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Electronic Products Repair

Test Instructions for

0621L0117 G001 & G002
Device Number

Six pulse non reversing speed current control card
Description of Device

Originated By: Dennis Cully
Typed Name

Date: April 4, 2005
mm/dd/yy

Approved By: Lucio carrescia
Signature

Approval Date: April 4, 2005
mm/dd/yy

TEST INSTRUCTIONS

PREVIOUS REVISION SHEET

0621L0117 G001 & G002
Device Number
Six pulse non reversing speed current control card
Description of Device

Originated By	**Date mm/dd/yy**	**Description of change**
Dennis Cully	April 4, 2005	Created test instructions for Six pulse non reversing speed current control card 0621L0117 G001 & G002
Dennis Cully	April 4, 2005	Created cover and revision sheet
Dennis Cully	April 4, 2005	Created new format and added upgrades
S. Pharris	March 13, 2013	Added step 4e.

TEST INSTRUCTIONS

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Location: Book or file File

Six pulse non reversing speed current control card
0621L0117 G001 & G002 Pg.: 3/13
Date: April 4, 2005~~March 15, 2013~~~~April 4, 2005~~

1. PURPOSE:

   a. Static and dynamic test procedures for Six pulse non reversing speed current control card 0621L0117 G001 & G002

2. ELEMENTARY:

   a. 0291A3387

3. EQUIPMENT:

   a. Dedicated station test box TL# 363
   b. Digital Multi meter
   c. Regulated Power Supply
   d. Oscilloscope
   e. Interface DII card 621L115 - 118
   f. Resistors 2MΩ & 100KΩ

4. SET UP:

   a. Make the following connection:
      i. 0° to cp205.
      ii. 180° to cp204.
      iii. 120° to cp201.
      iv. 300° to cp200.
      v. 240° to cp202.
      vi. 60° to cp203.
      vii. CT to cp220.
      viii. P1FG to cp001.
      ix. P1FC to cp002.
      x. P2FG to cp003.
      xi. P2FC to cp004.
      xii. P3FG to cp005.
      xiii. P3FC to cp006.
      xiv. N1FG to cp007.
      xv. N1FC to cp008.
      xvi. N2FG to cp009.
      xvii. N2FC to cp010.
      xviii. N3FG to cp011.
      xix. N3FC to cp012.
      xx. Ø1 acct F1 to cp146.

xxi. Ø1 acct F2 to cp147
xxii. Ø2 acct F1 to cp148
xxiii. Ø2 acct F2 to cp149
xxiv. Ø3 acct F1 to cp150
xxv. Ø3 acct F2 to cp151

b. **Install the interface DII card (912 Jig)–621L115 - 118 and set the switches in the following positions.**
   i. 1 out (cr. 2).
   ii. 2 in (cr. 2).
   iii. 3 in (cr. 2).
   iv. 5 out (cr. 2).
   v. 6 in (cr. 2).
   vi. 7 in (cr. 2).
   vii. 8 in (cr. 2).
   viii. 9 in (cr. 2). 10 in (cr. 2).
   ix. Suicide off.
   x. 3000 / 3100 to 3100.

c. Make sure that the cp. jumpers are as follows:
   i. Cp030 to cp031
   ii. Cp032 to cp033
   iii. Cp035 to cp036
   iv. Cp039 to cp040
   v. Cp041 to cp042
   vi. Cp043 to cp044
   vii. Cp045 to cp046
   viii. Cp049 to cp050
   ix. Cp062 to cp063
   x. Cp181 to cp182
   xi. Cp206 to cp207.

d. Set all unsealed pots. CCW~~.~~

e. ~~e~~ If connected remove connection between CP250 to CP251

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5. ~~PROCEDURE~~INSTRUCTION:

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a. **Static Tests**
   i. **AC Input Power**
      1. Make sure that the main 3ϕ 600 VAC is turned on.
      2. Apply 3ϕ 208/120 VAC power to panel with the disconnect switches.
      3. Turn panel CB1 up to apply AC power to the card.
      4. With oscilloscope observe that the inputs are between 28 & 34 volts AC p-p. Phase shift is not important.

a. Cp205 is 0°.
b. Cp204 is 180°.
c. Cp203 is 60°.
d. Cp202 is 240°.
e. Cp201 is 120°.
f. Cp200 is 300°.

