INSTRUCTION MANUAL
FOR
MINIMUM EXCITATION LIMITER
Model: EL 300
Part Number: 9 1747 00 111

Basler Electric

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INTRODUCTION

This manual provides information concerning the operation and installation of an EL 300, Minimum Excitation Limiter. To accomplish this, the following is provided.

- Specifications
- Theory of Operation
- Human-Machine Interface
- Installation
- Operation
- Maintenance

WARNING!

TO AVOID PERSONAL INJURY OR EQUIPMENT DAMAGE, ONLY QUALIFIED PERSONNEL SHOULD PERFORM THE PROCEDURES PRESENTED IN THIS MANUAL.

CAUTION

Meggers and high potential test equipment should be used with extreme care. Incorrect use of such equipment could damage components contained in the device.

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It is not the intention of this manual to cover all details and variations in equipment, nor does this manual provide data for every possible contingency regarding installation or operation. The availability and design of all features and options are subject to modification without notice. Should further information be required, contact Basler Electric Company, Highland, Illinois.

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CONTENTS

SECTION 1 • GENERAL INFORMATION

DESCRIPTION

The Basler Electric Minimum Excitation Limiter (Model: EL 300) senses the field current output of the voltage regulator or static exciter and limits any further decrease in excitation (as necessary) to prevent loss of synchronization and end iron heating during parallel operation.

The EL 300 Excitation Limiter has circular characteristic that is compatible with typical motor reactive capabilities as shown by Figure 1-1.

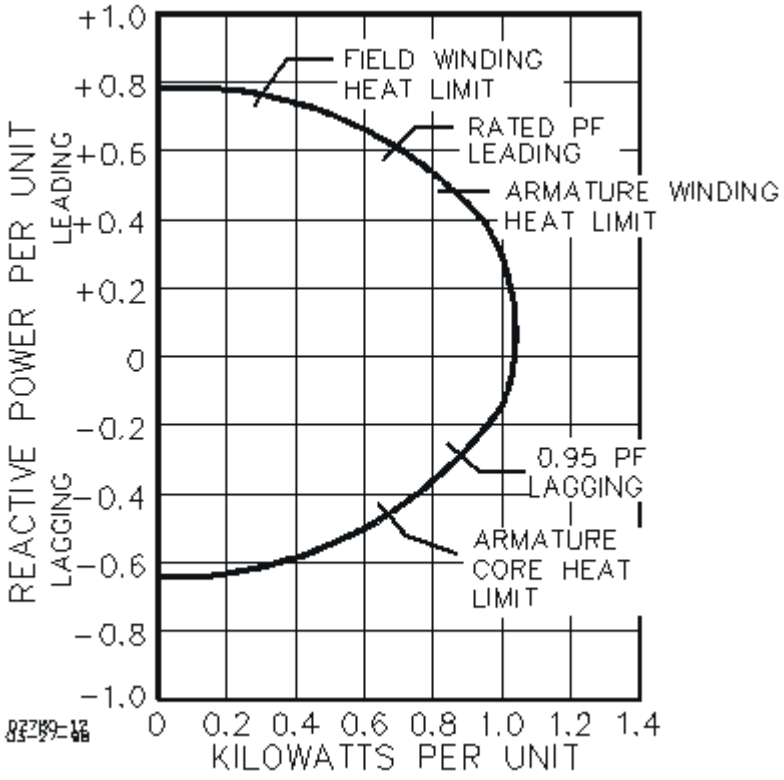

Figure 1-1. Typical Motor Reactive Capability

APPLICATION

The EL 300 Excitation Limiter can be used with the following Basler voltage regulators and excitation systems: SSR, SR-A Series, SR-F Series, SR-E Series, and SR-H Series. The EL 300 is designed for use on synchronous motors or condensers.

SPECIFICATIONS

Refer to Table 1-1 for the electrical specifications and to Table 1-2 for the physical specifications.

Table 1-1. Electrical Specifications

Input Voltage:	90 - 139/180 - 264/342 -528/540 - 660 Vac, ±10%, 50/60 Hz.
Burden:	12 VA maximum.
Output:	±8 Vdc.
Drift:	Less than 5% of nominal per 50°C change.
Field Current: **EL 300:**	0.2 to 7 A
Output Contacts Rating:	10 A @ 24 Vdc/240 Vac/120 Vac; 0.5 A @ 125 Vdc.

