Natural Gas Compressor Station Using Emerson DeltaV

B.Sc.(Honours) in Instrument Engineering

Department of Physical Sciences

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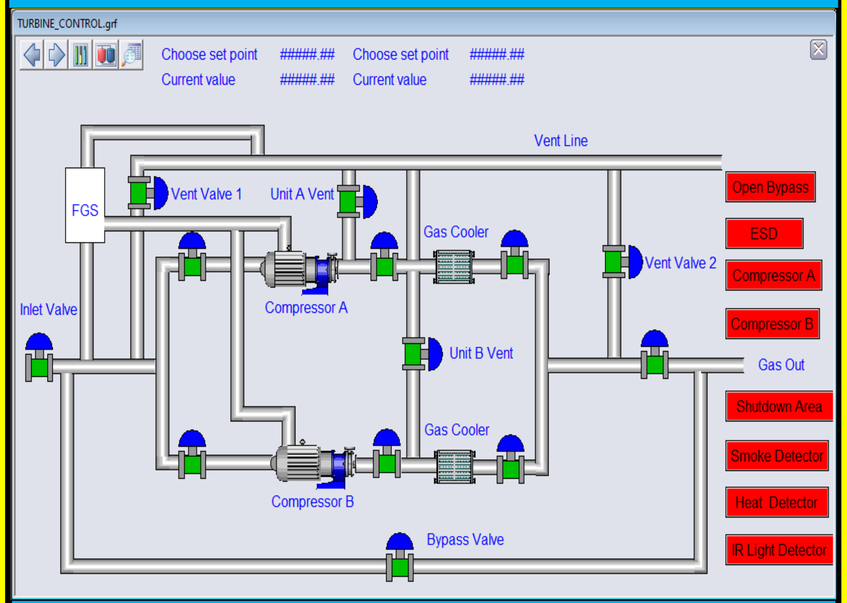
Background Information

- Natural gas is one of the most important energy sources to Ireland, but it has a high dependency on imports from Scotland to meet its demand.
- There are two interconnectors transporting natural gas across the Irish Sea from Scotland to Ireland and then the natural gas is distributed through Gas Networks Ireland's network to households.
- Natural gas needs to be transported at high pressures to meet customers' demands so the pressure must be boosted at compressor stations along the network.
- Emerson DeltaV is highly reliable and has a lightning-fast speed of operation making it a popular choice of control system in many different areas of the globe.

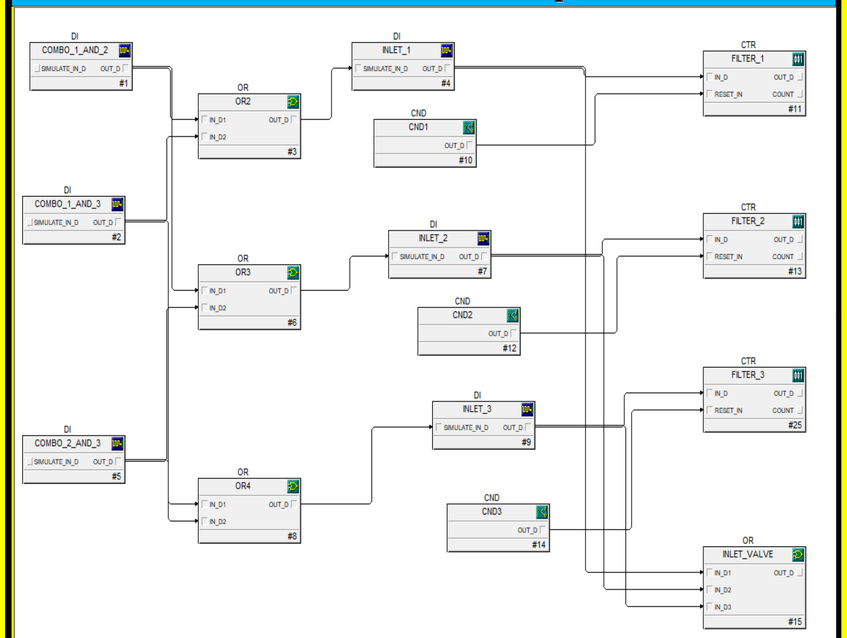
System Design

- The DeltaV program is based on the ISA S-88 model and has one area and five control modules with this area.
- The five control modules constructed are;
  - Fuel Filters
  - Fuel Gas Skid
  - Turbine Control
  - Fire and Gas Detection
  - Emergency Shutdown
- Pressure is the controllable element in this simulation, and this is simulated using a first order PID controller function block inside DeltaV.
- Graphics are included to make the simulation easier to understand and more realistic.

User Interface



Control Studio Set Up

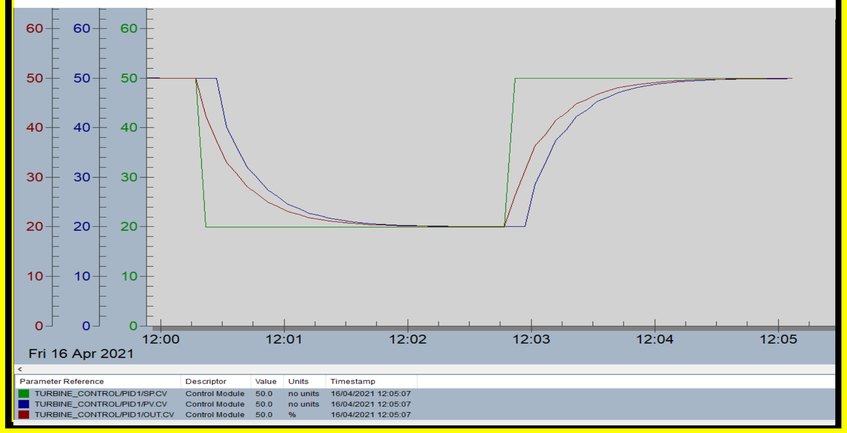


Cause and Effect Table

	Sytem Outputs	Alarm Type	Trip Value	Filter A drain valve open	Filter A shutdown	Filter B drain valve open	Filter B shutdown	Filter C drain valve open	Filter C shutdown	Close Gas Meter Path 1	Close Gas Meter Path 2	Filter A Open	Filter B Open	Filter C Open
PROCESS STEP	System Inputs													
	Filters Control Module													
1	Filter A level high	Hi	> 40 cubic metres	X										
2	Filter A clogged	HiHi	42 cubic metres		X		X		X	X	X			
3	Filter B level high	Hi	> 40 cubic metres			X								
4	Filter B clogged	HiHi	42 cubic metres		X		X		X	X	X			
5	Filter C level high	Hi	> 40 cubic metres					X						
6	Filter C clogged	HiHi	42 cubic metres		X		X		X	X	X			
7	Sutdown Area Button Pressed	Critical	N/A		X		X		X	X	X			
8	ESD Button Pressed	Critical	N/A		X		X		X	X	X			
9	2 Out of 3 Detectora Activared	Critical	N/A		X		X		X	X	X			
10	Select Combo 1 and 2	N/A	N/A									X	X	
11	Select Combo 1 and 3	N/A	N/A									X		X
12	Select Combo 2 and 3	N/A	N/A										X	X

Pressure Control

- Set point changed from 50 bar to 20 bar and back to 50 bar again.
- The change in pressure is in a controlled manner.
- The pressure never exceeds the set point.



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