



TEST PROJECT DAY 1 / PROJET D'ÉPREUVE JOUR 1

# **AUTOMATION AND CONTROL**

# **CONTROLE ET AUTOMATISATION**

POST-SECONDARY /  
NIVEAU POSTSECONDAIRE

## 1.0 - INTRODUCTION

1.1 – GENERAL.....	3
1.2 – STEP A: INSTALLATION OF ELECTRICAL RACEWAYS AND COMPENTS AS PER SPEC. ....	3
1.3 – STEP B: WIRING AN AUTOMATED PROCESS WITHIN A PANEL.....	3
1.4 – STEP C: PROGRAMMING THE AUTOMATED PROCESS.....	3
1.5 – STEP D: TROUBLESHOOTING .....	3

## 2.0 - CONDUCTORS

2.1 – SIZE AND USE .....	4
2.2 – COLOUR CODE.....	4

## 3.0 - GENERAL DESCRIPTION

3.1 – PROCESS DESCRIPTION .....	4
3.2 – PROCESS DIAGRAM.....	6

## 4.0 - INPUT AND OUTPUTS

4.1 – TECHNICAL DETAILS.....	7
4.2 – INPUTS .....	8
4.3 – OUTPUTS .....	9

## 1.0 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 as per specifications

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 and the provided VFD. The system must be functional, and adhere to the instructions.

### 1.5 – Step D: Troubleshooting

Your ability to detect and solve problems will be assessed.



## 2.0 – Conductors

### 2.1 – Size and use

1. Power connections must be 12 AWG gauge.
2. Control conductors must be 18 AWG gauge.
3. Ground conductors must be 14 AWG gauge.
4. 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:

- |                      |                      |                    |
|----------------------|----------------------|--------------------|
| 1. Single phase      | Identified Conductor | → White            |
|                      | Line                 | → Red              |
| 2. Three phase       | Line                 | → Red, Black, Blue |
| 3. DC Control        |                      | → Blue             |
| 4. Bonding/Grounding |                      | → Green            |
| 5. Input/output      | 18/2 Cable           | → White            |
|                      |                      | → Black            |
|                      | 18/3 Cable           | → Red              |
|                      |                      | → Black            |
|                      |                      | → White            |
| 6. Motor Connections | 14/4 Cable           | → Red              |
|                      |                      | → Black            |
|                      |                      | → White            |
|                      |                      | → Green            |



