CONTEL

טכנולוגיות ניטור גזים בארובות תחנות כח ותחנות הפחתת גז טבעי

יובל אייל, מנהל מחלקת מכשור אנליטי-
קונטאל אוטומציה ובקרה בע"מ

קבוצת קונטאל טכנולוגיות

- חברה פרטית נוסדה ב-1964
- מטה החברה בפתח תקווה עם פריסה גאוגרפית ב- 5 מיקומים שונים ברחבי הארץ למכירות , הנדסה ושירות סניף ראשי בקרית אריה פתח תקווה וסניפים ביוקנעם , בר לב , עומר וראשון לציון .
- מרבית העיסוק הינו במערכות בקרה, סייבר , ניטור גזים , ברזי בקרה ,לוחות חשמל , התקנות מכשור וחשמל וכיולים , מיזוג אוויר ,VISION , רובוטיקה ועוד .
- 300+ עובדים מתוכם מעל 120 מהנדסים

CONTEL
BEYOND PERFORMANCE

CONTEL

The department contain 22 technicians , project managers , sales and back office

Main office in Petach Tikva and service offices in Haifa & Beer Sheva that serve 24/7

Hold Stock of spare parts for immediate support for customers

Business Partners- Analytical

- ABB Analytical –gas analyzers
- Neo Monitors –gas analyzers
- Durag – dust and flow
- Ados GmbH
- Compur Monitors –Fix gas detectors
- GFG – portable gas detectors
- CALGAS& EFFECTECH –calibration gases
- And many others…

CONTEL
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ABB Analytical Measurement

Global product portfolio and production sites

Germany

Continuous Gas Analyzers

Advanced Solutions

Canada

FTIR/NIR Spectrometers

USA

Gas Chroma-tographs

Multiwave Photometers

USA

Cavity Enhanced TDL Analyzer

CN, IN, SG, PL …

System Integration

UK

Oxygen Analyzer

Waste & Waste Water Analyzer

CONTEL BEYOND PERFORMANCE

DURAG GROUP ABB

Scope of Work-Control & Cyber

- Monitoring and management of all sub-systems within the plant
- Emergency Shut Down - Turbine trip functionality in the event of a fault or abnormal condition- based on AAdvance
- Balance of Plant based on Rockwell Automation PlantPAx process control system
- The system operates in a redundant architecture
- Communication between the central control system and all sub-systems based on RA industrial communication solution.
- Complete Cyber Security with all subsystem and auxiliary systems

מובילות הנדסית בבקרת לחץ וזרימה למערכות גז טבעי

דיוק מקסימלי ,חיסכון אנרגטי קריטי הדור הבא של מערכות הוויסות התעשייתיות

סדרת פתרונות בקרת הלחץ והזרימה המתקדמת מציעה מענה הנדסי חסר פשרות לשמירה מדויקת ואמינה על יציבות

Accurate and reliable measurement solutions
Serving your power plant operation

e for a thermal or combined cycle power plant?

Measurement & Analytics provides solutions for:

- **Boiler chemistry optimization**
- **Combustion efficiency**
- **Calorific value of incoming natural gas**
- **SCR DeNOx ammonia slip measurement**
- **Flue Gas Desulphurization (FGD)** **(only coal)**
- **Continuous emission monitoring systems (CEMS)**

Measurement & Analytics solutions specific to plant type:

- **Coal fired power plant**
- **Gas fired power plant**

ulatory compliance:

- **EN 14181**

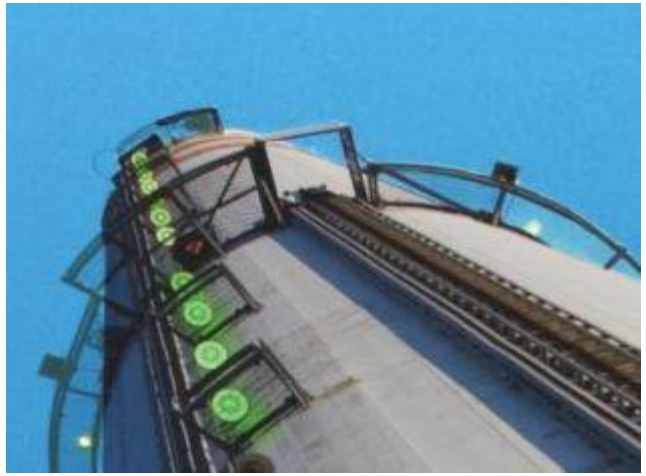
Controlling boiler chemistry for maximum steam quality
Offering the solution to your challenging application

The challenge - Monitoring and controlling multiple chemicals for maximum boiler and turbine protection

The solution - To measure multiple chemical parameters on-line:

- ABB pH analyzers monitor feed water acidity or alkalinity, while conductivity analyzers measure ionic content
- Monitoring and lowering the silica content in water can leader to longer turbine life and greater efficiencies.
- ABB's Navigator 600 Silica accurately monitors 0 to 5000ppb concentrations and substantially cuts costs and maintenance from silica monitoring

Deriving combustion efficiency by monitoring flue gas
Offering the solution to your challenging application



The challenge - finding the right air to fuel ratio for efficient combustion

The easy-to-install insitu solution - measuring flue gas oxygen with ABB's **AZ20 combustion gas oxygen analyzers**:

- Probe is inserted into a flue and accurately measures combustion gas oxygen content
- Applications from -4 to 1472°F

The high temperature hot gas solution - constant samples of flue gas oxygen and combustibles with ABB's AZ40 smart analyzer:

- Applications up to 3000ºF
- High accuracy and high performance

The fast response laser based solution – profile complete boiler outlet duct with ABB's **LS4000 tunable diode laser analyzers**:

- Response time usually within 2 seconds
- Applications up to 2732ºF

Measuring calorific values of fuel gas
Offering the solution to your challenging application

The challenge - Calculating the calorific value of a natural gas sample requires gas composition information

The solution - ABB's **PGC1000 field mounted gas chromatograph** analyzes natural gas composition in combined cycle power plants

- Gas sample data is used to inform other devices in the combustion process
- Achieves optimum combustion conditions

FLEXIBILITY

APPLICATION FLEXIBILITY
INDUSTRIAL / COMMERCIAL
PIPELINE TIE-INS
ENERGY PLANTS
LANDFILL
CITY GATES
HIGH-END SAMPLERS
GAS DISTRIBUTION
INTEGRAL FLOW-ENERGY
C6+
C7+
C9+
O_2 / N_2
H_2S%

CONTEL
BEYOND PERFORMANCE

ABB

SIMPLICITY

SERVICEABILITY
COMPLETE UNIT CONSISTS OF ONLY
3 REPLACEABLE MODULES

SELF DIAGNOSTICS THAT
GENERATE LOG FILES

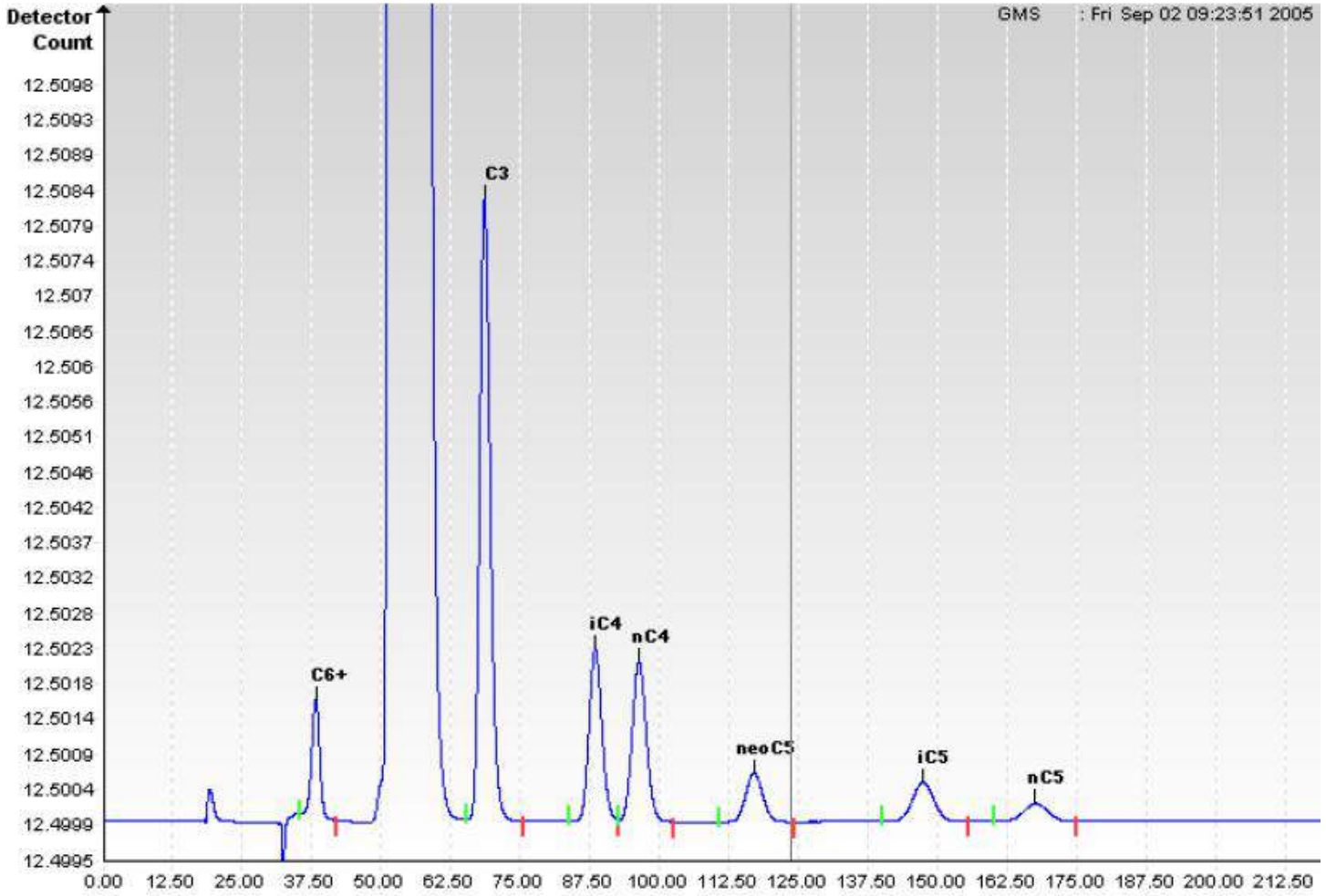
REMOTE OPERATION:
OFFSITE MAITENANCE
BY FACTORY EXPERTS

**THE CORE ANALYTICAL
COMPONENTS ARE ON A
SINGLE, EASY TO INSTALL MODULE**

CONTEL
BEYOND PERFORMANCE

ABB

PRECISION



CONTEL
BEYOND PERFORMANCE

ABB

PRECISION

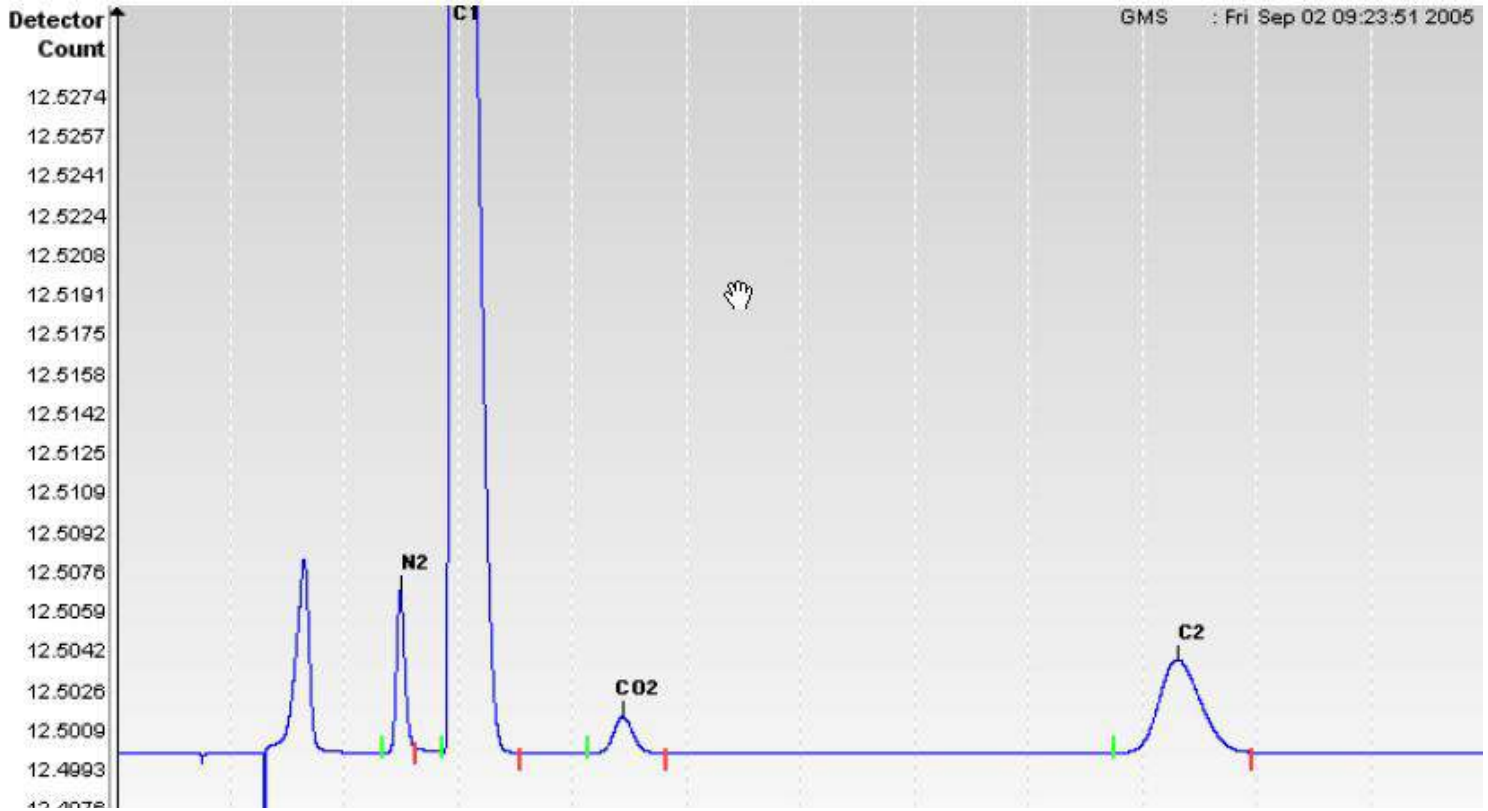


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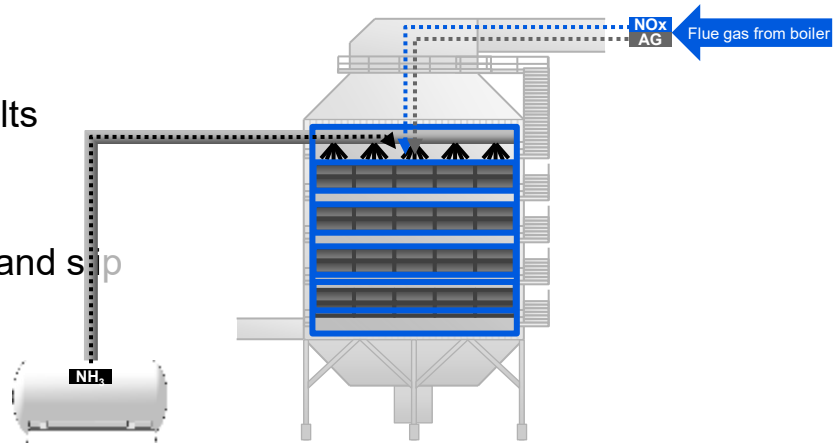
ABB

SCR DeNOx ammonia-slip measurement
Offering the solution to your challenging application

The challenges

- Prevent formation of ammonia salts
- Prevent contamination of fly ash
- Minimize ammonia consumption and slip
- Optimize catalyst regeneration



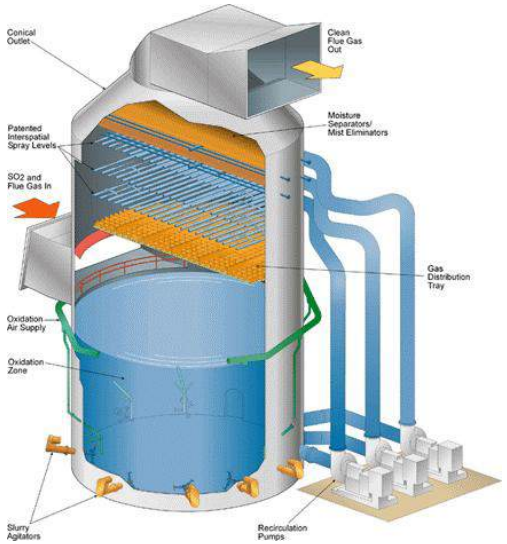
The solutions

- Simultaneous NO and NO_2 measurement using **Limas21/23 UV** analyzer
- NH_3-slip using in-situ **LS4000 tunable diode laser analyzers**
- **ACF5000 hot/wet extractive FTIR system** for multi-component measurements

Flue Gas Desulphurization (FGD)
Offering the solution to your challenging application

The challenges

- Minimize limestone usage (wet scrubber)
- Reduce active lime and calcium sulphite (DSI)
- Prevent contamination of fly ash
- Safe and economic handling of by-products



The solutions

- Extractive SO_2 measurement using **Uras26 IR** or **Limas21/23 UV** analyzer
- Wet gas at low temperature (~60degC) requires heated probe Type 42

Reducing emissions through continuous monitoring
Offering the solution to your challenging application

The challenge - Reduce pollution from gaseous stack emissions

The solution - ABB CEMS gas analyzers provide continuous emissions monitoring and full compliance with EPA and state regulations

