

PNID – 2013

Petroleum and Natural Gas Conference & Exhibition

“Instrumentation & Automation for Drilling Platform to Dispatch Terminal”



Date : 3rd October 2013 (Thursday)

Venue : Hotel Taj Palace, Sardar Patel Marg, New Delhi
(Shahjehan and Durbar Halls)



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Dated the 24th September, 2013

MESSAGE

It gives me immense pleasure that International Society of Automation (ISA) - Delhi section is organizing Petroleum and Natural Gas Industries domain (PNID-2013) conference and exhibition on 03rd October 2013 with the theme 'Instrumentation & Automation for Drilling platform to Dispatch Terminal'.

The Oil & Gas Sector an important energy provider to nation faces challenges from ever increasing demand for high productivity, improved plant efficiency, increased safety and security meeting regulatory requirements. Today's automation is fully equipped to face the challenges by adopting latest technological advancements without compromising operational safety.

The Symposium intends to engage automation experts from Petroleum and Natural Gas and Petrochemical industries (e.g. Offshore well Head and Process Platforms, Onshore Wellhead and Pipeline Industries, Gas processing plants, Oil Refineries and Petrochemicals), Automation Providers/manufacturers, system integrators, consultants, R&D Organizations, academicians and others for an invigorating exchange of knowledge.

I hope this symposium will provide a platform to share the latest trends in Instrumentation and Automation for stake holders and enhance knowledge base to meet the challenges at present and in future.


(Dr. M. Veerappa Moily)

MESSAGE



AK Purwaha
Chairman & Managing Director
Engineers India Limited

I am happy to note that International Society of Automation (ISA) - Delhi section is organizing the Petroleum and Natural Gas Industries Domain (PNID-2013) conference and exhibition on 3rd October 2013.

One of the principles of sustainability is 'Doing more with less' which is also one of the goals of automation. By replacing the routine part of human labor with the use of machines, automation not only increases productivity and the quality of products beyond what can be achieved by humans but also frees space, time and energy for humans to innovate and develop more advanced technologies.

To remain globally competitive it is imperative for organizations to innovate and develop solutions which are responsive to industry needs, compliant with changing regulations, competitive and effective. Automation thus plays an important role in improving this competitiveness of organizations by controlling manpower cost, reducing energy cost, improving quality and increasing production.

I am sure this meet will provide an advanced insight on the latest in instrumentation and automation technology and help in evolving the future roadmap of technologies in the plant control and monitoring applications with active participation and invaluable knowledge sharing between end-users, suppliers and consultants.

I wish delegates, speakers and organizers of this symposium all the success.

A handwritten signature in blue ink that reads "AK Purwaha". The signature is written in a cursive style with a horizontal line underneath.

(AK Purwaha)



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Dipak Chakravarty
Managing Director

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Message

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I am delighted to know that the International Society of Automation (ISA) - Delhi section is organizing a Petroleum and Natural Gas Industries Domain (PNID-2013) conference and exhibition with the theme 'Instrumentation & Automation for Drilling Platform to Despatch Terminal.'

With rapid advancement and constant development in technology, the need for one to keep abreast with this ever changing expertise has become indispensable. I am confident that this congregate will be an apt opportunity to learn about the latest technologies and know-how's in plant control and monitoring applications. With active participation and invaluable knowledge sharing between end-users, suppliers and consultants this meet would be an ideal platform to improve awareness about instrumentation and automation technology and also review and evaluate the future roadmap. This confluence of a host of leading automation experts from across the oil and gas sector, R&D organizations, academic organizations, manufacturers and others is one of a kind and would enable one to gain invaluable knowledge from their vast experience in their respective fields.

I am confident that this conference would benefit the Industry at large and wish the very best to the organizers.

Regards,

(Dipak Chakravarty)
Managing Director
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SHRI Ajay N Deshpande
Director (Technical)
Engineers India Limited



I am glad to be the part of Petroleum and Natural gas Industries domain (PNID-2013) conference and exhibition organized by International Society of Automation (ISA) - Delhi section on 03rd October 2013 with a vision and mission to take Instrumentation and Automation to global heights and acquire a numero-uno position in Petroleum and Natural Gas section.

The Oil and Gas Sector, which is the most critical Energy sector, continuously faces challenges from ever-increasing demand for high productivity, improved plant efficiency, increased reliability and security. While on one hand increase in complexity of material handled in Petroleum and natural gas section and hazardous potential nature of the fluids on the other hand increase in capacity of the complex including configuration, this industry demands Plant Intelligence solutions that connect and integrate the systems that work in isolation and ensuring availability of information round the clock. To enhance the production operations it's necessary to connect the plant floor with the enterprise level that will give real time plant information.

I hope this symposium will provide an opportunity for Indian Petroleum and Natural Gas sector automation experts, consultants, suppliers of automation systems and equipment manufacturers to get an exposure to the global developments in automation and thereby providing an opportunity to seek & implement latest state-of-the-art global solutions.

I wish them a great success.

Regards,

A handwritten signature in black ink that reads "Ajay Deshpande". The signature is written in a cursive style with a horizontal line underneath.

Ajay N Deshpande
Director (Technical)
Engineers India Limited



District 14

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Message from ISA District Vice President – District 14

Due to continuous changes in the field of Automation Technology, there is a tremendous demand and expectation from the Oil & Gas Industries, to get impartial and unbiased information, which in turn would enable them to take the right decisions and make their organization more profitable without compromising the quality or safety and protect the environment.

It is also worthwhile to mention that sustained development cannot be a one sided endeavor and in this context “The International Society of Automation” (ISA) with its decades of experience and strong network of professionals worldwide, constantly strives to address these challenges. This endeavor is clearly reflected by ISA-Delhi section, as they spearhead the “Petroleum and Natural gas Conference & Exhibition” event every year, which is laudable and this will be the third year of its glory. PNID - 2013 is absolutely crucial in the context of the current Indian Oil & Gas scenario and I am confident that PNID - 2013 will address these critical issues through seminars, presentations and deliberations.

I am privileged to be a part in an organization, which not only enlightens, but also empowers. I am extremely pleased to be part of this wonderful event and wish ISA – Delhi section members and participants to make the most of out of this event. I wish ISA-Delhi Section “All the very best for PNID - 2013” to be a Grand Success.

V.P. Raman
ISA District Vice President (District 14)



Message

It is indeed immense pleasure that ISA Delhi section is organizing another mega event in the series of PNID i.e. PNID-2013 on 3rd October 2013. As we all know Process Automation plays very vital role in running the plants in safest mode and at highest economical production level, starting from Upstream till Downstream. Thru this event ISA Delhi team has put all out efforts to present the programme, ensuring maximum number of participation from “Users & Producers” that will cater to the needs of today and the needs of tomorrow. Our senior and well experienced team members have put extra hours, to meticulously study all the Papers received, and to select the Paper topics. Exhibitors from the Industries have been invited to display their products, so that it benefits the “Users” immensely. Our team members are quite confident that at the end of this mega event, participants will gain immensely in their knowledge and will get answers to many of their queries, which were unsolved prior to their attending this programme.

I would like to convey thanks to the Technical team for timely preparing the Souvenir, compiling all the Technical Papers, various manufacturers details received and well designing the contents.

On behalf of the Executive Board of ISA Delhi, I would also like to convey thanks to the Convener PNID , HPTC members (High Power Technical Committee), supporters, Sponsors and other dedicated members for making this mega event a grand success.

With the support of “Users & Producers” and dedicated members of Programme Committee, ISA Delhi will reach you thru another mega event with new Theme, in the coming year.

With best wishes

A handwritten signature in black ink, appearing to be 'S K Dhawan'.

S K Dhawan
Hon. President
ISA-Delhi Section



Message

As India embarks into the process of redefining the Oil & Gas market. One of key challenges is balancing the economics to reduce import dependency by enhancing domestic oil and gas production with critical subject like energy security etc. Technology will play a key role in this balancing act..

It is commendable that ISA delhi has taken a huge responsibility of bringing together the users and technology vendors of India under one roof to address the challenges of growth of Oil & Gas sector.

The ISA team has worked hard to get together the Technical heads of various users organizations both Public and private to evaluate the "State of Art" technologies from global vendors to be presented in PNID 2013.

In dynamic times of Economy and India, we hope that PNID 2013 will set the stage for all the stake holders to come together and deliberate a successful path forward.

Special thanks to all the people who have worked tirelessly to make this event happen. Also, we appreciate the support of participants and sponsors who have reinforced the commitment to work together for the success of PNID 2013.

Wishing PNID 2013 all the success.

A handwritten signature in blue ink that reads "Anamika Bhargava". The signature is fluid and cursive.

Anamika Bhargava
Hon. Secretary
ISA-Delhi Section



Message

To share the knowledge and learn from the latest experiences of the Oil & Gas Segment, ISA-Delhi chapter (ISA-D) is taking consistent initiatives to create a progressive platform in India. ISA Delhi Section has planned to organize a Conference & Exhibition on 3rd October 2013 (Thursday) at Hotel Taj Palace, Sardar Patel Marg, New Delhi with topics related to Petroleum & Natural Gas sector.

The “PNID-2013” symposium will most certainly facilitate high-level interface among all the decision-makers of Petroleum & Natural Gas industry, wherein the concerns and prospects will be conferred in-depth.

Along with the conference proceedings, a souvenir has been prepared as a source of reference material on the subject for further reading. All the lectures and presentations covering various aspects of technology are included in the souvenir.

Technology is gaining importance in process control and monitoring and newer products are being introduced by manufacturers. The users are still cautious in using the ever new technology introduced at a rapid pace. This souvenir will help increase awareness about latest technology to pave way for its early implementation in process industry.

