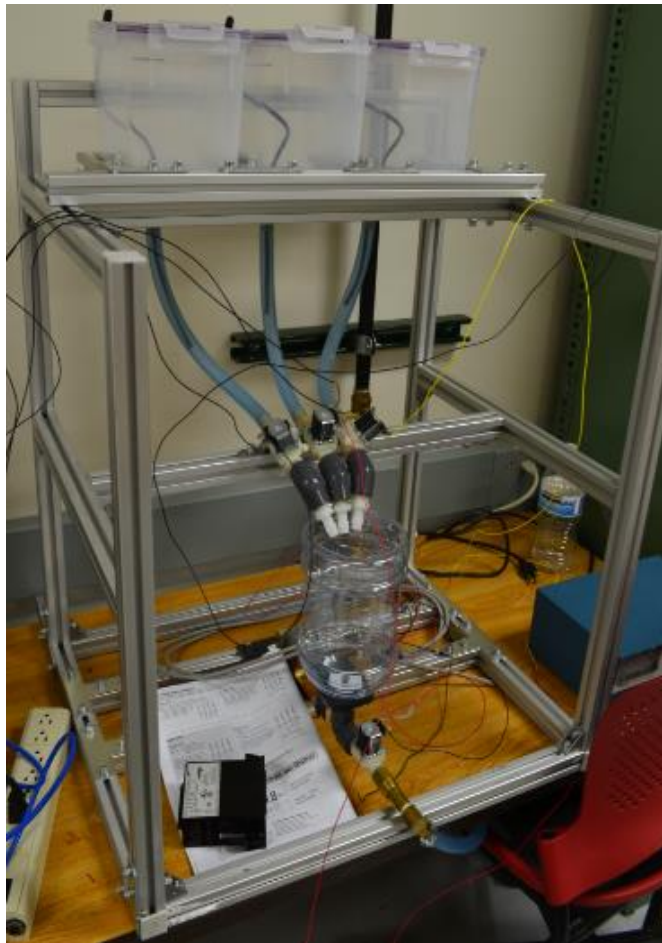


Chapter 14 Batch System Programming

Liquid Batch Lab

The lab was first built by a capstone group. Since then, it has been used by a second capstone group as well. It has been in storage at other times and is rather large.



Three Ingredient
Batch System

Purpose of the Lab – The purpose of this lab is to introduce students to batching system design. This simple lab is a second step in this effort. Earlier lab exercises include games that simulate the same principles of design. These are introduced in the text for the course (ch. 13).^[7]

Materials - This was a first experience with 8020 aluminum extrusion members. The students who built this lab were from industry and built the unit with structural material used in industry. They were very successful in mounting a number of devices that were integral to the system. This structural material is found in a variety of sizes and many maker kits feature the same construction material in smaller sizes. The batch system here is made from 1" x 1" members.

Cost – The cost of this system can be built for a total cost of between \$500 and \$1000.

Benefit – This lab experience has several benefits in that the actual control of weighing a fixed amount is required. The anticipation of cut-off, the adjustment for liquid head pressure all are integral to the actual weight measurement. This lab introduces statistics into a process since no two weigh adds are exactly the same. The statistical process can be used to analyze the mix system. It is an ideal system for report generation and database applications.

Challenges – There needs to be more of these built so several student groups can program the same lab simultaneously. There was a recent purchase through grants of a new scale interface card for the Siemens PLC which should be implemented soon.

This lab incorporates the mixing of three liquids weighed individually in the mix tank at the bottom. A load cell reports the change in weight through a Red Lion load-cell control interface. This interface outputs a linear weight in volts. The controller is a PLC or computer that controls the turn off of the valves to create a proper weighed mixed batch.

Two capstone groups gained experience with this lab. The students in both groups used the PLC and HMI to create a totally automated batching system. One used Allen-Bradley equipment. The other used Siemens.

This system is rather heavy and hard to move from room-to-room. It is difficult to store and only one was made. It will probably not be expanded to 8 units since the cost and size is prohibitive.

