smar

The Fieldbus Reference Book

Exploring the future

“Smar – Envisioning the future”.

“The future cannot be predicted, but it can be invented. It is our ability to invent the future which gives us hope and makes us what we are.”

- Dennis Gabor, Nobel Prize Winner.

This famous quote reflects Smar’s view of today’s business challenges, as well as our vision of technology achievements and innovations. It also embodies how we pursue our position in the market.

In a challenging economy, those who are alert will succeed, gaining advantages by monitoring and evaluating the market in search of innovative business opportunities. As a high-tech company with solutions that generate benefits for different segments of the industrial market, Smar is always on the lookout in an ever-changing environment. We strive for new opportunities that boost our evolution, with controlled risk to guarantee and differentiate our success, our associates and our customers.

Founded in 1974, Smar is recognized as a global leader in automation technology for process and discrete manufacturing. Our company maintains operations in 10 countries, as well as an extensive international network of 80 distributors and representatives. Smar has pioneered many of today’s advanced digital field instrument and control network technologies. Our capabilities are reflected in a broad product offering based on the industry-standard HART®, FOUNDATION™ fieldbus, PROFIBUS, OPC, Modbus and other protocols.

Smar’s powerful SYSTEM302 enterprise automation system has gained prominence as a “best-in-class” solution in industrial facilities around the world. In addition, our complete system integration capabilities include one of the industry’s largest selections of field devices, interfaces, integrated circuits and software.

“Exploring the future can bring great rewards if you are right – but losses can be immense if you are wrong. There’s no small or easy task. The future is not for us to see. A lot of research, expertise, intuition and even good luck are required in order to stay ahead. Fortunately, by working together with our customers, we have managed to succeed over the years”.

- César Cassiolato, Smar Director

SYSTEM302 and fieldbus advantages

Reliable and valuable information to integrated enterprise solution

Fieldbuses keep the signal purely digital all the way, to the end of the automation chain, avoiding loss of accuracy or signal integrity.

Comprehensive connectivity

Multiple devices and communication protocols, independent of the manufacturer, will operate in the same system, without any loss of functionality.

Scalability

Due to the fieldbus flexibility and scalability, SYSTEM302 provides seamless expansions for projects with regular changes in the scope, drastically reducing the need of reinvestments.

Simplified engineering

SYSTEM302 with its fieldbus based architecture, facilitates all automation engineering tasks: Control strategies, Process Visualization, Alarms & Events, History, and Audit Trail.

Intelligent asset management

Smar's Asset Optimization helps you take advantage of proactive intelligence in your SYSTEM302 digital plant architecture. AssetView will help you diagnose efficiency losses and provides corrective action plans to improve your plant's performance.

Operational excellence

Real time evaluation and statistics analyses help you optimize different process. The robustness and high availability offered by the SYSTEM302 fieldbus based system ensure the overall quality and operational security.

Cost-savings technologies

Fieldbus provides lower investments in equipment and in installation, reduces maintenance cost, in addition to reduced engineering costs due to simplified configuration of control strategies.

Customer satisfaction

"During installation, commissioning and operation Smar SYSTEM302 on underground gas storage Banatski Dvor project has proven to be a reliable system suitable for distributed control and for simple system expansion (especially for the plant construction phase), and easy to configure. In particular I would like to point out that SYSTEM302 proved to be interoperable with Emerson instrumentation, Allen Bradley SLC500, HIMA F35 and Wonderware Intouch. And also, that FOUNDATION™ fieldbus brings freedom to choose and power to integrate. Smar AssetView is easy to use for maintenance, diagnostic and remote configuration of equipment. Smar engineers provide not just prompt technical assistance but permanent system support".

Mr. Miodrag Pramenko, Serbia Gas Control System and Instrumentation Engineer Leader

"The time for installation and start up was shortest than conventional systems due to the simplicity of wiring offered by twisted pair bus and also by the ability to calibrate and configure devices from the workstation. In terms of operation I can say Fieldbus is high reliable system." Smar Notes December, 1997.

Mr. Rogelio Berber Guzman, Chief of Instrumentation dept. - CFE CT José Aceves Pozos

"The main advantages of SYSTEM302 are its low implementation cost and the maintenance diagnostic. In addition to Smar's high quality of service."
Smar Notes December, 2001.

Mr. Hamilton Baldo,

Senior Instrumentation Technician - Rhodia

"It is with great pleasure that I say Smar is the very best control system provider I have ever been associated with in my 32 years as a Control System Engineer. It's commitment to Duke Energy and it's extraordinary service to provide instruments in a quick and efficient manner are also greatly appreciated. I look forward to a long and rewarding association with Smar. I will be making this known to all of my other associates in the Nuclear Industry. To sum it up, Smar is absolutely one to the very best."

Willard H. Killough, Jr. – Project Engineer

"Smar's SYSTEM302 has proved its superior reliability and availability in over 10 years of operation at various units of our plants. In addition, it's easy to install, commission and operate. But most importantly, it helps us reduce cost and improve efficiency in today's tough economic environment."

Wu Bopei - Instrumentation Director of Wuhan Youji.

"Fieldbus is cost-effective, simple, powerful, reliable, and a lot more. A traditional DCS system simply loses out to the virtues of a Fieldbus systems in nearly all aspects."
Smar Notes June/July, 1997.

Mr. Niu Qi, Vice-President - Binzhou Chemical Company

"The 'intelligent' instrumentation not only saved the company money, but took less time to install and configure. We are extremely pleased with the outcome of this project. It has exceeded all our expectations."

Mr. Philippe Mille - Project Engineer - Societé Française de thermolyse (SFT)

"The great experience that Smar has in FOUNDATION™ fieldbus in particular will strengthen the range of process automation solutions that we can offer to our customers world wide."

Mr. Klaus Endress,

Mr. Klaus Endress, CEO and Group's chief operating officer - Endress+Hauser

"We choose SYSTEM302 to carry through the automation of this important plant for the environment, because its devices are of latest generation and they provide a safer operation and a tight control to achieve an end product with better quality."

Mr. Maurício Mascolo, Process Engineer - Univen

"In addiction to the use of this technology, the SYSTEM302 OPC server provides an easy-to-use environment for process operations and fast plant information access. Besides of that I point out the easiness of the system interoperability and a process broader view. The Smar's engineering service team has not measured efforts to quickly put the system in operation."

Wilson de Souza Castro Júnior, Instrumentation Manager - Alto Alegre Sugar Mill

"The Fieldbus System installed by Smar in our factory at Camaçari - Bahia is a complete success. In addition to reducing our operational losses and maintenance costs, it significantly contributed to the improvement of our product quality. Regarding our productivity, Smar fieldbus has given our personnel a great professional motivation, making it possible for us to put in operation the Advanced Process Control and have other gains".

Eng. Luiz Petersen - DETEN Instrumentation and Electrical Coordinator.

"The Fieldbus System version ISP-50 was a pioneer at DETEN, as it also pioneered in the world. In spite of the difficulties involving the implementation of an entirely new system, it was successfully carried out with a lot of zeal and a lot of work by DETEN and Smar partnership. Its performance, reliability and operational continuity are excellent, beyond expectations, and we no longer have problems such as freezing, communication errors, loss of information, etc. The ISP-50 reduced our operational loss and maintenance costs. It was surely the right investment and made us very pleased!"

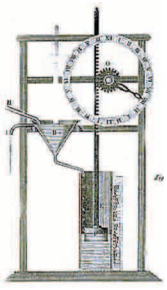
Alexandre Pessoa, Instrumentation Engineer - DETEN

"The SYSTEM302 automation system implemented is robust and capable of providing a wide range of information and equipment diagnostics that only a purely digital system can offer, including the analysis and network structure verification."

Mr. Eduardo Pitondo, Electrical and Instrumentation Supervisor - Alvorada Bebedouro Sugar and Ethanol Mill.

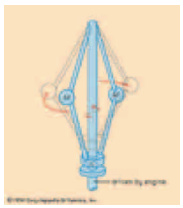
Fieldbus:

The revolutionary technology that is changing the world of automation.



270 BC: Float regulator for a water clock.

1588: Invention of the mill-hopper.



1774: Flyball governor for steam engine applications.

1883: Invention of the damper-flapper regulator.

1928: Pneumatic operational amplifier.

1948: First pneumatic differential - pressure transmitter.

1959: First supervisory digital computer in self-employed power plant and refinery application.

1964: First automated boiler control system.

1969: First programmable logical controller

1973: Electrically driven industrial robot.

1975: First distributed digital control system.

1984: First PC based supervisory control and data acquisition system.

1987: Fieldbus standardization studies.

1992: First chip fieldbus.

1994: First fieldbus plant.

2000: First registered HSE device.

2001: World's first fieldbus device with flexible function block

2002: Fieldbus age - world's first FOUNDATION™ fieldbus Flow computer;
• World's first HART® to FOUNDATION™ fieldbus interface.

2003: First FOUNDATION™ fieldbus Tank measurement system;
• First FOUNDATION™ fieldbus & PROFIBUS PA ASIC with arithmetic coprocessor and LCD driver.

2004: First fieldbus relay.

2005: First FOUNDATION™ fieldbus multiprotocol remote I/O.

2006: First OPC-UA and EDDL technologies in a unique Prototype;

2007: First high performance digital pressure transmitter;

2008: FF-SIS - First FOUNDATION™ fieldbus™ SIS instrumentation;
• First FOUNDATION™ fieldbus™ HSE flow computer.

2009: First PROFIBUS DPV1 master with 4 or 2 PROFIBUS PA channels.

Fieldbus brings to the industrial environments the same advantages and easiness of operation that computer networks brought to the offices in the recent years. Fieldbus is a digital network that interconnects field instruments, such as transmitters, controllers and actuators with each other and the host computer. Advanced features in hardware and software make it robust, reliable, safe, powerful, elegant and easy to install and use.

First in fieldbus

As the leading company in developing and applying Fieldbus technology Smar has achieved several firsts.

Here are some of the firsts from Smar…

FB1050

World's first fieldbus chip. (1992)

LD302

World's first fieldbus device to receive the Control Engineering Product Recognition Award (1994)

Deten

World's first commercial fieldbus plant. (1994)

IF, FI and FP302

World's first 4-20 mA/Fieldbus, Fieldbus /4-20 mA and Fieldbus /pressure converters. (1995)

LC700

World's first fieldbus programmable controller. (1995)

FY302

World's first fieldbus valve positioner (1996)

FB Stack

World's first fieldbus stack approved by Fieldbus Foundation. (1997)

First line of PROFIBUS PA field devices, profile V3.0 (1999)

LD303

LD303 - First PROFIBUS PA device with profile V3.0 (1999)

IF, FI and FP303

World's first 4-20 mA/PROFIBUS PA, PROFIBUS PA/4-20 mA and PROFIBUS PA/pressure converters (1999)

DT303

First concentration/density PROFIBUS PA transmitter(2000)

First registered HSE device and commercial installation. (2000)

DT302

First FOUNDATION™ fieldbus concentration/density transmitter (2001)

DFI302

First control platform based on FOUNDATION™ fieldbus Remote I/O concept to integrate several fieldbus standard protocols as PROFIBUS, DeviceNet, MODBUS and ASI. (2005)

OPCUA and EDDL

First convergent prototype for these two technologies. (2006)

DF95/DF97

First PROFIBUS DPV1 master with 2 or 4 PROFIBUS PA channels. (2009)

1994 to 2000

First commercial fieldbus installations in the following countries:

Germany
Belgium
Canada
China
United States
Italy
Mexico
Jordan

Argentina
Brazil
Chile
Singapore
France
England
Norway

Thousands of applications in hundreds of installations.

Committed to the development of the open technology

Over the last 20 years Smar has significantly contributed to the development and standardization of the technology.

ß Test:
the Monsanto Co. Chocolate Bayou petrochemical complex
December 95 to April 96

Test:
H1 technology validation
May 95 to September 95

1998:
SYSTEM302 version 4.0, a complete system for industrial automation.

FF Beta Test.

Syncrude Trial.

Sira Field Trial.

1996:
Fieldbus H1 profile finalized.

1994:
First commercial fieldbus plant.

LD302
Product Recognition Award from Control Engineering magazine.

1997:
Communication stack registered.

FY302 - Product Recognition Award from Control Engineering magazine.

Daishowa - First fieldbus interoperable production installation.

1995:
FF Alpha Test.

Donation of fieldbus system to ISA's training center.

1992:
FB 1050 first fieldbus chip.

BP field trial
IEC/SP 50 test.

