Yokogawa Field Instruments

Pressure & Temperature development

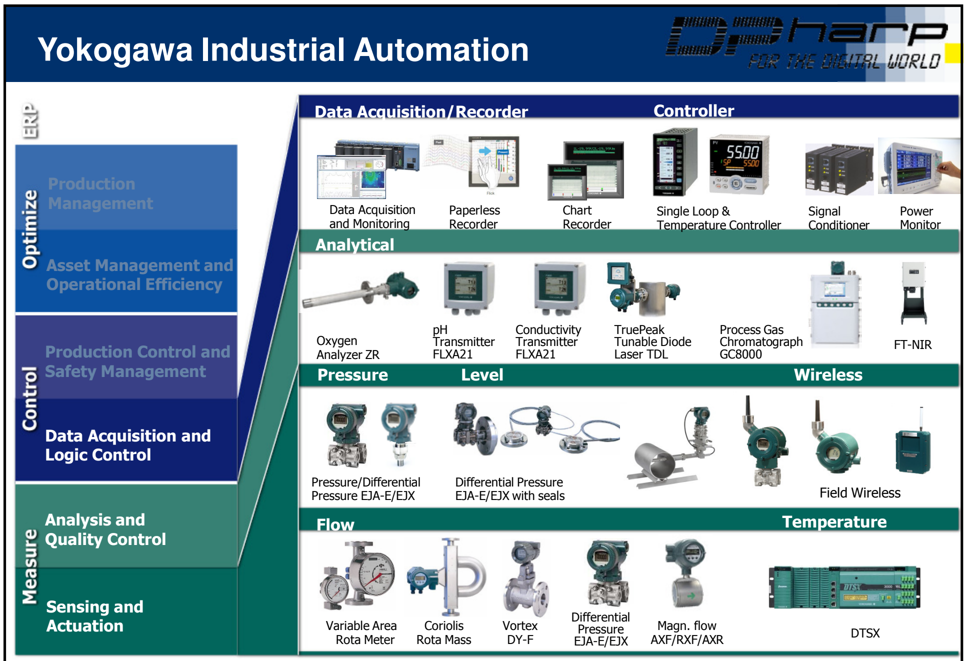
&

Process Analyzers from a engineering perspective

Erik Visser & Loek van Eijck
16-11-2017

KIVI Engineering Society

Yokogawa Industrial Automation



Pressure Transmitters

EJX

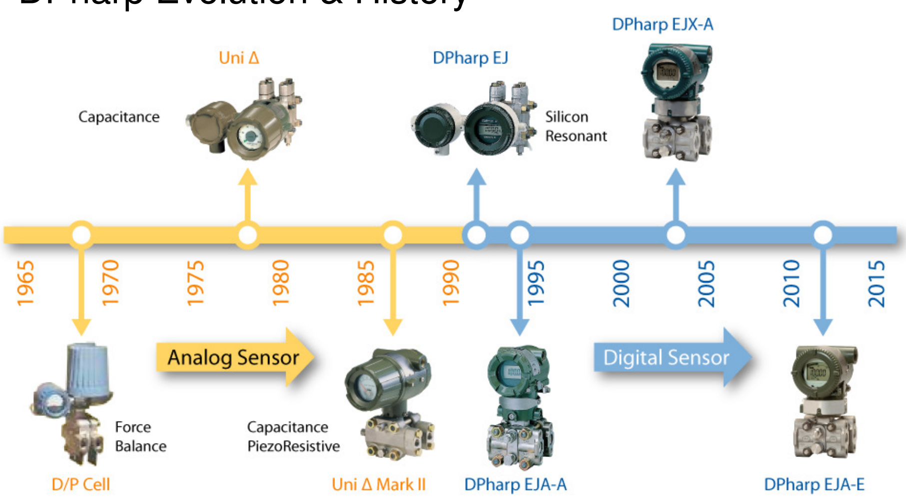
EJA-E

Multi-Variable
Pressure Transmitters
(only EJX)

