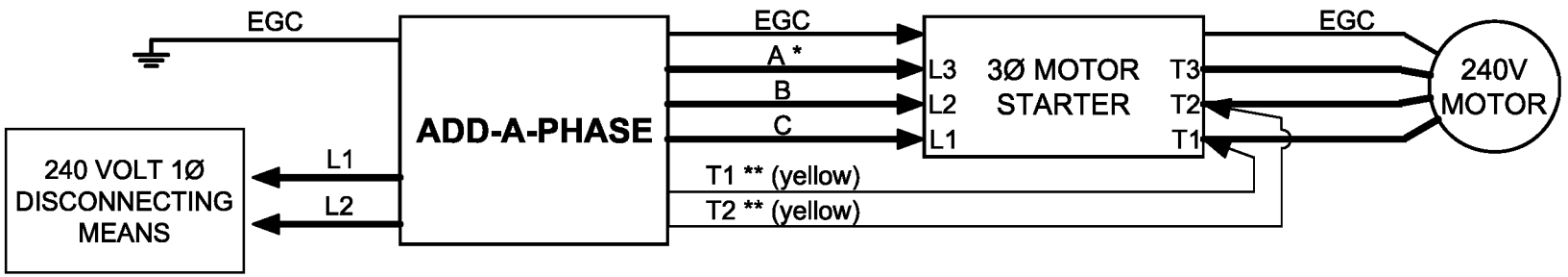
Power Leads

Control Leads

EGC = Equipment Grounding Conductor



* Do not connect control circuits or other single-phase loads to A phase (phase with highest voltage to ground) from the converter.

** VERIFY FIELD CONNECTION OF T1 AND T2 CONTROL LEADS:
Energize the circuit up to the motor starter. Do NOT turn on the starter. On the input side of the motor starter, measure the phase-to-phase and phase-to-ground voltages to verify the voltage on each pole. The T1 and T2 leads should be connected on the motor side of the starter on the two poles that measure 120 volts phase-to-ground.

CONNECTION CHECKLIST

Single-Phase to L1 & L2	✓

At 3Ø Motor Starter			
A to L3		EGC(s)	
B to L2		T2 to T2	
C to L1		T1 to T1	

VOLTAGE CHART

Location	Voltage Between	Motor Off - No Current	Motor On - Balanced 3Ø Currents
1Ø Input	L1 to L2	240 Volts +	240 Volts +
At 3Ø Magnetic Starter	L1 to L2 (C-B)	240 Volts +	240 Volts +
	L1 to L3 (C-A)	Approx. 440 Volts ++	Approx. 240 Volts
	L2 to L3 (B-A)	Approx. 200 Volts ++	Approx. 240 Volts
	L1 (C) to Ground	120 Volts	120 Volts
	L2 (B) to Ground	120 Volts	120 Volts
	L3 (A) to Ground	Approx. 320 Volts ++	Approx. 210 Volts

\+ Line voltage may vary from nominal 240 volts, other voltages will vary proportionally.

++ Motor off voltages on L1-L3 (C-A) and L2-L3 (B-A) depend on transormer tap setting. The values given are for factory TAP 4 setting. Higher tap setting will cause higher motor off voltages. **Regardless of tap setting, $V_{AB} + V_{BC} = V_{AC}$.**

WIRING

- Size A, B, and C leads according to Article 430 of NEC®.
- Size L1 and L2 for 125% MIN of the 1Ø FLA on the ADD-A-PHASE nameplate.
- Size EGC (see above) according to Article 250 of NEC.
- Size control leads - #16 MIN.
- See Article 455 of NEC for rules governing phase converter installations.

INTERCONNECTION DIAGRAM FOR ADD-A-PHASE®	TYPE 2S(...)
REVISIONS (DATE / BY)	RONK ELECTRICAL INDUSTRIES, INC. NOKOMIS, ILLINOIS
DRAWN - NCL	DRWG. NO. 2-5330-1
DATE - 2/20/08	
APP'D - PG	

ADD-A-PHASE®
240 Volt Input – 240 Volt Output (TYPE 2S)

GETTING STARTED

Before installing the ADD-A-PHASE power converter, verify that the single-phase supply voltage matches the converter rating; 240 Volts, 60 Hz. Consult the converter nameplate for input voltage and amperage requirements.