Table 1-2. Physical Specifications

Overall Dimensions:	8.2 inches (208 mm) X 11.5 inches (292 mm) X 4.2 inches (107 mm).
Weight:	10 lbs (4.6 kg) net.
Storage Temperature Range:	-65°C (-85°F) to +85°C (+185°F)
Operating Temperature Range:	-40°C (-40°F) to +70°C (+158°F)
Vibration:	Withstands the following: 2 to 27 Hz. at 1.3 G's; 27 to 52 Hz. at 0.036 inch double amplitude; 52 to 1000 Hz. at 5.0 G's.
Shock:	Withstands up to 15 G's in each of three mutually perpendicular axes.

SECTION 2 • THEORY OF OPERATION

POWER SUPPLY

The EL 300 senses the motor voltage through transformer T1. This transformer has taps for use with the following input voltages: 90-139, 180-264, 342-528, and 540-660 Vac, ±10%, 50/60 Hz.

A portion of the transformer (T1) output feeds the regulated power supply to produce a +14 Vdc and a -14 Vdc output for operating the limiter circuitry. The transformer (T1) also provides power to the dc transducer (transformer T2).

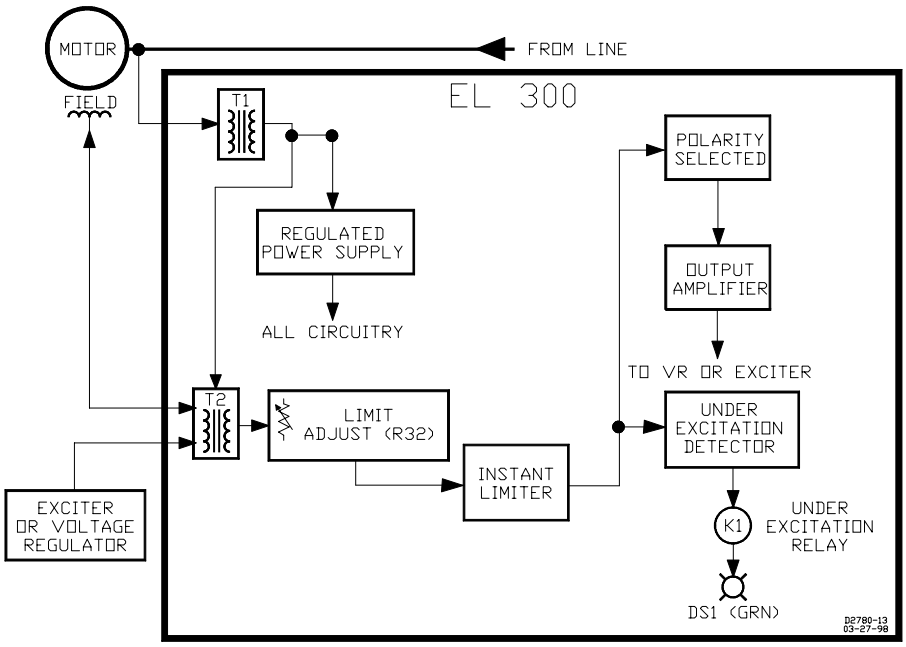

Figure 2-1. Excitation Limiter Block Diagram

OUTPUT CIRCUITRY

The output amplifier produces either positive or negative signals to drive the regulator or exciter (as required). The polarity of this signal is determined by the appropriate jumpering of the A-B Polarity Fanning Terminal Strip.

UNDER-EXCITATION LIMITING

Under-excitation limiting provides an initial fast acting limit of the field current at a pre-selected level. Once the field current has decreased to the selected level (0.2 to 7 A), the output provides a signal to the regulator to increase excitation.

The dc current output of the exciter or regulator will pass through a winding of the dc transducer (T2). The ac output of T2 will always be proportional to the input. This ac output is rectified, adjusted, and applied to the Instant Limiter.

RELAY AND INDICATORS

When the under-excitation portion is functioning, the Under-Excitation Detector will illuminate a green LED on the printed circuit board and energize relay K1. Relay K1's form C contacts are connected across terminals 10, 11, and 12.

SECTION 3 • HUMAN-MACHINE INTERFACE

CONTROL

For the control and its function, refer to Figure 3-1 and Table 3-1.

