INTRODUCTION

The EDM-200 Exciter Diode Monitor connects to the exciter field circuit and monitors the output of the brushless exciter power semiconductors. The EDM-200 can detect the failure of a power rectifier in the brushless exciter which fails in either the open or shorted mode. A set of Form C contacts provides alarm annunciation. A bar graph display enables easy onsite calibration and monitoring of EDM-200 operation.

CONTROLS AND INDICATORS

EDM-200 controls and indicators are illustrated in Figure and described in Table 1.

Table 1. Control and Indicator Descriptions

Locator	Description
A	*Threshold Control.* During calibration and a no-load condition, this potentiometer is rotated clockwise until the Threshold segment of the bar graph display (locator C) just lights. This sets the threshold to the automatic gain control amplifier output level.
B	*Null Control.* This potentiometer is used to null out the voltage regulator ripple component of the field current.
C	*Bar Graph Display.* This ten-segment LED displays the ripple level of the exciter diode current.
D	*Gain Control.* This potentiometer adjusts the threshold for indicating an alarm and activating the output relay.

THEORY OF OPERATION

Rectifier diodes mounted on the rotor of a brushless generator or motor fail by either opening or shorting. If a rectifier shorts, very high current flows through the associated exciter armature winding and causes excessive heating and probable failure of the exciter. If a rectifier opens, the voltage regulator will substantially increase the excitation to maintain the operating level. This constant, high level of excitation could lead to failure of the regulator.

The EDM-200 determines the status of the rotating rectifiers by sensing the ripple content of the exciter field current. The waveform shown in Figure 2A is the normal ripple measured with all diodes functional. Figure 2B illustrates a waveform where one diode is open. Figure 2C illustrates a waveform where one diode is shorted.

FUNCTIONAL DESCRIPTION

EDM-200 functional description is illustrated in Figure 3 and described in the following paragraphs.

Input Amplifier

Resistor R is connected in series with the negative lead to the exciter field. The small voltage drop developed across R is amplified by the input amplifier to approximately 1 volt when the generator is unloaded. During various load conditions, the amplifier output will increase from 1 volt to about 4 volts.

Automatic Gain Controlled Amplifier

As the output of the input amplifier varies from 1 to 4 volts, the associated ripple content also varies. To prevent the monitoring circuits from interpreting the 1 to 4 volt change as a diode failure, the automatic gain controlled amplifier offsets the signal variations so that the monitoring circuit monitors the ripple in a constant amplitude signal.

Variable Bandpass Ripple Amplifier

When all of the rotating diodes are operating normally, the field current ripple is of small amplitude and high frequency. When a diode is faulty, the ripple is of large amplitude and low frequency (one-third or one-sixth of normal). Thus, the ripple amplifier has a high gain at low frequencies and a low gain at high frequencies. The amplifier provides adjustment of the high frequency gain to provide compatibility with a wide variety of brushless generators.

Precision Rectifier

This rectifier converts the ac output of the ripple amplifier to a dc signal.

Inverse Timer

The dc output of the precision rectifier passes through an inverse timing network to provide prompt tripping for a shorted diode but allow longer delays for an open diode.

Relay Driver

The relay driver consists of a transistor that controls the relay (K1) coil voltage.

Bar Graph Display

This ten-segment indicator graphically displays the level of ripple and is used during EDM-200 calibration and for monitoring EDM-200 operation.

AVR Ripple Amplifier

Since the AVR output consists of pulses, a strong ripple component consisting of these pulses is present in the field current and makes the detection of an open diode difficult. To eliminate the AVR ripple, the AVR voltage at terminal F+ is passed through a filter, a null adjustment, and the AVR ripple amplifier. The amplifier output is then used by the input amplifier to cancel out the AVR ripple component in the field current.

Power Supply

EDM-200 circuitry operates from a regulated +14 Vdc source that is provided by the transformer-rectifier type power supply. The relay output will be inhibited and the bar graph display may indicate incorrect information until the input voltage is at least 50% of nominal.

