g GE Energy	**Functional Testing Specification**
Parts & Repair Services ***Louisville, KY***	**LOU-GED-994D129**

Test Procedure for a Voltage Comparator 994D129G1, G2, G4, and G5.

DOCUMENT REVISION STATUS: Determined by the last entry in the "REV" and "DATE" column

REV.	DESCRIPTION	SIGNATURE	REV. DATE
A	Initial release taken from paper procedure dated 1/19/1984. Procedure needs to be validated before finalizing.	G. Chandler	10/15/2011
B	Added Brunswick specific test, added figure 2, and data sheet for G1 and G2 models	G. Chandler	3/23/2012
C			

PREPARED BY	REVIEWED BY	REVIEWED BY	QUALITY APPROVAL
G. Chandler			Charlie Wade
DATE	**DATE**	**DATE**	**DATE**
10/17/2011			2/23/2012

1. SCOPE

1.1 This is a functional testing procedure for a Voltage Comparator 994D129G1, G2, G4, and G5.

2. STANDARDS OF QUALITY

2.1 Refer to the current revision of the IPC-A-610 standard for workmanship standards.

3. APPLICABLE DOCUMENTS

3.1 The following document(s) shall form part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue shall apply.
- **3.1.1** Check board's electronic folder for more information.
- **3.1.2** Referenced P24B-AL-4960 Test Procedure.
- **3.1.3** Referenced P3K-AL-0218 (125D3225G1/G2) Special Test for RC Contact Protection

4. ENGINEERING REQUIREMENTS

4.1 Equipment Cleaning
- **4.1.1** Equipment should be clean and free of debris prior to applying power unless performing an initial check. Refer to site specific SRA's for cleaning guidelines.

4.2 Equipment Inspection
- **4.2.1** Equipment should be visually inspected for any defects prior to applying power. This inspection should include the following as a minimum:
  - **4.2.1.1** Wires - broken, cracked, or loosely connected
  - **4.2.1.2** Terminal strips / connectors - broken or cracked
  - **4.2.1.3** Components - visually damaged
  - **4.2.1.4** Capacitors - bloated or leaking
  - **4.2.1.5** Solder joints - damaged or cold
  - **4.2.1.6** Circuit board - burned or de-laminated
  - **4.2.1.7** Printed wire runs / Traces - burned or damaged

5. EQUIPMENT REQUIRED

5.1 The following equipment is required to perform the process requirements. Equipment may be substituted provided that all accuracy's and test ratios are equivalent or better.

Qty	Reference #	Description
1		Test Box
2		30VDC Power Supplies
1		Fluke 85 or equivalent
1		Oscilloscope
1		Function Generator

6. Testing Process

6.1 Testing Procedure

6.1.1 Connect +30VDC HQ to Pin 17, -22VDC to Pin 21, and HQ Ground to Pin 19. Connect lights L1 and L2 as shown in figure 1.

