INSTRUCTIONS
FOR
VOLTAGE REGULATOR
APR 63-5X

Basler Electric
Phone: +1 618.654.2341
Route 143, Box 269
Highland IL 62249 USA

Power Systems Group
Fax: +1 618.654.2351
www.basler.com
info@basler.com

INTRODUCTION

The APR 63-5X Voltage Regulator controls the dc field power of a conventional, 400 Hz brushless generator that has a 63 Vdc field to regulate the generator output voltage. The APR 63-5X regulates the generator output by sensing the generator output voltage, converting it to a dc signal, and comparing the signal to a reference voltage. An error signal is developed and used to control the dc field power in order to maintain a constant generator voltage.

The APR 63-5X is contained in an encapsulated, plastic case.

SPECIFICATIONS

Power Input

Configuration:	1-phase, 400 Hz
Range:	190 to 277 Vac, ±10%
Burden:	650 VA maximum
Dissipation:	25 W maximum

Sensing Voltage

Configuration:	1-phase, 400 Hz
Range	
240 Vac:	190 to 240 Vac
480 Vac:	380 to 480 Vac
Burden:	5 VA

Power Output *

Continuous:63 Vdc, 5 Adc, 315 W
1-Min. Forcing: 105 Vdc, 8.5 Adc, 893 W
* With 240 Vac input power.

DC Exciter Field Resistance

12.6 to 100 Ω

Voltage Adjustment Range

Internal

170 to 264 Vac or 340 to 528 Vac using the internal voltage adjust.

External

±10% of the nominal value determined by the internal voltage adjust. A 1 kΩ, 2 W potentiometer with a locking, screwdriver-adjusted shaft is supplied with the APR 63-5X for remote mounting.

Regulation

Accuracy:	±0.5%
Voltage Drift:	<±1% variation for a 50°C (90°F) change
Response:	<1 cycle

Voltage Buildup

Automatic voltage buildup from generator residual voltage as low as 6 Vac.

Frequency Compensation

See Figure 1

Overexcitation Shutdown

See Figure 2. If the field voltage exceeds 100 ±5 Vdc, the APR 63-5X automatically removes the field current after a time delay. The time delay is inversely proportional to the magnitude of the detected overvoltage condition. At approximately 135 ±5 Vdc, the field voltage is removed instantaneously.

Upon detection of overexcitation and the resulting field voltage shutdown, the APR 63-5X will not reset or return to an operational condition until the generator output drops to less than 6 Vac for 10 seconds.

Shock

Withstands up to 15 G in each of 3 mutually perpendicular axes.

Vibration

5 to 26 Hz:	1.2 G
27 to 53 Hz:	0.036" double amplitude
54 to 1,000 Hz:	5.0 G

Temperature

Operating:	–40 to 60°C (–40 to 140°F)
Storage:	–65 to 85°C (–85 to 185°F)

Weight

1,110 g (2.5 lb)

INSTALLATION

Mounting

The APR 63-5X may be mounted in any position. The APR 63-5X may be mounted directly on the generator using ¼" hardware. Select the proper hardware to withstand any expected transportation and operating conditions. Outline drawings are provided in Figures 3 and 4.

Connections

APR 63-5X connection diagrams are provided in Figures 5 through 7.

Connecting Procedure

CAUTION

Do not make any connections to the 50 Hz, 60 Hz, or COM terminals.

1. Connect terminals F+ and F– to the field. Observe proper polarity.
2. Connect terminals 3 and 4 to the generator output. Fuse both leads. If desired, install a shutdown switch.
3. Connect either the 240 or 480 terminal to the sensing source. Sensing should be connected line-to-line.

ADJUSTMENTS

Field Flashing

When the regulator is operated with the generator for the first time, the polarity of the residual magnetism may be incorrect or of insufficient magnitude. If the residual voltage at terminals 3 and 4 is greater than 6 Vac, replace the regulator. If generator residual voltage is less than 6 Vac, stop the prime mover and proceed with the following steps.

CAUTION

The regulator may be damaged if the field is flashed with the generator in motion.

