

Safety in control

Integrating control and safety functions in a single automation system reduces engineering time and delivers significant cost savings over the plant lifecycle.

There has been a notable increase in attention to the subject of human safety in both discrete and process manufacturing plants over the last few years. While safety lapses in the factory environment can cause nasty injuries or even amputations, they rarely produce the mass casualties and deaths that can occur in a process plant mishap.

In the process industries, hazards arise from materials being toxic, flammable or potentially explosive. And the process itself may be hazardous – involving high pressures, temperatures or exothermic reactions. If not properly addressed, any of these hazards could lead to fatalities.

A recent high-profile case was the 2005 BP refinery disaster in the US, in which 15 people were killed and scores injured when inadvertently-released hydrocarbon vapors ignited to cause a huge explosion.

Aside from the cost in innocent lives, BP is having to pay out billions in compensation and its corporate reputation has taken a major hit. On the positive side, if there can be one, the global oil giant has promised to install modern process control systems on major units and is hiring 300 external safety experts to conduct comprehensive audits of its safety system.

"I have witnessed a big change over the previous two to three years, from 'don't want to know' to great interest and healthy attendance in my Safety Lifecycle Concepts Workshops," says Stephen Burke, TÜV-certified functional safety expert and Siemens Process Safety Promoter in Southeast Asia. "New international standards and requirements of global investors in joint venture facilities are driving this, especially in the oil & gas sector."

Integration at the core

For Siemens, its approach to process safety comes with "Safety Integrated for Process Automation", a comprehensive range of products and services for fail-safe and fault-tolerant applications for the process industry. All the principal components of a typical safety instrumented system (SIS) are available, including controllers, network, I/O modules, instruments, and actuators.



A comprehensive range of products for process safety.

As a constituent of the company's Totally Integrated Automation (TIA) philosophy, it is not surprising that "integration" plays a key part in Siemens' offerings, with the full potential of Safety Integrated being realized through combination of BPCS (basic process control system) and SIS in the SIMATIC PCS 7 process control system:

- A common engineering system for standard and critical applications
- Homogenous integration of safety technology into the automation system of PCS 7
- Visualization of safety-related fault messages data on the PCS 7 operator station (OS), with common time stamping

In essence, this approach means a reduction in required space, hardware and wiring, and shorter installation and engineering time. And overall, there are significant and much welcome cost savings over the complete lifecycle of the plant.

Safety system highlights

Some examples of safety technology and components available from Siemens:

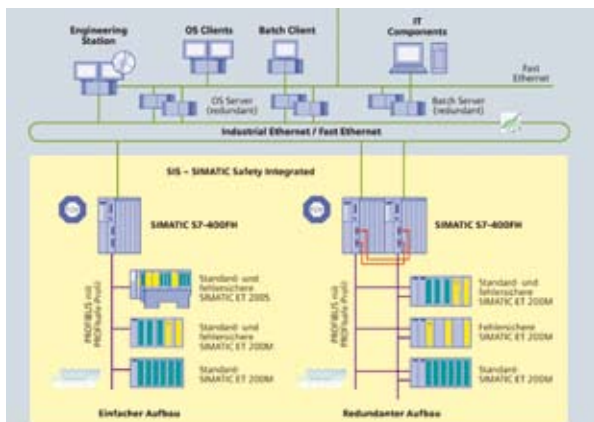
• Control

For emergency shutdown (ESD) valves, carrying out partial stroke tests (PST) enables the time interval between full stroke tests (FST), which normally involves complete plant shutdown, to be extended e.g. from one year to two. The Siemens SIS contains preconfigured function blocks for automatic execution of the PST at the defined test intervals. These provide operator alarms and feedback on valve state along with calculation of the time of the next full stroke test.

• Network

PROFIsafe was the first communication protocol approved (up to SIL 3) under international safety standard IEC 61508 that permits both standard and safety-related comms on the same data.

The PROFIsafe profile implements as an additional software layer without modifying communication mechanisms of the standard PROFIBUS. And through counteraction mechanisms, PROFIsafe is able to recognize and compensate for various types of faults: repetition, loss, insertion, incorrect sequence, data falsification, delay, masquerade.