A handwritten signature in blue ink that reads "Rajiv Gupta".

RAJIV GUPTA
CONVENOR
PNID 2013



Message

I am glad to be the Technical Co-ordinator of Petroleum and Natural gas Industries domain (PNID-2013) conference and exhibition organized by International Society of Automation (ISA) - Delhi section on 3rd October 2013.

Instrumentation & control systems have always kept pace with the technical and scientific evolutions - from pneumatically controlled system to fully automated state-of-the art Distributed control Systems and microprocessor based field instruments having analog and digital communication with SMART & Foundation Fieldbus technology which are in place for more than a decade. Wireless technology being picked up in the industry is really regarded as the paradigm shift in the world of automation and process industry.

Technology being on the cutting edge with continuous development, I am sure this meet will provide more insight to improve awareness instrumentation and automation technology and generate lot of inspiration and confidence to review and evaluate the future roadmap of technologies in the plant control and monitoring applications with active participation and invaluable knowledge sharing between end-users, suppliers and consultants.

Thanks for the support extended by all.

Regards,

S. Mahesh Kumar
Technical Co-Ordinator
ISA-PNID 2013

PNID is an initiative taken by ISA-Delhi section to provide a common platform to all stakeholders of Instrumentation and Automation solutions providers. This forum aims at sustainable development of Measurements, Control, Safety & Automation solutions in Oil & Gas sector.

Vision

“To take Instrumentation in Indian Petroleum, Oil & Gas sector to global heights and acquire a state-of-the-art instrumentation technology”

Mission

To engage all petroleum sectors in adopting the latest standards and technology in Instrumentation & Automation and thereby increasing efficiency and productivity.

To realize the above vision and to execute the mission, the various long term and short term activities being carried out by PNID are:

- Enabling knowledge sharing among Petroleum, Oil & Gas sectors Instrumentation & Automation fraternity including End users, EPC Companies/ Consultants, Suppliers and Academicians.
- Facilitate through integrated automation, the realization of a world class Petroleum, Oil & Gas plants in India, setting and sustaining higher bench marks for safety, cost and environment.
- Integrate Indian Petroleum, Oil & Gas sector to global developments in Control & Automation there by setting up local vision with global approach.
- Provide an interface for the automation fraternity with the statutory bodies, policy makers and regulators

The engagement and involvement of various End-users, EPC companies and suppliers including technology providers and developers would certainly help in achieving the roadmap for implementing strategies and best engineering practices for level-4 automation so essential for a world-class Petroleum, Oil & Gas sector.



2013-2014 ISA Delhi Section Leaders

Position	Name	Mem. #	E-mail Address
President (3130)	S K Dhawan	33187323	sk.dhawan51@yahoo.co.in
President-elect (3150)	S.K. Bardhan	32930445	bardhansk@yahoo.co.in
Vice President (3390)	S Samanta	33137156	ssamanta@ntpceoc.co.in
Secretary (3250)	Anamika Bhargava	33259183	anamika@hitachi.co.in
Treasurer (3350)	Arun Gupta	32929694	arung@indure.com
Delegate (1370)	Ravinder Goyal	32180883	eipenviro@gmail.com
Alt. Delegate (0030)	S Mahesh Kumar	32978456	s.mahesh.kumar@eil.co.in
Program Chair (0950)	Manish Kumar	33080951	manish.kumar@eil.co.in
Education Chair (1350)	Anil Chaudhary	32247401	anil@elconsys.in
Membership Chair (0790)	Prateek Srivastava	33137155	prateek1508@rediffmail.com
Newsletter Editor (2970)	Chattar Singh	33224930	chattar.singh@eil.co.in
WebMaster (3420)	Radheyshyam Tiwari	33146408	radheytiwari@gmail.com
Exhibit Chair (0430)	S K Dhawan	33187323	sk.dhawan51@yahoo.co.in
Marketing Chair (1010)	Ashish Manchanda	33042943	AManchanda@phoenixcontact.co.in
Publications Chair (0970)	Rohit Goswami	33238168	rohitgoswami@ntpceoc.co.in
Honors & Awards (0510)	C Saroj	33187332	csaroj@ntpceoc.co.in
Historian (1990)	Akash Sharma	33129424	asharma@provibtech.com
Student Section Liaison (2870)	Anuja Thukral	33173214	anuja.thukral@gmail.com
Section-Division Liaison (2850)	R K Bassi	32941231	rkbassi@yahoo.com
Standards & Practices (1150)	R Shanti Devi	32978454	r.shantidevi@eil.co.in
Past Section President (3090)	Prasenjit Pal	32156518	prasenjit@ntpceoc.co.in
Other (2950) Sr. Advisor	M P Singh	32046378	mp1.singh@jalindia.co.in
Other (2950) Sr. Advisor	S Verma	32154992	sureverma@hotmail.com
Other (2950) Sr. Advisor	R G Dhalwani	32205732	rdhalwani@deseinindure.com
Other (2950) Sr. Advisor	Arundhati Bhattacharya	32972094	arundhatib@ntpceoc.co.in
Other (2950) Sr. Advisor	Rohit Bhardwaj	33026902	rohit_iocl@yahoo.co.in
Other (2950) Sr. Advisor	Ms. R Priyamvada	32191437	priyamvada.r@eil.co.in
Other (2950) Sr. Advisor	N K Pande	04117201	pande.nk@gmail.com
Other (2950) Sr. Advisor	Ravi Shankar Kommu	33211662	ravishankar.kommu@jindalsteel.com
Other (2950) Sr. Advisor	Ashok Panda	33148417	ashok.panda@tatapower.com
Other (2950) Sr. Advisor	Alok Shrivastava	32247966	alok@ntpceoc.co.in

PROGRAM OUT LINE

PNID-2013	3rd October 2013	
	Time	
Registration	From	To
	8:30 AM	9:00 AM
Inauguration Session (Shahjehan Hall)		
Welcome of Dignitaries with Bouquet & Lamp Lighting	9:05 AM	
Welcome address by ISA-D President	9:15 AM	
Address by Guest of Honour Sh. Ichiro Iino, MD, Hitachi	9:20 AM	
Address by Guest of Honour Sh. Dipak Chakravarty, MD, Numaligarh Refinery Limited	9:30 AM	
Address by Guest of Honour Sh. A N Deshpande, Director - Technical, EIL	9:40 AM	
Address by Guest of Honour and Key Note Speaker by Sh A K Purwaha, C&MD, EIL	9:50 AM	
Address by Chief Guest, Dr. M Veerappa Moily, Honourable Minister Petroleum and Natural Gas	10:00 AM	
Release of Souvenir by Chief Guest	10:10 AM	
Vote of Thanks by Convener-ISA(D) PNID-2013	10:20 AM	
Inauguration of Exhibition by Chief Guest and Dignitaries (Durbar Hall)	10:25 AM	
Tea Break	10:30 AM	11:00 AM
Session-1 "Latest Trends in Control and Analyser System Technologies"	11:00 AM	1:00 PM
1) Network Security on Control System	Mr. Glenn Bounds	M/s Invensys, Singapore
2) Design of Interposing Switching Components	Mr. Nelson Finan	M/s Finder, Italy
3) TDL Analyser Technology	Mr. Jiwan Jain	M/s E&H, India
4) Optical Sensors in Analyser Technology	Dr. Sam Langridge	M/s Servomex, UK
Lunch Break	1:00 PM	1:45 PM
Session-2 - "Asset Management & ASME PTC updation"	1:45 PM	3:45 PM
1) Essential Asset Monitoring	Mr. Kaushal	M/s Emerson, India
2) Asset Management System-Interface with Field	Mr. UnniKrishnan	M/s P&F, India
3) Diagnostic Features acc. to NAMUR NE 107	Mr. Kumaraswamy	M/s R. Stahl, India
4) ASME PTC 19.3 TW Latest requirements	Mr. Rejath Thomas	M/s Technip, KT

PROGRAM OUT LINE

5) Manufacturer Perspective ASME PTC 19.3 TW	Mr. M. D. Bichu	M/s Pyro, India
Tea Break	3:45 PM	4:00 PM
Session-3 - "Pipeline protection and Fire protection"	4.00 PM	6:00 PM
1) Fire Protection System	Mr. Ray Browne	M/s K-Mass, UK
2) Fire protection System	Mr. Robert Pitman	M/s Darchem, UK
3) Corrosion Integrity of Natural Gas Pipeline	Mr. Amitabh	M/s Honeywell, India
4) Leak Detection and Location Detection	Mr. Mohit Agarwal	M/s Pentair, India
Lucky Draw (Durbar Hall)	6:00 PM	
Visit to Stall By Delegates	6:00 PM	7:00 PM
Honours and Awards (Durbar Hall)	7:00 PM	7:30 PM
Networking Dinner (Durbar Hall)	7:30 PM onward	



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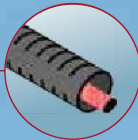


