

Additional Notes for 2012 Skills Canada Secondary Electronics Competition

Please note:

The material presented in this document is based on typical past practice at the Skills Canada Secondary Electronics Competition. The 2012 competition will be based on this past practice but changes in technology, equipment available and National Technical Committee membership have been accommodated.

This competition will test the competitor's ability to assemble and take measurements on a variety of pieces of electronics apparatus.

The judges expect that each competitor will be able to correctly use:

1. a dual power supply to provide positive and negative voltages plus ground to integrated circuits that use dual voltage supplies.
2. a digital multimeter to read DC and AC voltages, currents and resistance.
3. a function generator to inject signals into equipment being tested.
4. an oscilloscope to measure DC and AC voltages and various waveforms which include both DC and AC components.
5. a soldering iron and vacuum solder remover and/or solder wick and lead free solder.
6. personal protective equipment as required by the Scope document.

The judges also expect that competitors will be able to answer questions on common integrated circuits such as

- LM555/556 timers used as astable, bistable and mono-stable multivibrators,
- LM741, LF411 and LM1458 op-amps used as inverting and non-inverting amplifiers, integrators and differentiators, oscillators, etc.
- LM311 comparators
- LM7805, LM7809 and LM723 voltage regulators.

**There are typically seven (7) sections to this competition.
The time and marks allotted vary from competition to competition.**

1. Circuit Analysis

- The time allowed for this completion is typically 30 to 45 minutes.
- This event is typically worth 10 to 15 % of the total competition mark.

Typical Assignment

The competitor will be provided with an unpopulated Printed Circuit Board (PCB) from a kit and a partially completed schematic diagram.

The competitor must neatly and accurately complete the schematic diagram of the circuit and then answer the some questions about the circuit.

Typical Evaluation Criteria

- a. 40 % will be awarded if the schematic diagram is accurate. 5 % will be deducted for each inaccuracy to a maximum of 8.
- b. 20 % will be awarded for correct answers to the questions.
- c. 40 % will be awarded for the drawing judged to be the neatest.
30 % will be awarded to the drawing judged second neatest.
20 % will be awarded to the drawing judged third neatest.
10 % will be awarded to all other drawings.

2. Breadboarding Technique

- The time allowed for this competition is typically 75 to 90 minutes.
- This portion of the competition is typically worth 15 to 20 % of the total competition mark.
- Please note that precut or preformed wires are **not allowed**.

Typical Assignment

The competitor will be given a set of components, a schematic diagram and some data sheets.

The competitor, using his/her best breadboarding technique, will neatly breadboard the circuit and then answer some questions about the circuit produced.

The competitor will be required to connect a power supply (possibly a dual or tri power supply) to the circuit and take measurements with an oscilloscope. He/she may be required to connect a function generator as well.

Typical Evaluation Criteria

- a. 20 % will be awarded for questions answered correctly.
- b. 15 % will be awarded if the component leads are an appropriate length. 3 marks will be deducted for each lead of inappropriate length to a maximum of 5.
- c. 15 % will be awarded if the wires are an appropriate length. 3 marks will be deducted for each lead of inappropriate length to a maximum of 5.
- d. 30 % will be awarded if the outputs function correctly.
- e. 10 % will be awarded if the circuit is logically laid out.
- f. 10 % will be awarded for the board judged to be the neatest.
8 % will be awarded to the board judged second neatest.
6 % will be awarded to the board judged third neatest.
4 % will be awarded to all other boards.

3. Project Assembly and Testing

- The time allowed for this portion of the competition is typically 4 to 5 hours.
- It is typically worth 25 to 35 % of the total competition mark.
- The competitor may use all the tools brought with him/her.
- Solder and solder wick will be provided.
- Safety glasses must be worn.

Typical Assignment

The competitor will be provided with a kit and all necessary instructions.

The competitor, using best assembly and soldering techniques, will neatly assemble and solder the projects.

He/she must pay attention to component orientation, lead length, lead dress and soldering technique.

He/she should be aware that all components without built in spacers should be placed and soldered so they have a strain relief, a height of .5mm to 1mm above the PCB and solder lead length of .5mm to 1.5 mm.

He/she will use the necessary drawings and follow the detailed Instructions provided.

Typical Evaluation Criteria

- a. 40 % will be awarded if the circuit functions as designed.
- b. 20 % will be awarded if the components are correctly soldered.
5 marks will be deducted for each incorrectly soldered component to a maximum of 4.
- c. 10 % will be awarded if the component leads are neatly bent and inserted.
2 marks will be deducted for each component incorrectly bent and inserted to a maximum of 5.

