**Skills Alberta**

**Skill 19**

**Industrial Control**

**Post-Secondary Competition**

**Test Project**

**Day 1**

# Table of Contents

## 1. INTRODUCTION
### 1.1 General

With this challenge, we will assess your abilities in the following criteria:
   a) Ability to analyze technical data.
   b) Quality of wiring.
   c) Capacity to implement an automatic process.
   d) Troubleshooting techniques.
   e) Abilities for error detection.



### 1.2 Step A: Installation of Electrical Raceways and Components

Part of all process type projects is the installation of the raceways and components that function as inputs and outputs. We will assess the quality of your installation, interpretation of site drawings, and precision of equipment placement.

### 1.3 Step B: Wiring an automated process within a panel

As a technician, you should have the ability to completely wire a system and make the necessary modifications. We will assess the quality of your manual work, the organization of components, and the use of materials provided.

### 1.4 Step C: Programming the automated process

You are provided with a function, and you must program the automated process with your PLC. The system must be functional and adhere to the instructions.

### 1.5 Step D: Commissioning, Start-up and Troubleshooting

Your ability to validate the safety of your installation prior to power up and/or detect and solve problems will be assessed.

## 2. Conductors

### 2.1 Size and use

1. Power connections must be 14 AWG gauge.
2. DC Input/Output single conductors must be blue 16 AWG gauge.
3. DC Input/Output cables must be 18 AWG, 2-conductor or 3-conductor cables
4. Ground conductors must be 14 AWG gauge green conductors.
5. Any exceptions to paragraphs 1, 2 & 3 will be specifically mentioned on the drawings.

### 2.2 Colour Code

The following colour code must be used to distinguish circuits:

| Single Phase Power | Line | Red |
| --- | --- | --- |
| | Identified | White |
| Three Phase Power | Line 1 | Red |
| | Line 2 | Black |
| | Line 3 | Blue |
| | Neutral | White |
| DC Control | Input/0utput | Blue |
| | 18/2 Cable | |
| | 18/3 Cable | |
| | | |

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### 3. General Description

#### 3.1 Process Description

Edmonton International Airport (EIA) is the primary air passenger and air cargo facility for the Province of Alberta's capital city, Edmonton.  Additionally, it is a hub facility for Northern Alberta and Northern Canada providing regularly scheduled non-stop flights to over fifty communities in Canada, the United States, Latin America and Europe. It is Canada's largest major airport by total land area, and 5th busiest airport by passenger traffic. The Skill 19 project represents that portion of automated process for sorting and transporting passenger luggage within EIA.

#### 3.2 Process Equipment Description

The system consists of the following components:
- Control panel equipped with:
    - Green (L1), Amber (L2) & Red (L3) stack lights
    - Emergency Stop push-pull button (PB1)
    - Green (PB2), Red (PB3) and Black (PB4) momentary push buttons
    - Maintained 3 positions selector switch (SS1 & SS2)
    - Green (L4), White (L5) and Red (L6) pilot lights
- Unidirectional Sorting Belt Conveyor, driven by the motor M1 (fed by K1 contactor)
- Bidirectional Distribution Belt Conveyor, driven by the motor M3 (fed by K3 Contactor)
- Bidirectional Size Belt Conveyor, driven by the motor M2 (fed by K2 contactor)
- Optical sensors [replaced by limit switches for the purpose of this contest] (LS1 to LS4)
- A pneumatic actuator, driven by a solenoid (SOL)