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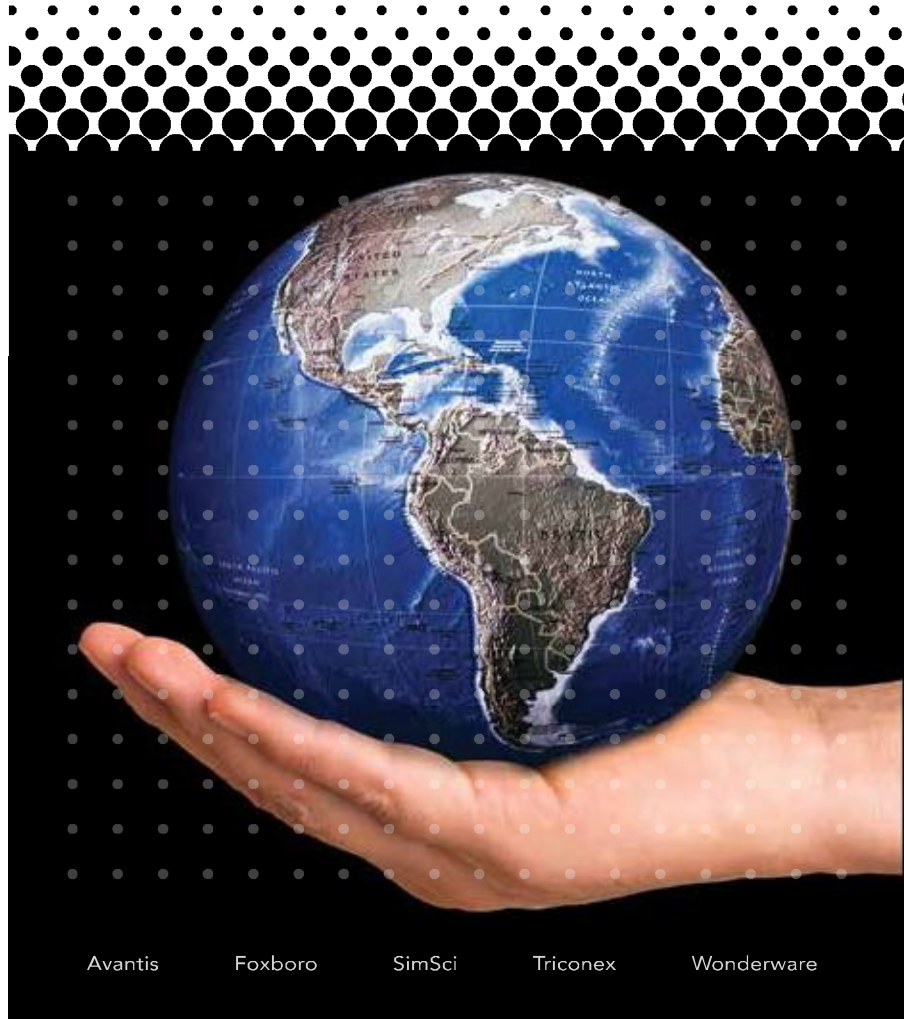
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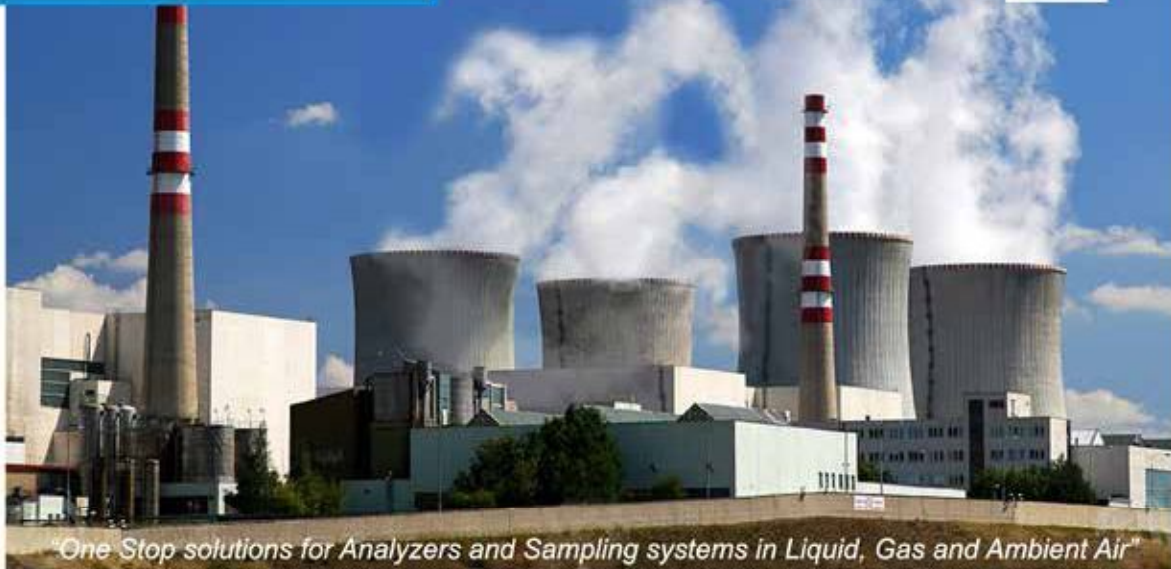
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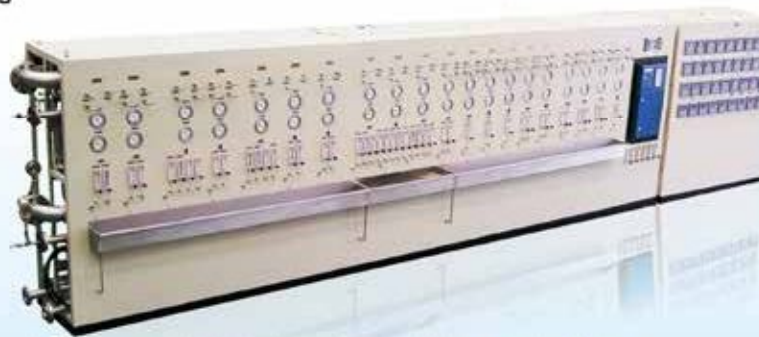
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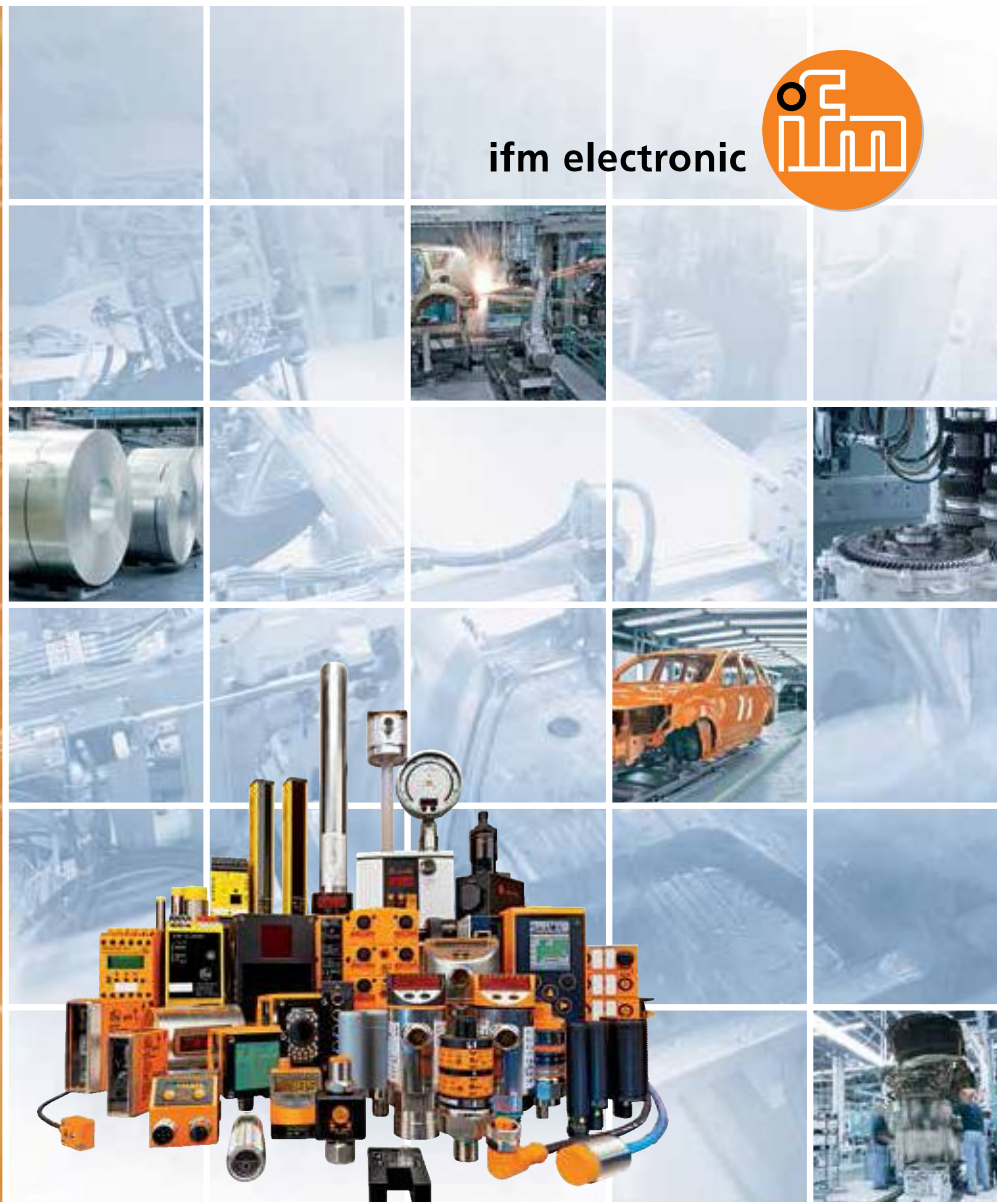
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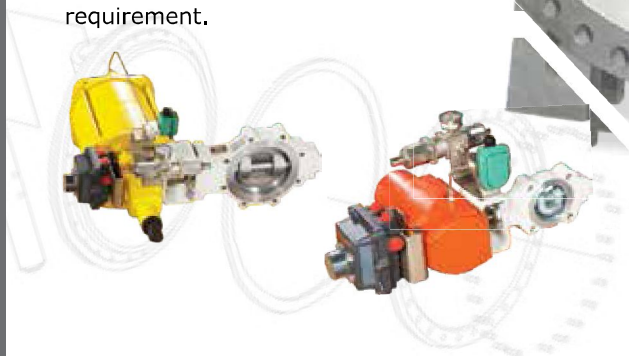