The single-phase supply should be connected to the unit through a disconnecting means (a circuit breaker or fused disconnect switch), utilizing a time-delay type breaker or fuses. The ampere rating of the disconnecting means shall not be less than 115% of the single-phase ampere rating of the ADD-A-PHASE. A three pole across-the-line starter with appropriately sized overloads is highly recommended for proper motor operation and protection. All wiring should be done by a qualified electrician in accordance with all applicable electrical codes. See Article 455 of the NEC® (and other applicable Articles) for rules governing phase converter installations.

The following connections need to be made (**see diagram on reverse side for more details**).

- Equipment ground(s):
  - All equipment must be properly grounded. See Article 250 of the NEC for proper grounding and bonding.
- Input: (L1, L2)
  - Connect incoming single-phase service to L1 and L2.
- Motor Starter: (C, B, A) and (T1, T2)
  - Connect the power leads C to L1, B to L2, and A to L3 on the **line** side of the starter.
  - Connect the control leads T1 to T1 and T2 to T2 on the **load** side of the starter (with the motor leads).

Do not connect starter coils, control transformers, or single-phase loads to "A" phase (manufactured phase) from the converter. "A" phase may only be used to power the three-phase motors.

STARTING THE MOTORS

Close the single-phase disconnecting means, applying voltage to the ADD-A-PHASE. Measure and record the voltages on the line side of the motor starter. The measured voltages should match the Voltage Chart on the reverse side of this page. Label the phase conductors "C", "B", and "A" as defined by these voltage measurements. Proper identification of the phases is necessary. You should now be ready to start the motor. Refer to the manual for component descriptions.

When starting the motor, observe the following sequence of events.

1) The motor is energized.
2) The ADD-A-PHASE auxiliary relay should energize immediately and remain closed.
3) The ADD-A-PHASE start contactor should engage.
4) The motor should accelerate to full speed within 1 to 3 seconds.
5) The start contactor will drop out and motor will continue running.

IF THE MOTOR DOES NOT REACH FULL SPEED WITHIN 10 SECONDS, SHUT OFF POWER TO STARTER. Place a voltmeter across T1 and T2 of the starter and reenergize the starter long enough to read this voltage. The indicated phase-to-phase voltage on T1-T2 must be above 220 volts for the motor to start properly. If the voltage is adequate and the motor does not start, refer to the Troubleshooting Chart in the manual. DO NOT ALLOW THE START CONTACTOR TO REMAIN CLOSED FOR MORE THAN 10 SECONDS – LONGER PERIODS CAN DAMAGE THE START CAPACITORS OR OTHER EQUIPMENT!

BALANCING CURRENTS

In order to use these balancing procedures, the "C", "B", and "A" phases must be properly identified. Phase identification can be verified by measuring the motor off voltages on the line side of the motor starter. With "X" connected on tap 2 or above, "A" will always have the highest phase-to-ground voltage, and "A to C" will always have the highest phase-to-phase voltage. "X" is for adjusting the tap setting on the ADD-A-PHASE autotransformer.

The three motor currents ("C", "B", and "A") should be checked with a clamp-on ammeter and balanced if necessary. The motor must be under normal operating load when taking the readings. To balance the currents, follow these procedures.

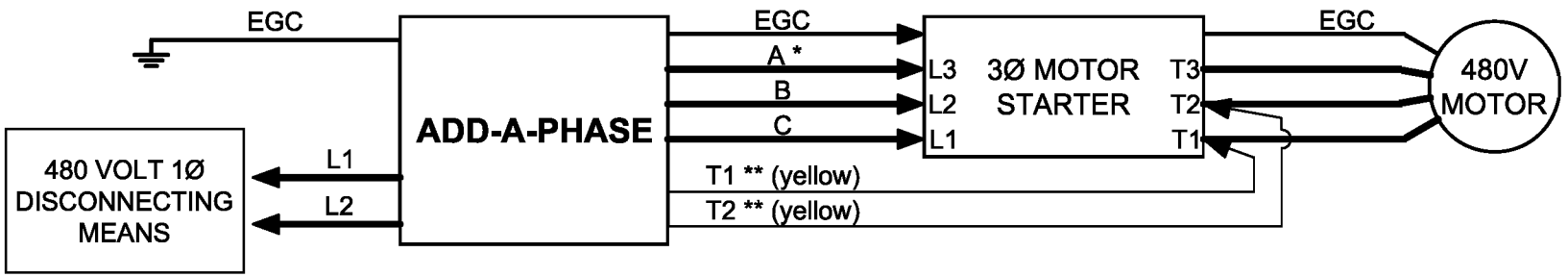
1) Identify the phases at the motor starter as stated above. Then measure the three running amperages on the motor leads.
2) If closer balance is desired, shut off and lock out the single-phase disconnecting means for the converter. Discharge all capacitors before beginning to adjust the unit for better current balance.
3) If "A" current is considerably higher than "C", a light load condition is indicated. If "A" is near FLA and "B" and "C" currents are higher, an overload condition is indicated. If either of these conditions exists, verify load is correct before proceeding with balancing.
4) If "A" is high with "C" low and you have verified the motor is lightly loaded, disconnect some capacitance to bring "A" down and "C" up. If "B" amperage remains higher than both "A" and "C", it may be necessary to move "X" down to a lower tap of the autotransformer.
   Note: Moving to a lower (higher) tap will decrease (increase) "A" phase voltages thereby decreasing (increasing) "A" phase current. Capacitance may need to be connected (disconnected) to readjust "A" phase current.
5) If "A" is lower than "B" and "C", more capacitance needs to be connected.
6) If "B" is lower than "C", then "X" needs to be moved to a higher tap.
7) For future reference, record the final phase-to-phase voltages, phase currents, and motor off voltages.