1993:
Pressure transmitter ISP/ WorldFIP

1987:
Contributions for fieldbus standardization.

1999:
American Automatic Control conference.

First fieldbus mobile training center.

First line of PROFIBUS PA field devices, profile V3.0 (1999)

2000:
DFI302 HSE linking device.

2001:
Smar Albert F. Sperry Award.

The first book about fieldbus "Fieldbuses for process control".

First web based asset management.

First FFB for H1 device.

2002:
FC302 - World's 1st FOUNDATION™ fieldbus flow computer

2004:
TM302 - First FOUNDATION™ fieldbus tank measurement system

2005:
Smar is considered the largest company in the brazilian automation market, according with the American Chamber of commerce.

2006:
SYSTEM302 is the first fieldbus based control system to be used in nuclear applications.

Smar assumes the PROFIBUS Latin America Chair

2007:
More than 2 million fieldbus chips produced

Smar assumes the Latin America PROFIBUS competence center Technical Direction

2009:
DF97/DF95 First PROFIBUS DPV1 master with 4 or 2 PROFIBUS PA channels.

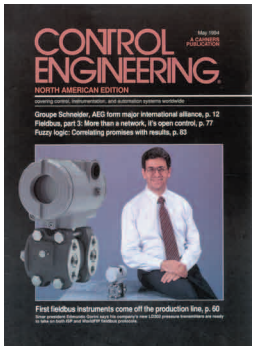
Fieldbus trials

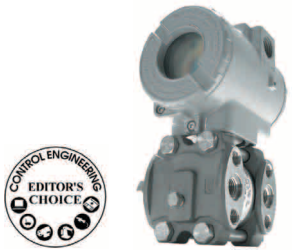
The Syncrude Trial occurred in 1998 to evaluate operating requirements and devices' communication with each other, a host or a distributed control system.

Smar provided technical support and equipment for Sira to set up a facility to provide practical demonstrations of process control products and systems that incorporate Fieldbus technology.

Awards an recognition

Smar has received several awards and recognitions for the outstanding results in the development of the fieldbus technology.





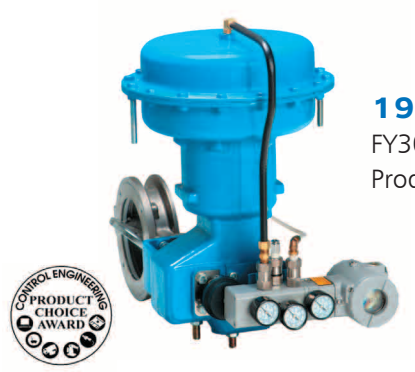
1994:
LD302 Fieldbus Pressure Transmitter - Product Recognition Award from Control Engineering magazine.

1995:
Recognition for the significant time and resources devoted to bringing the advantages of ISA Membership to measurement and control professionals throughout South America and for the donation of Fieldbus instrumentation for use in ISA training programs, to Smar and its Management, on December.

1996:
Specification Team Leader for the Fieldbus Foundation Mr. Libânio Carlos de Souza.

1996:
Pressure Profile Team Leader for the Fieldbus Foundation Mr. Eugênio F. da Silva Neto.

1996:
Excellence in Documentation Award - **"Three Views of Fieldbus in Water and Wastewater Applications"** by Libânio Carlos de Souza, Edward W. Baltutis, Mark T. Hood, and Joseph Signorelli.



1997
FY302 Fieldbus Valve Positioner
Product Recognition Award from Control Engineering magazine.

2000:
Data Link Bridge Team Member, on the High Speed Ethernet Development Program - Mr. Libânio Carlos de Souza.

2000:
Multiple Input/Output (MIO) Team Leader on the High Speed Ethernet Development Program - Mr. Sérgio Hideki Tateishi.

2001:
To the success of the High Speed Ethernet Development Program - Smar Linking Device Development Team.

2001:
DT301 Density Transmitter
Control Engineering Editor's Choice.

2001:
Recognition of Smar Dedication to the Fieldbus Technology, ISA Albert F. Sperry Award.

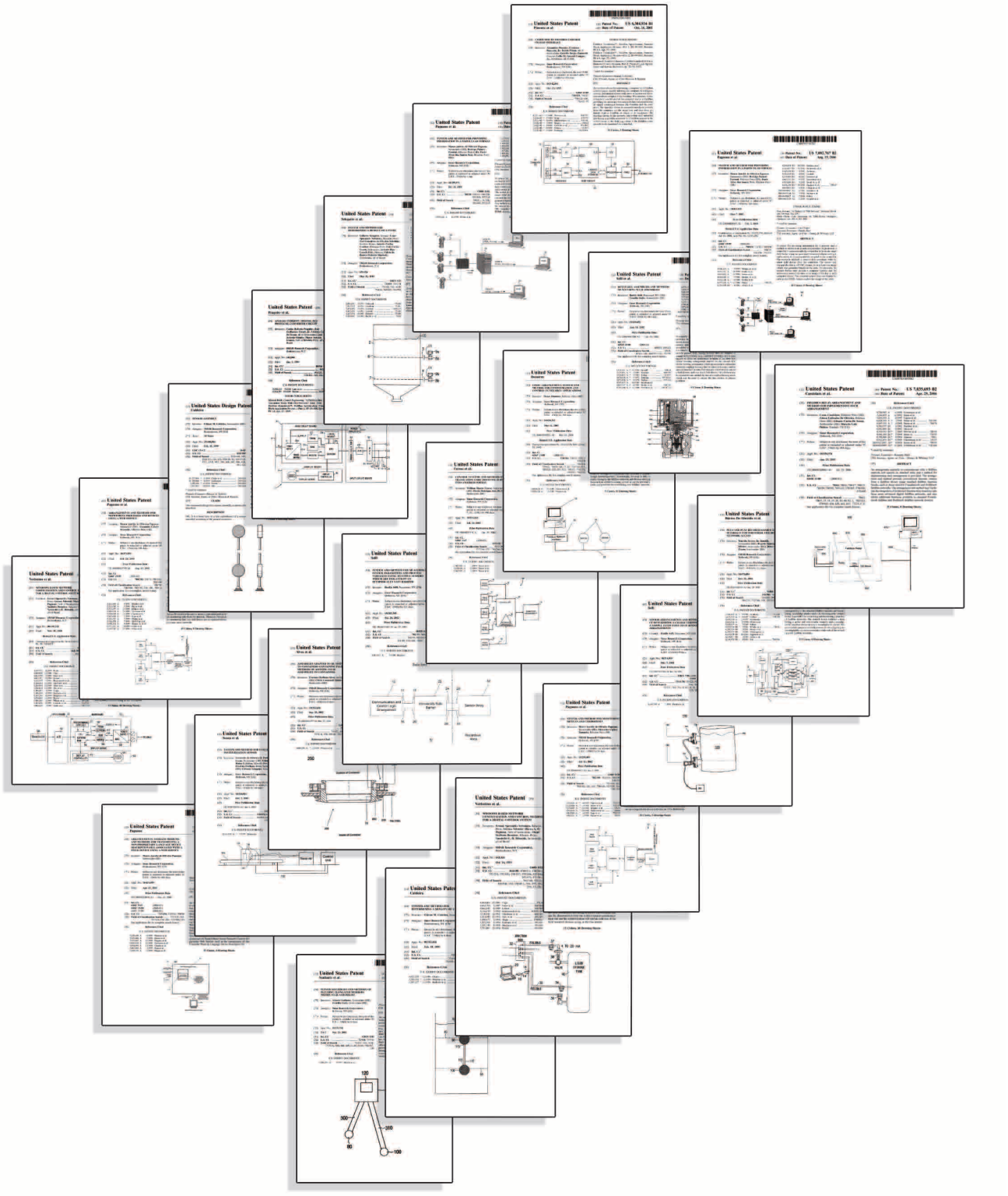
2001:
First registered device.

2002:
IAN Magazine Excellence Awards - DC302

2003:
FINEP Award for Product Innovation - AssetView

Patents

Smar has applied for and obtained several patents covering its products.



Fieldbus Products

Smar has the world's largest line of Fieldbus products.

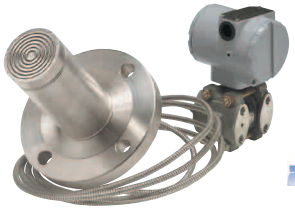
Pressure + Differential Pressure + Level

LD301
LD302
LD303

Differential Pressure Transmitter

LD301
LD302
LD303
LD400

Level Transmitter Sanitary connection



LD301
LD302
LD303
LD400

Transmitter with Extended Remote Seal SR301E

LD301
LD302
LD303

Gauge Pressure Transmitter

LD400

Diferential, Gauge, Absolute and Flanged Pressure Transmitter.

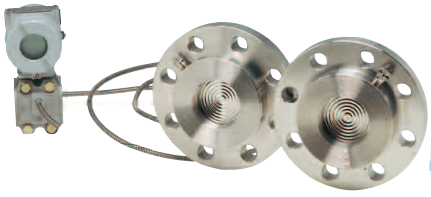
LD301
LD302
LD303

Absolute Pressure Transmitter

RD400

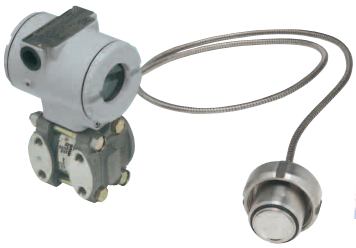
Level Transmitter

Gauge Economic Capacitive Pressure Transmitter



LD301
LD302
LD303
LD400

Transmitter with T-Type Remote Seal SR301T



LD301
LD302
LD303
LD400

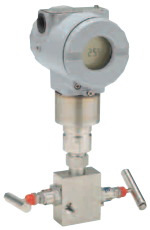
Transmitter with sanitary connection Remote Seal SR301S

LD301
LD302
LD303

Transmitter with threaded Remote Seal SR301R

LD301
LD302
LD303

Flanged Pressure Transmitter



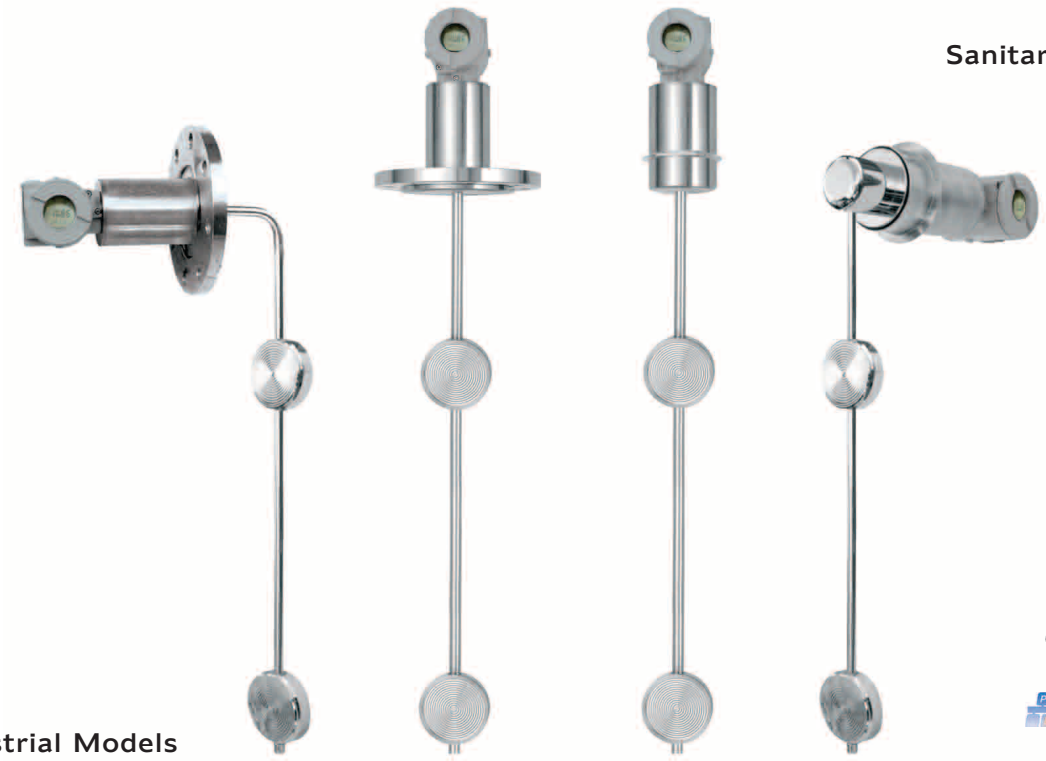
LD290
+
Válvula
Manifold

Pressure Transmitter 4-20mA (manifold not included)