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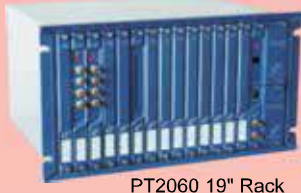
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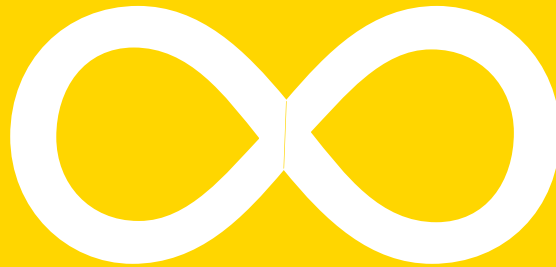
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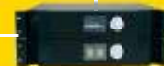
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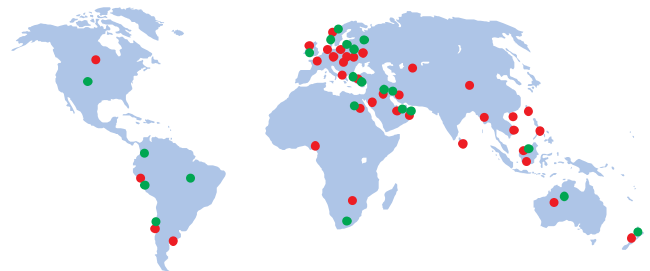
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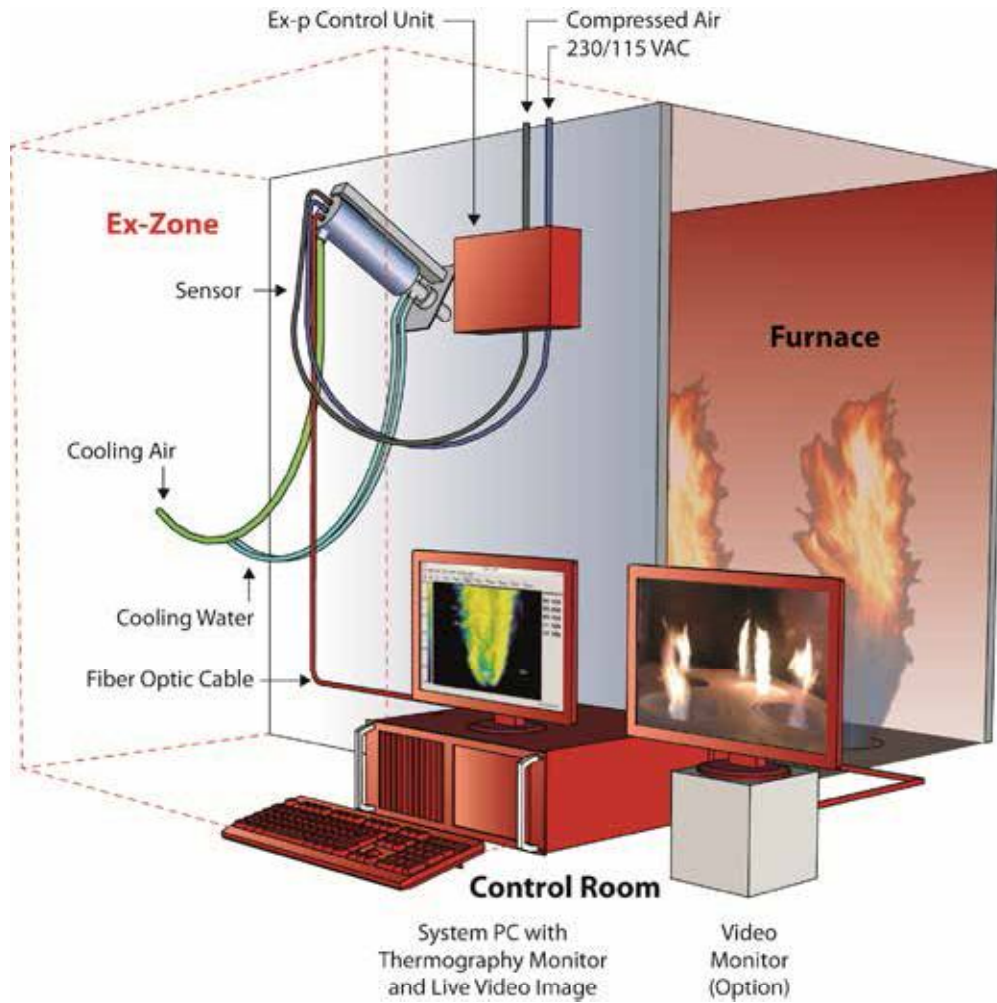
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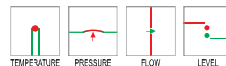
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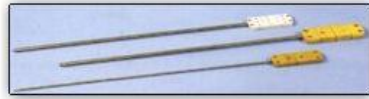


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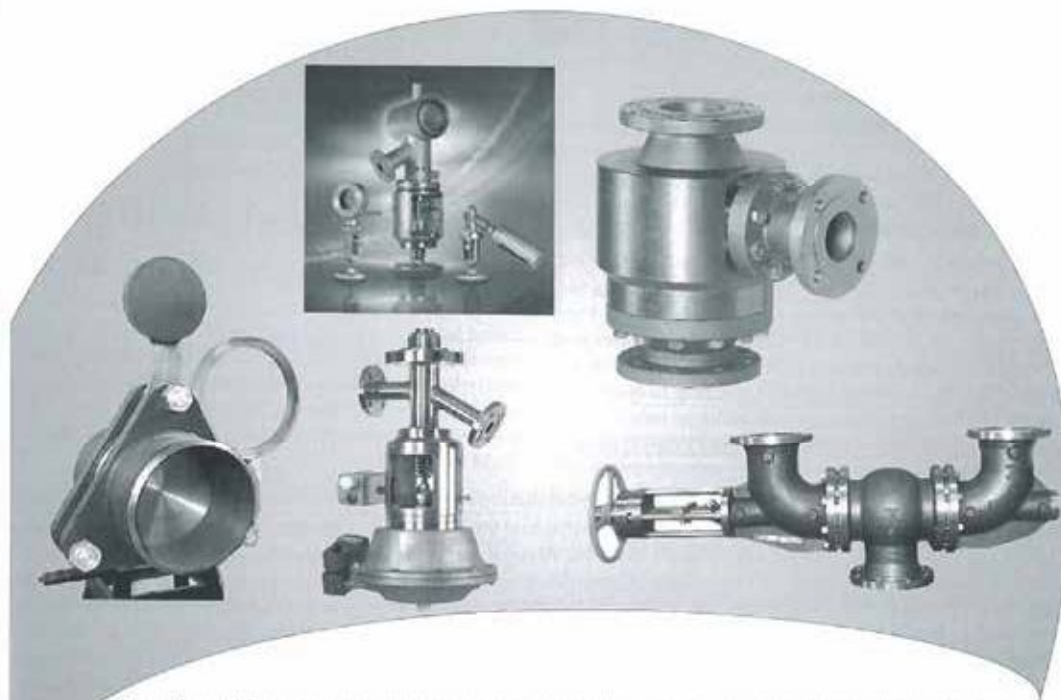


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- IS/IEC 60079-0 : 2004 *General Requirements*
- IS/IEC 60079-1 : 2007 *Flameproof enclosures Ex 'd'*
- IS/IEC 60079-2 : 2007 *Pressurised Enclosures- Ex "p"*
- IS/IEC 60079-5: 2007 *Equipment Protection by Powder Filling Ex "q"*
- IS/IEC 60079-6: 2007 *Equipment Protection by Oil Immersion Ex "o"*
- IS/IEC 60079-7 : 2006 *Increased safety Ex 'e'*
- IS/IEC 60079-11 : 2006 *Intrinsic safety Ex 'i'*
- IS/IEC 60079-15 : 2005 *Non Sparking type of protection Ex "n"*
- IS/IEC 60079-18 : 2004 *Encapsulation Ex "m"*
- IS/IEC 60079- 31:2008 *Equipment dust Ignition Protection By Enclosure "t"*



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- Approval of our laboratory under the BIS laboratory scheme.
- PESO / CCoE, approval for testing electrical equipments intended for use in potentially explosive atmosphere and
- Accredited to IECEx under the IEC ExTL scheme with Baseefa, UK as a notified body.

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IS/IEC 60034-5:2000 and IS 4691 for
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IP1X	IP2X	IP3X	IP4X	IP5X	IP6X		
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- Introduction to Hazardous Atmospheres & Protection Techniques.
- Design and certification requirements for Hazardous Area electrical products.
- Area classification and Electrical installations design, selection and erection.