Table 3-1. Controls

Control	Function
Potentiometer R32:	Used to adjust the Limiter threshold current (Field Current Calibration).

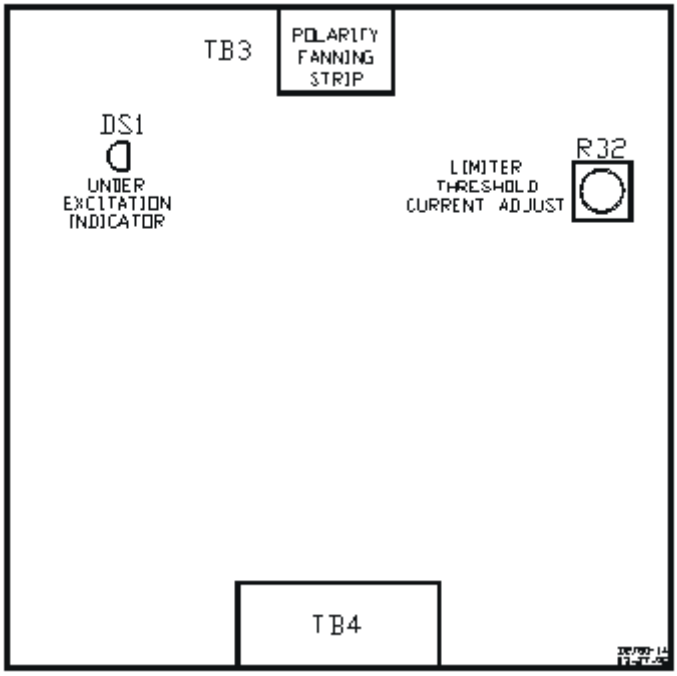

Figure 3-1. Controls and Indicators

INDICATOR

For the indicator and its function, refer to Figure 3-1 and Table 3-2.

Table 3-2. Indicators

Indicator	Function
LED DS1 (Green):	Illuminates to indicate an under-excitation condition exists.

SECTION 4 • INSTALLATION AND CALIBRATION

MOUNTING

The EL 300 Excitation Limiter should be mounted in a vertical position for maximum convection cooling. Refer to Figure 4-1 for mounting holes and dimensions.

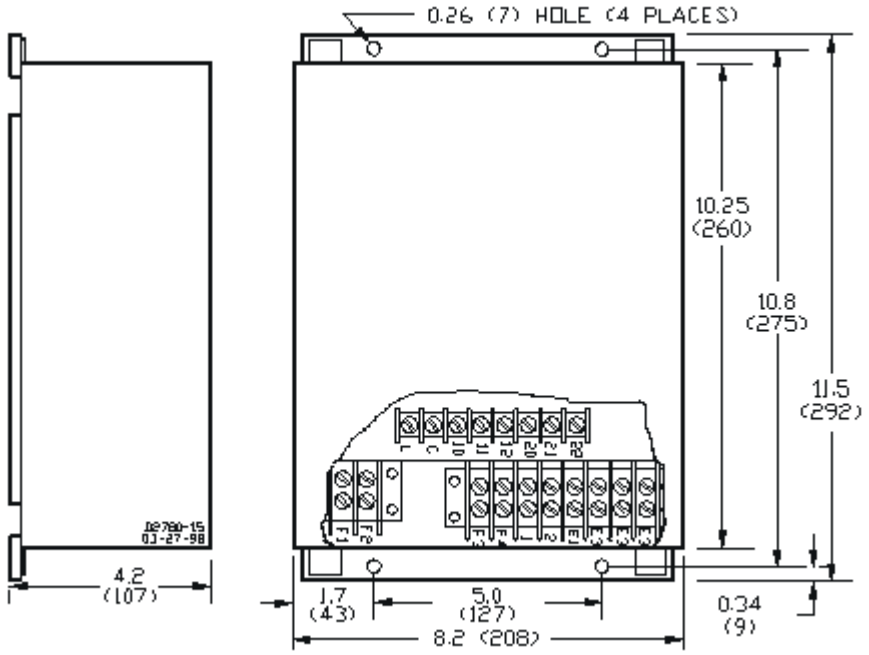

Figure 4-1. Outline Drawing

INTERCONNECTION

Connect the EL 300 Excitation Limiter and other equipment in accordance with either Figure 4-2, 4-3, 4-4, or 4-5 as applicable.