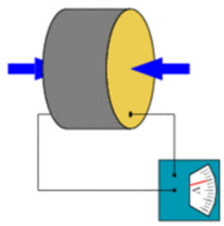
EJX Wireless

Dpharp Specification

DPharp Evolution & History



Piezo-element based transmitters



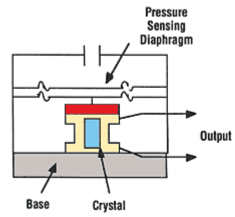
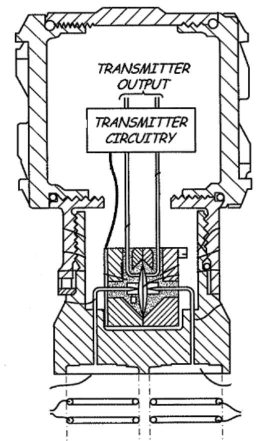
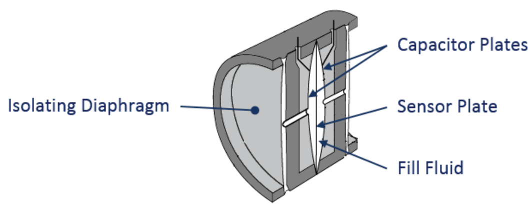


Figure 6. Piezoelectric Pressure Transducer [4]

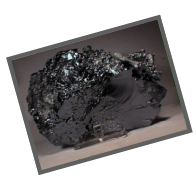




Single Crystal Materials

- Single crystal materials have the following generic properties;
  - Superior elasticity
  - High long term stability
  - Hysteresis free
- Therefore sensors based upon these materials are able to offer higher long term precision

Sapphire



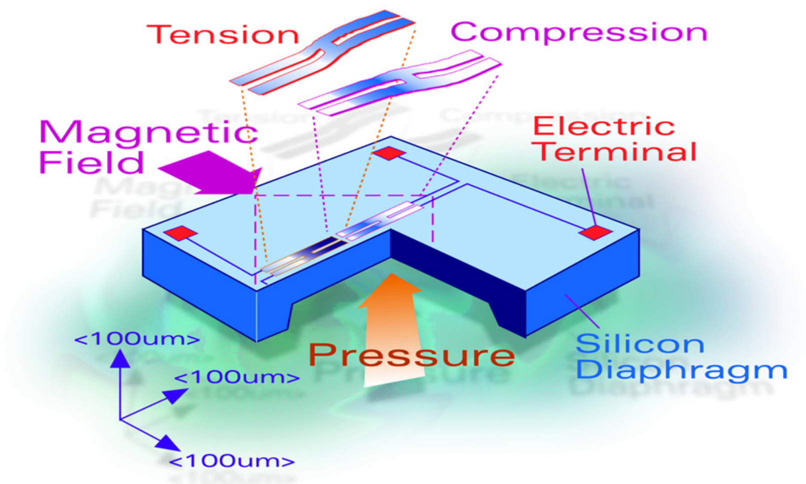
Silicon

Quartz

Ruby

Diamond

The Resonant Sensor



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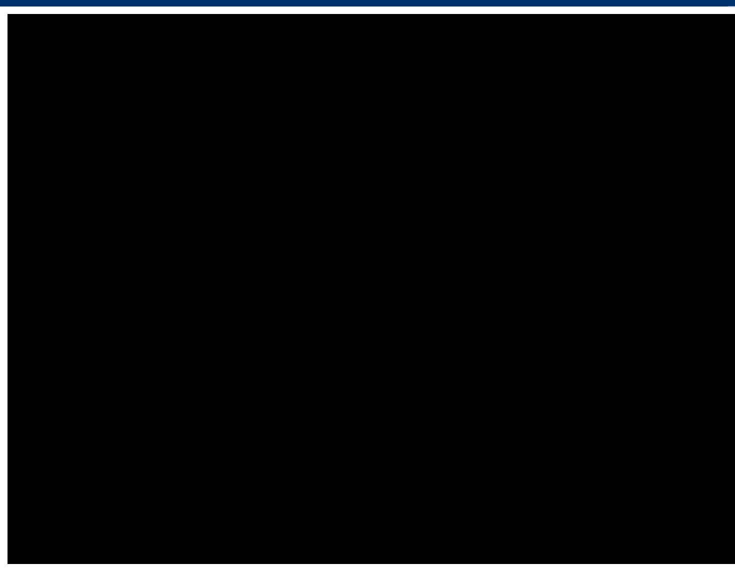
Working Principle of the Sensor



