phase rotation (SW1 section 7 open, section 6 & 8 closed)

   Relay K2 is only energized when there is incorrect phase rotation on the line side.

f. By-pass (SW1 section 6 open, 7 & 8 closed)

   In the by-pass contactor mode, relay K2 is energized in the "run" mode after starting is complete, to energize the by-pass contactor.

NOTE: Controller trip and LED indicators are not affected by K2 fault selection.

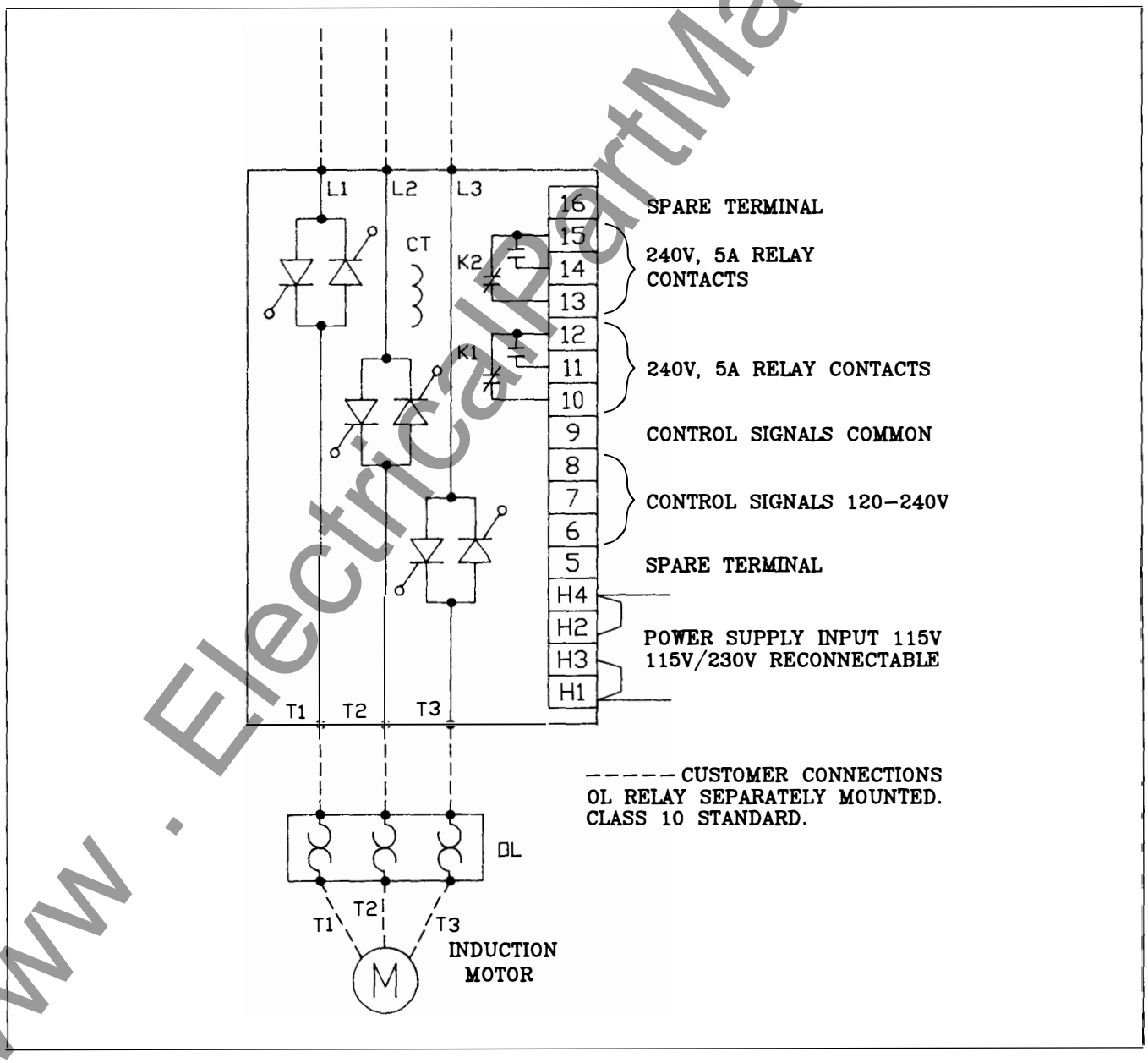
Wiring Diagrams

1. Customer Connections
2. Start-Stop
3. Hand-Off-Auto
4. Shunt-Trip
5. Start-Stop With By-Pass
6. Start-Stop With Load Isolation
7. Start-Stop With Load Reversing

