White Paper written for
World Batch Forum
June 2004

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White Paper
S88 for beginners

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Are you interested in or curious about Batch Control, ISA S88, and/or Plant Automation in general, then this whitepaper is for you.

In the following three pages you will learn the basics about Batch Control and ISA S88 and you will understand how you can benefit from knowing them. For a deeper understanding I recommend you to read the other whitepapers in this series as well as reading the ISA S88 standard.

ISA S88 is a standard. But what is a standard?

A standard does not tell you what you have to do (regulations do), but rather what you should do in order to be successful. A standard has normally been developed with lots of thought and with input from many-many people with different knowledge and experience, i.e. a standard contains common and good knowledge.

ISA S88 is a standard for Batch Control. But what is Batch Control?

Industrial processes can be classified as continuous, discrete or batch. Very briefly, continuous processes are classified as processes which have a continuous outflow, e.g., production of energy, discrete processes have a discrete output. One example could be the production of a car. It is possible to trace the production of each car and each piece individually. Batch processes are a mixture of continuous and discrete as it posses characteristics from both. The outcome is called a batch. Controlling a batch process is referred to as Batch Control.

In the beginning of the 90ies a standard - ISA S88 - was developed and published, focusing on batch processes and the control of such. It defines terminology and concepts that makes design and operation of batch plants easier.

The ISA S88 standard consists of three parts:

- ANSI/ISA-88.01-1995 Batch Control Part1: Models and Terminology
- ANSI/ISA-88.00.02-2001 Batch Control Part 2: Data Structures and Guidelines for Languages.
- ANSI/ISA-88.00.03-2003 Batch Control Part 3: General and Site Recipe Models and Representation

At this initial point in time, part 1 is definitely the most important part and the only one that you have to consider. It presents four basic concepts;

1. How to depict what you have in the plant (referred to as the physical model)
2. How to define what you would like to accomplish in the plant (referred to as the recipe)
3. Implementation of what you can do in the plant (referred to as the equipment logic)
4. How to put the three pieces mentioned above together in an intelligent, reusable and successful way.

The standard is not very long. The printed version is about 90 pages and it would surprise me if a thoroughly reading took more than three or four hours.

ISA S88 provides value for you

Before shortly explaining about the basic concepts, let us give some examples of how this standard will provide you with a mind-set highly appreciated and needed in industry today.

First of all, the standard was developed especially for batch processes; however, it can successfully be applied also to continuous and discrete processes that require a certain amount of flexibility. This means that whatever domain you are working in, the standard provides you with a clever and successful way of thinking.

Secondly, S88 offers standard terminology, with the objective of improving communication. In this way different people don't use different terms for the same thing, or the same term for different things. Difficulties in communication can cost time and money, or even worse, it can cause failures in control systems.

More over, an important aspect of S88 is modularity. This makes process equipment and procedures developed in one application reusable in another application, resulting in savings in time and money.

Many more examples can be listed, and I am sure you will agree after reading and understanding the standard.

ISA S88 basic concepts

So which are the basic concepts presented in ISA S88?

In order to depict what you have available in the plant in terms of equipment, the **Physical Model** should be used. The physical model provides you with a terminology and a hierarchy than can be applied on the physical equipments in the plant. In the

physical model, the highest levels are the Enterprise, Site and Area. However, the levels of importance for batch control and S88, start with the process cell. A process cell consists of one or many units that in turn consist of equipment modules and control modules. Within a process cell, a product is made. A unit might be a reactor or a mixer.

> An example of a similar approach used in our everyday life concerns our living; we live in a house, a house contains one or many rooms, and a room contains one or many pieces of furniture. A house is where we live. A room might be a kitchen, office or a bedroom.

In order to describe what you would like to achieve in the plant a **Recipe** should be created. The most important part of the recipe is the procedure, defining what you would like to do, e.g., first you would like to fill the mixer with a certain substance, then mix it and finally empty what you have in the mixer. The procedure complies with the **procedural model**, i.e., a procedure can be broken down into unit-procedures, a unit-procedure into operations and an operation into phases. A recipe also contains the formula, i.e., parameter values useful in the procedure.

> An example of a similar approach used in our everyday life concerns baking; we make cakes according to recipes. The cake-recipe contains a “procedure”, i..e, a description of what we would like to do (first add sugar, then add eggs, then mix, then add flour, etc etc.). In addition, the recipe contains the “formula”, i.e., 500 grams of sugar, 3 eggs, mixing time 3 minutes, etc etc).

The functions requested in the recipe need to be implemented in the equipment control system. Their implementation is referred to as **equipment logic**.

Well, what is so smart about this? The smart thing is that the recipe can be written without knowing anything about how the equipment logic is implemented. It is enough to know their interfaces. Vice versa is also true, the equipment logic can be implemented without knowing anything about how they will be used in different recipes. The two activities can be completely separated. The equipment logic focuses on implementing a certain function in a good and efficient way, whereas the recipe focuses upon combining the equipment logic in such a way that the desired end product is produced.

> In the example above, this implies that the writer of the cake-recipe does not need to know how you add your sugar, e.g., if you use a scale for measuring your sugar or if you measure by knowing the corresponding volume.

The concepts of the standard seem obvious and natural, when you think of similar approaches taken from our everyday life, however, used in industry and in large scale they have not been so obvious and easy to grasp. Nevertheless, by knowing and applying these concepts, positive improvements can be achieved.

More info

The standard can be purchased from ISA (www.isa.org), the organization that development of the standard. The international version of ISA S88 is called IEC 61512 and is available from the International Electrotechnical Commission (www.iec.ch). World Batch Forum provides valuable information regarding Batch Control and S88, and they organize conferences, web seminars, etc related to Batch and S88. Their site, www.wbf.org, is recommended.