LD291
LD292
LD293

Pressure Transmitter

Density / Concentration Transmitters



Sanitary Models

Industrial Models

DT301
DT302
DT303

Valve Positioners and Position Transmitters

FY301
FY302
FY303

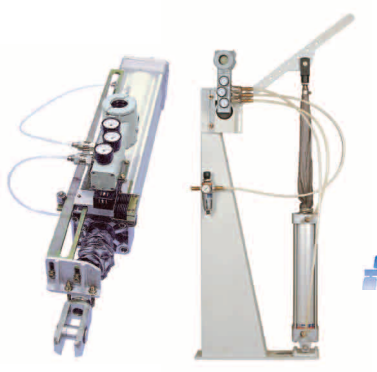
Valve Positioner

FY400

Valve Positioner
with self tuning

FY301
FY302
FY303

Valve Positioner
with remote sensor



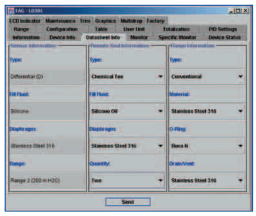
ACP301
ACP302
ACP303
ACP400

Linear Rotary
Pneumatic - Cilinder Actuator

TP301
TP302
TP303

Position Transmitter

Configurators and Interfaces



HART® Configurator
Interface CONF401

HART® Configurator
for Palm HPC401

USB HART® Interface
for PC´s HI321

HART® Serial
Interface HI311

Temperature

TT301
TT302
TT303

Temperature
Transmitter

TT411

Panel Mounting
Temperature Transmitter

TT421
TT423

Head Mounting
Temperature Transmitter

Converters

FP302
FP303

FOUNDATION™ fieldbus or Profibus PA to pneumatic signal Converter

IF302
IF303

Current to FOUNDATION™ fieldbus or Profibus PA Converter

FI302
FI303

FOUNDATION™ fieldbus or Profibus PA to current Converter

HART® / FOUNDATION™ fieldbus Interface HI302

HART® /Current Converter HCC301

Chips

HART® Modem HT2015

HART® Modem HT2012

Communication Controller FB2050

Communication Controller FB4050 - TQ

Communication Controller FB3050 - TQ

Mathematical Coprocessor, LCD Controller and D/A Converter HT3012 - TQ

Controllers

Programmable Logical Controller LC700

Digital Controller CD600Plus

FOUNDATION™ fieldbus Universal Interface DFI302

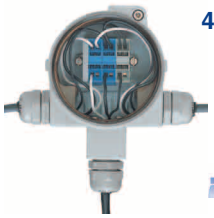
Instructional Pilot Plant

Accessories

Auto/Manual Transfer Station AM01P

RP302 RP312H1
Fieldbus Reapeaters

Current to Voltage Converter CIV200P



3 Ways Junction Box JM1

4 Ways Junction Box JM400

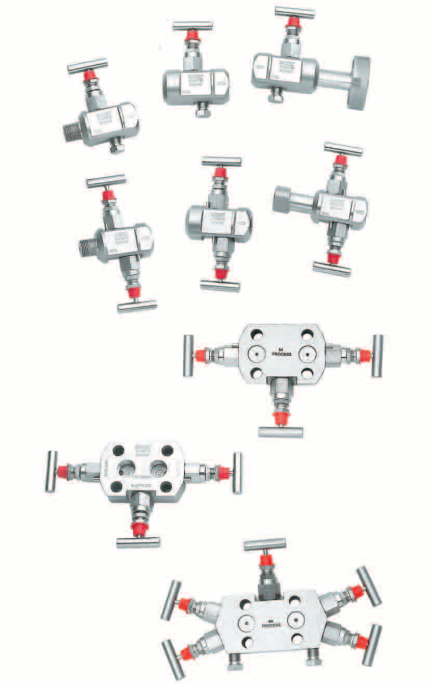
Signal Distributor and Isolator IS400P

FOUNDATION™ fieldbus and Profibus PA Bus Terminator BT302

H1 Bus Power Supply DF52

SB312 DF47
Isolated Intrinsic Safety Barriers

Others



Manifolds and Block Valves

FOUNDATION™ fieldbus Relay FR302

FOUNDATION™ fieldbus Remote I/O DC302

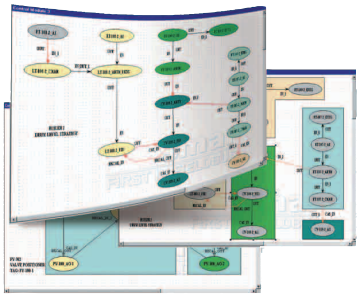
Systems

Studio302
System302 Management Tool

AUDITFLOW
Flow Measurement System

ProcessView
Process Visualization
Tool

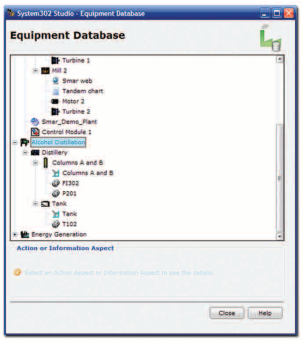
LC700 Configurator Software
CONF700



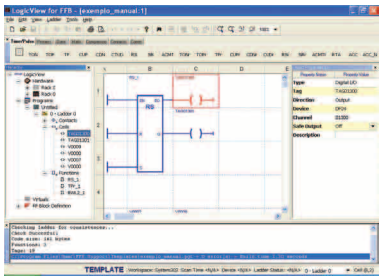
Syscon
System Configurator

CONF600Plus
Configurator Software
CONF600

AssetView
On Line Plant Asset
Management Tool

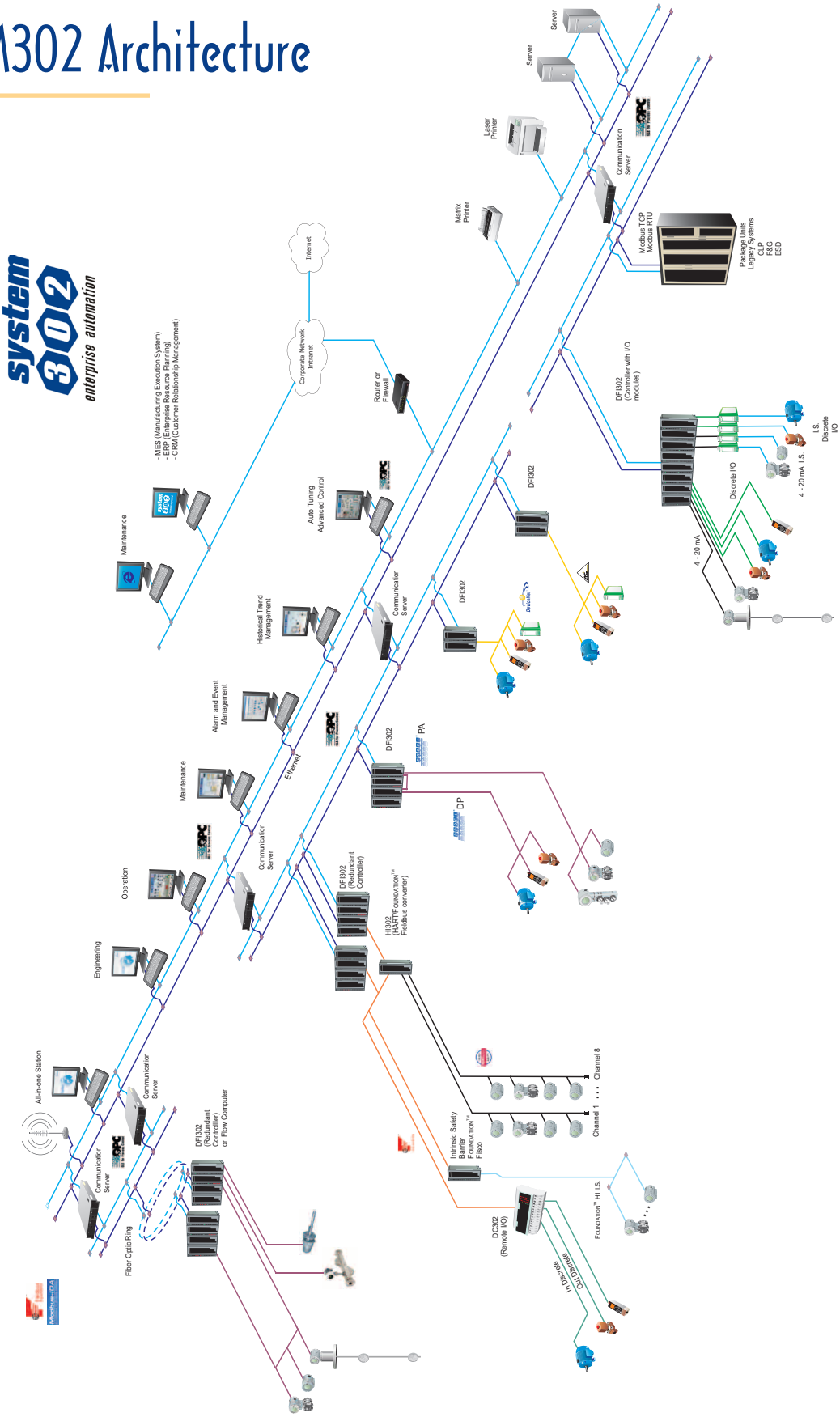


Equipment Database
Plant Information
Management



LogicView
IEC61131
Programming Tool

SYSTEM302 Architecture



Training

Since the beginning of its involvement with Fieldbus, Smar has been leading the promotion of this technology to users around the world.

Smar has donated equipment to several entities, Universities and Technical Schools, such as ISA, Lee College, SENAI and others.

Instructional Pilot Plant

Demo-kit

The world's first mobile training center for teaching and learning Fieldbus technology started operation in August 1999 in Brazil.

Engineering and Project

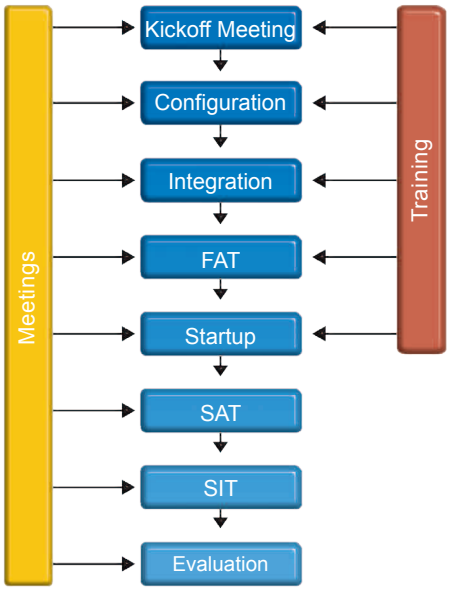
Most customers prefer a complete Smar solution when acquiring their initial SYSTEM302. However, Smar also partners with integrators in various regions throughout the world who can engineer and support SYSTEM302 installations on a local basis. In most cases, the best approach is to let Smar's experienced team oversee the initial project and commissioning, while the customer handles system installation and maintenance.
A Smar project group can supervise the entire job, starting from the basic system engineering. Users are natural project leaders, as they know their process best.

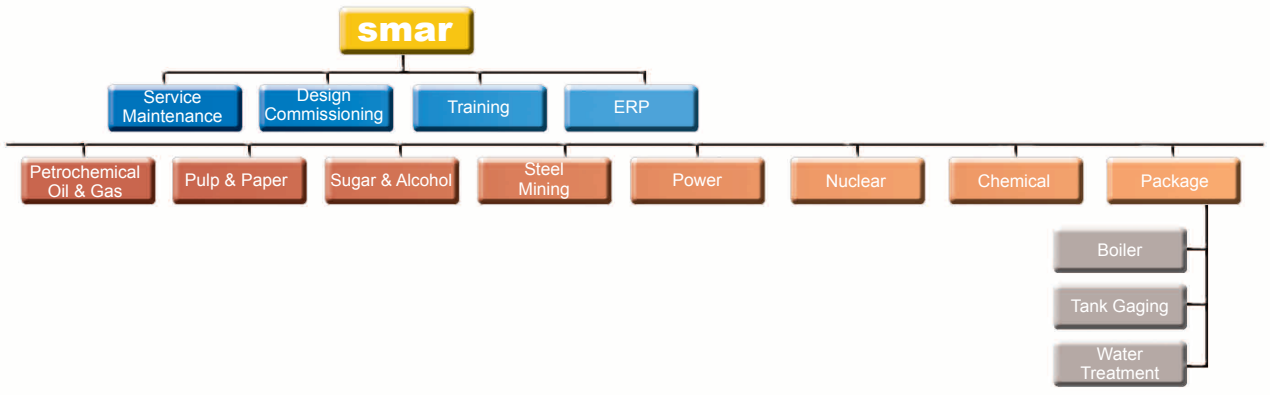
Preparation and configuration of operator workstations and the Factory Acceptance Test (FAT) can be done at a Smar facility under the user's supervision. System Acceptance Tests (SAT) and Field Integration Tests with all the field devices are also available options.

