סוגי מכשירי ניטור רציף בארובות

סדנת ניטור רציף 20.11.2018

יובל אייל - מחלקת מכשור אנליטי

נתחיל בחידה

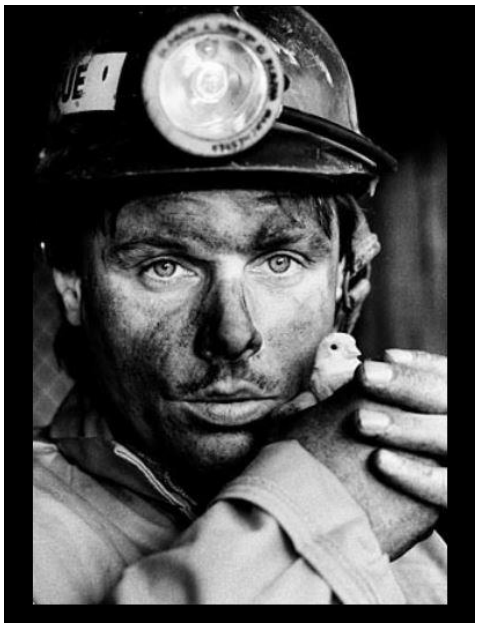
יוני 2017 – נוהל ניטור רציף בישראל גירסא 3

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.



מדידות גזים רציפות הנן מהמדידות החשובות ביותר בתעשייה..

נהוג לחלק מדידות אלו למס' קבוצות ומטרות עיקריות:

- **CO, O2, CO2 - בקרת בעירה ובקרת תהליך**
- **CO H2 - בטיחות והגנה מפני התפוצצות וע**
- **הפחתת הפליטה של גזים רעילים ומזיקים חלקיקים ועוד. SO2, NOX, CO,HCL,HF**

- 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 פחמית אשר בה מגוון ההתקנות רב הן לצורכי בקרת תהליך ,בטיחות , איכות הסביבה, ועוד..

Meas. Point	Task	Meas. Component
1	Fire Optimization	$CO - O_2$
2	Fire Monitoring	CO-NO-CO2-O2
3	DENOX Efficienty	NO NO - NO2 - NH3
4	E- Filter Monitoring	$CO-O_2$
5	Milk of Lime Dosing	SO_2
6	Flue-gas-desulphurisation Efficienty	$SO_2 - O_2$
7	Emission monitoring	$CO-NO-SO_2-O_2$
8	Coal bin monitoring	CO
9	Turbo generator monitoring	H_2

ישנם שני סוגים עיקריים של מכשירים

מכשירים
ניידים

בד"כ מכשירים קלים ופשוטים הכוללים תאים אלקטרו כימיים.

מכשירים
קבועים

משמשים למדי

למדידת גזים **UV** או **IR**במכשירים קבועים משתמשים ג

NOX, SO2

O2בתאי צירקוניה או מגנטי .

HC ל

ומכשירים נוספים לאפליקציותFTIRכרומטוגרפים , מכש

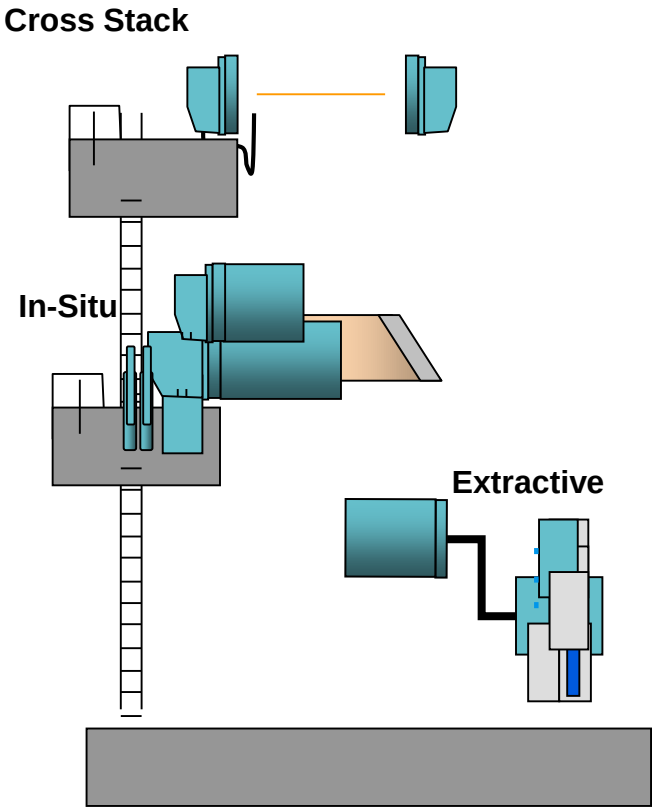
''מיוחדות'' כגון הלוגנים ועוד

ישנן שתי שיטות מדידה עיקריות:

א : 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



ב : 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


ABB
ACF-NT
ABB
ACX
ABB
ABB
ABB

QAL 1 – Where to Find Certificates?

- Germany www.qal1.de/en/index.htm
- UK www.siraenvironmental.com/UserDocs/mcerts/MCERTSCertifiedProductsCEMS.pdf

sira CSA Group

MCERTS

Environment Agency

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 this 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 4000 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: 674/0244
Certificate No: Sira MC 080122/08
Inital 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

This certificate may only be reproduced in its entirety and without change
To authenticate the validity of this certificate please visit www.siracertification.com/mcerts
Registered Office: Rake Lane, Eccleston, Chester, UK CH4 9JN

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ZERTIFIKAT ◆ CERTIFICATE ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Umwelt Bundes Amt

TÜV SÜD Industrie Service

Zertifikatsnummer: 1669640-ts

ZERTIFIKAT

Über Produktkonformität (QAL 1)
Zertifikatsnummer: 1669640-ts

Messeinrichtung	EasyLine EL3000 Serie für CO, NO, SO_2, N_2O, CO_2, und O_2
Geräteherstelle	ABB Automation GmbH Stierstädter Straße 5 60488 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.

Zertifikat Nr: 1669640-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 Waeber

TÜV SÜD Industrie Service · GmbH · Abteilung Umweltservice · Westendstraße 199 · 80686 München · Germany
Seite 1 / 14