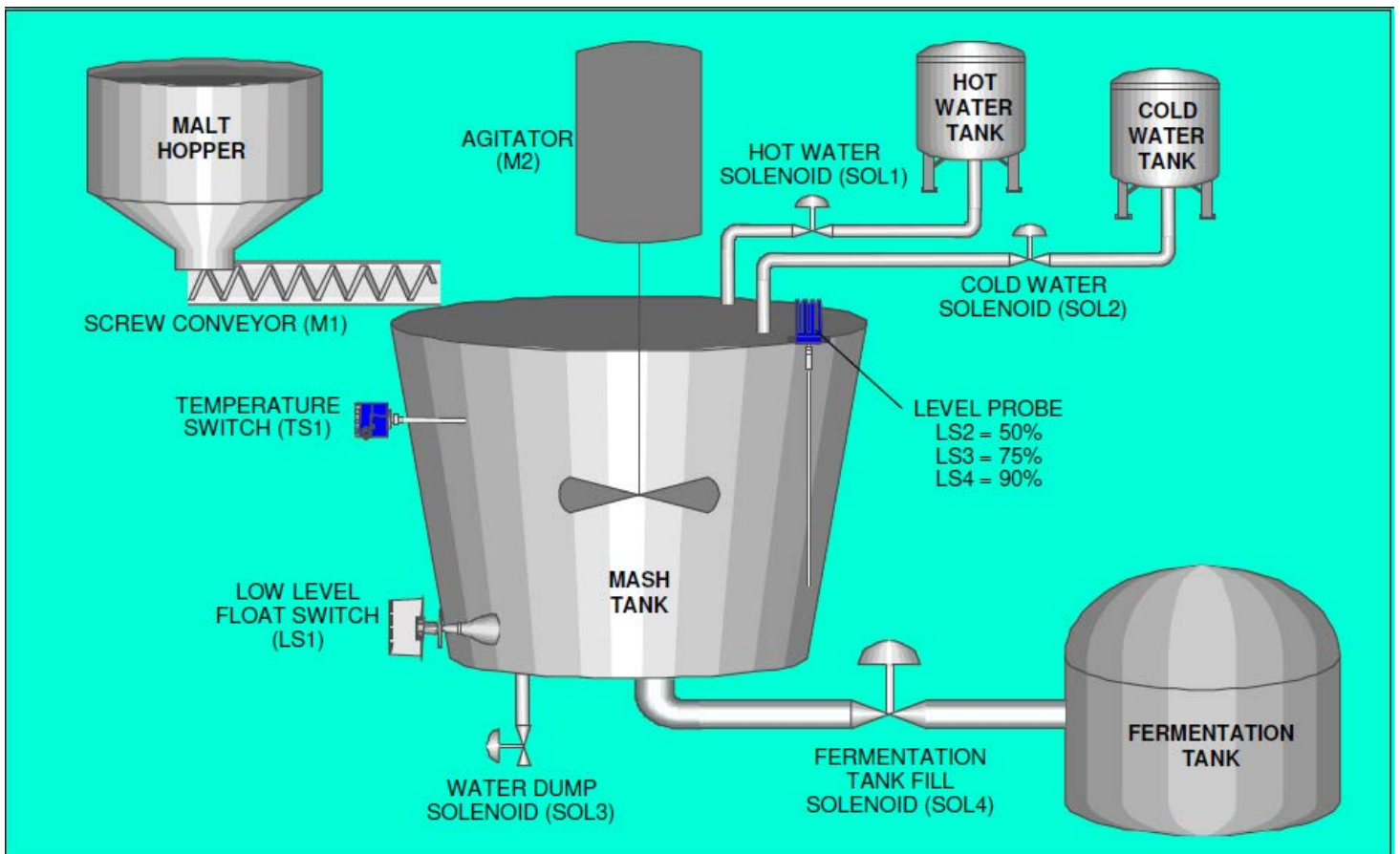
DOCUMENT USE



### 3.0 – General Description

#### 3.1 – Process Description

To make a quality whiskey the “mashing” of ingredients is a critical part of the process, mashing consists of mixing cooked grain with malted barley and pure warm water. The amylase in the malted barley converts the starch in the other grains into sugars. After several hours the mixture is converted into a turbid, sugar-rich liquid known as mash. (In making Scotch malt whiskey the mixture consists only of malted barley and warm water. After mashing the mixture is filtered to produce a sugar-rich liquid known as wort.) – Process Diagram



## 4.0 - Input and Outputs

### 4.1 Technical Details:

#### Inputs

##### Emergency Stop

The system is equipped with a general Emergency Stop 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.

See Input Table for Input designations

#### Outputs

For details of the location of the outputs, see the attached drawings.

See Output Table for Output designations.



## 4.2 - Inputs

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.

Input Detail	Symbol	Contact Type	PLC inputs Assignment
Emergency Stop	PB1	NC	In0
Stop	PB2	NC	In1
Start/Jog (Manual)	PB3	NO	In2
Jog Cycle Select	PB4	NO	In3
Automatic Mode	SS1	NO	In4
Tank Temperature	TS1	NO	In5
Tank Low Level	LS1	NO	In6
Tank 50% Level	LS2	NO	In7
Tank 75% Level	LS3	NO	In8
Tank High Level (90%)	LS4	NO	In9
VFD Output 1	VFD OUT01	NO	In10
K1F/K1R Auxiliary Contact (Paralleled)	K1F/K1R	NO	In11



DOCUMENT USE

### 4.3 – Outputs

Output Detail	Symbol	PLC outputs Assignments
Tower Lamp Red	L1	Q0
Tower Lamp Green	L2	Q1
Tower Lamp Amber	L3	Q2
Indicating Lamp Green	L4	Q3
Indicating Lamp Green	L5	Q4
Indicating Lamp Blue	L6	Q5
Indicating Lamp Amber	L7	Q6
Motor Contactor M1 Fwd (Screw Conveyor)	K1_F	Q7
Motor Contactor M1 Rev (Screw Conveyor)	K1_R	Q8
Hot Water Tank Solenoid	SOL1	Q9
Cold Water Tank Solenoid	SOL2	Q10
Mash Tank Empty Solenoid	SOL3	Q11
Fermentation Tank Fill Solenoid	SOL4	Q12
VFD Digital Input 02	VFD IN02	Q13
VFD Digital Input 05	VFD IN05	Q14
VFD Digital Input 06	VFD IN06	Q15



DOCUMENT USE