6.1.2 Turn R22 and R44 fully CCW.

6.1.3 Apply HQ Ground to Pin-9 (TP1), Pin-31 (TP8), Pin-41 (TP10), and Pin-39 (TP9).

6.1.4 Adjust R21 so that L1 is just on the point of lighting. These may have to be re-adjusted in steps 18 and 36.

6.1.5 Adjust R43 so that VC2 is just on the point of lighting. These may have to be re-adjusted in steps 18 and 36.

6.1.6 Remove the grounds from Pin-9 (TP1), Pin-31 (TP8), Pin-41 (TP10), and Pin-39 (TP9).

6.1.7 Hookup board as per test set up (See figure 1).

6.1.8 Turn R22 and R44 fully counter-clockwise.

6.1.9 Close S1.

6.1.10 Adjust 2K-pot (See figure 1), for +8.0 volts at Pin-31. Check that TP8 reads +8.0 volts.

6.1.11 Adjust R20 for +9.0 volts at Pin-9. Check that TP1 reads +9.0 volts.

6.1.12 Adjust R20 CCW slowly, observing L1. When L1 lights, stop turning R20.

6.1.13 Read the voltage at Pin-9 (TP1).

6.1.13.1 G1 and G2 should be +8.08VDC, +/- 0.3V. See note 1.

6.1.13.2 G4 and G5 should be +8.03VDC, +/- 0.3V. See note 1.

6.1.14 Adjust R20 CW slowly, observing L1. When L1 goes out, stop turning R20.

6.1.15 Read the voltage at Pin-9 (TP1).

6.1.15.1 G1 and G2 should be +8.08VDC, +/- 0.3V. See note 1.

6.1.15.2 G4 and G5 should be +8.03VDC, +/- 0.3V. See note 1.

6.1.16 Turn R20 about “3” turns clockwise.

6.1.17 Turn R22 fully clockwise.

6.1.18 Repeat steps 6.2.11 thru 6.2.15. This time L1 should go out at +8.2VDC, +/- 0.5V. See note 2..

6.1.19 Turn R22 fully (CCW) counter-clockwise.

6.1.20 Adjust 2K pot, for -8.0 volts at Pin-31 (TP8).

6.1.21 Adjust R20 CCW for -7.0VDC at Pin-9 (TP1).

6.1.22 L1 should be out. Adjust R20 CCW slowly observing L1. When L1 lights, stop turning R20.

6.1.23 Read voltage at Pin-9. It should have a value of -8.0VDC, +/- 0.3V.

6.1.24 Adjust R20 CW slowly observing L1. When L1 goes out, stop turning R20.

6.1.25 Read the voltage at Pin-9 (TP1).

6.1.25.1 G1 and G2 should be -7.92VDC, +/- 0.3V. See note 1.

6.1.25.2 G4 and G5 should be -7.97VDC, +/- 0.3V. See note 1.

6.1.26 Turn R20 about "3" turns clockwise.

6.1.27 Turn R22 fully clockwise. Repeat steps 6.2.21 thru 6.2.25. Only this time L1 should go out at -7.8VDC, +/- 0.5V. See note 2.

6.1.28 Turn R22 fully (CCW) counterclockwise.

6.1.29 Open S1 and close S2.

6.1.30 Adjust 2K pot for +8.0 volts at Pin-39 (TP9). Check that TP9 reads +8.0 volts.

6.1.31 Adjust R42 CW for +9.0VDC at Pin-41 (TP10). Check that TP10 reads +9.0 volts.

6.1.32 L2 should not be lighting. Adjust R42 CCW slowly, until L2 lights. When this happens stop turning R42.

6.1.33 Read voltage at Pin-41 (TP10). It should have a value of +8.0VDC, +/- 0.3V.

6.1.34 Adjust R42 slowly CW, L2 should go out. When L2 goes out, stop turning R42.

6.1.35 Read the voltage at Pin-41 (TP10).

6.1.35.1 G1 and G2 should be +8.08VDC, +/- 0.3V. See note 1.

6.1.35.2 G4 and G5 should be +8.03VDC, +/- 0.3V. See note 1.

6.1.36 Turn R44 fully clockwise. Repeat steps 6.2.31 thru 6.2.35. This time L2 should go out at +8.2VDC, +/- 0.5V. See note 2.

6.1.37 Turn R44 fully (CCW) counterclockwise.

6.1.38 Adjust 2K pot (see test set up) for -8.0 volts at Pin-39 (TP9).

6.1.39 Adjust R42 CCW for -7.0VDC at Pin-41 (TP10).

6.1.40 L2 should be out. Adjust R42 CCW slowly, until L2 lights. When this happens stop turning R42.

6.1.41 Read voltage at Pin-41. It should have a value of -8.0VDC, +/- 0.3V.

6.1.42 Adjust R42 slowly CW, observing L2. When L2 goes out, stop turning R42.

6.1.43 Read the voltage at Pin-41 (TP10).

6.1.43.1 G1 and G2 should be -7.92VDC, +/- 0.3V. See note 1.

6.1.43.2 G4 and G5 should be -7.97VDC, +/- 0.3V. See note 1.

6.1.44 Turn R44 fully clockwise. Repeat steps 6.2.39 thru 6.2.43. This time L2 should go out at -7.8VDC, +/- 0.5V. See note 2.

6.1.45 Turn R44 fully (CCW) counterclockwise.

6.1.46 Connect oscilloscope in place of L1.

6.1.47 Set R20 and R42 for zero volts at TP1 and TP10, respectively.

6.1.48 Close S1, adjust the 2K pot for +5VDC at Pin-31 (TP8).

6.1.49 Open S1. Connect S1 to trigger the scope. Close S1 and observe the trace on opening or closing on the scope. The pickup time should be less than 16ms.

6.1.50 Open S1 and observe the dropout time of the VC. It should be less them 30ms.

6.1.51 Connect up the oscilloscope in place of L2

6.1.52 Close S2 and observe the trace on the oscilloscope. The pickup time should be less than 16ms.

6.1.53 Open S2 (S8) and observe the trace on the scope. The dropout time should be less than 30ms.

Note: 1

For G1 and G2 cards, when hysteresis pot (R22 or R44) is set full CCW, the difference between pick-up voltage and drop-out voltage must be less than 80mv. For G4 and G5, when hysteresis pot (R22 or R44) is set full CCW, the difference between pick-up voltage and drop-out voltage must be less than 30mv.