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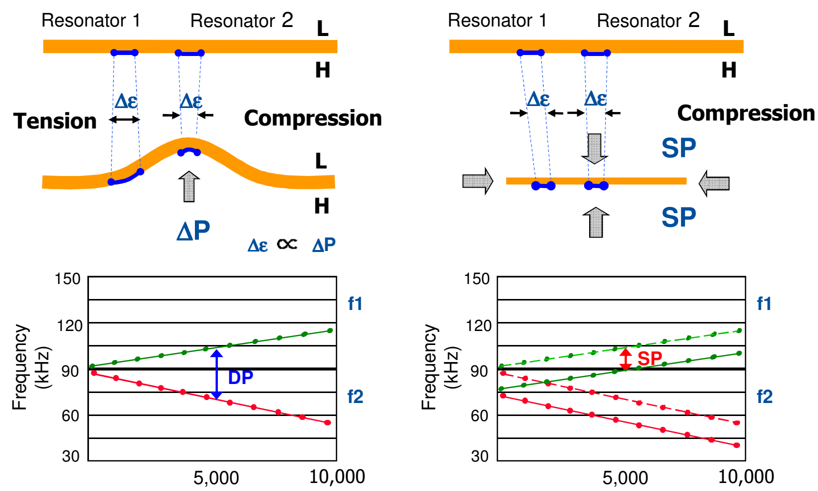
Dpharp Specifications

Multi-Sensing principal (DP/SP sensing)



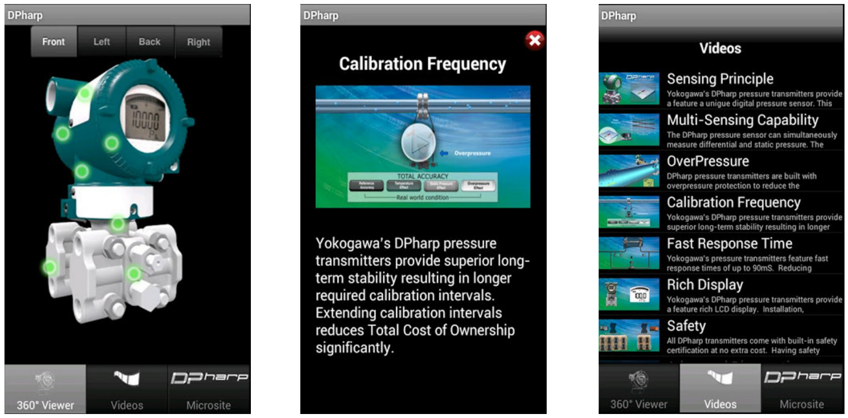
EJX & EJA

DPharp FOR THE DIGITAL WORLD

Differential Pressure and Pressure Transmitter

Performance	EJX-A	EJA-E
ACCURACY		
+/- 0.025%	●	
+/- 0.040%	●	●
+/- 0.055%		●
+/- 0.065%		
STABILITY		
+/- 0.1% of URL for 10 years	●	
+/- 0.1% of URL for 7 years		●
+/- 0.1% of URL for 5 years		
TURN DOWN		
200 : 1	●	
100 : 1		●