TÜV®

CONTELTECHNOLOGIES for Smart Manufacturing

DURAG GROUP

ABB

סוגי מכשירים

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

HCLמסיסות הגז הנמדד-קירור וייבוש של מביאה ל"העלמותו"במים

CONTELTECHNOLOGIES for Smart Manufacturing

DURAG GROUP

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

Inflammable ❒ 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

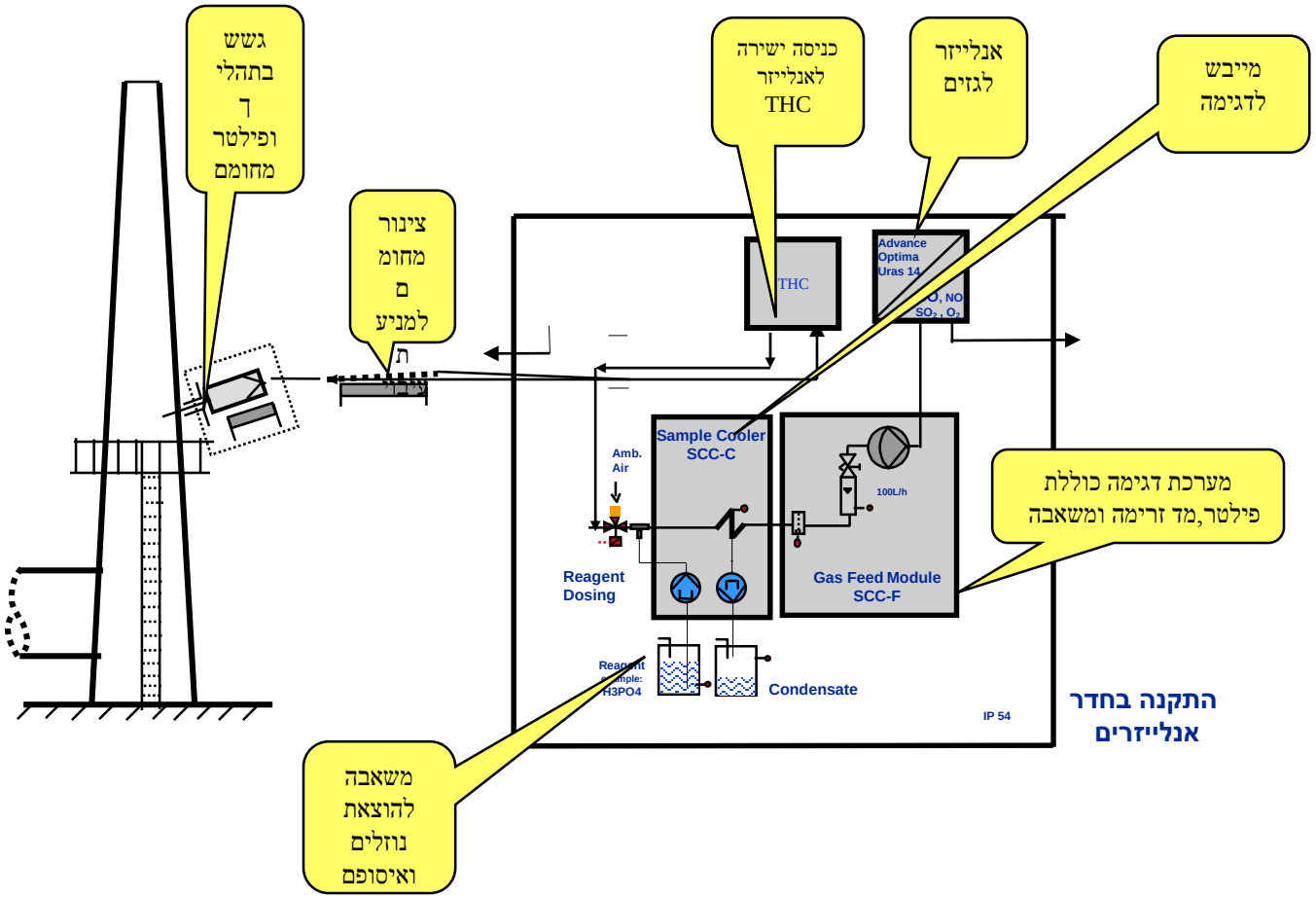
Company

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

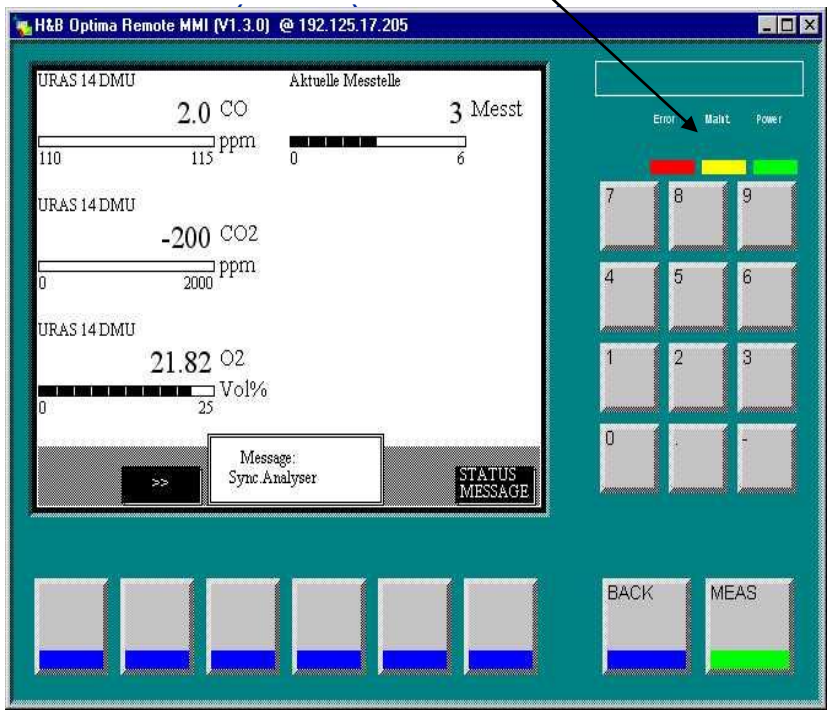
Subject to technical changes.
Printed in the Fed. Rep. of Germany
80/23-100 EN 04.01

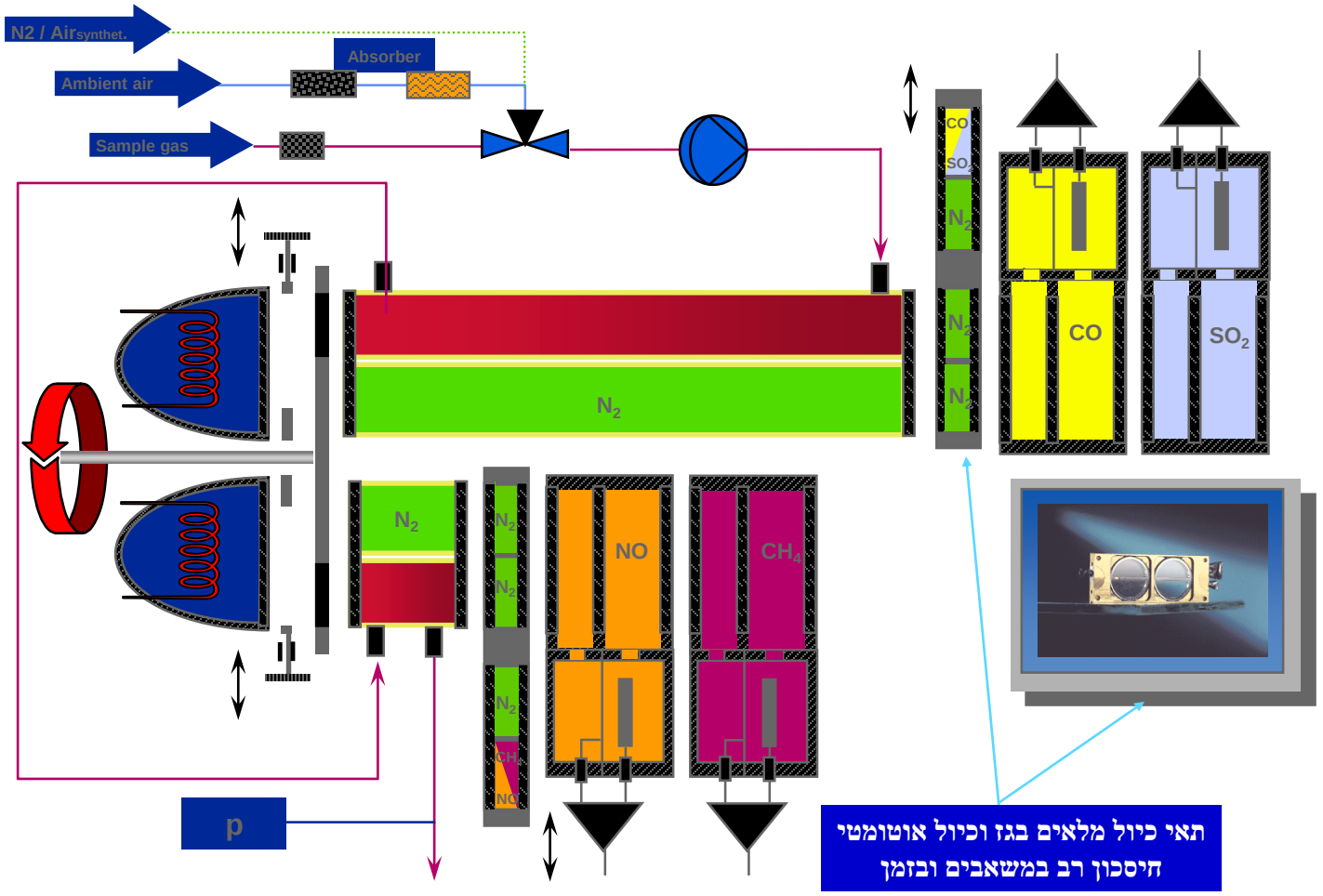
מערכת דגימה לגזים לארובת דגם ABB



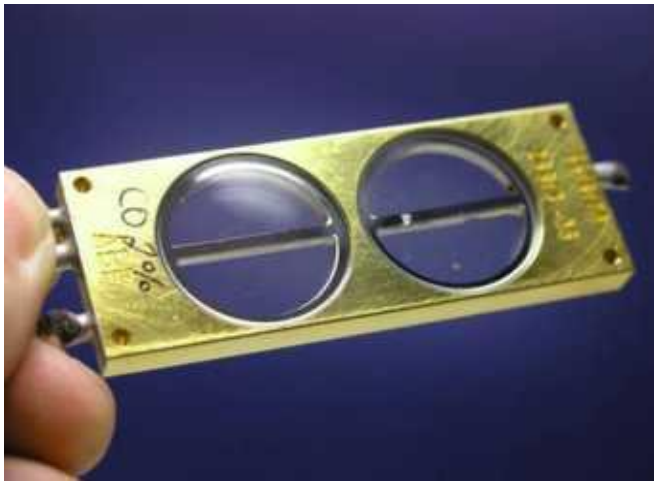
ערכים +תקלות צג האנלייזר- סטטוס מדידה +

על הצג תקלה (




N2 / Airsynthet.
Absorber
Ambient air
Sample gas
CO
SO2
N2
N2
N2
CO
SO2
N2
N2
N2
N2
NO
CH4
p
תאי כיול מלאים בגז וכיול אוטומטי
חיסכון רב במשאבים ובזמן