5. Observe that the phase shift inputs are between 22 & 26 volts AC p-p. Phase shift is not important.
   a. Cp210 is 30°.
   b. Cp211 is 210°.
   c. Cp212 is 90°.
   d. Cp213 is 270°.
   e. Cp214 is 150°
   f. Cp215 is 330°.

ii. **DC Power**

1. P15 VDC @ 1TB39 15.0 ±1.5V <300 MV p-p ripple.
2. N15 VDC @ 1TB37 15.0 ±1.5V <300 MV p-p ripple.
3. Adjust R16 for P10 VDC @ 1TB40 ±100 MV < 30 MV p-p ripple.
4. Adjust R15 for N10 VDC @ 1TB36 ±100 MV < 30 MV p-p ripple.
5. P5 VDC @ cp206 ±200 MV < 30 MV p-p ripple.
6. N5.6 VDC @ cp208 ±1.9V

iii. **Phase Rotation Circuit**

1. With the 6ϕ AC power applied in the correct sequence and the suicide down L180 should be illuminated.
2. Reverse 0° and 180° and note that L111, L113 and L181 illuminate.
3. Replace 0° and 180° and note that step 2 stays true until PB100 is pressed and released.

iv. **Reset**

1. Depress and release PB100 and observe that the IEC relay picks up after 100 MS ±50 MS.
2. With the oscilloscope observe the 100msec ±50msec delay between cp115 (when released) and cp103 and the 850µsec ±350 µsec wide pulse on cp103.

v. **Phase Loss and Relay Driver**

1. With initial card power up the phase loss circuit will be in a "trip" state until it sees the reset pulse from the PTD circuit (cp103), so L100 & L181 will both be lit for ~100 MS after power up and then go out until a fault occurs.
2. With correct card phasing sequence verify the following:
   a. L111, L113 & L181 are off.
   b. CP182 is at logic "1"(+5 VDC ±200 MV).

c. The volt between 1TB29(+)& 1TB37(-) is +22Vdc ±3V DC (relay on).
d. With the phase loss switch down, 0° removed, L181 is lit.
e. With the phase loss switch up, L111, L113 & L181 are lit.
f. Verify That CP182 is at logic "0"(+250 MV ±100 MV).
g. Voltage between 1TB29 & 1TB37 is ~2 VDC (relay drops out).
h. With PB100 depressed, L111, L113 & L181 still lit.
i. With PB100 released, (after RESET delay) 1), 2) & 3) are met again.
j. Reconnect any removed connections.

vi. **Lockouts, IEC and Fault Finder Logic**

1. The voltage on 1TB28 should be zero VDC, L100 and L181 should not be illuminated.
2. The voltage on cp100 should be -8.50 VDC ±500 MV.
3. The voltage from 1TB29(+) to 1TB37(-) should be +22 VDC ±3 VDC.
4. Cp104 should be +5VDC ±200 MV.
5. Suicide switch up
6. Note:
   a. That L111 and L113 are illuminated.
   b. Cp104 should be +5VDC ±200 MV.
   c. Cp108 and cp110 should be -15VDC. ±1.5V.
7. Suicide switch down.
8. Both L111 and L113 should be extinguished.
9. Voltage on cp108 and cp110 should be 0VDC ±500 MV.
10. L100 and L181 should be extinguished.
11. Cp104 should be +5VDC ±200 MV.
12. Apply 0VDC to 1TB28 with power supply.
13. Slowly increase the voltage on 1TB28 and note when L111 illuminates. This should occur at +350 MV ± 150 MV.
14. The voltages on cp104 should be + 5 VDC. ±200 MV.
15. Continue to slowly increase the voltage on 1TB28 to +10VDC ±1 2V until IEC trip occurs.
    a. This should result in L100, L111 and L113 being illuminated
    b. Cp104 goes to 0VDC ±500 MV
16. Reduce the power supply on 1TB28 to 0VDC
    a. The voltage on cp104 should return to +5VDC ±200 MV.
    b. L100, L111 and L113 remain illuminated
    c. 100 MS ±50 MS after PB100 is depressed and released, L100, L111 and L113 extinguishes.
17. Remove the power supply from 1TB28.