DPharp App



Available on the App Store

GET IT ON Google play

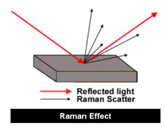
Distributed Temperature Sensor

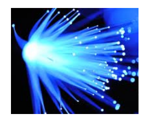
E. Visser

DTSX™ BY YOKOGAWA

Introduction DTS Technology

- The fiber optic Distributed Temperature Sensing (DTS) method using the **Raman-effect** has been developed at Southampton University in England, UK in the early 80's.
- The DTS method is based on **Optical Time-Domain Reflectometer (OTDR)** technology and uses a technique derived from telecommunication cable testing.
- The fiber optic-based DTS method measures temperature using **optical fiber** instead of thermocouples or thermistors
- DTS systems represent a **cost-effective method** for obtaining thousands of accurate, high-resolution temperature measurements.
- DTS technology offers a safe and **non-intrusive measurement** with has the capability to pinpoint the **precise location** of any warm or cold spot instantly.



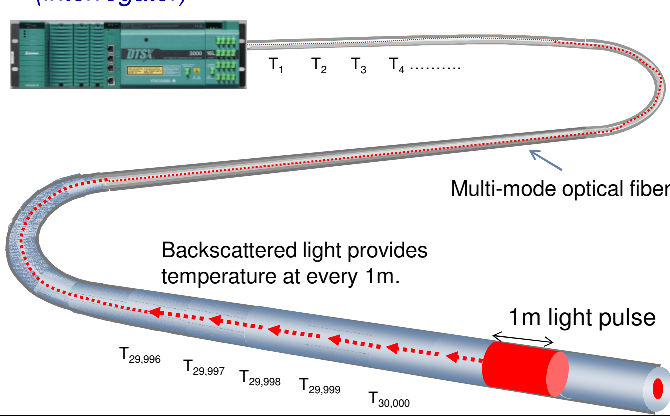


Distributed Temperature Sensor (DTS)

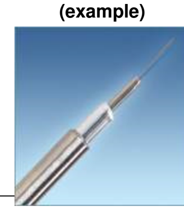
Optical Fiber is "Temperature Sensor"

Safe – No electronics – explosion proof & non-inductive
*Distributed Measurement: Every 1m average temperature measurement of **30km fiber = 30,000 sensors!***

DTS Instrument
(interrogator)



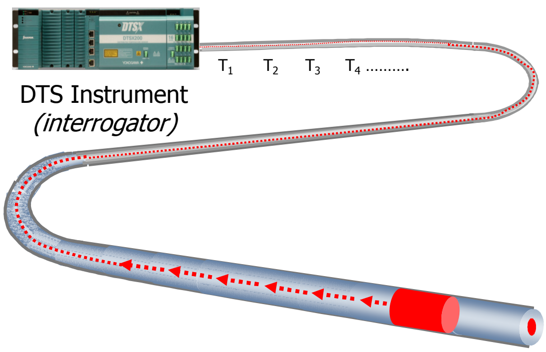
Specialty Optical Fiber Cable (example)



Distributed Temperature Sensor (DTS)

Principle
Measurement

- Distributed Measurement - 1m spatial resolution
- Measurement of 50 km
  - Optical fiber = 50,000 sensors!
- Backscattered light provides temperature at every 1m
- Standard multi-mode optical fiber



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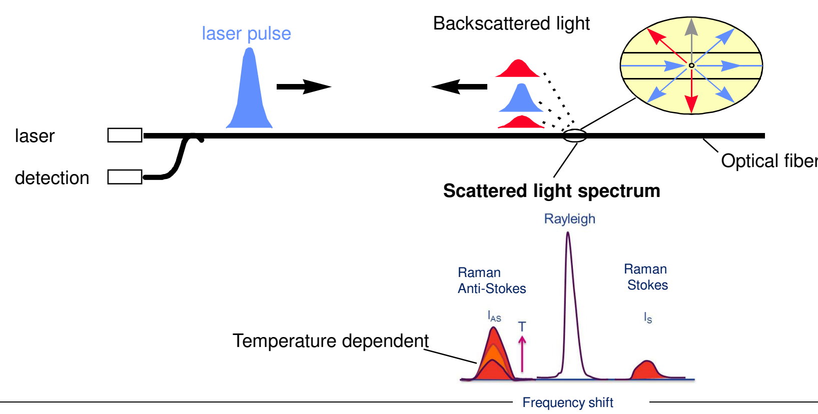
Distributed Temperature Sensor (DTS)