Note: 2

For G1, G2, G4, and G5 cards, when hysteresis pot (R22 or R44) is set full CW, the difference between pick-up voltage and drop-out voltage must be greater than 200mv.

6.1.54 Post Testing Burn-in Required _X_ Yes ___ No

6.2 TEST COMPLETE for all cards without RC Contact Protection.

6.3 Testing Procedure for Cards with RC Contact Protection. Use new hand written test (9336) to be used for RC contact Protection, reference P3K-AL-0218 (125D3225G1/G1).

6.3.1 This test should be carried out if the VC output relays have RC Contact Protection. Connect up the VC board as in Figure 2.

6.3.2 Circuit 1

6.3.2.1 Set Voltage Vo to 2VAC at 200 Hz

6.3.2.2 Increase frequency until voltage drops to 1.41V

6.3.2.3 Frequency should be between 3984 Hz and 5976 Hz

6.3.3 Circuit 2

6.3.3.1 Set Voltage Vo to 2VAC at 200 Hz

6.3.3.2 Increase frequency until voltage drops to 1.41V

6.3.3.3 Frequency should be between 3984 Hz and 5976 Hz

6.3.4 Circuit 3

6.3.4.1 Set Voltage Vo to 2VAC at 200 Hz

6.3.4.2 Increase frequency until voltage drops to 1.41V

6.3.4.3 Frequency should be between 3984 Hz and 5976 Hz

6.3.5 Circuit 4

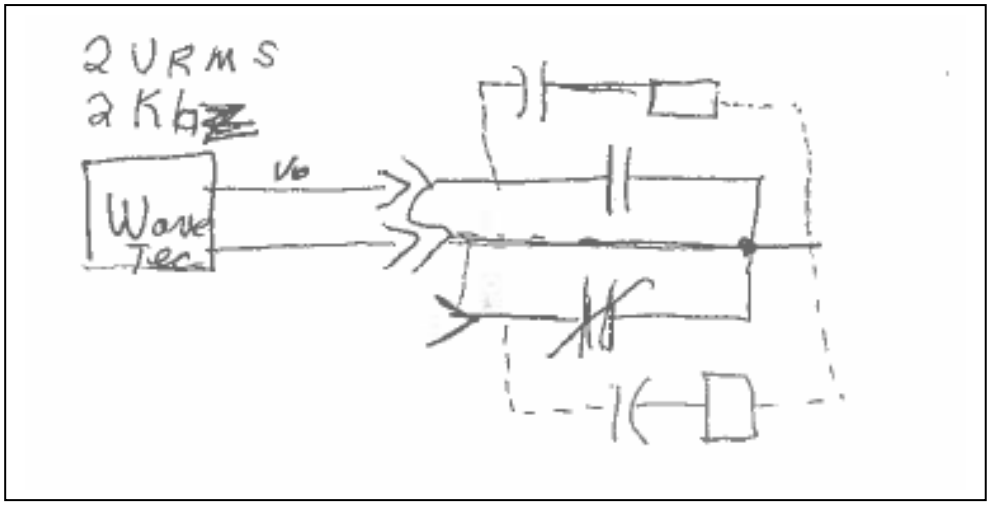
6.3.5.1 Set Voltage Vo to 2VAC at 200 Hz