4. Cable Construction

- The time allowed for this portion of the competition is typically 30 to 45 minutes.
- This portion of the competition is typically worth 10 to 15 % of the total competition mark.

Typical Assignment

The competitor will be given a length of multiconductor cable and some connectors.

Using best soldering technique the competitor will install the connectors on the cable.

Typical Evaluation Criteria

- a) 10 % will be awarded if the colour code is followed correctly.
- b) 10 % will be awarded if the wires are stripped to the correct length. 2 marks will be deducted for each incorrectly stripped wire to a maximum of 5.
- c) 20 % will be awarded if the insulation is not melted or burned. 2 marks will be deducted for each melted or burned wire to a maximum of 5.
- d) 20 % will be awarded if the wires are soldered correctly. 2 marks will be deducted for each incorrectly soldered wire to a maximum of 5.
- e) 20 % will be awarded if there is no flux residue. 2 marks will be deducted for each spot of residue to a maximum of 5.
- f) 20 % will be awarded if there are no "shorts" or "opens". 2 marks will be deducted for each "short" or "open" to a maximum of 5.

5. Fault Finding

- The time allowed for completion is typically 1 to 1.5 hours.
- This event is typically worth 10 to 15 % of the total competition mark.
- The competitor will be given a PCB or breadboarded circuit that functions correctly. He/she will be instructed to connect the circuit to a power supply and take DC and AC measurements with a multimeter and waveform measurements with an oscilloscope to determine normal operating parameters. After a specified period of time the correctly functioning circuit will be removed and the competitor will be given a faulty circuit.

Typical Assignment

The PCB or breadboard will have a number of faults. Using the attached schematic diagram and the test equipment available, the competitor will find and correct the faults on the PCB or breadboard.

The competitor will list:

- Each fault found
- The condition each fault caused and
- What the competitor did to correct the fault.

Typical Evaluation Criteria

Assuming there were 5 faults and each fault is worth 20 % of the total mark for this session. The 20 marks for each fault will be awarded on the basis of

- a) 10 % for finding the fault
- b) 5 % for correcting the fault
- c) 5 % for indicating how the fault affected the circuit operation

For example

Fault 1

- Diode D1 is in backward
- The bias for all components is incorrect. The signal generator will not work
- I inspected the PCB and noted that the diode orientation was different than the symbol on the PCB
- I unsoldered the diode and reconnected it in the correct orientation.

6. Rework Technique

- Time allowed for this portion of the competition is typically 30 to 45 minutes.
- This event is typically worth 10 to 15 % of the total competition mark.
- The competitor may use all the tools brought with them. Flux remover is not permitted. Solder and solder wick will be provided, if necessary. Safety glasses must be worn.

Typical Assignment

The competitor will be given a working piece of equipment that contains a PCB.

He/she will test it to see that it works correctly by using specified test equipment.
He/she will then neatly desolder the specified components from the PCB in such a way that neither the PCB or any of the components are damaged.
The competitors will then show the components and PCB to a judge.
Once the equipment has been evaluated by a judge, the competitor will reinsert and resolder the components. He/she will then test the unit to see that it works.

Typical Evaluation Criteria

- a) 15 % will be awarded if no damage is done to the PCB.
5 marks will be deducted for each pad damaged to a maximum of 4.
- b) 15 % will be awarded if the holes are left clear of solder.
5 marks will be deducted for each partially filled hole to a maximum of 4.
- c) 15 % will be awarded if there is no flux residue left on the board.
5 marks will be deducted for each spot of residue to a maximum of 4.
- d) 15 % will be awarded if no damage is done to the components.
5 marks will be deducted for each component damaged to a maximum of 4.
- e) 15 % will be awarded for answering the questions correctly.
- f) 25 % will be awarded if the unit works correctly

7. Measurement

- Time allowed for this portion of the competition is typically 45 to 60 minutes.
- This event is typically worth 10 to 15 % of the total competition mark.

Typical Assignment

The competitor will be given a working circuit.
He/she will be asked to take measurements at specific points.
He/she will be asked to neatly produce a drawing that shows how the test equipment will be used to make that measurement.
He/she will be asked to accurately draw the waveform and indicate on the drawing the period of the wave (and then determine frequency if required) the voltage peak-to-peak and the offset voltage if applicable.

Typical Evaluation Criteria

- a) 68 % will be awarded for accurate measurements.
- b) 32 % will be awarded for neat drawings.