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# PLC& SCADA Based Measurement and Data Collection for Gas Filling Application

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## Abstract:

All atmospheric air contains some water vapour and mixture of gases which will begin to condense into liquid water inthe compressed air or gas system when the air orgas cools past the saturation point, i.e., the pointwhere it can hold no more water vapour.Condensation in the compressed air system would occur at the inlet air saturation temperature if temperatureremained constant as air was compressed.However, since there is a rise in temperature duringactual compression, condensation generally isavoided withinthe compressor. Later, as compressedair is discharged and cooled in an after cooler,condensation begins to occur. The condensedmoisture must be removed by a separator and trap.Theair leaving the after cooler normally is saturatedat the after cooler discharge temperature.

This project describes the calibration section of gas cylinders filling plant using a system for collecting data from the gas analyzers and other sensors. The system replaces manual inspections of values measured by set of analyzers and their comparison with values from data sheets and automates subsequent manual entry in the list and accompanying tables. The existing system consists of measuring software running on a PC via Programmable Logic Controller. Gas containers and gas compounds are identified by bar codes. In the proposed system PLC program is developed to understand the process of Air distillation for the separation of Stock, Gases like Oxygen & Nitrogen in CODESYS to analyze the result.

## Keywords:

Compressed air, Gas Analysers, PLC, SCADA.

## Introduction:

The problem of measurements in many older plants is that they were based on separated manual device. Employees have to start measurement on multiple devices, check and evaluate results and make record of values to paper or digital form. This solution could be cheaper and simpler to realize in past, but nowadays trends in industry leads to minimalize operations made by human if they can be automatized by computer.Worker can focus on manual operations and decisions, which machine can't do, instead of repetitive actions like periodically checking multiple devices and fill paperwork. In long term, this automation leads to lover cost by saving time and avoiding of typographical errors. The aim of this project was to improve procedure of checkout measurements in cylinders filling plant where situation was similar as described above.

## Programmable Logic Controllers:

PLCs (programmable logic controllers) are the control hubs for a wide variety of automated systems and processes. They contain multiple inputs and outputs that use transistors and other circuitry to simulate switches and relays to control equipment. They are programmable via software interfaced via standard computer interfaces and proprietary languages and network options. Available inputs for programmable logic controllers include DC, AC, analog, thermocouple, RTD, frequency or pulse, transistor, and interrupt inputs. Outputs for PLCs include DC, AC, relay, analog, frequency or pulse, transistor, and triac. Programming options for PLCs include front panel, hand held as well as computer. PLCs can also be specified with a number of computer interface options, network specifications and features. In addition to controlling

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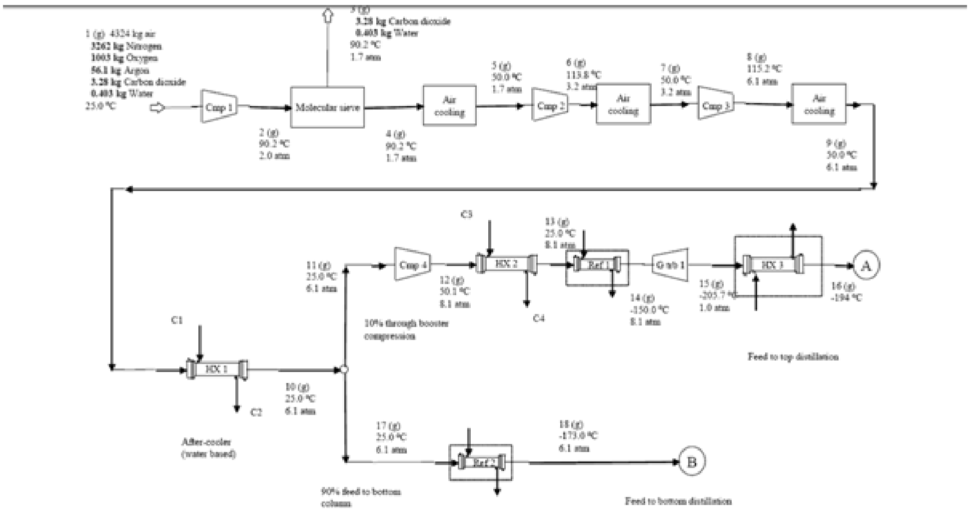
## Supervisory Control And Data Acquisition:

SCADA stands for Supervisory Control And Data Acquisition. As the name indicates, it is not a full control system, but rather focuses on the supervisory level. As such, it is a purely software package that is positioned on top of hardware to which it is interfaced, in general via Programmable Logic Controllers (PLCs), or other commercial hardware modules. SCADA systems are used not only in industrial processes: e.g. steel making, power generation (conventional and nuclear) and distribution, chemistry, but also in some experimental facilities such as nuclear fusion. However, SCADA systems evolve rapidly and are now penetrating the market of plants with a number of I/O channels of several 100K SCADA systems used to run on DOS, VMS and UNIX; in recent years all SCADA vendors have moved to NT and some also to Linux.