MOUNTING

The EDM-200 should be mounted in a position that enables easy viewing of the bar graph display. Figure 4 illustrates the overall dimensions and mounting hole locations of the EDM-200.

CONNECTIONS

Depending upon the application, the EDM-200 should be connected according to the connection drawing shown in Figure 5 or Figure 6. All EDM-200 connections are terminated with #6 screws which have a maximum torque rating of 9 inch-pounds (1 N•m).

CALIBRATION

Before starting EDM-200 calibration, adjust the Gain, Null, and Threshold controls fully counterclockwise.

After EDM-200 calibration, check that it does not trip during buildup, load application, load removal, coast-down, etc.

Standard Calibration: Startup Procedure

1. Start the generator system and check that it operates properly.
2. Ensure that all loads are removed.
3. Ensure that the Alarm and Threshold segments of the bar graph display are not lit.
4. Rotate the Threshold control until the lowest segment (Threshold) of the bar graph display just lights.
5. Rotate the Gain control until the second Ripple segment (third from the bottom) of the bar graph display just lights.
6. Rotate the Null control carefully until the lowest Ripple segment (second from the bottom) of the bar graph display is fully lit.
7. Rotate the Gain control until the second Ripple segment (third from the bottom) of the bar graph display just lights.
8. Carefully rotate the Null control until the lowest segment possible of the bar graph display is still lit.
9. Adjust the Gain control clockwise until the second Ripple segment (not counting the Threshold segment) of the bar graph display is lit.

Standard Calibration: Trip Test

1. Note the number of bar graph display segments that are lit and the physical position (angle of rotation) of the front panel Gain control.
2. Slowly rotate the front panel Gain control clockwise until the top Ripple segment of the bar graph display is lit.
3. After a short time delay (about 5 seconds for a shorted diode or 15 seconds for an open diode), the Alarm segment of the bar graph display will light and the output relay (K1) will energize (change state). This can be verified by checking for an open contact across terminals 11 and 12 and a closed contact across terminals 10 and 11.
4. Rotate the front panel Gain control back to the position noted in step 1 and verify that the relay de-energizes.

Calibration with DECS Controller: Startup Procedure

1. Start the generator system and check that it operates properly.
2. Ensure that all loads are removed.
3. Ensure that the Alarm and Threshold segments of the bar graph display are not lit.
4. Rotate the front panel Threshold control until the lowest segment (Threshold) of the bar graph display just barely lights.
5. Rotate the front panel Gain control until the second Ripple segment (third from the bottom) of the bar graph display just lights.
6. Rotate the front panel Null control fully counterclockwise.
7. Rotate the front panel Gain control until the second Ripple segment (third from the bottom) of the bar graph display just lights.
8. Carefully rotate the front panel Null control until the lowest segment possible of the bar graph display is still lit.
9. Adjust the front panel Gain control clockwise until the second Ripple segment (not counting the Threshold segment) of the bar graph display is lit.

Calibration with DECS Unit: Trip Test

1. Note the number of bar graph display segments that are lit and the physical position (angle of rotation) of the front panel Gain control.
2. Slowly rotate the front panel Gain control clockwise until the top Ripple segment of the bar graph display is lit.
3. After a short time delay (about 5 seconds for a shorted diode or 15 seconds for an open diode), the Alarm segment of the bar graph display will light and the output relay (K1) will energize (change state). This can be verified by checking for an open contact across terminals 11 and 12 and a closed contact across terminals 10 and 11.
4. Rotate the front panel Gain control back to the position noted in step 1 and verify that the relay de-energizes.

MAINTENANCE AND TROUBLESHOOTING

Periodic inspection of the EDM-200 should be made to ensure that the unit is clean and free from accumulations of dust and moisture. When inspecting the unit, check that all electrical connections are clean and secure.