Process control and safety control integrated in SIMATIC PCS 7.

- **I/O**
Moving towards the field, fail-safe I/O systems are available for connecting actuators and sensors: ET 200M – modular I/O for multi-channel applications, and ET 200S – bit-modular I/O. Cost and space-saving features include fail-safe shutdown without additional safety relays, and standard/ fail-safe modules in one station.
- **Device**
Down at the device level, the SITRANS P DSIII

digital pressure transmitter becomes the first PROFIBUS PA device available for SIL 2 safety shutdowns in accordance with IEC 61508/61511. In a safety application, the pressure transmitter can connect to the S7-400 FH controller over PROFIBUS PA + PROFIsafe.

The matrix

In the engineering phase, for configuration of safety applications, and for their operation and maintenance, Siemens has developed an innovative safety lifecycle software tool – SIMATIC Safety Matrix.

Based on the familiar principle of a cause & effect grid, the tool is suitable for processes where defined statuses require specific safety reactions. Possible process events (inputs) are entered in the horizontal lines of the matrix, and then their type, logic operations, delays, interlocks, as well as any tolerable faults are configured. The reactions (outputs) to a particular event are then

defined in the vertical columns.

Benefits of the Safety Matrix include automatic generation of safety-related STEP 7 program; easy, clear configuration to minimize sources of design faults; automatic generation of visualization for display on operator station; and easy modification of safety function.

Healthy growth ahead

Asish Ghosh, Vice President of ARC Advisory Group, in a recently-published report, predicts a CAGR of 10 percent for the process safety systems market, meaning that by the end of this decade, the market would be worth about US\$1.5 billion.

"Rough estimates of safety related I/O, in the oil and gas sector instance, of the total I/O's in a project, would be something like 15-20 percent for refining, 50 percent for upstream and 30 percent for LNG," said Ghosh when quizzed by *CE Asia*. He singles out India and China as the main drivers of this market.

Siemens' Stephen Burke concurs, pointing out that the fastest growth region in Asia and that MNCs relocating to the region "cannot discriminate between their operations in the first and developing worlds, as far as process safety goes".

EXCELLING IN INTEGRATION

Siemens safety technology plus a high level of sector expertise and systems integration skills is proving to be a winning formula for Singapore's Excel Marco.

Established just seven years ago, Excel Marco Industrial Systems is a Singapore-based control and safety systems provider that has quickly built up a reputation for delivering specialized safety solutions to the oil & gas and chemical/ petrochemical sectors. Signs of the current industry good times are reflected in a healthy order book and in plans to boost the current 40+ staff numbers to handle the increasing number of projects.

In 2006, Excel Marco was awarded the contract to supply the ICSS (Integrated Control & Safety System) for a floating, storage, offloading (FSO) vessel operated by MODEC, a world leader in FSO/FPSOs, on behalf of Brazilian national oil company Petrobras.

With the vessel construction being subcontracted to the Jurong Shipyard in Singapore, the company worked with the local office of Siemens Automation & Drives to deliver a total turnkey solution, including design, engineering, programming, installation and testing of all ICSS components, namely: process control system, safety instrumented system, fire & gas detection system, and emergency shutdown system (ESD).

In-depth knowledge

"We have used Siemens equipment on several jobs now, to the extent that about 75 percent of our people have in-depth knowledge of Siemens control technology," says David Ong, Managing Director and a Certified Functional



David Ong, Managing Director, Excel Marco

Safety Expert (CFSE).

As well as components like redundant S7-400 controllers, PROFIBUS DP network, and ET 200M remote I/O used in the installation, for the design phase, Excel Marco engineers found the Siemens Safety Matrix to be an extremely useful tool.

With the project completed earlier this year, the two million plus barrel capacity FSO, which David Ong says is the "world's most complex", is now stationed many thousands of miles away in the South Atlantic and is all set to receive stabilized crude oil from the Marlim Sul, Roncador and Marlim Leste fields. ♦



Members of the Excel Marco team that worked on the FSO ICSS project (l-r): M.M. Saw, Thomas Lin, B.F. Xia, K.T. Phua.