תאי כיול



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

INSTALLATION IN ISRAEL ELECTRIC CO
15 CEMS SYSTEMS – 15 GAS TURBINES

(Continues Emission monitoring system)

חברת החשמל

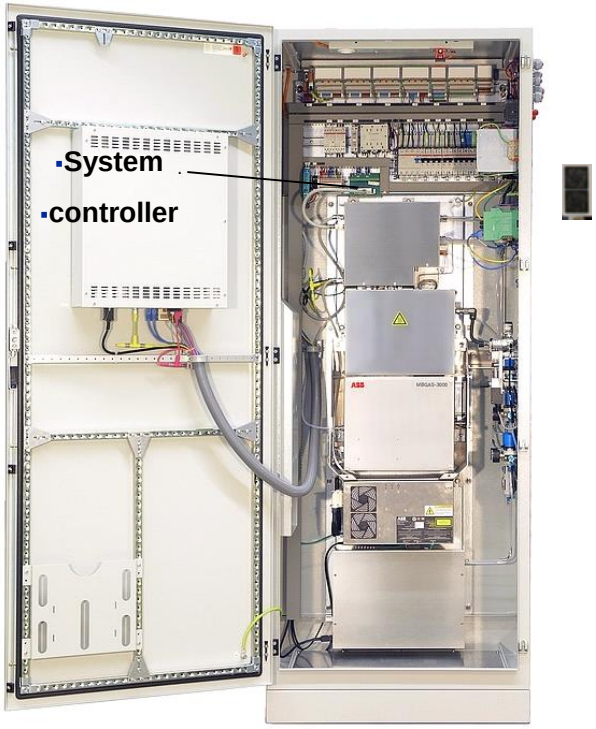

WWW.FAYMONVILLE.COM

CONTELTECHNOLOGIES
for Smart Manufacturing

DURAG GROUP

ABB

ACF5000
Complete turnkey system



▪I/O Interface

▪Power Distribution

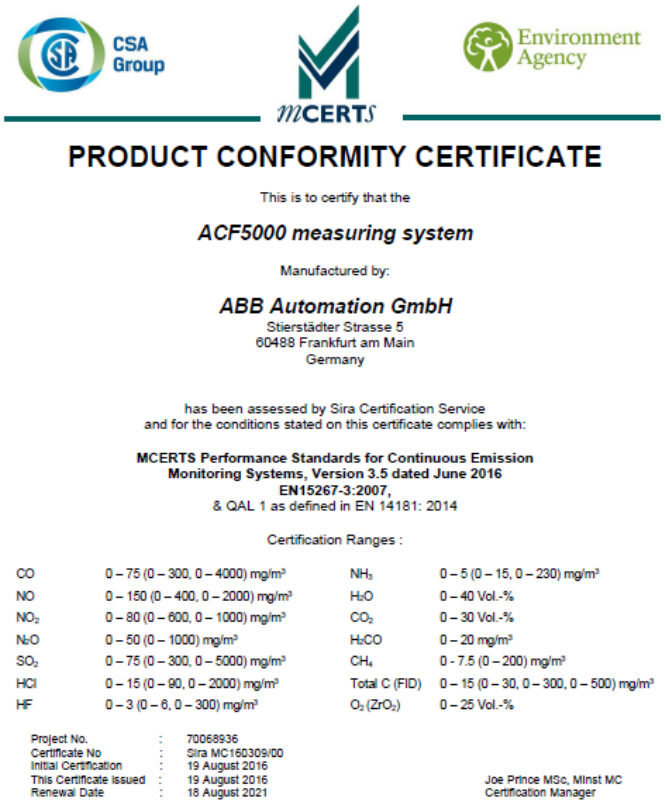
▪Electronic Box

▪FTIR, O2, FID

▪Air Cleaner Box

Certification according to the EN 15267

MCERTS certified since August 19th, 2016



CSA Group

mCERTS

Environment Agency

PRODUCT CONFORMITY CERTIFICATE

This is to certify that the

ACF5000 measuring system

Manufactured by:

ABB Automation GmbH
Stierstädter Strasse 5
60488 Frankfurt am Main
Germany

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

MCERTS Performance Standards for Continuous Emission Monitoring Systems, Version 3.5 dated June 2016
EN15267-3:2007,
& QAL 1 as defined in EN 14181: 2014

Certification Ranges :

CO	0 – 75 (0 – 300, 0 – 4000) mg/m³	NH_3	0 – 5 (0 – 15, 0 – 230) mg/m³
NO	0 – 150 (0 – 400, 0 – 2000) mg/m³	H_2O	0 – 40 Vol.-%
NO_2	0 – 80 (0 – 600, 0 – 1000) mg/m³	CO_2	0 – 30 Vol.-%
N_2O	0 – 50 (0 – 1000) mg/m³	H_2CO	0 – 20 mg/m³
SO_2	0 – 75 (0 – 300, 0 – 5000) mg/m³	CH_4	0 - 7.5 (0 – 200) mg/m³
HCl	0 – 15 (0 – 90, 0 – 2000) mg/m³	Total C (FID)	0 – 15 (0 – 30, 0 – 300, 0 – 500) mg/m³
HF	0 – 3 (0 – 6, 0 – 300) mg/m³	O_2 (ZrO_2)	0 – 25 Vol.-%

Project No. : 70068936
Certificate No : Sira MC160309/00
Initial Certification : 19 August 2016
This Certificate issued : 19 August 2016
Renewal Date : 18 August 2021

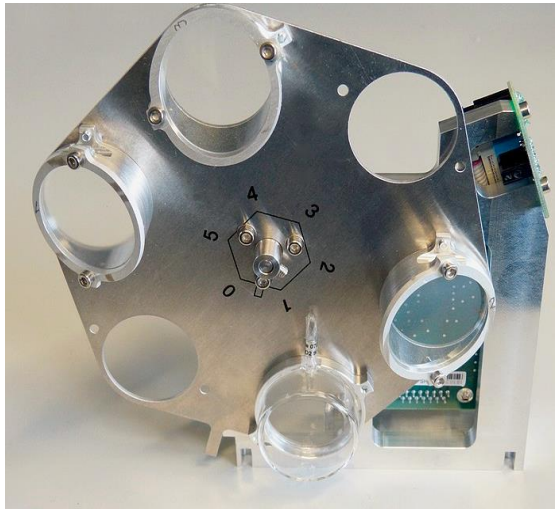
Joe Prince MSc, MInst MC
Certification Manager

Download the certificate from :

