



CONTEST DESCRIPTION

# **Mechatronics**

POST-SECONDARY

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## **1 THE ESSENTIAL SKILLS FOR CAREERS IN THE SKILLED TRADES AND TECHNOLOGY**

SCC is currently working with Employment and Social Development Canada (ESDC) in order to bring awareness to the importance of Essential Skills that are absolutely crucial for success in the workforce. Part of this ongoing initiative requires the integration and identification of Essential Skills in contest descriptions, projects, and project documents. The next phase and very important aspect of our Essential Skills (ES) initiative is to provide an ES report card to each competitor at the Skills Canada National Competition. The purpose of the ES report card is to inform the competitor about their current level of essential skills based on their competition scores. With this knowledge, the competitor will be made aware which essential skill may require improvement. Full implementation is expected in the next Skills Canada National Competition.

The following 9 skills have been identified and validated as key essential skills for the workplace in the legend below:

<sup>1</sup>Numeracy, <sup>2</sup>Oral Communication, <sup>3</sup>Working with Others, <sup>4</sup>Continuous Learning, <sup>5</sup>Reading Text, <sup>6</sup>Writing, <sup>7</sup>Thinking, <sup>8</sup>Document Use, <sup>9</sup>Digital

These essential skills have been identified in section 2.4 and/or 3.2 of your Contest Description and if applicable, in your Project and supporting documents.

## **2 CONTEST INTRODUCTION**

### **2.1 Description of the associated work role(s) or occupation(s).**

<http://skillscompetencescanada.com/en/careers/manufacturingengineering/mechatronics/>

### **2.2 Purpose of the Challenge.**

- The goal is to provide competitors with the opportunity to demonstrate certain skills and knowledge that every technician must have in the field of Manufacturing, Automation and Technology.
- Mechatronics skills will be judged on a practical demonstration of abilities to complete the mechanical, electrical and pneumatic assembly of a manufacturing production system as well as creating and commissioning the controls based on a documented working sequence using Programmable Logic Controllers (PLC). Team of two participants.
- Open to Mechatronics, Industrial Automation & Robotics, Instrumentation, Electro-Mechanical or related Technologies sectors.

### **2.3 Duration of contest.**

12 hours (6 hours a day for 2 days)

## 2.4 Skills and Knowledge to be tested.

- General Electrical and Mechanical knowledge<sup>7</sup>
- Interpret and use electronic, electrical or mechanical schematics.<sup>8</sup>
- Render operational and modify sequential mechanisms that have a PLC.
- Commissioning electrical, pneumatic and mechanical systems.
- Programming PLCs<sup>9</sup>
- Skillful troubleshooting techniques<sup>7</sup>
- Speed of execution
- Wiring skills
- System Optimization (increasing the system performance)
- Professional workmanship
- Professional practices
- Know-how to look for information efficiently in industrial equipment<sup>7</sup>

*Essential Skills – <sup>7</sup>Thinking(Problem Solving, Significant use of Memory, finding information)*

*<sup>8</sup>Document Use, <sup>9</sup>Digital*

## 3 CONTEST DESCRIPTION

### 3.1 List of documents produced and timeline for when competitors have access to the documents.

DOCUMENT	DATE OF DISTRIBUTION VIA WEBSITE
Professional Practice	November 2020
PLC Wiring	November 2020

### 3.2 Tasks that may be performed during the contest

- Unpacking and preparation of components including cutting cables to length, stripping of insulation and crimping of ferrules<sup>1</sup>
- Install mechanical modules with proper alignment<sup>1</sup>
- Wire solenoid valves and sensors according to schematics<sup>8</sup>
- Pneumatic tubing for cylinders, valves terminals and service unit according to schematics<sup>8</sup>
- Write PLC programs according to instructions<sup>5</sup>
- Conduct maintenance task by replacing various components in the system
- Debug and troubleshoot the assembly to operate according to instructions<sup>7</sup>
- Optimize the system performance