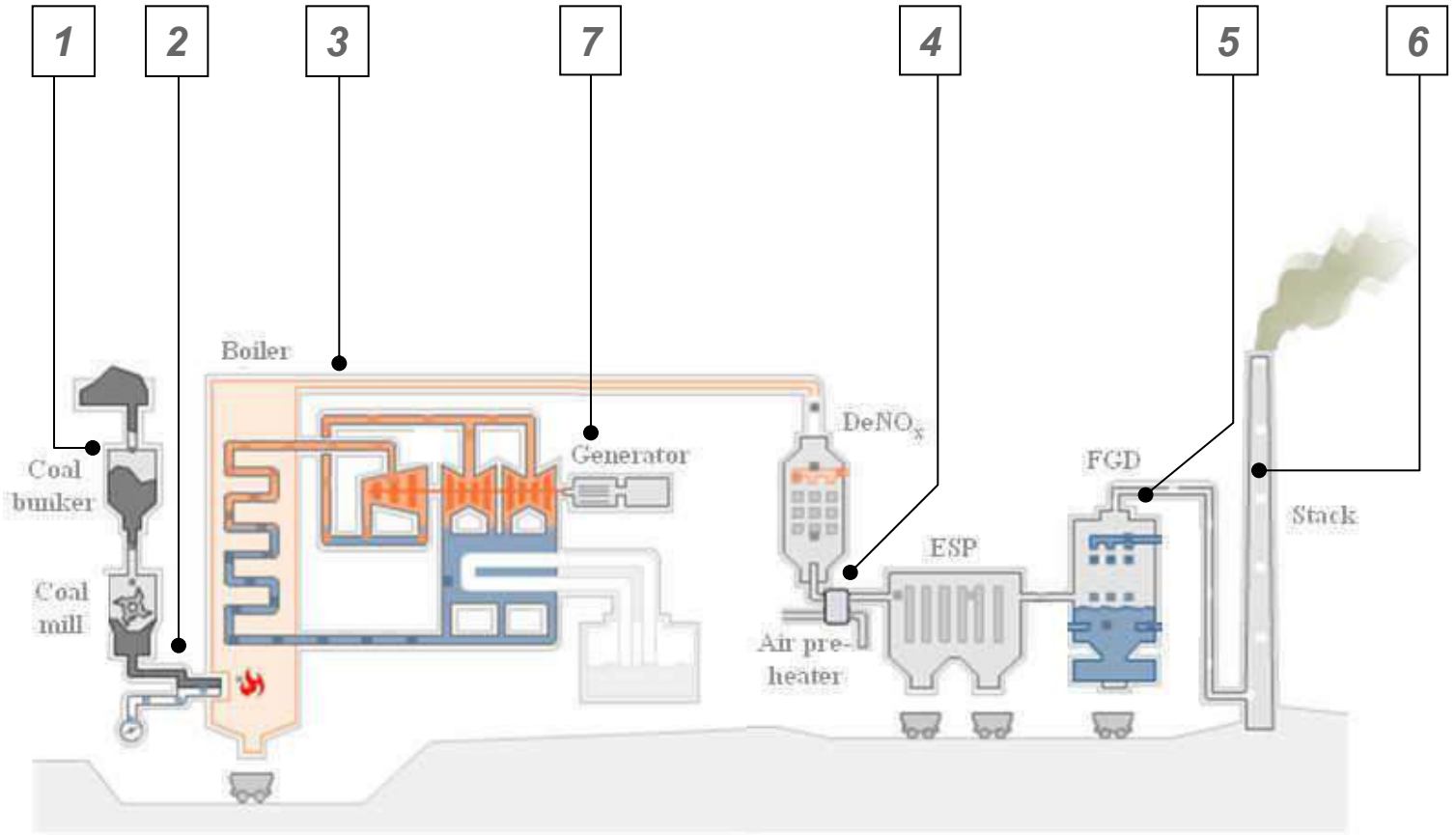
- **Advance Optima series** or **EasyLine series** with NDIR, NDUV and Paramagnetic analyzers measuring NO, NO_2, NOx, SO_2, CO, CO_2 and O_2
- **ACF5000 hot/wet extractive FTIR system** for multi-component monitoring of up to 15 components simultaneously incl. HCl and NH_3
- **StackFlowMaster** using differential pressure to measure flue gas flow rates
- Fully integrated **CEM-DAS** Data Acquisition & Handling System
- EPA compliant **Predictive Emission Monitoring System (PEMS)** to quantify emissions using process and historical data

The solution for your application - ABB CEMS gas analyzers are compatible with both full-extractive or dilution-extractive systems

- **Coal fired power plant - CEMS**
- **Gas fired power plant – CEMS**

CEMS Introduction

Coal fired power plant
Measuring points for gas analyzers



Coal fired power plant
Measuring points for gas analyzers

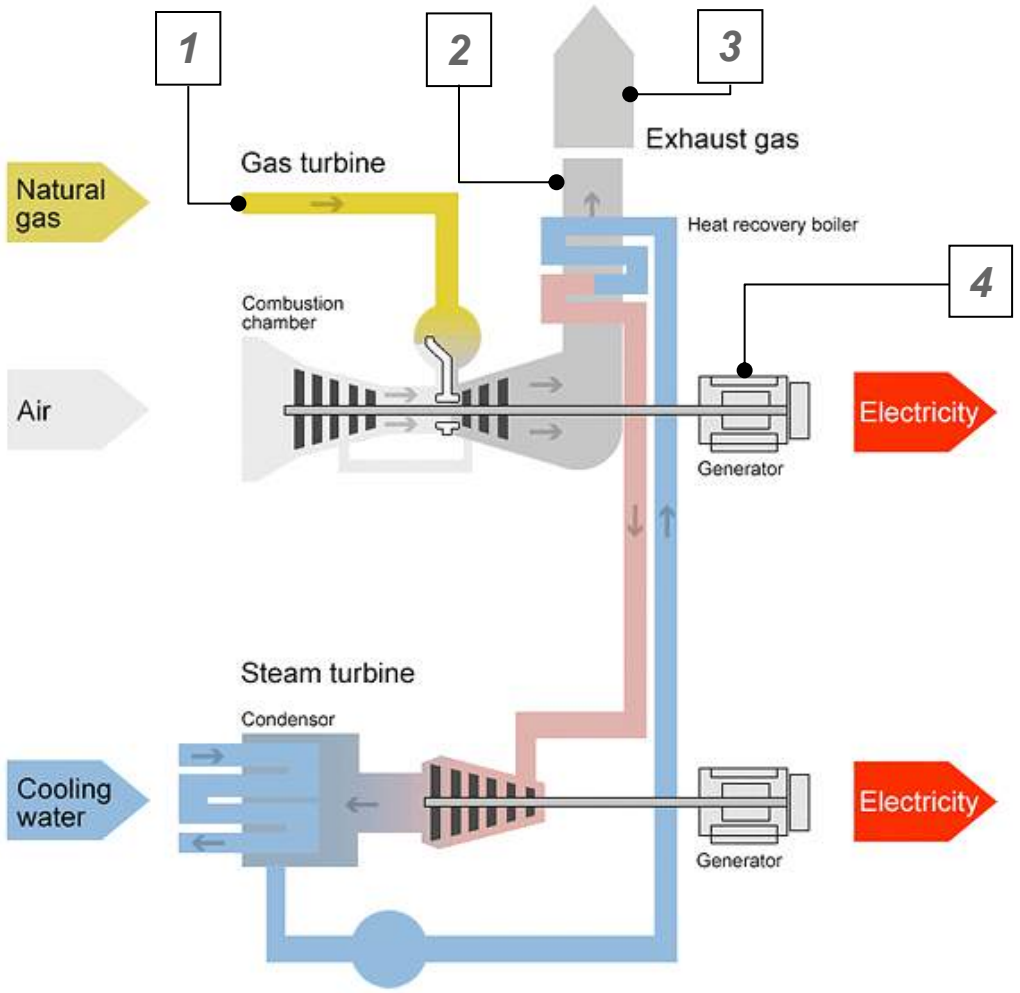
No.	Measuring Point	Measuring Task	Measuring Components	Solution	Measuring Principle
1	Coal bin	Smouldering fire and explosion protection	CO	Uras26	NDIR
2	After coal mill	Leakage monitoring	O_2	Magnos206	Paramagnetic
3	Boiler outlet	Combustion optimization	O_2, CO_e	AZ20 **AZ40** LS4000	Zirconia Zirconia TDL
4	After DeNOx	NOx control (NH_3-slip)	NH_3	LS4000	TDL
5	DeSOx	SOx control (pre-FGD SO_2)	SO_2	Uras26 Limas21/23	NDIR NDUV
6	Stack	Continuous emission monitoring	CO, NOx, SO_2 (HCl, NH_3, H_2O) CO_2 or O_2 diluent Flow	**See next 2 slides**	NDIR NDUV Paramagnetic FTIR Off-Axis ICOS dP
7	Turbogenerator	Leakage monitoring, inertization, filling	H_2 in air CO_2 in air H_2 in CO_2	Caldos27	TCD

* NH3 measurement due for release soon for LS4000

CONTEL
BEYOND PERFORMANCE

ABB

Combined cycle power plant
Measuring points for gas analyzers



Source: E.On

CONTEL
BEYOND PERFORMANCE

ABB

Combined cycle power plant
Measuring points for gas analyzers

No.	Measuring Point	Measuring Task	Measuring Components	Solution	Measuring Principle
1	Fuel gas analysis	Combustion optimization, calorific value, regulatory compliance	BTU Flow	**PGC1000** **FV/FS4000**	GC Vortex/Swirl
2	After DeNOx	DeNOx control (NH_3-slip)	NH_3	**Limas23** **LS4000**	Δ NO_x (NDUV) TDL
3	Stack	Continuous emission monitoring (or predictive emission monitoring)	CO NO_x O_2 (Flow) (or PEMS)	**Uras26** **Limas21/23** **Magnos206** **StackFlowMaster** **PEMS**	NDIR NDUV Paramagnetic dP PEMS
4	Turbogenerator	Leakage monitoring, inertization, filling	H_2 in air CO_2 in air H_2 in CO_2	**Caldos27**	TCD

CONTEL
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ABB

Gas fired power plant - CEMS
Full-Extractive

- Typical emission ranges:
  - CO 0 – 50 / 250 ppm **Uras26 NDIR**
  - NOx 0 – 50 / 250 ppm **Limas21/23 NDUV/URAS 26 NDIR**
  - O2 0 – 25 vol% **Magnos206 PMD**

מדידות גזים רציפות

מדידות גזים רציפות הנן מהמדידות החשובות ביותר בתעשייה.
נהוג לחלק מדידות אלו למס' קבוצות ומטרות עיקריות:

בקרת בעירה ,בקרת תהליך , הזרקת אמוניה במתקני DENOX

NH3,CO, O2, CO2

בטיחות והגנה מפני התפוצצות ועל הציוד

H2 , CO

הפחתת הפליטה של גזים רעילים ומזיקים

HCL, HF, SO2, NOX, CO חלקיקים ועוד.

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נתחיל בחידה

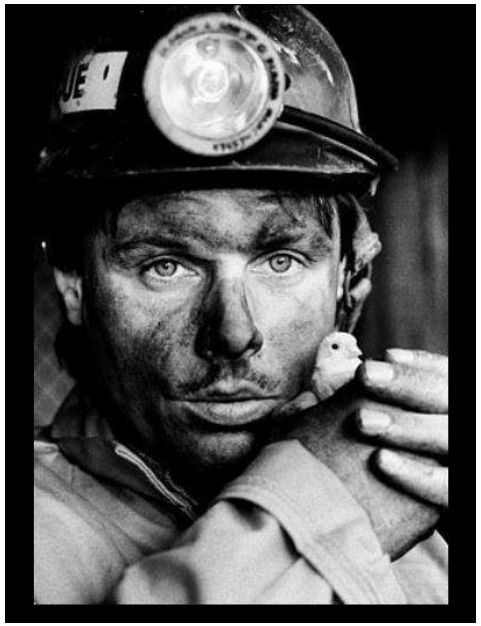
יוני 2017 – נוהל ניטור רציף בישראל גירסא 3

נוהל ניטור רציף ראשון בישראל –מתי נכתב ?

מרחיקים את הנבלות ואת הקברות ואת הבורסקי מן העיר חמישים אמה. אין עושין בורסקי, אלא למזרח העיר" (כדי שרוח מערבית תרחיק את הריח הרע מן העיר)
(משנה, בבא בתרא, פרק ב, משנה י **).**

אנלייזר ניטור הראשון – מיהו ?

- הקנרית שימשה כורי פחם על מנת להתריע על נוכחות גזים רעילים במכרות. אם הקנרית הייתה מגלה סימני מצוקה זו הייתה אינדיקציה לקיומם של גזים רעילים.



סוגי מכשירים

ישנם שני סוגים עיקריים של מכשירים:

מכשירים קבועים

משמשים למדידה רציפה.

במכשירים קבועים משתמשים בד"כ בתאי IR או UV

למדידת גזים כגון: CO, NOX, SO2 ואמוניה

בתאי צירקוניה או מגנטים למדידות O2.

FID למדידת HC

כרומטוגרפים, מכשירי לייזר, FTIR ומכשירים נוספים לאפליקציות "מיוחדות"

כגון הלוגנים ועוד

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סוגי מכשירים

ישנם שני סוגים עיקריים של מכשירים:

מכשירים ניידים

בד"כ מכשירים קלים ופשוטים הכוללים בעיקר תאים אלקטרו כימיים
, כמו גם סנסורים ל IR

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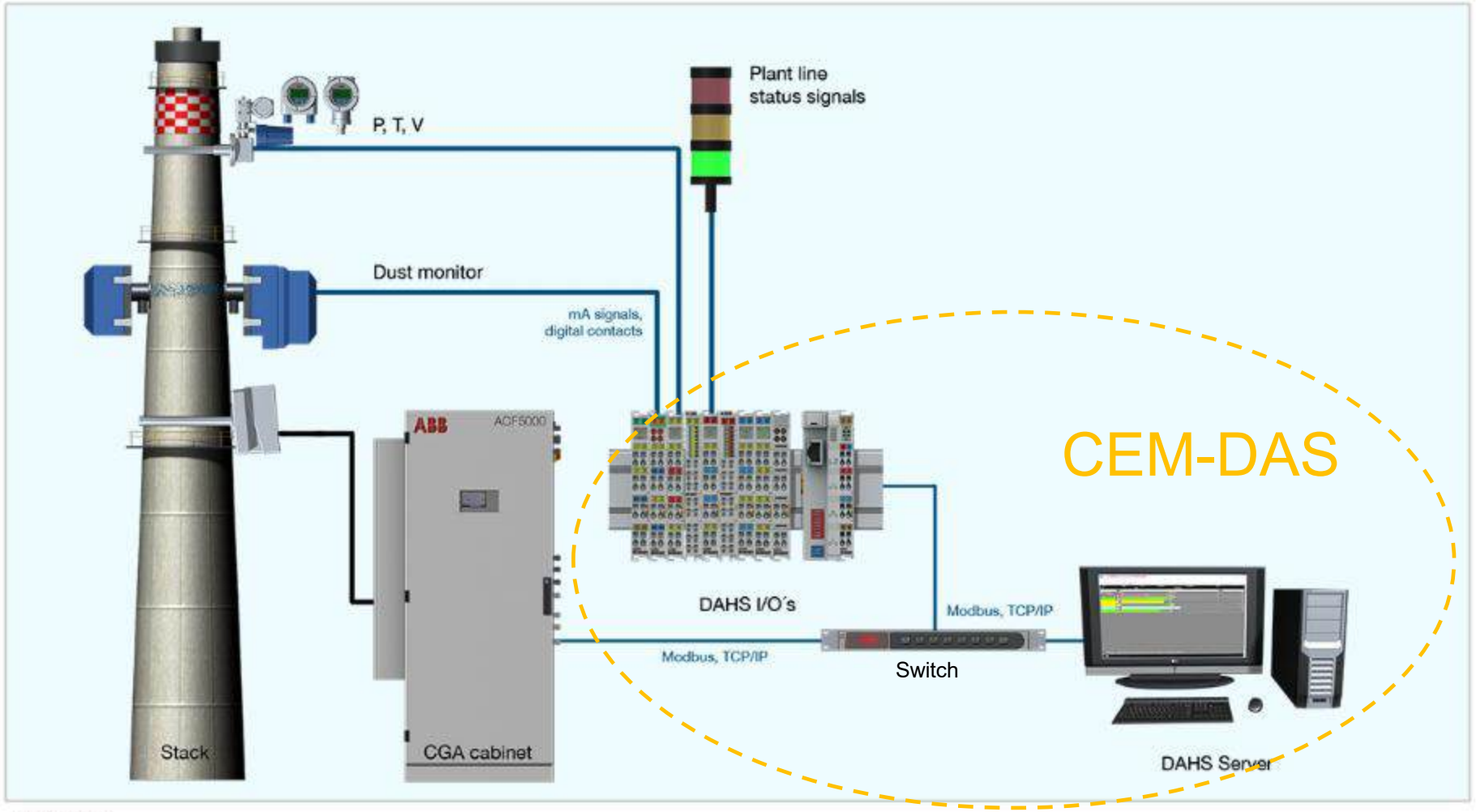
CEM-
Basic architecture