- SIRA homepage

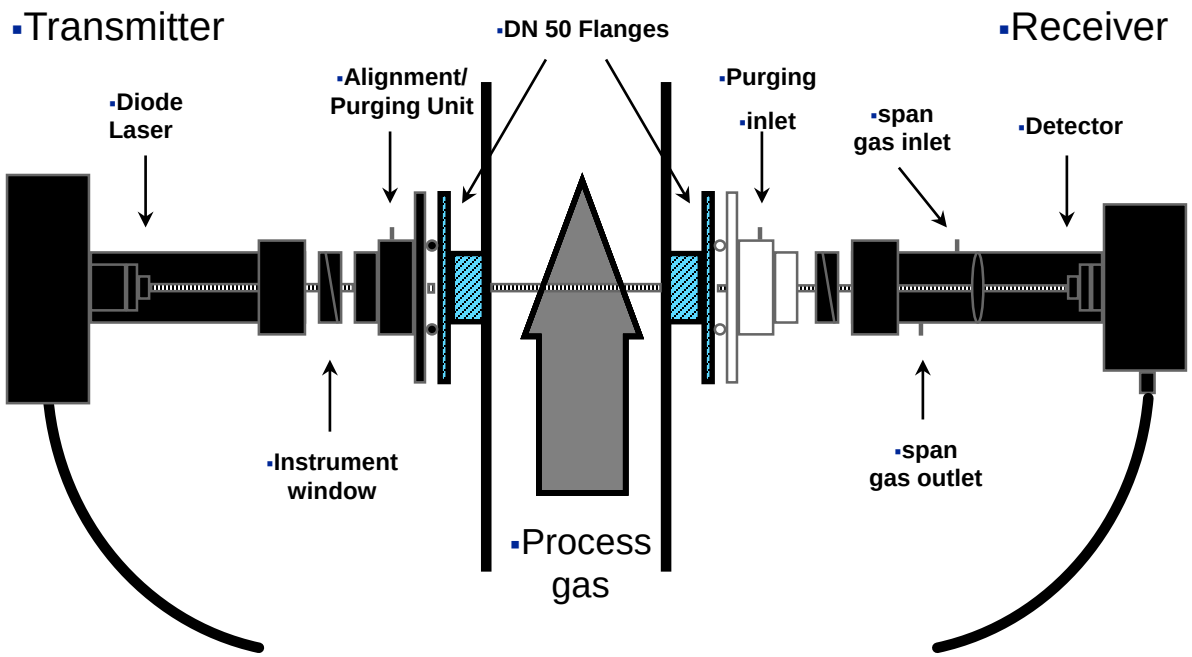
http:/www.csagroupuk.org/wp-content/uploads/2016/08/MCERTSCertifiedProductsCEMS.pdf

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

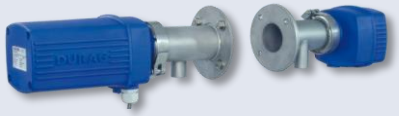
IN SITU -LaserGas II Single Path



Dust concentration and opacity monitors

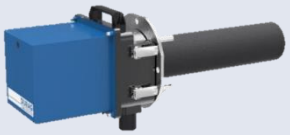
DURAG

D-R 220



D-R 290

D-R 320



D-R 800

Filter monitors

D-FW 230/231/240

DURAG

Combination probe

D-RX 250

DURAG

Dust concentration monitors for wet gases

D-R [illegible]

DURAG

F-[illegible]

VEREWA

Ambient air monitor

F-701-20

VEREWA

Total mercury analyser

HM-1400 TRX

VEREWA

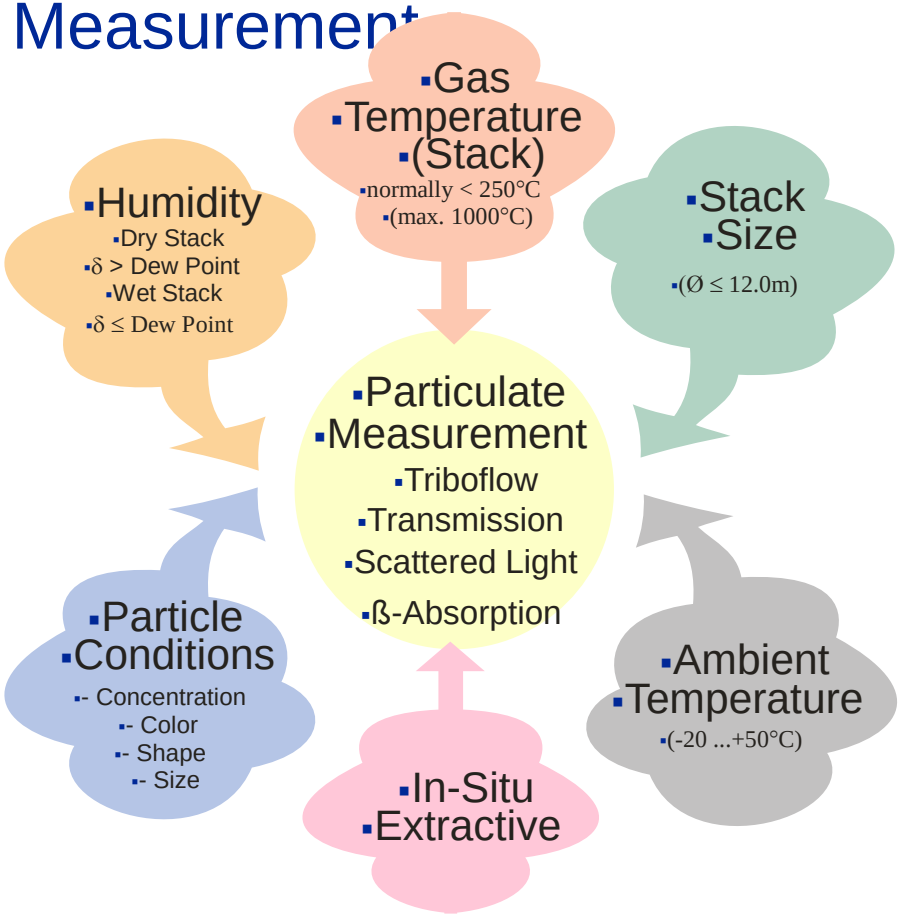
DURAG

Volume flow monitoring systems

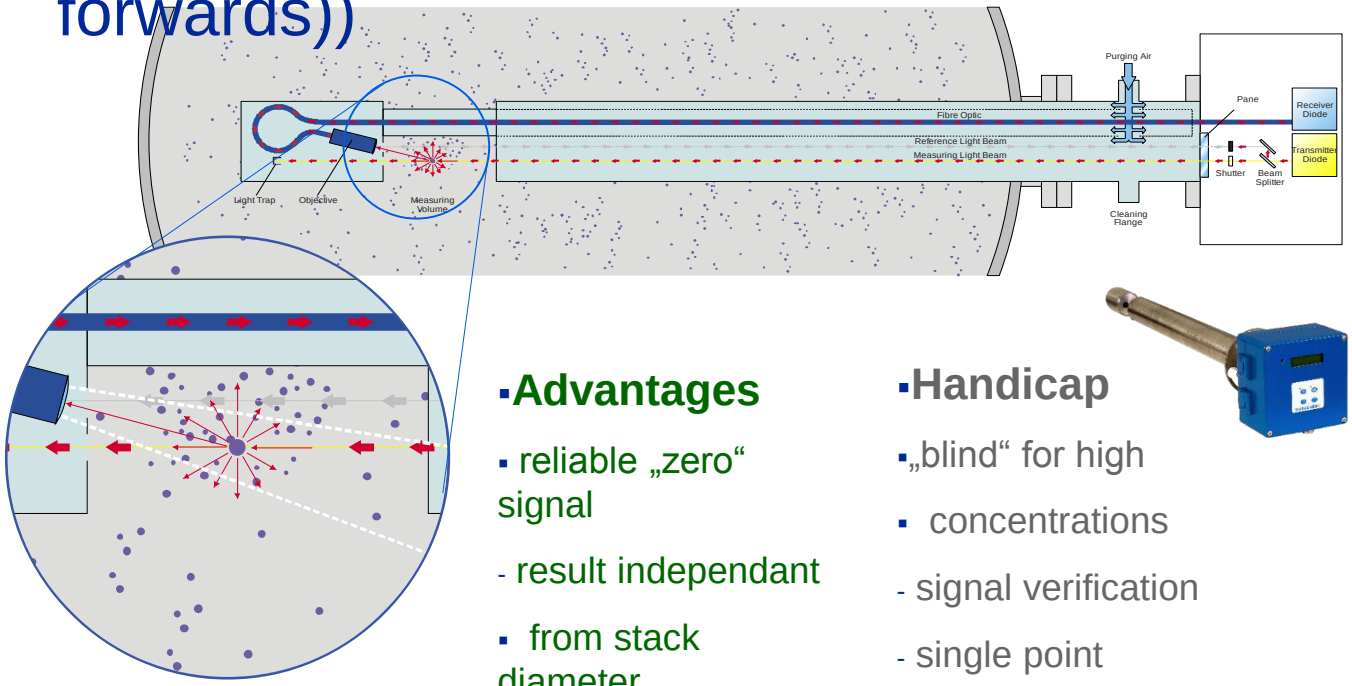
D-FL 100

D-FL 220

Dust Measurement



AMS (Scattered light monitor (scattering forwards))