## Structure of the System




## Compressed Air:

Compressed air is air kept under a pressure that is greater than atmospheric pressure. It serves many domestic and industrial purposes. In Europe, 10 percent of all industrial electricity consumption is to produce compressed air—amounting to 80 terawatt hours consumption per year.In industry, compressed air is so widely used that it is often regarded as the fourth utility, after electricity, natural gas and water. However, compressed air is more expensive than the other three utilities when evaluated on a per unit energy delivered basis.

## Molecular Sieve:

A molecular sieve is a material with very small holes of precise and uniform size. These holes are small enough to block large molecules, while allowing small molecules to pass. Many molecular sieves are used as desiccants. Some examples include activated charcoal and silica gel.

## Air Cooling:

Air cooling is a method of dissipating heat. It works by making the object to be cooled have a larger surface area or have an increased flow of air over its surface, or both. An example of the former is to add cooling fins to the surface of the object, either by making them integral or by attaching them tightly to the object's surface (to ensure efficient heat transfer). In the case of the latter it is done by using a fan blowing air into or onto the object one wants to cool. The addition of fins to a heat sinkincreases its total surface area, resulting in greater cooling effectiveness.

## Joule-Thomson Effect::

In thermodynamics, the Joule–Thomson effect (also known as the Joule–Kelvin effect, Kelvin–Joule effect, or Joule–Thomson expansion) describes the temperature change of a gas or liquid when it is forced through a valve or porous plug while kept insulated so that no heat is exchanged with the environment. This procedure is called a throttling process or Joule–Thomson process.

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At room temperature, all gases except hydrogen, helium and neon cool upon expansion by the Joule–Thomson process; these three gases experience the same effect but only at lower temperatures.

## After Cooler:

Air-Cooled After coolers provide economical cooling by utilizing ambient air to cool the hot compressed air from an air compressor. Discharge air from an air compressor is generally 180°F - 350°F, depending on the type of compressor. With a properly sized after cooler, as much as 60% of the water in compressed air can be removed.

## Heat Exchanger:

A heat exchanger is a piece of equipment built for efficient heat transfer from one medium to another. The media may be separated by a solid wall to prevent mixing or they may be in direct contact. They are widely used in space heating, refrigeration, air conditioning, power stations, chemical plants, petrochemical plants, petroleum refineries, natural-gas processing, and sewage treatment. The classic example of a heat exchanger is found in an internal combustion engine in which a circulating fluid known as engine coolant flows through radiator coils and air flows past the coils, which cools the coolant and heats the incoming air.