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vii. **Zero IC21**

1. Remove jumper from cp030 to cp031.
2. Connect cp031 to 1TB38.
3. Suicide switch down.
4. Connect a 2MΩ resistor between 1TB3 and 1TB4.
5. Adjust R4 to give 0VDC ±10 MV on 1TB4 (Wait at least ten sec. after each adjustment of R4).
6. Remove jumper from cp031 and 1TB38 and replace the original jumper between cp030 and cp031.

viii. **Zero IC20**

1. Turn R2 and R3 CW.
2. Remove the 2MΩ resistor from 1TB3 and 1TB4
3. 1TB1 should be 0VDC with R14 CCW.
4. Adjust output on 1TB4 to 0VDC. ±10 MV with R1.

ix. **Positive Ramp and Suicide (Maximum Ramp Rate - set R2&3 CW)**

1. Suicide switch up.
2. 1TB1 should be +10VDC with R14 CW.
3. Suicide switch down.
4. Output on 1TB4 should ramp to +10VDC ±400 MV in 450 MS ±150 MS.
5. Suicide switch up.
6. Output on 1TB4 should snap to 0VDC ±10 MV and voltage on 1TB8 should be between -10VDC & -15VDC.

x. **Negative Ramp and Suicide (Maximum Ramp Rate)**

1. On D2 Card set switch 5 in.
2. Suicide switch down.
3. Output on 1TB4 should ramp to -10VDC ±400 MV in 450 MS ±150 MS.
4. Suicide switch up.
5. Output on 1TB4 should snap to 0VDC ±10 MV and voltage on 1TB8 should be between +10VDC & +15VDC.

xi. **Minimum Ramp Rate**

1. Put R2 and R3 CCW.
2. On D2 card set switch 5 in.
3. Suicide switch down.
4. Output on 1TB4 should ramp to -10VDC ±400 MV in 9 seconds ±2 seconds.
5. Suicide switch up.
6. On D2 card set switch 5 out.
7. Suicide switch down.
8. Output on 1TB4 should ramp to +10VDC ±400 MV in 9 seconds ±2 seconds.

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9. Suicide switch off.
10. Put R14 CCW and R2 and R3 CW.

xii. **Auxiliary operational amplifier.**

1. **IC44 & IC45**
2. Disconnect wire on 1TB35.
3. Connect 1TB1 to 1TB35
4. Turn R14 CCW
5. On D2 card set switch 5 in.
6. 1TB34 = 0VDC ±40 MV and 1TB32 = 0VDC ±80 MV
7. Tie 1TB34 to COMM
8. 1TB32 should be = 0VDC ±40 MV.
9. Remove COMM from 1TB34
10. Leave 1TB1 tied to 1TB35.
11. Turn R14 to -10V @ 1TB35.
12. 1TB34 should be +10VDC ±250 MV
13. Turn R14 to +10V @ 1TB34.
14. 1TB32 should be -10VDC ±250 MV.
15. Put switch 5 out.
16. Turn R14 to +10V @ 1TB35.
17. 1TB34 should be -10VDC ±250 MV.
18. Turn R14 to -10V @ 1TB34.
19. 1TB32 should be +10VDC ±250 MV.
20. Turn R14 CCW
21. Remove 1TB1 from 1TB35.
22. Reconnect wire to 1TB35.

xiii. **Speed Regulator Amplifier**

1. **Zero IC40**
   a. Ensure that the voltage on 1TB12 is -10VDC ±500 MV
   b. 1TB10 should be +10VDC ±500 MV.
   c. Adjust R5, and R7 through R10 CW.
   d. Suicide switch down.
   e. Connect a 2MΩ resistor between 1TB13 and 1TB16 with 1TB16 & 1TB7 wires disconnected.
   f. On D2 card set switch 2 out and set R14 (voltage source) CCW.
   g. Adjust voltage on 1TB22 to 0VDC ±10 MV with R6.
   h. Remove the 2MΩ resistor from 1TB13 and 1TB16.
   i. Reconnect 1TB7 and 1TB16.
2. **Minimum Current Limit**
   a. Set R10 and R14 CW. On D2 card set switch 2 in.
   b. Suicide switch down.

c. With R7 CCW output on 1TB22 should be −500 MV ±100 MV
d. Output on 1TB9 should be +500 MV ±100 MV.
e. On D2 card set switch 5 in.
f. With R8 CCW output on 1TB22 should be +500 MV ±100 MV
g. Output on 1TB9 should be −500 MV ±100 MV.
h. Suicide switch off(Center Position)
i. Voltage on 1TB22 should snap to 0VDC.