▪Advantages

▪ reliable „zero“ signal

- result independant

▪ from stack diameter

- simple design

▪Handicap

▪„blind“ for high

▪ concentrations

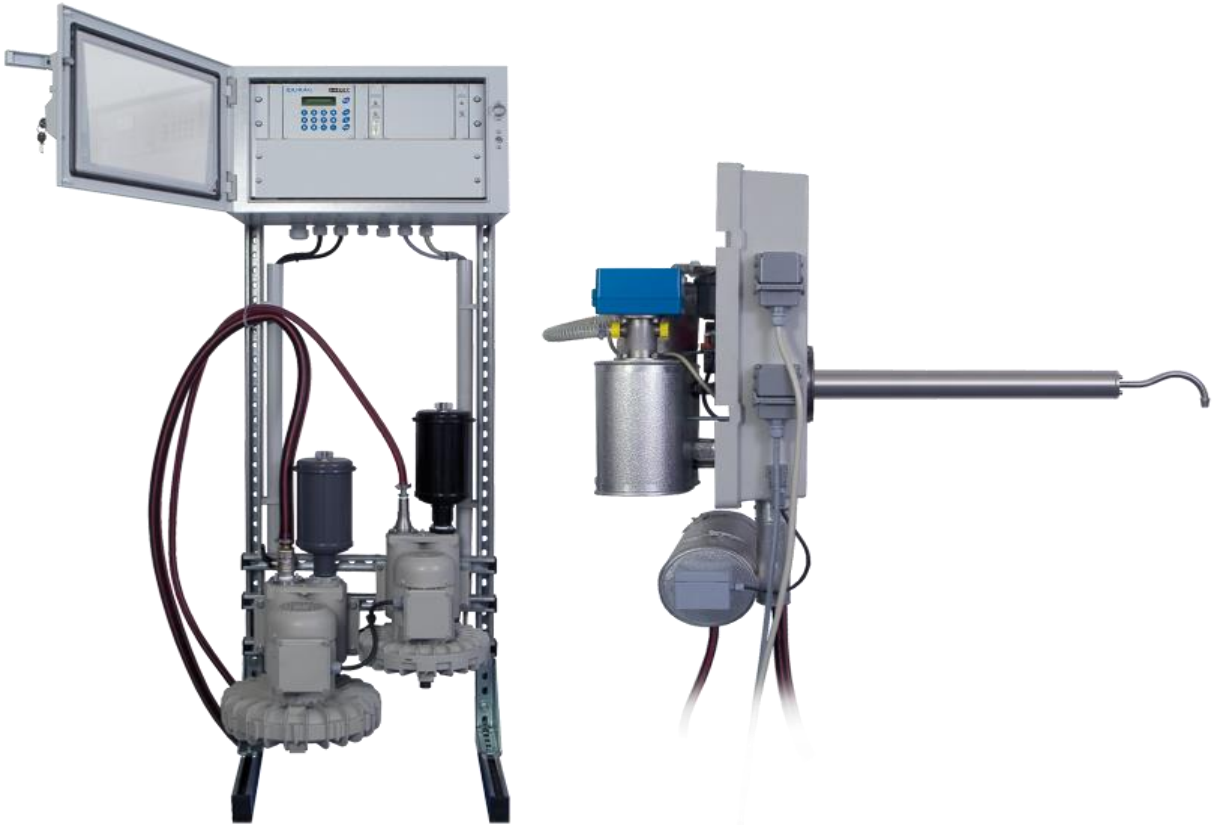
- signal verification

- single point measurement

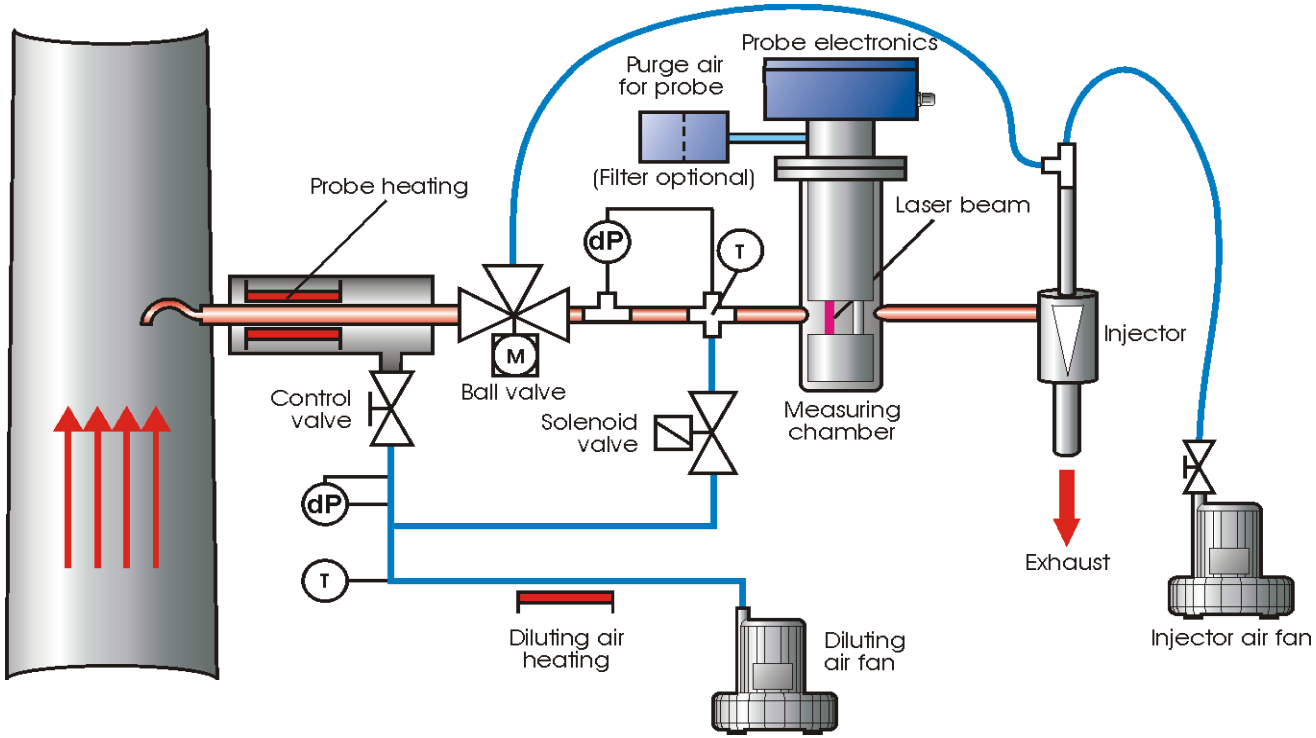
- probe inside of stack

- r.H < 95%!

D – R 820 F Wet Stack Dust Concentration Monitor



D – R 820 F Operating Principle: Sampling



מדידות פריפריאליות
לפי שיטת מדידה , סוג התהליך ודרישות המפקח) (

Various regulations require the conversion of the measurd data to stand conditions at 0 °C, 1013 hPa, dry flue gas and a specific oxygen content. The conversion follows the equitation:

$$\hat{y}_s = \hat{y} \times \frac{t + 273{,}15\,K}{273{,}15\,K} \times \frac{1013\,hPa}{1013\,hPa + p} \times \frac{100\,\%}{100\,\% - h} \times \frac{21\,\% - o_s}{21\,\% - o}$$

where

t	is the Celsius temperature;
p	is the difference between the static pressure of the sample gas and the standard pressure;
h	is the absolute water vapour content (by volume);
o	is the oxygen content in dry gas (by volume);
o_s	is the oxygen standard condition.

Important Note: Some measurement techniques, e.g. extractive AMS do not require a full conversion of the measurement data, because a part of the calculation is already inherent within the measuring principle. There are three major cases for the conversion to standard conditions. The table below gives a summary, which conversion is required.