Our Systems

Smar can develop program applications executing measurement, control, logic sequencing and functionality according to instructions provided in user documents. These may include flowcharts, logic diagrams, cause and effect tables, and other descriptive operational papers.

The projects managed by our company are supplied with the complete system documentation, including programs and configurations, connection schemes, cross-reference and manuals.





Published Papers

Smar technology is widely recognized in the press.	
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An open and non-proprietary device description for fieldbus devices for public IP networks	Congresso IEEE 2007: INDIN 2007
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Gallery of Applications

Smar has Fieldbus experience in practically all industry segments in all continents.

Food & Beverage

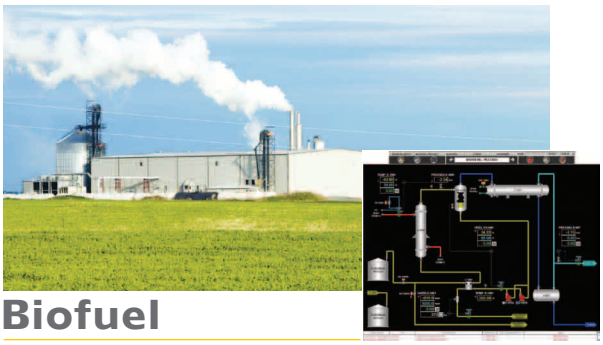
• Evaporators • Blending and Batching
• Retorts • Fermenting

Sugar

• Vacuum Pans • Mills• Boilers
• Evaporators

Brewery

• Mashing • Lautering • Boiling • Fermenting
• Conditioning • Filtering • Filling • Pasteurisation

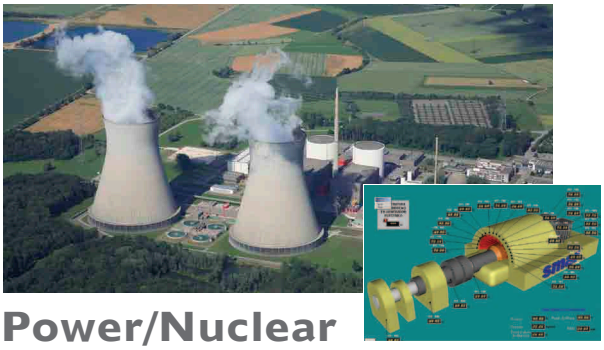


Biofuel

• Reactors • Separators • Washers • Purificators
• Evaporators

Pharmaceutical

• Fermentation •Extraction • Formulation
• Packaging

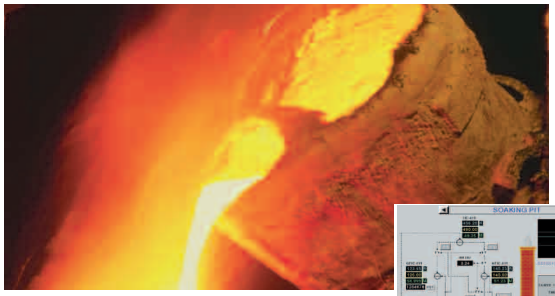


Power/Nuclear

• Boiler • Generator • Cooling Water
• Cooling Tower and utility systems

Textile

• Weaving•Dyeing



Steel

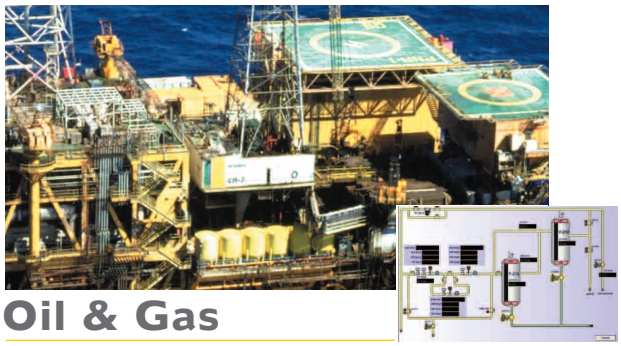
- Blast Furnaces • Continuous Casting • Reheating Furnaces
- Biological Waste Treatment • Annealing Lines
- Sintherization

Mining

- Ore Dressing • Pyro/hydro Processing • Electrolytic Refining
- Crushers • Ball Mills • Classifiers • Filters • Flotation Devices
- Magnetic Separators • Calcining Kilns • Digesters
- Evaporators

Pulp & Paper

- Mass Preparation • Inlet Box • Bleaching
- Recovering Boiler



Oil & Gas

- Platform and Pipeline • Catalytic Cracking
- Distillation Columns • Blending • Reactors

Water & Wastewater

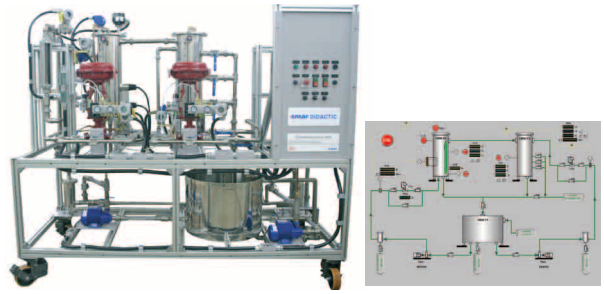
- Filter Backwash • Chemical Treatment and Feed Systems • Water Pumping and Control • Remote Telemetry • Sludge Processing • Sludge Drying
- Sludge Incinerator Control

Chemical & Petrochemical

- Distillation columns • Reactors • Evaporators
- Heat Exchangers • Blenders • Tank farm

Glass

- Glass Ovens • Suppliers •Thermic Treatment



Training & Research

- Instructional Pilot Plant • Demo-kit
- Automation Projects for Pilot Plant

Expertise

Smar has thousands of applications.

We selected some examples on the following pages.

Santelisa Vale Bioenergia S/A

The merger of Cia Energética Santa Elisa and Cia Açucareira Vale do Rosário gave birth to Brazil´s second largest sugar and ethanol producing group, Santelisa Vale Bioenergia S/A. With an annual grinding capacity of over 20 million tons of sugar cane, the group encompasses five sugar mills: Cia. Energética Santa Elisa, Cia. Açucareira Vale do Rosário, Usina de Açúcar e Álcool MB, and Jardest S/A e Continental S/A.

In 1997, the Santa Elisa plant started an ambitious and advanced automation project involving the most up-to-date control technology for the time: the first digital field network, known as Fieldbus.

The project included all production areas in the mill, which was divided into three parts: steam generation, sugar production and ethanol distilling plant.

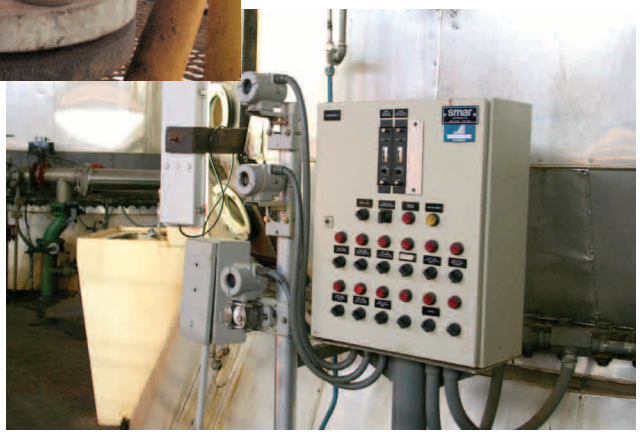
Smar's SYSTEM302 solution enabled the distribution of logic functions and total integration of all fieldbus equipment in over 5.000 I/O points connected to Programmable Logic Controllers (PLCs) co-existing with other controllers.

A well-tailored SYSTEM302 Training Program provided complete qualification of the company's technical team, which worked in close contact with the Smar AE group processing a large part of the configuration, control loops and supervisory points.

Today, the plant is monitored and operated from an integrated control room with 24 operator stations and two engineering stations. Since March 1997, when the system became fully operational, Santa Elisa Vale has benefited from improvements in its process variability and productivity. Steam production went up, the process became much more stable, and the sugar cooking process had an unprecedented measure of 30% growth in productivity.

The system advantages were noted from plant startup through the current operation, as costs associated with maintenance and raw-material wastes were minimized. Plus, the adoption of open-standard technologies has unleashed the connectivity to higher-level systems such as ERP and CRM.

With the creation of the Santelisa Vale Bioenergia S.A. group, plus the support from investors and the joint venture formed with BP Biofuels and Maeda Group, five more manufacturing units will be operating by 2010, using Smar technology and solutions. With more than 5,000 nodes and thousands of Smar devices, the automation project spans from the field level to the control room interconnected on a High Speed Ethernet (HSE) network, which will also integrate all plants in the new SYSTEM302-7 engineering environment. Santa Elisa was the first global ethanol, sugar and bioenergy producer to install a complete Smar SYSTEM302-based automation system with continuing production excellence achievements throughout all stages of the project. „This investment, which is the largest made by an international oil company in the Brazilian ethanol industry, represents a significant step in delivering BP's strategy for biofuels centering around sustainable feedstocks which do not impact on food supplies, and investing in research work to develop the technologies required to produce advanced biofuels," commented Phil New, head of BP Biofuels.



Usina Alvorada do Bebedouro Açúcar e Álcool

Foto Ilustrativa

Founded in 1983, Alvorada do Bebedouro is an ethanol and sugar mill located in Minas Gerais state, with over 2 million tons of annual sugar cane grinding capacity. This facility is also producing VHP (Very High Polarization) sugar for the food industries, with a goal of reaching over 120K tons of sugar for exportation by the end of 2009.

With unprecedented operational investments in grinding, steam generation, juice treatment, evaporation and the sugar plant implementation, Usina Alvorada do Bebedouro selected Smar-PROFIBUS industrial network technology for the automation infrastructure.

The architecture project determined that PROFIBUS DP networks would be installed on the MCC (Motor Control Center). PROFIBUS PA was adopted for process automation, and AS-I bus was chosen for discrete signals starting equipment distributed among PROFIBUS DP master controllers. Also, horizontal communication between controllers was implemented by using 100 Mbit/s Ethernet through the HSE control and supervisory protocol.

.Control loops, drives and interlocking were configured on the same PROFIBUS DP controller of the DFI302 control platform, known as DF73. All controllers were connected in an optical ring configuration throughout the Ethernet network, allowing data exchange in a noisy environment as well as supervision among controllers, operation, and engineering and maintenance stations at long distances.

PROFIBUS technology is largely used in the Ethanol industry due to the high degree of protocol acceptance and reliability. PROFIBUS is also an open communication standard interoperable with multiple suppliers that is easy to install and configure with a simplified architecture.

Smar's Training Department was also responsible for the complete plant technological skills revamp. In addition to monitoring all process data for the enterprise network via the Web, local operator stations made it possible for operators to supervise and command the plant through supervisory software containing synoptic screens, tuning, graphs, alarms and archives.

Smar SYSTEM302 features were used to configure the PROFIBUS DP/PA and AS-i bus networks (cyclic and acyclic configurations) by accessing and adjusting parameters such as calibration and field device diagnostics on the PROFIBUS PA network and designing the control logics. This key SYSTEM302 capability of providing integrated engineering, maintenance, operational and analytical tools for open-standard industrial networks reduced the customer's capital expenditures.

The SYSTEM302 architecture also provides ease of integration with specialized administration and quality systems, including MES (Manufacture Execution System) and the ERP (Enterprise Resource Planning).

With the SYSTEM302 solution, production planning, administration and industrial management levels can access all critical information, providing the plant with follow-ups, logistics support, real-time control and improvements during the production process. It also enables more precise and better-coordinated decision-making, while bringing greater efficiency to implemented actions and plant improvements.

Rhodia

Rhodia is a world leader in the development and production of specialty chemicals. Operating in Brazil since 1919, the company provides value-added products and high-performance solutions to diversified markets, including automotive, electronics, perfume, health & beauty and home care, through its six global enterprises.