If the EDM-200 fails to operate, check for proper input voltage and correct the wiring if the proper voltage is not present. Incorrect operation may be corrected by recalibrating the EDM-200 according to the procedures of the *Calibration* paragraphs. If these measures fail to restore proper operation, replace the EDM-200 or return it to Basler Electric for repair.

SPECIFICATIONS

EDM-200 specifications are listed in the following paragraphs.

Input Power

Range (±10%):	100 to 120 Vac, 200 to 240 Vac, 380 to 480 Vac, or 528 to 600 Vac
Frequency:	50/60 Hz
Burden:	10 VA

Field Sensing

Sensing Ranges	
Current:	0.5 to 7.0 Adc
Signal Shunt:	20 to 100 mVdc
Exciter Rectifier	
Frequency:	50 to 400 Hz
Ripple Frequency:	150 to 2,000 Hz

Annunciation

Type:	Form C Output Contacts
Rating:	10 Aac at 120/250 Vac 10 Adc at 24 Vdc 0.5 Aac at 125 Vac
Time Delay	
Open Diode:	Approximately 15 s
Shorted Diode:	approximately 5 s

Type Tests

Vibration:	Withstands 5 to 26 Hz at 1.2 G, 27 to 52 Hz at 0.036 in (0.9 mm) double amplitude, and 53 to 1,000 Hz at 5 G
Shock:	Withstands up to 15 G in each of three mutually perpendicular axes

Physical

Temperature	
Operating:	–40 to 70°C (–40 to 158°F)
Storage:	–65 to 85°C (–85 to 185°F)
Weight	
Unit:	3.625 lb (1.64 kg)
Shipping:	4.875 lb (2.21 kg)

Agency Recognition

Output contacts are not UL recognized or CSA certified for voltages greater than 250 volts.

UL:	UL recognized per Standard 508, UL file E75380
CSA:	CSA certified per Standard CAN/CSA-C22.2, No. 14-M91, CSA file LR23131