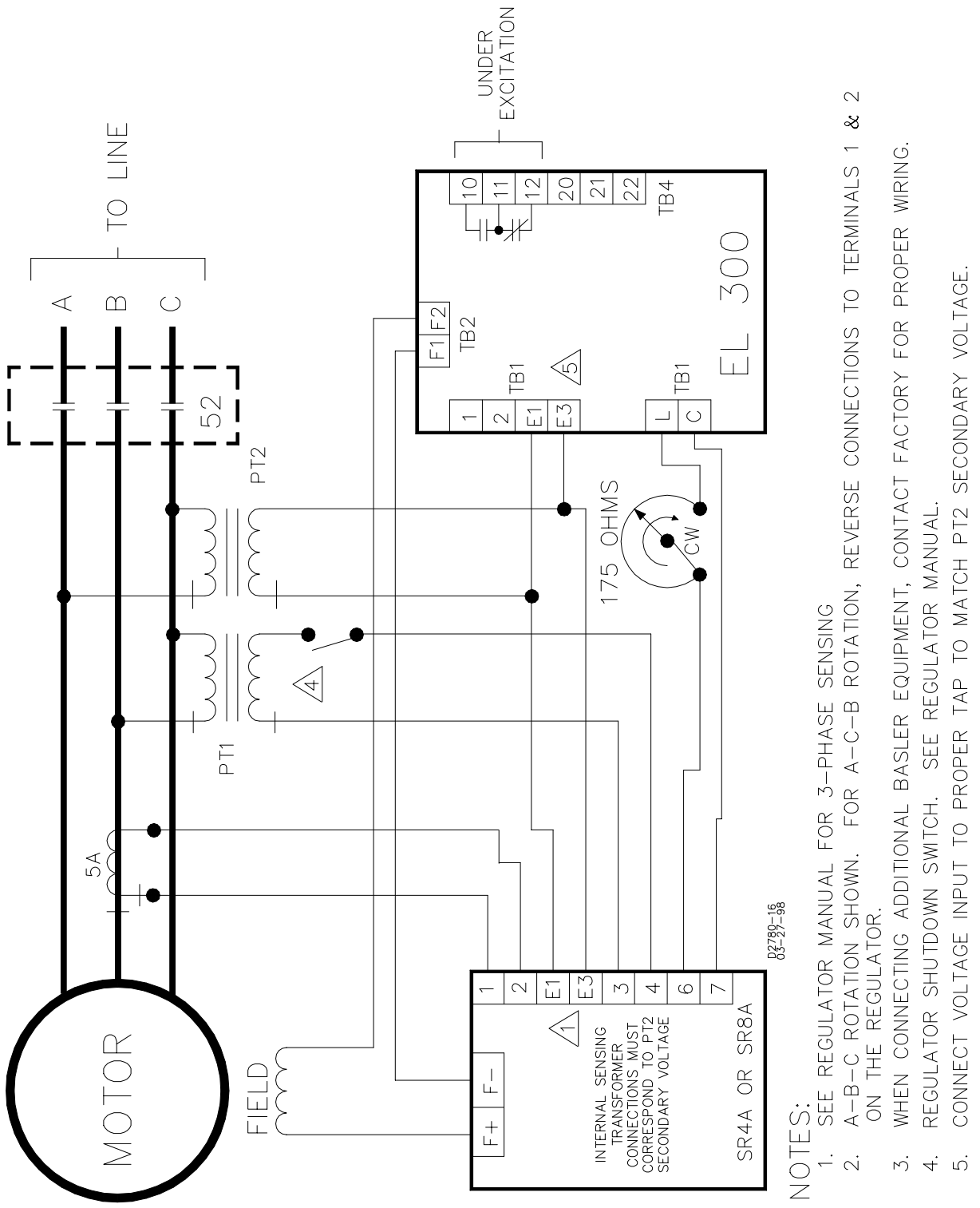

Figure 4-2. SR-A Voltage Regulator Interconnection Diagram

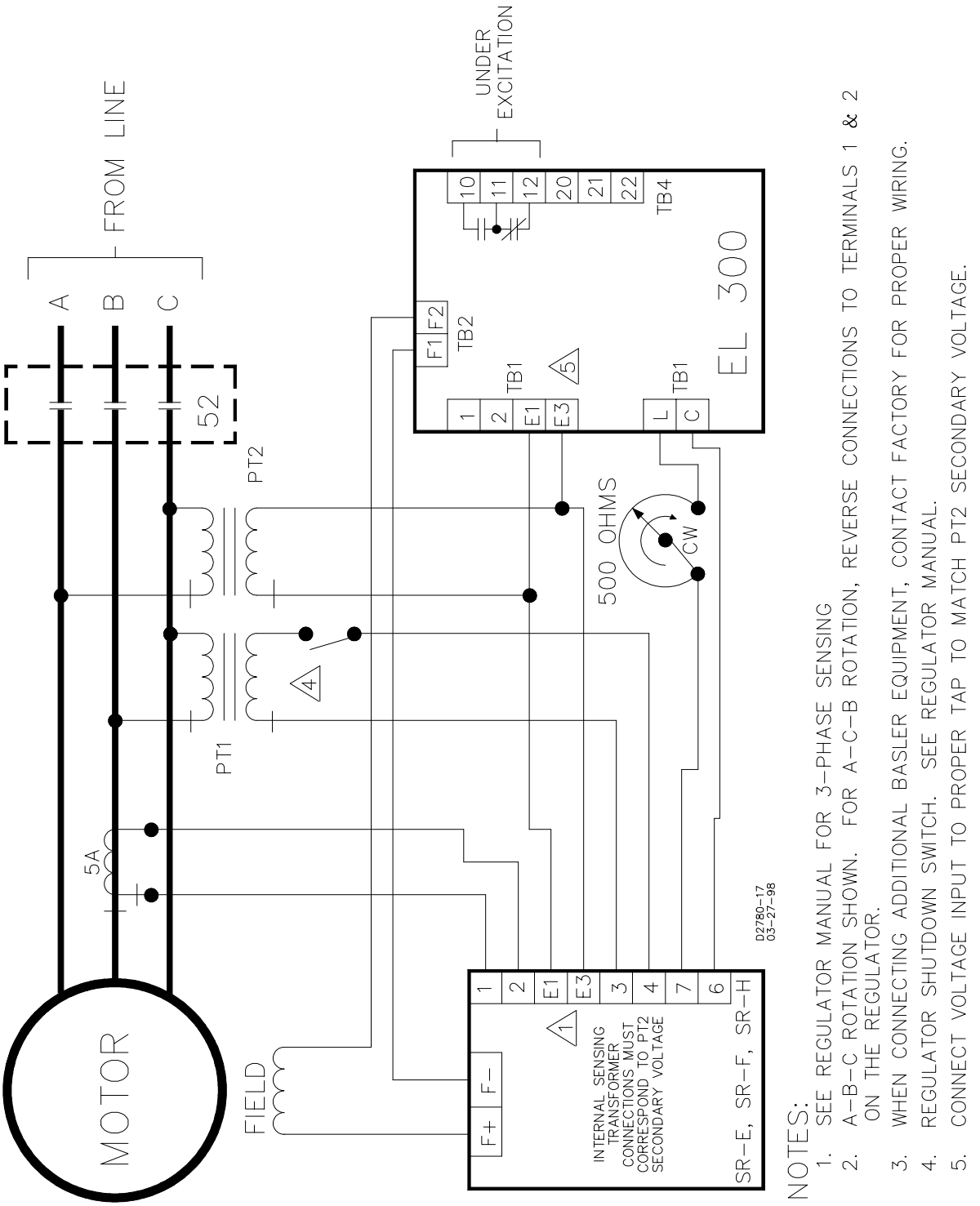

Figure 4-3. SR-E, SR-F, SR-H Voltage Regulators Interconnection Diagram

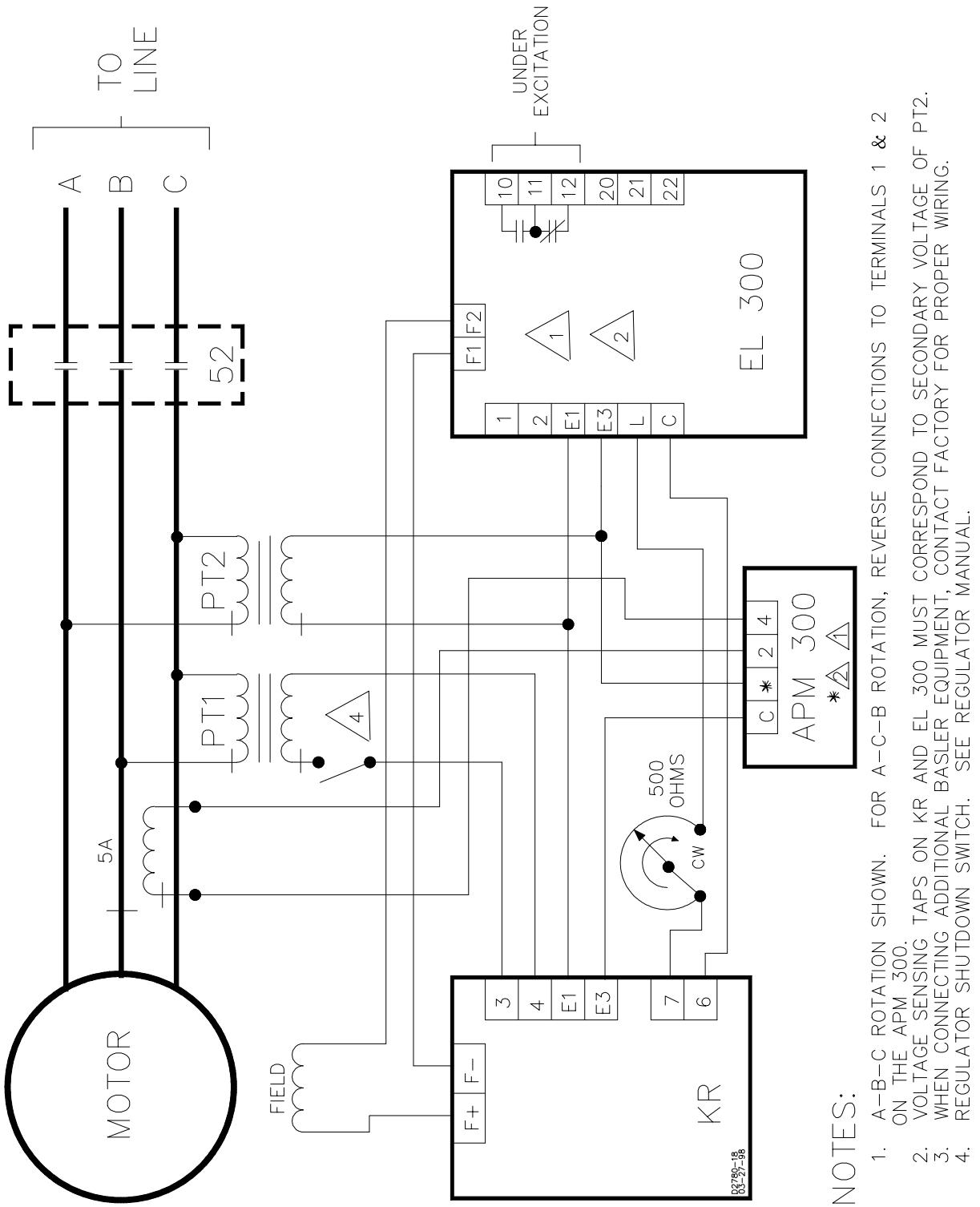

Figure 4-4. KR-F Voltage Regulator Interconnection Diagram

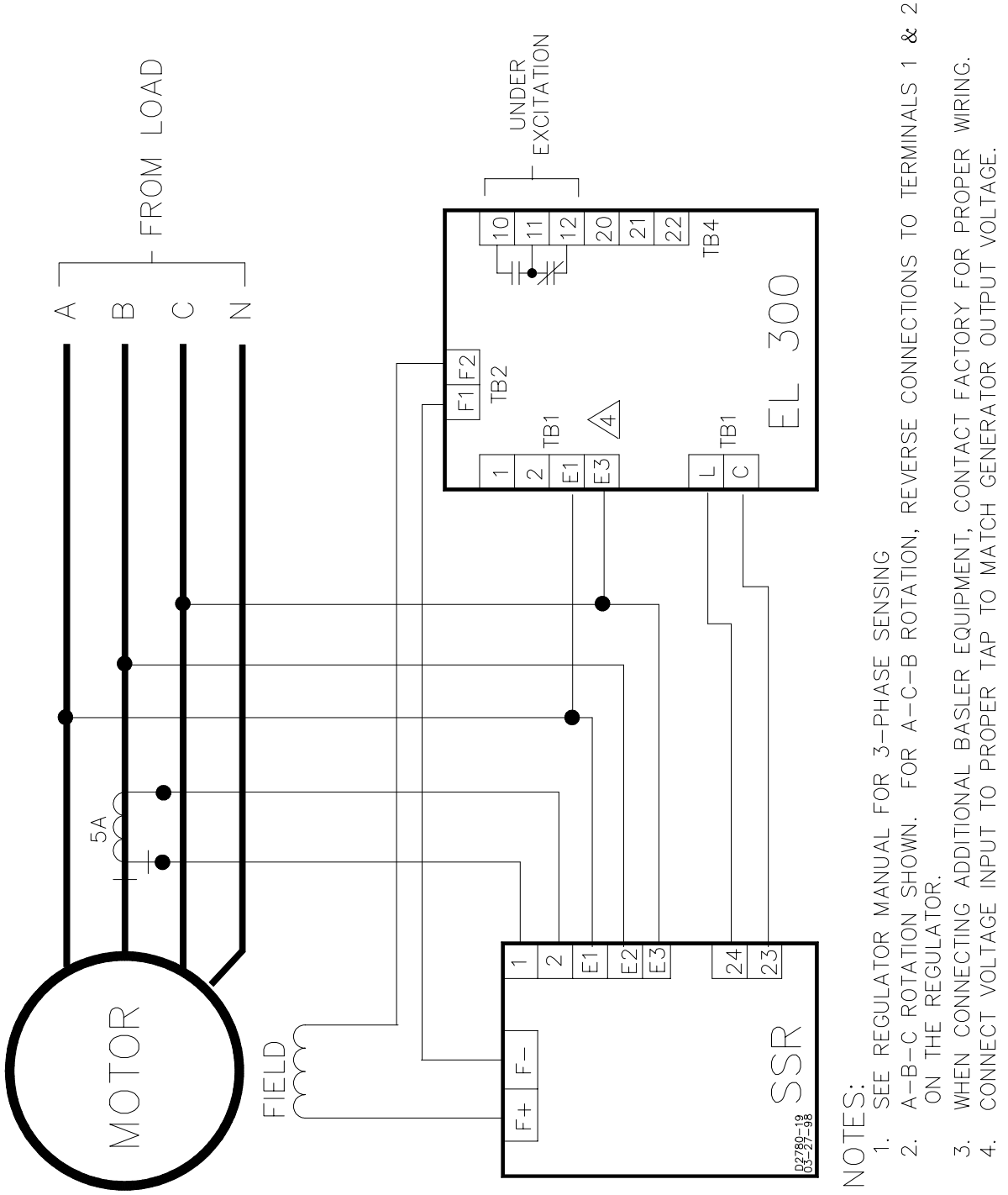

Figure 4-5. SSR Voltage Regulator Interconnection Diagram

PRELIMINARY SET-UP