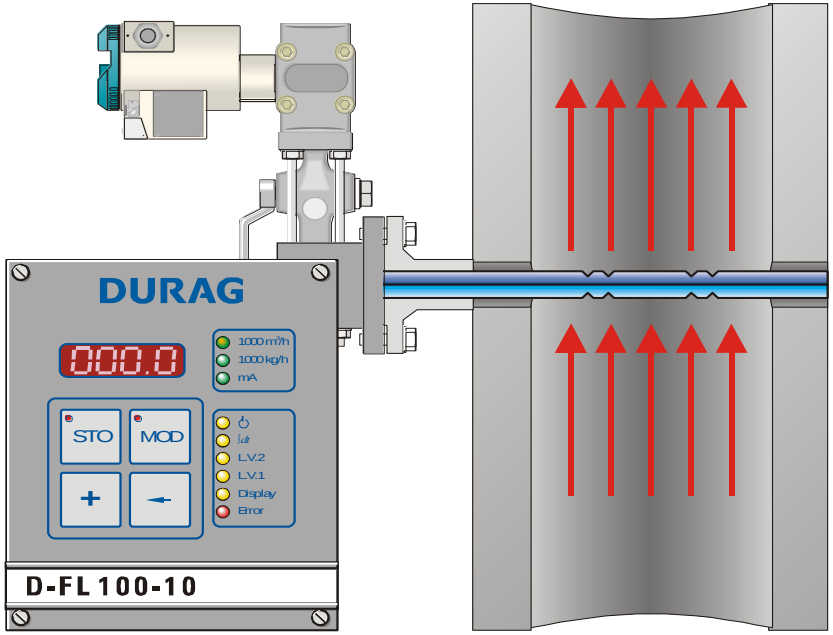
Measurement principle	Temperature	Pressure	Water Vapor Content	Oxygen
Insitu measurement (e.g. dust measurements)	YES	YES	YES	YES
Hot extractive measurement (e.g. ABB ACF NT)	NO	NO	YES	YES
Cold extractive measurement (e.g. ABB URAS with gas cooler)	NO	NO	NO	YES

D – FL 100

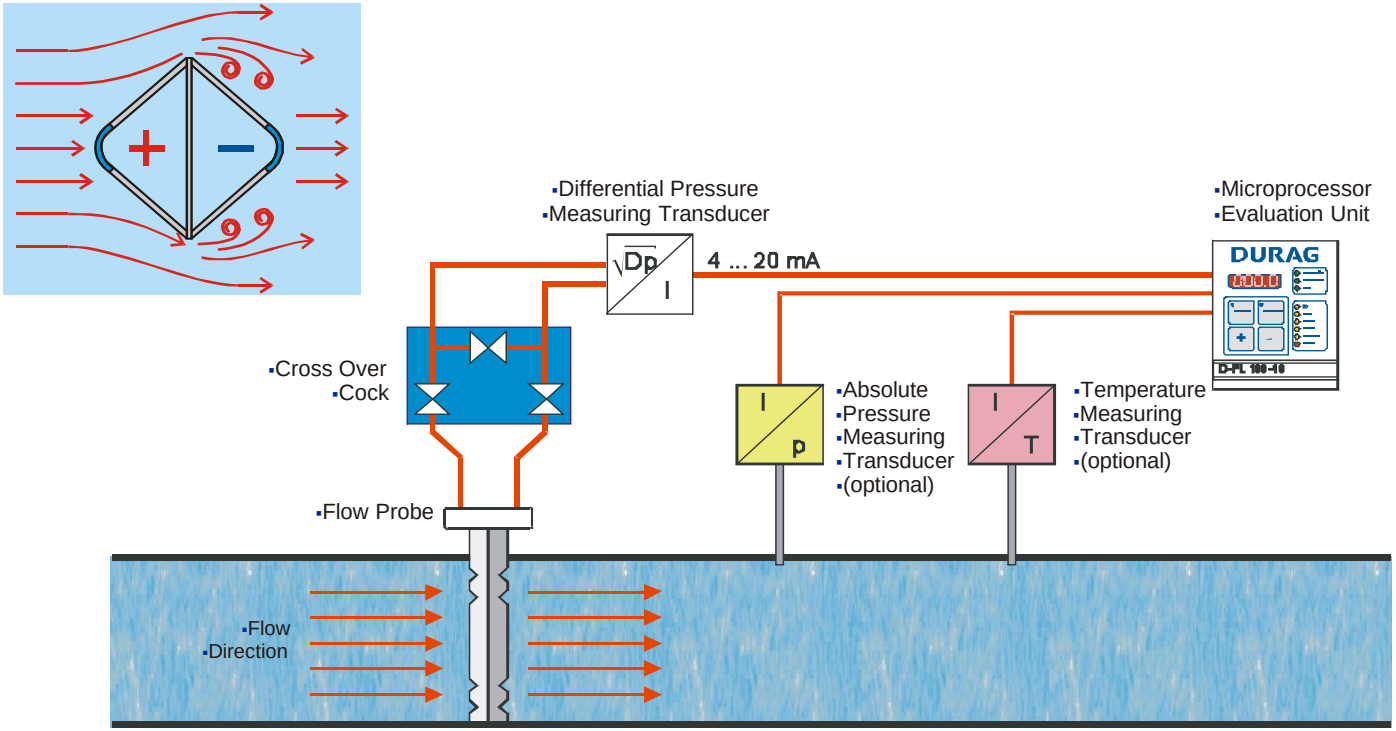
Flow By Differential Pressure Probe

Overview

- **Flow rate measurement with a probe by the principle of differential pressure method**
- **Evaluation with the Microprocessor Unit D-FL 100-10 (optional)**
- **Adjustable parameters**
- **Load-independent current for line recorder and indicator instrument**