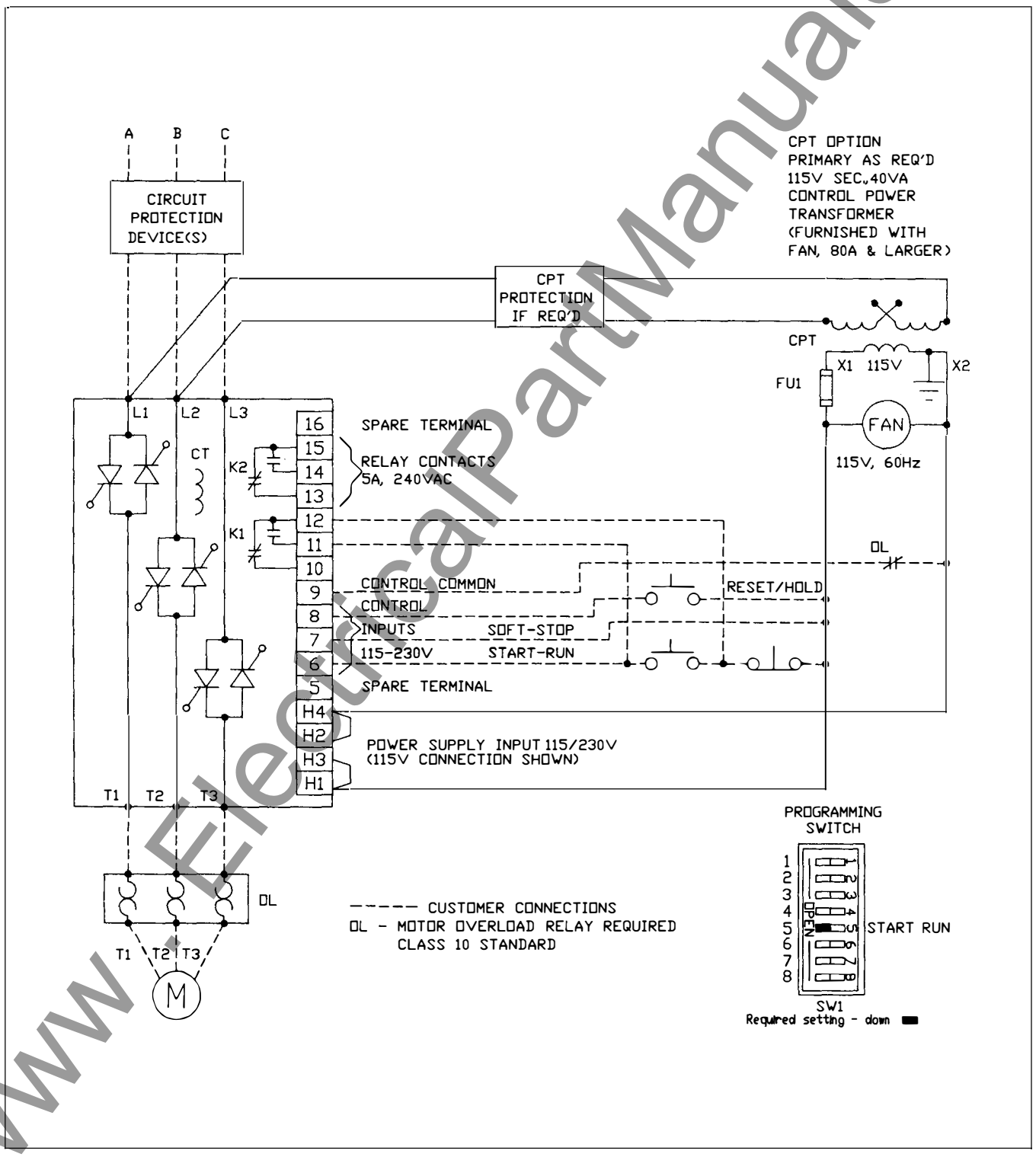
Customer Connections

1. Power
   Compression terminals for motor rating
   Input line connections L1, L2 & L3 Top of Unit
   Motor connections T1, T2 & T3 Bottom of Unit

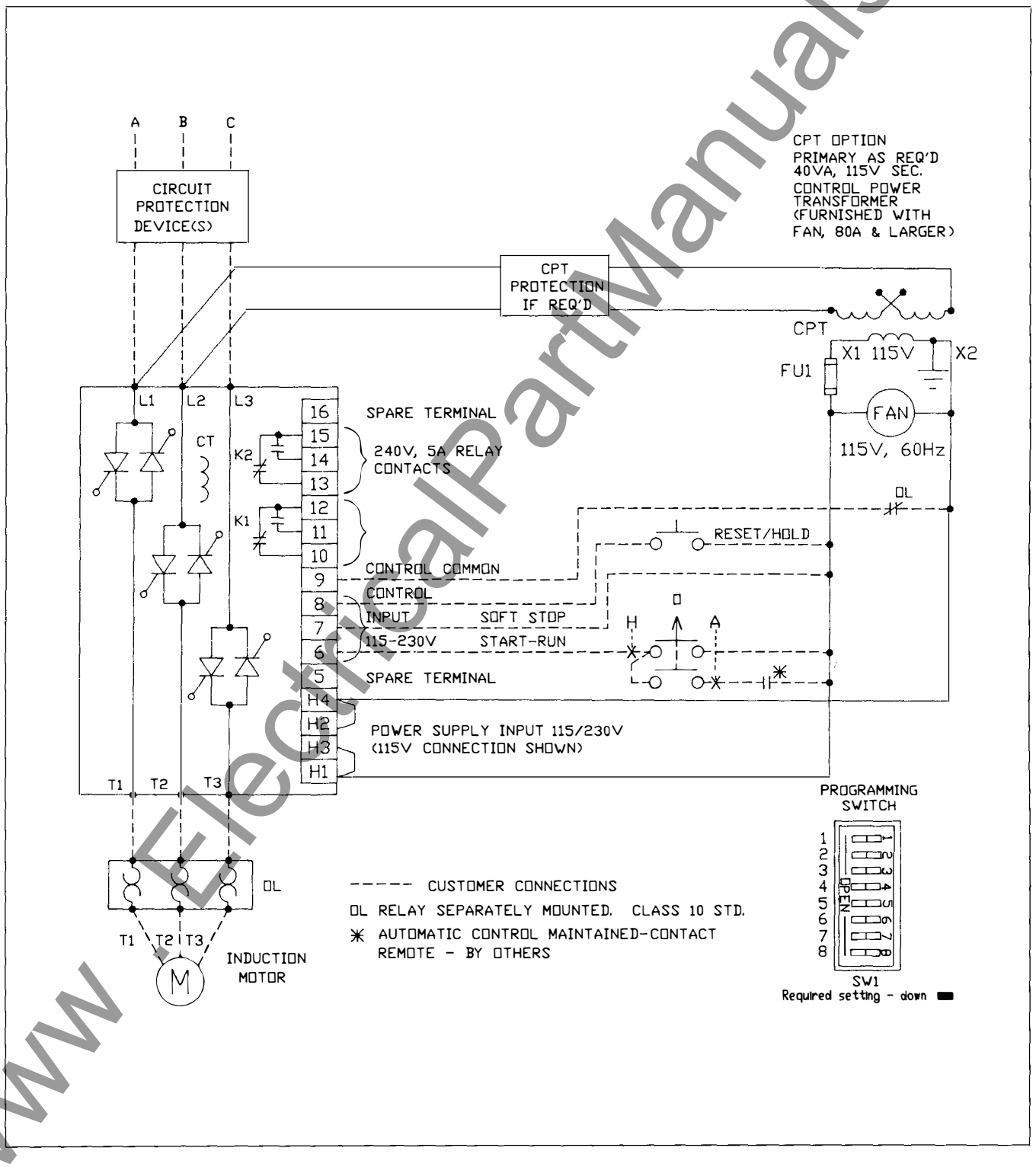
2. Control Circuit
   Terminal strip on main board: 2 #14 AWG Max.
   - Output relays contacts K1 & K2; terminals 10 thru 15, Form C contacts rated at 5 Amp 240V.
   - Input signals; terminals 6, 7 & 8 with 9 common, 115 to 240 Volt.
   - Power supply; H1, H2, H3, H4; 115 or 230 V reconnectable.
   - Terminals 5 & 16 are unused spares.



