Info

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Test Title: Power Tree Outputs test 1
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Test description

Test objectives and goals: Test the output capabilities of the power tree board.

Sub-system(s): Output 5V, 12V, Variable, 19V and MotorBase

Component(s) (devices and test equipment): Voltmeter, E-Stop button, Power supply(19V), Test bench with power-resistor, PCB guard, Variable Power supply.

Environment (location, conditions): Clean non-conductive workspace with an access to PCB guard and variable power supply. Establish perimeter if other persons are around.

Setup block diagram:

Risk table :

#REF	Description	Situation	Probability & Gravity	R.I.	Security measure	Procedure for emergency
R1	Exploding component	Powering the PCB & there is a component failure	F1 & G2	4	Put guard over PCB when powering up a section. Wearing safety glasses.	Stop the test. Treat the victim. Call medical assistance if lesions occur.
R2	Burning with hot component	Adjusting the power resistor after testing	G1 & F2	4	Test will include a small fan to cool the power resistor. The tester will wear gloves when manipulating the power resistor.	Stop the test. Apply first aid on burn. If the burn is severe, call medical assistance.
R3	Bad PCB assembly causes breakage	When powering up the PCB, shorts or assembly defects	G0 & F1	1	Impedance will be measured before powering the board to ensure there is no short.	Find the problem source and repair the board
R4	Shock	A missed manipulation causes a shock to one of the operators	G1 & F1	2	Operators' vigilance.	Stop the test. Treat the victim. If the shock is severe, call medical assistance.

Gravity :
G1 : light lesion, normally reversible
G2 : severe lesion, normally irreversible

Probability
F1 : Very rare to much frequent
F2 : Frequent et very probable

R.I (Risk indicator)
Equals to 2 for G1 & F1 or F2
Equals to 4 for G2 & F1
Equals to 6 for G2 & F2

Test Procedure (include files and illustrations):

1. Measure output from supply (19v is expected) R4
2. Unplug the power supply
3. Measure impedance of 19v input barrel on PowerTree board (high impedance is expected) R3
4. Adjust variable power resistor to 2.7Ω
5. Connect power resistor to the first output of 5V (J5) and measure impedance of supply output R3
6. Put jumper of the corresponding output
7. Plug the power supply in the power tree board without having the power supply powered
8. Put PCB guard over PCB
9. Power the supply R4
10. Wait 30 sec and remove the guard if nothing failed R1
11. Measure current with TP5 & TP6 (A drop voltage of 0.18V is expected) R4
12. Measure voltage on power-resistor (Voltage should be 5V) R4
13. Unplug power supply
14. Unplug power resistor
15. Remove output jumper
16. If everything is correct, repeat the steps 5 to 14 for each 5 volt output with their corresponding test point. R4
17. Adjust variable power resistor to 6.6Ω R2
18. Connect power resistor to the first output of 12V (J2) and measure impedance of supply output R3
19. Put jumper of the corresponding output
20. Plug the power supply in the power tree board without having the power supply powered
21. Put PCB guard over PCB
22. Power the supply R4
23. Wait 30 sec and remove the guard if nothing failed R1
24. Measure current with TP14 & TP15 (A drop voltage of 0.18V is expected) R4
25. Measure voltage on power-resistor (Voltage should be 12V) R4
26. Unplug power supply
27. Unplug power resistor
28. Remove output jumper
29. If everything is correct, repeat the steps 18 to 28 for each 12 volt output with their corresponding test point. R4
30. Put jumper of the variable output
31. Plug the power supply in the power tree board without having the power supply powered
32. Put PCB guard over PCB
33. Power the supply R4
34. Wait 30 sec and remove the guard if nothing failed R1
35. Measure voltage on output (Voltage should be between 2.5V and 13V) R4
36. Adjust voltage to 13V with potentiometer (R46) R4
37. Unplug power supply
38. Adjust variable power resistor to 7.22Ω R2
39. Connect power resistor to Variable output (J5) and measure impedance of supply output R3
40. Put PCB guard over PCB
41. Power the supply R4
42. Wait 30 sec and remove the guard if nothing failed R1
43. Measure current with TP21 & TP22 (A drop voltage of 0.18V is expected) R4
44. Measure voltage on power-resistor (Voltage should be 13V) R4
45. Adjust voltage to 2.5V with potentiometer (R46) R4
46. Unplug power supply
47. Unplug power resistor
48. Adjust variable power resistor to 1.38Ω R2
49. Connect power resistor to Variable output (J5) and measure impedance of supply output R3
50. Put PCB guard over PCB
51. Power the supply R4
52. Wait 30 sec and remove the guard if nothing failed R1

53. Measure current with TP21 & TP22 (A drop voltage of 0.18V is expected) **R4**
54. Measure voltage on power-resistor (Voltage should be 2.5V) **R4**
55. Unplug power supply
56. Unplug power resistor
57. Remove output jumper
58. Adjust variable power resistor to 8.3Ω **R2**
59. Connect power resistor to robot base output (J4) and measure impedance of supply output **R3**
60. Put jumper of the 15V DC-DC output
61. Plug the power supply in the power tree board without having the power supply powered
62. Put PCB guard over PCB
63. Power the supply **R4**
64. Wait 30 sec and remove the guard if nothing failed **R1**
65. Measure current with TP19 & TP20 (A drop voltage of 0.18V is expected) **R4**
66. Measure voltage on power-resistor (Voltage should be 15V) **R4**
67. Unplug power supply
68. Unplug power resistor
69. Remove output jumper
70. Power a variable power supply **R4**
71. Adjust voltage with measure to 14.8V **R4**
72. Turn off the variable supply
73. Adjust variable power resistor to 12.84Ω **R2**
74. Connect power resistor to the 19V output (J11) and measure impedance of supply output **R3**
75. Put jumper of the corresponding output
76. Plug the power supply in the power tree board without having the power supply powered
77. Put PCB guard over PCB
78. Power the supply **R4**
79. Wait 30 sec and remove the guard if nothing failed **R1**
80. Measure current with TP2 & TP3 (A drop voltage of 0.148V is expected) **R4**
81. Measure voltage on power-resistor (Voltage should be 19V) **R4**
82. Unplug power supply
83. Unplug power resistor
84. Remove output jumper

Test parameters and inputs (limits, tolerances, settings): Every output should have a 10% tolerance and current should not exceed 2A

Security

Potential risks:
[YES] Mechanical equipment damages (high speeds, sharp objects, projectiles)
[YES] Electrical equipment damages (high power, reverse polarity, ESD, shorts)
[YES] Thermal hazards (power dissipation, friction, heat-sensitive/flamable components)
[NO] Chemicals (batteries, contaminants, exposition, airborne particles)
[YES] New components (first tests, original/student designs)
[YES] Human risks (operator proximity, ergonomics, environment, bystanders)
[NO] Others: _____
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_____

Risk mitigation:

Neutralization at the source: Estop controlling the supply of the board, PCB protector, Failure and reverse connection protection by design

Collective protections: PCB protector for exploding component if there is failure at startup

Personal protections: Safety googles, Heat gloves

Approbation

Approved by: _____
Date: _____

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Date: _____

Test Results

Tester	Time & date	Results	Comments

Warning
For testing, we highly suggest to adapt the procedure to the environment. This is only an example and Securbot is not responsible for the procedure written below. Any reference to the Université de Sherbrooke is forbidden. The name of Université de Sherbrooke cannot be used without it's consent.

Comments

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