ADD-A-PHASE®

USER MANUAL

The Ronk ADD-A-PHASE is the finest static phase converter available. The design allows adjustment to provide balanced three-phase power at any motor load point up to the converter's rating. The high operating efficiency and low standby losses make the ADD-A-PHASE ideal in most automated applications.

Balanced three-phase power is dependent on both the converter and the motor. When no current is drawn by the load (motor off), voltages will not be balanced. When the motor is energized, the third phase current is supplied by capacitors at an appropriate phase angle. When the motor reaches full speed, a portion of the capacitance is automatically switched out of the circuit, and running current is provided by the transformer and oil capacitors. Changing capacitance will change the magnitude of manufactured phase current. Changing transformer tap will change the phase angle. The ADD-A-PHASE is the only static converter which provides these two degrees of freedom to balance currents.

The converter is specified by horsepower and type designation. The horsepower rating indicates the maximum total load which may be operated by the converter. The number and letters of the type are coded as follows:

Example: 10 HP 2 SUB

2	– 240V in, 240V out	S	– standard converter
3	– 240/480V in, 480V out	SUB	– for deep well submersible pump motors
4	– 480V in, 480V out	SAC	– for refrigeration & air conditioning
5	– 240/575V in, 575V out	K	– DUO ADD-A-PHASE
6	– 575V in, 575V out	L	– TRIO ADD-A-PHASE

Suffixes may be added to this designation to indicate factory modifications.
(i.e. -8 → 208 volt output)

INSTALLATION

The ADD-A-PHASE should be installed by a competent electrician in accordance with good wiring practice and applicable electrical codes. The converter should be mounted in an upright position, preferably near the magnetic starter for the motor, and fastened securely to a firm support. Large horsepower units are supplied in a floor mount enclosure, and should be placed on a concrete pad or floor. Standard enclosures are designed for outdoor mounting, but protection from weather and direct sunlight can prolong the life of the unit. The wiring diagram and installation instructions provided with the converter must be followed to provide satisfactory operation.

The manufactured phase on a Ronk converter is identified as "A". Motor control circuits and single-phase loads must not be connected to this phase. When installing DUO ADD-A-PHASE or special multiple models, the "A" lead for each motor must be kept isolated from other leads.

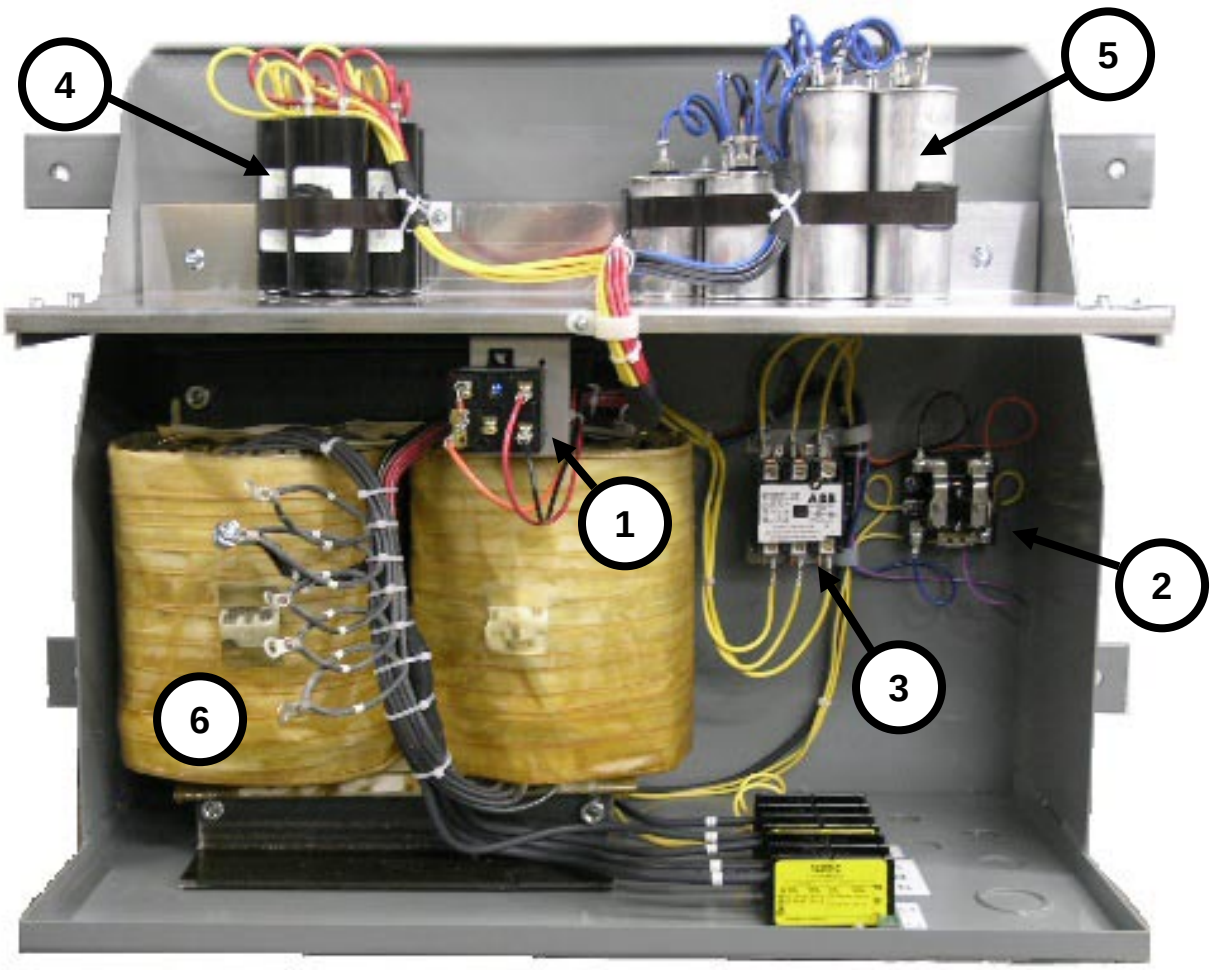
The two additional control leads (for each motor) used with standard converters must be connected to the load side of the magnetic starter and phased as shown on the wiring diagram. Some applications involve additional contactors controlling the motor -- the control leads must be connected to the load side of the last controlling device. In reversing applications, the reversing contactor should switch the two phases to which the control leads are connected.