Inspection and Audits of Hazardous Area Installation,

specific standards covered are:

1. **IS: 5572: 2009 and IEC 60079-10:** Electrical Apparatus for Explosive Gas Atmospheres Part-10: classification of Hazardous Area.
2. **IS: 5571: 2009 and IEC 60079-Part 14:** Electrical installations designs, selection and erection.
3. **IS/IEC 60079-17:2007** Electrical Installation, Inspection and Maintenance.
4. **IS/IEC 60079-25:** Intrinsically safe electrical systems.
5. **IS/IEC 60079-19:2006** (Ex Equipment Repair, overhaul & redamation)

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- Type Examination & Testing
- Environmental Testing
- Ingress Protection (IP) Testing
- Training
- Calibration & Validation Services

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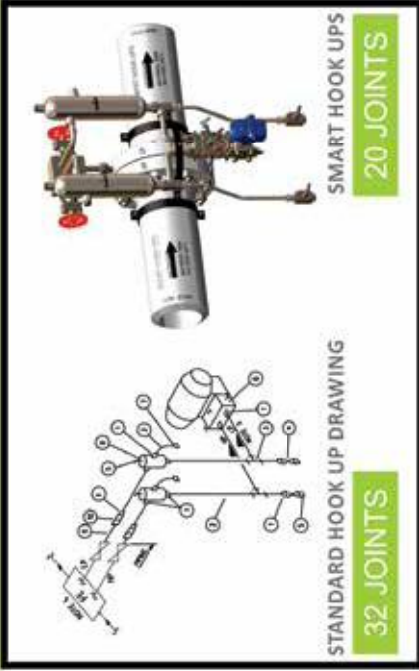
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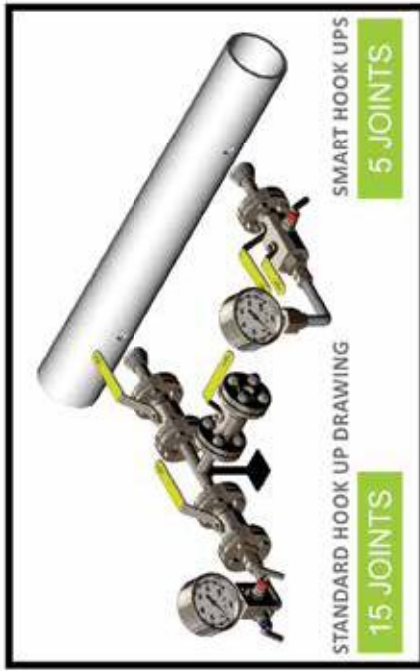
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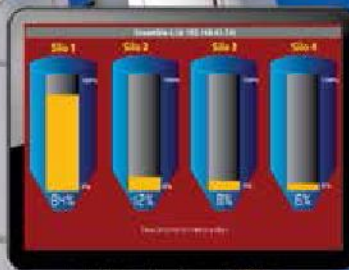
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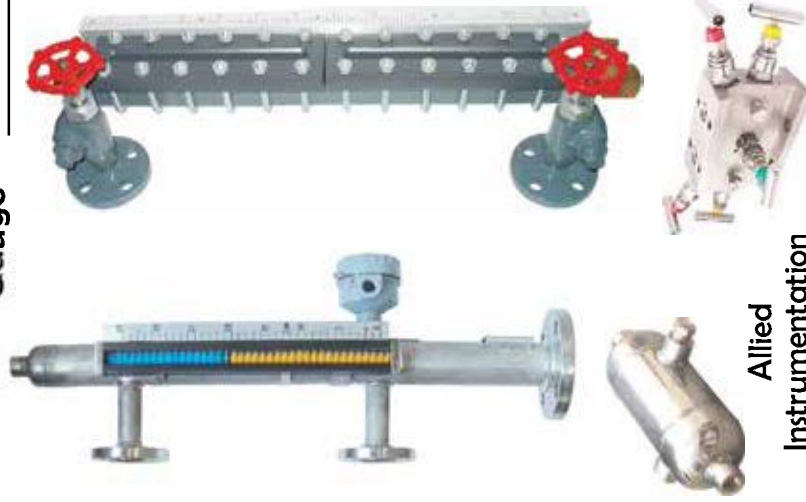
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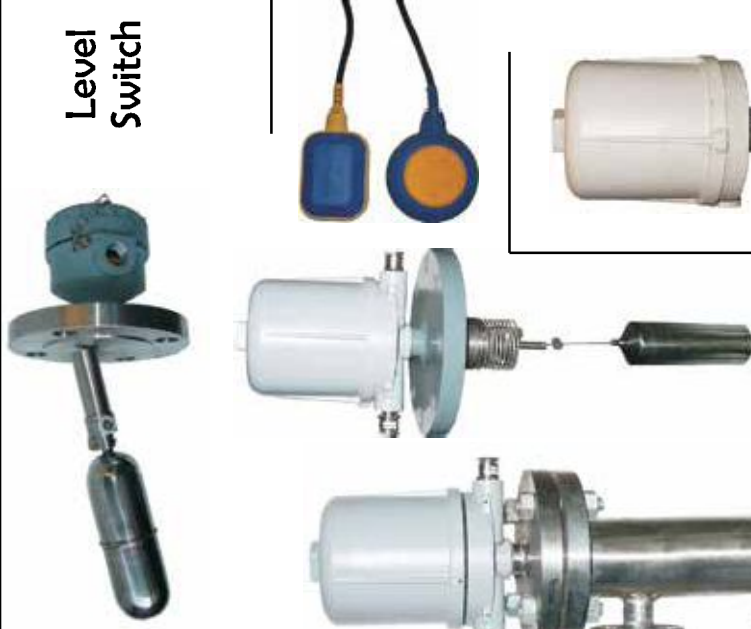
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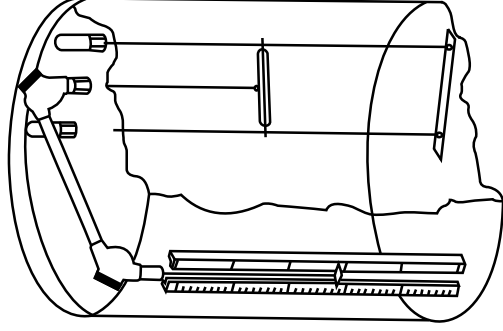


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Technical Papers

“Latest Trends in Control and Analyser System Technologies”

Cyber Security - Safeguarding Assets in Industrial Control Systems (ICS).

By: Glen Bounds, Invensys Cyber Security

Abstract:

Industrial control systems; in the past their reliance was on isolation, proprietary networks and hardware. Once they were thought to be immune to the network attacks that have wreaked havoc on corporate and government information systems. Unfortunately, recent experiences prove this complacency is misplaced – the move to open standards such as Ethernet, TCP/IP and web technologies has let hackers take advantage of the process industry’s ignorance. This discussion summarizes the recent ICS attacks and looks at the lessons that can be learned from these security events. We will also discuss the penetration points used by most attacks vectors and how many security efforts may be misguided. Finally we look at the trends in terms of how the nature and sources of attacks have changed over the past few years, where

the hacker community is beginning to focus their efforts, and how the industry needs to focus its security responses.

Speaker Profile:

Glen Bounds has thirty-two years of instrumentation, control and safety systems experience in widely diverse industrial areas. For the past seven years, Glen created and managed an Invensys cyber-security group based in Dubai for the EMEA region as well as being the Technical Manager of major projects. He has extensive knowledge and experience both physical and cyber security from a customer as well as a vendor’s perspective. Glen is originally from Louisiana, USA and lives in Dubai.

Selection of Switching Interface – A Need for Reliable Control Systems

Introduction

A relay is considered to be two different items connected together- An Electromagnetic Coil and a Switch/Poles, the coil changes the switch from one state to another when a rated voltage is applied to it. This operation seems to be so simple but the question is- Is it really so SIMPLE or we should give it a second thought...

Many relay users take a standard product for all applications and more often than not they're perfectly happy even if the relay performs for a consistent time period which may be shorter than the complete life cycle of the relay due to which they never examine the important parameters necessary for optimum utilization of these switching interfaces. It could be that a same relay works for all applications for a limited time period but as every application is different, so is the relay.

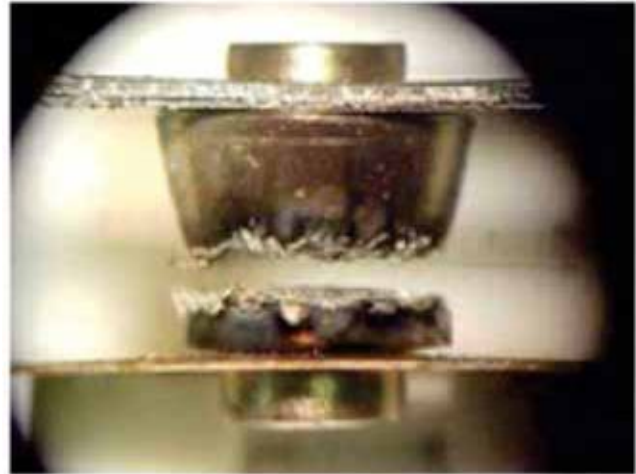
Factors affecting performance of Relay

Many internal and external factors influence the performance of relay, they can be broadly classified into 10 different types:-

Each of these factors affects the relays performance in some or the other way. Based on the application one must carefully analyze all these parameters and select an appropriate relay as its failure is immediately reflected on the control system reliability.

1. Contact Material

The contact material has the major influence on the relay performance when it is compelled to be used under high current, continuous operation and connected load. The correct contact material is like the correct tires for a race car, Rally tires on a F1 car are not so good. The same is for relays, the wrong material will have a big effect on its performance.



PIC: Relay Contacts showing the effects of severe over current due to misuse

There is no universal contact which covers all applications. The selection depends on various factors like type of load, level of load, type of supply, frequency of switching etc. 4 different contact materials are widely used today for manufacturing of contact material depending on their properties.

AgNi (Silver Nickel):- It is a good standard contact for most relay applications. The ratio of Rated Current Vs Inrush Current handling capability is 1:2

AgCdO (Silver Cadmium Oxide):- It has high wear resistance and welding resistance when used with high AC loads.

AgSnO₂ (Silver Tin Oxide):- It has excellent resistance to welding and is best suited for lamps and capacitive load. It has very high ratio of rated Vs inrush current of 1:5.