*Essential Skills – <sup>1</sup>Numeracy, <sup>5</sup>Reading Text, <sup>7</sup>Thinking (Problem Solving), <sup>8</sup>Document Use*

## 4 EQUIPMENT, MATERIAL, CLOTHING

### 4.1 Equipment and material provided by Skills/Compétences Canada

- Manufacturing Production Stations (MPS®): A model of a real production system from Festo Didactic.
- Pneumatic Tubing

- Wires
- Ferrules
- Tie-wraps
- Compressed Air
- A 120 VAC power bar will be provided to each team complete with electrical power (15 amps).
- Tubing cutter
- Work pieces (Cylinder and Meter Bodies)

#### **4.2** Equipment and material provided by the competitor

- A PLC Programming Computer with PLC programming software. Computer and PLC to be free of all preprogrammed PLC files. Only PLC software, and Windows will be allowed on this computer. Computer may be inspected by Judges prior to usage
- A CAD Viewer Computer with AutoDesk Design Review software (free software) for viewing project 3D files provided at the competition. Computer and PLC to be free of all preprogrammed PLC files.
- 2x PLCs with a total of 48 inputs and 48 outputs (maximum 32 Inputs and 32 Outputs per PLC) and other necessary cables and tools. One PLC will be used for each or multiple MPS Workstations. PLCs must be able to pass tag or data information over a network connection.
  - A power supply (120 VAC to 24VDC) rated at least 4.5 amps should be used to power each PLC and the MPS station.
  - All PLC inputs shall be sinking inputs. The sensors and buttons shall switch (source) +24VDC to each PLC input. Sensors are PNP type and shall source the current and the PLC input module will sink the current.
  - All PLC outputs shall be sourcing outputs. The output shall switch (source) +24VDC to turn an individual load on. The load shall sink the current to 0VDC (Ground).
  - The PLC outputs should be at least 400 mA. All I/Os are 24VDC.
  - Each team will have their own table. Mounting the PLC on a back-plate is recommended.
  - See PLC Wiring document posted on the Skills/Compétences Canada web site for more information
- SysLink cable connectors (IEEE 488) will be connected to the PLCs (6 cables in total)
  - Each cable will connect 8 Inputs and 8 Outputs to the PLC: One cable will connect from the PLC to the MPS station containing sensors and solenoid valves. The other cable will connect from the PLC to the control panel, which contains operator devices such as pushbuttons, switches and pilot lights.
  - These cables must be connected to the PLCs before the competition.

- Multimeter (VOM)
- Set of Screwdrivers
  - Recommended
  - Pozi Drive PZ0, PZ1
    - Philips #0, #1
    - - Flat 1.2, 1.6, 2.5, 6 mm
- Set of Hex metric keys.
  - Recommended Sizes: 1.5, 2, 2.5, 3, 4, 5, 6, 8, 10 mm
- Set of Open ended metric wrenches
  - Recommended sizes: 7, 8, 9, 10, 19 mm
- Metric Socket wrenches and/or nut drivers
- Adjustable wrench
- Wire strippers
  - 25mm<sup>2</sup> to 1.5mm<sup>2</sup> (AGW 24 – 16)
- Side and flush cutters
- Measuring tape or ruler (metric)
- Ferrule crimping tool
- Dustpan and a broom
- **Note:** No Internet connection will be allowed on any computer and NO PDA or Cell phone can be used during the competition.

COMPETITORS WILL BE REQUIRED TO USE THE MATERIAL AND EQUIPMENT PROVIDED BY SCC. ALL OTHER MATERIAL AND EQUIPMENT WILL BE REMOVED FROM THE SKILL AREA.

#### 4.2.1 Toolboxes Guidelines

One of the objectives of SCC is the sustainability of the Competition. As a result, the toolboxes brought by Competitors will be restricted to the following maximum specifications.