Rhodia leads the world in the production of mild amphoteric surfactants, phosphorus chemistry and guars and derivatives, as well as high-performance silicas, rare earth-based formulations and diphenols. Rhodia is also number two globally in polyamides and the number three producer of cellulose acetate tow. Additionally, the company is recognized as the major sulfuric acid regenerator in the U.S.

As one of the first companies to implement the Clean Development Mechanism of the Kyoto Protocol, Rhodia is at the forefront of combating climate change.
Located in Paulinia, São Paulo, Brazil, Rhodia selected advanced Fieldbus protocols to optimize its processes. According to Rhodia senior maintenance engineer Ronaldo Sergio Novaes Manzano, the most qualified technologies available at the time were DCS or Fieldbus technology. Fieldbus ISP50 was the choice based on two main factors: economic feasibility, which would include the project within the approved budget;

and the strong previous partnership with Smar, the national company that introduced Fieldbus technology in Brazil, namely, ISP50 and later FOUNDATION™ fieldbus H1/HSE.

Manzano indicated that several key aspects, such as the time available for the migration between both systems, was vital for the undertaking, and listed the benefits gained as:

- Ease of maintenance due to the centralization of procedures in a single workstation, reducing field interventions
- Faster identification of failures
- Reduced time per intervention
- Increased volume of information for diagnostics and control
- Increased plant availability through the distribution of control for field devices and the use of advanced resources, such as the master backup
- Fewer trips to the field by instrument technicians
- Expanded process visibility

Other decisive factors in choosing Fieldbus technology were noted by Rhodia Senior Engineering Technical Assistant Hamilton Roberto Baldo. He stated that for every plant operation there was a corresponding improvement, such as the refinement of information at the supervisory level. With Fieldbus, each device provides its own status on monitoring screens, and complementary technologies like OPC complete the solution.

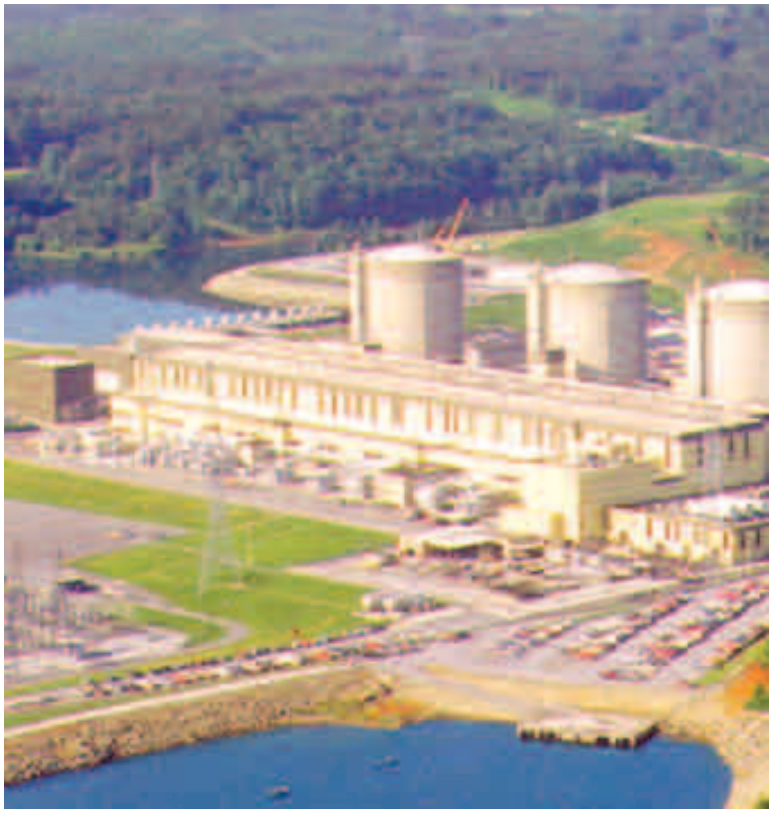
In the project area, the volume of documentation, wiring and accessories was dramatically reduced. The control room layout was also optimized (smaller cabinets, etc.), as well as the use of equipment from other suppliers to strengthen interoperability.

Before the new automation technology was implemented, the 11 Rhodia plants used pneumatic controls. The modernization now encompasses all of the solvent units. "Today, all of our units are stable and reliable," said Baldo. "Thanks to integration, the units are interconnected and exchange data considerably improving our operation with more efficient control and increased data and diagnostics."

Baldo added, "The cost per loop is lower and the units are more competitive, while the increase in information from the plant makes it possible for us to make faster and more efficient decisions."

Rhodia is currently implementing one more plant that will adopt FOUNDATION™ fieldbus HSE and is projecting new investments in the technology during the near future.

Duke Energy



Oconee Nuclear Station was the first nuclear plant to be built and operated by Duke Energy. The facility, located on Keowee Lake in Seneca, South Carolina, has provided safe, reliable and cost-effective energy to customers in South Carolina and North Carolina since 1973.

Since startup, the Oconee Station has generated more than 500 million megawatts/hour the first American nuclear station to reach this figure. With the capability of generating approximately 2.6 million kilowatts, it is one the largest nuclear power facilities in the U.S. and the second nuclear plant to have its license revalidated by the U.S. Nuclear Regulatory Committee for 20 years.

During the process of revalidating its license, Duke Energy searched for new technologies to replace its outdated pneumatic control equipment. For the utility area of its three nuclear station reactors, Duke selected FOUNDATION™ fieldbus from all of the existing alternative solutions. Smar was chosen to supply the SYSTEM302 control system due to its expertise in implementing FOUNDATION™ fieldbus systems, as well as its ability to meet Duke's plant customization requirements.

The SYSTEM302 provided for each reactor has a redundant control system employing Smar's Model DF62 FOUNDATION™ fieldbus HSE controllers. The system architecture was designed for over 500 devices in the channel. The technology and controllers were also selected to allow for future plant expansion.

Besides redundancy on the Smar HSE controllers for each control loop, the Fieldbus system has field equipment configured as masters. In the event of a triple failure and loss of the fieldbus processors, only the supervisory station will be lost resulting in no interruption in field control. Since 2005, the reactor control loops utilizing FOUNDATION™ fieldbus have added field equipment such as pressure transmitters, temperature transmitters, Fieldbus current and pressure converters, and Fieldbus relays.

In addition to the Smar solution, the Duke Energy reactors use FOUNDATION™ fieldbus equipment from other manufacturers, thus taking advantage of the interoperability resources made available by SYSTEM302 and

eliminating the dependence on a single supplier of technology and equipment.

Each reactor counts on an OPC server and switch redundancy, with four operating terminals, namely, three stations (one engineering and two operational), and one database SQL server for data history storage and alarms.

On each reactor, SYSTEM302 has an advanced diagnostic system that, combined with the Smar DC302 feature (FOUNDATION™ fieldbus remote input and output), localizes and identifies failures on each HSE controller, H1 Fieldbus power source, and HSE controller power source. SYSTEM302 also reports on the availability of every point supervised by the system and indicates temperature levels inside the cabinets. The alarms and diagnostic data are available on the supervisory system and through audio-visual signals in the control room.

The control strategy implemented for each reactor is entirely distributed in the field. It includes PID control loops, indication, conversion of Fieldbus signals to pressure and current, and interlocking with the use of the FR302 (Fieldbus relay) to turn on/off pumps and motors.

Satisfied with the technology and the quality of supply and diagnostics, which provide easy maintenance for each reactor, Duke Energy continues to install FOUNDATION™ fieldbus control loops as substitutes for its existing pneumatic control loops as part of SYSTEM302's expansion capability.

Pemex – E-KU-A2 Platform

Pemex's platform E-KU-A2 is located on the KU-MALOOB-ZAAP field, in Campeche, Gulf of Mexico. As the Mexican state oil company responsible for exploring, refining and distributing oil and gas, Pemex is making large investments is this area of the gulf.

E-KU-A2 is a linking platform, whose main function is to connect production and housing platforms and perform treatment on extracted gas prior to storage. Smar has participated in the project since the implementation of the SDMCP (Digital Monitoring and Process Control System). The automation work has included:

- Integration of plant and instrumentation air compressors
- Integration of drinking water treatment systems
- Integration of service water control systems
- Treatment of dejected and oily water
- Integration with HVAC system
- Integration with SPPE (Emergency stop system)
- Integration with platform control and power systems

For process control, Pemex utilizes Smar's SYSTEM302 based on the FOUNDATION™ fieldbus protocol to integrate a series of Fieldbus instruments and analog 4-20mA devices. These include:

- Pressure and temperature transmitters
- Multivariable ABB transmitters
- Foxboro pressure and temperature transmitters
- KTEC level transmitters
- Fisher positioners

The entire system, including supervisory and control networks, was developed by Smar using its advanced Process View Human-Machine Interface (HMI). The HMI incorporates:

- HSE network / Modbus TCP/IP
- Operation station / engineering (redundant server) LAN network
- Operation station with event printer
- Report system

A totally redundant architecture was developed that used redundant sources, processors and networks to guarantee high availability of the supplied systems.

Pemex – HA-KU-M and HA-KU-S Platforms

The HA-KU-M and HA-KU-S platforms were also installed on the KU-MALOOB-ZAAP field, in Campeche, Gulf of Mexico. One platform is in the MALOOB-ZAAP-S area and the other is in the MALOOB-ZAAP-M area. These installations are "Flotels," or lodging platforms, a.k.a. "Floating Hotels." Each platform is designed to accommodate 200 people and is connected to the other platforms on the Campeche field by bridges.

Smar was selected to provide FOUNDATION™ fieldbus SDMCS technology with redundant networks, processors and sources, including the integration of all fieldbus instrumentation on both platforms, as was responsible for the development of control logic equipment not supplied with proprietary packages.

The system was based on a high availability redundant architecture in networks, processors and sources, inclusive in terms of integration with other controllers. Part of the integration was accomplished on a PLC supplied by ICS Triplex. Smar's DFI302 served as master for the redundant Modbus TCP/IP communication with this PLC.

The system architecture included three operator stations and one engineering station for each platform. Smar provided the database and OPC software for complete, interoperable integration with the ICS Triplex (HMI Panorama) supervisory controls.

SYSTEM302 with FOUNDATION™ fieldbus technology integrated a variety of Fieldbus devices, analog 4-20 mA devices, and flow transmitters with the Modbus RTU protocol for each platform.

Pemex selected the DC302 to execute discrete field logic, which minimized the amount of cable required for each package by providing a truly distributed automation architecture.

Comisión Federal de Eletricidad - CFE

CFE - Comisión Federal de Electricidad is the body responsible for the generation of energy in Mexico. Currently, it has seven units that use SYSTEM302.

The first fieldbus system installed in Mexico started its operations on the Mazatlan Thermo-electric Energy Plant located in northeastern part of the country. A high-pressure boiler that produces 600 ton/hr of steam at 150 kgf/sq cm powers this unit. The following loops were involved: air pressure master control, combustion control (crossed limits), two air dampers with a balance station, oxygen adjustment, 3-element pipe level control, power water flow control, deaerator level control, feed forward steam flow and LC700 interlocking and alarms.

This system has worked continuously for more than 36 months, without outages or other severe problems, ensuring 50 percent cost reduction compared to a traditional DCS/PLC.

In 1998, after establishing SYSTEM302´s performance, a second system was installed on the Unit 2 plant. With the same capability and control loops, the new SYSTEM302 exceeded expectations. It operated exactly as the first system, but with a new record installation time period: one week. Up until now, neither of the two systems has required maintenance.

Applied also on Unit 3, SYSTEM302 today supports 616 Mw generation capacities by the Mazatlán units.

In addition, Punta Prieta thermo-electric station, located in the city of La Paz, Baja California Sur, Mexico, adopted the new SYSTEM302 on its three units automated by Smar. A total 113 Mw is generated by the power plant.

Also in México, in Guaymas, Sonora, the Carlos Rodríguez Rivero thermo-electric (Guaymas II) facility installed SYSTEM302 on its Unit 4, to produce a total 150 Mw. SYSTEM302 has totally automated the unit boiler, with thousands of connected E/S points. Over 500 field devices are connected to several units automated by the system, with control loops producing approximately 880 Mw.