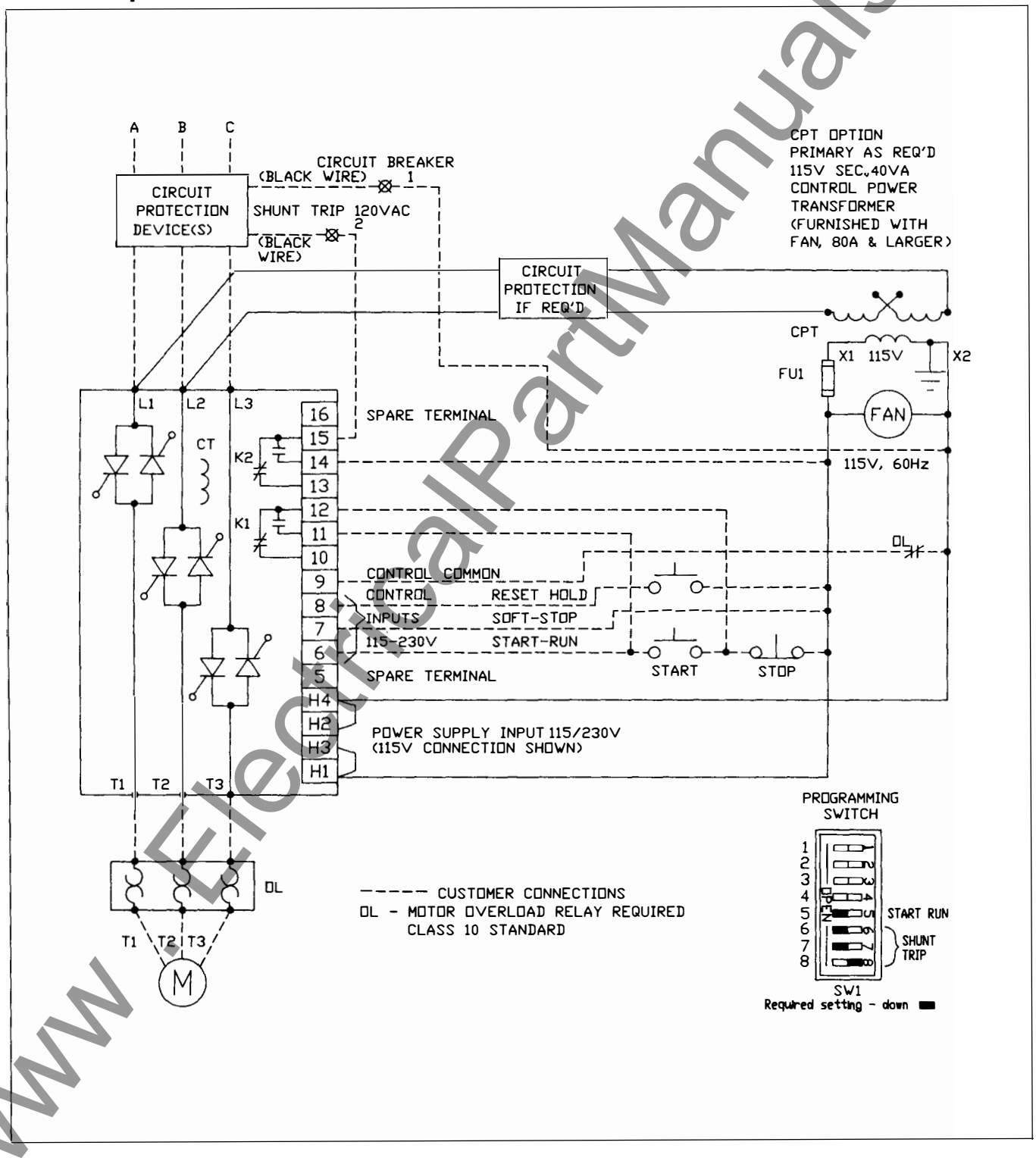
Start-Stop



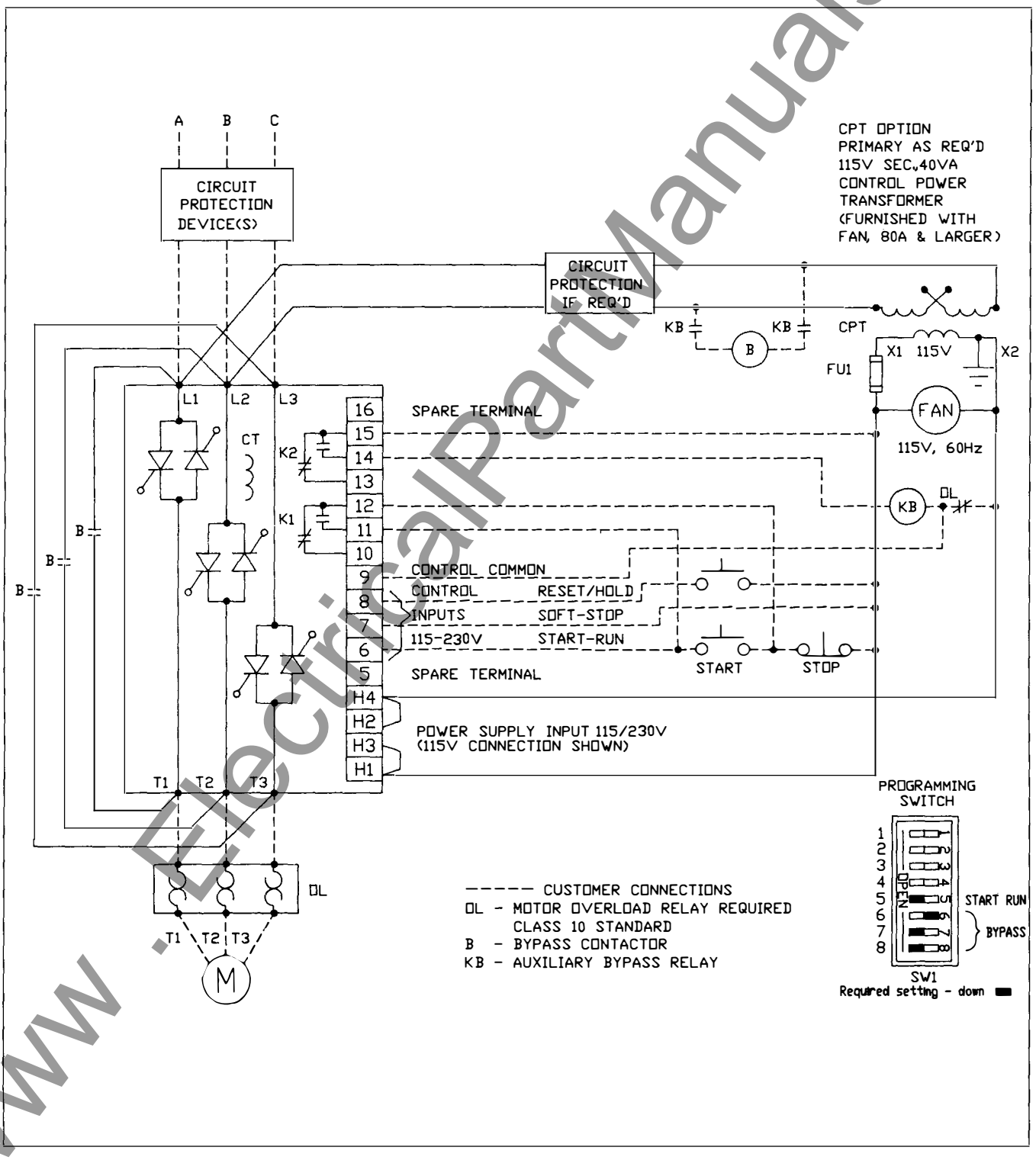
Hand-Off-Auto



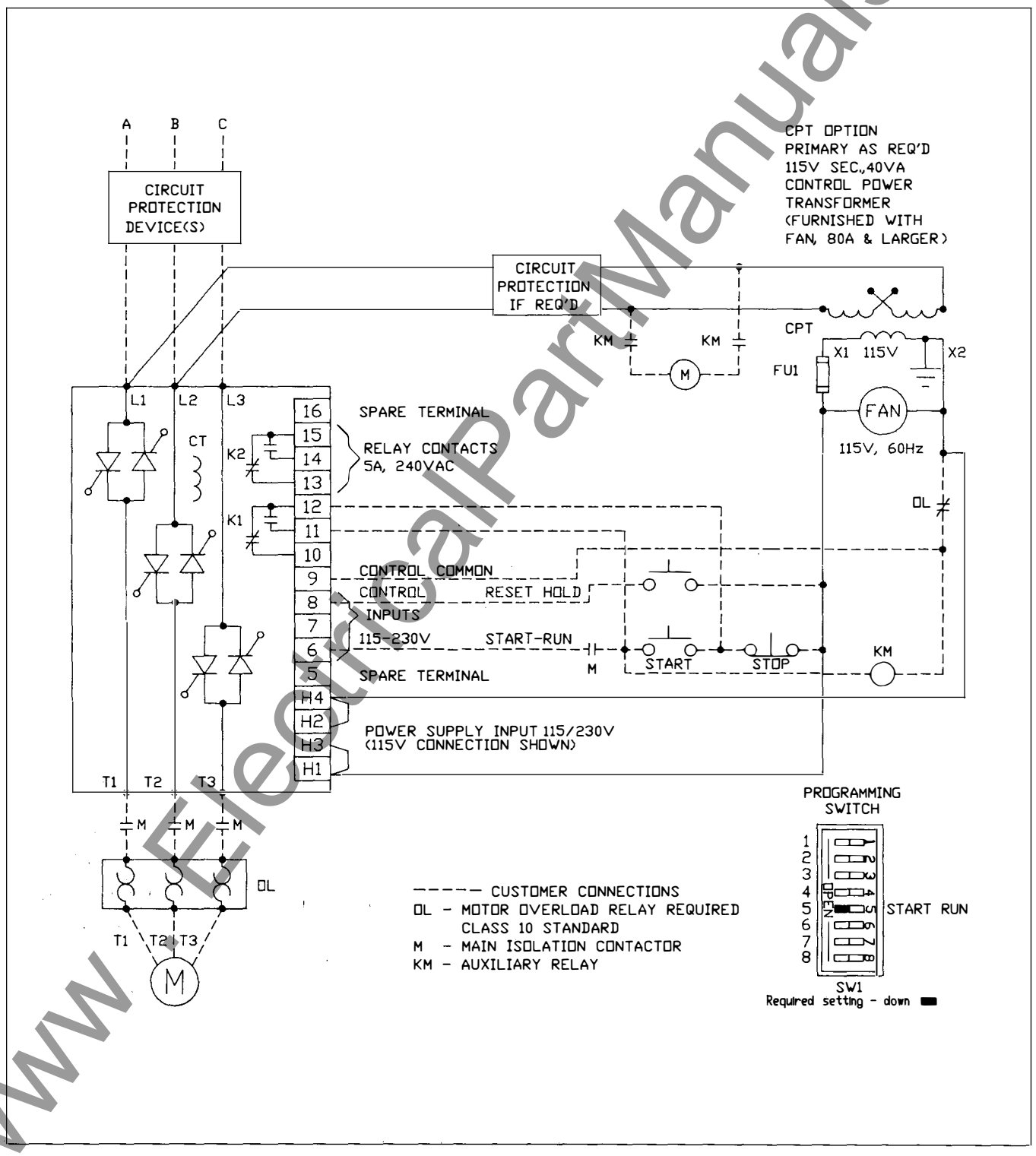
Shunt Trip



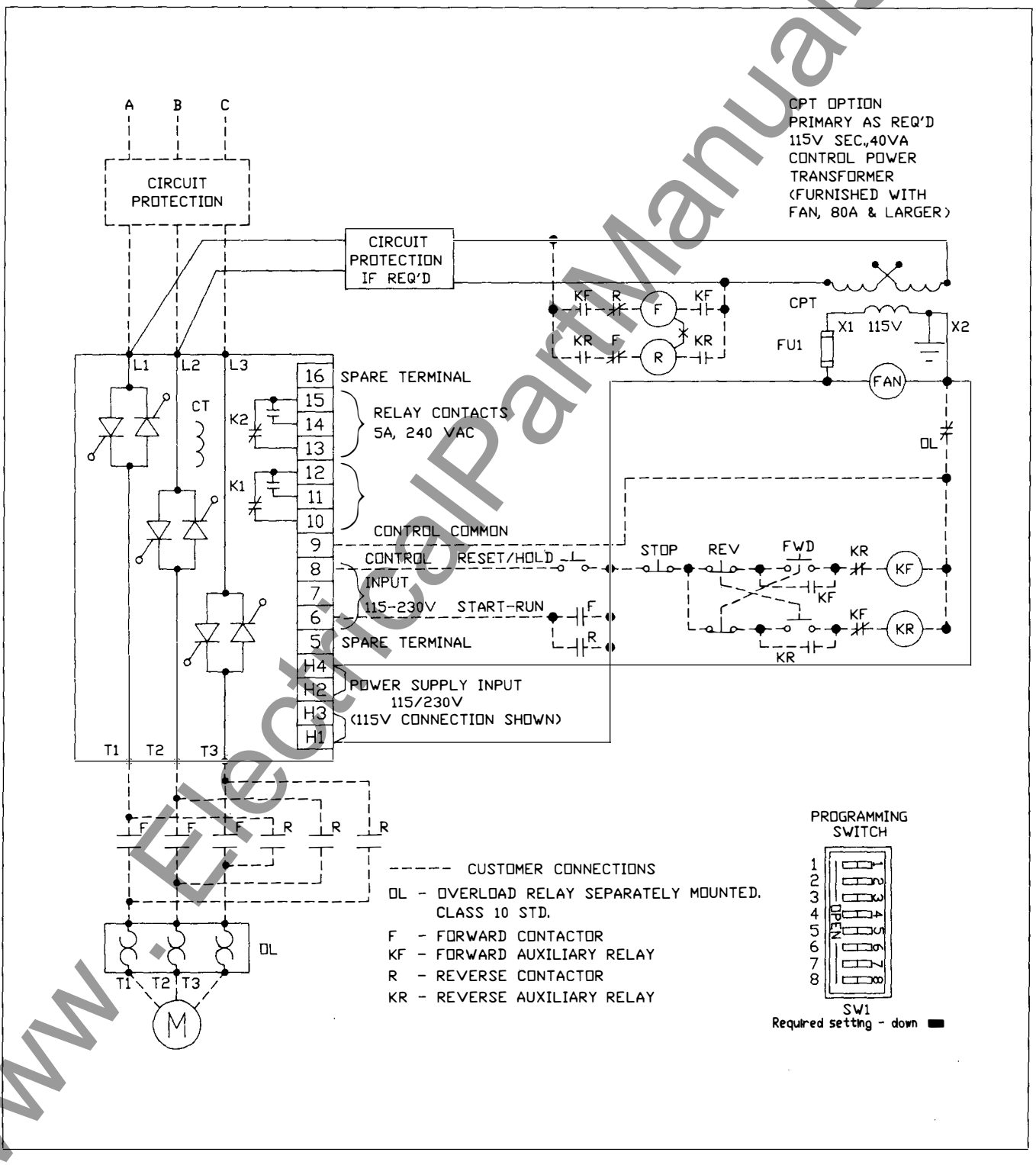
Start-Stop With By-Pass



Start-Stop With Load Isolation



Start-Stop With Load Reversing



1. Select Starting Mode:

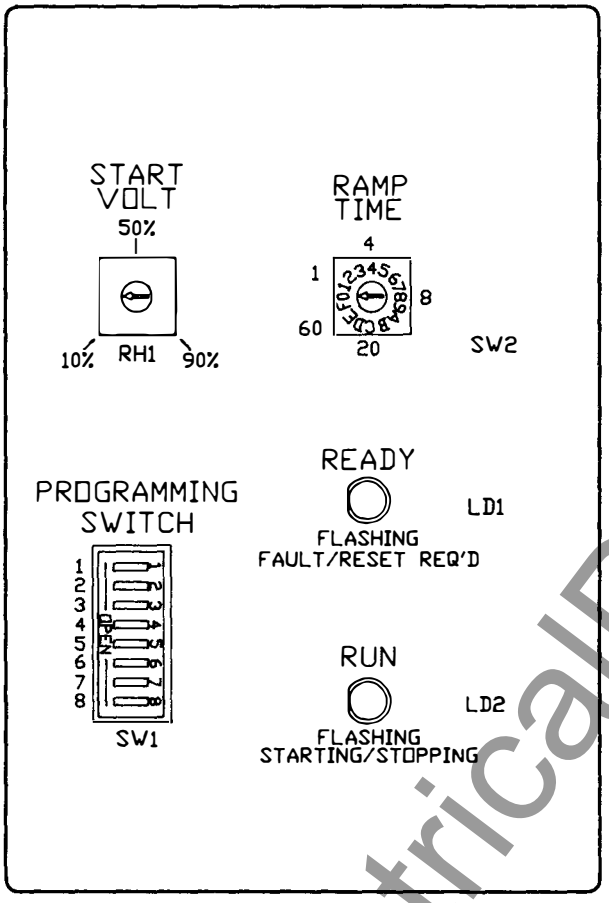


Figure 14. Controller Set-Up

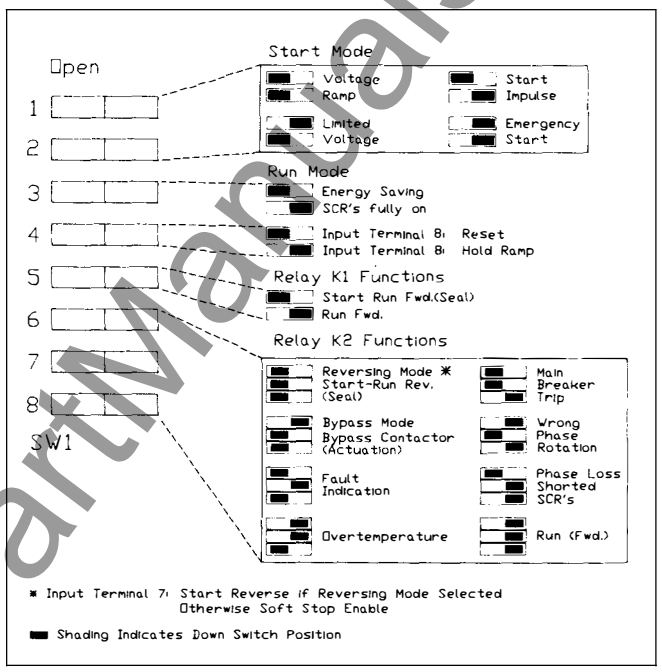


Figure 15. Programming Switch Settings

Use SW1 Programming Switch Section 1 & 2

A. Voltage Ramp: (SW1, sections 1 & 2 open)

A linear increase in voltage occurs from initial voltage value to 100% in the starting time.

B. Limited Voltage: (SW1, section 1 closed, 2 open)

A fixed voltage is maintained at the initial value until end of start time, when full voltage is applied.

C. Start Impulse: (SW1, section 1 open, 2 closed)

A voltage impulse is delivered at initial voltage setting value for a short time to break away high static friction loads; voltage ramp then continues from minimum to full voltage in set starting time.

D. Emergency Start: (SW1 section 1 & 2 closed)

The controller will start with one shorted SCR in the selected ramp time.

2. Set Start Voltage:

Set RH1 to desired initial starting voltage.

Adjustment potentiometer range 10-90% line voltage. Typical setting is 35-65% depending upon application.