6.3.5.2 Increase frequency until voltage drops to 1.41V

6.3.5.3 Frequency should be between 3984 Hz and 5976 Hz

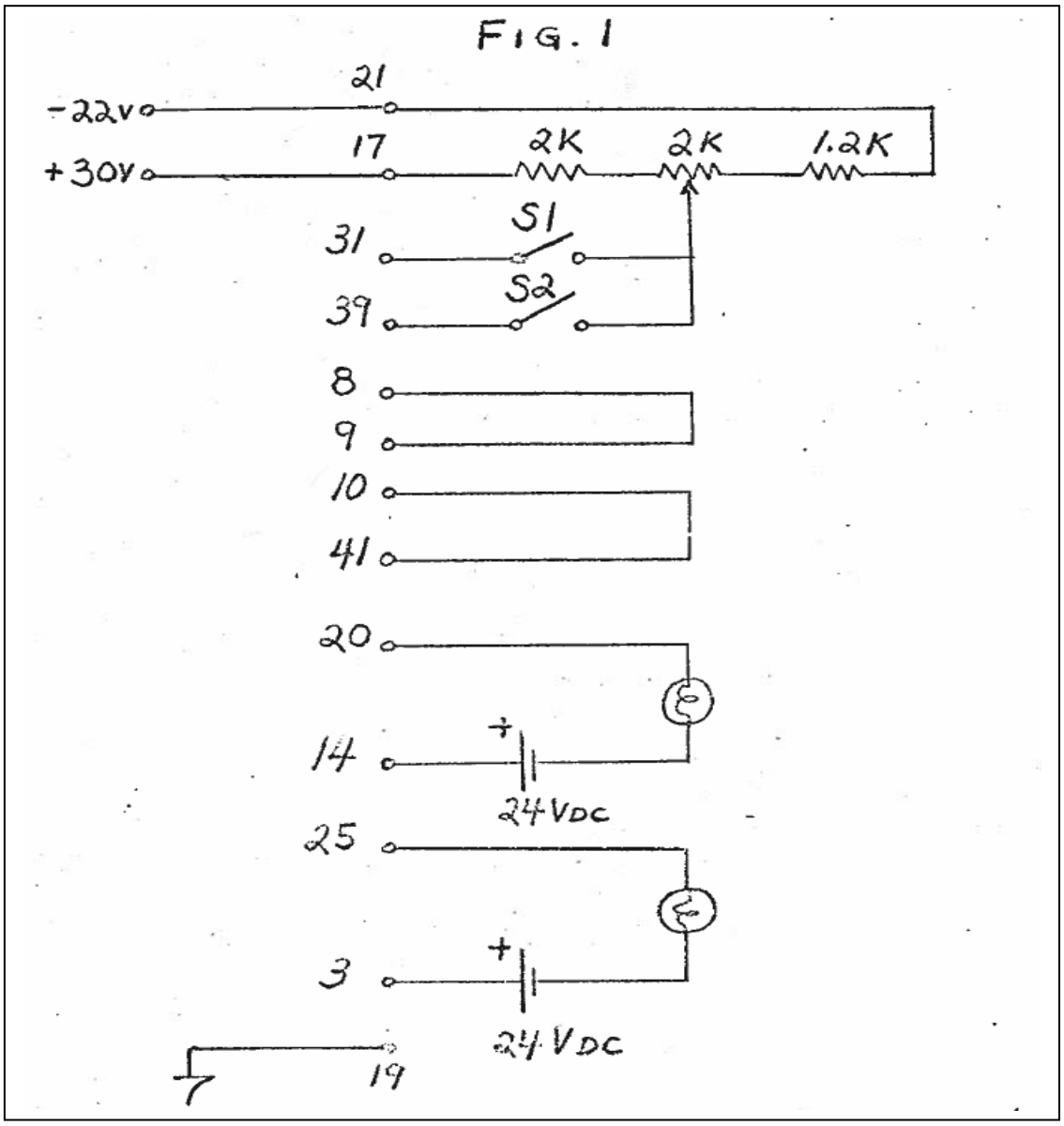
6.4 ******TEST COMPLETE ******

FIGURE 2



7. Notes

7.1 The setup below is for testing. You can reference the drawing on the following page for more information on connections.