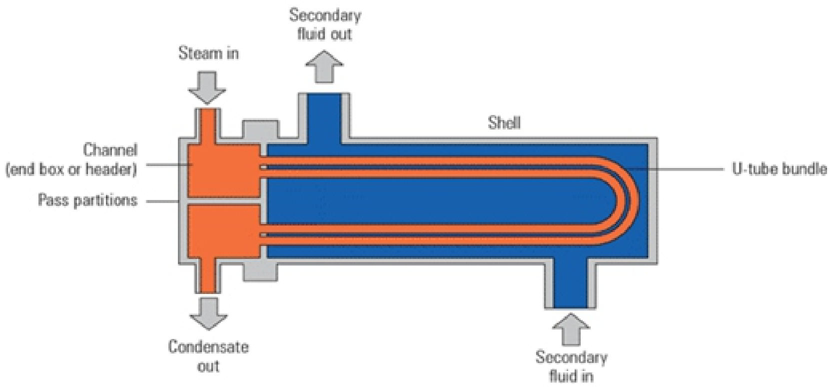


**Figure Heat Exchanger**

## Implementation ofMeasurement And Data Collection For Gas Filling Application:

Since the hardware and software requirements should besatisfied according to defined safety standards in the implementationphase, on the hardware side, fail-safe programmablelogic controllers are used. Therefore, a CoDeSys based model fail-safe programmable logic controller was used in thisstudy. In the fail-safe programming, it is allowed to use only alimited set of programmable-logic-controller commands. Userdefined data types, or other complex data types, such as REAL,ARRAY, BYTE, are also mpy allowed to be used in the fail-safeprogram. Only basic data types, such as WORD, INT, BOOL, andTIME are allowed to be used. The fail-safe programmablelogic-controller program can be written only in ladder-diagram(LD) or function-block-diagram (FBD) languages. All of theselimitations lead to difficulty in programming. However, with allthese precautions, safe operation is guaranteed.It is easy to implement the design of measurement and data collection for gas filling application on the programmable logic controller using the basic logical expressions and the SCADA screens are given in the figure below.

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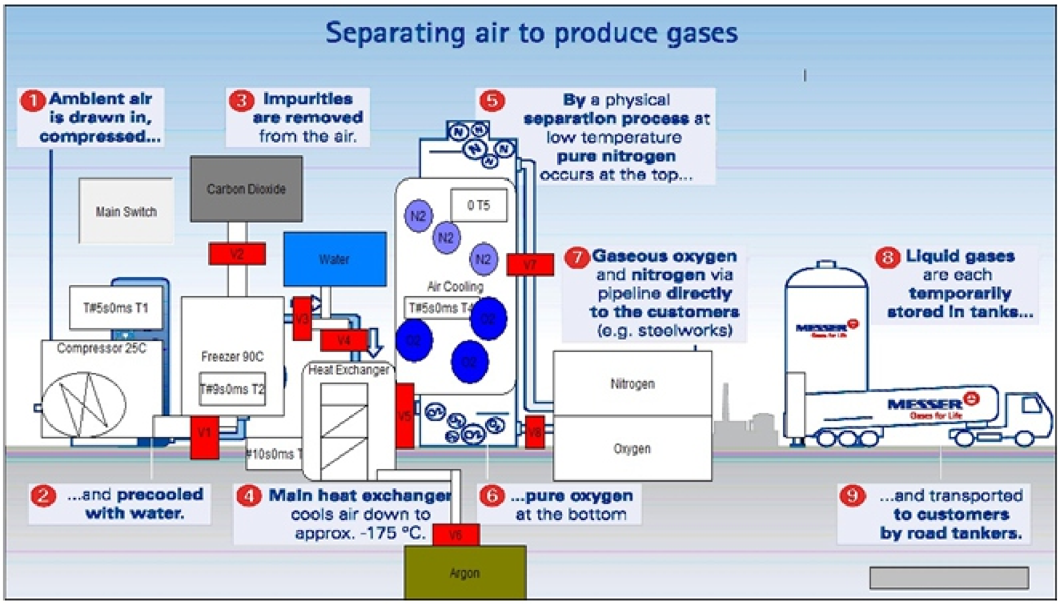
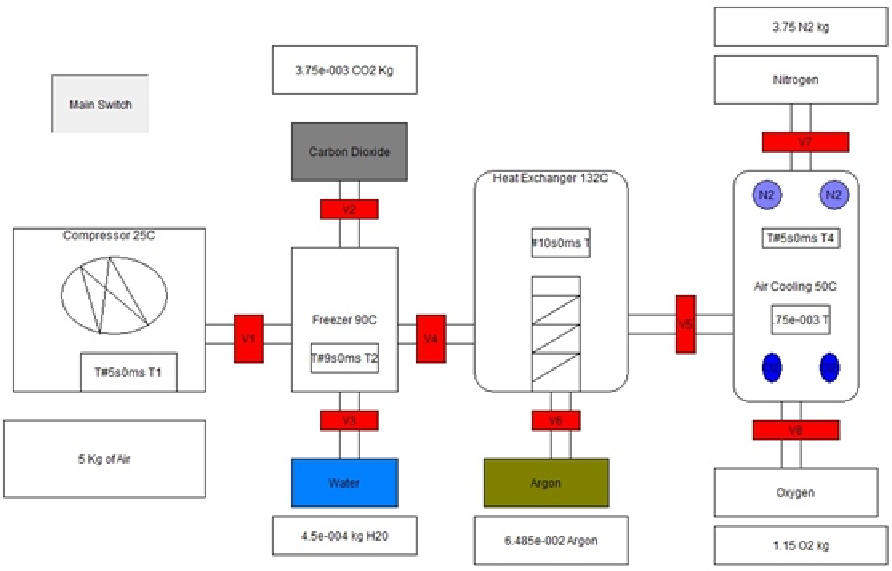