If you have any questions about these procedures or need assistance with balancing, call RONK at (217) 563-8333.

Power Leads

Control Leads

EGC = Equipment Grounding Conductor



* Do not connect control circuits or other single-phase loads to A phase (phase with highest voltage to ground) from the converter.

** VERIFY FIELD CONNECTION OF T1 AND T2 CONTROL LEADS:
Energize the circuit up to the motor starter. Do NOT turn on the starter. On the input side of the motor starter, measure the phase-to-phase and phase-to-ground voltages to verify the voltage on each pole. The T1 and T2 leads should be connected on the motor side of the starter on the two poles that measure 240 volts phase-to-ground.

CONNECTION CHECKLIST

Single-Phase to L1 & L2	✓

At 3Ø Motor Starter			
A to L3		EGC(s)	
B to L2		T2 to T2	
C to L1		T1 to T1	

VOLTAGE CHART

Location	Voltage Between	Motor Off - No Current	Motor On - Balanced 3Ø Currents
1Ø Input	L1 to L2	480 Volts +	480 Volts +
At 3Ø Magnetic Starter	L1 to L2 (C-B)	480 Volts +	480 Volts +
	L1 to L3 (C-A)	Approx. 890 Volts ++	Approx. 480 Volts
	L2 to L3 (B-A)	Approx. 410 Volts ++	Approx. 480 Volts
	L1 (C) to Ground	240 Volts	240 Volts
	L2 (B) to Ground	240 Volts	240 Volts
	L3 (A) to Ground	650 Volts ++	Approx. 420 Volts

\+ Line voltage may vary from nominal 480 volts, other voltages will vary proportionally.

++ Motor off voltages on L1-L3 (C-A) and L2-L3 (B-A) depend on transormer tap setting. The values given are for factory TAP 4 setting. Higher tap setting will cause higher motor off voltages. **Use meters with a sufficient voltage rating. Regardless of tap setting, $V_{AB} + V_{BC} = V_{AC}$.**

WIRING

- Size A, B, and C leads according to Article 430 of NEC®.
- Size L1 and L2 for 125% MIN of the 1Ø FLA on the ADD-A-PHASE nameplate.
- Size EGC (see above) according to Article 250 of NEC.
- Size control leads - #16 MIN.
- See Article 455 of NEC for rules governing phase converter installations.

INTERCONNECTION DIAGRAM FOR ADD-A-PHASE®	TYPE 4S(...)
REVISIONS	RONK ELECTRICAL INDUSTRIES, INC. NOKOMIS, ILLINOIS
DRAWN - NCL	DRWG. NO. 2-5334-1
DATE - 2/20/08	
APP'D - PG	

	DATE	BY		DATE	BY
A			F		
B			G		
C			H		
D			I		
E			J		

ADD-A-PHASE®
480 Volt Input – 480 Volt Output (TYPE 4S)

GETTING STARTED

Before installing the ADD-A-PHASE power converter, verify that the single-phase supply voltage matches the converter rating; 480 Volts, 60 Hz. Consult the converter nameplate for input voltage and amperage requirements.