AgNi + Au (Silver Nickel Gold Plated):- It has a gold plating over AgNi of 5µm thickness and is used in applications involving small and middle load range 50mW (5V/2mA)

If selected a wrong contact material for an application, it can destroy the contact due to

material vaporization thus considerably reducing the electrical service life of the relay

2. Coil Requirement

Every coil has its own target voltage and working range, right relay for right application depends purely on the operating range of the coil. The relay might work correctly over the working range as specified by the manufacturer but proper attention shall be paid for selecting the coil as the manufacturer cannot guarantee the same.

A user should give emphasis to the minimum pick-up voltage and the maximum permitted coil voltage with respect to the ambient temperature. In some circuit's leakage current or Transient EMF might have enough voltage to keep some coils energized, therefore not releasing in the intended way. Different manufacturers specifies different coil voltage ranges, usually a 24V DC relay has a working range of 0.80 to 1.1 times the nominal voltage UN. The graph above shows a typical DC Coil operating range v ambient temperature.

3. Contact Requirement

As relays come in different configuration, thus several points of concerns arises in choosing the number of contacts required for the application. The question remains "How many Poles (Contact sets) does the user requires for the application?" Relays typically come in 1,2,3,4 poles and less main stream relays comes with more than 4 poles. The contacts can be understood on the basis of terminology of NO=Normally Open, NC= Normally Closed, CO=Change Over contacts (change from one set of contact to another) respectively.

CO=Change Over contacts can further be described as SPST (Single Pole Single Throw), SPDT (Single Pole Double Throw), DPST (Double Pole Single Throw) and DPDT (Double Pole Double Throw). SPST being the simplest of all with only two contacts. SPDT has three contacts. The Double Pole versions are similar to Single Pole versions except there are two switches that open and close together. Special attention

should be paid while selecting the contacts in accordance to the voltage and current requirements of the load.

4. Socket/ Base

This can be one of the most important and usually overlooked parts of a relay used in a control system. In all cases the relays and the bases/sockets should be made by the same manufacturer as per the specific mating requirements and considerations. The important bit is quality of materials and plating's in the base, the plastics need to withstand the heat generated from the contacts both in the relay, and the contact made between the terminal and the relay base, and the metal needs to have enough elasticity force to maintain its pressure on the terminals, usually this is where improperly designed bases/sockets fail and let down the electrical system, the clamps in the base open up with heat and fails to return to its original position, and this reduce the pressure, and increasing heat, until a failure occurs. The secret to a good electrical connection is the result of Area x Pressure. If a joint is made up with too little pressure, moisture and air will penetrate the joint an promote corrosion which raises resistance which increases heating which can accelerate corrosion

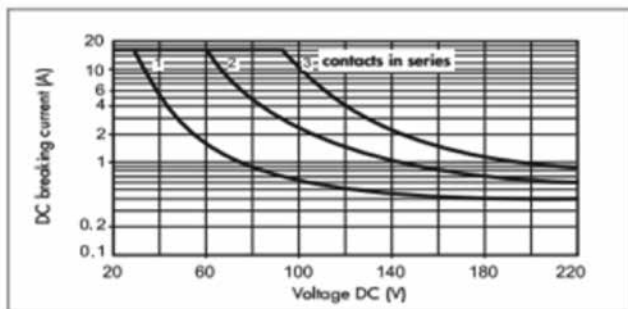
5. Type of Load

It is important to determine the parameters of relay in accordance with the type of load connected. Loads can be of different types example- Resistive, Inductive, Capacitive, Lamp Load, Motor Load etc. Some loads like Motor and Inductive loads have high inrush current and can damage the contacts of relay if not selected properly. An additional protective circuit shall be installed to overcome the ill effects of the using inductive loads and to increase the service life of the relay and the system

Loads are broadly classified into AC and DC loads. For both small AC and DC load especially for control applications, the arc produced during changeover of contacts is less but due to the contact friction during switching an oxidation layer is built over the

contacts due to which reliable switching becomes impossible for small loads. Thus Gold layer contacts are preferred universally for small loads due to its insensitivity to oxidation.

A basic separation should be maintained between large AC and DC Loads. When switching large AC loads, the relay can be operated up to the mentioned voltage and current levels as the arc produced during the switching goes out in the next zero phase of AC cycle. However while switching DC loads, due to non availability of Zero Crossing to extinguish the arc automatically, the relay can only switch relatively small DC load. In industrial applications demanding switching high DC loads, a user has an option to connect two contacts in series to increase the switching capacity.



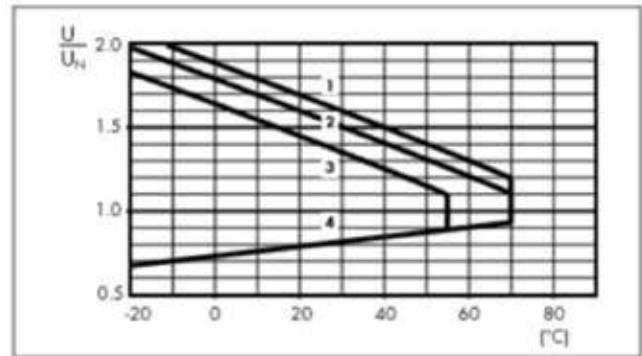
Contacts in Series to increase switching capacity

6. Insulation

The main functions of a relay is to connect and disconnect different electric circuits, and usually, to maintain a high level of electrical separation between different circuits. It is therefore necessary to consider the level of isolation appropriate to the application and the task to be performed - and to relate this to the relay's specification.

7. Temperature

Temperature plays an important role in defining the electrical service life of a relay. The relay exposed to harsh ambient temperatures would lead it to work unreliably. While designing the system it is therefore necessary to take temperature as the main criteria. A typical Coil Voltage variation graph with respect to temperature is shown below.



DC coil operating range v ambient temperature

- 1 - Max. permitted coil voltage at nominal load (DC coil).
- 2 - Max. permitted coil voltage at nominal load (AC/DC coils $U \leq 60$ V).
- 3 - Max. permitted coil voltage at nominal load (AC/DC coils $U > 60$ V).
- 4 - Min pick-up voltage with coil at ambient temperature.

8. Type of Mounting

Today depending on the application type, a user has different options for mounting the relay. The most common being the PCB version. These types of relays can directly be soldered on a PCB. In industries however Socket/Base mounted relays are preferred because of their modularity and ability to mount on DIN rails or screw mounting on panels. Third type of mounting is Flange mounting, which is used if there is no DIN Rail available.

9. Life Time

For a reliable switching interface, the components both electronic and electro-mechanical, installed within it should also have a high reliability factor. A relay should typically have an electrical service life in millions so as to efficiently work for a higher life span.

10. Service Factor

The Service factors are considered when there is a need to diagnose a fault in the relay and also the ease with which they relay can be replaced in an existing control system. It is very important to have indication for both - the Coil Actuation as well as the Contact Latching, so that the user can identify the nature of the fault. After the fault is diagnosed,

the user needs an easy identification of the key technical parameters of the relay, so that the correct replacement can be ensured without looking at extensive documentation. For this purpose, it is important that the technical parameters are Laser printed on the relay, as the ink printing normally wipes out over a period of time.

Conclusion

The reliability of relay plays an important role in the availability of control system. For each application therefore the best relay shall be chosen based on different technical parameters. With the advancements in technology and the multiple options now available in these Relays, the need of the hour is for optimization of the selection parameters. This kind of design elevation if considered at the time of detailed engineering, can not only help in increasing reliability, reducing the cabinet footprint, remove wiring errors, preventing additional heat generation inside the cabinet, save space but also optimize costs directly as well as indirectly by energy saving.

Speakers Profile:

Mr. Nelson Finan is an Electrical Engineer with more than 20 years of industry experience in the field of Automation & Control. He is currently working in the capacity of Manager - Technical Services at M/s Finder S.p.A., Italy and is responsible to providing technology support to industry users in the Asia Pacific, Middle East, South Africa and Australia regions.

Nelson is originally from New Zealand and has lived in various parts of the world including Asia, UK and now stationed in Italy. He likes to travel and interact with the people in every part of the world.

TRACE GAS MEASUREMENTS USING TUNABLE DIODE LASER SPECTROSCOPY.

An ideal gas analyzer would allow for on-site, accurate, continuous monitoring with unattended operation in hostile environment with wide temperature fluctuations and high humidity over long time periods.

TDL-based analyzers have developed tremendously over past few years and are now emerging as a new, main stream, on-line gas measurement technique for petrochemical and natural gas industries. Compared with traditional gas analysis methods Tunable Diode Laser Absorption Spectroscopy (TDLAS) offers significant advantages for measurement of trace gas concentrations due to their high sensitivity, high spectral precision, very fast response time, non-contact measurement and years of maintenance free operation. TDL-based analyzers are now commercially available for various applications. These analyzers employ the wavelength modulation spectroscopy (WMS) technique which provides real time measurements with high sensitivity and fast time response.

Tunable Diode Lasers are small solid-state devices similar to the ones in **common laser pointers**. They are **unique** in the sense that changing the laser temperature or operating current can tune the output wavelength. The tunable nature of the laser is used to scan the laser output wavelength across the gas absorption line. The laser light beam is configured so that it passes through a region of gas and falls onto a detector.