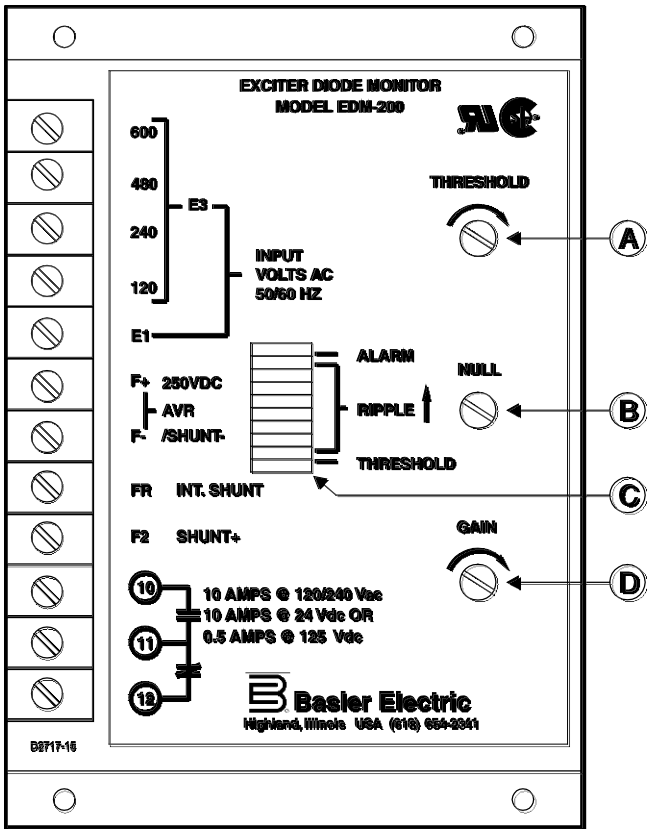

Figure 1. Controls and Indicators

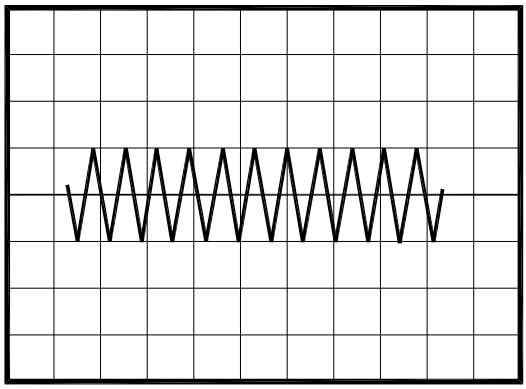

FIGURE A – ALL DIODES NORMAL

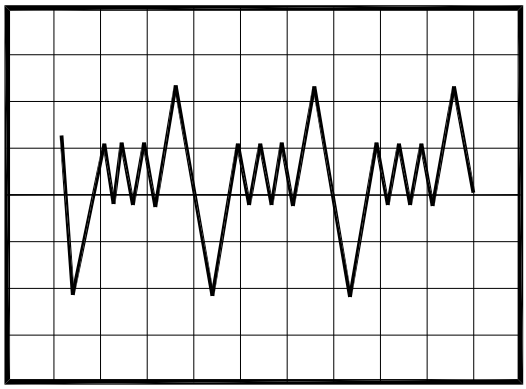

FIGURE B – ONE DIODE OPEN

D2717–13