3. Set Start Time:

   Start time is the time at which the voltage reaches 100% value. SW2 start time setting range is 1-60 seconds. Time dial settings are 1-9 and 6 letter positions.

   Typical start time setting for light loads is 6-10 seconds. Time is application dependent, affected by load torque, motor voltage, and total inertia. Positions 1-9 are in 1 second increments, the additional 6 positions represent larger increments to a maximum letter of 60 seconds: A, B, C, D, E, & F represent 10, 15, 20, 30, 40, & 60 seconds respectively.

4. Select Run Mode:

   Use SW1 programming switch section 3.

   A. Full Voltage: (SW1 section 3 closed)

      SCR's are fully on in continuous operation. The motor will receive full voltage during run regardless of load.

   B. Energy Saving: (SW1 section, 3 open)

      Energy savings and power factor improvement for lightly loaded motors is achieved by phase angle sensing and automatic phase controlled motor voltage reduction.

Initial Energization

Initial Energization must be done by qualified personnel.

1. Verify feeder source is de-energized.

2. Check the wiring and absence of unintentional grounds. Recheck source voltage and control voltage.

3. Temporarily remove run signal connections; open circuit at terminals 6 and 7. Remove CPT secondary fuse FU1, if provided.

4. Turn on power source disconnect, open doors, covers, and operate defeater mechanisms as needed to allow temporary access to the energized 3RW2 equipment.

5. Measure input AC voltages L1 to L2, L2 to L3, and L3 to L1. Voltages should be near rated (within +10, -15%) and balanced (within 1%) for proper motor operation.

   NOTE: Any input phase rotation is o.k., 3RW2 will automatically configure for existing rotation unless line side reversing is selected. If line side reversing is selected L1, L2, L3 rotation is required for forward motor rotation.

6. Measure individual input AC voltages L1, L2, and L3 to ground. On most systems voltage will be approx. 57% of line to line voltage and nearly equal. An unbalanced line may indicate an undesired ground in the motor or 3RW2 controller.

7. If a control power transformer is furnished, measure its secondary AC voltage. Nominal is 115V; typical is 130 V AC.

8. Measure voltage across each pole of the 3RW2 power unit. L1 to T1, L2 to T2, L3 to T3. These voltages should be nearly equal and approx. 57% of input line to line voltage. Low voltage, zero voltage, or unequal voltages indicate the load circuit to the motor is open or improperly grounded, or an SCR is shorted. If so, disconnect the power to the 3RW2, check the load circuit, correct connections & close any load circuit switching device(s). Re-energize and recheck L1 to T1, L2 to T2, L3 to T3 voltage.

9. Disconnect the power to the 3RW2, install the CPT secondary fuse FU1. Re-energize input, red and green LED's should both illuminate (initialization). After approx. 2 seconds, the red LED goes off, the green "ready" light stays on.

10. De-energize incoming and control power. Unit is now ready. Reconnect actuating signal wires to terminals 6 & 7. Verify proper settings: Start mode, run mode, relay function selections.

11. Energize power and control input, initiate start by actuating pilot device(s). Verify correct operation and desired starting performance. Optimize settings as needed. Verify proper motor rotation, reverse rotation if needed by interchanging motor leads. A flashing green light indicates a fault. The fault can be Reset by 120 Volt pushbutton input to terminal 8 or by switching control power off and on. Refer to troubleshooting section for fault diagnosis and correction.

Status Indicators

1. Basic Input Board LED

A. Initialization	Both green & red LED flash on momentarily upon applying initial power.
B. Power Available	Green LED on steady.
C. Starting/Stopping	Red LED flashing.
D. Run	Red LED on steady.
E. Fault	Green LED flashing. Reset required.

2. Main Board LED

F. Relay K1	Red LD1 on main board illuminated when relay K1 energized.
G. Relay K2	Red LD2 on main board illuminated when relay K2 energized.

Troubleshooting

Most faults are indicated by a flashing green LED. A fault must be reset with a “reset” button or the control power must be removed and re-applied. To determine the cause of the fault, follow the chart below.