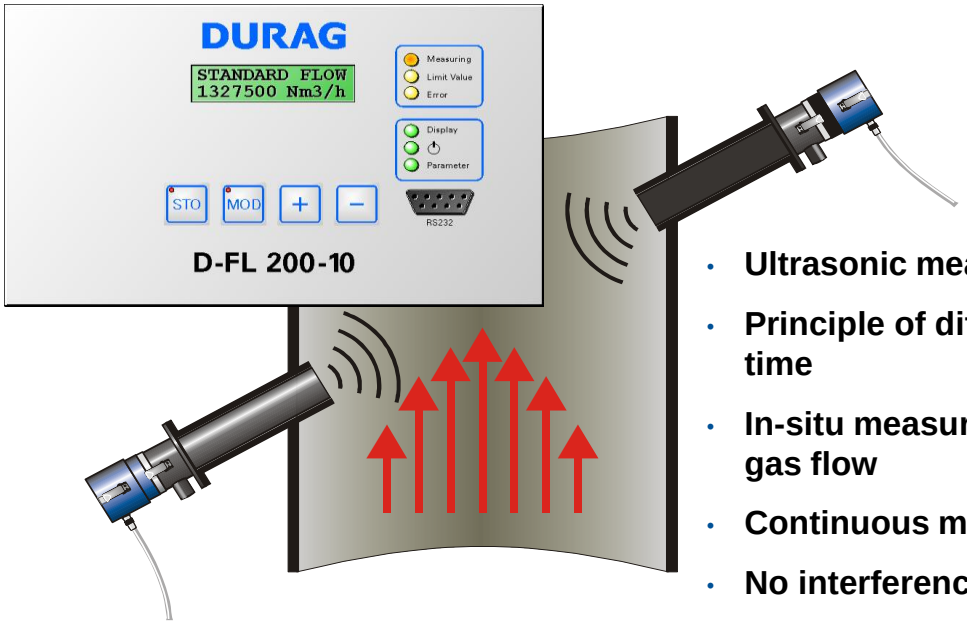
Measuring Principle



D – FL 220

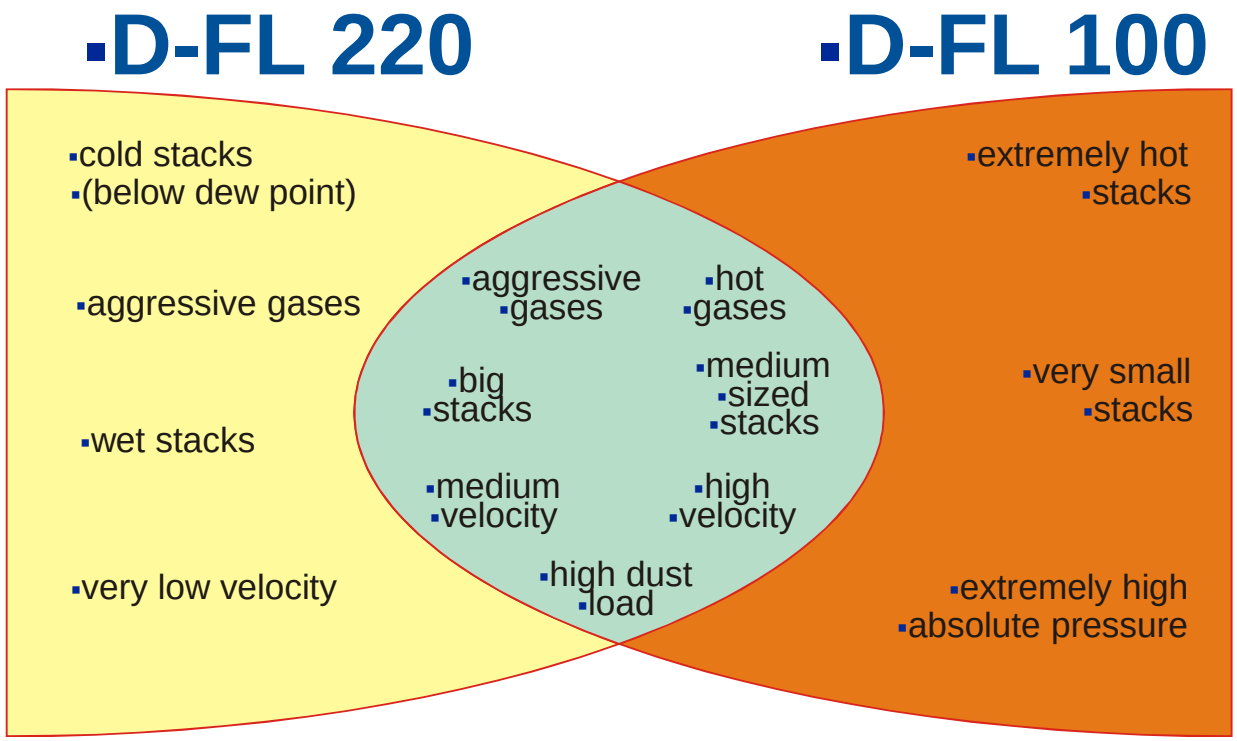
Ultrasonic Flow Monitor

D-FL 220 Flow Meter



- **Ultrasonic measuring system**
- **Principle of differential propagation time**
- **In-situ measuring directly in the flue gas flow**
- **Continuous measurement**
- **No interference with the medium**
- **Automatic zero-point and reference-point control**
- **Programmable via the evaluation unit's keys or via PC**
- **Load-independent current for line recorder and indicating instrument**

Applications of D-FL 100 and D-FL 220



שאלות בבקשה ?

QAL 3 Procedure
Ongoing Quality Monitoring

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ABB

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	**Manufacturer Declaration**
QAL 2	Calibration procedure of an AMS after commissioning with **S**tandard **R**eference **M**ethods (**SRM**) Determination of variability & comparison with required *Uc*	**Certified Body EN ISO 17025**
QAL 3	**Ongoing quality assurance during operation.** **Regular control of Drift and Precision of the AMS**	**Responsibility of Plant Owners**
AST	Annual Surveillance Test Yearly check of an AMS	**Certified Body EN ISO 17025**

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
  - CUSUM
    - Determines separately Drift and Precision
  - Shewhart
    - Determines combined Drift and Precision
  - EWMA
    - Exponentially Weighted Moving Average

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

- Minimum 1 time per certified maintenance interval
- Weekly recommended

  by using CUSUM control charts ➡ Very expensive

- For AMS without certification according EN 15267, 1 - 3
  - 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

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

AO2000 & EL3000
Adjustment concepts without test gases

Adjustment cells are standard for the reference point

- IR Photometer
- UV Photometer

Zero - point adjustment

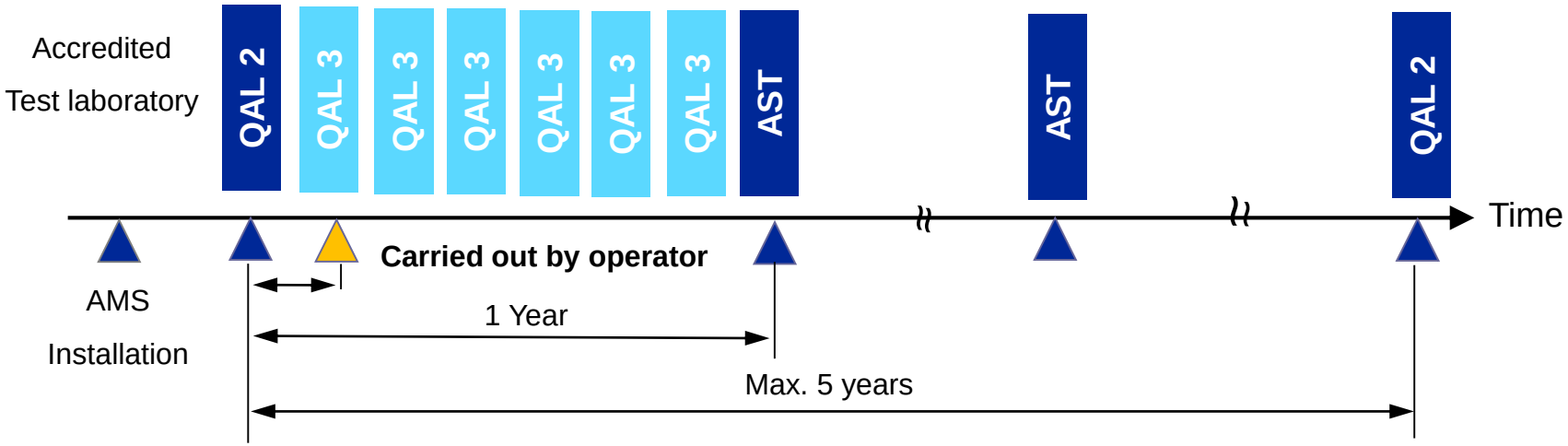
- With ambient air, clean and dry

Single - point calibration using dry ambient air

- Oxygen measurements
- O_2 - Sensors

12 months maintenance interval by using adjustment cells

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)

QAL3 Ongoing Quality Monitoring
Required values

Setpoint concentrations at zero and reference point

Measured concentrations at zero and reference point

Standard deviation S_{AMS}

Control Chart Algorithm

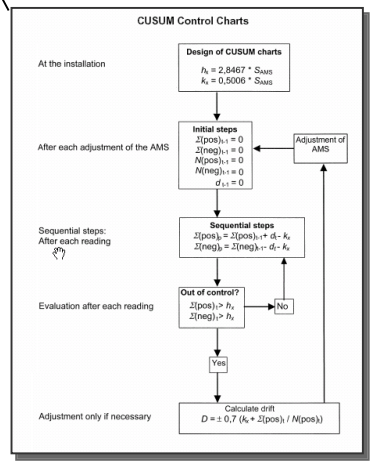
CUSUM

Shewhart

EWMA

Out-of-control situation for Drift and Precision of the AMS

Documentation / Charts



Control charts
Calculation of the Standard deviation S_{AMS}

S_{AMS} value necessary for evaluation according control charts (Chapter 7.4.2)

Method

- Using the Uncertainties *Uc* obtained during the suitability test
- Additional performance data of the AMS for each of the influence factors

U_{inst}	Is the uncertainty from stability
U_{temp}	Is the uncertainty relating from variations in ambient temperature
U_{volt}	Is the uncertainty relating from variations in voltage
U_{pre}	Is the uncertainty relating from the variation of pressure
U_{others}	Is any other uncertainty that may influence the reading on zero and reference material

Calculate

$$s_{AMS} = \sqrt{u_{inst}^2 + u_{temp}^2 + u_{volt}^2 + u_{pres}^2 + u_{others}^2}$$