#### 3.3 – Process Diagram
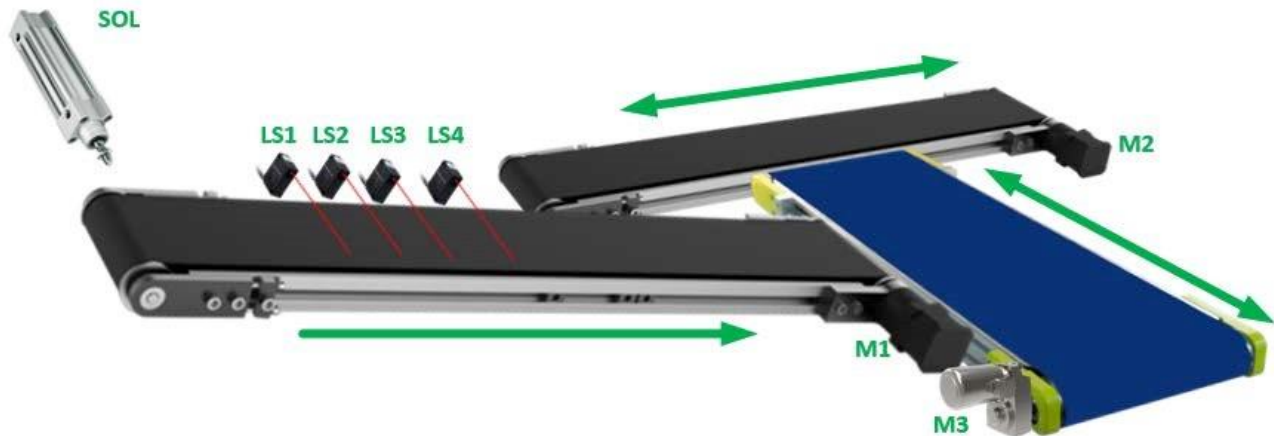
## 4. Technical Details

### 4.1 Emergency Stop Circuit

The system is equipped with a general Emergency Stop push-pull button.

The Emergency Stop button mounted on the Control Panel Door will be used in conjunction with a 24VDC relay (non-PLC) to create a Master Control Relay (MCR)/Emergency Stop Circuit. The 24VDC relay will be equipped with both normally open and normally-closed contacts, as required.

When the Emergency Stop button is depressed, The Master Control Relay/Emergency Stop Circuit will de-energize all of the PLC's outputs.

All of the PLC's outputs shall remain de-energized until the Emergency Stop button is reset (pulled).

The following tables are a recommended assignment of the inputs and outputs for your programmable control. As controllers vary in how they are connected and function, you must check your particular PLC to see if these assignments are suitable.

**4.2 Inputs**

| Input Detail | Symbol | Contact Type | PLC inputs Assignment |
|---|---|---|---|
| Master Control Relay / Emergency Stop Circuit | MCR | NO | In0 |
| Green push button | PB2 | NO | In1 |
| Red push button | PB3 | NC | In2 |
| Black push button | PB4 | NO | In3 |
| 3 positions Selector Switch 1 - Left Position | SS1_1 | NO | In4 |
| 3 positions Selector Switch 1 - Right Position | SS1_3 | NO | In5 |
| 3 positions Selector Switch 2 - Left Position | SS2_1 | NO | In6 |
| 3 positions Selector Switch 2 - Right Position | SS2_3 | NO | In7 |
| Contactor K1 Overload | K1_OL | NO | In8 |
| Contactor K2 Overload | K2_OL | NO | In9 |
| Contactor K3 Overload | K3_OL | NO | In10 |
| Optical sensor 1 | LS1 | NO | In11 |
| Optical sensor 2 | LS2 | NO | In12 |
| Optical sensor 3 | LS3 | NO | In13 |
| Optical sensor 4 | LS4 | NO | In14 |

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| Output Detail | Symbol | PLC outputs Assignments |
|---|---|---|
| Green stack light | L1 | Q0 |
| Amber stack light | L2 | Q1 |
| Red stack light | L3 | Q2 |
| Green pilot light | L4 | Q3 |
| White pilot light | L5 | Q4 |
| Red pilot light | L6 | Q5 |
| Contactor K1 | K1 | Q6 |
| Contactor K2 Forward | K2_F | Q7 |
| Contactor K2 Reverse | K2_R | Q8 |
| Contactor K3 Forward | K3_F | Q9 |
| Contactor K3 Reverse | K3_R | Q10 |
| Solenoid (White Pilot Light) | SOL | Q11 |

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