



INDUSTRIES
INC

PPS SY6

Solid State Controller w/Bypass

Instruction Manual

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PPS SY6 Model Numbers

MODEL PPS SY6	MAX AMPS	CONT. MAX HP		
		230V	460V	575V
SY680	120	30	75	75
SY6125	187.5	40	150	150



WARNING



Equipment is at possibly lethal AC line voltage when AC power is connected. Pressing "STOP" pushbutton does not remove AC line voltage. All phases must be disconnected before it is safe to touch motor terminals or control equipment parts.

Never connect power capacitors on the load side of a solid state starter. Refer to factory wiring diagrams or consult factory before connecting power factor capacitors in circuit. Capacitors connected on the load side of the solid state starter can cause severe damage to the SCRs.

1. DESCRIPTION

1.1. OVERVIEW

RAM's PPS SY6 Solid State Reduced Voltage Starters contain 6 SCRs (Solid State Rectifiers), electronically controlling the current supplied to an AC induction motor. The SCRs are connected in 3 back to back pairs, phase controlled over 180 degrees of each cycle of power line frequency by a phase locked loop digital firing circuit. This unique circuit continuously synchronizes to any frequency variations and requires no customer adjustment.

The PPS SY6 starters can be programmed to provide a gradual build up of torque from zero to almost full motor locked rotor torque, since a motor's torque varies as the square of the applied current. This method provides a gentle, jolt free method of starting for any AC induction motor. In addition, they can be programmed to limit peak starting currents to a constant low value, and so prevent excessive voltage drops during motor starting.

1.2 STANDARD FEATURES

Universal Source Matching: The PPS SY6 starter automatically adjusts itself to any input voltage and frequency applied between 200V to 600V and 45HZ to 65HZ, irrespective of phase rotation.

Closed Loop Starting: The PPS SY6 starts a motor in a continuous controlled current mode, eliminating any motor jerking or hunting that could be experienced in other forms of reduced voltage starting.

Automatic Bypass: The PPS SY6 starters are complete with a Horsepower Rated Bypass Contactor which is engaged automatically after startup. This reduces power losses and heat build up in the enclosure and can also serve as an emergency starting device.

Electronic Motor Overload Protection: The PPS SY6 starters are provided as standard with a RAM KL-1 Electronic Motor Protective Module. This microprocessor based device provides excellent motor overload protection and also displays numerous system alarm conditions such as: Locked Rotor, Stall Condition, Jam Detection, Short Circuit, Phase Loss, Phase Unbalance, Phase Reversal, and Thermal Faults. See separate copy of "Operator's Guide and Instructional Manual" for a full explanation of the RAM KL-1 Motor Protector.

Multiple LED Diagnostics: The following LEDs are provided on the Control Card in the SY6 Starter. "LED ON" means a healthy condition.

1. **Control Voltage ON - (On when 120VAC is applied)**
2. **Starter ON - (On when starter is activated)**
3. **Line Present - (On when line power and 120VAC control power is applied)**

Main Circuit Breaker w/Shunt Trip: The PPS SY6 starter is complete with a properly sized Main Circuit Breaker with a 120V Shunt Trip. The Circuit Breaker offers disconnect and short circuit protection.

Dual Starting Mode: Dual starting modes provide optimum performance to match the PPS SY6 to the motor load characteristics.

- a) **Constant Current Mode:** In this mode, the current during starting is maintained at a factory preset value of 400% of FLA (Full Load Motor Amps). This mode is field adjustable from 200-400%. At full speed, the current is determined by the motor load.
- b) **Step Ramp (Current Ramp) Mode:** In this mode, the starter provides an initial current (Factory at 400%), field adjustable from 200% - 400% of FLA (Full Load Motor Amps). The current is then ramped from its initial current setting to 600% over a time adjustable period between 1 second to 30 seconds. (Factory set at 8 seconds). At full speed, current is determined by the motor load.