To prepare the EL 300 Excitation Limiter for calibration, proceed as follows:

a. Set the Delayed Current Limiter Threshold Adjust Potentiometer (R32) fully counterclockwise.

b. Place the polarity fanning strip (TB3) in either the A or B position depending on the polarity required by the voltage regulator. (Refer to Table 4-1).

Table 4-1. Fanning Strip (TB3) Selection

Position A	Position B
SR-E	SR-A
SR-H	SSR
KR-F	

c. Tag and disconnect the leads from terminals TB1-L and TB1-C.

d. Tie the leads together.

e. Start the motor in the normal manner. Test for normal operation.

f. Rotate the voltage regulator/exciter Voltage Adjust rheostat clockwise to increase field excitation.

Result: Leading kVAR should flow from the motor into the bus. Field current from TB2-F1 of the EL 300 or through the primary of the external transducer should increase.

g. Rotate the voltage regulator/exciter Voltage Adjust rheostat counter-clockwise to decrease field excitation.

Result: Lagging kVAR should flow from the bus into the motor. Field current from TB2-F1 of the EL 300 or through the primary of the external transducer should decrease.

h. Check that the governor can be adjusted to produce any amount of kW between zero and rated.

i. If operation is normal, unparallel and then shutdown the motor.

j. Reconnect the wires to terminals TB1-L and TB1-C per the tagged identification.