1. With the prime mover at rest, apply an ungrounded dc source of not more than 48 Vdc to terminals F+ and F– in series with a limiting resistor. Use 1 Ω of resistance for each volt from the dc power source with a power rating of at least 1 W per ohm. For example, if using a 24 Vdc source, use a 24 Ω, 24 W resistor.
2. Allow the field to be flashed for approximately 10 seconds before removing the dc source.
3. If voltage does not build up after performing steps 1 and 2, verify the polarity of the dc source and perform steps 1 and 2 again.

APR 63-5X Controls

FREQ

This control prevents generator and regulator damage by decreasing the generator output voltage when the generator frequency decreases. To set the frequency roll-off, perform the following steps:

1. Adjust the generator rpm to the desired frequency compensation (corner frequency roll-off) point.
2. Adjust the FREQ control until the output voltage begins to drop-off.
3. Increase the generator rpm to nominal. The output voltage should return to normal.

STAB

This control allows the generator response time (and thus voltage stability) to be adjusted. Use an oscilloscope or other voltage recording device to set the STAB control.

Clockwise rotation of the STAB control slows response time and counterclockwise rotation of the STAB control speeds response time. If the STAB control is rotated too far counterclockwise, the generator voltage may oscillate (hunt).

When adjusting the generator response time, rotate the STAB control counterclockwise until the system starts oscillating and then rotate the control clockwise just past the point where oscillation occurred.

VOLT

Clockwise rotation of the VOLT control increases the generator output voltage.

Replacing the jumper connected across terminals 6 and 7 with a 1 kΩ, 2 W potentiometer allows a ±10% voltage range adjustment with the nominal level set by the VOLT control. If a range less or greater than that provided by the 1 kΩ potentiometer is desired, a 2 W potentiometer of any value from 50 to 5,000 Ω may be substituted.

OPERATION

Before proceeding with system startup, confirm the following:

- Verify that the APR 63-5X specifications conform with the requirements of the generator system.
- Ensure that the APR 63-5X has been installed and connected in accordance with *Installation, Mounting* and *Connections*.

During periods of prime mover idling, use the shutdown switch to remove power from the APR 63-5X.

System Startup

System startup is achieved by performing the following steps. If the desired results are not achieved during startup, refer to the procedures listed under *Troubleshooting*.

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1. Start the prime mover and bring it up to rated speed.
2. Slowly adjust the VOLT control (or external potentiometer) until nominal generator voltage is achieved.
3. Check stability by applying and removing load.
4. Check regulation under normal operating conditions.
5. Reduce the generator frequency to approximately 373 Hz. The generator output should decrease from this point.

Troubleshooting

If the system does not operate as expected, use the following information to determine the cause and remedy.

Generator Voltage Does Not Build

There may be no or incorrect input voltage applied to APR 63-5X terminals 3 and 4. Verify the wiring and check the fuses and shutdown switch.

The field may require flashing—flash the field.

The overexcitation function may be shutting the APR 63-5X off. Stop the prime mover and then restart. Watch for high voltage.

Voltage Builds and then Decays

The voltage adjust circuit may be open. If an external potentiometer is not used, verify that a jumper is installed across terminals 6 and 7. If an external potentiometer is used, the potentiometer may be defective or of the wrong value. Check the potentiometer and wiring and correct as necessary.

Voltage Does Not Build to the Rated Value

The jumper across APR 63-5X terminals CB+ and CB– may be missing—install the jumper.

Sensing may be connected to the wrong terminal. Correct the sensing connections as required.

The setting of the internal or external voltage adjust may be incorrect. Adjust the VOLT control or external potentiometer as needed.

Voltage High and Uncontrollable

Generator sensing may not be connected to the APR 63-5X or may be connected to the wrong terminal. Correct the sensing connections as needed.

Generator Response is Too Slow or Hunting

The generator load may be excessive or the generator output may be shorted. Check the generator load.

The STAB control may be improperly set. Adjust the STAB control according to the guidelines provided in *Adjustments, APR 63-5X Controls, Stab*.

Poor Regulation

The resistance of the field may not be matched to the capability of the APR 63-5X. Compare the field resistance with the specified field resistance range of the APR 63-5X.

The APR 63-5X output rating does not meet the requirement of the generator. Compare the excitation requirement of the generator with the specified output range of the APR 63-5X.