Field Level

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ABB Measurement & Analytics

CEMS Introduction
Advantages and disadvantages of different types of CEMS

CONTEL
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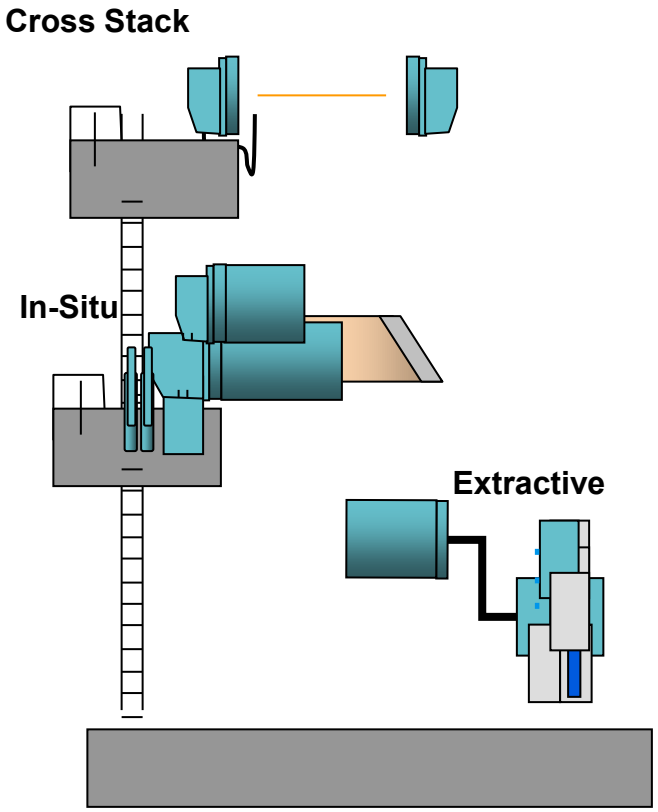
Power and productivity for a better world™
ABB

שיטות מדידה

ישנן שתי שיטות מדידה עיקריות:



IN SITU

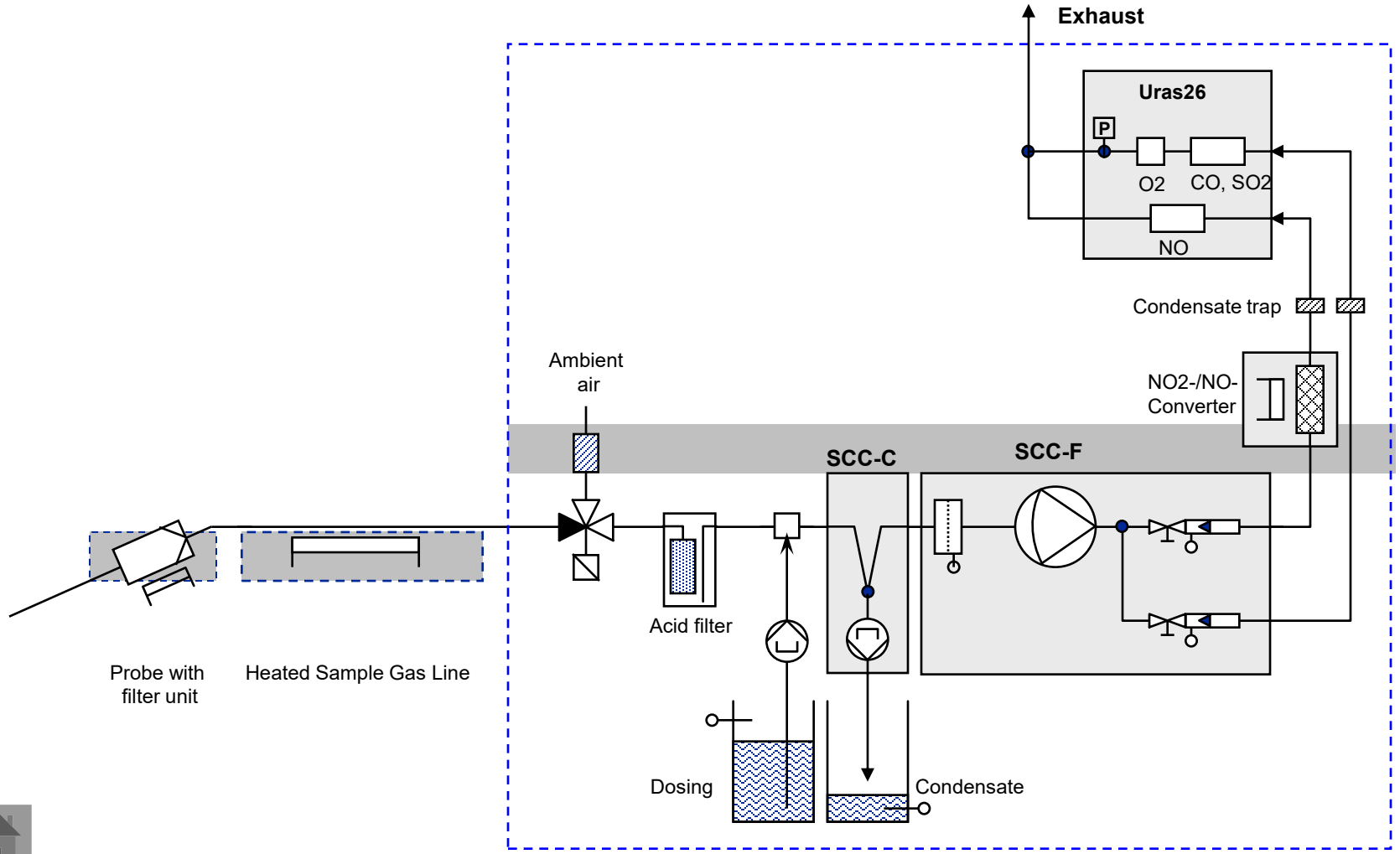
1. Point In Situ: בשיטה זו המשדר והמקלט נמצאים בגשש אחד בנקודת המדידה.
2. Cross Stack: בשיטה זו המשדר נמצא בצד אחד של הארובה והמקלט בצד שני.

EXTRACTIVE

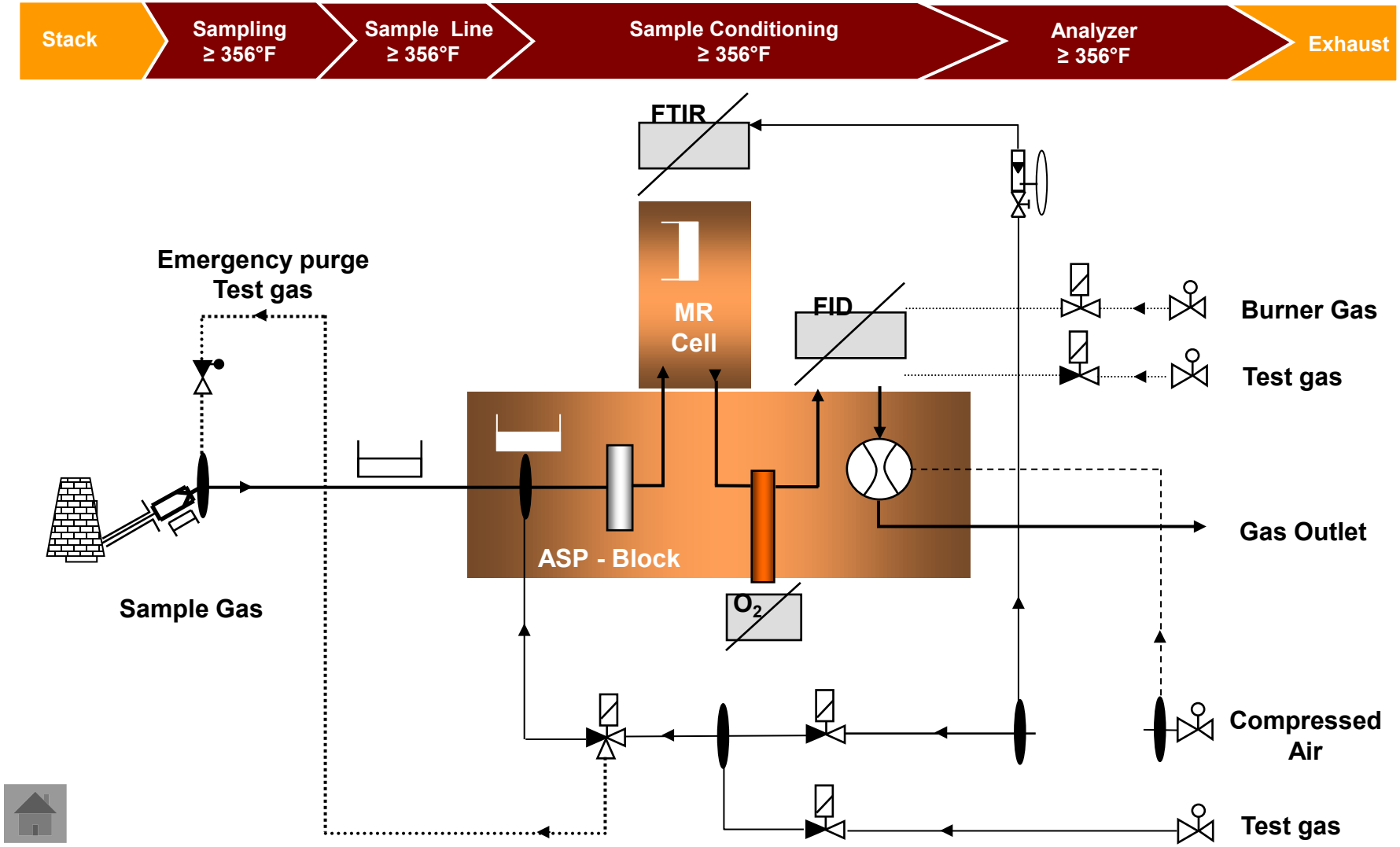
1. Cold Extractive: בשיטה זו הדגימה נשאבת מהארובה, מיובשת ומפולטרת והדגימה היבשה נכנסת לאנלייזר.
2. Hot Extractive: בשיטה זו הדגימה נשאבת מהארובה מפולטרת ונכנסת לאנלייזר חמה כפי שהיא בארובה. חשוב לגזים מסיסים כגון: HF, HCL, NH3.

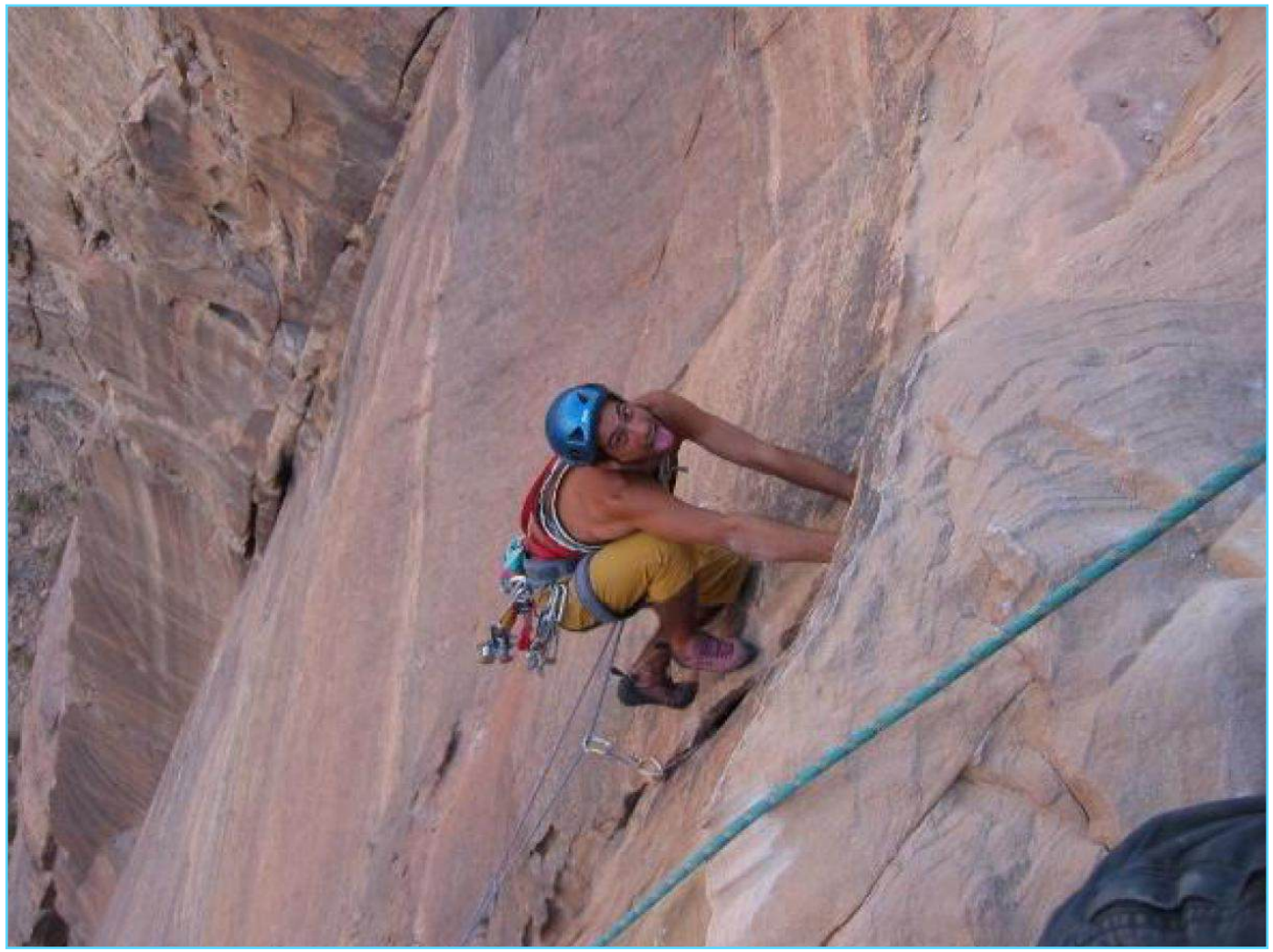
חשוב מאוד בשתי השיטות-נקודת דגימה מייצגת.

Cold/dry source level extractive – typical schematic
Sample cooled, H_2O removed



Hot/wet source level extractive – typical schematic
Sample temp. maintained above dewpoint



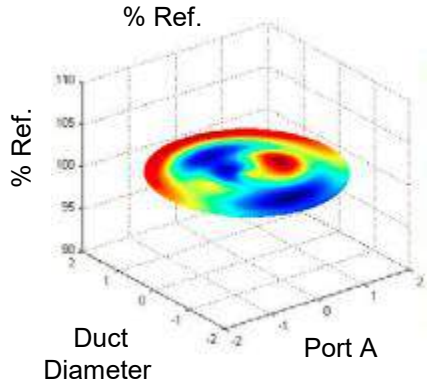


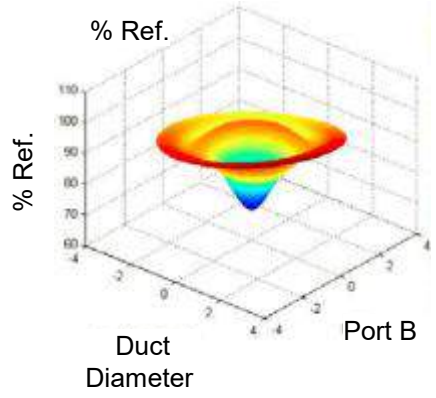
שיטת EXTRACTIVE- אין צורך לטפס לארובה –
הלוח נמצא בתחתית הארובה בלוח ממוזג או בחדר

CONTEL
BEYOND PERFORMANCE

ABB

DIN EN 15259
Criteria for Selection the Measurement Point

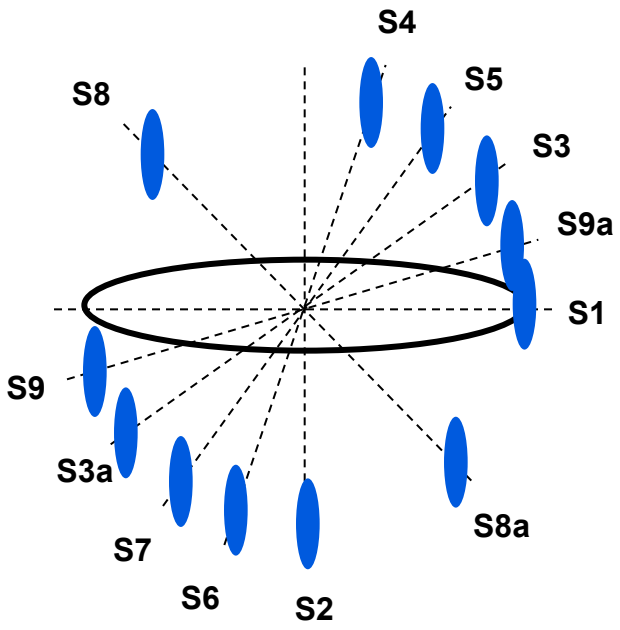




Homogeneity Test

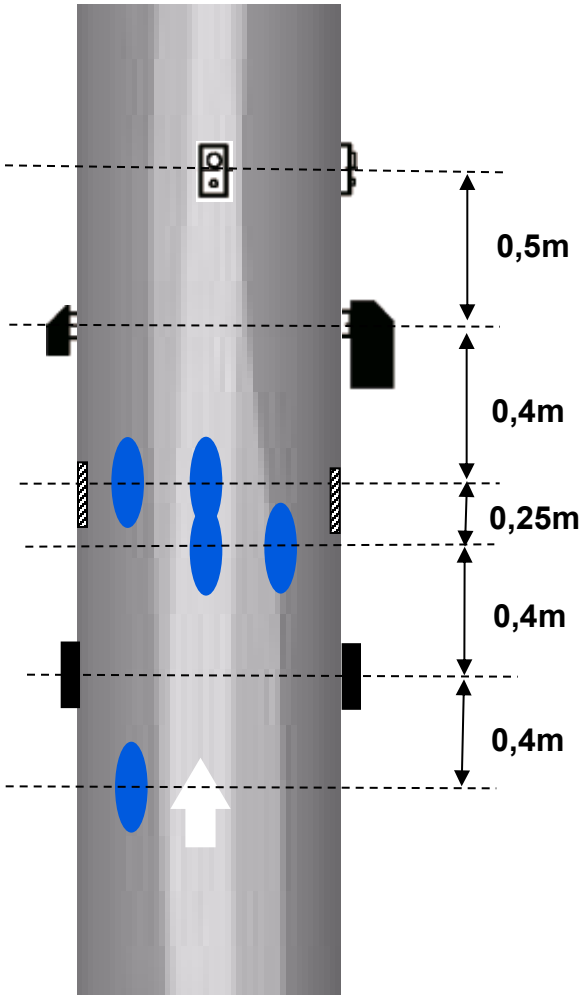
- Measurement sections shall allow representative samples
  - Homogenous flow conditions
  - Homogenous concentration profile
- Vertical sections are prefeered
- Located in a section of the duct with
  - 5 hydraulic diameters of straight duct upstream
  - 2 hydraulic diameters downstream
  - with a constant shape
- Provide
  - Suitable working platforms (Clearance Areas)