User Friendly Start-up: Quick and easy start-up is accomplished with no special tools or electrical skills.

2. SPECIFICATIONS

2.1 ELECTRICAL

2.1.1 POWER SUPPLY REQUIRED:

3 Phase, 200V to 600V, 45HZ to 65HZ.

2.1.2 CONTROL POWER:

Single Phase, 115V, 50/60 HZ control power from fused secondary of Control Transformer supplied in PPS SY6 starter. 230V control voltage and extra capacity Control Transformers available as options. Consult Factory for optional ratings.

2.1.3 OPERATOR DEVICES: (Supplied by Customer)

PPS SY6 starter is set up to accept starting and run contacts from customer supplied devices such as:

- Start/Stop pushbuttons for 3 wire control
- Run Contact or On/Off Selector Switch for 2 wire control
- Jog Pushbutton
- Fault Interlock or Motor Overtemperature Switch

See RAM wiring diagram for starting details.

2.1.4 OUTPUT CONTACTS: PPS SY6 starter is complete with the following Contacts.

- Run Contact - 1 Normally Open Contact for latching of start circuit.
- Run Contact - 1 N.O./1 N.C. contact

See RAM wiring diagram for contact details.

2.1.5 RATINGS:

Table 1
RAM PPS SY6 SOLID STATE STARTER

MODEL	MAX AMPS	CONT. MAX HP		
		230V	460V	575V
SY680	120	30	75	75
SY6125	187.5	40	150	150

OVERLOAD CAPACITY - 350% FOR 30 SECONDS

2.1.6. PROTECTION PROVIDED IN STARTER:

- Short Circuit Protection:

A Thermal Magnetic Circuit Breaker with a 120VAC Shunt Trip is supplied as standard for short-circuit protection and disconnecting means.

- Electronic Motor Overload Protection:

The RAM KI-1 Electronic Motor Protector is supplied as standard to provide superior motor protection and to display and monitor key information on motor operating conditions and faults.

- Single Phase Protection: (Active in 3 Phase mode)

The PPS SY6 starter will not operate if single phase is detected before starting. If motor is running under full load when a single phase fault occurs, the SY6 starter will trip.

- Surge Voltage Transient Protection:

High energy metal oxide varistors protect each SCR against damage caused by over voltage.

- Heatsink Overtemperature:

Thermal switches are provided to protect the heatsink assembly from overheating.

3. RECEIVING AND INSTALLATION

3.1 INSTALLATION

The enclosure containing the PPS SY6 starter must be installed in an area where the following conditions exist:

- Ambient Temperature does not exceed 40 Degrees C (104 Degrees F).
- Ambient Temperature is not less than 10 Degrees C (50 Degrees F).
- Altitude above sea level is 6000 ft (2000 meters) or less.
- Ambient air is reasonably clean, dry, and free of flammable or combustible vapors, steam, or corrosive gases.

The PPS SY6 enclosure must be installed away from any heat source and a minimum clearance of 1 ft. (30 cm) is required around the air inlet and outlet louvers on ventilated units. The PPS SY6 starter is designed for 40 Degrees C (104 Degrees F) ambient with a 15 Degree C rise inside the enclosure as maximum.

3.2 DERATING FACTOR:

Warning: When a PPS SY6 starter enclosure is mounted in an environment not in accordance with Paragraph 3.1 as described above, it must be derated as follows:

- Derate starter size 1.5% per Degrees C above 40 Degree C Ambient Temperature or .75% per Degree F above 104 Degree F Ambient Temperature.
- Derate starter size 1% for every 100m above 2000m or every 300 ft. above 6000 ft. elevation.

3.3 WIRING:

The PPS SY6 starter is to be wired in accordance with the National Electrical Code and other Electrical Codes in customer's area.

4. START UP INSTRUCTIONS

CAUTION!