Principle
Spectrum

- Light is backscattered from natural anomalies within the fiber
- This happens at all points within the fiber
- Range gating allows specific sections along the fiber's length to be examined



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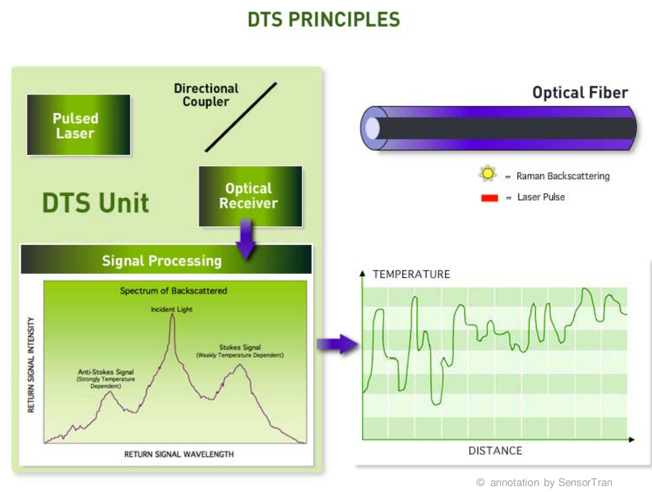
DTS Measurement Principle

Principle

Spectrum



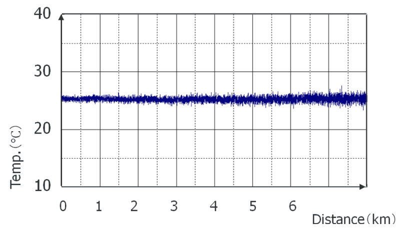
Main Specification

Item		Specification	
		DTSX200(Mid-Range)	DTSX3000(Long Range)
Performance	Distance range	6km	10, 16, 20, 30, **50Km**
	Temperature resolution (1 Sigma)	0.2 ºC (3 km , 10 min) 0.6 ºC (3 km , 1 min) 1.1 ºC (3 km , 10 sec)	0.03℃ (10Km , 10min) 0.06℃ (16Km , 10min) 0.20℃ (30Km , 10min)
	Spatial resolution	1m	1～2m
	Optical switch	2ch, 4ch, 16ch (Option)	
Measurement temperature range		**-200 ～ +500 ºC** (depends on the optical sensor cable specification)	
Operation ambient	Ambient temperature	-40 ～ + 65ºC	
	Ambient humidity	20 – 80% RH (no condensation)	
Network interface	LAN	Modbus/TCP HTTP(S) PUT/GET (Secured Protocols) SFTP/SCP (Secured Protocols)	
Power consumption		10W (Operating) 2W (Power saving)	16W (Operating) 2.W (Power saving)