The single-phase supply should be connected to the unit through a disconnecting means (a circuit breaker or fused disconnect switch), utilizing a time-delay type breaker or fuses. The ampere rating of the disconnecting means shall not be less than 115% of the single-phase ampere rating of the ADD-A-PHASE. A three pole across-the-line starter with appropriately sized overloads is highly recommended for proper motor operation and protection. All wiring should be done by a qualified electrician in accordance with all applicable electrical codes. See Article 455 of the NEC® (and other applicable Articles) for rules governing phase converter installations.

The following connections need to be made (**see diagram on reverse side for more details**).

- Equipment ground(s):
  - All equipment must be properly grounded. See Article 250 of the NEC for proper grounding and bonding.
- Input: (L1, L2)
  - Connect incoming single-phase service to L1 and L2.
- Motor Starter: (C, B, A) and (T1, T2)
  - Connect the power leads C to L1, B to L2, and A to L3 on the **line** side of the starter.
  - Connect the control leads T1 to T1 and T2 to T2 on the **load** side of the starter (with the motor leads).

Do not connect starter coils, control transformers, or single-phase loads to "A" phase (manufactured phase) from the converter. "A" phase may only be used to power the three-phase motors.

STARTING THE MOTORS

Close the single-phase disconnecting means, applying voltage to the ADD-A-PHASE. Measure and record the voltages on the line side of the motor starter. The measured voltages should match the Voltage Chart on the reverse side of this page. Label the phase conductors "C", "B", and "A" as defined by these voltage measurements. Proper identification of the phases is necessary. You should now be ready to start the motor. Refer to the manual for component descriptions.

When starting the motor, observe the following sequence of events.

1) The motor is energized.
2) The ADD-A-PHASE auxiliary relay should energize immediately and remain closed.
3) The ADD-A-PHASE start contactor should engage.
4) The motor should accelerate to full speed within 1 to 3 seconds.
5) The start contactor will drop out and motor will continue running.

IF THE MOTOR DOES NOT REACH FULL SPEED WITHIN 10 SECONDS, SHUT OFF POWER TO STARTER. Place a voltmeter across T1 and T2 of the starter and reenergize the starter long enough to read this voltage. The indicated phase-to-phase voltage on T1-T2 must be above 440 volts for the motor to start properly. If the voltage is adequate and the motor does not start, refer to the Troubleshooting Chart in the manual. DO NOT ALLOW THE START CONTACTOR TO REMAIN CLOSED FOR MORE THAN 10 SECONDS – LONGER PERIODS CAN DAMAGE THE START CAPACITORS OR OTHER EQUIPMENT!

BALANCING CURRENTS

In order to use these balancing procedures, the "C", "B", and "A" phases must be properly identified. Phase identification can be verified by measuring the motor off voltages on the line side of the motor starters. With "X" connected on tap 2 or above, "A" will always have the highest phase-to-ground voltage, and "A to C" will always have the highest phase-to-phase voltage. "X" is for adjusting the tap setting on the ADD-A-PHASE autotransformer.

The three motor currents ("C", "B", and "A") should be checked with a clamp-on ammeter and balanced if necessary. The motor must be under normal operating load when taking the readings. To balance the currents, follow these procedures.

1) Identify the phases at the motor starters as stated above. Then measure the three running amperages on the motor leads.
2) If closer balance is desired, shut off and lock out the single-phase disconnecting means for the converter. Discharge all capacitors before beginning to adjust the unit for better current balance.
3) If "A" current is considerably higher than "C", a light load condition is indicated. If "A" is near FLA and "B" and "C" currents are higher, an overload condition is indicated. If either of these conditions exists, verify load is correct before proceeding with balancing.
4) If "A" is high with "C" low and you have verified the motor is lightly loaded, disconnect some capacitance to bring "A" down and "C" up. If "B" amperage remains higher than both "A" and "C", it may be necessary to move "X" down to a lower tap of the autotransformer.
   Note: Moving to a lower (higher) tap will decrease (increase) "A" phase voltages thereby decreasing (increasing) "A" phase current. Capacitance may need to be connected (disconnected) to readjust "A" phase current.
5) If "A" is lower than "B" and "C", more capacitance needs to be connected.
6) If "B" is lower than "C", then "X" needs to be moved to a higher tap.
7) For future reference, record the final phase-to-phase voltages, phase currents, and motor off voltages.

If you have any questions about these procedures or need assistance with balancing, call RONK at (217) 563-8333.