UNDER-EXCITATION CALIBRATION

NOTE

If a runaway event occurs during the following test, it is probably caused by either a reversed polarity of the A-B fanning strip, or reversed connections at terminals TB1-L and TB1-C.

Current Limit (Field Current) Calibration

The following procedure will set the minimum continuous allowable field current and is performed as follows:

(1) To avoid stressing the motor system, the calibration procedure in this tests the limiting action at field current levels greater than those generally selected for current limiting. In the final steps of each procedure, potentiometer adjustments are performed to shift the thresholds to the selected levels.

(2) Begin the calibration by selecting a field current level for testing that is approximately equal to the full-load field current. Divide the test current level by the current level selected for current limiting.

EXAMPLE:

$$\frac{\text{Chosen Test Current Level}}{\text{Selected Current Level}} = \frac{5A}{3A} = 1.667$$

(3) With R32 fully counterclockwise, parallel the motor with the bus and set it for 10% of rated kW output.

(4) Set the voltage regulator's voltage adjust until the field current is equal to the test current chosen in step (2).

CAUTION

Continuously monitor the motor system to ensure that the system is not overstressed.

(5) Rotate R32 clockwise until indicator DS1 (green) illuminates. Continue turning R32 until the field current just begins to increase.

(6) Measure the dc voltage at TP1 with respect to TB4-C.

(7) Multiply the voltage measured in step (6) by the percentage calculated in step (2).

EXAMPLE:

4.8 V X 1.667 = 8.00 V

(8) While maintaining the field current at the test level, rotate potentiometer R32 counter-clockwise until the dc voltage at TP1 is the value calculated in step (7).

SECTION 5 • MAINTENANCE

PREVENTIVE MAINTENANCE

Periodic inspections of the EL 300 Excitation Limiter should be made on a regular basis to ensure that the unit is clean and free from accumulations of dust and moisture. When inspecting the unit, check that all parts are securely mounted and that all electrical connections are clean and secure.

CORRECTIVE MAINTENANCE

If a malfunction is detected in the system, use Table 5-1, *Troubleshooting Chart*. Repair is limited to the replacement of those parts listed in Table 5-2.

TROUBLESHOOTING

The more common malfunctions and their appropriate repair procedures are listed in Table 5-1.

Table 5-1. Troubleshooting Chart

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

1. EL 300 EXCITATION LIMITER CAUSES AVR TO GO TO MAXIMUM OUTPUT.

Step 1. Check the fanning strip (TB3) for proper polarity connection per Table 4-1.

If the polarity is incorrect, reconnect the polarity jumper on the fanning strip.

If the polarity is correct, proceed to step 2.

Step 2. Check for the proper voltage input phasing and connections at terminals TB1-E1 and TB1-E3 per Figures 4-2 through 4-5.

If the voltage input is reversed or improperly connected, reconnect properly.

If the voltage input is connected properly, replace the EL 300 printed circuit board.

2. THE SYSTEM BECOMES UNSTABLE WHEN THE EXCITATION LIMIT IS ATTAINED.

Adjust the voltage regulator Stability potentiometer(s) for maximum stability per the voltage regulator instruction manual.

REPLACEMENT PARTS

The following list (Table 5-2) describes the only assembly of the EL 300 Excitation Limiter that has maintenance significance. When ordering any part from Basler Electric Company, always specify the description of the item, the part number, and the quantity required.

Table 5-2. Replacement Part List

Basler Part Number	Qty	Description
9 1747 01 103	1	Printed Circuit Board

SECTION 6 • MANUAL CHANGE INFORMATION

CHANGES

Substantive changes in this manual to date are summarized in Table 6-1.

Table 6-1. Summary of Changes

Revision	Summary of Changes	ECA No.	Date
D	Changed all occurrences of “generator” to “motor.” Changed Section 3 from “Controls and Indicators” to “Human-Machine Interface.” Section 4, Step a. of Preliminary Set-up, changed “clockwise” to “counterclockwise.” Step f. Result, changed “Lagging” to “Leading” and Step g. Result, changed “Leading” to “Lagging,” “generator” to “bus,” and “bus” to “motor.” Step 3 of Calibration changed “clockwise” to “counterclockwise” and Step 5 changed “counterclockwise” to “clockwise.” Also changed the format of the manual.	16674	03/98