3. **Maximum Current Limit**
   a. Suicide switch down.
   b. Apply +10VDC to 1TB6 (via R14 reference potentiometer through ramp circuit) with switch 5 on D2 card out.
   c. Output on 1TB22 should be −500 MV ±100 MV.
   d. Turn R7 CW.
   e. Output on 1TB22 should be ≥ -10VDC.
   f. Turn R7 until output clamps at -10VDC ±5 MV.
   g. On D2 card set switch 5 in.
   h. Output on 1TB22 should be +500 MV ±100 MV.
   i. Turn R8 CW.
   j. Output on 1TB22 should be ≥ +10 VDC.
   k. Turn R8 until output clamps at +10VDC ±5 MV.
   l. Suicide switch up.
4. **Invert operational amplifier IC42**
   a. With R10 CCW and 0VDC @ 1TB21 the offset on 1TB14 should be 0VDC ±40 MV.
   b. Suicide switch down and turn R10 CW.
   c. Adjust -10VDC on 1TB6, with switch 5-in and R14 CW.
   d. Turn R10 CW until 1TB22 is +10VDC.
   e. Output on 1TB14 should be -10VDC ±250 MV.
   f. On D2 card set switch 5 out and R14 CW.
   g. Output on 1TB14 should be +10VDC ±250 MV.
5. **Current Regulator Amplifier**
   a. **Zero**
      i. Connect a 100KΩ resistor between 1TB18 and 1TB23.
      ii. Remove wire from 1TB15.
      iii. On D2 card set switch 3 out for 0V at 1TB17, with R14 CCW.
      iv. Suicide switch down.
      v. Adjust output of 1TB23 to 0VDC ±10 MV with R12.
   b. **Functionality**
      i. Remove the 100KΩ from 1TB18 and 1TB23.
      ii. Reconnect wire to 1TB15.
      iii. Ensure that the voltage on cp37 is −850 MV ±100 MV.

iv. Ensure that the voltage on cp38 is +850 MV ±100 MV (they should be fairly balanced).
v. Apply + 10 VDC to 1TB17 by setting switch 3 in, switch 5 out (CR.2) and R14 CW.
vi. Output on 1TB23 should be ≤ -10VDC
vii. Output on 1TB18 should be +1.6VDC ±200 MV.
viii. Suicide switch up.
ix. Ensure that 1TB23 snaps to 0VDC.
x. Suicide switch down.
xi. Adjust -10VDC at 1TB17 with switch 5 in and R14 CW.
xii. Output on 1TB23 should be ≥ +10VDC
xiii. Output on 1TB18 should be -1.6VDC ±200 MV.
xiv. Remove jumper from cp043 and cp044
xv. Connect a jumper between cp044 and 1TB23
xvi. Note that the output on 1TB23 is +7.5VDC ±250 MV
xvii. Note that the voltage on 1TB18 is 0VDC ±10 MV.
xviii. Suicide switch up
xix. Ensure that 1TB23 snaps to 0VDC.
xx. Remove the connection cp044 and 1TB23
xxi. Connect the original jumper between cp043 and cp044.

6. **Auxiliary Functions**
   a. Cp255 should be +10VDC ±500 MV.
   b. Cp257 should be -10VDC ±500 MV.
   c. Turn R17 and R18 CCW.
   d. Connect cp256 to cp257
   e. With 0VDC on 1TB43 (via R13 CCW):
      i. Cp251 should be 0VDC ±55 MV.
      ii. Cp252 should be 0VDC ±60 MV.
      iii. Cp253 should be 0VDC ±80 MV.
   f. Adjust R017 CW:
      i. Cp251 should be +2.0VDC ±355 MV.
      ii. Cp252 should be +2.0VDC ±360 MV.
      iii. Cp253 should be -2.0VDC ±380 MV.
   g. Adjust R018 CW:
      i. Cp251 should be +700 MV ±355 MV.
      ii. Cp252 should be +10.5VDC ±360 MV.
      iii. Cp253 should be -10.5VDC ±380 MV.
   h. Remove jumper from cp256 and cp257
   i. Connect cp257 to cp258
   j. Turn R017 CW and R018 CCW.

k. Apply +10VDC to 1TB43 (via R13): with switch 5 out and R13 CW.
   i. Cp251 should be 0VDC ±1V.
   ii. Cp252 should be 0VDC ±1.10V.
   iii. Cp253 should be 0VDC ±1.20V.
l. Apply -10VDC to 1TB43: with switch 5 in.
   i. Cp251 should be 0VDC ±1V.
   ii. Cp252 should be 0VDC ±1.10V.
   iii. Cp253 should be 0VDC ±1.20V
m. Remove the jumper cp257 - cp258.
n. Install cp250 - cp251
o. Turn R18 CCW and R17 CW.
p. Cp252 should be -2.0VDC ±360 MV.
q. Cp253 should be +2.0VDC ±380 MV.
r. Turn R18 CW:
   i. Cp252 should be -10.5VDC ±360 MV.
   ii. Cp253 should be +10.5VDC ±380 MV.