The speed of the prime mover may be too low. Check the speed of the prime mover.

The voltmeter may not be connected at the same point as the regulator sensing. Verify the voltmeter connections. Also verify that an average-sensing voltmeter is used—not an rms-sensing voltmeter.

Frequency Roll-Off Not Working

The FREQ control may be improperly set. Adjust the FREQ control according to the guidelines provided in *Adjustments, APR 64-5X Controls, Stab*.

Operational Test

To verify APR 63-5X functionality, perform the following steps:

1. Connect the regulator as shown in Figure 8 and apply 240 Vac as shown.
2. Adjust the VOLT control fully counterclockwise. Observe that the lamp does not light.
3. Adjust the VOLT control fully clockwise.
4. Adjust the VOLT control counterclockwise until the lamp just goes out.

Regulator operation is satisfactory if the above results are obtained. However, stability must be tested with the regulator and generator operating.

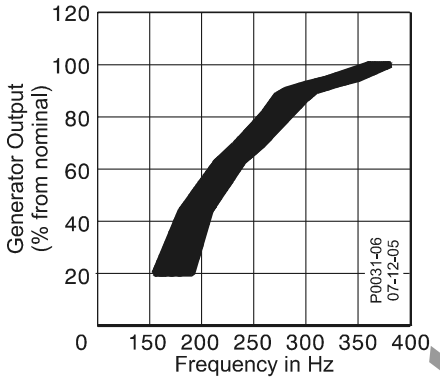


Figure 1. Frequency Compensation Curves

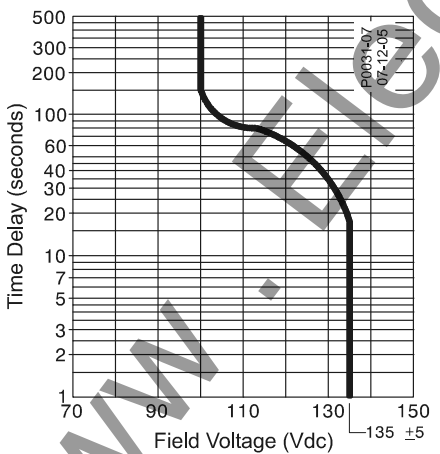
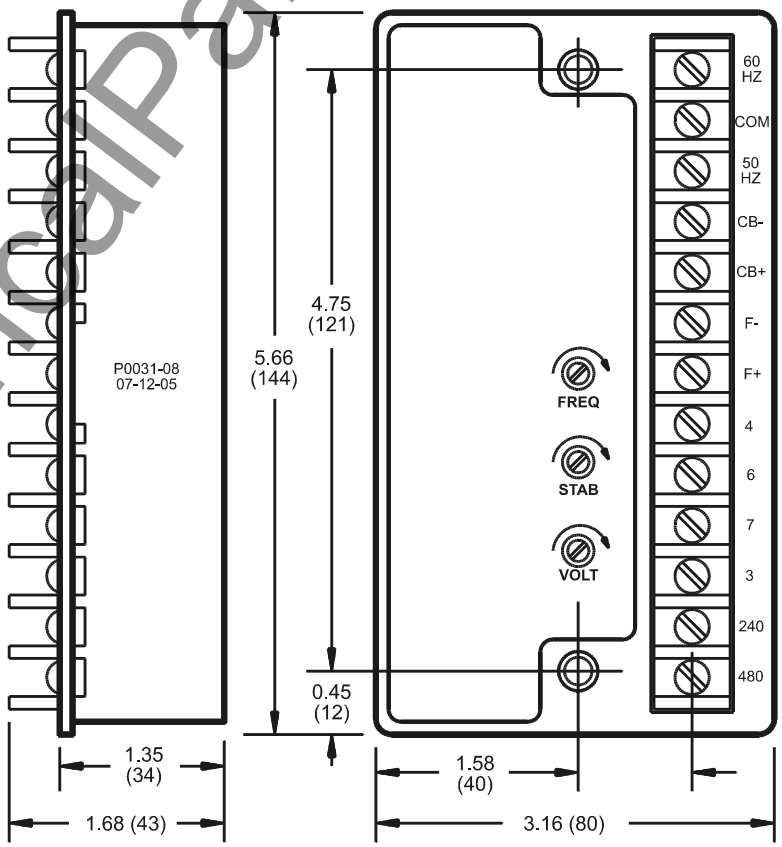
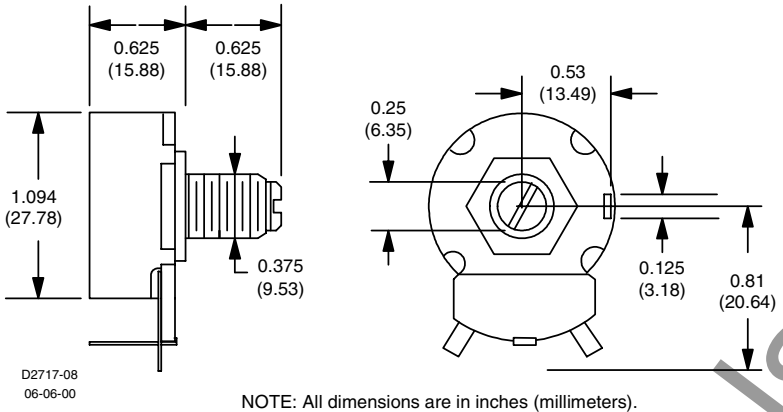