The procedures on the connecting instructions supplied with the converter should be followed for initial checkout and balancing. A motor smaller than the converter's horsepower rating may be operated, but the converter should be modified by disconnecting a proportional amount of starting and running capacitors. Consult our Service Dept. for assistance. Loads larger than the converter's rating should not be operated.

CONVERTER OPERATION

In normal applications, the ADD-A-PHASE is energized continuously by the single-phase input voltage. Standby losses are very low. Since no current is present in the capacitors, no voltage or phase shift is present on the capacitors and the output voltages reflect only the voltages across the transformer windings (see Interconnection Diagram for more information).

Two relays and a normally open contactor are used to switch start capacitance. When the motor is energized, the auxiliary relay closes and the start contactor closes. Both banks of capacitors deliver starting current in the "A" phase. As the motor reaches full speed (typically 1-3 seconds), voltage feedback from the motor is sensed by the control relay, opening its contacts. This drops out, or opens, the start contactor, removing start capacitance from the power circuit. The motor continues to run with "A" phase current supplied by the run (oil) capacitors and transformer. When the motor is turned off, the auxiliary relay opens and the control relay resets.



1. CONTROL RELAY – This relay controls the duration of time that the start contactor remains energized. Its N/C contact opens when the motor reaches full speed and closes when the auxiliary relay opens. This relay may employ one or more resistors in series with the coil.

2. AUXILIARY RELAY – This relay de-energizes the starting control circuits when the motor is off. Its contacts close when the motor is energized and open when the motor is de-energized.

3. START CONTACTOR – This contactor closes to add start capacitance to provide starting current to the motor. Its contacts close when the motor is energized and open when the motor reaches full speed. The coil is controlled by the auxiliary and control relays.

4. START CAPACITORS – These capacitors provide the high currents on the "A" phase required to start an induction motor. Start capacitors are connected in parallel with red and yellow wires, and may be connected in series-parallel in high voltage converters. The wiring diagram should be consulted for proper wiring pattern.

   Electrolytic capacitors are generally employed as starting capacitors. These provide large capacitance in compact components and are suitable for intermittent use. The case of this capacitor type is normally round plastic.

   Oil capacitors are employed in special models for frequent or long duration starting duty.

5. RUN (OIL) CAPACITORS – These capacitors provide the necessary running current on the "A" phase. This current is proportional to the amount of capacitance connected -- disconnecting run capacitors will reduce "A" amperage. Run capacitors are connected in parallel with blue and black leads, and may be connected series-parallel in high voltage converters. The wiring diagram should be consulted for proper wiring pattern.

   Oil capacitors are generally supplied in sealed metal cans. All oil capacitors are UL listed, non-PCB devices, and rarely fail in normal service.