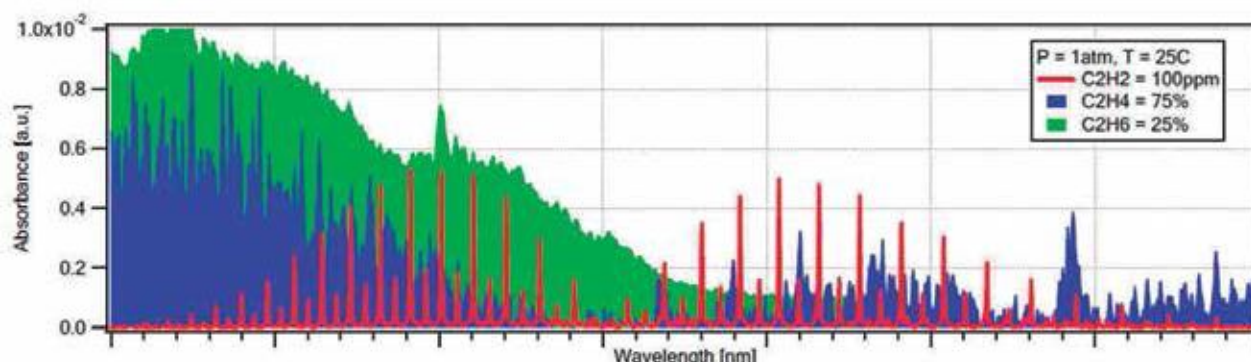
FUNDAMENTALS OF TDLAS

Each type of gas molecule has characteristic wavelength bands where it absorbs infrared light. Typical Non-Dispersive Infrared analysers use broadband light sources and band pass filters to produce a beam of light containing a band of wavelengths corresponding to the absorption band of the molecule of interest. This method does not work, if, target molecule and background, both absorb radiation around same wavelengths, because of the overlapping absorption bands. The absorption of monochromatic light along a uniform path is governed by Beer-Lambert's law:

$$\tau_v = \left(\frac{I_t}{I_0} \right)_v = \exp[-P \cdot X_{abs} \cdot S(T) \cdot \phi_v \cdot L]$$

Higher spectral resolution of TDL analyzers compared to traditional NDIR analysers, allows the use of a simple solution for overcoming background interferences, ie. choosing a suitable absorption line where background absorption is minimum.

Laser line selection is usually based on spectroscopy databases such as **HITRAN 2008** (Highresolution **TRAN**smission molecular absorption). A computerised spectral analysis algorithm is used to select the appropriate line for each application. An example of overlapping absorption lines is as shown in the figure below. This is an application example for measurement of trace Acetylene in Ethylene and Ethane background.

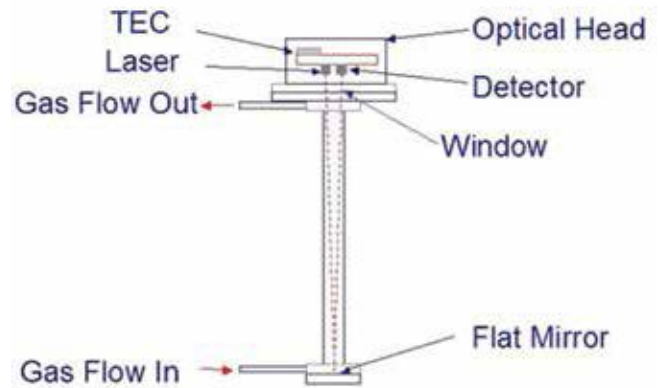


Absorption spectra of trace Acetylene in a stream of Ethylene and Ethane mix.

ANALYSER CONSTRUCTION

The output from the tunable diode laser is collimated by a suitable lens. Temperature of the diode laser is precisely regulated. Driven by a saw-tooth ramp and modulated by a faster sinusoidal waveform at few kHz, the light from Tunable Diode Laser is directed through the sample cell of length L containing gas with absorption factor X_{abs} . Transmitted power I_t will be less than incident power I_0 if target molecule is present in the cell.

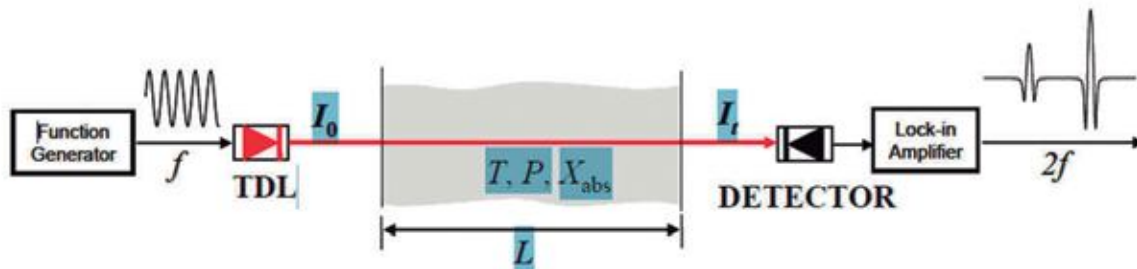
Different path lengths are chosen to achieve the desired sensitivity requirements. 0.8 m path length is achieved from a simple two pass design. Multiple pass Herriott sampling cells provide longer optical path lengths up to 28 m. Beam exiting the cell falls on detector. Detector output signals are directed to a lock-in amplifier for detecting the second-harmonic ($2f$) signal. The target gas absorption as well as the major background gas absorption can be obtained simultaneously in the same laser scan by using scanned-wavelength modulation spectroscopy.



Sample cell showing the laser beam path through the gas and reflecting back to the detector. Both the laser and detector are isolated from the gas by a window.

DIFFERENTIAL SPECTROSCOPY:

For removing the background interference, "differential spectroscopy" method is used, such that, background gas spectrum can be subtracted from the overall spectrum to isolate the spectrum



Schematic of the WMS-2f based TDLAS measurements.

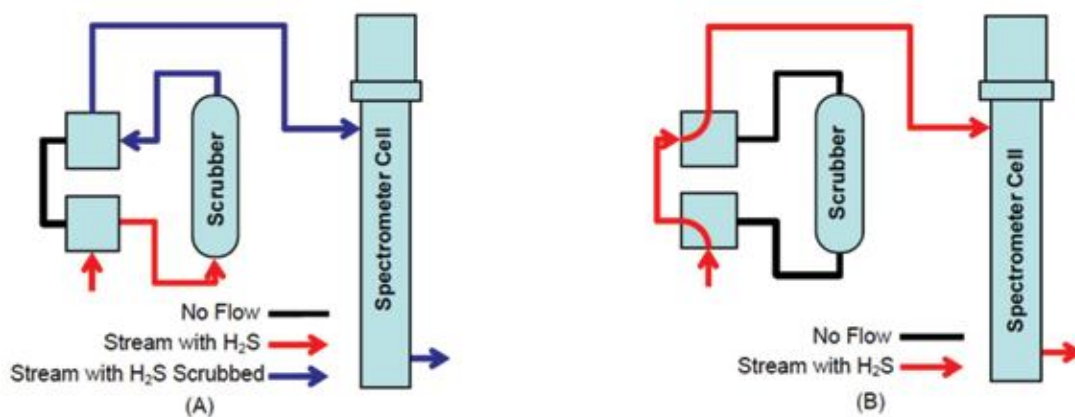


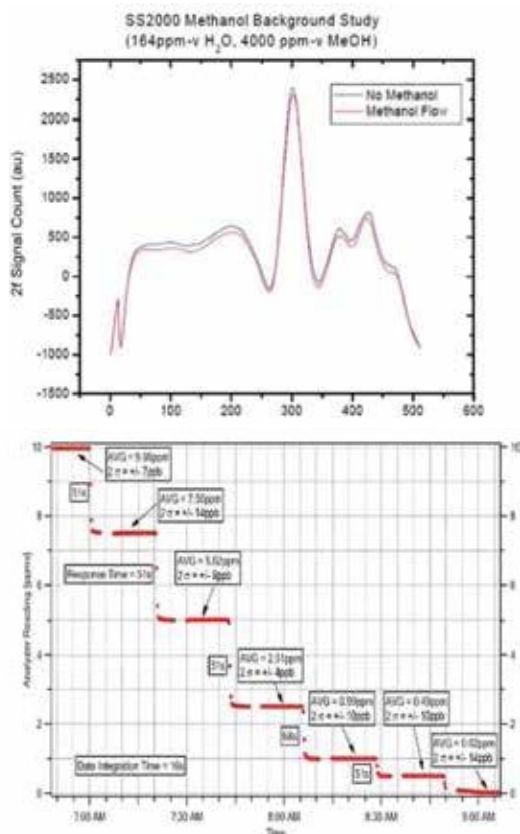
Illustration of the stream switching for differential spectroscopy
(A) Scrubbing cycle (B) Live measurement cycle.

of the H₂S (typical). To obtain a “Wet” and “Dry” stream for the spectrometer to analyze, an H₂S “scrubbing” system is used. The scrubber material and the reaction products (spent scrubber) are not classified as toxic or hazardous. A mechanical scrubber system is shown diagrammatically in figure below. The scrubber is designed for a minimum lifetime 12 months and may last as long to 10 years.

Performance:

Moisture measurement:

The speed of response of the TDL technique is unmatched by any other type of moisture sensor. Because there are no surface reactions in the TDL method, the instrument can respond to changes in moisture concentration as quickly as the laser can be scanned. The laser analyzer reading is not affected by even very high levels of vapor phase contaminants such as glycol, amines, or methanol. These contaminants do not have absorptions near the water vapor line and are not visible to the laser.

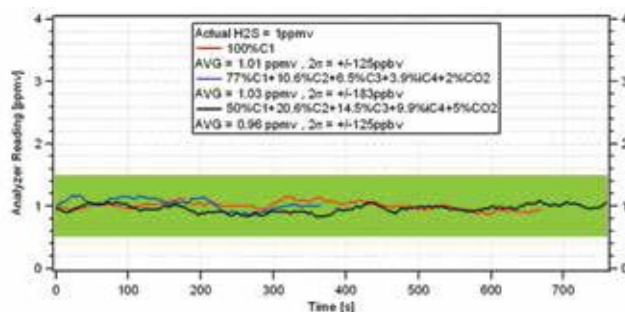


(a) (b)

(a)The absorption spectrum of natural gas near the water line is unchanged by the injection of 4000 ppmv methanol vapor into the gas. (b) Step down test of Trace H₂O analyser for accuracy, linearity, short term repeatability and the time response.

