SPECIFICATIONS

NB SKILLS

PROVINCIAL COMPETITION

AUTOMATION AND CONTROL

APRIL 20, 2018-NBCC MONCTON
LE 20 AVRIL-NBCC MONCTON

Contents

1.1 Scenario

1.1.1 General

With this challenge, we will assess your:

a) ability to analyze technical data.
b) quality of wiring.
c) capacity to implement an automatic process.
d) troubleshooting techniques.
e) abilities to detect errors.

1.1.2 **Step A: Wiring an automated process within a panel**

As a technician, you should have the ability to completely wire a system and make any necessary modifications. We will assess the quality of your manual work and the accuracy of your interpretation of the drawings provided..

1.1.3 **Step B: Programming the automated process**

The programmable controller used in this challenge will be provided by the competition technical committee. You must program an automated process based upon the function provided. The system must be functional and adhere to the drawing instructions.

1.1.4 **Step C: Troubleshooting**

This section will assess your ability to detect and solve problems. The troubleshooting portion of this competition will be done through the commissioning of your project.

2.1 Conductors

2.1.1 Size and use

1. Power connections must be 14 AWG gauge.
2. 120V control conductors must be 16 AWG gauge.
3. 24V input/output conductors must be 18 AWG gauge.
4. Any exceptions to paragraphs 1 & 2 will be specifically mentioned on the drawings.
5. Ground terminals must be used for grounding purposes only.
6. DIN rail must be individually bonded

2.1.2 Colour Code

The following colour code must be used to distinguish circuits:

1. Three phase power	motors/contactors	Black
2. AC Control	Identified Conductor Line	White Red
3. 24 VDC	inputs/outputs	Blue
4. Grounding/Bonding		Green