Deten

Deten Química S.A., located in the Camaçari petrochemical area, Bahia, Brazil, produces Linear Alquilbenzene (LAB). LAB is the basic raw material used for detergents. Deten was one the first manufacturers in the world to install and operate a Fieldbus-based control system, even before the Fieldbus final standard was established. All of Deten's production comes from two identical plants. At the time Fieldbus technology was installed, both plants were 15 years old and a large part of the instrumentation was still pneumatic. The Deten chemical process requires a high degree of reliability and flexibility, as well as both short- and long-term economical benefits. The operation involves critical applications such as reactors, batches, and boiler and compressor control. In December 1994, Deten commissioned a Fieldbus pilot project to partially test the technology on its facilities. The controls upgrade involved the addition of a process optimization unit to one of the plants, as well as a digital control system based on Smar intelligent transmitters and multi-loop controllers. The second unit also received an optimization unit, but it was implemented with Fieldbus technology from the beginning. The installation encompassed thousands of field devices, including pressure transmitters, temperature transmitters, flow equipment, level measuring equipment, conventional signal converters to Fieldbus and I/O discrete conventional points. Plant supervision was distributed among 12 operator stations. On the basis of the successful execution of this project over more than 12 months, Deten undertook its largest project in 1996, one that increased the number of Fieldbus devices. The equipment included pressure and temperature transmitters, current-to-Fieldbus converters, Fieldbus pressure converters and programmable controllers with Fieldbus communication modules. The plant has been designed for total redundancy in order to prevent any failure from interrupting the process; there are several redundancy levels that permit safe operation without interruption. In addition, triple-redundancy devices are installed on critical control loops, and safety and status information are exchanged between PLCs, including, for example, the watchdog timer.

In 1997, Smar gave a presentation on the use of the Internet to monitor chemical plants at a World Conference on Fieldbus held in São Paulo, Brazil. Smar used a dial-up connection supplied by an access provider. It was necessary to establish an account with this provider, and install a fax-modem and computer configuration. The application consisted primarily on a computer-server connected directly to the field equipment, and a computer-client installed on the Smar kiosk. The application demonstrated features such as remote maintenance, diagnostics and operation, and process integration. It showed how information offered by Fieldbus could be easily transmitted over the Internet, thus enabling remote maintenance. The integration of Internet technology with Fieldbus control improves the administration of process operations. With this capability, plant employees may check process variables, execute real-time maintenance and monitor supervisory screens.

For Deten, the project cost reduction and installation/startup improvements provided by Fieldbus delivered significant economical gains. The company calculated overall savings of 32 to 45 percent on the project. This included approximately 97 percent cost saving on cables. Other savings were realized through the reduction of cable trays and panel costs.

In 2000, Deten devised a plan to implement FOUNDATION™ fieldbus to ensure that the system would work until 2006, when installation of the final project was to start. This system employed a new interlocking philosophy based on HSE. The primary goal was to guarantee the system reliability. In 2004, the plant's Sulfonation area, the first phase of the planning, was implemented with 207 field devices using Modbus/TCP for communication between the FOUNDATION bridges and field PLCs via the Ethernet network.

In 2007, Deten II was updated to include over 600 field instruments. This project introduced an integrated architecture concept through HSE networks, with alarms generated on H1 devices connected to HSE linking devices (DF63) and signals sent directly to the interlocking logic implemented on HSE Controllers (DF75). The result was a control architecture that was simpler and much more and integrated.

Future planning includes the installation of additional field devices on Deten I sectors with the same philosophy one that will complete the entire plant integration.

To Deten management, project cost and time reductions, combined with improvements in documentation supervision and process data, were immediately apparent with Fieldbus technology. As the system started operating, overall reliability and reductions in maintenance costs were also substantiated. This immediately improved production technical indices.

Banatski Dvor Project

Serbia Gas is responsible for production, transportation, distribution and storage for Serbia's natural gas system. As the Serbian state energy company, it seeks to utilize the most advanced process control equipment. When developing strategies to meet customer demand in its region, Serbia Gas determined that one technology FOUNDATION™ fieldbus as a backbone of the SYSTEM302 infrastructure provided a fully integrated automation solution for its expanding natural gas operations.

Fieldbus is now replacing the traditional 4-20 mA platform, and this technology is the basis for a modern plant automation architecture. A bidirectional, fully digital communication system, Fieldbus supports increased intelligence in field devices and enables tighter control of the process.

Fieldbus communications makes it possible to "mine" important information from the plant floor. Delivering information to the right person, at the right time, empowers operators, technicians and process engineers making plant operation easier, faster and better. Fieldbus also unifies today's smart instrumentation and analytical highway to provide all-digital access to operational parameters and data at the point of measurement.

To keep pace with its developing natural gas infrastructure, Serbia Gas undertook construction of an expanded underground gas storage facility. Located in Banatski Dvor in northern Serbia, the facility is used for gas injection, extraction and production. Gas is injected into a bearing enclosure with compressors, and production includes exploitation of gas from stalled wells. As a result of its ongoing expansion and site improvements, the Banatski Dvor operation will increase its injection capacity from 1 million m3/day to 7 million m3/day. Long-range plans

call for a production capacity increase from 1-5 million m3/day to 10 million m3/day. This project will benefit Serbia Gas, and its customers, by reducing excess electrical power consumption during the winter, and lowering gas costs during the summer.

As part of the Banatski Dvor project, Serbia Gas wanted to install the latest process control technology to optimize plant efficiency and reduce operating costs. Serbian engineers specified a plant automation solution utilizing standard industry protocols not specialized software as well as an open, supplier independent control system platform.

The Banatski Dvor project involved integrating existing compressor controls and other legacy equipment as part of a unified, plantwide automation architecture. The plant required intrinsically safe (I.S.) technologies with high availability and redundancy as part of the new process control framework.

In addition, the system needed to support Emergency Shutdown (ESD) and custody transfer systems, as well as integrate ladder logic functions. The system for gas treatment consists of: wellhead controls and supervision; pipeline gathering and auxiliary equipment; separation vessels; utilities, transformer substation, and compressor cooler; ESD controls; gas custody transfer subsystem; and compressor controls.

Serbia Gas, through its engineering firm WIG, has had experience working with FOUNDATION™ fieldbus since 2001, so the technology was a natural choice for its Banatski Dvor facility. A modern control platform based on Smar's SYSTEM302-7 enterprise automation solution was implemented to handle DCS functions throughout the gas storage and production plant.

The Fieldbus Foundation's HSE implementation was ideally suited for use as a control backbone at the Banatski Dvor facility. Running at 100 Mbit/s, HSE is designed for device, subsystem and enterprise integration. It supports the entire range of fieldbus capabilities, including standard function blocks and Device Descriptions (DDs), as well as application-specific Flexible Function Blocks (FFBs) for advanced process and discrete/hybrid/batch applications. HSE provides the same benefits as H1 (31.25 kbit/s) fieldbus, but at the subsystem integration level instead of the field device level. The technology supports interoperability between disparate controllers and gateways in the same way that H1 supports interoperability between transmitters and actuators from different suppliers. FFBs in HSE devices can be set up using programming languages such as those found in the international standard IEC 61131-3.

The Serbia Gas control system integrates H1 fieldbus devices with HSE remote I/O, legacy HART® devices, and an ESD subsystem. The system links dedicated compressor controls via Modbus and ties all HMIs together using HSE through an OPC server. HSE serves as a data highway for communication between linking devices and operator workstations, as well as a network allowing communications between various controllers.

Thanks to SYSTEM302, Serbia Gas has achieved true distributed control across its process automation architecture. Control is completely distributed on different controllers, ensuring better reliability of the entire system. In addition, the fieldbus solution expanded data availability throughout the gas plant. This includes increased opportunities for process supervision; better alarm management, events and trends processing; and improved asset management with remote configuration, diagnostics, predictive maintenance, and calibration of FOUNDATION™ fieldbus and HART® devices.

SYSTEM302 also helped to improve Serbia Gas' bottom line: initial cost savings were realized through cable reductions not to mention simple and quick acceptance testing and commissioning.

Serbia Gas started up its new automation system in June 2007, and the equipment is now under operation. Plans call for continued expansion at the Banatski Dvor site, including an increase from seven to 21 wells and the addition of two more compressor units. The SYSTEM302 FOUNDATION™ fieldbus-based control system will grow to keep pace with this progress, including an ESD package expansion and additional enclosures, usage of existing spares for additional signals, and installation of new fieldbus transmitters.

ACE Ethanol LLC

ACE Ethanol LLC, located Stanly, Wisconsin, USA, produces approximately 40 million gallons of Ethanol annually. In 2004, ACE adopted an economical solution to convert its automation system to the latest technology using FOUNDATION™ fieldbus with Smar SYSTEM302. The system controls all operations from the entry of corn in the silo, up to final ethanol output.

ACE´s decision to modernize its control system protected investments made on conventional instrumentation, while putting the company on the digital technology highway. The initiative was so timely that a five-page technical article about the project was published in the September 2005 issue of Ethanol Producer magazine.

Prior to implementing SYSTEM302, ACE utilized an automation system based on PLCs. However, the company decided this was not the optimal solution for ethanol production. The system required a significant amount of memory and resources from the processors for storing great quantities of data. Management concluded that an open architecture control system based on FOUNDATION™ fieldbus would provide the best platform for the future. Therefore, it chose SYSTEM302 as the turning point for the controls modernization.

On this project, Smar was responsible for installing FOUNDATION™ fieldbus devices and converting a large portion of the Ethanol facility's conventional I/O to the new digital platform.

According to ACE Ethanol technicians, the ease of installation with Fieldbus was surprising and the new open digital architecture allows true distribution of control throughout the entire factory. Operators now have a user-friendly HMI network to integrate the new system and control operations more accurately. The system also provides a remote access capability for faster and easier communication between ACE Ethanol and Smar, while permitting configuration changes with remote supervision by Smar specialists.

Cognis (Formerly Henkel)

Cognis S.A, German company leader in specialty chemicals, has a plant located in Jacarei, São Paulo, that produces raw material for Pharmaceutical and Cosmetic Industry from vegetal oil. It processes 20 t/d of vegetal oil.

The SYSTEM302 is controlling the sterilization process, reactor, distillation towers, vacuum system, tanks level, and product stock. The Batch Control is performed in conjunction of the field devices and LC700 - Programmable Controller exchanging data through the Fieldbus module installed in the Programmable Controller, but that is also part of the Fieldbus network. The Programmable Controller also is responsible for the interlock system, and transportation for raw material and others products necessary for the plant.

The plant has 212 Fieldbus devices, 2 I/O servers, 3 operator's station, and over 930 I/O points. There are up to 16 devices per bus. The control strategies implemented by this system include Feed back, Feed forward, Split ranges, Override, Cascade Control totally performed by the field devices.

It is an interoperable system where Smar Field devices as LD302 - Pressure Transmitters, TT302 - Temperature Transmitters, FI302 - Fieldbus to Current Converters, FY302 - Valve Positioner and IF302 - Current to Fieldbus Converters are connected at the same bus with 19 Vortex Flowmeters from a third part supplier.

Binzhou Chemical Group

Binzhou Chemical Group (BCG), located in Binzhou, Shandong Province, one of China's major chemical producers, was formed in the late 1960's and operates several production facilities including a refinery, a chlor-alkli plant, a power plant, and a Propylene Oxide (PO) plant. These plants center around 2 main product categories: petrochemical products and specialty chemicals.

BCG previously installed Fieldbus on a boiler control project and used SYSTEM302 to control the system. This project assured that the use of Fieldbus improved diagnostic capabilities, reduced plant operating costs, minimized the effort required for the control system configuration, installation and commissioning. Because of the success on the boiler, BCG selected a Fieldbus-based solution to automate the PO plant. Unlike the boiler application, the PO plant presents a number of difficult control challenges, such as being extremely corrosive, highly toxic and highly explosive.

The Fieldbus system has met such important technical criteria to enable proactive maintenance. The features such as intrinsic safety, system redundancy, simplified safety and wiring, and remote instrument diagnostics all are part of the maintenance characteristics.

Installation of the Fieldbus-based control system was completed in November 1999. The system, which controls 22 individual control loops, includes two redundant workstations performing all operations, engineering and maintenance as well as 36 field devices spread over four Fieldbus networks. Both workstations connect the Fieldbus networks through redundant, independent interfaces. This configuration provides two paths from the control network to the operator with automatic switchover, ensuring higher system availability and fewer shutdowns.

Among the Fieldbus devices installed were LD302 - Pressure Transmitters, TT302 - Temperature Transmitters, IF302 and FI302 field-mounted converters for interfacing 4-20 mA to conventional equipment such as some analyzers. These devices have a wide diagnostic coverage giving reliable status information. SB302 - Safety Barriers with built-in repeaters were used to allow several barriers to be connected on the same network in the safe area requiring only a single interface port for a network of 12 devices.