H₂S measurement

The advantage of TDL technology for H₂S measurement is the overall operational cost and reliability. The initial capital expense is somewhere in the middle compared to other available technologies, but the cost of operation is much lower especially when measurement reliability in remote locations is needed. The speed of response to sudden changes in H₂S is excellent with TDL analyzers compared to other technologies. Speed of response is important otherwise contaminated gas can enter transmission pipelines in large volumes

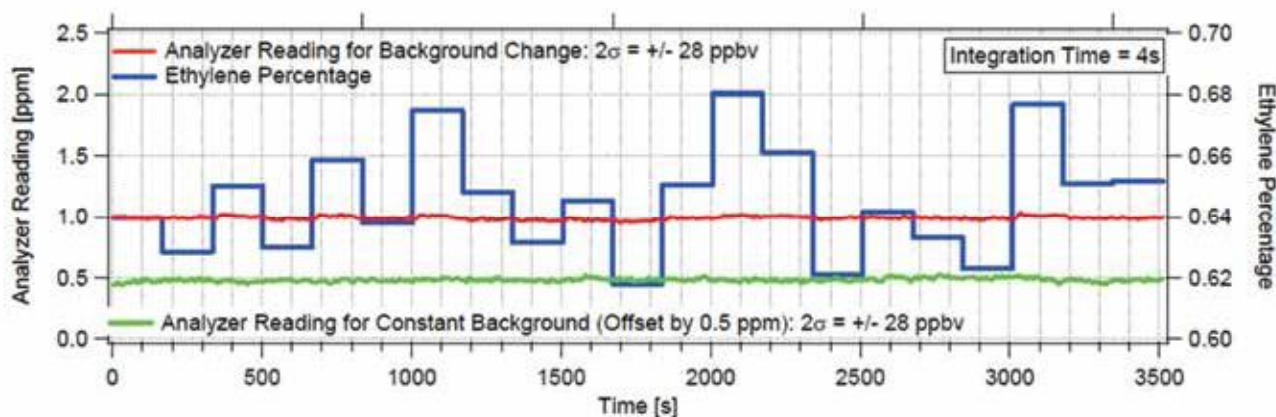


Measurement response from analyzer at 1 ppmv in a variety of background compositions over time with dry spectrum updates enabled. Methane varies from 50-100% with associated changes in ethane, propane, butane, and CO₂. The analyzer readings are well within the stated precision specifications represented by the green band.

Acetylene Measurement:

Figure below shows the performance of a 0-5 ppm trace C₂H₂ analyzer when the background ethylene and ethane concentrations change randomly. The analyzer reading 2σ is ±28 ppbv during the 1 hour test with ethylene changing by ±3% around the nominal value of 65%. The 2σ repeatability is the same as that achieved in a similar test but with

constant background, which demonstrates the effectiveness of the measurement technique to compensate for background variations.



Summary:

TDL analysers with their fast response times and superior linearity coupled with practically maintenance free installation are an attractive proposition for trace gas measurements in complex hydrocarbon backgrounds. These rugged analysers are free from periodic calibration needs and do not have any rotating or parts subject to wear and tear.

Acknowledgements:

Various Publications from Spectrasensors, Inc.

Author:

Jiwan Jain is working as DGM –Solutions with M/s Endress+Hauser India Pvt. Limited, Mumbai. A graduate in Electrical Engineering from University of Rajasthan, Jaipur he has more than 17+ years' experience in the field of analysers and analyser systems like SWAS, CEMS etc. He has also worked extensively on analyser shelters and their engineering. His past employers include Instrumentation Ltd, Kota, Thermax Ltd. Pune and Emerson , Mumbai in various capacities and aspects of analysers and analyser systems.

A TUNABLE FILTER OPTICAL SYSTEM FOR ON-LINE AND REAL-TIME HYDROCARBON GAS COMPOSITION ANALYSIS

Dr. Sam Langridge, Servomex

Jarvis Brook, Crowborough, East Sussex, UK

Dr. V Saptari, Precise, Woburn, MA, USA

A TUNABLE FILTER (TFS) OPTICAL SYSTEM FOR ON-LINE AND REAL-TIME HYDROCARBON GAS COMPOSITION ANALYSIS

ABSTRACT AND SUMMARY

Composition analysis of hydrocarbon gases is important in various applications in the Oil & Gas industries such as fuel gas quality monitoring, energy content measurement and in various applications within the hydrocarbon processing industry (HPI), as raw product is refined and processed to final plastics, rubbers and chemicals. Advanced process control technologies providing fast and accurate feed and product analysis are critical in optimizing efficiency and payback in ethylene (olefin) plants. Applications in typical ethylene plants start at the point of gas feed. Hydrocarbon feed gases (such as naphtha) are initially cracked in a furnace and then separated into desired products or fraction. This can be done in a variety of sequences. Monitoring of the feed gas compositions which may typically include methane, ethane, ethylene, propane and C4+s are generally required.

The prevalent instrumentation technology used to-date for hydrocarbon gas speciation and composition measurement is gas chromatography (GC), in particular process gas chromatography (PGC). It works by physically separating the hydrocarbon compounds through a long column as the stationary phase and a carrier gas as the mobile phase. The different hydrocarbon compounds exit the column at different times, which are then detected by a detector. For percent-level composition measurement, thermal conductivity detector (TCD) is generally used. Measurement time for a C1-C5 analysis varies between 90 seconds to 5 minutes, depending on the type of instrumentation and configuration used. A continuous flow of dry,

high-purity carrier gas, generally helium, is needed.

An optical hydrocarbon gas analyzer based on infrared absorption has long been envisioned and investigated by various groups, as it could provide fast analysis (in seconds) and simplified sampling enabling a true on-line or in-line solution. In addition, an optical analyzer does not need a carrier gas, which reduces the infrastructure requirements and operating costs. Popular carrier gases for PGC are helium and hydrogen for thermal conductivity based PGC measurements and hydrogen is also used as a fuel for FID detectors, but helium is becoming increasingly rare and expensive and hydrogen cylinder use and storage has safety considerations.

The challenges of an optical analyzer for hydrocarbon speciation and composition monitoring are clear. Overlapping spectra with substantial spectral nonlinearities generally present challenges even to advanced spectral processing methods. There are no isolated peaks for a simple peak analysis to be used, but rather, a more sophisticated "pattern recognition" algorithm or chemometrics needs to be used.

In addition to the overlaps, spectral nonlinearities may also occur. In this case, spectral nonlinearities refer to the feature changes of the spectrum due to changes in the background matrix, component concentration and/or conditions, such as spectral broadening, peak shifting and other feature distortions. Such spectral nonlinearities make it very difficult for a linear chemometrics method such as Classical Least Squares (CLS), Principal Component Analysis (PCA) or Partial Least Squares (PLS) to

model. These modeling techniques rely upon or assume linear and additive set of spectra.

An all-optical sensor platform has been developed for hydrocarbon gas composition analysis enabling speciation and quantification of the individual hydrocarbon components in multi-component matrices of alkanes, alkynes, alkenes and/or alcohols. It performs such speciation without requiring physical separation of the compounds as performed in chromatography. The flow-through optical sensor provides unattended, real-time and consumable-free analysis suitable for on-line fuel gas analysis, combustion control, pipeline gas quality monitoring, BTU/heating value measurement and various hydrocarbon processing applications including natural gas analysis, the very many hydrocarbon speciation applications on ethylene/olefins plants and flare stack analysis.

The system consists of a light spectrometer, a flow-through sample cell, a single-element photo-detector and electronics. The spectrometer uses a unique tunable Fabry-Perot assembly that provides wavelength scanning with high Etendue. An advanced spectral processing and chemometric algorithm provides highly accurate and robust speciation performance compensating for various spectral nonlinearities due to pressure, flow and temperature variations.

Challenges due to inherent spectral overlaps and nonlinearities are discussed, including methods of calibration and verification demonstrating the system performance in resolving interfering hydrocarbon spectra. Various test results using standard mixtures consisting of methane, ethane, propane, n-butane, iso-butane, propylene and

ethylene compounds, as well as natural gas samples are presented. A side-by-side test with an industry-standard Gas Chromatograph (GC) analyzer on a set of fuel gas mixtures, agreements within +/- 0.5 BTU were achieved. These Tuneable Filter Spectrometers (TFS) have now been widely employed for fast, accurate hydrocarbon measurements, initially in the natural gas industry where caloric value is also calculated but now increasingly in core hydrocarbon processing such as Ethylene Plants and flare stacks.

Author:



Sam started out as a chemistry teacher, joined Servomex, then went to work for Applied Automation, then ABB Process Analytics another stint at Servomex, next with ASI (Yokogawa), then AMETEK Process Instruments and back to Servomex (something of a 1-2-1-2-1 rhythm there with Servomex). His resume covers groundbreaking work in IR, UV, TDL, Paramagnetic and GC analytical technologies. He is being specifically honored for the development and application of novel Zirconia based sensors, CO equivalent sensors, extractive Zirconia analyzers for combustion analysis and control. Sam is known to all as a Boffin of the analyzer industry. An innovator who weaves high science to practical experience who can make you laugh at it all. This is the highest accolade for our profession. As with the four previous winners of this award (recast from the "Luft Award") Sam is a native son of the Analysis Division and he honors us all with his lifetime achievements