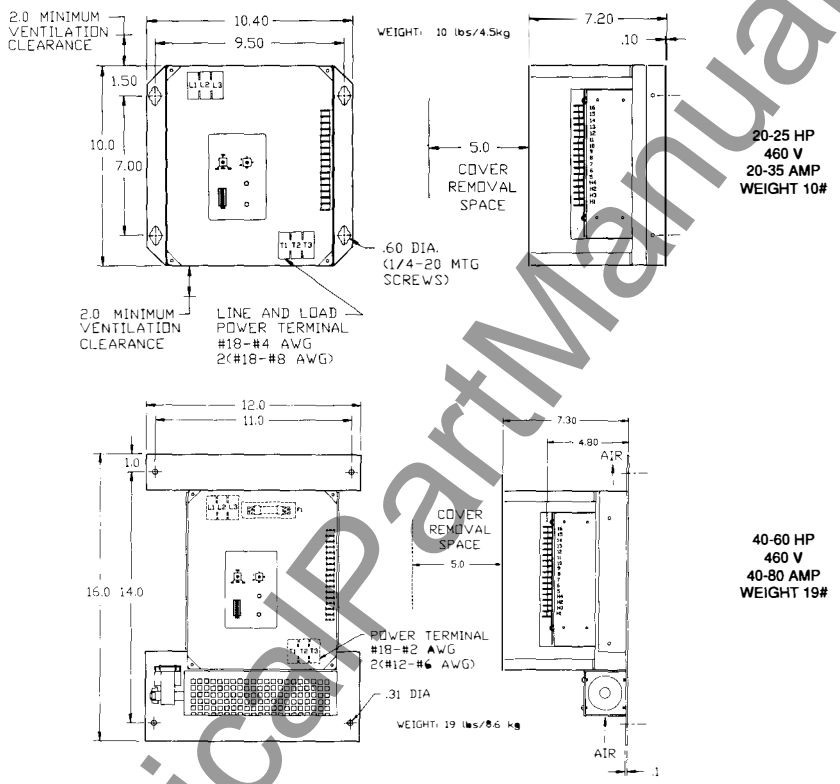
Faults	Indication	Probable Cause	Remedy
No Control Power	No LED’s on	CP Fuse(s) blown, main switch open	Install or replace fuses, turn switch on
No Main Power or Improper Main Power	Flashing green LED 5 seconds after start is actuated	Main disconnect is not closed	Close main disconnect and check voltage
Over-Temperature	Flashing green light, likely to occur while running	Fan stopped, air path blocked, starter overload	Correct cooling problem, wait for heatsink to cool down
Missing Phase	Flashing green LED	Blown fuse, line switching device faulty	Check and correct input fault
Shorted SCR (One Phase)	Flashing green LED	Overvoltage, ground fault	Determine cause. Can restart only if emergency start is selected with shorted SCR. Replace SCR
Shorted SCR (Two Phases)	Flashing green LED when stop is actuated. Shunt trip is actuated if used. No Indication while running	Overvoltage, ground fault	Interrupt power, replace SCR's. Determine and correct cause
Load Circuit Open on Start	Flashing green LED	Motor disconnect open	Close motor switching device, reset and restart
Load Short Circuit on Start	Flashing green LED immediately on start	Improper wiring, faulted motor, grounded cables	Turn main power off, locate fault and correct
Gating Fault	Flashing green LED. Most likely to occur on start or while running in energy savings	SCR line/load gating circuit connections faulty, SCR open/ shorted gate, motor grossly under sized	Replace SCR, check connections, match motor to power unit
Over/Under Voltage	Flashing green light	Control power out of range	Return control power to nominal values and re-start

Troubleshooting

Faults	Indication	Probable Cause	Remedy
Open/Shorted Thermistor	Flashing green light	Thermistor connection, defective thermistor	Measure resistance (terminal TE1 & TE2) nominal at room temp. is 10,000 Ohms
Over-Load or Over-Current	Flashing green LED, most likely to occur during start	Excessive load, air flow blockage, dampers not closed on fan, etc., possibly defective motor	Remove excess load, wait for the SCR's to cool down, press reset and re-start
Incorrect Phase Rotation	Flashing green LED immediately after pushing "Start" (if wrong phase rotation is selected)	Incoming phase rotation incorrect	Determine if phase rotation has changed up-stream of the controller since initial installation
No Main Power or Unsuitable Power	Flashing green LED a few seconds after "Start" is pushed and 0 current to the load	Line breaker not closed with control power applied	Close breaker, disconnect, check voltage balance (see set-up)
CPU Faults	Both LEDs on longer than five seconds at power up	Defective CPU, cables, and/or Main Board. Severe condensation on the circuit boards	Immediately turn off control power, check interboard cables. Exchange with spare board set or call factory representative

Tip: To determine the source of over-temperature, phase-loss/shorted SCR, phase rotation faults disconnect relay K2 common (terminal 15) and use SW1 sections 6 through 8 to select specific faults. If the relay K2 indicator lights after re-set, then the selected fault is confirmed.

Solid State Reduced Voltage Starters 3RW2



DIM.	90-130 AMP 75-100 HP 480 VAC	140-250 AMP 125-200 HP 480 VAC	275-420 AMP 250-350 HP 480VAC
A	5.50	4.25	6.5
B	6.38	5.13	6.5
C	19.75	19.75	24.5
D	5.38	5.38	5.0
E	5.38	5.38	9.5
A2	—	—	5.0
B2	—	—	5.0
WEIGHT	55#	60#	85#

Catalog Number

3RW2 - H 1 G T - 2HN - . . .

Type

Horsepower	**Enclosure**	**Voltage 50/60 Hz**	**Overload**	**Disconnect**	**Additional Options**
A 5					
B 7.5	0 - Open	G - 208V	5 - No Overload	Non-Fusible:	ISC-isolation contactor
C 10				30N- 30A Switch	
D 15	1 - NEMA1	2 - 230V	letter designate	60N- 60A Switch	BPC-by-pass contactor
E 20			OLR sized for	1HN-100A Switch	
F 25	2 - NEMA12	4 - 460V	current	2FN-250A Switch	REV-reversing contactor
G 30				4HN-400A Switch	
H 40		5 - 575V		6HN-600A Switch	Other options refer to control catalog reduced voltage starters
J 50			Letter Code Type		
K 60			UNPQRST 3UA5200	Fusible:	
L 75			BCDFWY 3UA5800	Switch Fuse	
M 100				32R- 30A 250V	
N 125				36R- 30A 600V	
P 150				62R- 60A 250V	
S 200				66R- 60A 600V	
U 250				12R-100A 250V	
V 300				16R-100A 600V	
W 350				22R-250A 250V	
X 400				26R-250A 600V	
				42R-400A 250V	
				46R-400A 600V	
				62R-600A 250V	
				66R-600A 600V	
				ETI:	
				Circuit Breaker	
				25M - 25A	
				50M - 50A	
				1HM - 100A	
				1FM - 150A	
				2FM - 250A	
				4HM - 400A	
				6HM - 600A	

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