Equipment is at possibly lethal AC line voltage when AC power is connected. Pressing "STOP" pushbutton does not remove AC line voltage. All Phases must be disconnected by shutting down main power feed to this unit before it is safe to touch motor terminals or control equipment parts.

4.1 INSPECTION

Ensure that the starter has been installed according to the above guidelines. Ensure that the unit has been wired according to the schematics and all electrical codes. Check that all connections are tight. Check that the motor shaft rotates freely.

4.2 PRESTART ADJUSTMENTS - CURRENT LIMIT (STANDARD SETTING)

Each RAM solid state starter is preset at the factory to operate in the “Current Limit” (Constant Current) mode. In this operating mode, the starting torque of this device has been preset to that of an autotransformer type starter with taps set at 65%. The “Current Limit” mode is recommended for light and moderate inertial type loads. This method limits the maximum initial current to 400% and sets the maximum % of LR Torque to approximately 42%. **See Chart A below** for Maximum % Locked Rotor Torque developed in Current Limit mode and its capability to start RAM Standard High Efficient motors. **See Chart B below** for Maximum % locked Rotor Torque developed in Current Limit mode and its capability to start RAM “Premium Efficient” motors. At rated horsepower, the Current Limit mode is capable of smoothly starting most loads without making any adjustments.

CHART A

PPS SY6 STARTING DUTY CURRENT LIMIT (CONSTANT CURRENT) MODE - 400% CURRENT LIMIT FOR RAM STANDARD EFFICIENT MOTORS						
HP RATING 460V	CATALOG NUMBER	RAM STANDARD EFFICIENT FLA	RAM STANDARD EFFICIENT LRA	ROTARY SWITCH SETTING	ACCEL. AMPS	MAX % LOCKED ROTOR TORQUE
50	SY680	63	317	2	228	52%
60	SY680	73	390	4	300	59%
75	SY680	88	530	7	408	59%
100	SY6125	115	722	5	510	50%
125	SY6125	147	908	7	630	48%
150	SY6125	174	1035	8	690	44%

CHART B

PPS SY6 STARTING DUTY CURRENT LIMIT (CONSTANT CURRENT) MODE - 400% CURRENT LIMIT FOR RAM PREMIUM EFFICIENT MOTORS						
HP RATING 460V	CATALOG NUMBER	RAM STANDARD EFFICIENT FLA	RAM STANDARD EFFICIENT LRA	ROTARY SWITCH SETTING	ACCEL. AMPS	MAX % LOCKED ROTOR TORQUE
50	SY680	59	363	3	264	53%
60	SY680	70	435	5	336	60%
75	SY680	87	543	7	408	56%
100	SY6125	115	725	5	510	49%
125	SY6125	142	908	7	630	48%
150	SY6125	166	1085	9	750	48%

4.2 PRESTART ADJUSTMENTS - STEP RAMP (OPTIONAL SETTING)

On heavy inertia and friction type loads, an alternate method of operating this starter at its rated horsepower can be accomplished by making one switch movement causing controller to operate in the “Step Ramp” (Current Ramp) mode (see Section 4.2.2) and, in some cases, as noted in Chart C & D, by adjusting the rotary switch setting. In this operating mode, the initial current is set at 400% and then ramped to a maximum of 600%. **See Chart C below** for Maximum % Locked Rotor Torque developed in Step Ramp mode and its capability to start RAM Standard High Efficient motors. **See Chart D below** for Maximum % Locked Rotor Torque developed in Step Ramp mode and its capability to start RAM “Premium Efficient” motors.