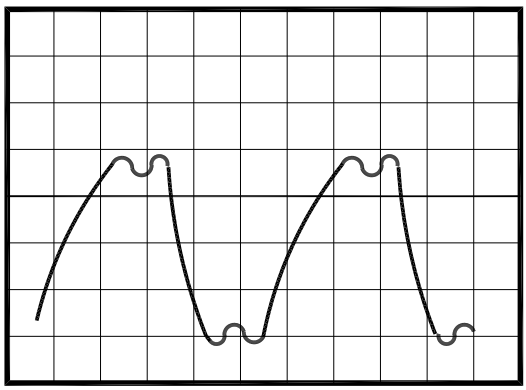

FIGURE C – ONE DIODE SHORTED

Figure 2. Typical Rectifier Diode Waveforms

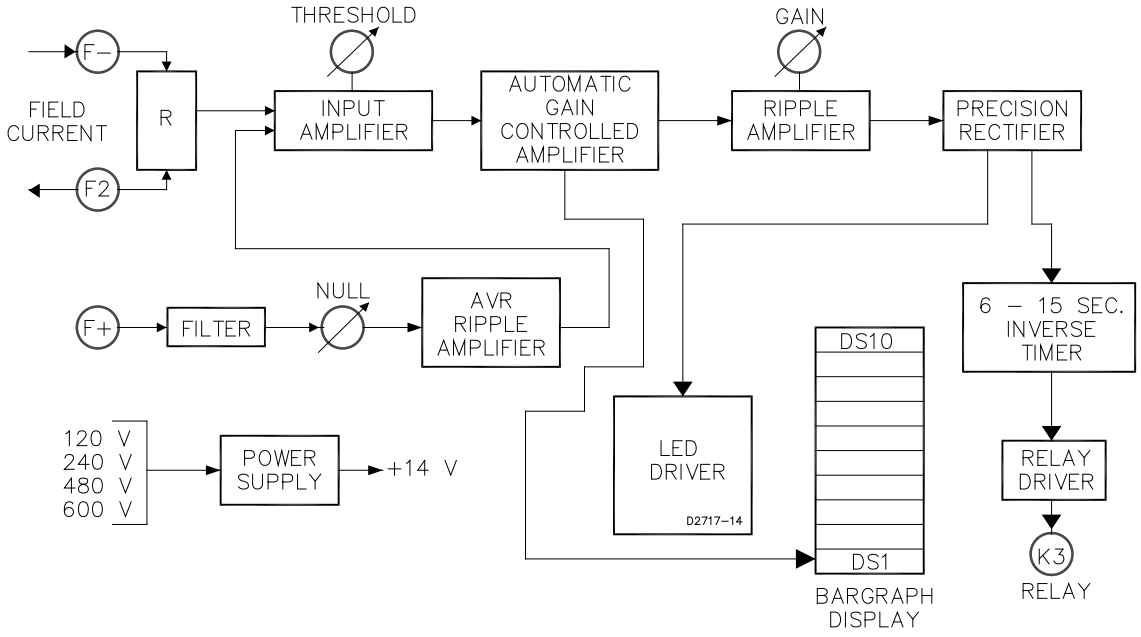

Figure 3. EDM-200 Block Diagram

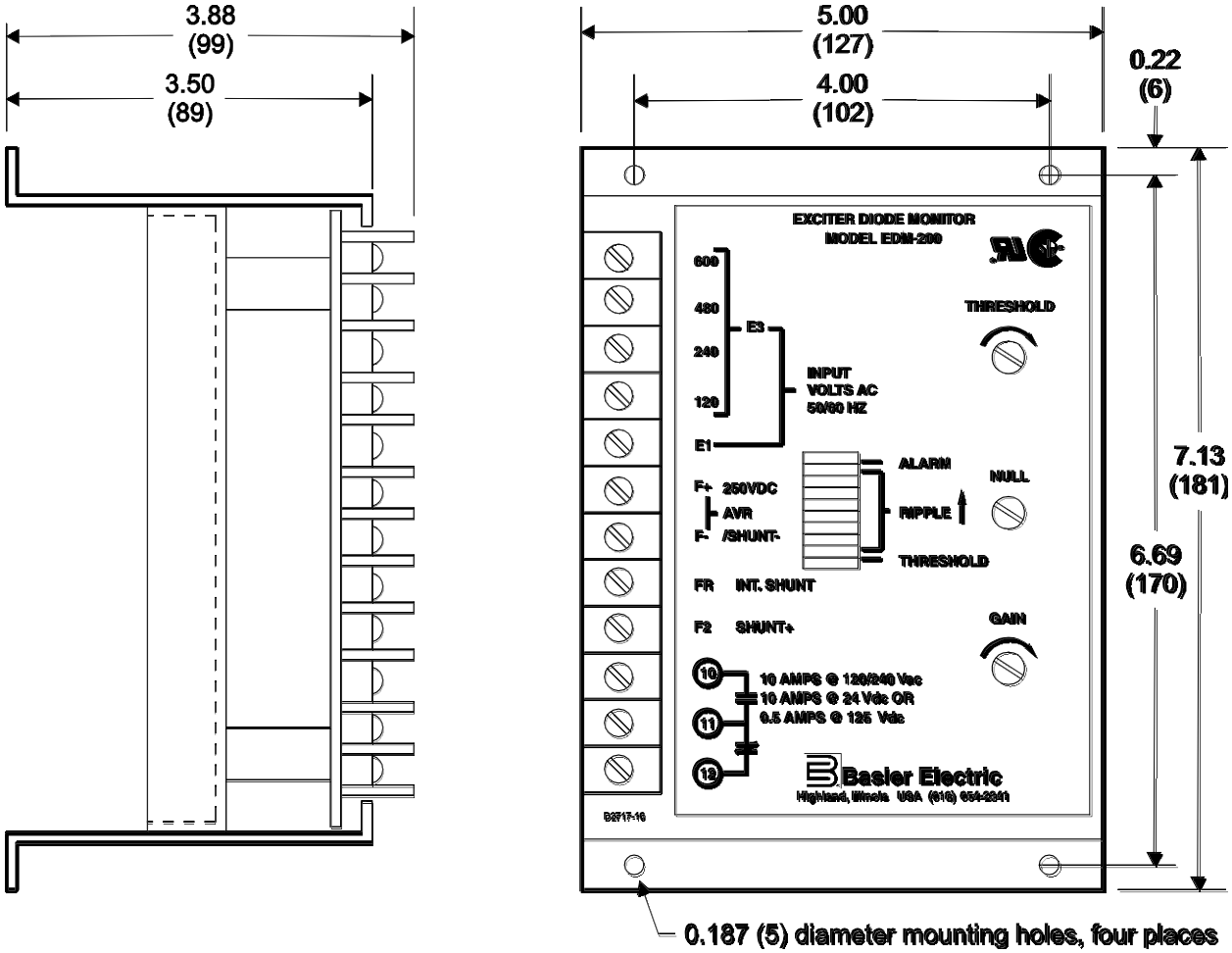