Temperature Resolution

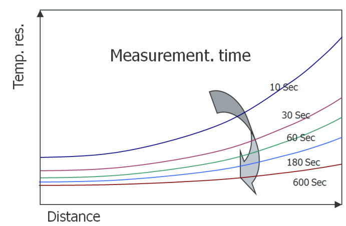
Resolution

Distance



Longer the Fiber Length

Less accurate temperature measurement



Longer the Measurement time

More accurate temperature measurement

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DTSX Applications

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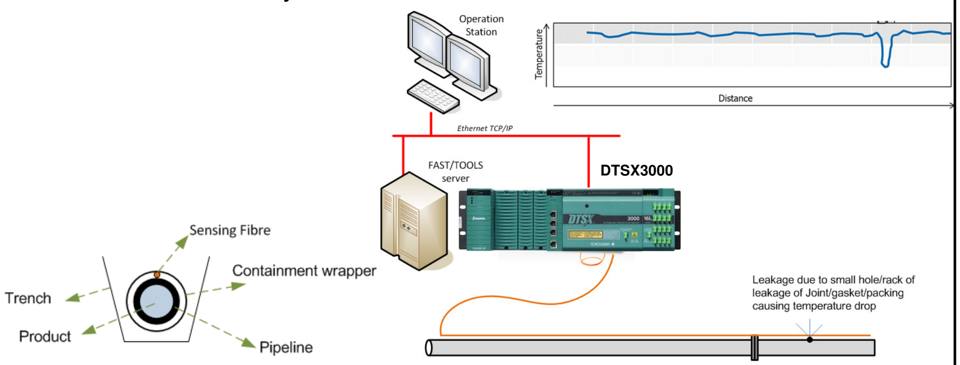
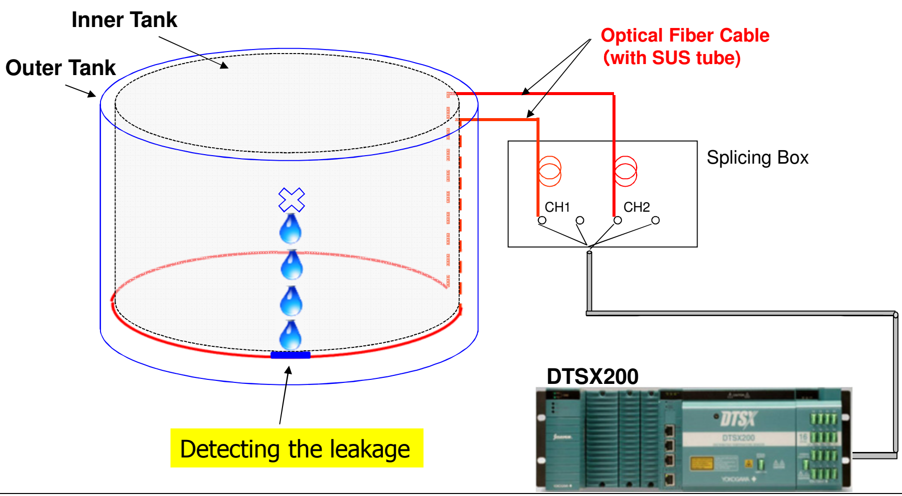
Applications: Pipeline Leak Detection

- Quick detection of small leakage events and monitoring of the pipeline temperature profile.
- Pipelines such as LNG, LPG, ammonia, ethylene create cold zones which can be easily detected when leaks occur.



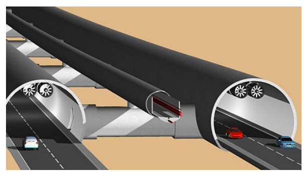
LNG Tank lead detection

DTSX can identify small leakage



Applications: Downstream and Others

- Refinery and Plants
  - Vessel “Hot Spot”
  - Tank & Pipeline Leak Detection
- Fire Detection
  - Industrial Facilities
  - Tunnels
  - Structures & Buildings