Mounting Locations of Measuring Systems
Within a Measurement Section at a Stack



S1…9 Measurement Ports
at 6 measurement planes

Top View



Reference Method (S1 / S2 / S5)

Dust (S3 / S3a)

AMS SO_2 / NO / O_2 / HCL / VOC
(S4 / S6)

Volume Flow (S8 / S8a)

Temperature / Pressure (S9 / S9a)

Front View

CONTEL
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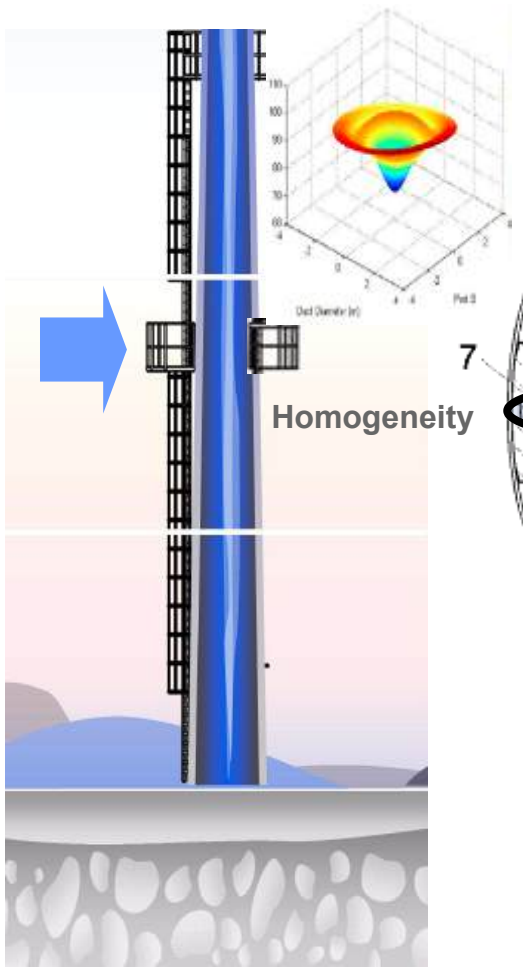
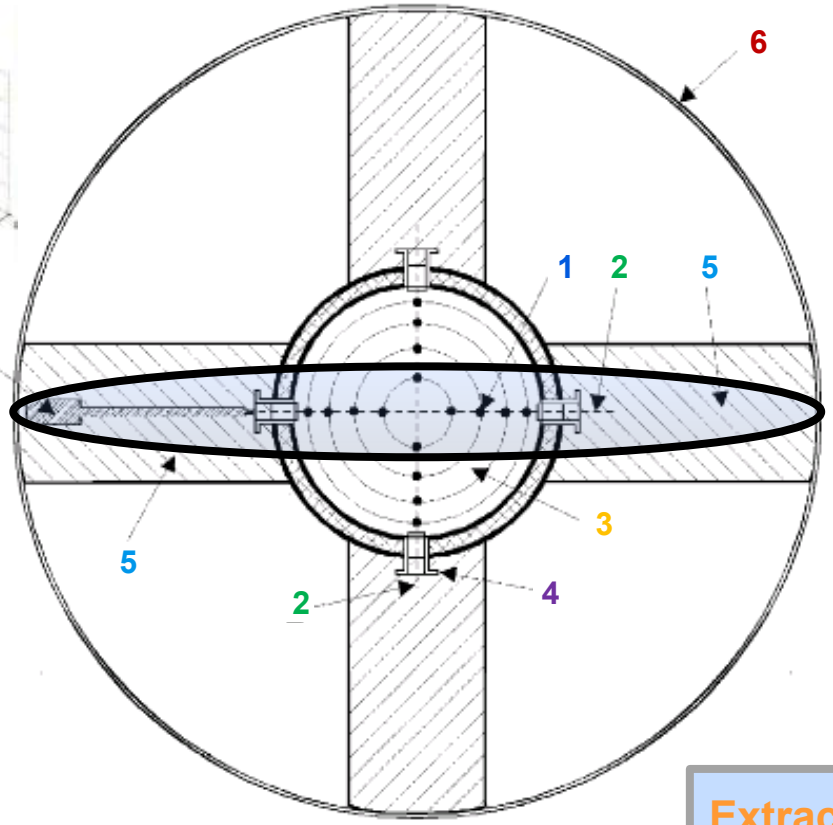
ABB

Illustration of Terms
Measurement Plane – Old - New Stacks Challanges





Top View

1. Measurement point
2. Measurement line
3. Measurement plane
4. Measurement port
5. Working platform
6. Measurement site
7. Manual sampling train

Extractive system - (2X Dia - ID)

Insitu system - (5X Dia - ID)

$$C_{Corrected} = C_{Raw\ value} \times \frac{21 - O_{2\ Reference}}{21 - O_{2\ measured}}$$

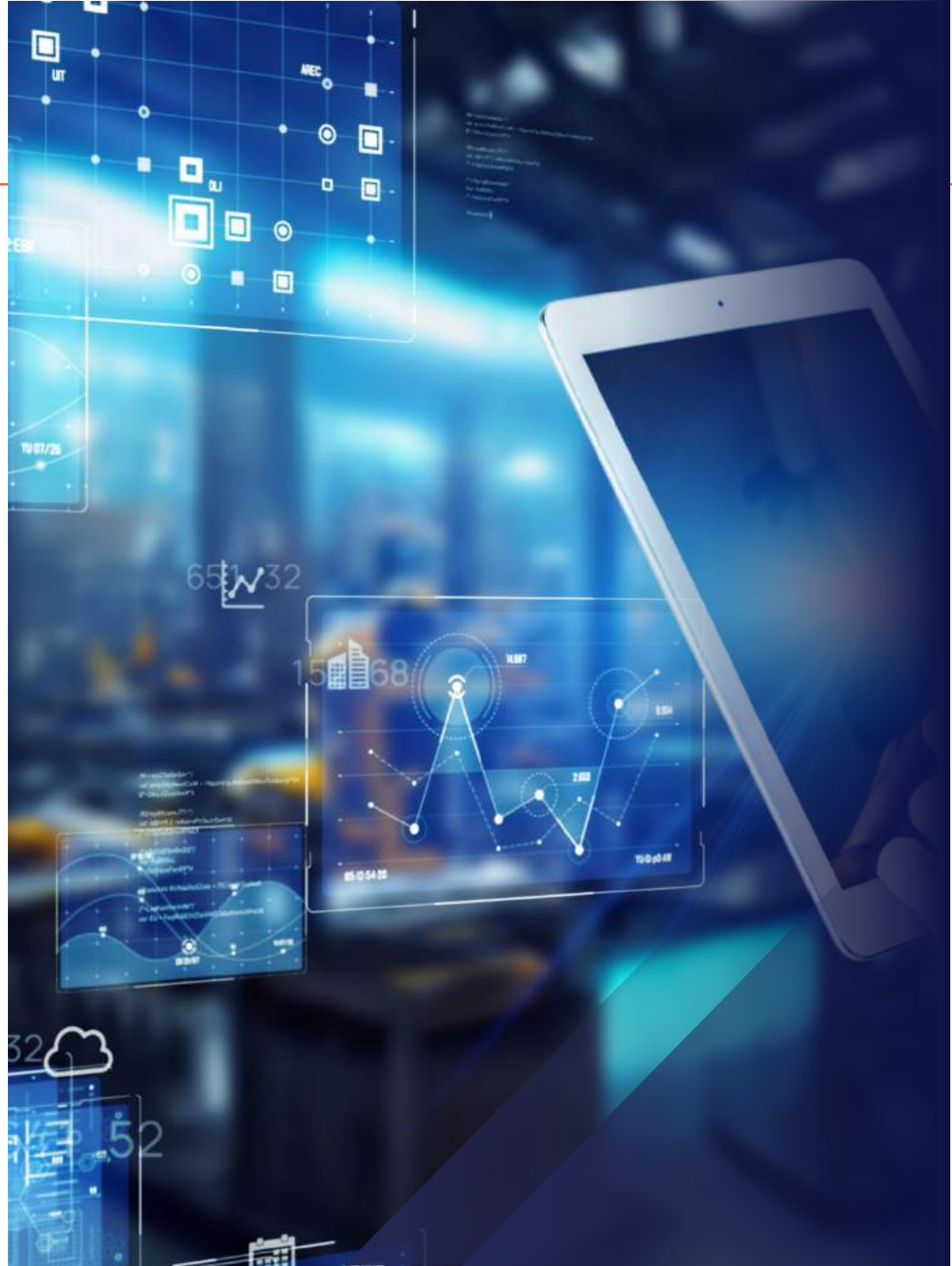
CONTEL BEYOND PERFORMANCE

ABB

תכנון מערכת הדגימה

אחד המרכיבים החשובים בהצלחת התקנה של מדידת ריכוזי גזים בתהליכים תעשייתיים הנה בתכנון מערכת הדגימה.

ישנן התקנות רבות אפשריות בכל מפעל וכדוגמא ניתן תחנת כח אשר בה מגוון ההתקנות רב, הן לצורכי בקרת תהליך, בטיחות, איכות הסביבה ועוד.



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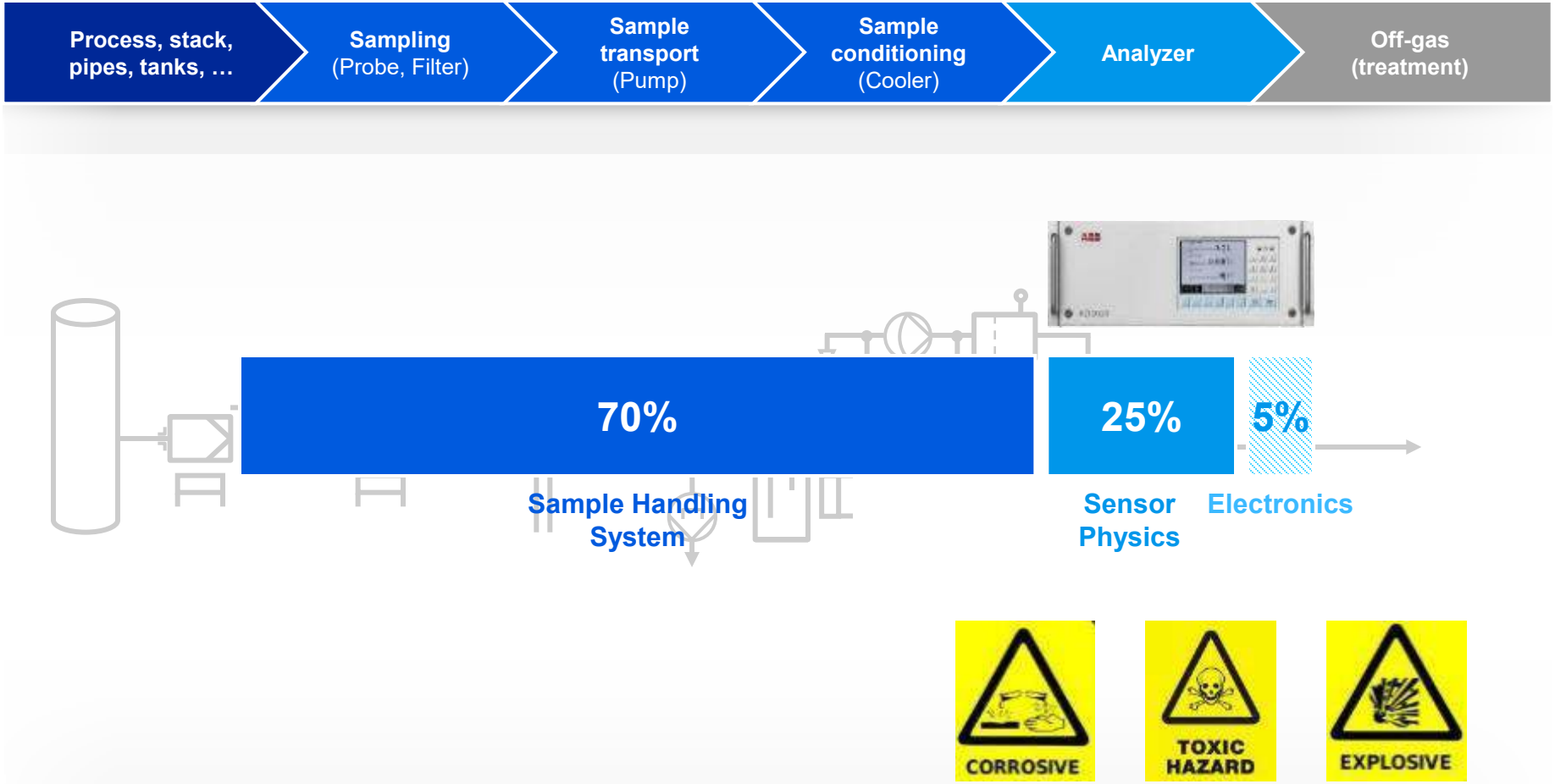
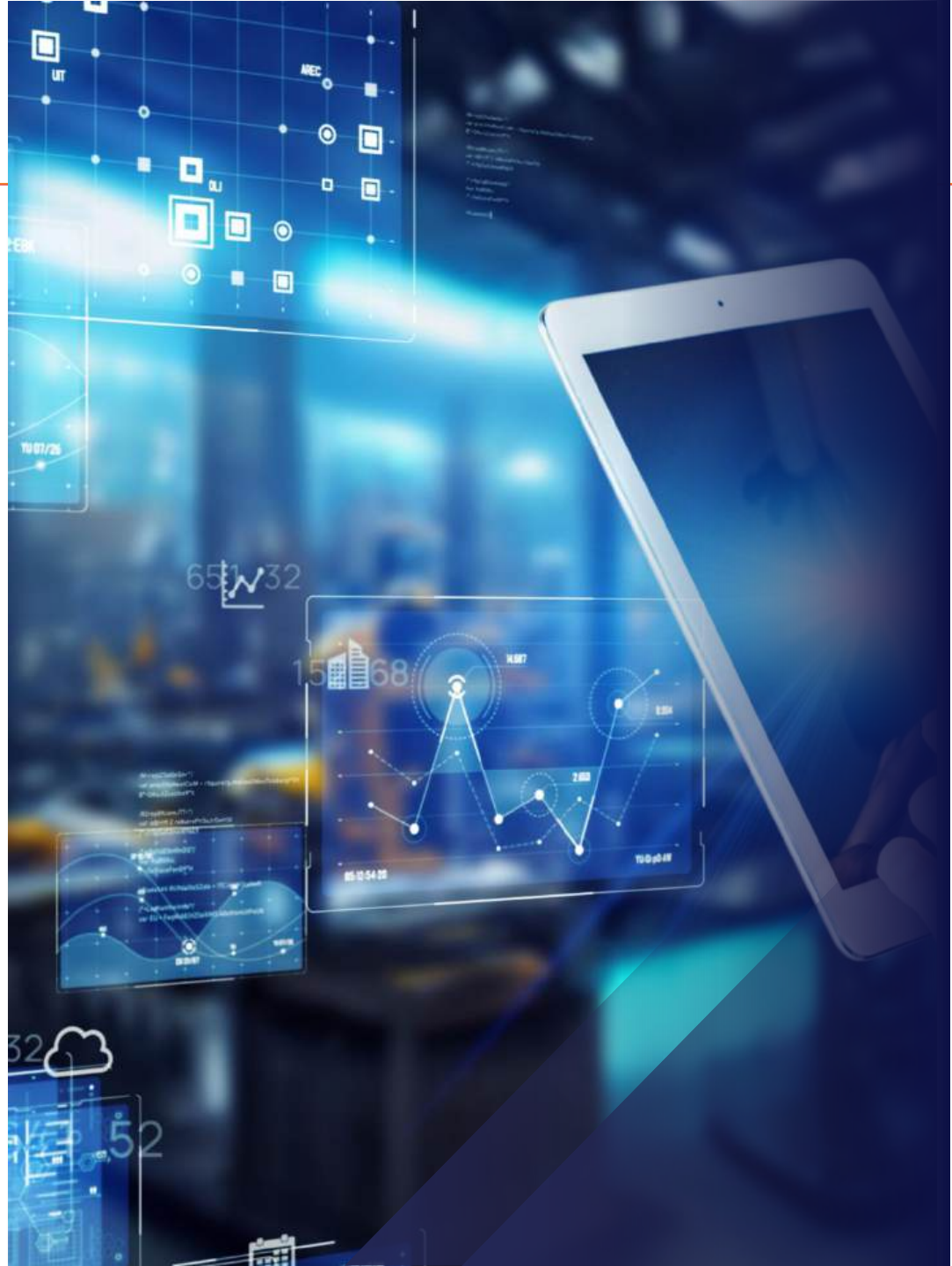
Importance of sample gas conditioning
Challenges with gas analysis systems



פרמטרים לבדיקה

בשתי השיטות בכדי לבחור מערכת נכונה יש לדעת מספר פרמטרים בנקודות הדגימה וביניהם:

- לחץ
- טמפ' בסביבה ובתהליך
- חומרים קורוזיביים
- כמויות אבק ולחות
- גזים אחרים והשפעתם על הגז הנמדד
- מסיסות הגז הנמדד-קירור וייבוש של HCL מביאה ל"העלמותו" במים



CONTEL BEYOND PERFORMANCE

DURAG GROUP ABB

From sample point to analysis
Full range of sample handling components

Probes	Filter Units	Heated Lines	Sample Conditioning	and more...
Probe 11 	**FE2** 	**CGWB13** ▪ Self regulated heater ▪ Regulated heater 	**SCC-C** Cooler 	**SCC-K** NOx-Converter 
Probe Tube 40 	**Annular Heater** 		**SCC-F** Feed Unit 	**CGO-9** 800°C Tubular furnace 
Probe Tube 60/R/S 	**PFE2** 	**TBL01** ▪ Self regulated heater ▪ Fixed resistor heater ▪ Typical for MultiFID 	**SCC-S** Cooler & Feed Unit 	**SCC-U** Utility Unit 
Heated Probe Tube 42 	**PFE3** 			
Probe Tube 2 with protection boc 				

CONTEL
BEYOND PERFORMANCE

ABB

????