6. AUTOTRANSFORMER – The conservative design of this component provides many years of trouble-free service. Its function is to allow adjustment of "A" current to the proper phase angle, depending on the power factor of the load. Adjustment is performed by bolt connection of lead "X" to the appropriate numbered tap at the front of the transformer.

TROUBLESHOOTING

For proper converter operation, the start contactor in any ADD-A-PHASE must engage during motor acceleration and disengage when the motor reaches full speed. Proper connection of the auxiliary relay coil leads (T1 and T2 terminal block) to the load side of the motor starter is mandatory. The auxiliary relay must close and remain closed (not chatter) whenever the motor is energized and open whenever the motor is off. If the relay does not perform properly, the most likely cause is misconnection of the auxiliary relay coil leads. See the Interconnection Diagram for connecting instructions.

Operating voltage will significantly affect operation of the start circuit. If higher than normal starting voltage is encountered, the start contactor may chatter. The chatter may be eliminated by reducing the connected start capacitance. If the 1Ø voltage is higher than +10% of nominal, notify the power company. Damage to equipment may result. Low starting voltage on the single-phase line may prevent the motor from accelerating to full speed. If the 1Ø voltage drops -10% nominal during start, the motor may not be able to draw sufficient power from the single phase service to accelerate. Lights dimming and/or chattering of control circuits may be observed. This problem must be identified and corrected for proper operation.

CAPACITOR CHECKING PROCEDURES:

Before proceeding with any checks on the capacitors, make sure the single-phase power is locked off and all capacitors are adequately discharged.

- Check capacitors individually.
- At least one side of the capacitor to be checked must be disconnected from the circuit.

Capacitors are easily checked with a digital multimeter that has a capacitance setting. The symbol will look like "--|(--" and is usually located near the ohms "Ω". If you have the manual for your meter, look for "Capacitance" in the Index. Compare measured MFD (µF) with the rating stamped on the capacitor.

Capacitors can also be checked in the field with an analog ohmmeter that has X100 and X1000 scales. Follow the steps below.

1. For oil capacitor checks, select the X1000 scale on the ohmmeter.
   For start capacitors, use the X100 scale.
2. Connect the two ohmmeter leads to the two capacitor terminals.
3. Capacitor okay: Ohmmeter swings to zero "0" and slowly floats back to an infinity reading (∞) after several seconds.
4. Capacitor shorted: Ohmmeter reads "0" or very low ohm value and does not move after several seconds.
5. Capacitor open: Ohmmeter does not move, stays on infinity (∞) reading.
   Switch ohmmeter leads and observe readings, should be the same.

TROUBLESHOOTING CHART

		POSSIBLE CAUSE OF TROUBLE																				
	TYPE OF TROUBLE	Shorted "A" phase	Open "A" phase	Shorted "B" or "C" phase	Open "B" or "C" phase	Open 1Ø fuse or power lead	Low 1Ø voltage	High 1Ø voltage	Motor control circuit misconnected or open	Auxiliary relay leads misconnected or open	Control relay N.C. contacts open	Open coil on start contactor	Open coil on control relay	Open coil on auxiliary relay	Shorted run capacitor	Open run capacitor	Bad start capacitor	Insufficient start capacitance	Excess start capacitance	Motor load increased	Motor load decreased	Insufficient run capacitance	Excess run capacitance
STARTING PROBLEMS	Motor starter won't engage				●	●	●		●														
	No voltage on "A" phase	●	●												●								
	Blows fuses immediately			●																			
	No or low amps on "A" phase		●							●					●	●							
	No or low amps on "B" or "C" phase				●	●																	
	Auxiliary relay won't engage				●	●	●			●				●									
	Start contactor won't engage		●		●	●	●	●		●	●	●		●									
	Auxiliary relay chatters						●		●	●													
	Start contactor chatters						●	●	●	●						●			●				
	Start contactor won't disengage	●					●						●		●		●	●					
RUNNING PROBLEMS	"A" phase amps lower than "B" & "C"						●									●				●		●	
	"C" phase amps lower than "A" & "B"							●													●		●

INFORMATION REQUIRED WHEN ORDERING REPLACEMENT PARTS

A file is kept on each of the ADD-A-PHASE converters manufactured. Therefore, to order replacement parts always advise Ronk of the serial number, type, and model of the unit. This information is located on the nameplate that is riveted to the cover of every unit. Also, list any information that is available from the part in question or identify it from the wiring diagram. Identical parts or satisfactory replacements are always available for any ADD-A-PHASE regardless of age, though some wiring modifications may be required to install.