Scale Weighing

Scale Weighing Systems are an important part of a batch system. Siemens provides a load cell interface system for weighing applications called the SIWAREX WP231. It is pictured in the picture in Fig. below.

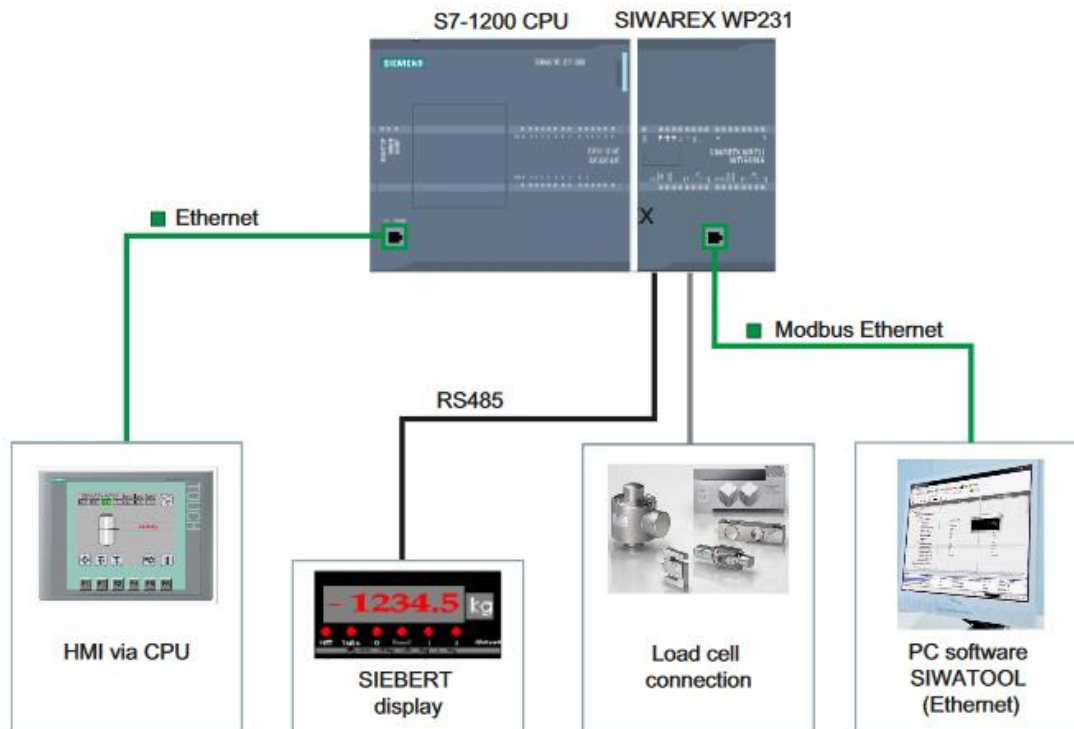


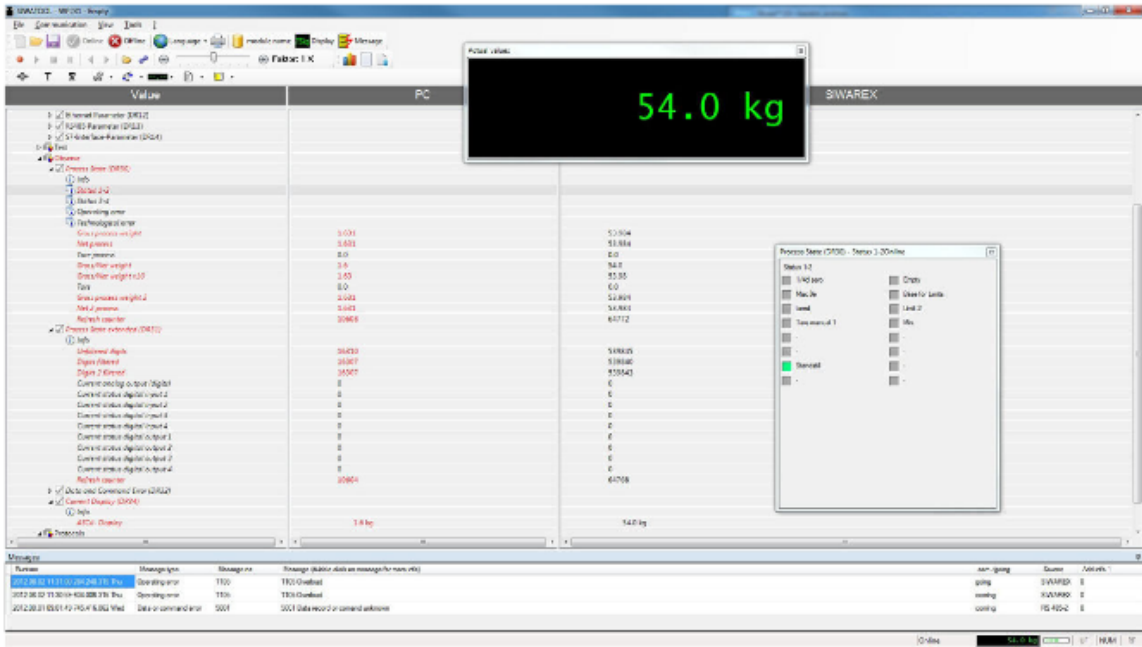
The electronic weighing system has the following characteristics as listed by Siemens:
“

- Uniform design technology and consistent communication in SIMATIC S7-1200
- Parameter assignment by means of HMI panel or PC
- Uniform configuration option in the SIMATIC TIA Portal
- Measuring of weight with a resolution of up to 4 million divisions
- High accuracy, 3000 d, legal for trade according to OIML R76
- Legal-for-trade display with SIMATIC operator panel or PC
- High measuring rate of 100/120 Hz (effective interference frequency suppression)
- Limit monitoring
- Flexible adaptation to varying requirements
- Easy calibration of the scales using the SIWATOOL program
- Automatic calibration is possible without the need for calibration weights
- Module replacement is possible without recalibrating the scales
- Use in Ex Zone 2 / ATEX approval
- Intrinsically safe load cell supply for Ex Zone 1 (SIWAREX IS option)