ABB ref.		Dated		ID	

Measuring Point Data Sheet

Preliminary notes

The aim of this Measuring Point Data Sheet is to document and clarify the measurement task. The Measuring Point Data Sheet is a pre-requisite for an order to be processed fully.

A separate Measuring Point Data Sheet must be prepared for each measuring point. Supplementary information on specialized measuring methods (e. g. FTIR, gas chromatography) should be recorded on a separate Data Sheet. A sketch should be attached where appropriate. The Measuring Point Data Sheet is to be attached to the quotation.

General Details

Inquiry / order from:
Company, department, contact name, address, tel. no., fax no.

Inquiry — No. — Dated

Project / System

Method / Process (method of firing)

Measuring task / Sampling point

Name / number of measuring point

Details of installation location

	Sampling point	Line routing	Installation site for analyzer
Ambient temperature range			
Air humidity			
Corrosive substances in the local atmosphere			
Area subject to explosions (zone, temperature class)			
Electricity supply			
Supply of compressed air, N_2, H_2, H_2O, ...			
Distance from sampling point to analyzer			
Height above sea level			

ABB

Details of the measurement medium

Composition of the measurement medium (list all measuring and associated components)	Concentration minimum	typical (Σ = 100 %)	maximum	Measuring ranges/ Unit	

Temperature on sampling		Dew point (water, acid)			
Boiling point		Melting point			
Dust / solids		Pressure on sampling			
Explosive during normal operation	☐ yes ☐ no	Inflam-mable	☐ yes ☐ no	Corrosive	☐ yes ☐ no

Special notes

E.g. details for response time (T_{90}), cycle time, special requirements, experience with the meas. task concerned

Preparation / revision date			
Prepared by (name)			
Department			
Company			

ABB

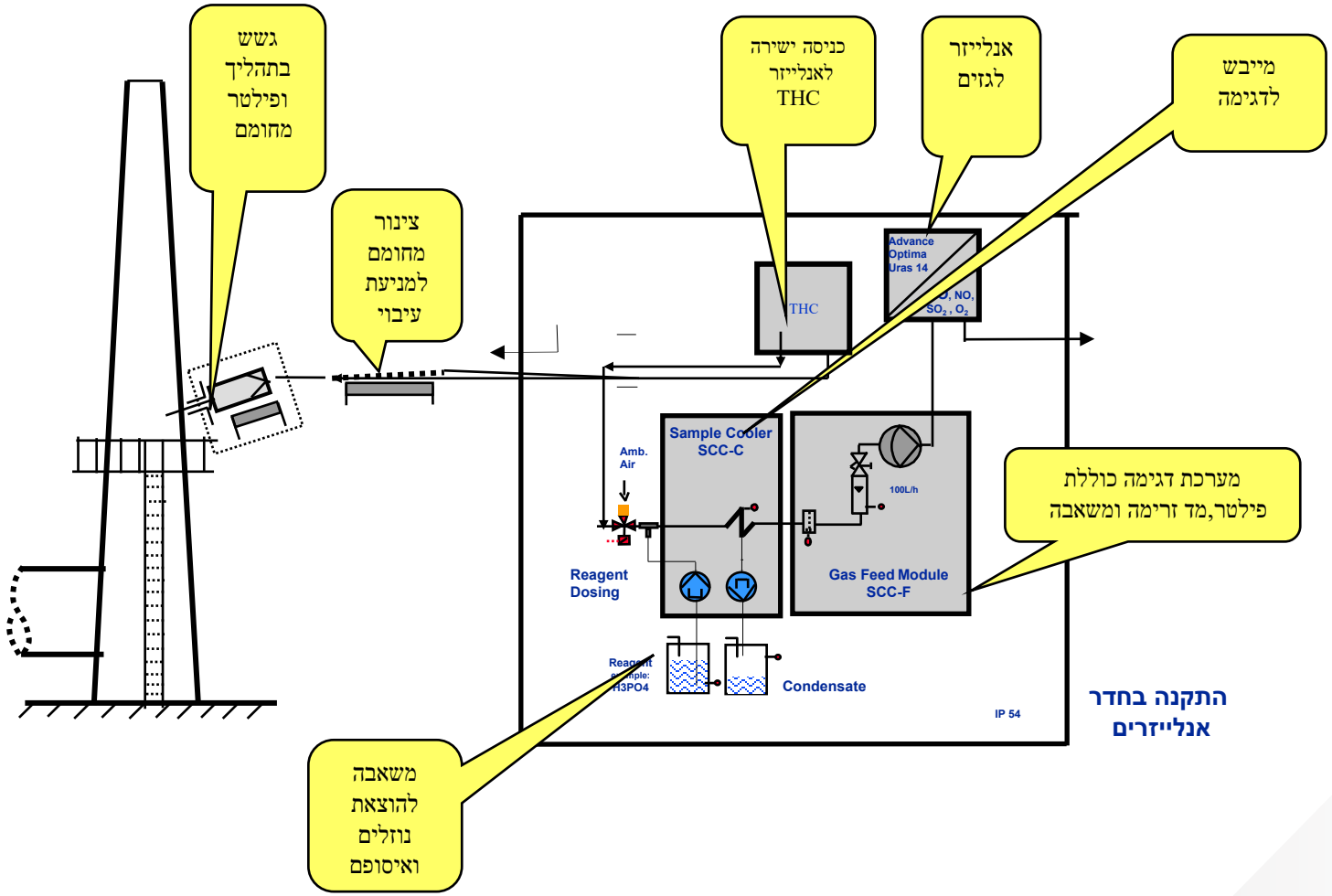
ABB Automation Products GmbH
Analytical Division
Stierstaedter Strasse 5, D-60488 Frankfurt am Main
Phone +49 - 69 - 79 30 - 40, Fax +49 - 69 - 79 30 - 45 66
E-Mail analytical-mkt.deapr@de.abb.com, http://www.abb.com/analytical

Subject to technical changes.
Printed in the Fed. Rep. of Germany
80/23-100 EN 04.01

CONTEL BEYOND PERFORMANCE

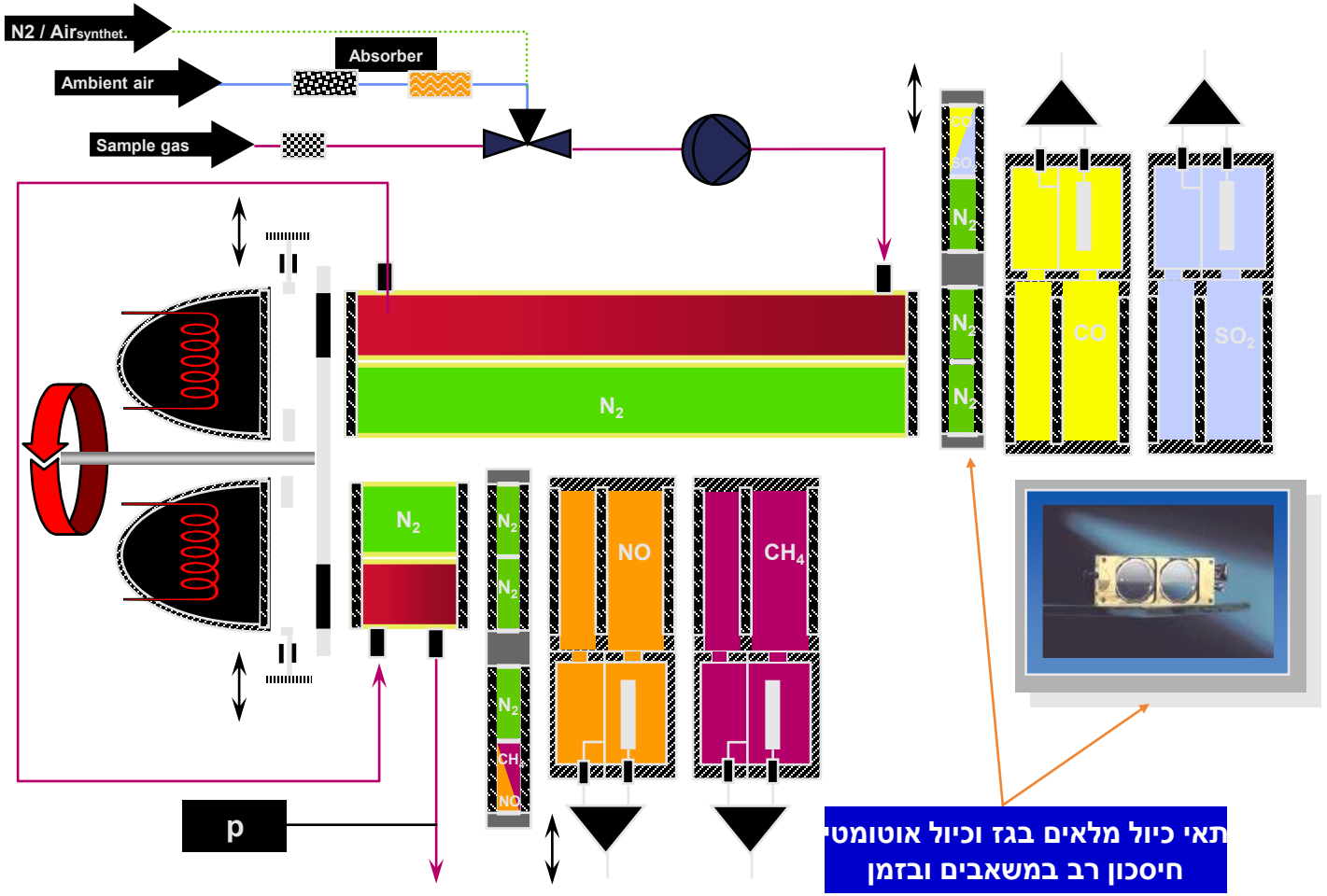
DURAG GROUP ABB

מערכת דגימה לגזים לארובת דגם ABB



CONTEL BEYOND PERFORMANCE

DURAG GROUP ABB



CONTEL
BEYOND PERFORMANCE

DURAG GROUP

ABB

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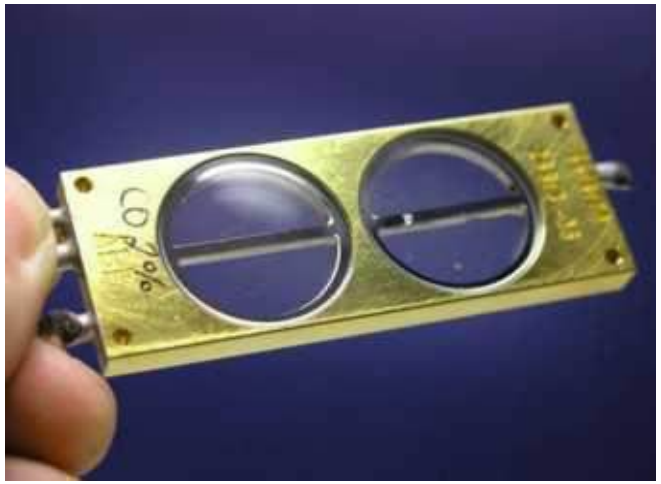


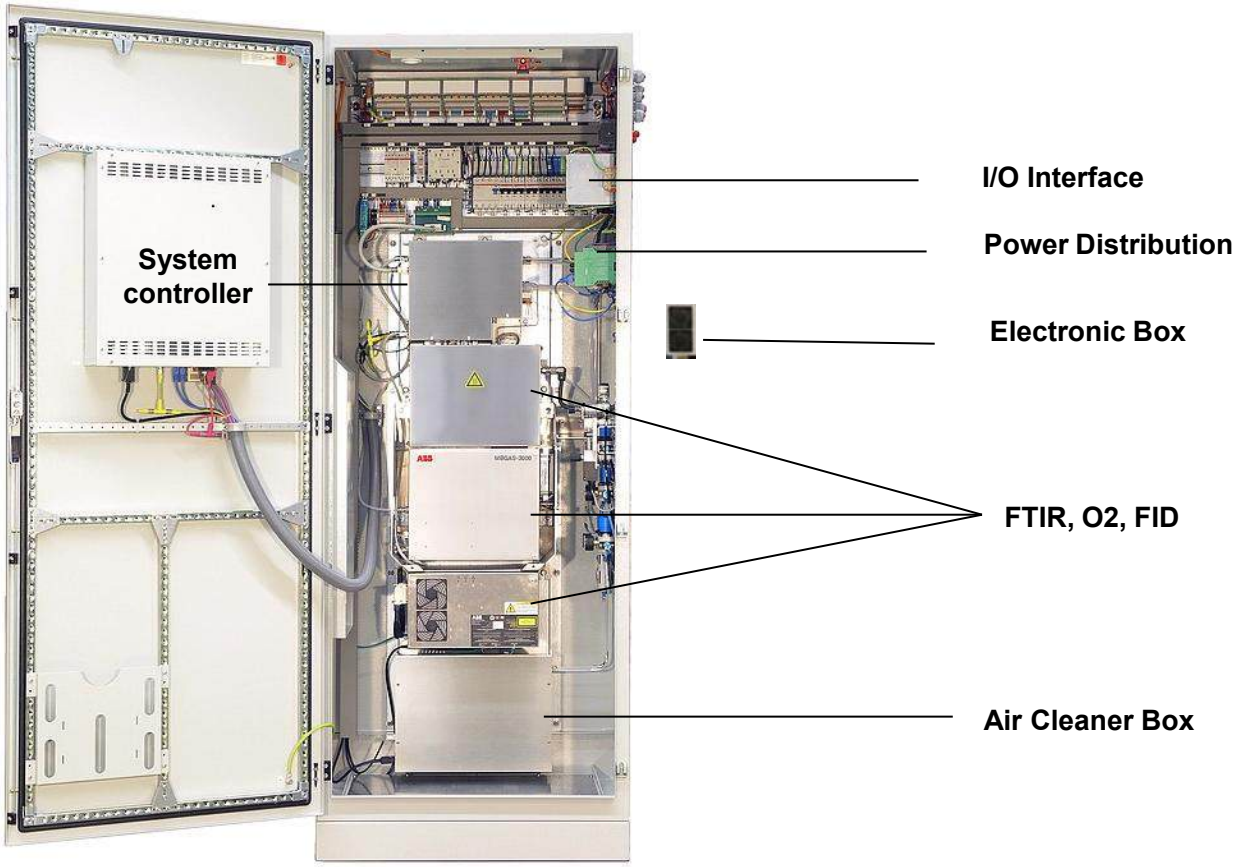
- הגדלת הדיוק ע"י כיול יום יומי ללא מאמץ.
- מניעת הצורך בגזי כיול (אחת לשנה בלבד).
- אורך חיים של למעלה מ 10 שנים.