xiv. **Current Feedback**

1. Note: burden resistor between 1TB28 and COMM is already in place via the interface card.
2. Apply 10 VAC RMS to cp146 and to cp147.
3. Repeat for cp148 and cp149.
4. Repeat for cp150 and cp151 in turn.
5. Measure +7.5VDC ±500 MV on 1TB28.
6. Measure +7.5VDC ±580 MV on 1TB41 for each set.

xv. **Gate Pulse Generator**

1. Remove jumper from cp062 and cp063.
2. Suicide switch up.
3. Connect 1TB1 to 1TB23.
4. Output on cp085, cp086, cp087, cp088, cp089 and cp090 should be +15VDC.
5. Adjust R14 until + 8VDC is applied to 1TB23.
6. Put suicide switch down.
7. Measure pulses with oscilloscope (comparing channel 1 on 0° with channel 2)(Scope across Green and Red banana jacks on front of tester)
   a. P1 occurs at 120° ± 5°.
   b. P2 occurs at 240° ± 5°.
   c. P3 occurs at 0° ± 5°.
   d. N1 occurs at 300° ± 5°.
   e. N2 occurs at 60° ± 5°.
   f. N3 occurs at 180° ± 5°.

Each pulse width should be 500µs ± 125µs with its multiplexed pulse 2.78 MS ± .2 MS later. Also over-lap pulses and make sure, that the amplitudes are exactly the same, (if not change Q83 in the small amplitude circuits).

8. Disconnect 1TB1-1TB23 and connect 1TB23-1TB39 (+15V buss).
9. Pulses should appear as in N.7, but at the following positions with the same pulse width.
   a. P1 occurs at 60° ± 5°.
   b. P2 occurs at 180° ± 5°.
   c. P3 occurs at 300° ± 5°.
   d. N1 occurs at 240° ± 5°.
   e. N2 occurs at 0° ± 5°.
   f. N3 occurs at 120° ± 5°.
10. Connect cp208 to 1TB37 (-15V buss) and all pulses will disappear.
11. Disconnect cp208 from 1TB37 and all pulses should reappear after the time delay.
12. Trip IEC by momentarily shorting 1TB28 to 1TB39
13. With IEC tripped and all pulses should disappear from the forward GPG's.
14. Push and release PB100 and all forward pulses should reappear.
15. Replace jumper CP62 to CP63.

b. **Dynamic Tests** (**suicide switch up to Dynamic**)
   i. **AC. Input Power and oscilloscope lead connections**
      1. Put R9 and R11 3/4 CW
      2. Put R7, R8, R13 and R14 CCW
      3. Put R2, R3, R5, and R10 CW.
      4. Put M1 field >40%.
      5. Set switch 1 on D2 Card out, all others in.
      6. Push start button.
      7. **To adjust forward current limit perform the following:**
         a. Adjust R14 CW and motor should begin to rotate.
      8. Seal R1, R4, R6, R12, R15, and R16, with red RTV.

6. UPGRADES:

a. Revision 1 changes to revision 2
   i. Remove C42
   ii. Replace IC40 with 0177A1630 P016.
   iii. Change the status from revision 1 to revision 2.
b. Revision 2 changes to revision 3
   i. Replace R89A-F with 0177A1460 P058.
   ii. Mount this resistor in reverse.

iii. Add R87A-F, 0177A1460 P159, between R87A-F and the five volt bus.
iv. Change the status from revision 2 to revision 3.

c. Revision 3 changes to revision 4
i. Replace R90A-F with 0177A1504 P066.
ii. Replace L80A-F, L11 & L113 with 0177A1953 P001.
iii. Replace L180 with 0177A1954 P001.
iv. Change the status from revision 3 to revision 4.

d. Revision 4 changes to revision 5
i. Add C102, 0177A1283 P018, between COMM & pin5 of IC113.
ii. Change the status from revision 4 to revision 5.

e. Revision 5 changes to revision 6
i. Replace R115 with 0177A1460 P240.
ii. Replace Q106 with 0177A1067 P020.
iii. Change the status from revision 5 to revision 6.

f. Revision 6 changes to revision 7
i. Add C230, 0177A1283 P018, between COMM & pin8 of IC180.
ii. Change the status from revision 6 to revision 7.

7. END.