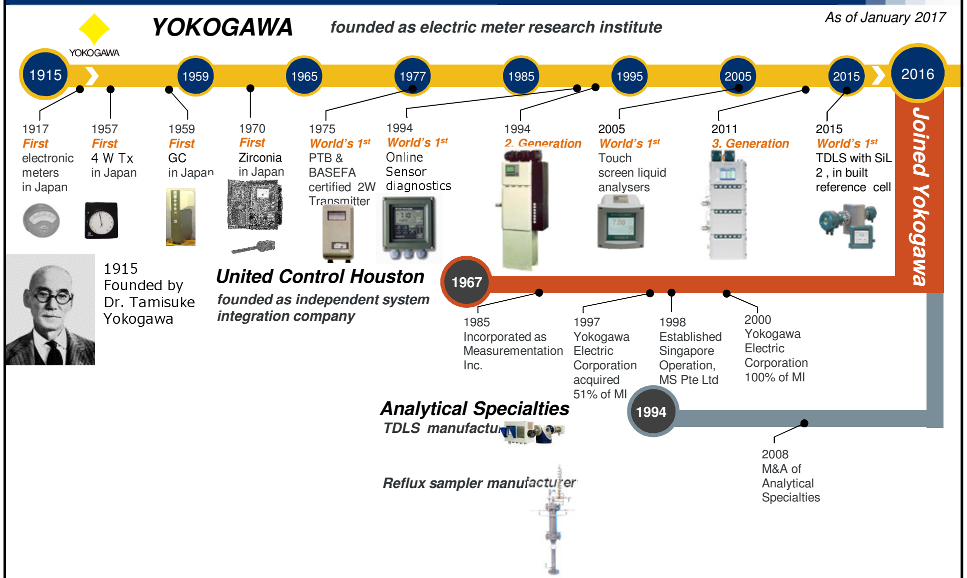
Process Analyzers

from a engineering perspective

Loek van Eijck
Analyzer Center Europe

November 2017

Yokogawa Analytical History



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Process Analyzers Solutions

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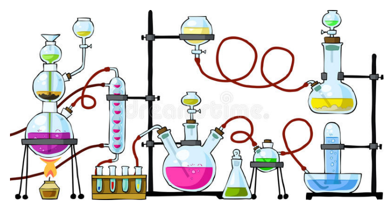
Analyzer Solutions

- Why do we need process analyzers?

Each plant has a laboratory for measuring chemical components and/or physical properties

So, WHY?

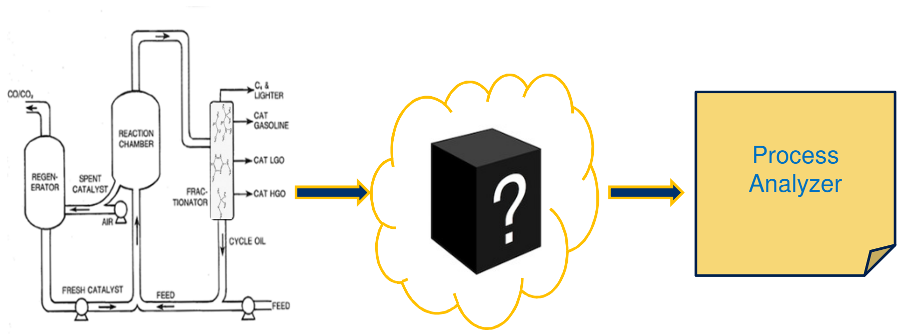
- *Fast results*
- *No human interference*
- *No influence on sample composition*



Analyzer solutions contribute to the plant performance

- **Process Analyzers contribute to:**
  - **Product Quality**
  - **Throughput / Yields Optimization**
    - Debottlenecking of the plant unit
    - Increase yield of product (control of chemical reaction)
  - **Plant Safety**
    - Prevention of explosions
    - Health safety aspects

System Integration solution



80 % of Analyzer System problems are caused by a wrong design of the

Sample Conditioning System

Engineering Important aspect!

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Engineering

- To implement a process analyzer require engineering
  - Site Survey/Feasibility study
  - Front End Engineering design
  - Project management & Detailed engineering
  - In-house fabrication and assembly
  - In-house Testing & FAT (acceptance test)
  - Start-up/Commissioning
  - Maintenance support