The Competitor toolbox must not exceed 2 meters<sup>3</sup> in volume. It can be multiple toolbox but the total of all toolbox, must not exceed the maximum volume indicated. There is no exception to this rule. If the Competitor toolbox is larger than what is indicated, the Competitor with the guidance of the NTC, will need to remove items from the toolbox and those items will not be used during the competition. All tools must fit inside one or more toolboxes. Tools outside of a toolbox will not be permitted.

#### 4.3 Required clothing (provided by competitor)

- Competitors are to be dressed in a clean and appropriate manner. The Mechatronics contest recommends that you wear long pants, belt, socks, and must wear close toe shoes



- T-shirts and/or lab coats may be provided to competitors.
- Jewellery such as rings, bracelets and necklaces or any deemed unsafe by competition judges shall be removed
- Proper shop attire is to be worn (no loose straps, baggy sleeves etc.). Or any item deemed unsafe by competition judges

## 5 SAFETY REQUIREMENTS

### 5.1 Safety workshop

Upon arrival at the Skill area, Competitors will participate in a Safety workshop and they will be expected to work and maintain a safe working area during the competition. Any Competitor breaking any health, safety and environment rules, may be required to undertake a second safety workshop, this will not affect the Competitor's competition time.

### 5.2 List of required personal protective equipment (PPE) provided by Skills/Compétences Canada

- Safety glasses will be mandatory during competition – McCordick

## 6 ASSESSMENT

### 6.1 Point breakdown

POINT BREAKDOWN	/100
Professional Practice	20
Time Evaluation	20
I/O Check and Allocation	20
Expected functionality	40

## 7 CONTEST SPECIFIC RULES

Contest specific rules cannot contradict or take priority over the Competition Rules. They do provide specific details and clarity in areas that may vary from contest to contest. Any additional contest rules will be reviewed during the competitors orientation.

TOPIC/TASK	CONTEST SPECIFIC RULE
Use of technology - personal laptops, tablets and mobile phones	<ul style="list-style-type: none"> <li>• Competitors are not allowed to bring personal laptops tablets or mobile phones into the skill area, only the PLC programming computers will be allowed in the skill area and will remain in the skill area for the duration of the competition</li> <li>• National Technical Committee (NTC) members, Interpreters and judges are allowed to use personal devices in the skill area</li> </ul>

Use of technology - Internet	<ul style="list-style-type: none"> <li>Competitors are not allowed to use internet in the skill area</li> </ul>
Safety	<ul style="list-style-type: none"> <li>At the discretion of the National Technical Committee any competitor can be removed from the skill area for not having the proper safety equipment and/or not acting in a safe manner</li> </ul>

## 8 ADDITIONAL INFORMATION

### 8.1 Interpreter

If a competitor requires the help of an interpreter once onsite during the competition, the Skills/Compétences Canada Provincial/Territorial offices must advise Skills/Compétences Canada National Secretariat a minimum of 1 month prior to the competition or this service might not be guaranteed.

### 8.2 Ties

- Tiebreaker #1: In the event of a tie, the team with the highest score in “Expected Functionality” over the two days will be declared the winner.
- Tiebreaker #2: If a second tie occurs, the team with the highest score in “Time Evaluation” over the two days will be declared the winner.
- Tiebreaker #3: If a third tie occurs, the team with highest score in “I/O Check and Allocation” over the two days will be declared the winner.

### 8.3 Test project change at the Competition

Where the Test Project has been circulated to Competitors in advance, NTC shall change a maximum of 30% of the work content. Please refer to the Competition Rules

### 8.4 Competition Rules

Refer to the competition rules of the Skills Canada National Competition which can be found on our website.

## 9 NATIONAL TECHNICAL COMMITTEE MEMBERS

Member Organization	Name
Ontario	Greg James
Alberta - Chair	Neil Wenger
Newfoundland and Labrador	Rajendra Jani
Nova Scotia	Kelly Tompkins
Québec – Co-Chair	Steve Collard

Contact the Skills/Compétences Canada national secretariat for any questions or concerns: Nathalie Maisonneuve (nathaliem@skillscanada.com).