- Diagnostics functions”

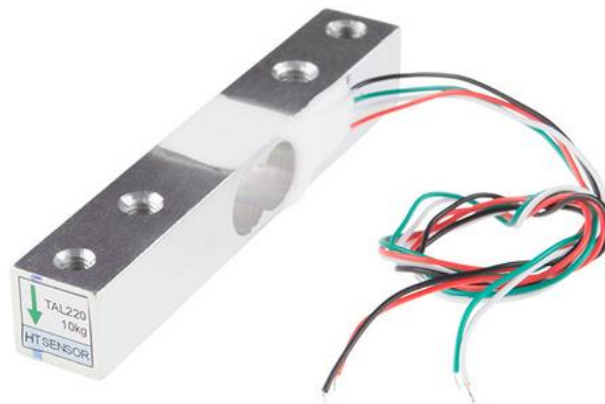
SIWATOOL overview

SIWATOOL does not only offer support when you set the scale but also when you analyze the diagnostic buffer that can be saved after being read out of the module together with the parameters. The display of the current scale status can be configured.





A load cell is pictured in the figure below:



The following weigh vessels show the location of load cells with the vessel suspended in space. These weigh vessels show the traditional locating of load cells at four corners of the tank.



The Siemens system is described in the manual: Weighing systems Electronic weighing system SIWAREX WP231.

Also, the load cell can be terminated in a converter box similar to the Red Lion Strain/Load Cell Panel Meter pictured below. Since it can be used to interface to a PLC using an optional analog output, the Red Lion is used simply to pass through a signal from the scale to the PLC after linearization has occurred with the scale signal.



Red Lion PAXS0000 Strain/Load Cell Panel Meter

Red Lion - Mfr # PAXS0000 - Item # EW-68486-20

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