A LC700 - Programmable Controller was used for discrete control and conventional I/O. Syscon was the client application used for configuration and maintenance of field devices and to build the control strategies. System engineering was simplified by using the host system's preconfigured templates for graphics and control strategies. BCG selected AIMAX for Windows NT for Human Machine Interface because of its OPC client and Chinese language.

Best of all, system commissioning is achieved with "plug-and-play" simplicity because field devices are automatically detected at the time they are connected.

The company's experience demonstrates that Fieldbus' robust device diagnostics improve predictive maintenance, and in doing so, minimize costly downtime. The use of standardized Fieldbus programming and function block languages simplifies training, and allows regulatory control strategies to be developed in much less time. Because Fieldbus enables regulatory control to be performed in field devices, fewer centralized controllers are required on the PO process. The technology also provides substantial reductions in I/O, and supports a smaller, more efficient supervisory control architecture.

The SYSTEM302 has been providing continuous, reliable control performance since its commissioning and start-up.

BASF

Smar participated in a partnership with Krohne/Conaut to supply equipment with the Profibus PA protocol, that included the configuration, to revamp the Resin Plant of the Paints Unit of Glasurit (BASF group), located in São Bernardo do Campo, SP. This is the largest installation with Profibus PA technology in Brazil. The Profibus PA series of Smar was launched in October of 1999 at Interkama, Dusseldorf, Germany, in response to the request of the European market, where this protocol is stronger.

A total of 109 instruments were used for the control and indication of the chemical reactors and tanks farm of Glasurit. The equipment was supplied in two stages. The first stage was started in April 2000 and the second one July 2000. The first stage was comprised of 30 Profibus PA pieces of equipment, provided by Smar as well as other suppliers.

The Profibus PA protocol was chosen by BASF based on their existing equipment that uses the Profibus DP protocol. Also the Supervisory System already had interfaces for this protocol.

The project, called FRIAS 3, included two supervisory stations operating with ABB software "DCS Advant Controller ". Two ABB Programmable Controllers, each one with a communication module Profibus DP, make two Profibus DP networks.

A total of 21 DP/PA Couplers of the Pepperl & Fuchs were connected, totaling 21 Profibus PA buses.

There are 76 Smar devices distributed in these buses: 20 Pressure Transmitters LD303/LD293, 30 Temperature Transmitters TT303, 25 Valve Positioners FY303 and 1 Current to Profibus Converter IF303.

A configuration and maintenance station with Siemens CP5611 module running the Siemens PDM configurator, was part of the project and was used by Smar to configure the Profibus PA buses.

All of control strategies of the system were developed by ABB and uploaded to its Programmable Controllers. Smar supplied the files necessary for these strategies, such as the GSD_File (Device Master Date) and others.

Foto Ilustrativa

Petrobras

The world's first FOUNDATION™ fieldbus System on an Off Shore application is situated in Campos Basis area known as "Namorado 1" Platform in Rio de Janeiro, Brazil. Petrobras, a Brazilian oil company and one of the twenty major oil companies in the world producing more than 1.6 million of barrels per day, operates this Platform.

Biblioteca de Fotos Petrobras

The installed System measures Natural Gas Pressure and Flow. It operates with a network connecting the Field Devices and the operating stations in a control room. This platform is responsible to control the gas pipelines from and to Roncador, Marlim-S, Cabiunas, Marlim PCH-1 Namorado 2.

Fieldbus technology was chosen due to its easy integration of all data generated by the system instruments, and its modern architecture, with distributed control located inside field devices.

As apart from providing much more information very fast and most reliably, it also brings down costs of cables, cable trays, labor for wiring and trays and finally maintenance. The time spent in installations is also significantly reduced.

The project includes 21 devices and 6 DFI302 - Fieldbus Universal Bridges in redundancy, monitored centrally by Intouch HMI software. In the Control Room there is a provision for two Operator Stations and two Engineering Stations connected through an Ethernet fiber optic network.

Gas-line pressure control is based on a valve and two transmitters, one upstream and the other downstream of the valve. Two PIDs are linked to an input signal selector function block that provides the output for the control valve.

Two control loops manage the plant's deaeration system for the water injection. The architecture is designed to have all Fieldbus gateway nodes installed on pressurized panels in the field. These then connect to the control room via fiber optics.

Smar also achieved the first commercial installation in the world of HSE (High Speed Ethernet) technology using SYSTEM302 on this platform, which is also the first installation in the world on a platform of H1 Fieldbus.

Smar coordinated the project and also supplied all Field Devices, Control Hardware and Software.

CENPES

Foto Ilustrativa

The Center of Research and Development Leopoldo Americo Miguez de Mello (CENPES), under the direction of the Management for Research and Development of the Supplies Area (PDAB), in Brazil, has worked for 40 years supplying advanced technology to make Brazil's state oil company, PETROBRAS, more efficient and competitive.

Located in the campus of Rio de Janeiro Federal University, CENPES performs automation tests for pressure, temperature and flow measurement and control for the research and development of oil refining processes, in 28 pilot plants and five laboratories. STD, a Brazilian company that is Smar's product representative for engineering services and management of industrial projects and installations, carries out automation. STD is located in São Paulo state, and includes a team of engineers and technicians with a long history of providing turnkey solutions and EPC.

The entire PETROBRAS refinery automation architecture is based on SYSTEM302-7, comprising thousands of devices connected in a network. Only an open architecture like the one utilized by SYSTEM302 could perfectly integrate FOUNDATION™ fieldbus and PROFIBUS technologies without sacrificing functionality. Intelligent field devices provide information on the process, as well as advanced self-diagnostics to 21 operator, maintenance and engineering stations. All of the stations run the latest-generation Smar ProcessView supervisory system, which has real, in-born OPC technology resources.

In addition to alarm and event management, ProcessView provides a user-friendly interface to advanced information from the entire system. A new resource available for the DF302 family of multi-functional CPUs is an information service via SNMP, which makes diagnostics management easier and more complete.

US Navy

Smar has deployed its SYSTEM302 to sea. Since 1998 Smar has been supplying control systems and instruments to the U.S. Navy. Nowadays several ships are already using SYSTEM302 to control their fuel injection system, their engine lubrication oil injection system, as well as the boiler pressure reduction loops.

Smar's SYSTEM302 is not only improving the control loop performance, but also delivering fault tolerant installations using Fieldbus status and diagnostic information. The fact that all of the loop controls can be done inside the field devices, even when all of the control systems are down, was one of the key features for the acceptance of a Fieldbus system in the U.S. Navy. SYSTEM302 proved to be an extremely reliable system, resistant to vibrations, high temperatures and strong electromagnetic interference of extreme conditions.

Other characteristics of a true Fieldbus System like SYSTEM302 were extremely useful in the ship. Cable reduction, less equipment in the control room, control in the field, instantaneous status message on failures, were some of the features analyzed by the U.S. Navy.

Today, Smar is proud to say that we have our equipment being used by one the most demanding customers in the world, the U.S. Navy, where high reliability, high availability and high performance are a must.

Reference List

Customer	*Segment*
Abengoa - São João Da Boa Vista	Ethanol & Sugar
Ace Ethanol	Ethanol & Sugar
Açucareira Bortolo Carolo	Ethanol & Sugar
Açucareira Guaraní	Ethanol & Sugar
Agro Industrial Paramonga S.A.A	Ethanol & Sugar
Azucarera Del Noroeste	Ethanol & Sugar
Azucarera Paraguaya	Ethanol & Sugar
Azucarera Teran	Ethanol & Sugar
Azucarera Toilman	Ethanol & Sugar
Campina Verde Bioenergia Ltda.	Ethanol & Sugar
Central Romana Corporation Ltd.	Ethanol & Sugar
Cia. Industrial Usina Albertina	Ethanol & Sugar
Cirio Brasil	Ethanol & Sugar
CNAA	Ethanol & Sugar
Cocal Com. Ind. Cana Acucar E Alcool	Ethanol & Sugar
Coop. Agropec. Rolandia	Ethanol & Sugar
Coopernavi	Ethanol & Sugar
Cosan - Unidade Corona	Ethanol & Sugar
Cosan - Unidade Costa Pinto	Ethanol & Sugar
Cosan - Unidade Ibaté	Ethanol & Sugar
Cosan - Unidade São Francisco	Ethanol & Sugar
CTC - Centro Técnico Canavieiro	Ethanol & Sugar
Destilaria Alvorada Do Bebedouro Ltda.	Ethanol & Sugar
Empresa Agraria Azucarera Andahuasi S.A.A.	Ethanol & Sugar
FB Açúcar E Álcool	Ethanol & Sugar
FBA - Franco Brasiliense S/A	Ethanol & Sugar
Ind. Porto Rico	Ethanol & Sugar
Ingenio Rio Paila	Ethanol & Sugar
Ingenio San Carlos	Ethanol & Sugar
Ingenio Tulula	Ethanol & Sugar
Irmãos Franceschi	Ethanol & Sugar
Ituiutuba Bionergia Ltda.	Ethanol & Sugar
JW Ind e Com. de Equip.em Aço Inoxidavel Ltda.	Ethanol & Sugar
Laginha Agro Industrial - Guaxuma	Ethanol & Sugar
Laginha Agro Industrial - Vale Do Paranaíba	Ethanol & Sugar
Lasuca Project	Ethanol & Sugar
Louis Dreyfus Commodities Bioenergia S/A	Ethanol & Sugar
Molipasa	Ethanol & Sugar
NY Sugar Co. Ltd.	Ethanol & Sugar
Pablo Noriega	Ethanol & Sugar
Refinadora Catarinense	Ethanol & Sugar
Ron Brugal & Co., C. Por A.	Ethanol & Sugar
S/A Usina Coruripe Açucar e Alcool	Ethanol & Sugar
Santelisa Vale - Unidade Orlandia	Ethanol & Sugar
Santelisa Vale - Unidade Sertãozinho	Ethanol & Sugar
Sermatec Industria e Montagens Ltda.	Ethanol & Sugar
Shree Chh. Shahu S. S. K. Ltd.	Ethanol & Sugar
Tropical Bioenergia S/A	Ethanol & Sugar
Univalen	Ethanol & Sugar
US Sugar	Ethanol & Sugar
Usina Acucareira de Jaboticabal S/A	Ethanol & Sugar
Usina Alto Alegre S/A - Açucar e Alcool	Ethanol & Sugar
Usina Caeté S/A - Filial Cachoeira	Ethanol & Sugar
Usina Caeté S/A - Filial Delta	Ethanol & Sugar
Usina Caeté S/A - Filial Marituba	Ethanol & Sugar
Usina Caeté S/A - Filial Volta Grande	Ethanol & Sugar

Reference List

Usina Caete S/A - Matriz	Ethanol & Sugar
Customer	***Segment***
Usina Cerradinho	Ethanol & Sugar
Usina da Barra S/A - Açucar e Alcool	Ethanol & Sugar
Usina de Açúcar Sta.Terezinha	Ethanol & Sugar
Usina Furlan	Ethanol & Sugar
Usina Guariroba S/A	Ethanol & Sugar
Usina Itapagipe S/A	Ethanol & Sugar
Usina Maracai	Ethanol & Sugar
Usina Maracaí	Ethanol & Sugar
Usina Moema S/A	Ethanol & Sugar
Usina S. João de Araras	Ethanol & Sugar
Usina São Carlos	Ethanol & Sugar
Usina Vertente S/A	Ethanol & Sugar
Usina Zanin Açucar e Alcool Ltda.	Ethanol & Sugar
Equipalcool Equipamentos Industriais Ltda	Ethanol & Sugar
Granja Rezende S/A	Water Treatment
Cia. Saneamento de Minas Gerais	Water Treatment
Cafeco Armazens Gerais Ltda	Beer Industry
Central Itumbiara de Bionergia e Alimentos Ltda	Beer Industry
Cervejaria Kaiser Brasil S/A	Beer Industry
Cervejarias e Refrigerantes Convenção	Beer Industry
Cia Cervejaria Brahma	Beer Industry
Cia de Saneamento Basico do Estado de Sao Paulo - SABESP	Beer Industry
Cocamar Cooperativa Agroindustrial	Beer Industry
Codevasf - Dist. de Irrigação de Mororos	Beer Industry
Cooperativa Agroindus. dos Produtos Rurais do Sudeste Goiano	Beer Industry
Corn Products Brasil Ingredientes Industriais Ltda	Beer Industry
Gold Meat - Cajuru Ind. e Com. Ltda	Beer Industry
Marine Lipids	Beer Industry
Mekorot Ltd.	Beer Industry
Nestle Brasil Ltda	Beer Industry
Sadia S/A	Beer Industry
Nestlé - Perugina	Beer Industry
Cerveceria Centroamerica Sa	Beer Industry
Nordon Industrias Metalurgicas S/A	Beer Industry
Primo Schincariol Ind. de Cerv. e Ref. do Rj S/A	Beer Industry
Fincantieri - Splendour	Naval Automation
Fincantieri - Carnival	Naval Automation
U.S. Navy	Naval Automation
Chemin	Building automation
Construtora Pessoa	Building automation
Mercedes Benz do Brasil S.A.	Automotive
Refinacoes de Milho Brasil Ltda	Boiler
Seattle Steam	Boiler
Ahlstrom Louveira Ltda	Pulp & Paper
Cambara S/A Produtos Florestais	Pulp & Paper
Celulose Cambará	Pulp & Paper
Cia Suzano de Papel e Celulose	Pulp & Paper
Daishowa America	Pulp & Paper
International Paper do Brasil Ltda	Pulp & Paper
Klabin	Pulp & Paper
Korsnas	Pulp & Paper
Lwarcel Celulose e Papel Ltda	Pulp & Paper
Nan Leer/Jgl	Pulp & Paper
Pepper Fuchs Ltda.	Pulp & Paper
Riocell	Pulp & Paper
Selecta	Pulp & Paper
Trombini Embalagens Ltda	Pulp & Paper
Ical Industria de Calcinaçao Ltda	Cemente