SCADA Screen in CoDeSys Software




SCADA Screen2 in CoDeSys Software

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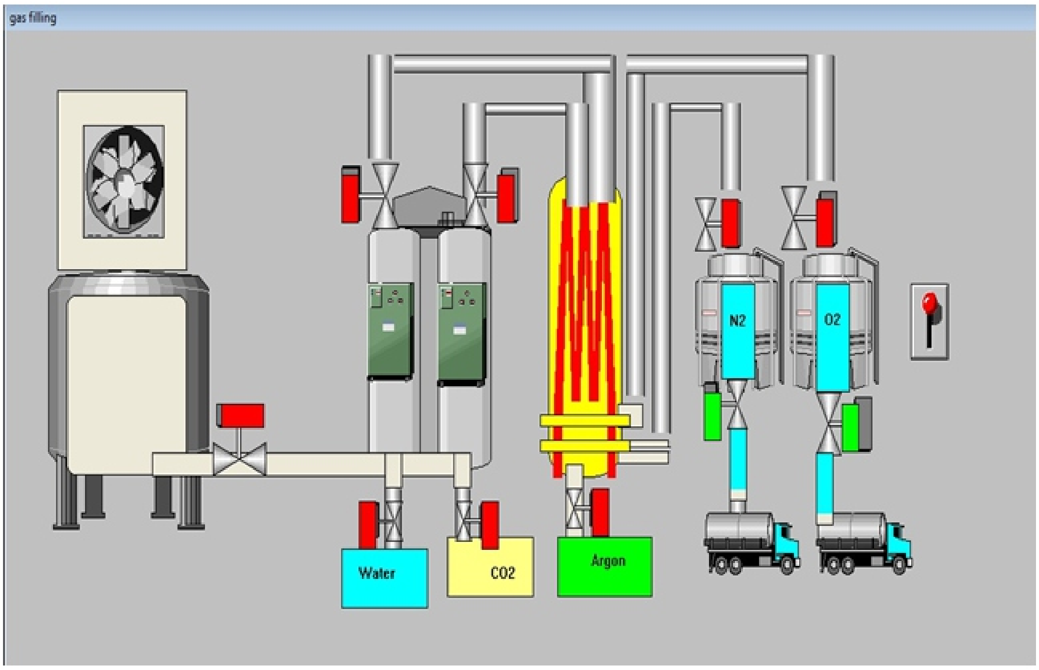


**SCADA Screen in Wonderware InTouch Software**

## Conclusion:

A detailed model of PLC & SCADA Based Measurement and Data Collection for Gas Filling Application is designed. A control system based on LadderLogic technique which collects the air in compressed form and is liquefied by reducing the temperature and collection of fluids at differentlevels has been presented. The simulation shows that theseparation of gases and measurement and data collection areautomated.

From the simulation results, it is also shown that the measurement and data collection using ladder logictechnique compensates the time and provides excellent separation of gases at different levels. The monitoring systemprovides the operator to monitor and control the processwithout any difficulties and also under emergency situations. The main advantage of the automated systems is that it is highly efficient and its control is simple. This system is high cost but the cost can be compensated in future as it is one time investment.

## References

[1] Qingyuan Ma; Chen Wang; Jian Lu; Chenming Jiang; Intelligent Transportation Systems (ITSC), 2014 IEEE 17th International Conference on Year: 2014.

[2] Yi-Li Huang; Shih-Han Chen; Fang-YieLeu; Chia-Yin Ko; Jung-Chun Liu; Intelligent Networking and Collaborative Systems (INCoS), 2014 International Conference onYear: 2014.

[3] Xinping Yan; Hui Zhang; Chaozhong Wu; IEEE China; Distributed Computing and Applications to Business, Engineering & Science (DCABES), 2012 11th International Symposium on Year: 2012.

[4] Automation of measurement and data collection for gas filling line, PetrPodešva, David Fojtík, Jan Gebauer, Department of Control Systems and Instrumentation, VŠB Technical University, Ostrava Czech Republic IEEE 2014.