Control charts
Calculation of the Alarm Limit A_{Limit}

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

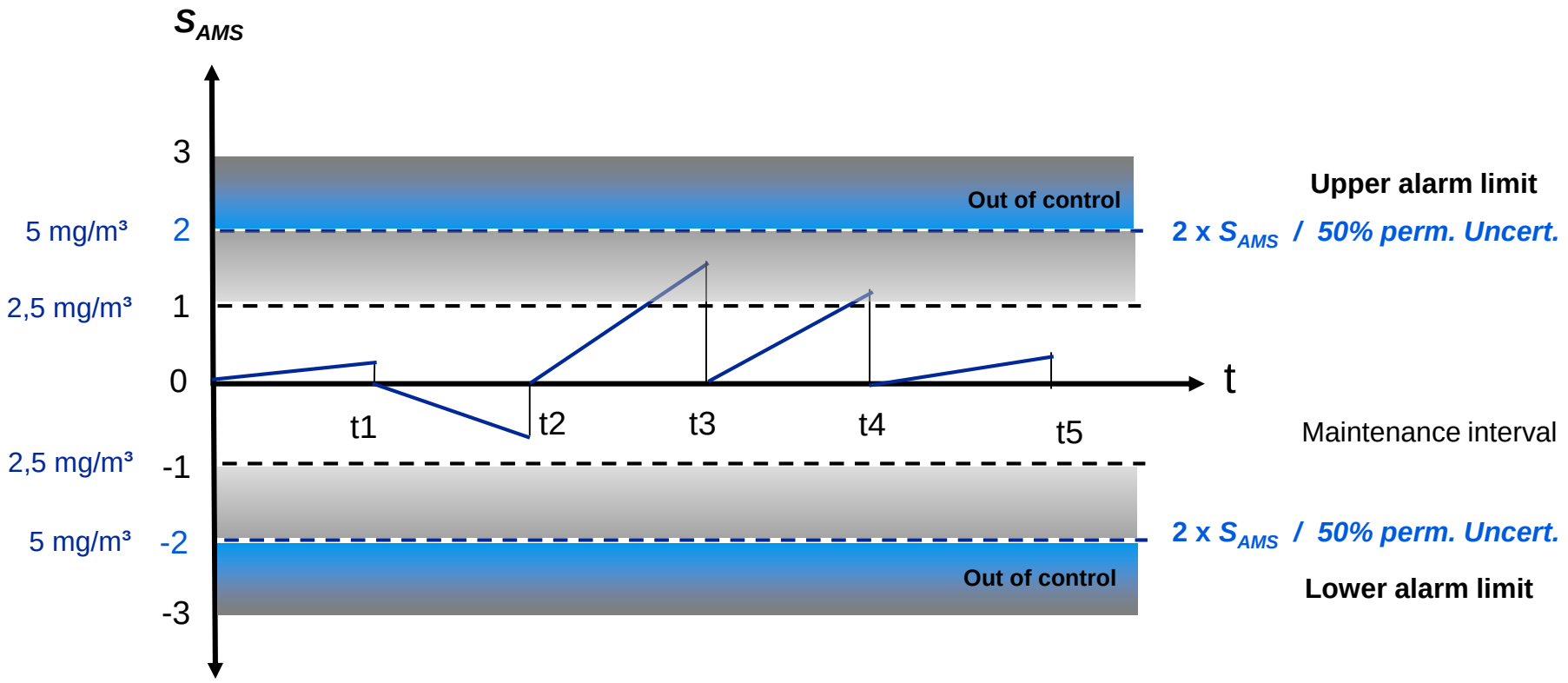
- Doing a calculation based on the maximum permissible uncertainty
  - ± 50 % of the max. permissible uncertainty can be used to set the alarm limits
  - ± 25 % of the max. permissible uncertainty can be used to set the warning limits

Example

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

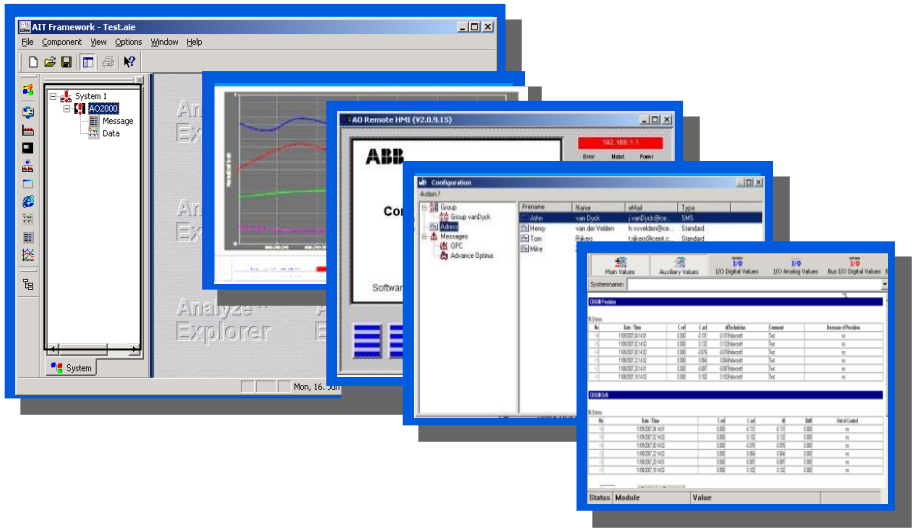
$$A_{Limit} = 100\ mg/m^3 \times 10\% = 10\ mg/m^3 \times 50\ \% = 5\ mg/m^3$$

Shewhart Control Charts
Example



- Shewhart ➡ The most popular control chart

Evaluation and data logging
Solutions with integrated functionality



Analyze^{IT} Explorer

- QAL3 evaluation & reporting
- Continuously recording & logging
- Displays status & measuring values
- Allow complete remote operation
- Graphic and trend chart recorder
- Logbook functionality

Inside the Analyzer

- QAL3 functionality integrated

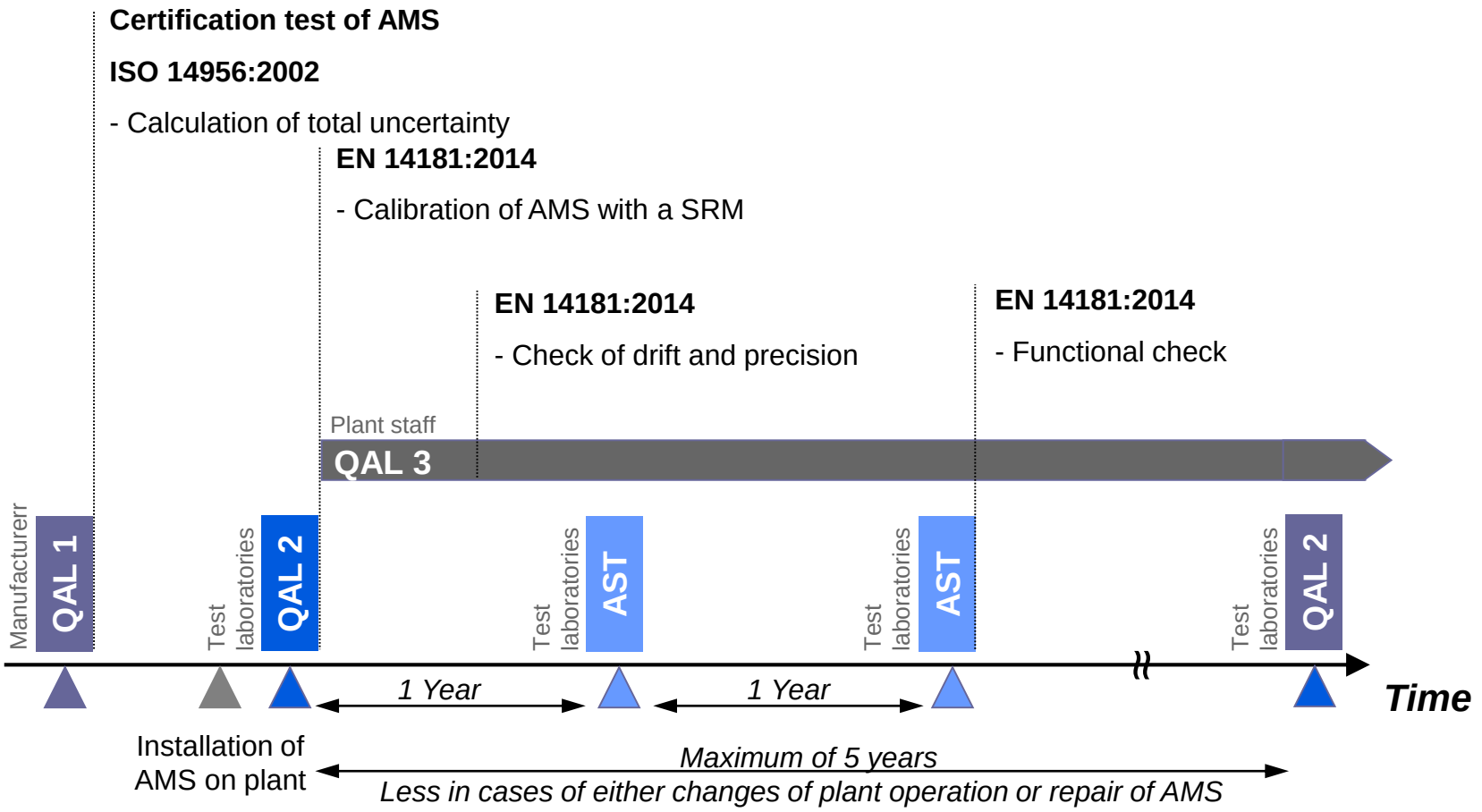
Ongoing Quality Assurance • QAL3
The AMS runs out of range

A full new calibration (QAL2) shall be performed within 6 months if any of the following conditions *) occur :

- If > 5% of the number of measured values between 2 ASTs are outside the valid calibration range for more than 5 weeks
- If > 40% of the number of measured values are outside the valid calibration range for more than 1 week

*) According Para. 6.5 of the EN14181

EN 14181
QAL1…3 over time



AST = Annual Surveillance Test

AMS = Automated Measuring System

SRM = Standard Reference Method

תודה

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