Figure 4. EDM-200 Mounting Dimensions

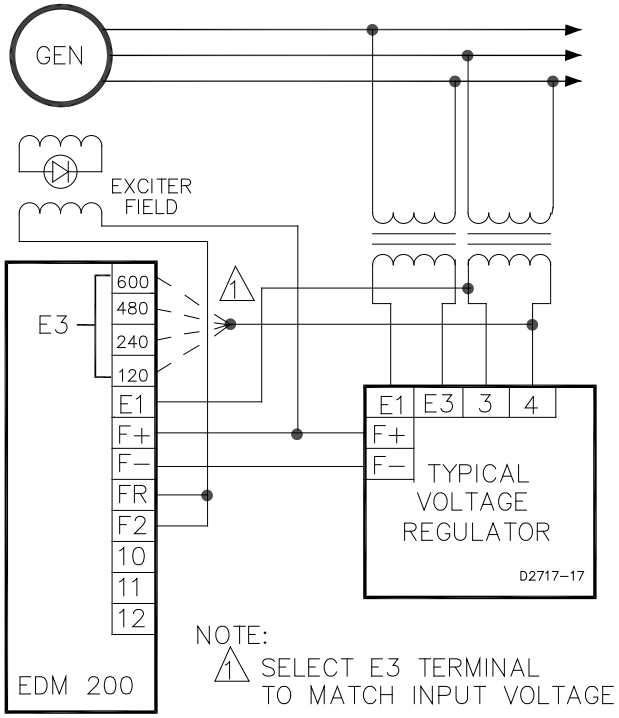

Figure 5. Typical Connections, 0-7 Adc Exciter Current

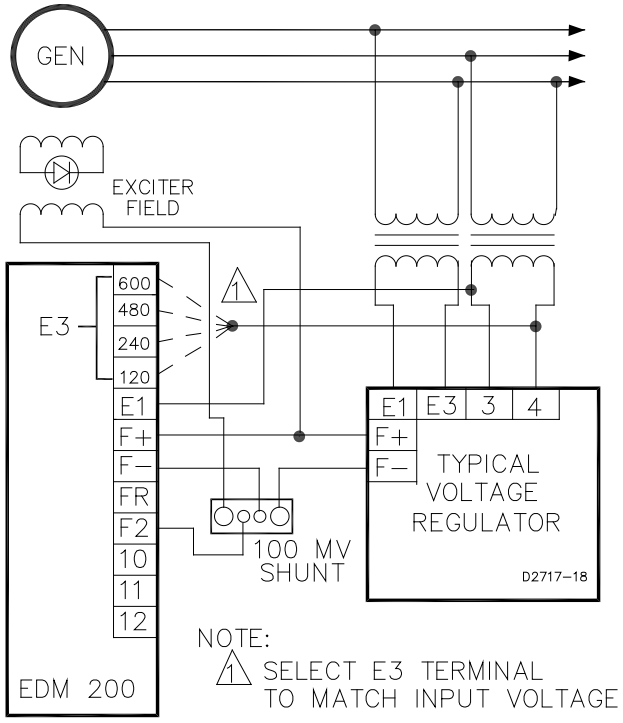

Figure 6. Typical Connections, 100 mV Shunt