CONTEL
BEYOND PERFORMANCE

DURAG GROUP ABB

ACF5000

Complete turnkey system



Low cost of operation

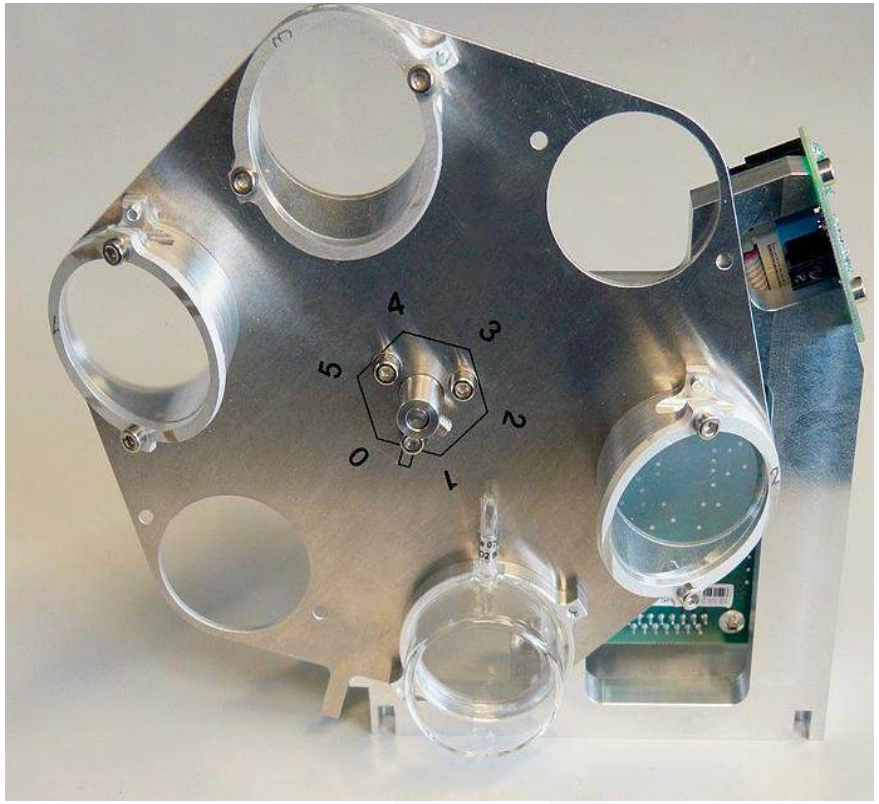
Validation Unit for QAL3 checks

Feature

- Films and gas cells for all FTIR components as a surrogate to test gases (EN 14181 compliant)
- Allows on-going system validations as required for QAL3
- Validation runs automatically

Customer benefit

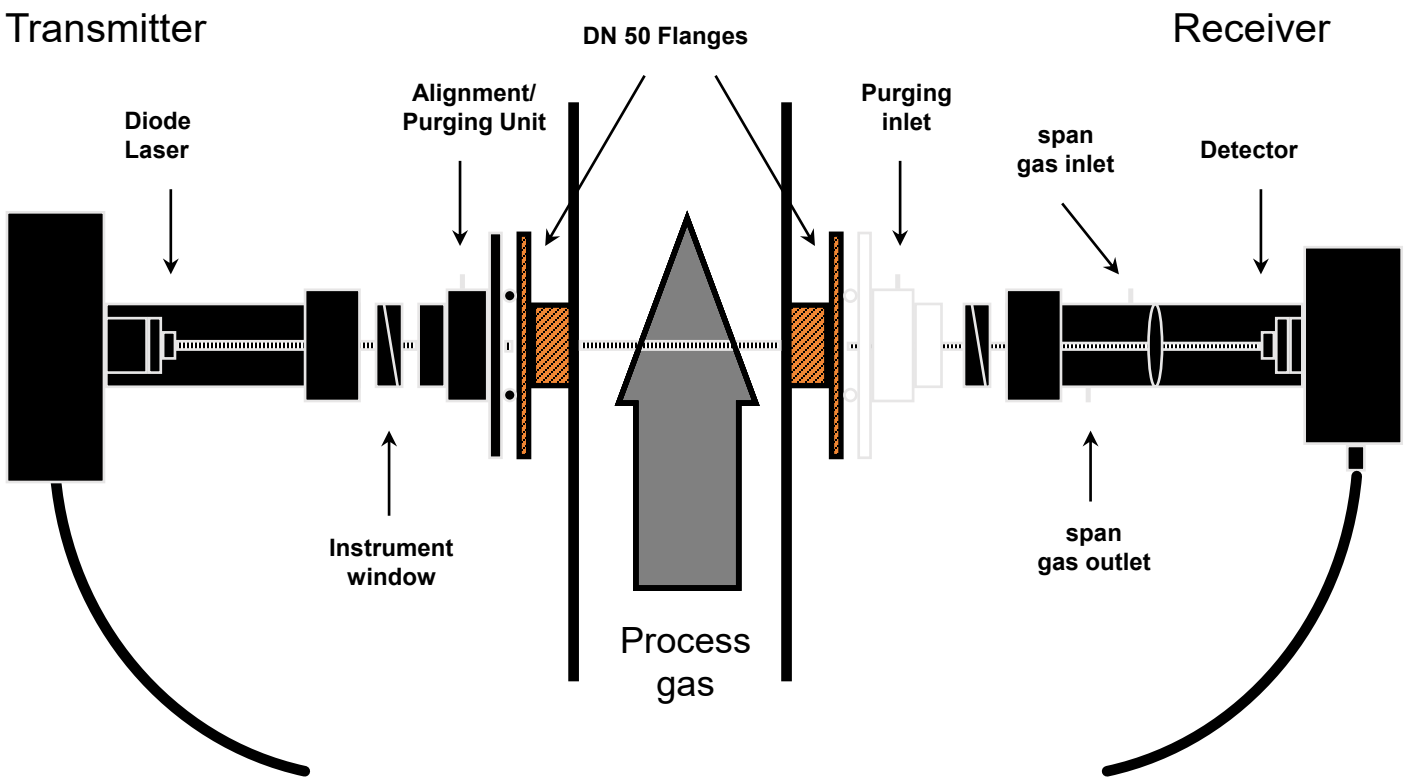
- No specialist for operating a water vapor generator
- Save cylinder gases



CONTEL BEYOND PERFORMANCE

DURAG GROUP ABB

IN SITU - LaserGas II Single Path

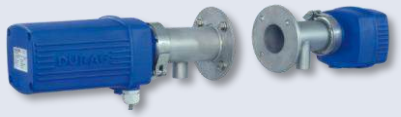


סוגי מכשור לחלקיקים וספיקה

Dust concentration and opacity monitors

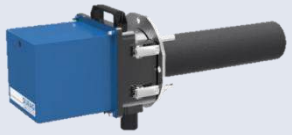
DURAG

D-R 220



D-R 290

D-R 320



D-R 808

Filter monitors

D-FW 230/231/240

DURAG

Combination probe

D-RX 250

DURAG

Dust concentration monitors for wet gases

D-R 820F

DURAG

F-904-20

VEREWA

Ambient air monitor

F-701-20

VEREWA

Total mercury analyser
HM-1400 TRX

VEREWA

Volume flow monitoring systems

D-FL 100

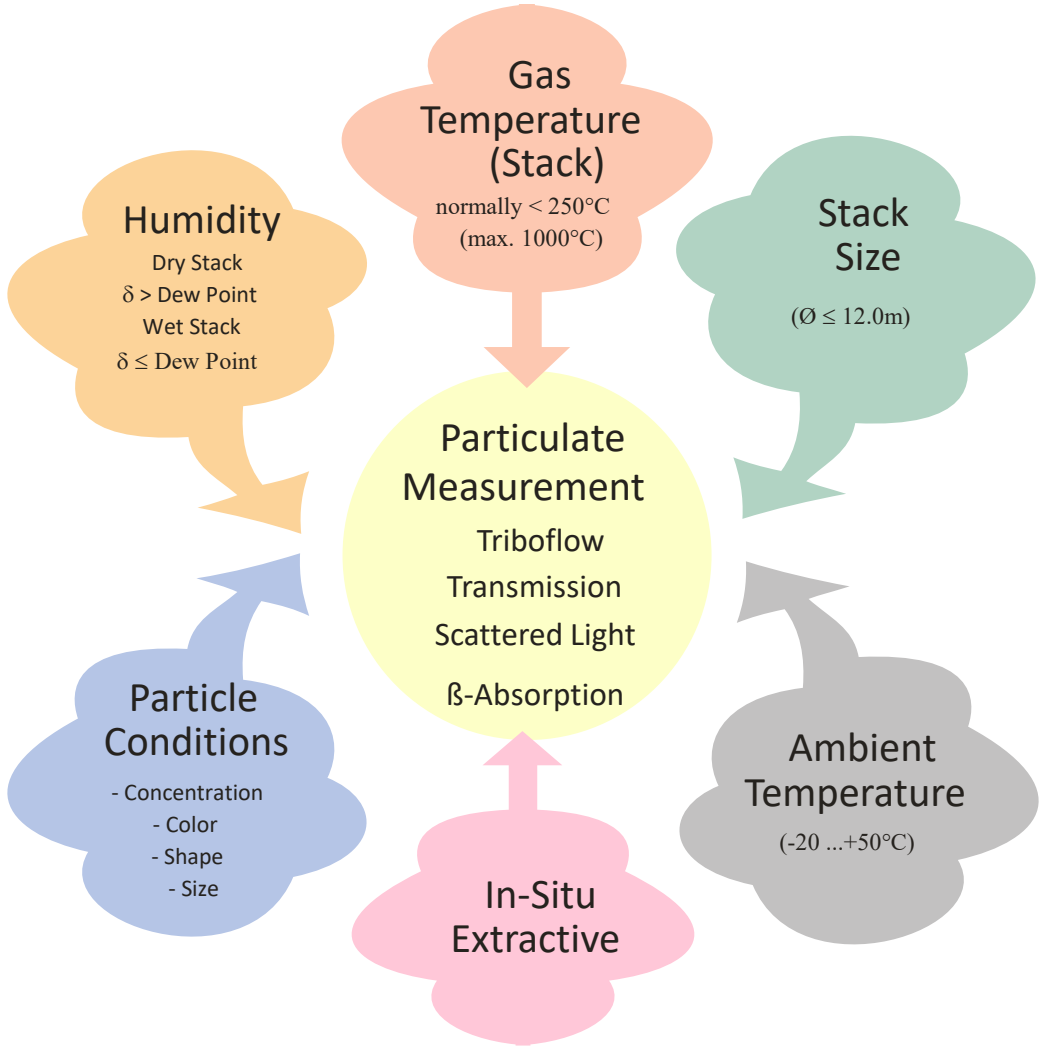
D-FL 220

DURAG

CONTEL
BEYOND PERFORMANCE

DURAG GROUP ABB

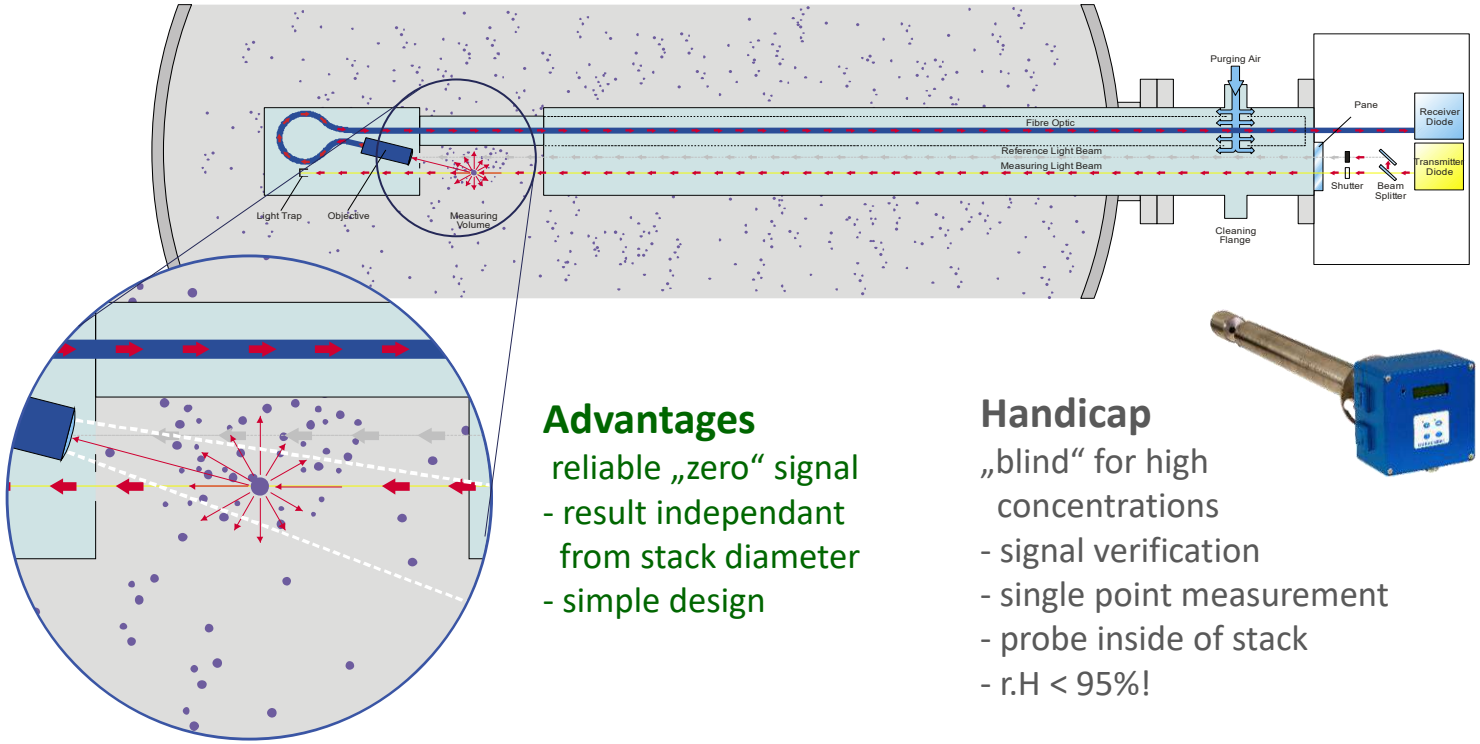
Dust Measurement



CONTEL BEYOND PERFORMANCE

DURAG GROUP ABB

AMS (Scattered light monitor) scattering forwards



Advantages

reliable „zero“ signal
- result independant from stack diameter
- simple design

Handicap

„blind“ for high concentrations
- signal verification
- single point measurement
- probe inside of stack
- r.H < 95%!

הבסיס לדרישות לניטור רציף – נוהל ניטור רציף של המשרד – גרסת 2017

המשרד להגנת הסביבה
אשכול תעשיות
אגף איכות אוויר ושינוי אקלים
נוהל ניטור רציף בארובה

בתוקף מתאריך : 23 אפריל 2017
מהדורה : **2**
עמוד 1 מתוך 35 עמודים
מאשר/ת הנוהל : ראש אגף איכות אוויר

נוהל ניטור רציף בארובה

גרסה 2 מיום 23.04.2017

EN 14181

The three QALs and AST

QAL 1

Confirms the suitability of an AMS for the measuring task according to EN 15267-3 and EN ISO 14956

QAL 2

Calibration procedure of an AMS after commissioning with **S**tandard **R**eference **M**ethods (**SRM**)

Determination of variability & comparison with required *Uc*

QAL 3

Ongoing quality assurance during operation.