2.2 Liquid Tight Conduit

2.2.1 Bending radius

No liquid tight conduit will be used for this competition

2.2.2 Liquid Tight Conduit Supports

No liquid tight conduit will be used for this competition

2.2.2 Quality and Finish

No liquid tight conduit will be used for this competition

2.3 Conduit fill Table

No conduit will be used for this competition

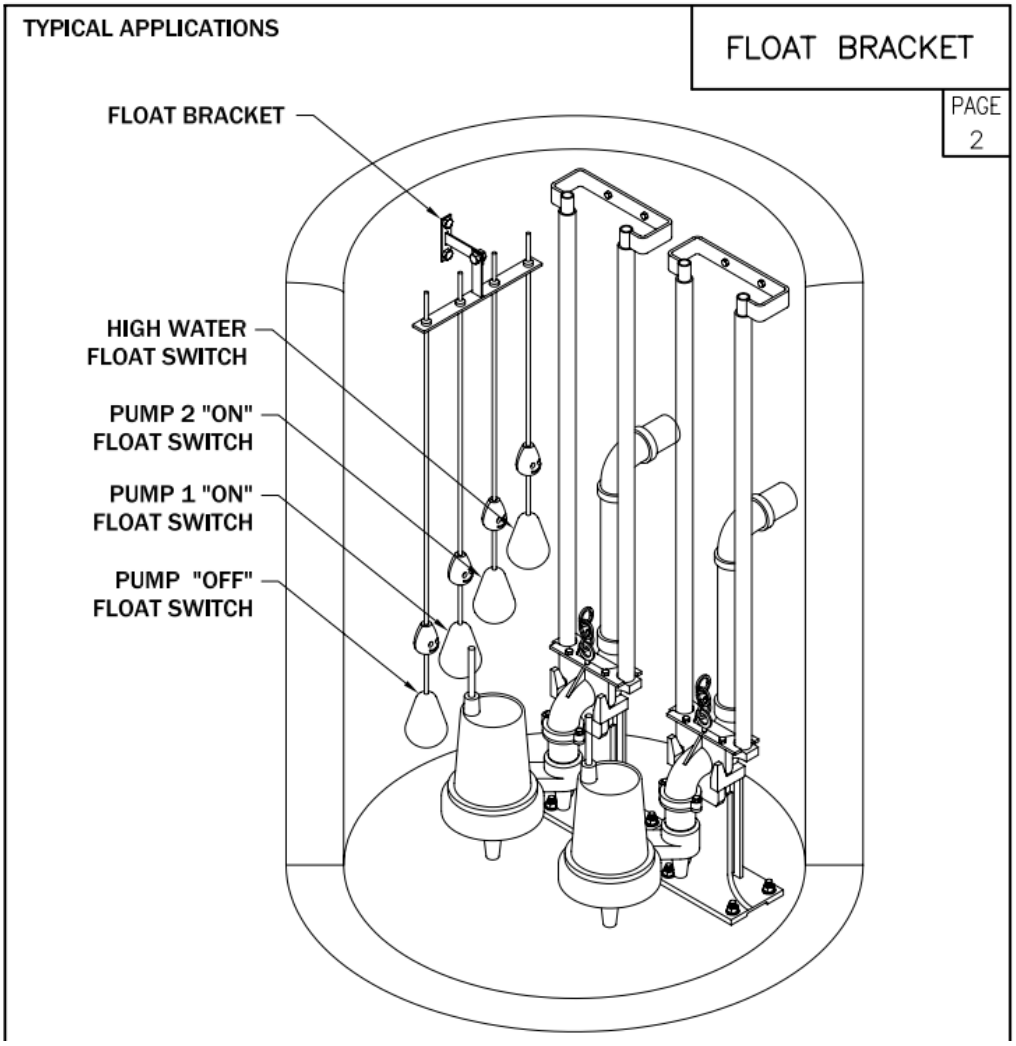
2.4 Cabinet Wiring

Each station will be provided with a 30”x 30” enclosure

- A cheater cord will be provided to supply 120V to the panel, which can be de-energized via the panel disconnect switch.
- 3 phase wiring must be installed from the panel disconnect. Only one phase and neutral will be used to power the project.
- All inputs and outputs are to be wired to terminal blocks.
- E-Stop will cut all power to the outputs only, using a Master Control Relay.
- Wire a single breaker to protect all 120V control circuit.
- Wire a single breaker to protect all the inputs and outputs (24V control circuit).

3.1 General Description

Lift stations or pump stations are often used by municipalities to pump effluent or wastewater from a lower elevation to a higher elevation, where gravity would be used to convey the wastewater to a water treatment facility. This project will be a working simulation of a lift station, containing 2 effluent pumps that will run alternately. No motors will be connected, however, wiring must be supplied to the line side of the contactors.



This system consists of:

- A single emergency stop
- 4 level switches
- 2 panel lamps, each of which will indicate that a specific motor is running.
- A red tower lamp will flash when the water level reaches the highest level switch.
- Two across-the-line starters.
- A selector switch to select Manual or Auto
- A selector switch to select either pump when in Manual

System Design

- The system is equipped with an Emergency Stop push button (PB1). Its contact (normally closed) de-energizes the power to all PLC outputs via the MCR. The E-stop is mounted on the panel door. The emergency stop push button must be wired to the Master Control Relay, which will interrupt power to all of the outputs when de-energized. With the E-stop pressed your program should run normally with the inputs operational.

- The system will run in two modes: Manual and Automatic. SS1 will be used to select between Manual and Automatic.

- There will be 4 Level Switches that will operate the system in Auto
    - LS1 – shut off pumps
    - LS2 – start first pump
    - LS3 – start second pump
    - LS4 – high water alarm

- L1 will illuminate when Pump 1 is running

- L2 will illuminate when Pump 2 is running

Auto Mode

- When water level reaches LS2, the first pump will come on. Pump will shut off when water level drops below LS1

- When there is an excessive amount of wastewater and one pump is not sufficient, the second pump will come on to assist the first when the water level reaches LS3. Both pumps will shut off when the water level drops below LS1
- L1 will come on with Pump 1, L2 will come on with Pump 2

- Pumps will alternate every other cycle as to which one comes on first (example: Pump 1 is the first pump to come on, the next time Pump 2 is the first one to come on)

- Auxilliary contacts from each motor contactor will be used to provide feedback to the PLC for the seal-in

- L3 will flash if the water level reaches LS4

Manual Mode

- LS1 must be made for any motor to run.
- A 3-position switch will be used to select between Pump 1 and Pump 2. Pump 1 will run when the switch is turned to the left. Pump 2 will run when the switch is turned to the right. Neither pump will run with the switch in the center position.

3.2 Technological Choices

- The automated process is controlled by a CompactLogix L32E processor provided by the technical team.

3.3 Inputs and outputs technical details

Inputs

Selector switches SS1 (Manual/Auto) and SS2 (Pump1-Off-Pump 2) will be mounted on the panel door.

Limit switches LS1-LS4 will be mounted on the wall to simulate level switches

NO Auxilliary contacts from K1 and K2 will provide feedback to the PLC

Outputs

24VDC contactors will be used for motor starters K1 and K2.

L1 and L2 shall be connected to separate outputs to indicate that Pump1 and Pump 2 respectively, are running.

L3 (red tower lamp) shall be used to show a high water alarm and shall flash at 1-second intervals.

3.3.1 Input table

Input Detail	Tag name	Alias	Information supplied at state "1"
SS1	Man_Auto	Local:2:I:Data.0	Automatic mode
SS2.1	Pump_1	Local:2:I:Data.1	Pump 1 selected
SS2.2	Pump_2	Local:2:I:Data.2	Pump 2 selected
LS1	Low_Lvl	Local:2:I:Data.3	Water is above the low level
LS2	First_pump	Local:2:I:Data.4	Start first pump
LS3	Second_pump	Local:2:I:Data.5	Start second pump
LS4	High_Lvl	Local:2:I:Data.6	Water is at high level
K1_AUX	K1_Aux	Local:2:I:Data.7	Pump1 is running
K2_AUX	K2_Aux	Local:2:I:Data.8	Pump 2 is running

3.3.2 Output table

Output detail	Tag name	Alias	Action at state "1"
K1	K1	Local:3:O:Data.0	Pump 1 on
K2	K2	Local:3:O:Data.1	Pump 2 on
L1	L1	Local:3:O:Data.2	Pump 1 running
L2	L2	Local:3:O:Data.3	Pump 2 running
L3	L3	Local:3:O:Data.4	High water alarm

FOR MORE TECHNICAL INFORMATION PLEASE CONTACT:

Mike McGaw : mmcgaw@nbpower.com
Eric Arseneau: eric.arseneau@ccnb.ca