Figure 2. Typical Inverse Time Delay Characteristic Curves



All dimensions are in inches (millimeters).

Figure3. Mounting Dimensions



NOTE: All dimensions are in inches (millimeters).

Figure 4. External Voltage Adjust Potentiometer (Basler P/N 17727)

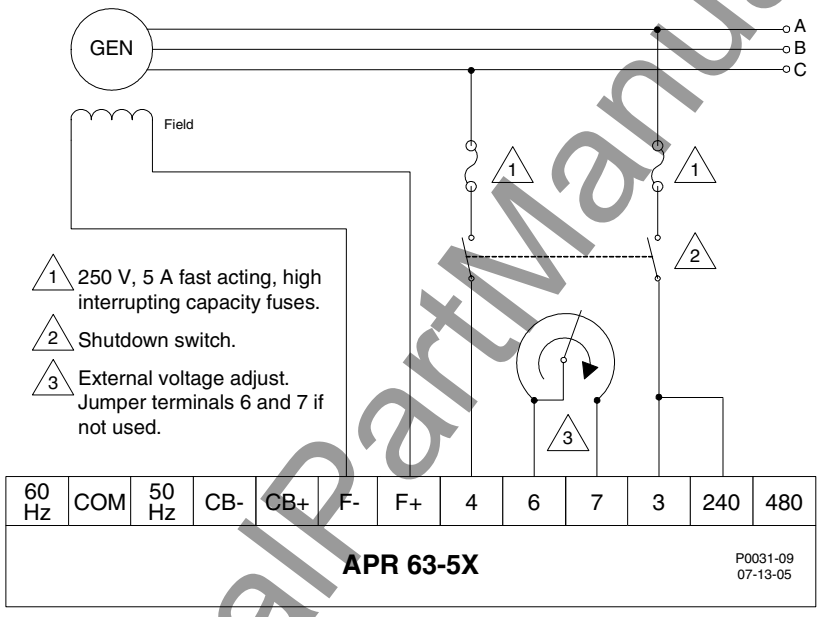