Regular control of Drift and Precision of the AMS

AST

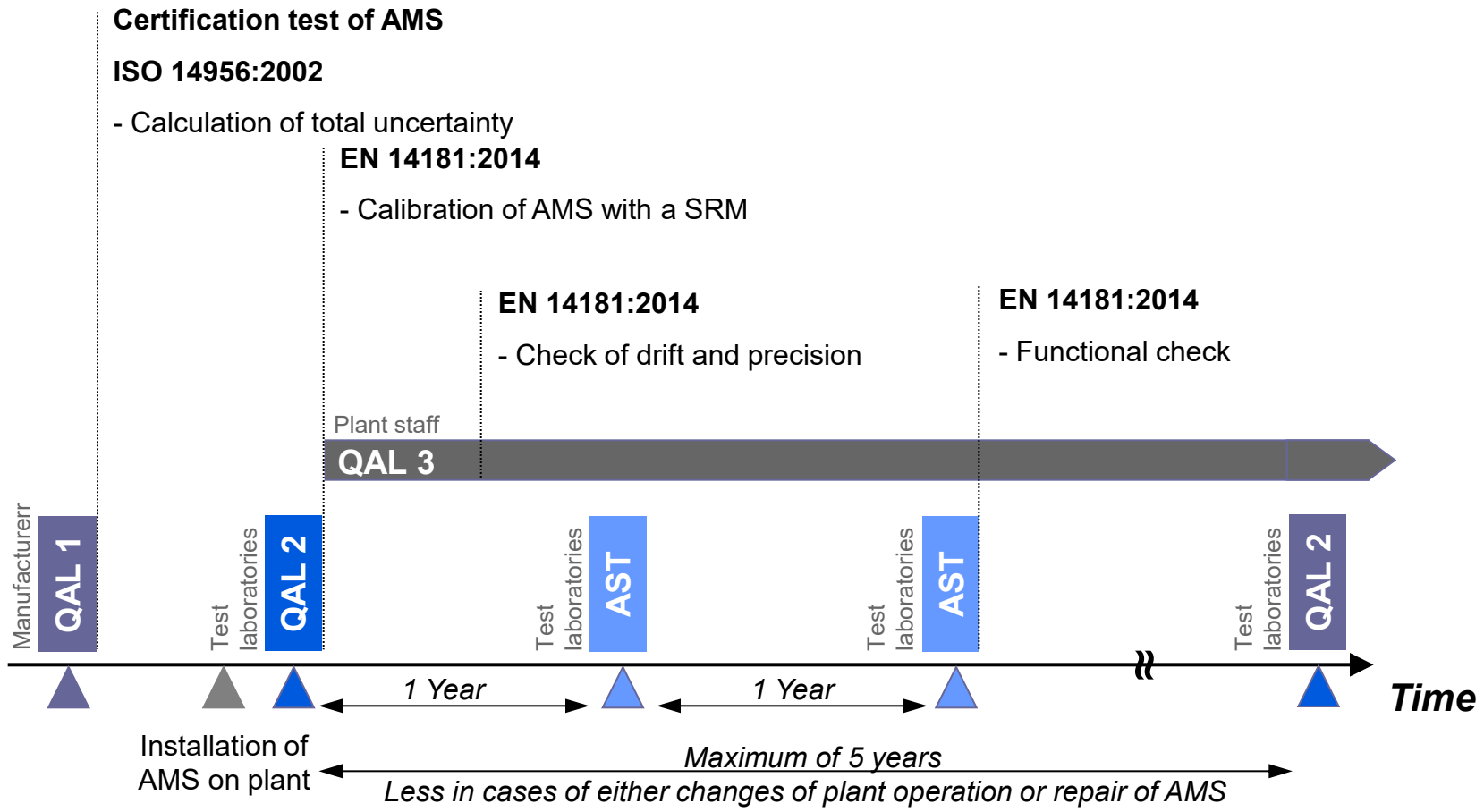
Annual Surveillance Test

Yearly check of an AMS

CONTEL
BEYOND PERFORMANCE

ABB

EN 14181
QAL1…3 over time



AST = Annual Surveillance Test

AMS = Automated Measuring System

SRM = Standard Reference Method

CONTEL
BEYOND PERFORMANCE

ABB

QAL 1 Procedure
Suitability evaluation of an AMS

CONTEL
BEYOND PERFORMANCE

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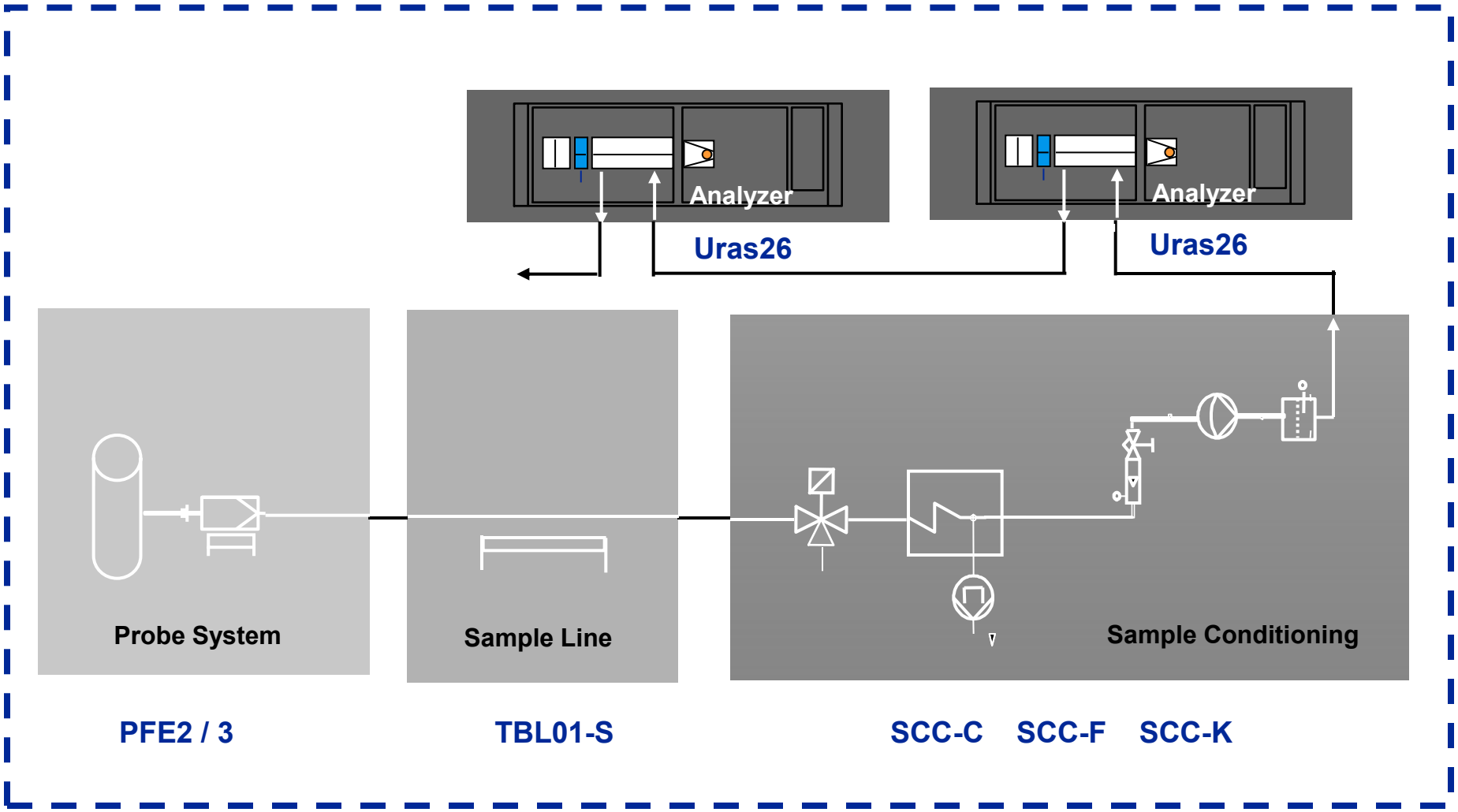
EN 14181 – QAL1
AMS • Automated Measuring System



CONTEL
BEYOND PERFORMANCE

ABB

QAL1 procedure
Implementation according Chapter 5.1 & Annex H

General conditions

- The AMS is proven and suitable for the measuring task

- Fulfills the performance criteria according EN 15267-3
  - Linearity, drift, cross-sensitivity, influence effects, detection limit, response time, etc. obtained during the suitability test

- Demonstrate capability of the AMS
  - Applying the QAL1 procedure accord. to EN ISO 14956
    - Calculate the expanded uncertainty

CONTEL
BEYOND PERFORMANCE

ABB

Relative total expanded uncertainty – EN 15267-3
QAL1 application

Requirement of the EN 15267-3,

Chapter 14 – Measurement Uncertainty

- The total uncertainty of the AMS determined from the tests should be at least **25 %** below the maximum permissible uncertainty specified e.g. in applicable regulations (IED, …)

- A sufficient uncertainty contribution range needs to be considered for the individual installed AMS to pass the QAL2 and QAL3 successfully
  - Reason: Having an expanded range for adaption during QAL2 by meeting the ELV

CONTEL BEYOND PERFORMANCE

ABB

Permitted Uncertainties • 95% - Confidence Interval
Based on the IED 2010/75/EC and EN 15367-3

95 % of all single measured results shall meet the 95% confidence interval and

5 % shall not exceed the following percentages of the daily emission limit value (*Daily ELV*)

Pollutant		Max. Uncertainty IED	Plant type	Max. Uncertainty EN 15267-3 (IED - 25%)
Carbon monoxide	CO	10 %	WIP / LCP	7,5 %
Sulphur dioxide	SO_2	20 %	WIP / LCP	15 %
Nitrogen dioxide	NO_2	20 %	WIP / LCP	15 %
Dust		30 %	WIP / LCP	22,5 %
Volatile organic carbon	VOC	30 %	WIP	22,5 %
Hydrogen chloride	HCl	40 %	WIP	30 %
Hydrogen fluoride	HF	40 %	WIP	30 %
Mercury	Hg	40 %	WIP / LCP	30 %

CONTEL BEYOND PERFORMANCE

ABB

EN 14181 – QAL1 • Extract of TÜV – Report – SO_2

Example how to use for different ELVs

and comparison with competitors

TÜVRheinland®
Precisely Right.

Calculation of overall uncertainty for QAL1 in EN 14181 and EN 15267-3

Calculation of the combined standard uncertainty

Test Value	$\Delta X_{max,j}$			u	u^2
Standard deviation from paired measurements under field conditions *	1,22	mg/m³	u_D	1,22	1,493
Lack of fit	- 0,45	mg/m³	u_{lof}	-0,26	0,068
Zero drift from field test	0,83	mg/m³	$u_{d,z}$	0,48	0,227
Span drift from field test	- 1,43	mg/m³	$u_{d,s}$	-0,82	0,677
Influence of ambient temperature at span	- 0,83	mg/m³	u_t	-0,48	0,227
Influence of supply voltage	0,08	mg/m³	u_v	0,04	0,002
Cross sensitivity (interference) **	3,23	mg/m³	u_i	1,86	3,467
Influence of sample pressure	0,00	mg/m³	u_p	0,00	0,000
Influence of sample gas flow	0,56	mg/m³	u_p	0,32	0,105
Uncertainty of reference material at 70% of certification range	1,05	mg/m³	u_{rm}	0,61	0,368

* The bigger value of: "Repeatability standard deviation at span" or "Standard deviation from paired measurements under field conditions"

** The absolut value of the Sum of positiv cross sensitivity is greater than the Sum of negativ cross sensitivity

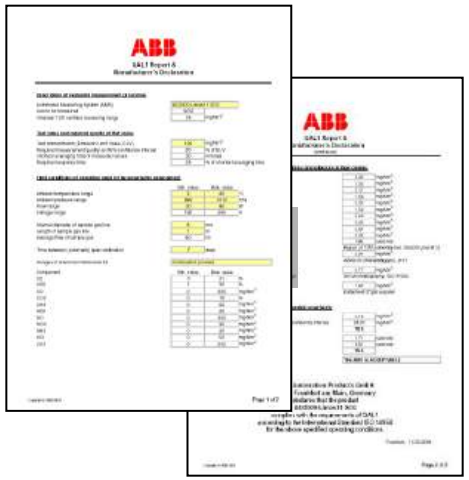
Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	2,58	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1,96$	5,05	mg/m³

Relative total expanded uncertainty		**U in %**	**of the ELV**	**50 mg/m³**	**10,1**	**Result**
Requirement of 2000/76/EC and 2001/80/EC	**U = 20 % for SO_2**	**U in %**	**of the ELV**	**50 mg/m³**	**20,0**	**Requirement**
Requirement of EN 15267-3	**U = 20 % - 25 %**	U in %	**of the ELV**	50 mg/m³	15,0	**Requirement**

CONTEL
BEYOND PERFORMANCE

ABB

EN 14181 - QAL1 Manufacturer declaration
Calculation of the Total Expanded Uncertainty *U*



Calculation procedure

as described

according

EN ISO 14956

- **Prior to the installation**
  - Provided by the manufacturer of an AMS
    - Complying with the requirements acc. to the regulations
    - Demonstrating capability of the AMS
- **With performance values for**
  - Linearity, drift, cross-sensitivity, influence effects detection limit, response time, etc.
  - Obtained during the suitability test according EN 15267-3
  - Considering the daily ELV at the 95% confidence interval
- **Using the ABB QAL1 - calculation tool**

CONTEL
BEYOND PERFORMANCE

ABB

QAL 1 – Where to Find Certificates?

Germany

www.qal1.de/en/index.htm

UK

www.siraenvironmental.com/UserDocs/mcerts/

MCERTSCertifiedProductsCEMS.pdf

PRODUCT CONFORMITY CERTIFICATE

This is to certify that the

EL3000 Series Multigas Analysers with SCC-K NO/NO_2 converter

manufactured by:

ABB Automation Products GmbH

Stierstadter Strasse 5
Frankfurt-am-main
D-60488
Germany

has been assessed by Sira Certification Service and for the conditions stated on the certificate complies with:

MCERTS Performance Standards for Continuous Emission Monitoring Systems, Version 3.3 dated January 2011, EN15267-1:2009, EN15267-2:2009, EN15267-3:2007, & QAL 1 as defined in EN 14181: 2004

Certification Ranges

CO	0 to 150 mg/m³	to	0 to 6000 mg/m³
NO	0 to 100 mg/m³	to	0 to 5000 mg/m³
NOx	0 to 150 mg/m³	to	0 to 7500 mg/m³
SO_2	0 to 300 mg/m³	to	0 to 8000 mg/m³
N_2O	0 to 100 mg/m³	to	0 to 6700 mg/m³
CO_2	0 to 20%vol		
O_2	0 to 10%vol	to	0 to 25%vol

Project No: 0749044
Certificate No: Sira MC 080123/06
Initial Certification: 14 January 2008
This Certificate Issued: 30 May 2012
Renewal Date: 13 January 2013

Technical Director

MCERTS is operated on behalf of the Environment Agency by

Sira Certification Service

12 Acorn Industrial Park, Crayford Road, Crayford, Dartford, Kent, UK DA1 4AL
Tel: +44 (0)1322 520500 Fax: +44 (0)1322 520501

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Registered Office: Rake Lane, Eccleston, Chester, UK CH4 9JN

Page 1 of 13

Umwelt Bundes Amt

ZERTIFIKAT

Über Produktkonformität (QAL 1)

Zertifikatsnummer: 1669540-ts

Messeinrichtung	EasyLine EL3000 Serie für CO, NO, SO_2, N_2O, CO_2 und O_2
Gerätehersteller	ABB Automation GmbH Stierstadter Straße 5 60489 Frankfurt Deutschland
Prüfinstitut	TÜV SÜD Industrie Service GmbH

Hiermit wird bescheinigt, dass die AMS die Anforderungen der Normen DIN EN 15267-1: 2009, DIN EN 15267-2: 2009, DIN EN 15267-3: 2008 und DIN EN 14181: 2004 erfüllt.

TÜV SÜD

Zertifikat Nr: 1669540-ts

Eignungsbekanntgabe im Bundesanzeiger vom 02.03.2012

Gültigkeit des Zertifikates bis 01.03.2017

Umweltbundesamt
Dessau, den 20.03.2012

i. A. Dr. Hans-Joachim Hummel

TÜV SÜD Industrie Service GmbH
Prüflaboratorium Emissionsmessung/ Kalibrierung
München, den 19.03. 2012

Dr. Michael Wasser

ZERTIFIKAT ◆ CERTIFICATE ◆ CERTIFICADO ◆ CERTIFICAT

CONTEL
BEYOND PERFORMANCE

QAL 2 Procedure
Certification of the AMS

CONTEL
BEYOND PERFORMANCE

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EN 14181
Calibration versus Adjustment

- European regulations strictly separates calibration from adjustment of a measuring system

- Calibration

  of an AMS by means of parallel measurement with a Standard Reference Method (SRM) by a test laboratory accredited according to EN ISO 17025

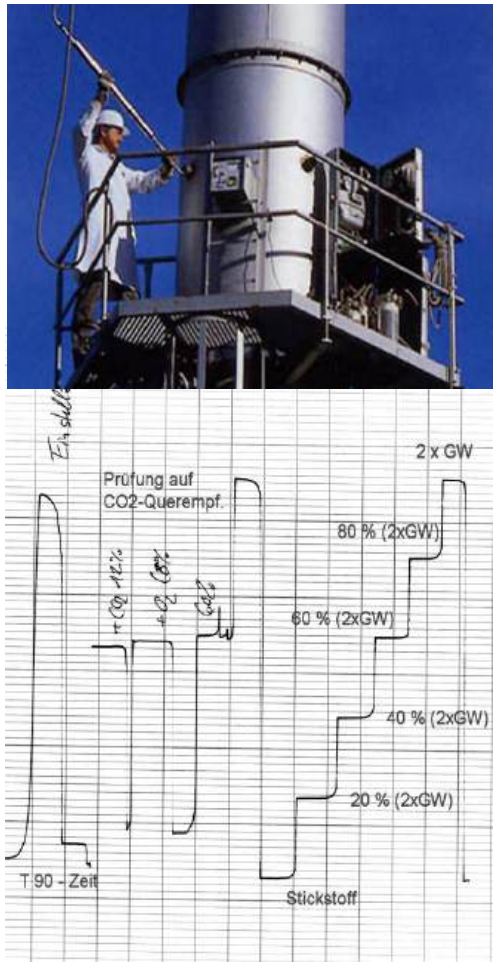
- Adjustment

  of an AMS with reference material is done by the operator (or automatically by the AMS)

CONTEL BEYOND PERFORMANCE

ABB

EN 14181
QAL2 • Calibration with a SRM

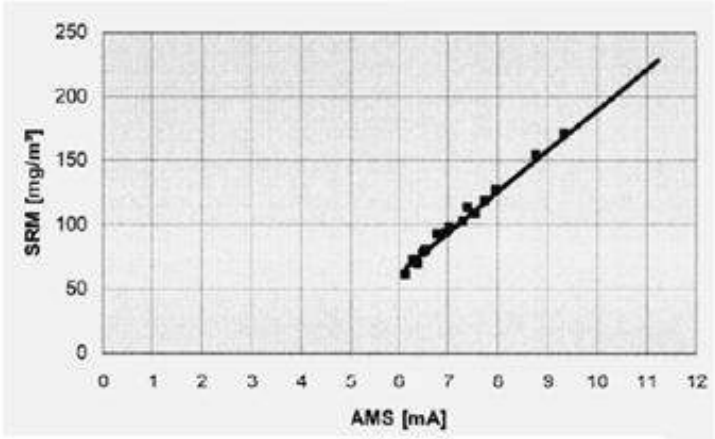


- Carried out after installation, then 3 to 5 years by a certified body accredited to EN ISO 17025
- **Scope**
  - Verification of correct installation
  - Calibration with a SRM
    - at least 15 measurements on 3 days over 8 - 10 h
  - Testing of variability
  - Testing of functionality
  - Reporting
- Must be repeated earlier if
  - Major changes of plant operation
  - Major repairs or modification of an AMS
  - Out of calibration range

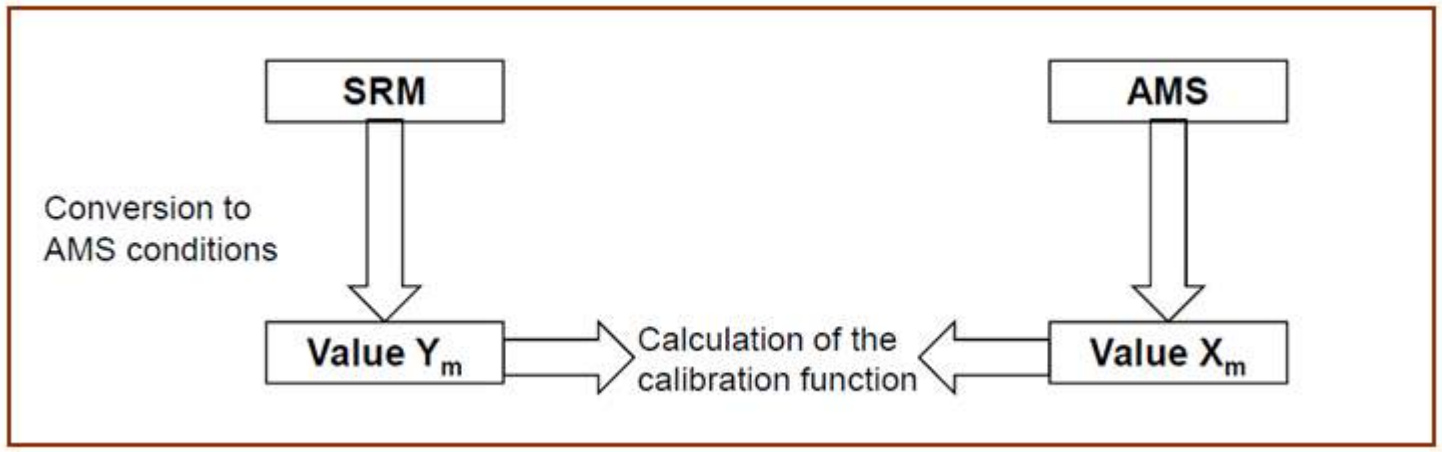
CONTEL
BEYOND PERFORMANCE

ABB

EN 14181
QAL 2 • Calibration Function



- Comparision of SRM and AMS values at AMS measurement conditions
- At least 15 valid pairs required on 3 days over 8 - 10 h