4.2.1. PHASE SELECT

CHART C

PPS SY6 STARTING DUTY - SET FOR LIGHT DUTY STEP RAMP (CURRENT RAMP) MODE - 600% CURRENT RAMP FOR RAM STANDARD EFFICIENT MOTORS						
HP RATING 460V	CATALOG NUMBER	RAM STANDARD EFFICIENT FLA	RAM STANDARD EFFICIENT LRA	ROTARY SWITCH SETTING	ACCEL. AMPS	MAX % LOCKED ROTOR TORQUE
50	SY680	63	317	2	342	116%
60	SY680	73	390	3	396	103%
75	SY680	88	530	4	504	90%
100	SY6125	115	722	4	675	87%
125	SY6125	147	908	5	855	89%
150	SY6125	174	1035	8	1035	100%

CHART D

PPS SY6 STARTING DUTY - SET FOR LIGHT DUTY STEP RAMP (CURRENT RAMP) MODE - 600% CURRENT RAMP FOR RAM PREMIUM EFFICIENT MOTORS						
HP RATING 460V	CATALOG NUMBER	RAM STANDARD EFFICIENT FLA	RAM STANDARD EFFICIENT LRA	ROTARY SWITCH SETTING	ACCEL. AMPS	MAX % LOCKED ROTOR TORQUE
50	SY680	59	363	4	342	89%
60	SY680	70	435	6	396	83%
75	SY680	87	543	8	504	86%
100	SY6125	115	725	6	675	87%
125	SY6125	142	908	8	855	89%
150	SY6125	166	1085	9	1035	91%

Starter is factory set at 3 Phase (switch down). Consult factory for single phase operation.

4.2.2 STARTING MODE

Starter is factory set for "Current Limit." (Constant Current - switch up). If more starting torque is required, the starting mode can be changed by putting switch in "down" position which changes the starting mode from "Current Limit" to "Step Ramp - Current Ramp".

4.2.3 MOTOR FLA

Motor Full Load Amps have been factory set per attached Starter Data sheet in the Rotary Switch on drawings or tables listed above.

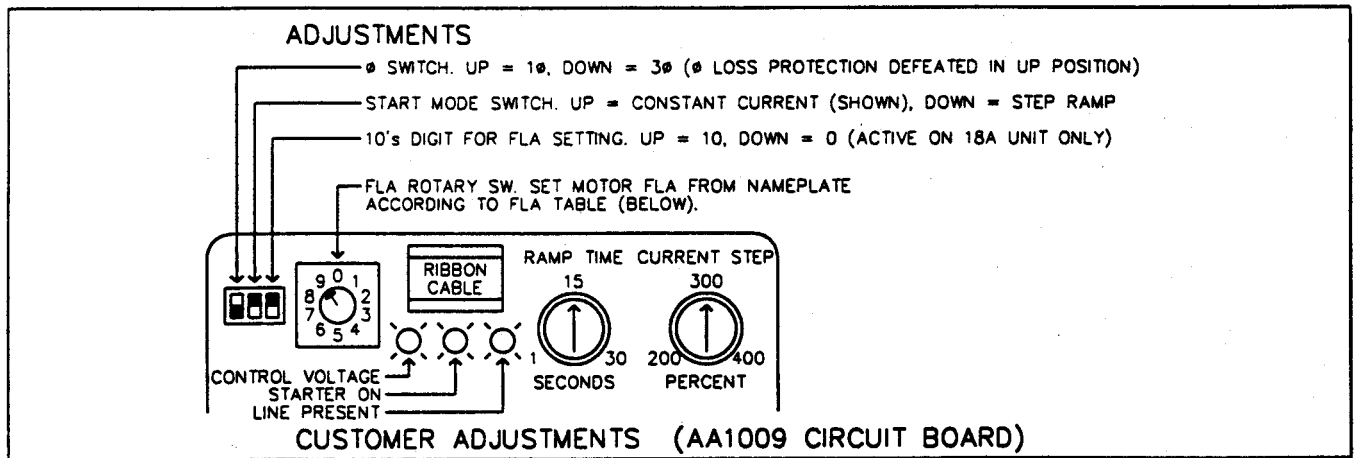
4.2.4 CURRENT STEP

Factory set for 400% initial current. This switch is adjustable from 200-400% for smooth acceleration.