Figure 5. 240 Vac, Single-Phase Interconnection Diagram

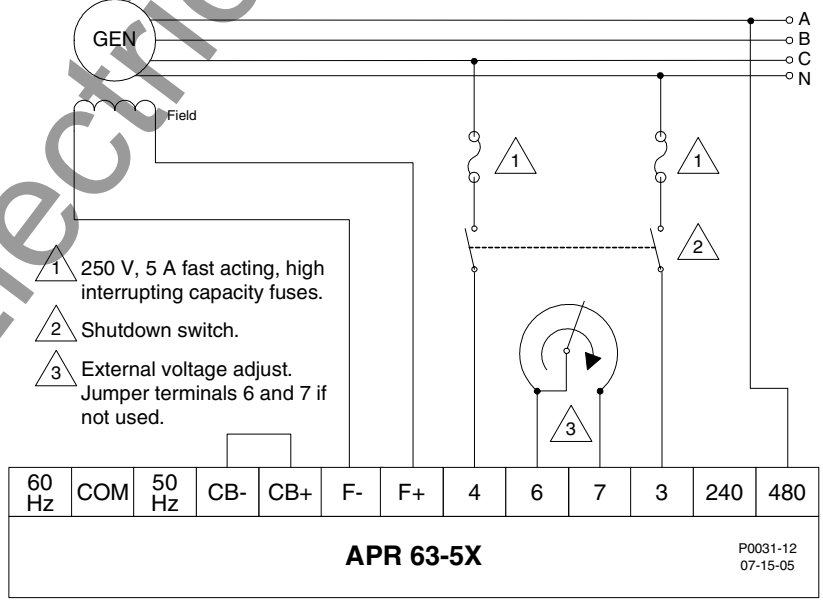


Figure 6. 480 Vac Interconnection Diagram

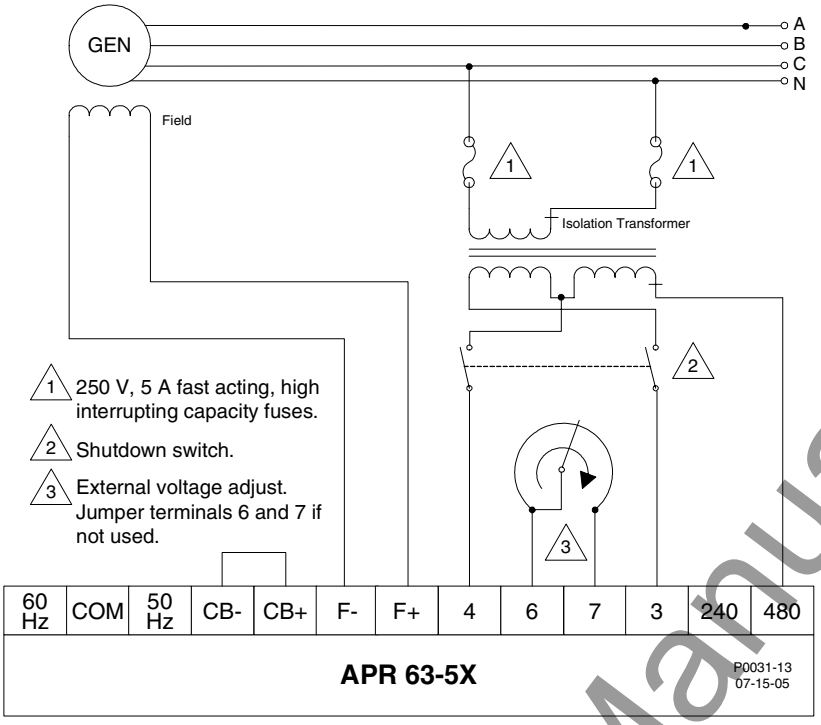


Figure 7. Isolation Transformer Interconnection Diagram

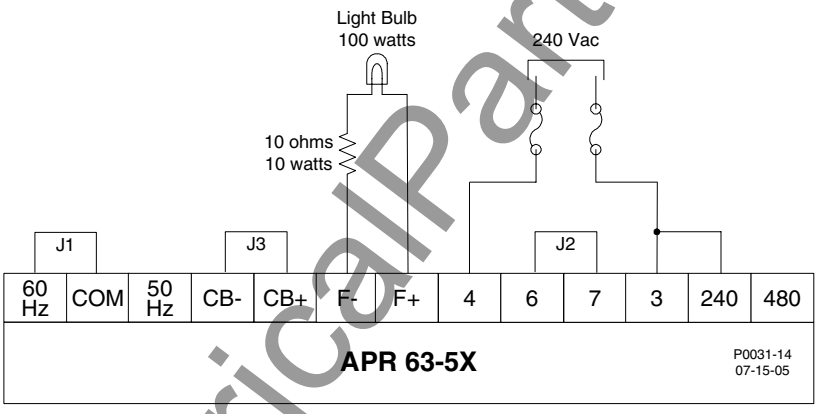


Figure 8. Test Setup Diagram