8. <u>Brunswick Specific 994D129G0001 & G0002</u>

8.1 R22 & R44 full CCW.

8.2 Setup Figure 1 of test P24B-AL-4960

8.3 Remove jumper from pin-8 to pin-9 and jumper pin-8 to pin-31

8.4 Round pin-9

8.5 Adjust R20 for P/U - D/O (approx) 0V at TP8

8.6 Set R22 for a dead band of 100mV at TP8. (Aprox ___ turns CW). (PU + and DO-).

8.7 Adjust R20 for 0.00V at TP8

8.8 Adjust R21 CW for lamp to just light.

8.9 Verify P/U at 0.000V and D/O at -0.100V

8.10 Repeat procedure for second circuit.

8.11 Remove jumper pin-10 to pin-41 and jumper pin10 to pin-39

8.12 Round pin-41

8.13 Adjust R20 for P/U - D/O (approx) 0V at TP9

8.14 Set R44for a dead band of 100mV at TP9. (Aprox ___ turns CW). (PU + and DO-).

8.15 Adjust R42 for 0.00V at TP9

8.16 Adjust R43 CW for lamp to just light.

8.17 Verify P/U at 0.000V and D/O at -0.100V.

8.18 Data Sheet for Test Procedure (994D129G1, G2, G4, and G5) (Three sheets)

Job # _____

Serial # _____ Burn-in Start _____

Date _____

Data Sheet for ____996D957G0001 & G0002____Page 1__ Burn-in Stop _____

Test Procedure ___P24B-AL-4816_____ Technician _____

Test Procedure Step	Nominal	Lower Limit	Pre-Burn in Results	Post Burn in Results	Upper Limit	Pot Values If applicable CW	Pot Values If applicable CCW	Pass/Fail
6.1.4 R21	Lamp On "Dim"	-		-				
6.1.5 R43	Lamp On "Dim"	-		-				
6.1.10 Pin-31 (TP8)	+8.0VDC	-		-				
6.1.11 Pin-9 (TP1)	+9.0VDC	-		-				
6.1.12 L1	Lamp "On"	-		-				
6.1.13 Pin-9 (TP1)	+8.08VDC	+7.78VDC		+8.38VDC				
6.1.14 L1	Lamp "Off"	-		-				
6.1.15 Pin-9 (TP1)	+8.08VDC	+7.78VDC		+8.38VDC				
6.1.18 Pin-9 (TP1)	+8.2VDC	+7.7VDC		+8.8VDC				
6.1.20 Pin-31 (TP8)	-8.0VDC	-		-				
6.1.21 Pin-9 (TP1)	-7.0VDC	-		-				
6.1.22 L1	Lamp "On"	-		-				
6.1.23 Pin-9 (TP1)	-8.0VDC	-7.7VDC		-8.3VDC				
6.1.24 L1	Lamp "Off"	-		-				
6.1.25 Pin-9 (TP1)	-7.92VDC	-7.62VDC		-8.22VDC				
6.1.27 L1	Lamp "Off"	-		-				
6.1.27 Pin-9 (TP1)	-7.8VDC	-7.3VDC		-8.2VDC				
6.1.30 Pin-39 (TP9)	+8.0VDC	-		-				
6.1.31 Pin-41 (TP10)	+9.0VDC	-		-				
6.1.32 L2	Lamp "On"	-		-				
6.1.33 Pin-41 (TP10)	+8.0VDC	+7.7VDC		+8.3VDC				
6.1.34 L2	Lamp "Off"	-		-				
6.1.35 Pin-41 (TP10)	+8.08VDC	+7.78VDC		+8.38VDC				
6.1.36 L2	Lamp "Off"	-		-				
6.1.36 Pin-41 (TP10)	+8.2VDC	+7.7VDC		+8.7VDC				

Page 2 data sheet

Job # _____

Serial # _____ Burn-in Start _____

Date _____

Data Sheet for ____996D957G0001 & G0002___Page 2__ Burn-in Stop _____

Test Procedure ___P24B-AL-4816_____ Technician _____

Test Procedure Step	Nominal	Lower Limit	Pre-Burn in Results	Post Burn in Results	Upper Limit	Pot Values If applicable CW	Pot Values If applicable CCW	Pass/Fail
6.1.38 Pin-39 (TP9)	-8.0VDC	-		-				
6.1.39 Pin-41 (TP10)	-7.0VDC	-		-				
6.1.40 L2	Lamp "On"	-		-				
6.1.41 Pin-41 (TP10)	-8.0VDC	-7.7VDC		-8.3VDC				
6.1.42 L2	Lamp "Off"	-		-				
6.1.43 Pin-41 (TP10)	-7.92VDC	-7.62VDC		-8.22VDC				
6.1.44 L2	Lamp "Off"	-		-				
6.1.44 Pin-41 (TP10)	-7.8VDC	-7.3VDC		-8.2VDC				
6.1.48 Pin-31 (TP8)	+5VDC	-		-				
6.1.49 Scope	<16ms							
6.1.50 Scope	<30ms							
6.1.52 Scope	<16ms							
6.1.53 Scope	<30ms							
Contact Protection								
6.3.2 Circuit 1		3984 Hz			5976 Hz			
6.3.2 Circuit 2		3984 Hz			5976 Hz			
6.3.2 Circuit 3		3984 Hz			5976 Hz			
6.3.2 Circuit 4		3984 Hz			5976 Hz			

Page 3 data sheet

Job # _____

Serial # _____ Burn-in Start _____

Date _____

Data Sheet for ____996D957G0001 & G0002___Page 3___ Burn-in Stop _____

Test Procedure ___Burnwick Specific_____ Technician _____

Test Procedure Step	Nominal	Lower Limit	Pre-Burn in Results	Post Burn in Results	Upper Limit	Pot Values If applicable CW	CCW	Pass/Fail
8.5 - R20 - TP8	0.0V							
8.6 - R22	100mV							
8.7 - R20 - TP8	0.0V							
8.8 - R21	Lamp "On"							
8.9a - P/U	0.000V							
8.9b - D/O	-0.100V							
8.13 - R20 - TP9	0.0V							
8.6 - R44	100mV							
8.7 - R42 - TP9	0.0V							
8.8 - R43	Lamp "On"							
8.9a - P/U	0.000V							
8.9b - D/O	-0.100V							