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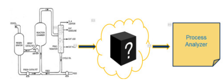
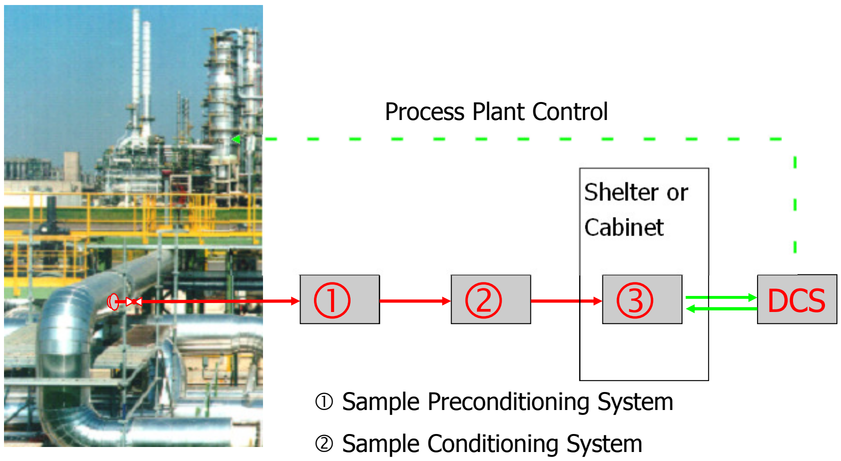
Overview

Process Analyzer System Flowchart





① Sample Preconditioning System
② Sample Conditioning System
③ Analyzer

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Deliverables Yokogawa Analyzer Solutions *examples*

- Analyzer Cabinet's/Houses
- Samples Systems
- Analyzer panels






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Process Gas Chromatograph
example

Process Gas Chromatograph (GC)

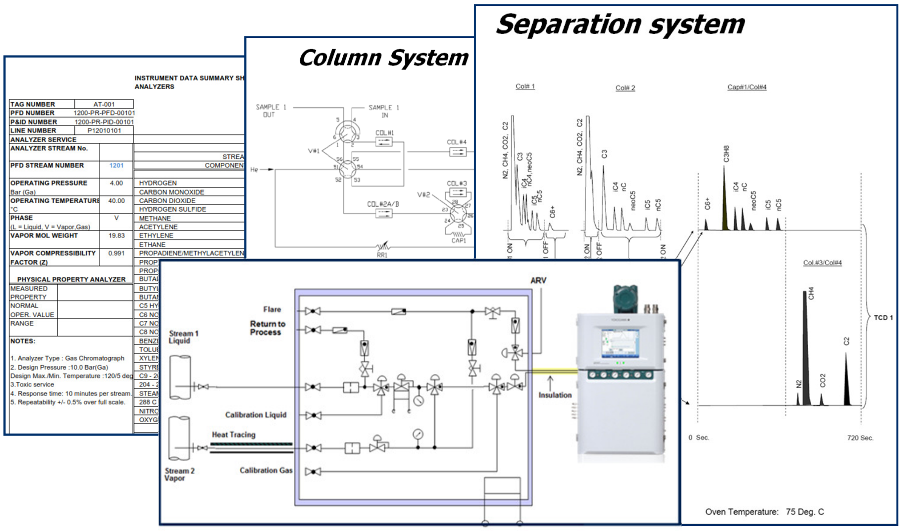
Process GC

- Most versatile multi-component analyzer
- **GC application** engineer start with process datasheet
  - GC chemist develop separation concept followed by GC hardware configuration
- **System Integration** engineer
  - Detail engineering how to handle the process stream to provide a representative sample.

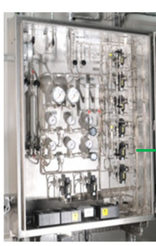
    From process to analyzer

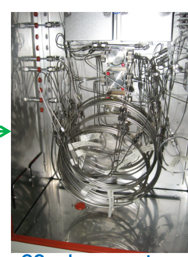
GC8000

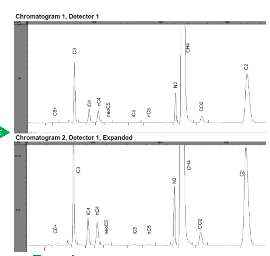
Engineering details



Engineering result







Sample Conditioning System

Process Gas Chromatograph

GC columns system

Result: Chromatogram

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Questions?