4.2.5 RAMP TIME

Factory set for 8 seconds. The ramp time is adjustable from 3-30 seconds.

4.3 START-UP



SY680 FLA PER ROTARY SWITCH SETTING

SY680	2	3	4	5	6	7
SETTING	38	44	50	56	62	68
FLA	57	66	75	84	93	102

SY6125 FLA PER ROTARY SWITCH SETTING

SY6125	2	3	4	5	6	7
SETTING	55	65	75	85	95	105
FLA	82.5	97.5	112.5	127.5	142.5	157.5

When starting the PPS SY6 unit, it is recommended that a clamp-on AC Ammeter be used to continuously monitor the motor current during the start-up procedure. A Voltmeter placed across the starter output is also desirable.

4.3.1 POWER UP

Once the prestart adjustments have been checked and correctly set up, it is ready for power up.

Check that all personnel are clear of the starter and motor, then apply power.

After power is applied, all LEDs in the AA1009 card must be "ON", except "STARTER ON", (see paragraph 1.2 LED Diagnostics). If they are not, refer to Paragraph 5 - Troubleshooting.

4.3.2 STARTING

To start the unit, energize the "Compressor Start" relay CR-1 and determine if the motor accelerates smoothly to full speed. If the motor does not accelerate, confirm all adjustments and make sure the compressor is starting unloaded.

CAUTION: *Do not allow the motor to stall. If the motor fails to accelerate, shut down power to the "start" contactor immediately.*

For remotely located motor, it will be necessary to have another person stand by the motor to communicate motor rotation during initial Start Up.

With the clamp-on Ammeter, check that all three line currents are balanced.

4.3.3 RE-ADJUSTMENT

After the motor has been started, fine adjustment might be required. It is a good practice to set the starter to reach full speed in the minimum time permissible without causing any appreciable power dip or excessive mechanical stress. The longest acceleration time is not necessarily the best setting.

5. TROUBLESHOOTING

CAUTION!

Equipment is at possible lethal AC line voltage when AC power is connected. Pressing "STOP" pushbutton does not remove AC line voltage. All phases must be disconnected by shutting down main power feed to this unit before it is safe to touch motor terminals or control equipment parts.

5.1 DIAGNOSTICS

The PPS SY6 has been designed with LED indication for quick diagnostics. The controller card AA1009 contains the LEDs listed hereafter. They are visible from the front of the controller. In all cases, LED "ON" means a healthy condition.

5.1.1. CONTROL POWER LED

If the Control Power LED does not light, check terminals 1 and 2 on the AA1009 (Main Control Card) for 120VAC control power. If 120VAC is present, check terminals 2 and 3 on the board. If the same voltage is not present, the fuse (F1) on this control card is blown or the control card is defective and should be replaced.

5.1.2. LINE PRESENT LED

If the Line Present LED does not light, check the line voltages at terminals L1, L2, and L3. If correct voltage is present, check the SCR gate leads to insure proper connection and try again. If the LED still fails to light, replace the AA1009 card.

5.1.3. UNIT WILL NOT START

If both the Control Power and Line Present LEDs are illuminated and the control unit will not start, use a wire jumper to momentarily connect terminals 3 and 5 on the AA1009 card. If the unit starts, there is an open circuit in the start circuit or fault interlock that must be corrected. If the unit does not start, the AA1009 card should be replaced.

5.1.4. UNIT STARTS THEN SHUTS DOWN

If the unit starts, but then shuts down after a short period of running, the bypass contactor may not be operating (causing the unit to trip on overtemperature). Start the unit up again (after allowing about 15 minutes for cool down), and observe the bypass contactor. It should close within a very short period of time. Once the contactor closes, check the AC voltage L1-T1, L2-T2, and L3-T3. In each case, the voltage should be less than 0.5 VAC. If this voltage is higher, the bypass contactor may be defective and should be replaced.



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