Reference List

BRCS Instrumentation	University/School
Customer	***Segment***
Chemtech - Servico Eng. e Software Ltda	University/School
CSN - Companhia Siderurgica Nacional	University/School
GSE	University/School
GSI	University/School
IBP - Instituto Brasileiro de Petroleo	University/School
ISA	University/School
JGL Controls International S. A. de C. V.	University/School
KDG	University/School
Konics Co. Ltd	University/School
Martin Controls	University/School
OY E Sarlin Ab	University/School
Petro - Tech	University/School
PUC - Pontificia Universidade Catolica do Parana	University/School
Singapore Polytechnic	University/School
Standard Auto	University/School
Technical Specialties	University/School
Tillquist	University/School
UFV - Universidade Federal De Viçosa	University/School
UNESP - Universidade Estadual Paulista	University/School
UFMG - Universidade Federal de Minas Gerais	University/School
UFTPR - Universidade Tecnologica Federal do Paraná	University/School
AmBev - Companhia de Bebidas das Américas	University/School
American University of Sharjah	University/School
Ana Maria Frattini Fileti	University/School
APM S/C ETE Aristoteles Ferreira	University/School
Assoc. de Pais e Mest. do Col. Tec. Indus. de Guaratingueta	University/School
Associacao Educacional Dom Bosco	University/School
Automation Research and Design Institute of Metallurgical	University/School
Ben Gurion University Of The Negev	University/School
Casa de Nossa Senhora da Paz - Univ. Sao Francisco	University/School
CEFET - Centro Federal de Educacao Tecn. de Campos	University/School
Centro de Estudos Superiores Positivo Ltda.	University/School
Centro Federal de Educacao Tecnologica do Maranhao - CEFET	University/School
Centro Movel de Treinamento Smar/SENAI	University/School
Cia Itauleasing Arrendamento Mercantil - Grupo Itau	University/School
Escola de Quimica UFRJ	University/School
FACIT - Fundacao Educacional Montes Claros	University/School
FEI - Fund. Educ. Inaciana Pe. Saboia De Medeiros	University/School
FPTE - Fundacao Paulista de Tecnologia e Educacao	University/School
FUJB - Fundacao Universitaria Jose Bonifacio	University/School
FUNCEFET PR/ Unidade Ponta Grossa	University/School
Fund. de Apoio ao Instituto de Pesquisas Tecnológicas - FIPT	University/School
Fund. de Empreend. Cientif. e Tecnolog. - FINATEC	University/School
Fundacao Assis Gurgacz	University/School
Fundacao Souzandrade de Apoio ao Desenvolvimento da UFMA	University/School
FUNDEP - Fundacao de Desenv. Pesquisa	University/School
FUNPEC - Fundacao Norte Riogr. Pesquisa e Cultura	University/School
FUVASTES - Fund. Vale do Taguari de Educação e Desenvolvimento Social	University/School
Instituto Catolico de Minas Gerais	University/School
Instituto Superior no Estatal TECSUP	University/School
Lee College	University/School
Louisana Technical College	University/School
Nederlands Meetinstituut - NMI	University/School
Ngee Ann Polytechnic	University/School
OPC Foundation	University/School
Patumwan Institute	University/School
Pontifica Univers. Católica do RS	University/School
Rajabhat Institute	University/School

Reference List

SENA Colombia	University/School
Customer	***Segment***
SENAI - Serviço Nacional de Aprendizagem Industrial	University/School
Singapore Polytechnic	University/School
S'Pore Poly	University/School
Technical Schoold of Tampere	University/School
Technische Universitat Munchen	University/School
Training for FFEUC	University/School
Training Institute	University/School
Trainning Mobile Center	University/School
UERGS - Univ. Estadual do Rio Grande do Sul	University/School
UERJ / SIDES / LETPP	University/School
Universidad San Marcos	University/School
Universidade do Estado de Santa Catarina - UDESC	University/School
Universidade Estadual Paulista - UNESP	University/School
Universidade Federal do Parana	University/School
Universidade Federal do Rio Grande do Norte	University/School
University of Canterbury	University/School
Zhengzhou Electric Power College.	University/School
CFE - Comisión Federal de Electricidad	Power Plant
International Atomic Energy Agency	Power Plant
Mohave Generation	Power Plant
Ciccolella	Power Plant
Tecnoparco	Power Plant
Alston Brasil Ltda	Power Plant
CEPEL - Centro Pesquisa	Power Plant
Duke Energy	Power Plant
Manaus Energia S/A	Power Plant
Rockwell Automation do Brasil Ltda	Power Plant
Lotil Construcoes e Incorporacoes Ltda	Building & Engineering
Centro de Servicos de Automação PID Ltda	Building & Engineering
Eproduction Solutions UK Ltd.	Building & Engineering
Fluor Federal	Building & Engineering
MIP Engenharia S.A	Building & Engineering
Promon Engenharia Ltda	Building & Engineering
Setal Engenharia Construcoes e Perfuracoes S/A	Building & Engineering
Técnicas Reunidas S. A.	Building & Engineering
Weltek Incorporated	Building & Engineering
Aalborg Industries S/A	Industrial Equipment
De Nora do Brasil Ltda	Industrial Equipment
Electromach	Industrial Equipment
Emerson Process Management Ltda	Industrial Equipment
Endress + Hauser Process Solution Ag	Industrial Equipment
Festo Automação Ltda	Industrial Equipment
HBR Equipamentos Ltda	Industrial Equipment
HIMA Australia Pty Ltd	Industrial Equipment
IASTECH Automacao de Sistemas Ltda	Industrial Equipment
ICS-Triplex	Industrial Equipment
Industria e Comercio Lucato Ltda	Industrial Equipment
Interfor Ltda	Industrial Equipment
Metso Autmation Networks	Industrial Equipment
Schlumberger Serviços de Petroleo Ltda	Industrial Equipment
Sierra Instruments Inc.	Industrial Equipment
Tyco Valves & Controls Brasil Ltda	Industrial Equipment
Johnson & Johnson Ind. e Com. Ltda	Pharmaceutical
Smithkline Beecham Brasil Ltda	Pharmaceutical
Açoforja	Steel Mill
Aços Villares	Steel Mill
Albrás	Steel Mill

Reference List

Companhia Mineira de Metais	Steel Mill
Customer	***Segment***
Forjacero/Controlflux	Steel Mill
Furnas	Steel Mill
Mannesmanm	Steel Mill
Sid. Barra Mansa	Steel Mill
Acesita S.A. - Usina Timoteo	Steel Mill
Acoforja - Industria De Forjados S/A	Steel Mill
Belgo Siderurgia S/A	Steel Mill
CSN - Cia Siderurgia Nacional	Steel Mill
Gerdau S/A	Steel Mill
Hansteel	Steel Mill
Kuttner do Brasil Equipamentos Sider. Ltda	Steel Mill
V&M do Brasil S/A	Steel Mill
Vallourec & Mannesman do Brasil S/A	Steel Mill
Birac	Mining
KAP - Podgorica	Mining
BSB - Zeolit	Mining
Minera Michilla	Mining
Muis Trading Company	Mining
Votorantim Metais Zinco S.A	Mining
Belayim Petroleum Company - Petrobel	Oil & Gas
Lukoil - Brilijant	Oil & Gas
Serbiagas - Banatski Dvor I	Oil & Gas
NIS Naftagas - Becej	Oil & Gas
Construtora Norberto Odebrecht S/A	Oil & Gas
Ecopetrol	Oil & Gas
GDK S/A	Oil & Gas
Liquigás	Oil & Gas
Minasgás Distribuidora de Gás Combustível Ltda.	Oil & Gas
PDVSA S.A.	Oil & Gas
PEMEX	Oil & Gas
Petrobras - Petroleo Brasileiro S/A.	Oil & Gas
Petropar	Oil & Gas
Qatar Petroleum, Navigator Plaza	Oil & Gas
Queiroz Galvao Serviços Especiais de Engenharia Ltda	Oil & Gas
Sarkhoun Gas Refinery	Oil & Gas
Saudi Aramco	Oil & Gas
Shell	Oil & Gas
Sonatrach	Oil & Gas
Total Austral S.A.	Oil & Gas
Unocal Tanjung	Oil & Gas
Total - Weisz	Oil & Gas
YPF	Oil & Gas
Refinery Pancevo - Jetty Loading System	Oil & Gas
Refinery Novi Sad - Custody Transfer System	Oil & Gas
Cameron Petreco Process Systems - Singapore	Oil & Gas
Bandar Imam Petrochemical Co. Ltd.	Petrochemical
BIPC	Petrochemical
Bisotoun Petrochemcal Company	Petrochemical
Fox Petroli	Petrochemical
Ipiranga Comercal Quimica S/A	Petrochemical
Kavir Phosphate Complex	Petrochemical
Khangiran Refinery	Petrochemical
Petrochemical Commercial Co.	Petrochemical
Petrochemical Research And Technology	Petrochemical
Petróleo Ipiranga	Petrochemical
Petrom Petroquimica Mogi das Cruzes S.A.	Petrochemical
Petroquimica União	Petrochemical
Razi Petrochemical Company	Petrochemical

Reference List

Statoil	Petrochemical
Customer	***Segment***
Suez Oil Company (Suco)	Petrochemical
Univen Petroquimica Ltda	Petrochemical
Yanshan Petrochemical Corporation	Petrochemical
Quimpac S.A.	Chemical
Acelab	Chemical
Anling Chemical	Chemical
Binzhou Chemical	Chemical
Borden Chemical	Chemical
Carbocloro S/A - Industrias Quimicas	Chemical
Chemagis	Chemical
China National Chemical	Chemical
Cia. Nitro Quimica Brasileira	Chemical
Clorox	Chemical
Cognis Brasil Ltda	Chemical
Corning Incorporated	Chemical
CP Kelco Limeira S.A.	Chemical
DETEN Quimica S.A.	Chemical
Elf - Penwalt/Cobando	Chemical
Fermic/JGL	Chemical
Fertilizer Plant, Han Steel Group	Chemical
Firestone	Chemical
Firmenich & Cia. Ltda	Chemical
Henkel Ltda	Chemical
Jilin	Chemical
Kemira Chemicals	Chemical
Khalista (Liuzhou)	Chemical
Kodak Brasileira Comércio e Indústria Ltda.	Chemical
Kolynos	Chemical
Metton America	Chemical
Penta	Chemical
Polioles S.A	Chemical
Praxair Venezuela, S.C.A.	Chemical
Primax	Chemical
Productos Quimicos y Anexos Proquimsa S.A.	Chemical
Quimica Central/JGL	Chemical
Recicla Aluminio Ltda.	Chemical
Rhodia	Chemical
Rodhar Transportes e Encomendas Ltda	Chemical
Sapici	Chemical
Southern Edison	Chemical
Tintas Renner	Chemical
Titan Wood	Chemical
Transultra-Solvay	Chemical
Triken	Chemical
Usine D'Amiens	Chemical
White Martins Gases Industriais S.A.	Chemical
Wuhan Youji	Chemical
Shanghai Dongdao Carbon Chemical Industry	Chemical
Termolyse	Chemical
Alpargatas Santista	Textile
Fermic	Textile
Corning Glass	Textile
Cebrace Cristal Plano Ltda	Textile

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