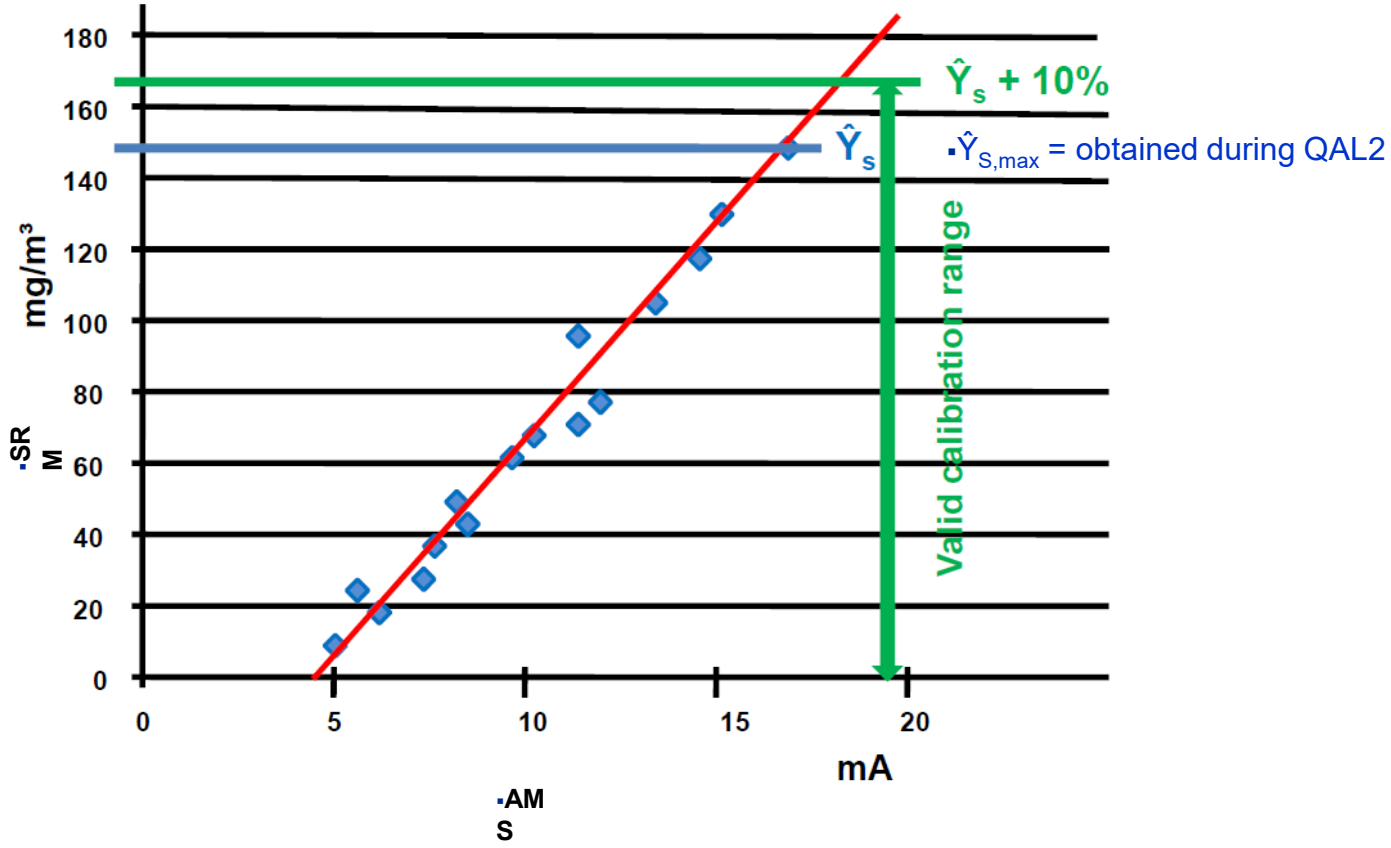


CONTEL
BEYOND PERFORMANCE

ABB

Regression line
QAL 2 • Range of Calibration Function (para. 6.5)

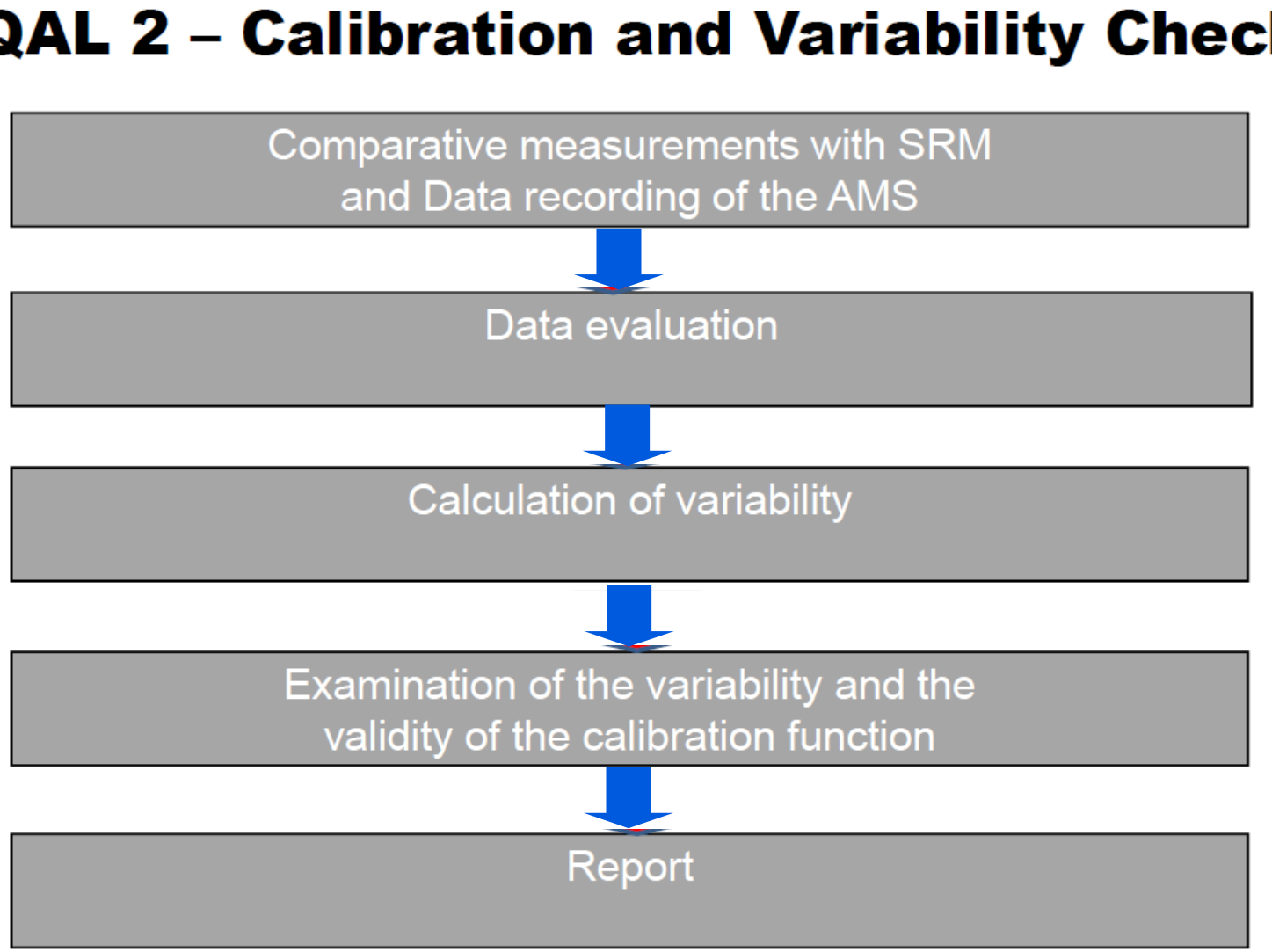
- The calibration function is valid when the plant operates within the valid calibration range
- The valid calibration range is defined during QAL 2 procedure plus an extension of 10%



CONTEL BEYOND PERFORMANCE

ABB

EN 14181
QAL 2 – Calibration and Variability Check



CONTEL
BEYOND PERFORMANCE

ABB

QAL 3 Procedure
Ongoing Quality Monitoring

CONTEL
BEYOND PERFORMANCE

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QAL3 Ongoing Quality Monitoring
For Plant Owners

- Regular control of Drift and Precision of the AMS
  - Drift — Systematic deviations
  - Precision — Random deviations
    (e.g. temporary higher ambient temperature)
- Control charts permitted for evaluation

CONTEL
BEYOND PERFORMANCE

ABB

QAL3 Ongoing Quality Monitoring
Frequency of Zero – and Reference Point Checks

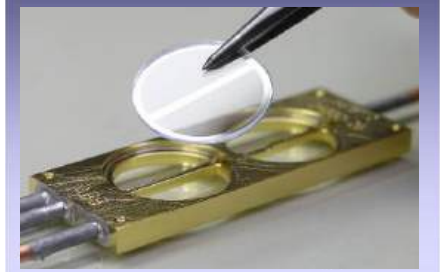
- Minimum 1 time per certified maintenance interval
  - At list Every 4 weeks
    unless there is a reason to extend this period
  - Every 4 weeks for multi-component AMS
    a QAL3 check shall be conducted for 1 component

CONTEL
BEYOND PERFORMANCE

ABB

QAL3 Ongoing Quality Monitoring
Reference Materials for extractive operating AMS

Adjustment cell IR-Anaylzer



Suitable Reference Standards

- Analyzer internal facilities
  - Gas filled adjustment cells
  - Optical filters
  - Films
- Flowing mediums
  - Ambient air or N_2
  - Cylinder test gases
  - Vaporization
    - Water measurements
    - Components not available in test gas cylinders

CONTEL
BEYOND PERFORMANCE

ABB

AO2000 & EL3000
Adjustment concepts without test gases

Adjustment cells are standard for the reference point

- IR Photometer
- UV Photometer

Zero - point adjustment

- With ambient air, clean and dry

Single - point calibration using dry ambient air

- Oxygen measurements
- O_2 - Sensors

12 months maintenance interval by using adjustment cells

CONTEL
BEYOND PERFORMANCE

ABB

Control charts
Calculation of the Alarm Limit A_{Limit}

Suitable to be used for Shewhart & EWMA Control Charts (Chapter 7.4.3)

- Doing a calculation based on the maximum permissible uncertainty
  - ± 50 % of the max. permissible uncertainty can be used to set the alarm limits
  - ± 25 % of the max. permissible uncertainty can be used to set the warning limits

Example

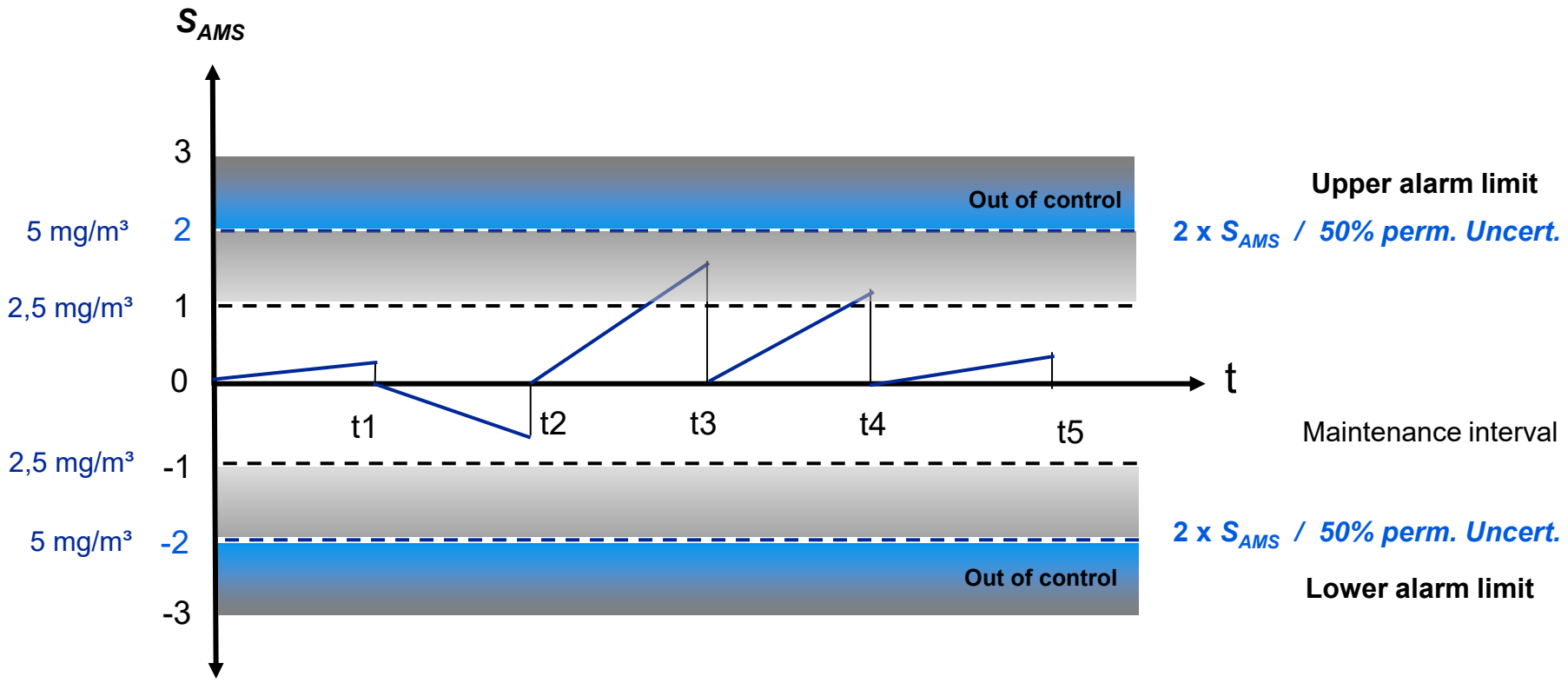
- CO measurement
- ELV 100 mg/m³
- Max. perm. uncertainty 10% (95% confidence interval - IED)

$$A_{Limit} = 100\ mg/m^3 \times 10\% = 10\ mg/m^3 \times 50\ \% = 5\ mg/m^3$$

CONTEL BEYOND PERFORMANCE

ABB

Shewhart Control Charts
Example

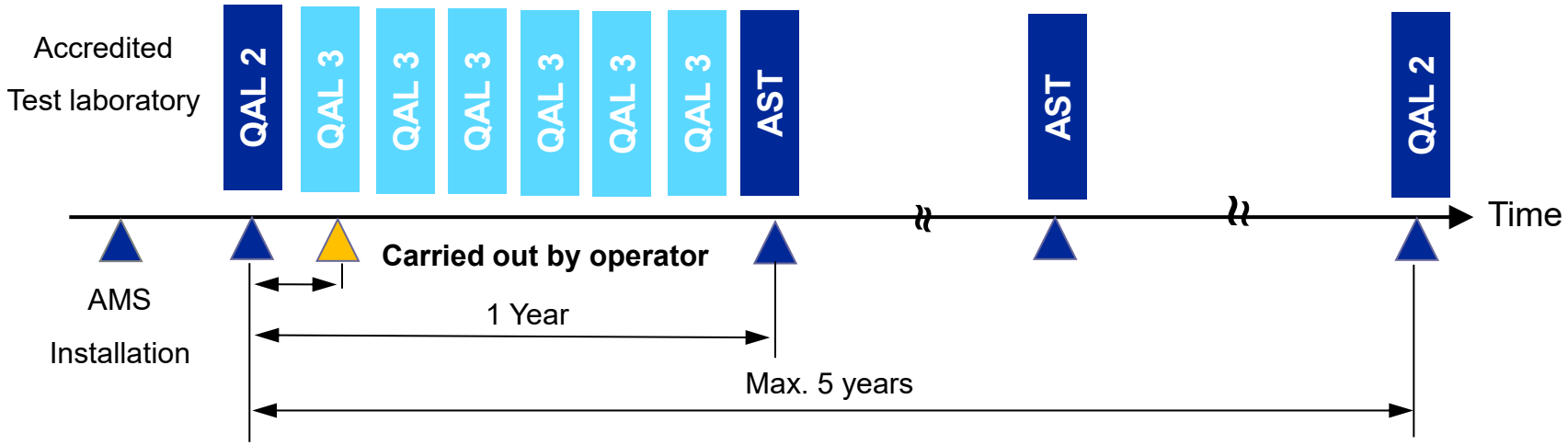


- Shewhart ➡ The most popular control chart

CONTEL
BEYOND PERFORMANCE

ABB

EN 14181 – QAL3
Ongoing quality assurance during operation



Frequency

- Once in the certified maintenance interval
- More frequent checks are recommended

Reference Materials

▪ Test gases	Always possible
▪ Surrogate materials	Yes, if type approved (EN 14181 compliant)

CONTEL BEYOND PERFORMANCE

ABB

דוגמא למערכות – ייצור במפעל הלוחות של קונטאל

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BEYOND PERFORMANCE

CONTEL

Reference – Israel Electric CO

25 CEMS SYSTEMS – 25 GAS TURBINES

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DURAG GROUP ABB

DORAD ASHKELON

12 complete CEMS and shelters

12 complete CEMS and shelters

6 מערכות - צומת OPC

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אתגל- אשדוד- חדר CEMS

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חיפה כימיקלים אמוניה – חדר 10 EX מטר

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